Global Coal Trade:

An international political economy approach

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Abbreviations and Definitions

ACA	Australian Coal Association
AD	air dried basis
ADAF	dried ash free basis
AFT	ash fusion temperature
Agip	Azienda Generale Italiana Petroli
ARA	Amsterdam-Rotterdam-Antwerp
ATIC	Association Technique de l'Importation Charbonniere
BC	British Coal
BHP	Broken Hill Proprietary
BP	British Petroleum
BSC	British Steel Corporation
CAID	Coal & Allied Industries
CdF	Charbonnages de France
CEGB	Central Electricity Generating Board
cif	customs, insurance and freight (included in price)
CO_2	Carbon dioxide
CSN	Crucible Swelling Number
CWI	Coal Week International
DME	Department of Minerals and Energy (NSW), previously Department of Mineral Resources (DMR)
DOE(USA)	Department of Energy (USA)
ECC	European Community Commission
EdF	Electicite de France
EEC	European Economic Community
EPDC	Electricity Power Development Corporation
EIA	Energy Information Administration
ENEL	Ente Nazionale per L'Energia Electtrica
ENI	Ente Nazionale Indrocarburi
fas	free along side
fob	free on board
for	free on rail
FTEE	Financial Times Energy Economist
gar	gross as received basis
GE	General Electric Company
Gencor	General Mining Union Corporation
HGI	Hardgrove grindability index
ICL	International Coal Letter
ICR	International Coal Report
IEA	International Energy Agency
IEACR	International Energy Agency, Coal Research Unit
IEE	Institute of Energy Economics, Japan
ILO	International Labor Organisation
JAPAC	Japanese Committee for Pacific Coal Flow
JCB	Joint Coal Board, Australia
JCD	Japan Coal Development Company
JSM	Japanese steel mills
kcal	kilocalorie
kg	kilogram
KCIM	Keystone Coal Industry Manual
KICT	King's International Coal Trade

Abbreviations and Definitions (contd)

KNB	Keystone News Bulletin
kt	kilotonne (metric)
LDC	less developed country
Mcal	Megacalories
MITI	Ministry of International Trade and Industry
Mj	Megajoule
mt	million tonnes (metric) (= 1.102st = 0.9841t)
mtpa	million tonnes (metric) per annum
MW	megawatt
NCA	National Coal Association, USA
NCB	National Coal Board, Australia
NEDO	New Energy Development Organisation (renamed New Energy and Technology Development Organisation, Japan)
NO_x	Nitrogen oxides
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
OPEC	Organisation of Petroleum Exporting Countries
PECC	Pacific Economic Co-operation Conference
pt	per tonne (metric)
SITC	Standard International Trade Classification
SO_2	Sulphur dioxide
SOMO	Stichting Onderzoek Multinational Ondernemingen
tce	tonne coal equivalent (7Mcal=29.3MJ=29.3KJ/kg)
TCOA	Transvaal Coal Owners Association
TDM	Thiess Dampier Mitsui
toe	tonne oil equivalent (10Mcal)
TNC	transnational corporation
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
USA	United States of America
USSR	Union of Soviet Socialist Republics
VEW	Vereinigte Elektrizitatswerke Westfalen
wwcp	weighted world coal price
$	dollar (USA)
A$	dollar (Australian)
C$	dollar (Canadian)
%	percent

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Abstract

This thesis argues that to better understand global coal trade, the conventional economic model of trade needs to be replaced with a more comprehensive international political economy model of trade. The rapid growth of global coal trade during the 1970s and 1980s is disaggregated by coal type, source and destination. The extent and adequacy of various data sets are assessed and contract data are selected as the source of greatest information. The limitations of the conventional least cost trade model are then evaluated using detailed Japanese and European trade data. The global coal trade is found not to conform with a uniform commodity market model, but to be fragmented.

A new international political economy model is then developed to explain and evaluate the structures which create a fragmented coal trade. The importance of security, production, financial and information structures are each examined in turn. The security structure identifies the policies and decisions of the state and their importance in shaping trade. Important state initiatives include the protection of domestic industry and the promotion of diverse supply sources. Governments also enter bilateral trade and investment agreements and form international entities like the International Energy Agency which affect coal trade.

Most studies of the coal trade concentrate on the production structure where investment in mines creates the productive capacity of the industry. Particular attention is paid to investment where mines are integrated either horizontally or vertically into large productive units which may effect bargaining power in the trade. The financial structure grew in importance in the 1970s and 1980s. Coal mines are increasingly financed on an independent project basis. However, loan finance is not necessarily independent of traditional investors. Linkages among loans to established joint venture partners or parent corporations and long term contracts are shown to be strong.

The information structure is rarely studied, but essential to the trade process. Specialised information institutions have evolved to facilitate the reliable and coordinated control over trade flows. Japanese trading houses, sogo shosha, are shown to have an especially strong role in global coal trade. This pattern is contrasted with the declining and specialised role of European coal traders. The comparison of Japanese and European trade patterns and the attitudes of regional consumers offers a better understanding of global trade patterns than that offered by simple competitive models. The result is not only more detailed insight into trade patterns, but a better understanding of the resource trade process.

Global Coal Trade:

An International Political Economy Approach

Chapter 1 : Introduction

1.1 Global coal trade

> '(T)here is no other subject besides trade on which theories diverge more widely, or in which most theories diverge further from the facts... This is why, in order to get some overall grasp of the structure of trade, it is best to begin with the facts, so far as they are known, and then proceed to the conflicting theories' (Strange 1988:161).

Global coal trade expanded threefold between 1978 and 1988 to account for 11 per cent of all global seaborne trade[1]. The seaborne trade of 300 million tonnes (mt) across large distances in 1988 stands in marked contrast to the 46mt shipped largely across the Atlantic Ocean in 1960. At that time coal was rapidly being replaced by oil as the preferred energy source in many applications. The rapid demise of coal was expected, but did not arise for two reasons. First, the growing needs of the steel industry increased demand for coking coal and second, coal remained a low cost source of energy for large scale applications where its bulk and cost of handling was accommodated by large scale technology. Global consumption (mostly steam coal) grew from 2 billion tonnes in 1960 to 2.2 billion tonnes in 1970 and seaborne trade (mostly coking coal) reached 101mt in 1970 (Gordon 1987).

The expected demise of coal in the 1960s was converted into an expected bonanza in the 1970s when the rise in oil prices enhanced the position of competing fuels. Once again the overly enthusiastic claims of short term expectations were not realised. Coal trade grew rapidly, but it could not challenge the position of oil trade. The fears of oil threats to political security and claims of permanent shifts in economic advantage proved exaggerated. Simple causal models of change overlooked the rigidities and underlying structures of the international system. Forecasts were revised, but there remained a need to re-examine their underlying basis.

Many new suppliers and consumers joined the global coal trade. Over 50 countries traded coal volumes greater than 100,000 tonnes per annum in the late 1980s. Despite this growth, their experience was neither uniform nor as predicted by the models constructed only a few years earlier. Both countries and companies faced uncertainty.

This thesis argues that to understand the coal trade, the conventional economic model of a commodity market needs to be replaced with a more comprehensive model of trade which recognises the financial, production, security and information structures that dominate the international political economy. Trade is one of the most important forms of international interaction. It is shaped by the above structures and any attempt to understand trade must recognise their influence. The coal trade thus illustrates the complex reality which shapes most types of trade, especially trade in natural resources.

1.2 The complexity of coal

The failure of conventional models to adequately explain trade patterns has given rise to a call for new studies to analyse the 'dynamic interdependence between international transactions and different international institutions' (Vosgerau 1989). This study accepts the challenge by combining the investigation of detailed trade transactions with the study of the influence of specific trade institutions like contractual and ownership arrangements and the general international security, production, financial and information structures.

Coal embodies the complexity of natural resources in both its physical attributes and its trade patterns. Coal chemistry is complicated with the utility of the dominant carbon influenced by many other constituents like sulphur, moisture, ash, volatile hydrocarbons and heavy trace elements. Its trade is similarly shaped by many factors. Economic efficiency is one aim of trade, but idealised models of demand and supply fail to accurately predict trade patterns because they ignore the other structures and strategies that also influence trade.

Demand for coal is dominated by its use as a fuel to release energy and as a reducing agent in the manufacture of iron. These two uses and the resulting markets were generally considered to be independent, but now interact because technology has changed to enable many types of coal to be used for either purpose. The two prevalent models of resource trade overlap in a similar fashion. Global markets (like gold) and transfers within integrated firms (like bauxite/aluminium) offer distinct models of trade behaviour. To understand coal trade, elements of both models need to be used. The resulting political economy of trade is a dynamic process which recognises the forces of change and measures the influence of important structures or strategies.

Coal is a widely distributed natural resource, yet the centres of production and consumption may be separated by thousands of miles. The high value of specialised coking coals (relative to steam coal) and the higher value placed on energy resources in the late 1970s and 1980s combined with lower transport costs to enable coal trade to increase across long distances. National boundaries were crossed and international coal trade (including continental trade) expanded to 370mt in 1988. This growth in coal trade is forecast to continue in the 1990s, yet our understanding of the process is incomplete.

Many studies have been undertaken to estimate the cost of coal production in various countries and to construct components of the international supply curve based on estimated or average production costs. Other studies have focused on demand forecasts by estimating the demand for coal in electricity, steel and general industrial markets. In each case, coal faces competition from other sources of energy or alternative technologies. Rather than duplicate such studies, this thesis concentrates on the trading function which links the supplier to the consumer.

To better understand the resource trade function, elements of economic (least cost) and political (security) models are combined with a transaction based model of trade. The result follows recent developments in international political economy which explain trade flows as a product of structures built to meet economic and strategic objectives. The constraints on economic objectives are not only the well documented interventions of government, but also the strategic considerations and structures of the consumer.

To investigate this problem, the study begins its investigation of the international coal trade from the position of the consumer. The buyer is assumed to hold a set of objectives (least cost supplies, price stability/certainty, stable volumes, flexible volumes, reliable suppliers, diversity of supply, etc.) which can be identified. To achieve these objectives, alternative trade arrangements can be implemented. The arrangements frequently found in the coal trade include direct investment in production (majority or minority interests), spot or term contracts, financial support (loans or sale guarantees) to suppliers, control over transportation and the use of intermediary trading houses. These alternatives create many possible combinations for consumers to use to acquire their resource inputs. Many different trade networks result.

To evaluate what structures are considered important to the coal trade, a survey of coal buyers was conducted. The survey asked questions about buyer's investment in coal production facilities, the types of contracts used, the importance of different purchasing objectives and coal qualities, the basis for selection of suppliers, preferred limits to market share and number of suppliers, and whether special arrangements were suitable to establish new suppliers. Three time periods (1980, 1987 and 1995) were used to indicate past and anticipated changes (Appendix D). The results of this survey are used to develop a more complete coal trade model based on consumer attitudes towards coal quality, diversity of supply and specialised 'quasi-integration' arrangements.

The objectives of suppliers are not examined in equal detail because of the proliferation of more than 200 suppliers scattered among a dozen countries and their more restricted options (Appendix A). Admittedly, the largest suppliers have prominent roles in national industries and the transnational oil companies in particular have extensive international supply networks incorporating many corporate entities. The extent of horizontal and vertical integration is measured and the concentration is considered low enough for the supply industry to be competitive and responsive to consumer demands. Given this competition, why do some producers expand more rapidly or trade for longer periods than others? This question will be considered by investigating the relationship between various trade structures and the mines and consumers which are linked by the structures.

Detailed international trade networks are investigated using transaction data to gain greater insight into trade patterns and to assess the success of different strategies or combinations of consumer objectives. The use of transaction data is considered essential to overcome the limitations of aggregate trade data used in most studies. Possible changes in consumer objectives are also considered for their likely effect on future coal trade patterns.

Before starting the detailed analysis of particular coal trade patterns, chapter 2 locates the study within the broad expanse of existing international political economy ideologies and related trade models. The evolution of steel industry (hence coking coal trade) locational models is reviewed to identify the shift from simple production and transport cost models to recent corporate behaviour and political economy models. Trade models are often detailed compilations of the simple data sets incorporated in old industrial location models. The most popular approach to modelling commodity trade is to construct an economic model of the production function for identified supply regions, the demand function for consuming regions, the transport function for linking supply and demand regions and a linear programme to derive the least cost allocation of production to meet demand. These models generally make simple assumptions about international market structure. The conventional definitions and types of market structures are summarised and a more comprehensive framework proposed.

A more detailed look at the perfect competition model and its limits is provided in chapter 3. First, the conditions necessary for a competitive market are identified. The growth and extension of global coal trade to over 50 countries is assessed as evidence of competitive conditions being met. However, prices were found to vary both at the regional and national level. This challenge to the expectations of the conventional coal trade model created the need for more detailed investigation. The European spot market for steam coal is used as the case study where many consumers and suppliers have combined to form a growing spot market. The demand for flexible supplies of low cost energy is assumed to dominate longer term security interests. However, detailed examination reveals the inadequacies of this model to explain trade patterns and prices. The problem of data inadequacy (to accurately test the hypothesis) is considered, but the more general explanation for the failure of trade to conform to the perfect competition model is that the market is fragmented by the procurement strategies of various buyers.

Variations in international coal prices are explained in chapter 4 by the recognition of security or diversity of supply objectives held by most consumers. The results of a survey of consumers (conducted as part of this study) are used to support a detailed analysis of coal quality and security of supply variables as predictors of coal price. The largest and best established international market for coal, the Japanese coking coal market is used for the initial analysis. The steam coal market in Japan and Europe are then examined in the same manner. The conclusion is a call for a more complex model of global coal trade.

Chapter 5 provides the detailed introduction to the structural IPE model of coal trade by investigating the security structure created by major government and corporate actors. Government policies and security initiatives to protect or enhance the position of national importers and energy interests are reviewed. Government intervention in coal trade through boycotts, subsidies and selected purchases are identified as part of national security objectives. Links are then established between the security and other structures to reinforce shared objectives.

The production structure is investigated as a measure of the degree of vertical and horizontal integration operating in the global coal trade (chapter 6). Backward integration is a repeated practice by some consumers to secure part of their imports. The Japanese 'develop and import' policy is reviewed and the related investment by industry studied. Various groups of investors are identified and the implications for trade discussed.

The financial basis of the coal industry changed in the 1970s and 1980s with the investment in new projects largely drawn from project loans based on a future cash flow secured by long term contracts. The financial arrangements and contractual basis of this practice is studied in chapter 7 to determine the importance of the financial structure in the global coal trade. In some cases, loans provide a form of quasi-integration which reinforces direct investment patterns. In other cases, loan provisions are independent and based solely on the banking sector's assessment of project risk.

The information structure provides important linkages with the other three structures and assumes a central position in the trade process. The importance of transaction costs is reviewed and the ability of specialised trading companies, the Japanese sogo shosha in particular, to reduce the cost of information and facilitate trading partner selection and contract negotiation is assessed. Detailed transaction data from the Japanese and European coal trade are evaluated to gain new insights into the importance of information structures in arranging trade.

Each of the four structures is shown to contribute to the pattern and practices prevailing in the global coal trade. Important linkages are made between the structures, but their ability to enhance the power of related structures can also create conflicts. The result of these distinct structures operating simultaneously in the coal trade is the fragmentation of the trade into the diverse components active around the globe.

The insights gained in these analyses are summarised in chapter 9. The implications for models of the international coal trade, other commodity trades and global environmental issues are discussed. Areas in need of further investigation are identified and questions posed for further consideration. In short, international coal trade is shown to be more complex than suggested by simple models of either competitive markets (independent units), monopsonist control (Japan Inc.) or administrative transfers (vertical integration). The structural model provides explanatory power to understand the variation identified and to propose the means to make changes.

Endnote:

1. as measured by seaborne tonne kilometres of freight (Economist 28.1.1989).

Chapter 2
Trade theory and structural models

2.1 Introduction

The three dominant ideologies of international political economy and their associated trade theories are reviewed briefly in this chapter. The review serves three purposes. First it locates this study within the broad expanse of trade literature. Second, it serves as a reminder of some of the models and concepts which will be developed in more detail in later chapters. Third, it provides an opportunity to note the limitations of the assumptions underlying the standard models. The review is then completed with a formulation of the structural model of trade using the transaction as the basic unit of analysis.

2.2 Ideology and trade theories

Trade theories are best understood by studying them in the context of the ideology underlying their associated school of thought. The three dominant schools of thought in International Political Economy (IPE) are economic liberalism or neo-classical economics, Marxism or radical economics and neo-mercantilism or economic nationalism. Liberalism is based on the individual. Each individual is assumed to be rational and utility maximising through the use of markets where trade-offs are made among alternative goods and services. By contrast, the basic unit of analysis in Marxism is class. Each class (labour or capital) is rational and utility maximising, but capitalism enables capital to exploit labour through the accumulation of surplus value from the sale of products. Finally, neo-mercantilists believe that nation-states are the dominant actors. States are rational and seek to maximise their relative power through military or economic means (Frieden and Lake 1987). Each school of thought concentrates on explaining trade and other international relations through the study of its dominant actors; these varying explanations will be explored further in the next section. Before considering these in detail it is important to note the difficulty of deriving trade theories (or indeed most other types of comprehensive theory) based on the ideology of dominance of a single type of actor (Sayer 1984).

Gilpin (1987) emphasised the distinction between theory and ideology because of the fundamentally different view which each group has of the relationships among society, state and market. An ideology is the set of 'ideas at the basis of some economic or political theory' (Concise Oxford 1964:601). It entails an entire belief system or Kuhnian paradigm. As a result, the intellectual commitment to the ideology is held so tenaciously that logic or evidence are rarely able to displace it (Gilpin 1987). Theories or 'supposition(s) explaining something based on principles independent of the phenomena to be explained' (Concise Oxford 1964:1344) are constructed and facts are selectively recognised or interpreted so as to reinforce or 'prove' the theory derived from such an ideology (Strange 1988).

This inability to independently prove the validity of economic theories was demonstrated by Hamminga in his study of the neo-classical theory of trade:

> 'The study of the Ohlin-Samuelson programme (neo-classical theory of international trade) above is an example of such a study, showing that empirical, statistical investigations and refutability have absolutely nothing to do with the complicated, but clearly describable methods of theory development in neo-classical economics.' (Hamminga 1983:151)

The central problem is that each ideology and its associated theories claim to provide verified positive explanations of how the world does work, while also presenting normative positions on how the world should work (Gilpin 1987:26). The assumed objectivity is lost (Sayer 1984). To break this tautological underpinning of most studies, it is necessary to depart from the three dominant schools explaining trade in terms of either market, class or state relations. Instead, trade models should be constructed from the complex base of verifiable trade data and the associated international trading structures.

2.2.1 Mercantilism and economic nationalism[1]

Mercantilism is the forerunner of economic realist ideology or economic nationalism (Barry Jones 1986). It is based on the experience of the 16th-18th century when trade grew under the control of competing colonial powers. It explains trade as a product of the state and its security objectives. Security was based not only on military strength, but also on industrial self-sufficiency and the wealth and security of citizens. Policies were defined in nationalistic terms with the dual objectives to increase national power and wealth.

Trade was designed to create an excess of exports to facilitate the accumulation of wealth (historically in the form of precious metals). To achieve this end, domestic industry was promoted and imports restricted by tariffs and other measures (Viner 1958). Industry was regarded as superior to agriculture and self-sufficiency in industry was essential for independence. This industrial protection argument was articulated and promoted by Hamilton [1791] and List [1841]. The German Historic School was strongly influenced by List and argued for the protection of 'infant' German industry from cheap UK imports. The military importance of major domestic industries was also recognised as an important reason for their protection (Sen 1983).

The influence of mercantilism extended beyond the 16th - 18th centuries. Neo-mercantilism draws directly from mercantilist ideas of state action to control commerce, but many other terms have also been used to describe aspects of this body of thought. Economic nationalism, statism, protectionism, neo-mercantilism, new protectionism have all been used to describe state-based action to gain advantage through trade. States are the central actors in this ideology and employ a range of protective tolls, tariffs, subsidies, licenses, and regulations of access to promote their position. These policies have been shown by economic historians to have dominated the trading relations among nations throughout history. Rivalry among Greek city states and Mediterranean centres were followed by northern European rivalries (Lovett 1988). In each case a series of policies were used to enhance the revenue or trading position of each state.

The primary objective of each state was to increase its wealth and power relative to that of other states. Policies which reduce the total gains of free trade to both parties are thus justified by the criterion of relative gain to the state implementing the policy. This quest for relational power implies that trade is a zero-sum game with the gains of one party being achieved at the expense of the other. The result of such a system is conflict.

The incentive to implement neo-mercantilist trade policies is an uneven outcome from unrestricted free trade or liberalism. The assumption that all parties are equal in a market is rejected on the basis that wealth tends to become more concentrated in particular areas and with selected groups. Monopoly rents, economies of scale and other distortions enable these unequal outcomes to arise. Dependency or power relations develop between weak and strong economies. Given this unequal division of the benefits of increased trade, states may intervene to promote their position. The resulting economic nationalism can be defensive, aggressive, or somewhere between these two extremes. A defensive position or 'benign mercantilism' is the minimum level of state action required to preserve the security and survival of the state. At the other extreme aggressive or 'malevolent mercantilism' regards the international economy as an arena for expansion and national aggrandisement as in the case of Nazi Germany (Gilpin 1987:33).

The range of economic nationalist policies used to support domestic industries received renewed attention in the 1980s among the world's largest trading countries; USA, Japan and Europe. Although tariffs had been reduced through series of multilateral negotiating rounds under the GATT, the use of non-tariff barriers to trade increased. These interventionist policies follow the pattern of old mercantilism and indicate the revival of older models of gaining national advantage from trade. Lovett (1988) and Gilpin (1987) illustrate many of the protective trade policies in use. These trade instruments will be illustrated by the industrial policies advocated by the Japanese bureaucracy and implemented by industry (chapter 5). They provide a prime example of neo-mercantilist policies in action.

The growing attention paid to the role of the state in promoting or limiting trade is demonstrated by the 1989 start to negotiations for the Structural Impediments Initiative aimed at reducing the $50 billion annual trade deficit between the USA and Japan (Economist 1989.9.9). This illustrates that:

> 'states seek to protect themselves and limit the costs to themselves and their citizens. The struggle among groups and states over the distribution of benefits and costs (of trade) has become a major feature of international relations in the modern world.' (Gilpin 1987:24)

2.2.2 Liberalism, free trade and factor endowment

Liberalism, or economic liberalism, forms the basis of mainstream economics and includes the classical and modern theory of international trade. This body of literature is sometimes called neo-classical economics to recognise the developments since classical free trade theory was established. Like mercantilism, it is an ideology which has been developed over time. Liberalism began as a reaction by Adam Smith and David Ricardo to the prevailing mercantile system. Rather than have an international economic system distorted by state objectives, they advocated a free market based on economic efficiency. Smith [1776] explained that everyone would benefit from a market where 'the invisible hand' established a market price at the equilibrium created by balancing supply and demand. Individuals were able to make efficient trade-offs in choosing between goods by using the price mechanism. In this way, they maximised their individual utility or well-being. Improvements in efficiency increased total wealth and everyone was better off. The gains made in local markets applied equally at the international level as unrestricted markets were proposed as the best means to govern trade.

Ricardo added a new dimension to the free trade theory by demonstrating that the benefits of trade came not only from absolute advantages, but also from 'comparative advantage' within national economies. Each country should specialise in the production of goods which it is most efficient in producing, even if another country has an absolute advantage in producing those goods. The benefits of trade are shared because factors of production in both countries are used more efficiently than if no trade took place. An equilibrium is established between the countries based on the concept of reciprocal demand as explained by Mill [1848]. This result predicts harmonious relations among trading states in contrast to the rivalry predicted by economic nationalism[2].

The classical theory of international trade was extended in the 20th century to become the modern or neo-classical theory of international trade by linking comparative advantage to domestic factor endowments. The Heckscher-Ohlin theory of trade recognises differences in national factor endowments and predicts that countries will export goods which are relatively intensive in their abundant factor (eg. labour or capital). Heckscher (1949 translation [1919]) proposed the factor-endowments theory and Ohlin [1933] further developed and elaborated the theory. The theory is based on the comparative advantage of countries being derived from their factor endowments. In short, countries with abundant labour will specialise in labour intensive industry while those with abundant natural resources will specialise in resource industries. Changes in these endowments over time (ie. international labour mobility, skill acquisition, and capital accumulation) and the resulting change in trade patterns have been studied through the construction of general equilibrium models (Haaland, Norman, Rutherford and Wergeland 1988)[3].

2.2.3 Marxism and dependencia

The writings and ideas of Karl Marx have given rise to a wide range of theories and literature generally called Marxism or radicalism. The distinctive feature of Marxism is its use of class as the basic unit of analysis. Capitalism is seen as an economic system where one class owns the means of production (capital) and another (labour) provides the work to produce goods[4]. The value of a good was precisely equal to the labour time necessary for its production (labour value). Since the subsistence value of labour (that necessary for his/her maintenance) was less than the price the product was sold for, the capitalist was able to extract the difference, or surplus value of the good, as profit. This enables capital accumulation to take place. The conflict between classes arises from the capitalist accumulation of wealth (surplus value) from goods created by the work of labour.

The capitalist system is no longer the neutral provider of benefits to all as portrayed by liberalism. Instead, it creates conflict among classes within an economy and this conflict is extended into the international community by trade. Trade thus becomes a means to extend domestic capitalism and further the unequal allocation of wealth. In isolation, a capitalist economy suffered from the over-production of goods (because labour was not paid enough to afford to buy them) and a falling rate of profit (because the most profitable investments were made first) (Marx [1867]). Both of these problems are overcome by capitalist economies becoming colonial powers.

The colonies offered new markets for the sale of excess goods, sources of cheap raw materials and opportunities for profitable capital investments. This expansion of capitalism is based on unequal relations among classes and countries. Lenin (1933) termed this process, imperialism. Underdevelopment is created where the economic structures of capitalism cause the terms of trade for developing countries to deteriorate or remain unequal (Amin 1976). This model of development has been termed dependencia and is strongly supported by many Latin American scholars (Gunder Frank 1978). The result of the expansion of the capitalist system and international trade is uneven development and conflict among countries and classes.

The great contribution of Marx's analysis was not the labour theory of value which was shared by other classical economists like Ricardo. Instead, it was his exposition of the process of capitalist accumulation and use of surplus value. These structural insights formed the basis of much subsequent research and radical theory.

2.2.4 Intra-industry trade and transnational corporations

> 'There is a pressing need to integrate the study of international economics with the study of international politics to deepen our comprehension of the forces at work in the world.' (Gilpin 1987:3)

Each of the three ideologies outlined above failed to predict the major changes in the international trading system experienced during the post war expansion in trade. Two of the most important changes were the rise in intra-industry trade among developed economies and the rapid growth of transnational corporations. The dominant ideology governing trade during this period was an extension of the liberalism described above. Global trade was to move toward the free market ideal via an international system of rules to govern conduct and reduce tariffs (the General Agreement on Tariffs and Trade, GATT). The dominant neo-classical theory of trade is thus taken as the reference point from which new trade theories are developed.

Instead of experiencing increased specialisation and inter-industry trade as predicted by comparative advantage theory, the rapid expansion of trade in the 1960s-1980s was based on the simultaneous increase in exports from most industries (Balassa 1967; Grubel and Lloyd 1975). Cars, computers, components and machinery were exchanged among developed countries. The gaining of economies of scale (increasing returns to scale) and product differentiation provided an independent basis for trade from comparative advantage. The mobility of factors, especially capital, proved complementary to intra-industry trade.

The existence of scale economies, product differentiation and imperfect competition usually leads to trade studies based on partial equilibrium rather than general equilibrium. These models calculate a new equilibrium for the industry under study, in isolation from changes in the rest of the economy. The trade literature thus features industry specific models constructed in accordance with existing trade patterns rather than the abstract concepts of comparative advantage (Haarland et al 1988, Helpman 1984). This partial approach to trade studies by concentrating on a single industry will be explained in further detail when coal trade models are reviewed later in this chapter.

The intra-industry trade (IIT) model explains the divergence between the neo-classical model and post World War II experience in the trade of manufactured products (MacCharles 1987). It also has implications for resource trade because of the increased research into the role of transnational corporations (TNCs) in international trade[5]. The behaviour of firms is recognised as being of direct importance to the model and the advantages conferred in international marketshare by 'first mover decisions' are shown to be a significant determinant of success. The IIT model introduces firm-specific advantages to explain the role of transnational corporations (TNCs) as prominent international traders. Each company is a single entity which owns and manages economic units in more than one country. Definitions and the structure of these companies vary, but control is generally exercised from a central headquarters in the 'home' country over the branches in 'host' countries.

A substantial proportion of intra-industry trade thus takes place among the international branches of transnational corporations (MacCharles 1987). This intra-firm trade has lead to the recognition of new determinants of trade like the corporate promotion of brand names, marketing of differentiated products to maintain marketshares and the creation of barriers to restrict the entry of new producers. The role of large international producers is recognised as an important feature of international trade. The accurate measure of the amount of intra-industry trade which is conducted internally within transnational corporations is difficult because of limited reporting by firms. Despite the limitations of data, intra-firm trade in the 1970s was estimated to account for 70% of USA exports and 75% of UK exports (Strange 1988:173; Meyer 1978). Other studies suggested that 25% of global trade in manufactured goods was among international branches of integrated companies (Watts 1987). Transnational corporations are thus major actors in inter-industry trade where resources, goods and services are exchanged across national borders, yet within the same company (Taylor and Thrift 1982). Under these circumstances, trade becomes a function of transfers within vertically integrated companies and only follows the pattern of integrated specialisation predicted by neo-classical economics to the extent that the companies' assets follow the same pattern.

The importance of transnational corporations is well established by their prominent position in trade. However, the explanation of this phenomena is different for each of the three ideologies described above. Economic nationalists see TNCs as extensions of the interests of the state in other countries (despite conflicts between companies and home government policy) and are a measure of the power of the home state (Gilpin 1975). Liberal economists did not predict the emergence of large TNCs because the standard market model is based on the participation of many suppliers and consumers. Given that TNCs play such an important role in trade an explanation for their emergence was based on the identification of firm-specific advantages like brand names or market familiarity and control over technology or information. In contrast, Marxists often point to the role of TNCs in extending the conflict between capital and labour into the international arena.

Rather than examine these companies from one of the three ideological positions outlined above, this study argues that TNCs are better understood in terms of their relation to the four primary structures of international political economy (security, production, finance and information). The contribution of TNCs to the international production structure has received wide recognition and study. However, TNCs also have important implications for the political and economic security of both host and home countries. They have a major impact on international finance as diversified and often low risk borrowers from international financial institutions. The fourth structure, information, is also central to the role of TNCs as they are able to control market information, technology and other specialised information to use to their advantage in various national settings. The complementary study of these four structures thus provides a more complete understanding of TNCs and their role in the international economy than the focus on any one dimension alone. A similar four-sided approach is outlined below to study the international political economy of the global coal trade.

2.3 International political economy and primary structures

> 'The parallel existence and mutual interaction of "state" and "market" in the modern world create "political economy"... The relationship of state and market, and especially the differences between these two organising principles of social life, is a recurrent theme in scholarly discourse... For the state, territorial boundaries are a necessary basis of national autonomy and political unity. For the market, the elimination of all political and other obstacles to the operation of the price mechanism is imperative. The tension between these two fundamentally different ways of ordering human relationships has profoundly shaped the course of modern history and constitutes the crucial problem in the study of political economy.' (Gilpin 1987:9-11)

This study argues that the analysis of the international political economy of trade should contribute to the knowledge of scholars from any of the major schools of thought, despite its lack of conformity with a single ideology. The relative importance ascribed to markets, state objectives or class conflict can each be better informed by a detailed evaluation of trade patterns and processes. To organise such a study it is necessary to have a meaningful framework which relates the structures and processes in society to the trade patterns observed. Most political economy models are based on the tension between economic and political forces as represented by markets and government. Rather than restrict this study to such a two dimensional model, the complexity of trade is presented through a four dimensional framework. The structural approach is adopted to investigate the importance of the security, production, financial and information structures (Strange 1985, 1988). These four 'primary structures' are selected because of their dominant role in determining international political economy in general and trade in particular.

There is a need to merge the ideas and methods of individual disciplines. The state focus of international relations, the market focus of economics, the spatial focus of geography and contractual/regulatory focus of trade law each need to be broadened and integrated (Rees and Odell 1987). To achieve this integration, Strange proposed that the central feature to incorporate in IPE research is the study of structural power.

Structural power is the ability (unevenly distributed throughout the system) to shape the basic structures of production, security, finance and information (Strange 1988). Its study is absent from most IPE work, with the exception of Marxist studies which largely confined their research to structural power in the production structure. Strange (1988) extended this argument and declared that trade is dependent upon each of the four primary structures. Rather than regard trade as the outcome of unimpeded supply and demand, a complex and interlocking network is recognised. Political bargaining over access to markets, corporate decisions regarding secure as well as profitable sources of supply, and unequal access to finance and information all affect trade patterns.

The bargaining power exerted over trade through these structures is argued to be more important than the international trading regimes and international organisations normally studied. The current regime thus reflects 'the interests and bargaining power of the most powerful states on the conduct of the most effective traders' (Strange 1988:162). To gain a better understanding of trade, the security, production, financial and information structures each need to be studied to determine its individual effect and their combined impact on trade. The result of such studies should be an improved explanation of the uneven experience of trade participants.

2.3.1 The security structure

The security structure includes the military alliances and conflicts which promote or prevent trade flows. In the case of coal, the trade flows among the traditional blocks of countries in Eastern and Western Europe are comprised largely of exports from the east to the west. These exports are stimulated by the need for western currency, but are limited by the growing level of demand within the planned economies. Trade flows are also prevented by political decisions. Taiwan cannot import coal directly from the Peoples Republic of China so shipments need to be arranged through third countries like Hong Kong. Similarly, South African coal is prohibited from being imported by several European countries (SOMO 1989a).

The trade impacts of security objectives also arise from the promotion of military related industry in every industrial power (Sen 1983). Both domestic and secure international resources are integrated into a trading system to support military objectives. As part of this security system, priority is given to domestic industry and sources of fuel. The coal industries of Germany, UK, Japan, Belgium and other countries have been protected from international competition for decades as part of this arrangement (IEA 1988).

Security structures also extend to the security of the economic welfare of citizens. The state plays the dominant role in defining these security objectives and trade is influenced both indirectly and directly. In the 1970s, security issues were redefined in the USA and other countries to include energy security. Concern over oil supplies lead to the promotion of nuclear energy in the 1970s. The second oil shock stimulated an emphasis on coal as 'the bridge to the future' when new fuels were to come on stream (Ezra 1979,1980; Landsberg 1979; Wilson 1980a,b). In the 1990s issues of environmental security are assured a higher profile and studies of energy systems, including coal combustion, will need to investigate the sustainability of their impact on the environment.

Other examples of the importance of energy to security include historic disputes over access to coalfields in Europe and the 1987 initiatives to protect oil supplies by reflagging Kuwaiti tankers to ensure military protection by consuming countries (Strange 1988:186-190). The varied and complex interaction among importing states, exporting states and oil companies was demonstrated with the oil embargoes, expropriations, and oscillations in production and trading relations in the 1970s and 1980s (Odell 1986). Coal was included by the world's political leaders as an essential component of secure energy supplies in the 1980s (IEA 1982). Predictably, it has been included as part of the energy portfolio of most major oil companies. This raises the question of links between the security and production structures.

2.3.2 The production structure

The production structure is the primary structure which creates wealth and includes all of the arrangements that enable production to take place. It provides the base of all political economy and is the most extensively studied of the four primary structures. Conventional economists and Marxists alike have focused their attention on production. In the first case, the emphasis is on markets for the exchange of products and the promotion of economic efficiency and competition through the division of labour and promotion of specialisation. The Marxist studies concentrate on the production structure as the means by which the capital class systematically extracts surplus value or profit from the work of the labour class. This process has simply been extended from the national to the international scale. The studies of TNCs and intra-industry trade described earlier are also concerned mainly with the production structure. The result of all this investigation is a very large literature from a variety of perspectives. Valuable insights have been gained, but it is argued in this thesis that a more complete understanding of trade can only be achieved by recognising the role of other structures as well.

The current production structure has been shaped by the emergence of capitalism in North West Europe and its dynamic spread over most of the world. Even the centrally planned economies (CPE) are connected to the structure through their participation in international trade and their integration may accelerate in the 1990s. The structure has been reshaped through the internationalisation of production from its earlier national base. The rise of transnational corporations is only one expression of this change in the production structure whereby international structures have been constructed to replace independent national production structures in importance (Strange 1988:62-65).

2.3.3 The financial structure

The financial structure has two important elements. First it comprises the ability to create credit where power is shared between the state and banks. Second, it includes the establishment of exchange rates for currency exchange where power is shared by the state and markets. The capital markets of the world are closely integrated and provide strong connections between national elements of the financial structure.

The ability to create credit is a primary source of power in the international arena because it frees new investment in the production structure from the accumulation of past surplus value or profits. This is an important development which relaxed the tight linkage between production and financial structures when most investment was made by companies investing their profit in new ventures or using corporate loans to extend their production. In the coal industry, the shift from production to finance based structures as the source of new investment is well demonstrated. The old pattern of steel mills and electricity companies investing in mines to supply their coal needs (as part of a vertically integrated production structure) changed to the new pattern of project development where several parties take equity interests, but most of the investment is raised from project loans (financial structure) rather than equity capital.

The ability to create credit also creates discretionary power so that finance is made available to some actors in larger amounts and on better terms than to others. Developed countries and large corporations are likely to have better access than developing countries and small companies. Risk assessment is important and a preference may be made for capital intensive, low risk projects, like Alaskan/North Sea oil facilities or northern Canadian coal mines, over low cost, high risk investments in other countries (Strange 1988:88-91). Risks of changes in exchange rates also need to be taken into account. The denomination of loans in yen, dollars or other currencies can have a major impact on the allocation of exchange rate risk for repayments in the future. If loans are valued in yen, coal prices set in dollars and production costs based in a third currency, the viability of a project can vary markedly with exchange rate fluctuations.

The financial structure thus provides a related, yet distinct structure to the well recognised security and production structures described above. A growing literature has emerged to recognise the importance of this structure and its central role in the international political economy.

2.3.4 The information structure

The fourth primary structure is that of knowledge and information. It has received far less academic inquiry, yet is argued in this study to be equally as important as the first three structures. The knowledge structure can be divided into three levels: beliefs, knowledge/information and the channels of communication. As in the case of the financial structure, power in the knowledge structure is important in both the negative and positive direction. The decision to withhold or restrict information and knowledge is just as important as the positive decision to provide information (Strange 1988:115). The use of this structure is more difficult to quantify than the extension of credit or the approval rate for loan applications. For example, the supply and transfer of technology is one important measure of the knowledge structure in action. Even in conventional open cut coal mines, computer based systems can increase the productivity of workers and equipment.

The three tiered knowledge structure can undergo four types of associated change. First, the perceptions and beliefs which underlie value judgements and political/economic decision making can change (at the belief level). Second, the type of use of information channels, like language or annual reports, can change (at the information level). Third, the provision of and control over information can change (at the information level), and finally the channel itself can be changed in terms of technology or access (at the information channel level). The final two types of change are considered independently because they operate at different levels of the knowledge structure and are each important in the study of trade information[6].

The change in information channels has received the greatest amount of attention of the four changes identified. The increase in satellite communication and the exponential growth of computer based information systems and information storage are well known. However, information systems and channels also include trading houses and these play a central role in the distribution of trade information. The control over the information transferred has been given much less attention and this study will argue that the private control of information is one of the more important types of power in determining trade patterns.

Although information is rarely priced, the acquisition of information and its treatment as a private rather than a public good is important. Indeed, information may be transferred from private to public hands, but still hold significant value for the short, yet critical period when trade agreements are reached. The role of information is thus considered by this study to be of central importance to the determination of trade patterns. This hypothesis stands in contrast to the classical economic assumption of perfect information.

Given the relatively small amount of attention paid to the role of information in trade formation, this study offers a significant contribution by making a detailed evaluation of the role of trading houses as information channels. The importance of information is shown in its applied role rather than as an aggregate indicator of a new 'information era'. Information is not studied or valued in isolation. Instead it generates value by being integrated with the other three primary structures of security, production and finance. A more complete understanding of trade is thus generated by highlighting the role of information and its linkages to other international structures.

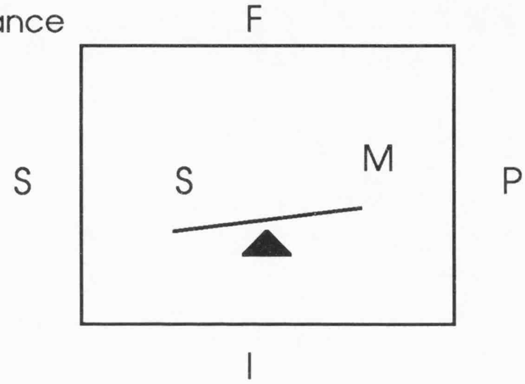
In addition to verifiable information and its communication channel, changes in beliefs can also be important for trade. Expectations about the future can change, not only on the basis of a known trend, but also as the fulfilment of dominant expectations. The role of forecasting and reliability of beliefs can also be examined as part of the knowledge structure.

Each of the four primary structures described above interact with the others. The measure of relative importance may be difficult because of these interactions. However, changes in the relative power of actors using these structures may be less difficult to identify because of reinforcing connections among the structures. Equally important will be conflicting changes where a positive change in one structure is offset by a negative change in another. Such comparisons should provide a more detailed insight into the influence of structural power on trade patterns than the single minded emphasis of any of the three ideologies outlined at the start of this chapter.

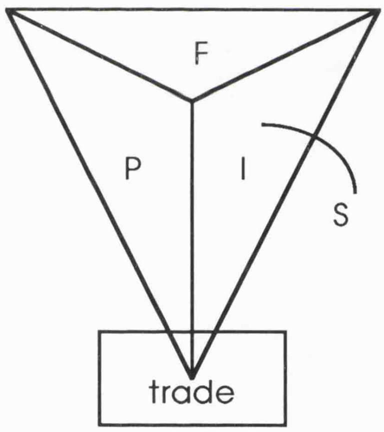
The pyramid of interaction illustrates how the four structures interact with each other to shape the international political economy (Figure 2.1). For example, the role of the information structure can be seen as linked to the other three structures. Each interaction will be considered in the chapters which follow. This identification of the primary international structures provides a broad framework on which to build a new analysis of international coal trade. However, these broad structures need to be complemented with a detailed understanding of the trade process if strength is to be added to the above model. This study provides internal strength through the provision of micro-level transaction data to fill in between the structures outlined above. Like the combination of concrete and steel in construction projects the result will be a better building than either would provide alone.

Figure 2.1: The IPE model of four primary structures

A. Balance



B. Pyramid



structures - S = security
P = production
F = financial
I = information

balance - S = state
M = market

Source: adapted from Strange 1988: 27

2.4 Conventional market structure studies

2.4.1 Definitions

The term 'structure' is used frequently in this text and the literature to which it relates. Indeed, the term is used so frequently, that it is rarely defined. To avoid confusion over terms this section contrasts the above definitions of the four primary structures (security, production, finance and information) with the definition and study of conventional market structures.

Studies in market structure generally equate structure with the number of firms active in a particular market and then consider what influences this number (eg. barriers to entry) and what behaviour is representative for a particular market structure (Stiglitz 1986). The common meaning of the term is worth noting to contrast the simple definition of market structure with the more extensive description of the four primary structures of international political economy presented earlier. Structure means the 'supporting framework or whole of the essential parts of something' (Concise Oxford 1964:1279). The 'whole of the essential parts' extends beyond the simple number of firms participating in a market, hence the need for detailed investigation into the components of the security, production, financial and information structures which influence trade. This section will explore this extension by briefly reviewing some of the literature relating to conventional market structures and their associated behaviour.

2.4.2 Competitive structure

The conventional structure of markets assumed by most trade models is that there are many producers and many consumers. Each actor has no influence over the price and acts as a price-taker. The price at which the market clears is determined by the marginal cost of supply equalling the marginal value of demand. Variations in price are caused by short term imbalances between demand and supply.

However, the functions of supply and demand represented in trade models are not necessarily independent as assumed in the competitive model. The characteristics of a competitive commodity market are examined in more detail in chapter 3 to enable a comparison to be made between the actual international coal trade pattern with its prevailing prices and that predicted by a perfectly competitive market.

To measure the degree of competition in a market, measures of industry concentration are usually made in terms of the marketshare controlled by the largest 4 or 8 firms. While these measures identify changes in industry composition over time or between markets, they are inadequate predictors of market behaviour. A range of models have been put forward to explain market behaviour under different levels of concentration.

2.4.3 Monopoly and monopsony

> '(T)he economists's interest in imperfect competition on resource markets is based on real world evidence.' (Withagen 1985:29)

The failure of international markets to perform as predicted by free trade theory led to the study of monopoly and oligopoly theory. In contrast to the many small firms operating in a competitive market, a monopoly consists of only one supplier. To maximise their profit, monopolists restrict supply (relative to a competitive market) until their marginal cost equals marginal revenue from the industry demand curve. A higher price for the good results and the monopolist gains the monopoly rent from this market structure. However, where other products act as substitutes for the good in question or other special conditions are met, the optimal pattern for the monopolist can approach that of a competitive market structure (Stiglitz 1986).

Unlike markets dominated by a monopolistic supplier (which have received detailed attention as indicated above), those with monopsonistic characteristics (a single buyer) have been given little attention. Anderson (1987) suggests that this lack of attention to monopsony is due to the bias that the consumer should benefit from market transactions. This bias has not been accepted by those interested in producer groups. Robinson (1987) articulates the economic concerns about monopsony in her study of commodity exports from less developed countries which are controlled by a single, or small group of, importers or processors based in the developed countries. The result is a transfer of the benefits of trade to developed countries and a continued decline in the terms of trade for less developed countries.

2.4.4 Horizontal integration and oligopolies

Given that the exercise of market power where numbers of suppliers are small can influence trade volume and price, the options for oligopolistic behaviour need to be considered. The number of suppliers may be small because of horizontal integration which combines many production units within a single corporate entity or because of factors like economies of scale or specialised technology which promote large scale operations and restrict entry. The behaviour of firms in such imperfect markets has been modelled with the Nash equilibrium being one of the best known solutions to cartel formation. In this case, it is assumed that the gains to each member are maximised and no side-payments are made. However, this solution is not unique and if other strategies are adopted, then a different solution will result. The range of options can be limited by cooperative cartel action, but no single behaviour strategy can be predicted.

Alternatively, oligopolies may act in non-cooperative ways where individual actors seek to maximise a particular objective. In the Cournot model, oligopolists decide their level of output based on the assumed output levels of their opponents. A Nash equilibrium can be calculated for such a model and is known as the Cournot-Nash equilibrium. By examining prices instead of output Bertrand suggested a similar model. The assumption that other producers had fixed levels of output was relaxed by Stackelberg who showed how other producers might react to oligopolists'decisions. These reactions were considered to form a reaction function by Bresnahan (1981).

Many insights into the theoretical performance of these market structures and alternative behaviour patterns were developed in relation to resource trade questions following the OPEC cartel's success in raising the price of oil in the 1970s. Simplified models were constructed where a cartel and fringe suppliers interact in a resource market. Questions about the effect of market structure on price, the order of exploitation of resources and the distribution of benefits among producers were addressed.

Initial oil industry studies (Salant 1976; Pindyck 1978) assumed a Nash-Cournot behaviour pattern where the behaviour of each participant was not affected by the behaviour of others. In this case, the cartel takes the supply from the fringe as given and sets the price to maximise its discounted profits. The result is simultaneous production by both groups of producers until the fringe exhausts its resources and the cartel then becomes the sole producer. Prices start higher than under a competitive market structure and the producers gain more benefits from the trade (at the expense of consumers). However, the derivation of the Nash-Cournot equilibrium is based on many assumptions. When the assumed identical revenue and cost structures of the two groups of producers are changed, the sequence of exploitation also changes (Ulph and Folie 1977, 1980).

Behavioural assumptions can also be changed. The Stackelberg equilibrium was considered a better model because it permitted strategic behaviour where the cartel could take into account the reaction of the fringe to its announced production schedule (Gilbert 1978). In this model the fringe is assumed to recognise the market power of the cartel and takes its supply schedule as given. A supply schedule is again derived and price paths assessed. A problem arises however, because 'dynamic inconsistency' creates an incentive to change from initial production schedules (Newberry 1981). If binding contracts were not made to ensure compliance with production schedules, the cartel will be tempted to change production levels when the fringe is depleted to maximise its discounted flow of profits (Ulph and Folie 1977, 1980). Unique solutions can be derived from either the Nash-Cournot or Stackelberg models. However, they are defined by strict assumptions and the relaxation of these assumptions or the introduction of uncertainty makes the model indeterminate with more than one outcome possible. Coal market studies considering such oligopolistic behaviour are reviewed later in this chapter.

2.4.5 Vertical integration

An alternative market structure is the vertical integration model where the production and consumption functions are contained within a single enterprise. Perry (1987) defines a vertically integrated transaction as one where either the entire output of a firm is used by a single firm or the entire input of a particular good is acquired from a single firm. In addition, these transactions are internalised by a single company owning or controlling the neighbouring stages of production or distribution. Other studies relax Perry's first assumption and consider a vertically integrated transaction to be one which takes place between two units of the same corporate entity. Some measure of control or coordination is assumed although the measure (i.e. 50% ownership) varies from study to study.

Transactions within the vertically integrated company replace market or contractual transactions and are administered by an internal hierarchy as explained by Williamson (1975, 1986, 1988) in the transaction cost literature. The objective of the vertically integrated enterprise is assumed to be the maximisation of profit (and reduction of risk) over the whole operation rather than rely on the profits from a single function[7]. This may be achieved through the reduction of transaction costs or improved efficiency from the coordination of both operations. Coal consumers like the mills, electric power companies and even cement companies in Japan have invested in overseas coal mines. This type of integration reshapes the production structure of the coal industry and will be examined in chapter 6.

2.4.6 Quasi-integration

In addition to the complete integration of two or more units within a single corporation, various forms of quasi-integration are possible. Vertical 'quasi-integration' was defined by Bloise (1977) to recognise special trading relationships between firms in neighbouring stages of production or distribution where all of the product of one firm is supplied to or consumed by the other. Equity investments, loans or loan guarantees, leases or real estate, long term contracts and capital or inventory credits have all been used as forms of quasi-integration. In the study of the Japanese coking coal trade, D'Cruz (1979) identified four forms of quasi-integration (partial equity linkages, long term loans, long term contracts and logistical linkages) for investigation.

> 'These linkages result in a closer than arm's-length relationship between the parties, a relationship intermediate between that which exists among independent buyers and sellers and that among divisions in a vertically integrated firm.' (D'Cruz 1979:1)

The detailed investigation of these various forms of quasi-integration as part of the structures which shape coal trade will be presented and evaluated in later chapters. Existing coal trade models based on simple market structure assumptions are examined first.

2.5 Coal trade models

2.5.1 Comparative advantage and resource endowment

> 'The most obvious factors that explain a good deal of international trade are 'natural resources' - land of different quality, mineral deposits, etc. ... While it is easy to explain why Kuwait has a 'comparative advantage' in oil, Bolivia in tin, (Australia in coal), etc., the existence of natural resources presents the economist with certain theoretical complications' (Haberler 1977:4)

The appealing simplicity of comparative advantage in natural resources as the model to explain resource trade has been proposed and refuted. While early descriptive trade studies and locational models followed this approach, later studies became more sophisticated. The evolution of these studies is illustrated by starting with the classic work of Jevons (1965 [1865]) and Chisholm (1980 [1889]). Jevons was concerned about the exponential growth in coal consumption and coal trade following the introduction of free trade laws in the 1840s. Given a finite endowment of coal, he calculated how long economic growth could continue before coal became prohibitively expensive because of the depths from which it had to be mined. Discoveries of new deposits, changes in technology and competition from other fuels have changed the actual pattern of trade and consumption from that calculated.

In contrast to the classic resource problem posed by Jevons, Chisholm presented a simpler description of global commerce which was revised 20 times over the next century (see also Stamp 1947). His 'Handbook' included substantial sections on resource (including coal) production and trade. The pattern of trade flows from production at scattered resource deposits to consumption in centres of population and industry provided useful overviews of global trade. These descriptions of trade patterns implicitly adopted a comparative advantage and factor endowment view of trade.

To improve these studies, the complexity of natural resources themselves needed to be recognised. Natural resources are much less homogeneous than labour and capital because of their chemical complexity, geographic location, depth of deposit, and other characteristics (Haberler 1977; Rees 1985). Production functions can not be assumed to be the same, or even homogeneous (constant returns to scale). The production of the same resource may be capital intensive in one country and labour intensive in another. Technologies vary in both distribution and suitability.

Brookfield (1977) responded to the comparative advantage explanation of resource trade by claiming that even if it explained the international pattern of the extraction industry, it certainly failed to explain the pattern of the processing industry. These were a product of the interdependent, yet uneven development process (Brookfield 1976). Resource endowment simply creates the opportunity to participate in resource trade, it does not imply the ability to mobilise other factors (ie. capital, technology, infrastructure, and specialised skills) required to achieve the opportunity (Radetzki 1990; Rees 1985). The simple economic model overlooks the need for all four primary structures to be coordinated to enable trade to happen.

One of the first groups of models used to explain the coal trade is the locational models. These models were first suggested as the basis of a unifying trade theory. However, their simplifying assumptions soon led to models conflicting with reality and the need for more complex models was recognised. In these location models, coal was incorporated as one of the inputs into the steel industry - the typical subject for this type of study. The increased complexity and sophistication of locational models provides a parallel for the changes required in coal trade models. Simple cost (extraction plus transport) based models need to incorporate the complex reality of international political economy to accurately depict actual trade flows. Trade is not created by abundant resource endowments alone.

2.5.2 Locational models - coal as an input to industry

> 'the theory of international trade is only part of a general localization theory' (Ohlin 1933)

> 'one can view trade theory and the general theory of location and space economy as synonymous' (Isard 1956:53)

Location theory and space-economy models recognise the geographic distribution of inputs to and outputs from production as well as the geographic variation in costs and prices. This complex system is usually restricted to special cases. For example, the general equilibrium theory is based on assumptions of zero transport costs and perfectly mobile inputs and outputs. Similarly, classical trade theory is a special case of location theory drawing broad generalisations from a restrictive set of assumptions in the two country by two commodity by two factor model. Rather than focus on such restrictive assumptions, location theory has extended the range of factors included in its models to explain the observed locational pattern.

This increasing sophistication is demonstrated by steel industry studies. The theoretical basis of most of the steel industry studies was the general theory of industrial location based on Weber's work on the transport of localised raw materials (Weber [1911] translated by Friedrich 1929). Weber pointed out that classical trade theory ignored transport costs. To overcome this deficiency he introduced a material index (based on the weight-losing properties of raw materials in the production of finished products) to enable optimal locations to be calculated on the basis of transport costs and the change in weight during processing. This cost minimisation model would then yield an optimal location based on transport and factor costs.

At the national level, steel industries symbolised industrialisation and were the subject of many descriptive and analytical studies (White 1929; Hartshorne 1929; Erselcuk 1946; and Brush 1952). Fewer studies developed general hypotheses of the role of material transport (coal and ore from mine to mill and steel from mill to market) as an explanation of plant location (Hartshorne 1928). Trade was included as a simple extension whereby Canadian or Brazilian iron ore was transported as an input to the American industry.

Changes in technology, markets and material reserves were recognised as important influences on steel industry location (Isard 1948), but the inertia of sunk capital and limited mobility of skilled workers were shown to reduce the incentive to change location (Rodgers 1952). Location studies became more sophisticated as Isard (1956) considered transport costs to be just one of many inputs and Smith (1966) recognised the importance of economies of scale and technology. Many other factors like access to information, plant extensions and government policy also became incorporated into models attempting to explain the location of industry and the resulting trade of products (Markusen 1986).

An important technological feature underlying this evolution in location theories away from transport-based models was the decreased relative cost of transport. By the 1960s proximity to resources was virtually disregarded as a locational factor for steel mills. Instead, the priority was to have large scale, low cost processing at a coastal centre where resources could be imported cheaply from distant mines by large bulk carriers (Warren 1985). The Japanese, South Korean and Italian steel industries demonstrate this shift. The evolution in location studies illustrates a path which resource trade studies need to follow. Initial descriptions and emphasis on a single feature are recognised as inadequate. The structural approach which links four primary structures as the basis of international trade provides a way forward.

2.5.3 Coal and transport costs

The cost of transport remains important to coal trade because of the weight of this bulky commodity. Although coal was being shipped from Newcastle in the early 1600s, the cost of transport was such that even in the early 19th century, industry was often located next to the bulky fuel which was consumed by the steam engines in the mills.

> 'Coal being bulky and heavy, the raw materials of manufacture were at first carried as near as might be to the pit mouths and the workers were gathered into towns round the collieries. Cotton could be brought to the coal with much greater ease than coal could be taken to the cotton' (Mackinder 1902).

The development of canals and steam locomotives reduced the cost of transport and coal was soon being transported to industrial sites in ever greater quantities. This pattern of coal transport was not restricted to the national economy. The British coal trade grew quickly in the late 19th century with annual exports rising from 8.5 million tonnes (mt) in 1861-65 to an average of 88mt in 1909-13 (Jevons 1915; ILO 1938). By 1900 coal was considered 'the one great ballast cargo which Britain sen(t) to the outer world in return for such massive imports as wheat, timber and iron ore'(Mackinder 1902:329). Coal was thus not only the fuel which powered the industrial revolution, ocean transport and the spread of industrialisation, it was also one of the principle commodities of international trade. The advantage of carrying coal in one direction and other commodities, like timber, in the other is that it reduces transport costs.

Transport costs remain a central issue in the coal trade with half of the value of delivered coal in Europe used to cover its cost of land and ocean transport in most cases. The long haul of Australian coal to Europe and South African or east coast American coal to Asia illustrate this pattern. The abundant supply of bulk carriers in the late 1970s and early 1980s helped to keep freight rates low and promote long distance transport.

2.5.4 The least cost model

> 'There is sufficient free competition in and between the four major exporting countries (Australia, Canada, South Africa and United States) for the price of coal to tend toward long run marginal cost.' (IEACR 1981)

The most common coal trade models are constructed to predict the pattern of trade based on the least cost or economic efficiency criterion. They provide specific examples of the approach advocated by the liberal or mainstream school of economics described earlier. Individual countries are chosen as a unit of analysis for international studies or individual mines for national studies. Most of these models consist of four main components: a supply model, a demand model, a transport model and a linear programming system to connect the other three models (Zimmerman 1981; US DOE 1982; Soyster, Gordon, Enscori and We 1985; Steenblik 1985). Variations arise in the definition and aggregation of coal supply and demand regions. Typically the model may consist of 10 supply regions and 20 consuming regions. Normally each supply country forms a unit with only the largest suppliers, like Australia or USA, divided into 2 or 3 parts in some models. On the demand side, countries importing over 3mtpa usually form individual regions in the model while countries with a smaller role in the coal trade are aggregated into regional units. The reason these larger regions are used is to simplify the model and to reduce computational time in calculating trade flows among all of the actual exporters and importers. The availability of data may also influence the level of aggregation adopted in a particular model.

One of the more prominent international coal trade models is that developed by Kolstad and Abbey (1984). It is used by various industry groups including the IEACR (International Energy Agency, Coal Research). IEACR has sponsored a series of coal studies to better specify the export supply curve of several countries (USA by Barnett 1985a; Colombia by Jamieson 1985; Canada by Jamieson 1986; South Africa by Long 1986; China by Doyle 1987; and Australia by Long 1987). These studies were complemented with studies of the major demand sectors (residential by Macadam 1983; industry steam raising by Holcomb and Prior 1985). Finally, the structure of the market was evaluated by Gaskin (1981, 1983a, 1983b, 1986) in a series of surveys. The model is then run under different sets of assumptions to see what pattern of coal trade results.

The model operates on the basis of the assumptions built into it. For example, the linear programme linking supply, demand and transport modules is usually set to derive a price which results in the consumer surplus being equal to the producer surplus. In this way both groups share the gains of trade equally. Coal trade is calculated for the least cost option which maximises the surplus and creates the most efficient allocation. Forecasts of optimal market allocations have been made using these models. They represent an equilibrium which stimulates discussion and represents the long run expectation. However, such studies are often not published because of the variation between the results and actual trade patterns. For example, the cost of production and transport costs virtually excludes Australian coal from the European market under the least cost assumption. At the same time as such models were being constructed in the late 1980s the Australian share of coal imports jumped. In reality, trade is not based on cost minimisation alone. Other factors need to be considered and are discussed in the next section.

2.5.5 Composite national models

> '(S)uch prominent studies as Steam Coal: Prospects to 2000, prepared by the IEA and the WOCOL study, probably represent a state-of-the-art approach to the noble art of economic forecasting, even though a number of the conclusions drawn by these studies are patently invalid.' (Banks 1985:91)

Given the difficulties in matching a least cost model to actual trade patterns, most coal trade studies and forecasts have adopted a different approach. Most studies base their forecasts on the present and use individual countries as their basic unit of analysis. This country based approach implicitly follows the economic nationalist approach described earlier although this link is rarely acknowledged. The objective is to construct an international model of trade, but the method is based on individual states and either implicitly or explicitly recognises the effect of national policies on coal trade.

International surveys are conducted to determine expected levels of exports and imports (IEA 1978a,1982a,1989a).

One of the most famous of these studies was the WOCOL report published in 1980. Surveys were made to gather national forecasts together and compile an aggregate trend for global coal trade. Steam coal imports were expected to increase five-fold from 60mt in 1977 to 300mt in 2000 (or 680mt in the case of limited oil supplies and delays to nuclear power) (Wilson 1980a:20). Imports of metallurgical coal were expected to double from 130mt in 1977 to 260 in 2000 (or 300mt in the high demand case).

Composite studies are very common, but suffer from problems of variations in the underlying economic circumstances or assumptions of the different national forecasts. This lack of internal consistency and the possibility of double counting where more than one country expects to supply a particular market point to some of the difficulties in these studies. However, they also offer some strengths. This lies in their ability to incorporate a variety of objectives which each country may seek to meet in its trade. For example, if a decision is made to pursue an objective other than least cost, like diversifying supply or reducing transaction costs by buying from the previous year's trading partner, then the results of a least cost model only match the actual trade pattern to the extent that the trade flows meet more than one objective. In the composite national models each nation can set its range of objectives implicitly or explicitly.

Objectives may be set by a government when a country like Poland or China determines its export levels on the basis of desired foreign currency earnings or countertrade obligations. Similarly, exports from less developed countries like Colombia or Indonesia may assume the 'social metal' pattern of producers maintaining output levels despite low prices to protect employment, government revenue and export earnings. Such decisions are not predicted by a least cost model. To incorporate these national objectives into a least cost model, they must be introduced explicitly as part of the linear programme or parameter definitions. Limits can be assigned to marketshares or trade capacities to reflect known objectives. The incorporation of these objectives in an international model can also be approximated by simply using accurate national models in a composite international model. However, problems may remain in the lack of consistency among the national components.

To overcome the limitations of these initial approaches to international coal trade modelling, the assumption of a competitive market structure was relaxed and the behaviour of an oligopoly or oligopoly/monopsony considered.

2.5.6 Oligopoly/monopsony models

> 'On the supply side, South Africa clearly has the appearance of an oligopolist enjoying very low production costs, a tight domestic producer cartel, and government export licenses and quotas. Poland, with low transport costs to western Europe and a state trading monopoly, also represents a supplier with potential market power. Even with the possibility of foreign investment, the Australian steam coal export industry is relatively concentrated. Mechanisms such as the federal export permit system, state ownership of railways, and labour union power bolster the opportunities for Australia to exercise market power.' (Abbey and Kolstad 1983:881)

Although concluding that 'the international steam coal market does not appear to be perfectly competitive' Abbey and Kolstad (1983:891), did not specify the actual market structure. Instead they pointed to South Africa, Poland and Australia as having the potential to exercise market power on the supply side and Japan and the European Community (if it acted collectively) as having the potential to exercise market power on the demand side. Their review of market structure and behaviour was inconclusive as to the best model to represent the market. To answer the question of model applicability for the international steam coal market, they called for further research.

In their next paper, Kolstad and Abbey (1984) pointed to the low extraction costs in South Africa and Australia and their large resource endowment. If international markets were perfectly competitive, there would be no need for high cost North American exports. To explain North American participation in the coal trade, models usually constrain the export capacity (esp. port) of South Africa and Australia (ICF 1981; US DOE 1982). Export constraints may be valid in the short term, but have little justification in the long run. Instead of repeating this approach, Kolstad and Abbey propose an oligopolistic model of coal supply to explain continued USA participation in the market.

Kolstad and Abbey (1984) compared the results of four assumed market structures: competitive; South Africa as a monopolist; South Africa and Australia as duopolists; and South Africa and Australia as duopolists with Japan as a monopsonist. The models were tested by comparison with actual 1980 trade data and 1990 forecast trade data. The competitive model had the greatest variation from the actual data because of the larger predicted role of South Africa and Australia (67% of exports predicted, 39% actual). The duopoly models successfully increased exports from other suppliers and were judged to predict trade patterns reasonably well (Kolstad 1988). Finally, the duopoly/monopsony model ensured that the duopolists were unable to extract any rent from Japan. This model of non-cooperative duopoly/monopsony assumes Cournot-Nash behaviour with South Africa and Australia independently and strategically raising export coal prices. The export patterns of other producers are thus taken as given with no reaction made to the strategies adopted by South Africa, Australia and Japan.

The results show that trade patterns predicted by the model which assumed that South Africa and Australia act as non-cooperative duopolists and Japan as a monopsonist are similar to actual trade data (Kolstad and Abbey 1984). However, the authors recognise that 1980 data is not representative of a market equilibrium because of the recent emergence and rapid growth of seaborne steam coal trade in 1980. Equal concern should be voiced about selecting a model on the basis of its ability to match predictions with the DOE 1990 forecasts. The DOE model incorporated parameters which constrained non-USA exports. The Kolstad and Abbey model simply provides a reason for such constraints - duopolistic behaviour. More detailed research is clearly required to explain the pattern of international coal trade.

2.5.7 Bilateral monopolies

The opposite extreme to perfect competition among many actors is a monopoly. In its simplest case a market may consist of a bilateral monopoly where there is only one buyer and one seller. Smith (1977) constructed a simple model where there is one seller, Australia, and one buyer, Japan, for a particular mineral. However, neither party has a monopoly in the global market. Instead, the monopoly is restricted to their bilateral trade. The bilateral monopoly arises from the bilateral trade offering some benefits over trade with others. This benefit is represented by reduced transport costs between the two parties (in comparison to the transport costs to alternative trade partners), but could be caused by a range of factors termed 'trade resistances'.

Smith (1977) identified a range of trade resistances including: rigidities and imperfections like internal transfers within TNCs and commitments under long term contracts which restrict short-term market options; market stabilisation arrangements like long term contracts and buffer stocks; the market search costs of finding other trade partners; institutional arrangements where facilities and staff have specialised benefits for the bilateral trade and resist change; and the transport cost differentials where trade with alternative partners, in the Atlantic for example, involves higher transport costs. The result of these resistances is to create 'additional gains from bilateral trade'.

The conventional model of monopoly behaviour involves a reduction in the volume of trade to enable the monopolist to gain the monopoly rent from this market structure. However, Smith follows the Spindler argument that a monopolist or monopsonist facing a single trade partner will behave differently than when facing a competitive industry. Instead, the standard economic model can be used to consider the relative bargaining strengths of the two sides. The volume of the trade is not restricted and the bargaining is over the appropriate price. The conclusion from the analysis of various price offers available to each side is that a price should be reached which divides the benefits of bilateral trade equally. This optimal long term arrangement assumes that the use of short term advantages is restricted in the interest of maintaining the trade.

The formation of cartels to achieve this balance in bargaining power and distribution of benefits was reviewed critically (Smith 1977). Certainly the Australian coal export industry would have great difficulty forming such a cartel given its different cost structures and the difficulties in being able to discriminate in prices allocated to different members. The problems of oligopoly models discussed previously appear again. The results of the Smith study extend the general imperfect or monopolistic competition models initiated by Robinson and Chamberlin into a resource trade, bilateral monopoly context. Further studies can extend this work to evaluate the structures which enhance bilateral monopolies and effectively insulate trade partners from outside competition.

2.5.8 Structural power and coal trade

The difficulty in matching market structure to market behaviour was illustrated above. The conventional measure of market structure is based on the number of parties active in the trade. The international coal trade has approximately 200 sellers and 200 buyers active in the 1980s (Appendix A & B). This number of participants clearly indicates that the market should be competitive as expected by IEACR. However, actual trade patterns were better approximated by oligopolistic or monopsonistic models (Kolstad and Abbey 1984). Despite the similarity between modelled and actual trade flows, the authors were careful not to argue proof of causality in the coal trade, only that the patterns were similar. The inconclusive and tentative findings reached by such studies implies that a new approach is required. Each of the four primary structures is argued to create opportunities to shift (distort) trade patterns from that predicted by the least cost model.

The security structure enables the state to improve its own interest and power through the promotion of collective purchasing by consumers, or extra taxes, railway charges or export quotas on suppliers. In each case the objective is to benefit the parties in a particular country. The result may be a significant reduction in the effective number of actors participating in the trade and changes in the size of trade flows.

The financial structure provides finance to coal projects. The uneven nature of this structure is demonstrated by the special interest rates and repayment terms gained by some projects. Special financial terms may be made available from government sources. In this case, the financial structure may be used to reinforce initiatives from the security structure. Currency denomination and exchange rates can also have a significant effect when repayments are made in different currencies from those which coal is priced in (eg. yen versus dollar). The hypothesis that these structures have an effect on trade will be tested by comparing transaction data for projects with and without special finance.

Production structures have received the most attention in other coal trade studies and will be treated selectively in this study. Market power and behaviour is considered a product of the concentration of production units in conventional studies. Integration of the production structure in both vertical and horizontal directions will be identified and measured to determine what its effects are on trade.

The knowledge structure is studied at two levels. First the detailed transaction level is examined to determine the role of specialised institutions like the general Japanese trading houses, sogo shosha, at providing detailed project data and continuous relational information. This is argued to reduce the transaction costs of trade and improve the position of small consumers. At another level, the beliefs of future trade size are argued to be a product of public forecasts. Both the detailed transaction information and general beliefs about market expectations are argued to be important determinants of trade.

2.6 Conclusion

The three ideologies of liberalism, mercantilism and Marxism were shown to have been the basis for different theories of trade. While each theory was able to explain trade in terms of the assumptions drawn from the associated ideology, the theories were inadequate to construct models representing the diversity encountered in global trade.

Rather than restrict this study to the assumptions of any one of the traditional trade models, a structural international political economy model of trade is proposed. This structural model draws on many of the insights gained from previous studies and integrates them by recognising the importance of four primary structures (security, production, financial and information) in determining global trade flows. The dominance of a single group of actors is replaced by the recognition of different groups being active through different structures and thus able to exert their influence on trade.

The conventional view of political economy as a contest for supremacy between market and state forces is replaced with a more powerful four-dimensional tool for the analysis of international political economy. Before developing this structural model in detail, the need for it must be proven. A rigorous investigation of the strengths and limitations of conventional coal trade models is made by comparing the models to the actual pattern observed in global coal trade.

Endnotes:

1. The following sections are based on the prevailing terminology used in studies of international political economy. The same terms may have different meanings for other groups of researchers. For example the economic realist school of thought described in this section is based on neo-mercantilist principles where the state introduces policies or laws which direct or limit market activity. This definition of realism is distinct from that found in other branches of the social sciences. In particular, Sayer (1984, 1985) articulated a realist approach for the social sciences where no single theory is regarded as fully describing reality. Instead, abstractions can be made from reality to identify a particular structure. The abstract structure is not considered to be a full representation of reality. However, several such abstractions can be made and compared for a more complete model. This 'realist approach' enables empirical research to be undertaken without claiming to provide complete explanations or theories of reality.

2. Despite the intellectual appeal of liberalism and free trade, the UK only adopted this policy in the 1840s after it had gained a clear international supremacy over its rival colonial power, France.

3. An interesting debate over the importance of factor endowments arose when Leontief [1953] presented his paradox of the USA trade pattern. The USA economy is relatively capital abundant and according to the factor endowments theory should export capital intensive goods. However, imported goods were found to be more capital abundant than exports. Vanek (1959) suggested that the capital intensive goods being imported were also resource intensive and that the Leontif Paradox was explained by the increasing relative scarcity of resources in the USA. Other explanations tried to identify reasons for a factor intensity reversal or demand reversal.

4. Marx used the term 'commodities' in his analysis of manufactured goods, but the term 'goods' is used here to avoid confusion with the more common meaning of commodities - primary products.

5. The term transnational corporation (TNC) is used here to conform with United Nations terminology. Other terms in common usage which define similar organisations include multinational enterprise (MNE) and multinational corporation (MNC).

6. This creates a small departure from their combined treatment proposed by Strange (1988:116).

7. In addition to the complete vertical integration described by Perry (1987), there are numerous intermediate positions between anonymous spot market exchange and vertical integration. For example, vertical controls can be used to transfer control over some aspects of production or distribution between firms (ie. resale price maintenance, exclusive territories).

Chapter 3

Coal trade models: unity or fragments?

3.1 Introduction

> `(I)t would be pleasant to say that this chapter will develop an efficient general equilibrium or econometric model for the forecast of international trade flows in steam coal, but instead I must begin this presentation by making the uncomfortable statement that no such model can be constructed at the present time, despite the fact that such models do exist and are used for forecasting, and the energy-related literature is unfortunately filled with references to them. ' (Banks 1985:91)

> `In short, all coal production forecasts must be built on highly imperfect information on all the key determinants.' (Gordon 1981:288)

Warnings by some analysts need to be compared to the achievements of others to provide a balanced evaluation of conventional coal trade models. To determine whether or not the international coal market follows the efficient commodity market model, the most important conditions for the operation of such a market are identified:

1. There will be multiple suppliers and multiple users of the commodity with no effective monopoly of either buyers or sellers.
2. The commodity will be widely traded and easily transported with the costs of movement between different markets easily calculated.
3. The commodity can be stored.
4. The commodity can be provided at a uniform quality and the product can be regarded as homogeneous or different qualities of the commodity can be related easily to a standard quality. (Berrie and Hoyle 1985)

Given these conditions, a single price can be determined to balance demand and supply for the commodity at any single point in time. Many analysts believe that an integrated international coal market has developed (IEA annual; Schulz 1988; Shell 1985).

> 'All in all, a vast supply of cheap coal is coming onto a world market whose potential for growth is now viewed with much less optimism than in the past. The world coal market is wide open at the supply end. There are no restrictions on access. The long term price trend on such a market is determined by the trend in costs.' (Schulz 1988:35)

The increase in the quantities of coal traded internationally in the 1970s and 1980s was accompanied by an increase in the number of countries making significant imports (section 3.2). As was seen earlier, over 200 suppliers from several export countries sold coal to over 200 buyers in 50 import countries (Appendix A and B). This large number of actors implies a competitive market structure and enables market behaviour and characteristics to be predicted.

The magnitude of seaborne trade has grown especially rapidly (from 46mt in 1960 to 101mt in 1970, 188mt in 1980 and 272mt in 1985). Bulk carriers transport the coal across long distances and the cost of single voyages is well known because shipping rates are widely quoted in industry journals (CWI; ICR ; Lloyds Weekly). The increase in the number of coal producers and consumers combines with the availability of transport to meet the first two conditions for an efficient commodity market.

The third condition is satisfied by coal being able to be stored in stockpiles. The practical length of storage is not infinite because coal will oxidise and become less valuable if left exposed to air and moisture for a long period of time. However, this storage restriction does not change the ability of coal storage to overcome short term demand/supply imbalances. It is readily bought one day for resale or consumption several months later and thus meets the third commodity market condition.

The fourth characteristic required for a commodity market, the homogeneous or uniform quality of the commodity, is less apparent in coal because of its variation in inherent quality and inclusion of impurities. In particular, coal sold for coking purposes has many more attributes of importance than coal sold for steam raising (see chapter 4). In steam raising the calorific value of coal is most important and can be used as a standard for quality comparisons. Indeed, the conversion of various types of coal or even other fuels to a standard unit (tonnes coal equivalent or tce) is achieved by the use of a calorific definition: 1 tce = 7 million kilocalories or 7,000 kcal/kg or 29.3 million Joules (IEA 1988a:II5)[1]. Prices for different quality coals can thus be compared directly. The adoption of calorific standards for coal comparisons should be qualified by other characteristics like ash and sulphur content because of differential impacts on boilers and emission levels. In practice, the standards imposed on coal quality restrict the range of coal types traded internationally to a narrow set of impurity characteristics, thereby eliminating many of the wide variations in quality.

Assuming that coal, especially steam coal, can be treated as a uniform commodity, the four conditions for a commodity market are satisfied. The operation of the international coal market can thus be studied to determine whether or not it conforms to this conventional market model. As international trade grows, competition should increase and any existing price variations caused by market imperfections are expected to decline.

International trade data is examined to measure price uniformity for coal. Given that transport costs can cause variations in price, it is expected that prices will become more uniform as one moves from comparisons of intercontinental to regional and then national markets. The examination of smaller markets should reduce the impact of geographic and quality variation. Similarly, steam coal with its smaller range of important quality characteristics is expected to have more uniform prices than coking coal. Each of these expectations is tested in this chapter.

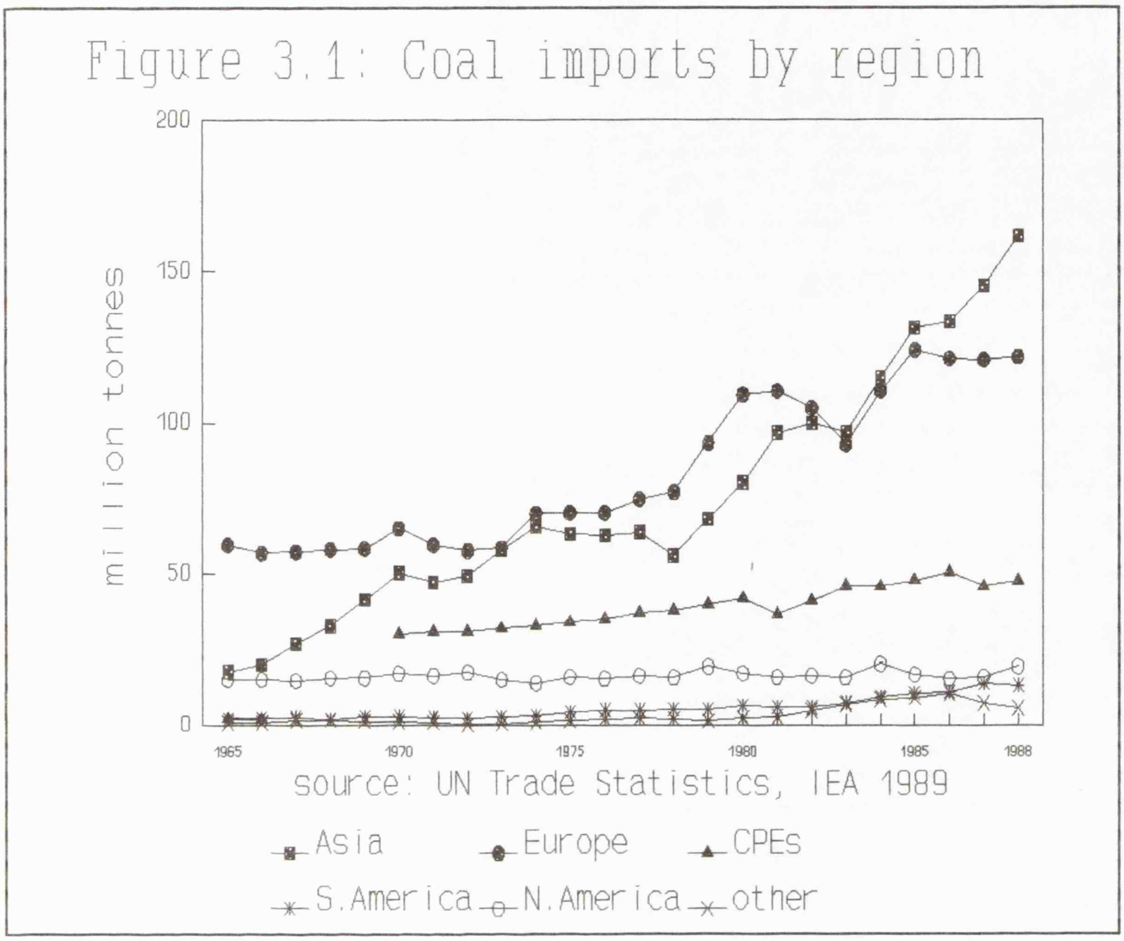
3.2 Trade expansion and the least cost model

3.2.1 The expansion of global coal trade

Coal trade in the 1960s-80s underwent a period of growth which exceeded its previous period of rapid growth in the 1860s-90s (Jevons 1915). The recent growth differed from that of one century earlier because it was no longer centred in Europe (Asteris 1981). Instead, coal became a global commodity with 371mt traded in 1988 among over 50 countries (market and planned economies alike). Shifts in the global focus of the trade occurred as Asian imports exceeded those of Europe (Figure 3.1)[2]. New markets emerged in Latin America, North Africa and the Middle East. The pattern of trade among centrally planned economies grew only slowly and North American imports were roughly stable. The overall trend was one of stability or decline in overland trade routes in North America and Europe and rapid growth in the seaborne sector.

Asia and western Europe were by far the largest markets importing 120-160mtpa in the late 1980s. Growth occurred in both regions, but the pattern was not the same. European imports were steady at 60mtpa in the 1960s and then rose sharply in the late 1970s to 110mtpa in 1980. The recession of the early 1980s was followed by an increased import level of 120mtpa in the late 1980s. In contrast, Asian imports achieved a higher rate of growth over the entire period, rising from 18mt in 1965 to 63mt in 1975, 131mt in 1985 and 162mt in 1988 (UN 1988; IEA 1989a).

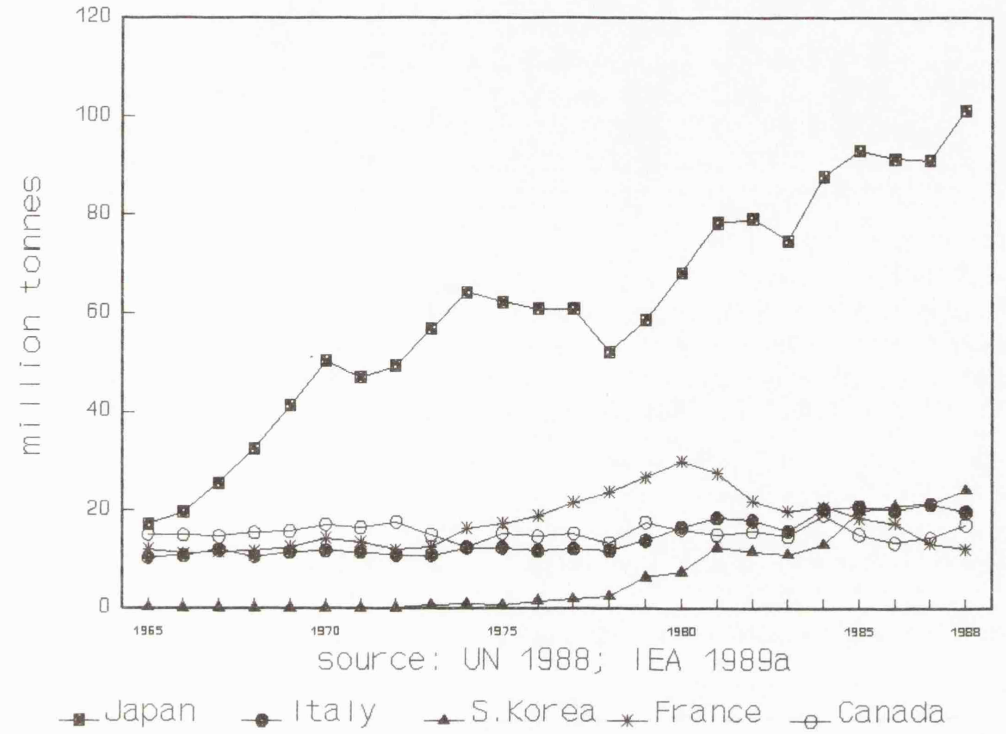
This regional pattern is better understood by examining its national components. Japan dominated the Asian market and provided most of the region's growth in the 1960s and 1970s (Figure 3.2). Japan was the largest single importer in 1965 with imports of 17mt, but by 1985 imports had grown by more than fivefold to reach 93mt or over four times the size of the next largest importer (Italy with 21mt of imports). In 1986 South Korea surpassed Italy to became the second largest importer of coal. This was achieved by a rapid rise in



imports from less than 1mt in 1975 to 21mt in 1986 and 24mt in 1988. Japan, not surprisingly, retained its dominant position with imports of 101mt in 1988.

The rapid growth in Asian imports is contrasted with the mixed European experience. French coal imports grew in the late 1970s to reduce reliance upon oil in power stations and reached nearly 30mt in 1980. These imports subsequently declined when many nuclear power stations were brought into operation. By 1988 France imported only 12mt of coal. As a result, France was replaced by Italy as the largest European importer of coal (from 1985 onward). Italy had imported a similar amount of coal as France in the 1960s (10-12 mtpa) and its increase in coal imports was delayed until the late 1970s when coal started to replace oil as a fuel in power stations.

Figure 3.2: Top five coal importers in 1985



Canada is the fifth largest importer of coal. Its pattern is the opposite of that of most other large importers. Rather than increase imports substantially, the pattern is one of cyclical variation from a base level of 15mt in 1965. In 1984 imports rose to 19mt because of increased steam coal demand by Ontario Hydro, but recessions in the steel industry also contributed to low import levels of 12mt in 1974 and 13mt in 1986. This comparison of national import levels can be extended from the five largest importers (Figure 3.2) to the 50 largest importers (Table 3.1).

Another example of rapid Asian growth in coal imports is Taiwan. Imports rose rapidly from 1mt in 1977 to 10mt in 1985 and almost 18mt in 1988. In a 1988 listing of the top five importing countries, Taiwan would replace France from the 1985 group and give Asia three of the five top positions in global coal trade. The ranking and importance of markets was changing rapidly.

Table 3.1: Global coal trade ranked by imports in 1985

importer	65	70	75	78	80	83	85	88
Japan	17.1	50.2	62.1	52.2	68.2	74.7	93.0	101.2
Italy	10.3	11.7	12.3	11.7	16.5	15.8	20.8	19.7
S.Korea	0.1	0.0	0.7	2.4	7.3	11.0	19.8	24.0
France	11.9	14.2	17.3	23.5	29.8	19.7	18.5	12.1
Canada	15.1	17.0	15.3	13.2	16.0	14.7	15.0	17.4
UK	0.0	0.1	5.1	2.3	7.3	4.5	12.7	12.0
Denmark	3.4	3.4	4.1	6.1	9.9	8.5	12.7	9.7
Netherlands	7.1	4.8	4.1	5.0	7.2	7.7	11.5	13.7
Taiwan	0.0	0.1	0.1	1.4	4.1	6.5	10.4	17.6
USSR	na	na	na	na	6.7	11.6	10.3	na
Germany FR	7.2	8.8	6.2	6.6	9.1	9.1	9.9	7.5
Belgium/Lux	6.9	7.7	6.8	7.6	10.6	8.0	9.5	11.3
Spain	1.7	3.5	4.0	3.4	5.7	5.9	8.4	8.8
Brazil	1.0	2.0	2.8	3.6	4.5	6.3	8.3	10.3
Bulgaria	na	na	5.7	na	6.1	6.4	7.4	na
Romania	na	na	4.7	na	6.6	6.9	6.6	na
Hong Kong	0.2	0.0	0.0	0.0	0.0	3.4	5.5	8.9
Germany DR	na	na	na	na	6.8	4.2	5.1	na
Finland	2.5	3.2	3.8	4.8	4.7	4.4	5.1	5.5
Sweden	1.7	1.7	1.6	1.5	2.2	3.1	4.8	3.8
Czech	na	na	na	na	5.1	4.9	4.6	na
Yugoslavia	2.2	1.8	2.1	1.7	3.6	4.0	4.3	4.5
Austria	3.6	3.5	2.5	2.3	2.9	3.0	3.6	3.9
Hungary	na	na	2.7	na	3.3	2.6	3.5	na
N.Africa	0.1	0.5	1.3	1.1	1.3	3.1	3.5	na
Israel	0.0	0.0	0.0	0.0	0.0	2.8	3.3	3.4
N.Korea	na	na	na	na	0.5	2.0	2.5	na
China	0.0	0.0	0.0	0.0	2.0	2.1	2.3	na
Turkey	0.0	0.0	0.0	0.6	0.5	0.9	2.1	4.5
Ireland	1.3	1.2	0.7	0.8	1.2	1.4	1.9	3.5
USA	0.0	0.0	0.7	2.7	1.1	1.2	1.8	1.9
Greece	0.2	0.2	0.7	0.4	0.5	0.5	1.5	1.7
Portugal	0.4	0.5	0.4	0.4	0.3	0.4	1.5	3.0
Philippines	0.0	0.0	0.0	0.1	0.0	0.1	1.2	na
Mexico	0.0	0.0	0.5	0.4	0.7	0.3	1.1	na
Poland	0.0	0.0	0.0	0.0	1.0	1.0	1.1	na
Norway	0.4	0.5	0.5	0.4	0.7	0.5	0.9	0.8
Pakistan	0.0	0.0	0.0	0.0	0.1	0.5	0.8	na
Argentina	0.7	0.7	1.0	1.0	0.8	0.5	0.8	na
Switzerland	1.1	0.4	0.1	0.1	0.6	0.3	0.5	0.4
Malaysia	0.0	0.0	0.0	0.0	0.0	0.4	0.5	na
Chile	0.3	0.2	0.0	0.2	0.3	0.3	0.4	na
Thailand	0.0	0.0	0.0	0.0	0.0	0.1	0.2	na
Albania	0.0	0.0	0.1	0.0	0.2	0.2	0.2	na
Malta	0.0	0.0	0.0	0.0	0.0	0.1	0.2	na
Pacific Is	0.2	0.2	0.1	0.0	0.2	0.1	0.1	na
oth S Amer	0.0	0.0	0.0	0.0	0.0	0.0	0.1	na
Peru	0.0	0.0	0.0	0.1	0.0	0.0	0.1	na
oth SE Asia	0.1	0.2	0.4	0.2	0.2	0.0	0.1	na
Iceland	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	na
oth Africa	0.5	0.5	0.1	0.1	0.1	0.1	0.0	na
Sri Lanka	0.1	0.0	0.0	0.0	0.0	0.0	0.0	na
India	0.0	0.0	0.0	0.0	0.4	0.5	0.0	na
S.Africa	0.0	0.0	0.1	0.2	0.2	0.0	0.0	na
Total (mt)	98	139	171	158	257	267	340	371

Sources: UN 1988; IEA 1989a; IEA 1988

When the global coal trade grew from 98mt in 1965 to 171mt in 1975, the number of countries (excluding centrally planned economies) which imported over 10mtpa remained at four and the number of countries which imported 1-9mtpa remained at 15. This period of expansion was thus narrowly based with the same group of countries increasing their demand for imports (largely of coking coal).

In contrast, the decade 1975-85 witnessed the doubling of trade volumes (171mt in 1975 to 340mt in 1985) and the increase in the number of countries importing over 10mtpa from 4 to 9 (excluding the USSR). The number of countries importing 1-9mtpa rose from 15 to 26 and in 1985 over 40 countries were importing over 0.1mt of coal[3]. Markets for coal were both growing and increasing in number. The result should be an increase in competition with the trade becoming more like that of a commodity market and less influenced by the imperfections known to affect energy markets.

3.2.2 Coal trade partners

> 'The coal buyer, in contrast (to the gas buyer), can dial himself a cargo from any of over 100 suppliers all of which at any one time will be able to give him a quoted price and time of delivery.' (FTEE 1988:21)

Having identified the growing international markets for coal, the level of supply competition can be measured by comparing the number of countries supplying each of the markets. The largest importing countries (over 10mtpa in the mid 1980s) are listed in Table 3.2 along with the number of significant suppliers they had at five yearly intervals between 1965 and 1985[4].

The number of supply countries is highest for markets in Europe as a result of the geographic proximity to coal in other countries. Germany, France and Belgium exchange coal among themselves and also import it from Eastern Europe (especially Poland and the USSR), the major seaborne suppliers (Australia, USA, South Africa and Canada) and new suppliers like Colombia. In contrast, Canada and the USSR each have one dominant source for their imports. In between these extremes, lie the Asian importers of Japan, South Korea and Taiwan. Japan has the most diverse supply network in the Pacific while South Korea and Taiwan imported coal from the four major seaborne exporters (Australia, USA, South Africa and Canada) to fuel their rapid growth in the 1980s. These trading patterns demonstrate that a more diverse supply network is emerging for most markets. The pattern of diverse supplies implies that competition has increased as predicted by the conventional coal trade model.

Table 3.2 Number of supply countries for major coal importers, 1965-85

year	65	70	75	80	85
importer	number of countries supplying over 50,000 t				
Japan	6	7	9	7	7
Italy	5	8	5	9	11
S.Korea	0	0	2	4	4
France	8	8	9	10	10
Canada	1	1	1	1	1
UK	0	1	4	7	10
Denmark	3	2	4	8	8
Netherlands	7	8	6	8	7
Taiwan	0	1	1	4	4
USSR	na	1	1	1	1
Germany,FR	7	8	11	12	11
Brazil	1	2	3	4	5

source: UN 1988; IEA 1989a

3.2.3 Competitive trade and production costs

> 'The world coal market is an open market with free access. The price on such a market cannot remain above the level of the total costs of the lowest offer price over the long term. This is why the world market price for coal is expected to be dominated by the long-term cost trend.' (Schulz 1988:39)

The Schulz (1988) study, prepared for the European Commission, illustrates the expectations and predictions of cost-based coal studies (see also Barnett 1984, 1985b; Calarco 1987; Drewry 1988; Moody 1989; OSC 1989; and Yuasa 1988). The cost of coal production in major exporting countries is compared and the capacity for future expansion assessed. Schulz concluded that South Africa, Australia, Colombia, China and other new suppliers will provide most of the coal for the growth in trade in the last decade of this century and beyond. Established suppliers like Canada, Poland and the United States will achieve only slight growth with the USA playing a special role as the high cost 'swing supplier'. To understand how these conclusions were reached, the analysis is reviewed.

The cost of producing and transporting steam coal for sale in Europe is compared for the three largest suppliers USA, South Africa and Australia (Table 3.3). The very large reserves of the countries (400,000; 57; and 33 billion tonnes, respectively) are presented as an indication of their ability to expand output. The costs of production are presented for both the actual 1985 experience and that projected for 2000.

Table 3.3: Coal production and transport costs, 1985

country	S.Africa		Australia			USA		
region				Qld	NSW		EC	Gulf
cost item (unit)								
	1985$	1987$	1985$	1987$		1985$	1987$	
	Schulz	Calarco	Schulz	Calarco		Schulz	Calarco	
operating cost		8		7	16		25	20
capital cost		5		9	8		7	6
FOR	7-14	13	14-35	16	24	27-49	32	26
rail	9	11	7-14	9	7	11-22	15	8
port		2		3	4		2	2
FOB	16-23	26	28-42	28	35	43-65	49	36
freight (frgt)	10		12			8		
CIF ARA	26-33		40-54			51-73		
sales revenue			Aus				USA	
FOB price[1]	31.22		32.28			48.10		
FOB for Europe[2]			32.50	26.18		46.06	43.35	
apparent frgt	10.52		19.85			9.37		
apparent frgt			17.13	15.14		9.30	8.44	
CIF price[1]	41.74		52.13			57.47		
CIF Europe[2]	41.79	32.77	49.63	41.32		55.36	51.79	
CIF Neth[2]	45.82	30.41	52.99	42.03		59.39	44.80	

note: ARA = Amsterdam-Rotterdam-Antwerp
Schulz presents cost range data,
Calarco presents typical costs

source: 1=Schulz 1988; Calarco 1987; 2=IEA 1989a.

To consider future developments in the market, Schulz first looked at the lowest cost producer, South Africa[5]. Steam coal exports in 1985 were 46mt and the export capacity could be raised to 3-4 times this level with a cost increase of only 50%. The cost to cover this expansion is shown in the calculations for the year 2000 (Table 3.4). Indeed, Schulz indicates that South African exports could be increased sixfold to over 250mtpa with production costs remaining under $30pt. Despite the appeal of expanding this low cost source of coal, Calarco (1987) considers 75mtpa to be the maximum likely to be exported from South Africa by 2000. Political factors restrict the economic least cost objective.

Table 3.4: Coal production and transport costs, 2000

country	S.Africa	Australia	USA
cost item	costs in year 2000 (1985$)		
FOR	18-22	39-42	50-54
rail	9	10	15
FOB	27-31	49-52	65-69
freight	13-15	15-18	10-12
CIF ARA[1]	40-46	64-70	75-81
CIF ARA[2]	44-62	49-65	50-63
ARA tonnage[2]	11-19	6-1	8-31

note: ARA = Amsterdam-Rotterdam-Antwerp
freight range has a 25-50% increase from 1985 levels
source: 1=Schulz 1988; 2=British Coal 1988

Australian coal exports received similar attention[6]. Production levels were considered able to expand to 150mtpa with no further increase in costs (Schulz 1988). The prices indicated in the projection for 2000 thus reflect those capable of supporting a very large industry (>150mtpa). Rail rates, which are controlled by state governments, are assumed to be moderate. As in the case of South Africa, the low cost of

Australian coal production creates the incentive for a large expansion in exports (Schulz 1988).

In contrast to the above suppliers, production in the USA involved higher production costs, but benefitted from lower ocean freight costs. USA production costs in Appalachia were estimated at four times those in South Africa (Schulz 1988). A lower cost view was presented by Calarco (1987) who pointed to the lower production and transport costs of some mines which can use barges down the Mississippi and then ship from the Gulf region. Production costs were forecast to remain constant in northern and southern Appalachia while costs in central Appalachia rise by 20% by 2000 (Schulz 1988). Despite moderate rail rates, USA coal would remain relatively high cost in Europe. As a result, they are expected to be the swing supplier which meets short term surges in demand from the industry's very large production capacity.

Transport costs are identified as over half of the cost of delivering coal in northern Europe from Australia or South Africa (Table 3.3). In the mid 1980s ocean freight rates were lower than the cost required to replace the fleet. Freight rates for the year 2000 were thus increased by 25% to meet the capital costs of replacement and by 50% to combine replacement costs with high oil prices (Schulz 1988). The effect of these increases is most pronounced on the long voyage from Australia to Europe where the delivered cost approaches that of USA coals.

The inclusion of actual price data for 1985 and 1987 indicates that not all mines were covering their costs during this period. Predictably, some of the high cost mines closed and coal prices rose in 1988 and 1989 in response to growing demand and the reduction in old supply capacity. Schulz estimated that future prices in Europe would need to be $10-15 above 1986 levels ($45pt) to meet the costs of future increases in production ($55-60pt).

The upper limit to coal prices was also identified. An oil price of $30 per barrel in 2000 would set a price ceiling for coal at $115ptce (per tonne coal equivalent)[7]. This high limit for the price of coal is based on the oil price and does not imply that prices would reach such levels. For example, in the 1970s the price of coal rose much more slowly than that for oil.

The selection of an oil price of $30 per barrel in 2000 reflects the expectations of many energy studies[8]. Despite the widespread assumption of high future oil prices, it should be noted that the implied wide gap in the competitive position of coal in the energy market is not so secure if oil prices are low, as occurred in the mid 1980s. For example, if oil prices are $15 rather than $30 per barrel, the ceiling price for coal falls from $115 to $45ptce. At this price, the prospects for coal's competitive future in Europe are restricted to the lowest cost mines.

An alternative view of future coal prices was provided by British Coal who also used a least cost model of international coal trade. However, they differed with Schulz on their assessment of production costs and European prices. The contrast between the two studies is striking. Whereas South African coal remains profitable for the entire projected price range, most Australian suppliers would be forced to leave the European market at prevailing prices of $50-55pt in 2000 and the USA would become the largest supplier to northern Europe (British Coal 1988). In contrast, the Schulz estimates of USA production costs are well above the British Coal price projection and USA suppliers would have only a limited position in the market.

The differences in the two views of the USA as a coal supplier are explained by the Schulz study requiring all production costs to be met. In contrast, other studies (British Coal 1988; Lee 1988; Mehliss 1988) consider USA coal as 'marginal coal'. Because of the size of the domestic USA coal market, most coal is sold within the country. Mines which choose to sell additional coal to the export market have their capital costs covered by sales in the domestic market. This enables them to accept lower prices for export sales which only cover their operating costs. This 'marginal coal' is priced on the basis of marginal production costs rather than the full cost of the mine. In this way, the USA is able to remain a significant exporter despite low prices, as in the mid 1980s.

Many studies consider the price of coal to be determined by the cost of production in the USA. Given a lower cost of production in other countries, the USA acts as the swing supplier which exports sufficient coal to balance global supply and demand. This role is especially important for short term adjustments. Over the longer term, coal must provide a return on the investment in mines (otherwise there is no incentive to make the investment). The Financial Times Energy Economist (FTEE 1988) thus argues that future coal prices are determined not by the USA, but by the Australian industry.

> 'Australia is not only the dominant influence on price levels, but this dominance will grow with at least three (more) major mines slated for development in Queensland.'(FTEE 1988:22)

To enable this Australian expansion to go ahead, the costs of production will need to be met. The estimated marginal cost of this production is $50pt (including a 15% return on capital) while the average cost is $41pt (A$50pt) (Barnett cited in FTEE 1988). Given a rise in freight rates from $11.50 to $17.00 to cover capital costs, the associated cif price in Europe is $58pt (within the Schulz range).

The emphasis placed by Schulz on production costs as the chief determinant of coal prices is correct as a first principle. However, production costs can vary unexpectedly. The emphasis on large scale open cut production has reduced unit costs and the low prices of the mid 1980s have stimulated substantial improvements in labour and equipment productivity. Both improved technology and work practices have contributed to these gains. Even the structure of the industry has changed with the Australian industry undergoing a substantial realignment with firms merging to reduce administrative and managerial costs (chapter 6). The result is a lowering of costs which enables mines to remain economically viable under lower prices than previously considered.

The main assumption underlying the conventional model of the coal trade, as outlined above, is that it has a competitive international structure[9]. The result is that a single clearing price will be determined for the competing South African, Australian, American and other suppliers. The next section examines coal trade data to find the prevailing price of coal.

3.3 International coal prices

3.3.1 Coal price deflators and trends

As Japan is by far the largest importer of coal, it provides an important starting point in the examination of international coal prices. Coal is a form of energy and its price underwent substantial changes in the 1970s and 1980s just like other forms of energy. However, coal prices are less volatile than oil or gas prices and a more subdued pattern emerged. When oil prices quadrupled in the 1970s, coal prices doubled. In current or nominal terms, coal prices continued to rise until they reached a peak in 1982 of $73 per tonne (average cif value delivered in Japan, UN 1988). However, a more meaningful measure is to compare deflated or real prices over time.

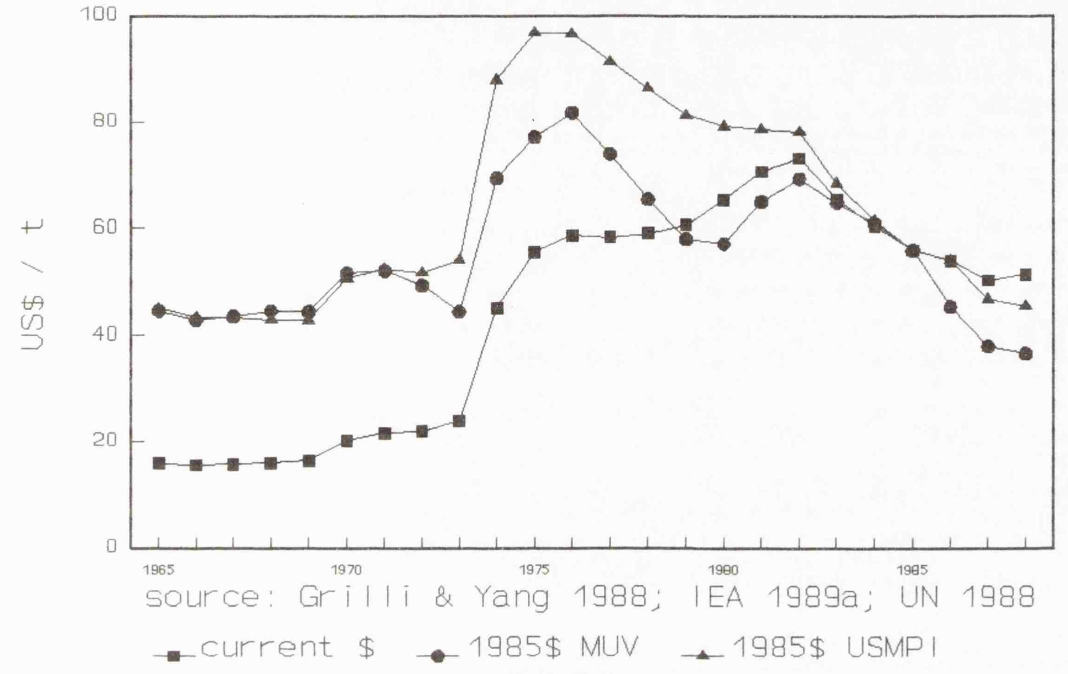
Various deflators have been used to standardise prices. Coal is usually priced in US dollars, but using a US price deflator like the wholesale price series would be using a domestic economic measure to adjust international prices. A more meaningful procedure would be to adjust the price in terms of its purchasing power (Radetski 1985). To do this, World Bank officials have constructed a long term deflator series from United Nations trade statistics of the unit values for exports of manufactures (Grilli and Yang 1988). The result is a price series for the manufactured products exported by mature developed economies. Given that coal exports generate foreign exchange which is often used to purchase manufactures, the best deflator for coal prices is the manufactures unit value (MUV) series compiled by Grilli and Yang (1988) and extended by incorporating recent trade values (UNCTAD 1989).

The comparison of current and deflated prices is provided in Figure 3.3. The apparent fivefold increase in Japanese cif coal prices from $15-16 per tonne in the late 1960s to $73 in 1982 is reduced to a twofold increase when the prices are deflated. Two deflators are used to compare their effects on the price pattern. A US manufactures price index (USMPI) was compiled by Grilli and Yang (1988) from the wholesale price index. This domestic index is compared with the MUV index derived from UNCTAD data. Both series indicate that the price of coal in the late 1960s and early 1970s was $40-50 per tonne in 1985$ terms.

The US index (US MPI) indicates a very rapid price rise in the mid 1970s and a gradual decline which accelerated in the 1980s (Figure 3.3). The preferred MUV deflated values clearly illustrate the two peaks in average coal values corresponding with the two peaks in oil prices. The deflated price series also demonstrates that coal values in the late 1980s had fallen in real terms below the level of the 1960s. Even the $2 average price rise in 1988 failed to generate a real gain in purchasing power because the unit values of manufactured exports rose even faster (UNCTAD 1989)[10].

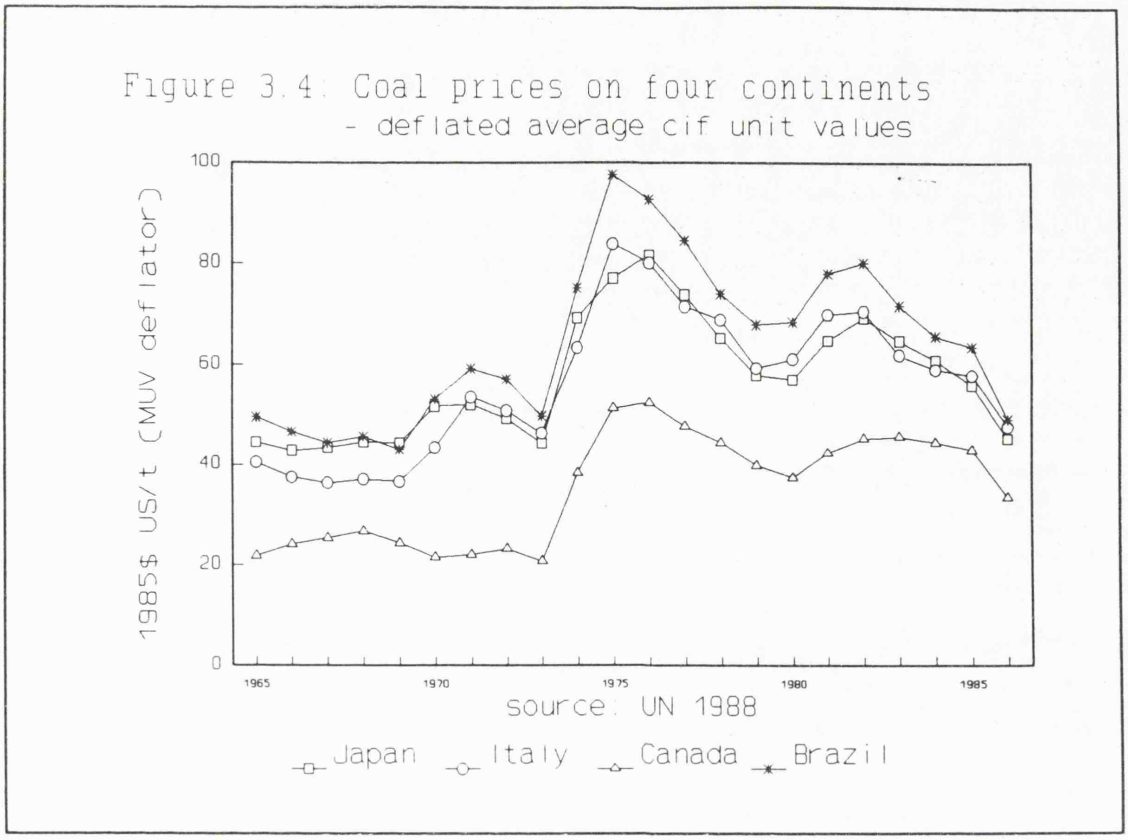
The Japanese cif price series can then be compared to other coal import prices. The largest importing country on each of four continents (Asia, Europe, North America and South America) are selected for comparison (Figure 3.4). Each country had imports of over 10mtpa in the 1980s. The prices in all four countries followed a similar pattern although their relative position changed gradually. Italian coal imports had cif values $5-10 per tonne below the Japanese price in the 1960s, but were effectively equal in the 1980s.

Figure 3.3: Average coal prices in Japan
- current and deflated cif unit values



In contrast, Brazilian cif values (mostly coking coal) climbed $10 above the Japanese and Italian average in the 1970s. Each of these three countries had a similar pattern with coal prices doubling in the mid 1970s and then falling in 1986 back to their level in the 1960s. Only in the case of Canada, where almost all imports came overland from the USA, did average values remain substantially (50%) above the 1960s level.

Given, the increased size of international coal trade and the investment in new mines to meet this demand, it is not surprising that prices could not continue to fall, yet support a viable industry. Company losses and mine closures occurred even in the low cost export countries of Australia and South Africa in the late 1980s (ACA 1988; JCB 1988; INCR 1989). In 1988 current coal prices rose by $2-5 on average and further increases were predicted. Despite these changes in price over time, a competitive market is expected to have uniform prices at any point in time. The analysis thus shifts from following price trends to measuring the degree of price uniformity.



3.3.2 International coal price uniformity

International price uniformity, that is an international price which is uniform when adjusted for differences like transport costs, is measured in this section as an indication of an efficient international coal market in operation. The general observation of similar price trends (Figure 3.4) can be examined more rigorously by measuring the variation in coal prices among different groups of countries. Coal prices are again measured as the average cif unit value of imports derived from trade statistics. The standard deviation is the most common measure of statistical variation in values and thus is used in this analysis[11]. The variation or uniformity of international coal prices is first examined at the intercontinental level.

The largest importer on each of the four main coal importing continents (Japan in Asia, Italy in Europe, Canada in North America and Brazil in South America) are compared. The average import cif values for each country were standardised by calculating price ratios using a weighted world coal price (wwcp) as the denominator[12]. The variation in prices was measured in terms of standard deviations. A clear trend emerged with the standard deviation rising sharply in the early 1970s and then declining over time (Figure 3.5a). This demonstrates that prices on the four continents gradually converged during the 1965-86 period. A simple least-square regression line indicates that the declining trend accounts for 41% (R-squared value of line R1) of the variation in standard deviation values. The rate of decline was more pronounced and consistent in the last decade (1977-86) where 69% (R-squared value of line R2) of the variation is accounted for by the trend. This finding supports the hypothesis of the emergence of an integrated global coal market with uniform prices.

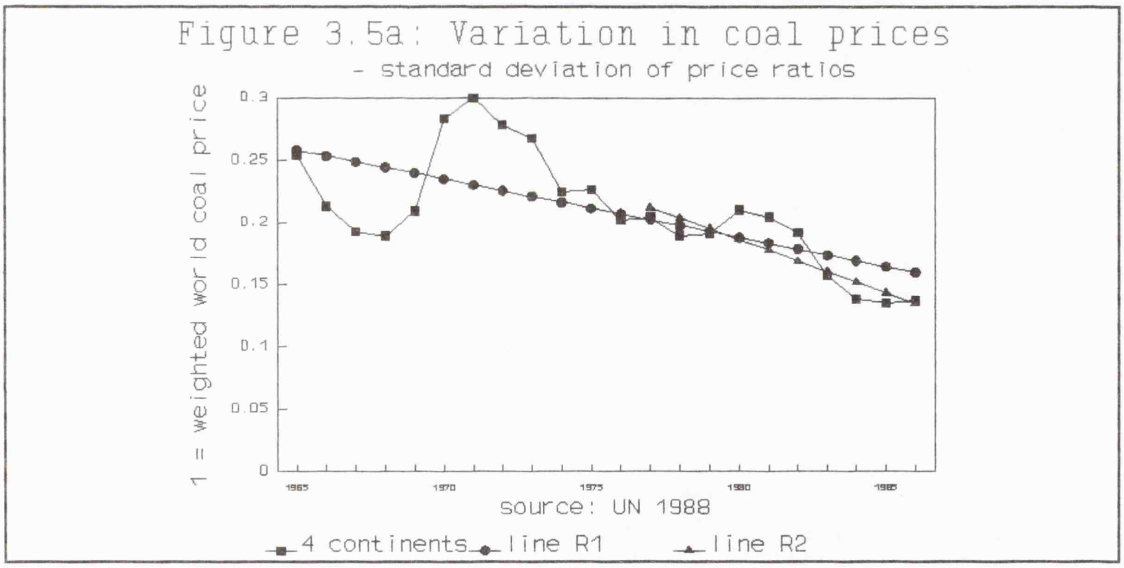


Figure 3.5a: Variation in coal prices

However, the identified trend could also be caused by other factors. While the trend can be interpreted as increased competition bringing prices toward a uniform global level, especially if the 1960s data is ignored, an alternative explanation is that the pattern was caused by higher Canadian import prices in the 1980s or the rise in freight rates in the early 1970s and their subsequent decline[13]. To overcome the effects of such variations in transport costs, a better measure of price uniformity should be found when comparing prices on a single continent.

Table 3.5: Analysis of the standard deviation of coal price ratios by groups of import countries

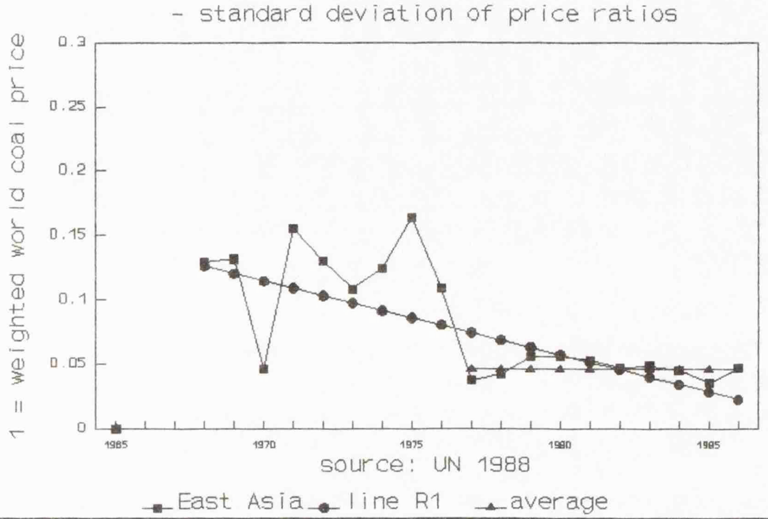
group	period / regression equation	mean	standard error	adjusted R-squared
4 continents (4 largest importers)				
	1965-86	0.209	0.045	
	line R1 = 9.531 - 0.0047 * T		0.036 #	0.41
	1977-86	0.176	0.029	
	line R2 = 17.25 - 0.0086 * T		0.017 #	0.69
East Asia (3 largest importers)				
	1968-86	0.082	0.043	
	line R1 = 11.43 - 0.0057 * T		0.032 #	0.49
	1977-86	0.046	0.006 #	
	line R2 = no significant correlation with time			
Europe (7 largest importers)				
	1965-86	0.191	0.062	
	line R1 = 13.55 - 0.00676 * T		0.048 #	0.44
	1977-86	0.145	0.046 #	
	line R2 = no significant correlation with time			

note: # indicates best description of standard deviation for group
the standard error is of the mean and of the y-estimate on the regression line, respectively
T = year (1965-1986)

The first group of countries on one continent to be examined is in East Asia where Japan, South Korea and Taiwan each import over 10mtpa using similar seaborne transport systems (Figure 3.5b). The wide price variations identified in the late 1960s and early 1970s are caused by the low volumes and recent formation of coal import markets in South Korea and Taiwan. These wide variations were replaced by very uniform average prices among the three countries in the late 1970s and 1980s. A competitive market with similar prices is expected in Asia as a result.

Statistical analysis shows that the East Asian pattern is different from the intercontinental coal price ratios where

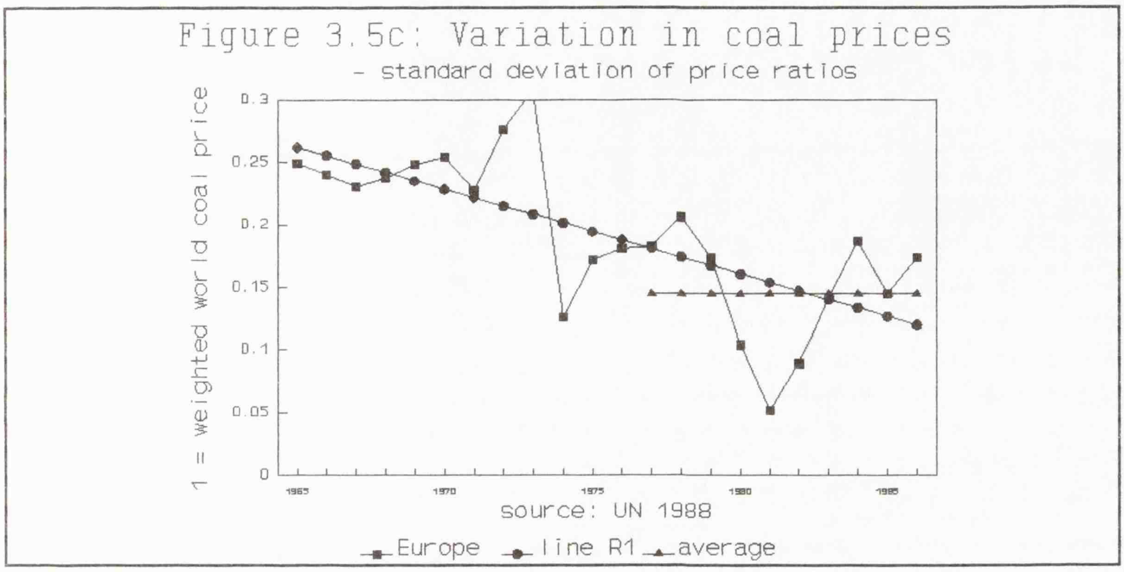
Figure 3.5b: Variation in coal prices
- standard deviation of price ratios



the standard deviation tended to decline with time during both reference periods, 1965-86 and 1977-86. Instead, the East Asian price ratios had a standard deviation which was stable throughout the last decade of data. It is best described by a simple mean rather than a trend line. Over this period, the standard deviation among the three East Asian import prices equalled 5% of the weighted world coal price.

The European market provides a contrast to the small variation found in East Asia. Seven European countries imported over 10mt of coal during two or more years in the 1980s. The large size of these individual markets should promote competition and uniform prices. The average cif unit values for each of the seven large importers (Italy, France, Denmark, West Germany, Netherlands, Belgium/Luxembourg and the UK since 1971 when it became a major importer) were used for comparison (Figure 3.5c). Variations in price increased in the late 1960s, declined sharply and rose slowly in the 1970s and then fell and rose again in the 1980s. The result of these fluctuations is that price variations in the late 1980s were at the same level as in the mid 1970s.

Statistical analysis reveals an overall pattern similar to that in East Asia (Table 3.5). The standard deviation among European price ratios declined over the period 1965-86, but



is best represented by a simple mean over the last decade. Prices varied less (were uniformly high) during the high price period 1980-82, but then returned to their earlier pattern of substantial variation (15% of the weighted world coal price) among the average coal prices for the seven importers. These variations have a systematic appearance and invite further investigation to identify causal structures or processes.

In conclusion, large variations in coal prices were found in the early 1970s, but these are probably related to disruptions in the oil market and its spill-over effects on the coal market. The trend of a convergence of coal prices on four continents toward a single global price was not necessarily caused by increased competition and the emergence of a single coal market. Higher prices for USA coal in Canada and lower ocean freight rates in the 1980s also contributed to this pattern. Still, the seaborne trade is expected to have become more competitive with many more suppliers competing in individual markets. These national markets will be examined next, but first the prices in regional markets offered an interesting insight.

Price variations within the East Asian and European markets were roughly stable throughout the late 1970s and 1980s. This indicates that price variations represent stable features of the market rather than changing trends. Although differences in average prices were consistent in each region, variation among average European prices was three times as large as the variation in East Asian prices.

3.3.3 National coal price uniformity

The largest national markets for coal imports are evaluated to avoid the complications caused by different transport costs in the international markets considered above. The number of major suppliers (>50,000 tonnes) to the largest coal importing countries was shown in Table 3.2. The variation in prices among these supply countries is examined in this section as an indicator of the competitive nature of the coal market.

The results of the previous section are reinforced with a clear difference emerging between European and East Asian patterns (Figure 3.6). These differences are well demonstrated by contrasting the coal import prices of Japan and France. In both cases a simple mean provides the better estimate of the standard deviation of price ratios for major suppliers during the 1965-86 period (in comparison to a regression line) (Table 3.6). The difference emerged with the average measure of variations in French import prices being higher than the Japanese value (26% rather than 19% of the weighted world coal price). In addition to this long term difference, the two values diverged further in the 1980s. Price variations among Japanese suppliers became less while those among French suppliers became greater during the 1977-86 decade (Figure 3.6a,b).

The pattern of greater variation in prices among the European countries is thus repeated for the import prices in France. Asian prices were more uniform both among the major importers and among the suppliers to Japan. To determine whether this pattern is unique to the two countries chosen, the second largest importers in each region in the 1980s are also compared.

Figure 3.6a: Variation in import prices
- standard deviation among suppliers (>50,000t)

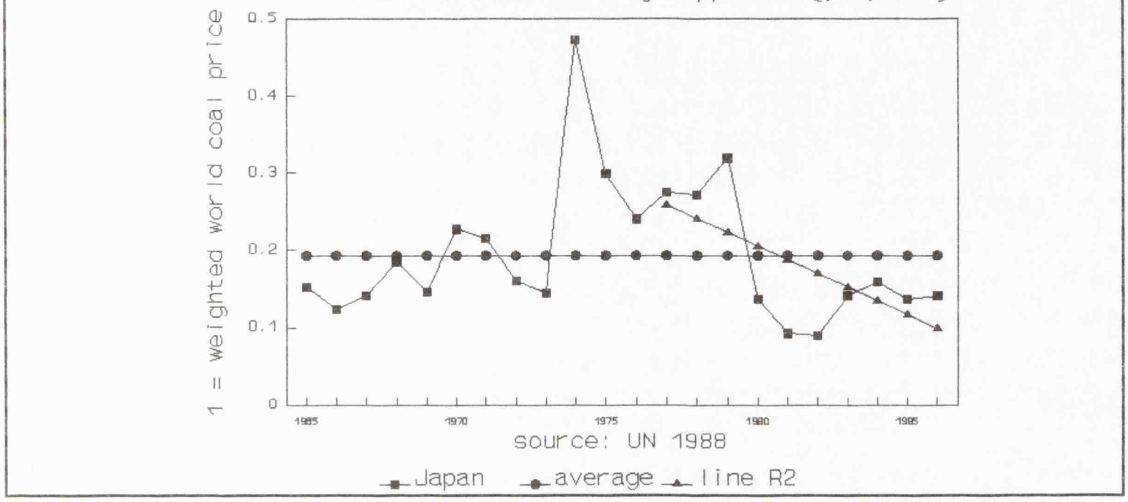


Figure 3.6b: Variation in import prices
- standard deviation among suppliers (>50,000t)

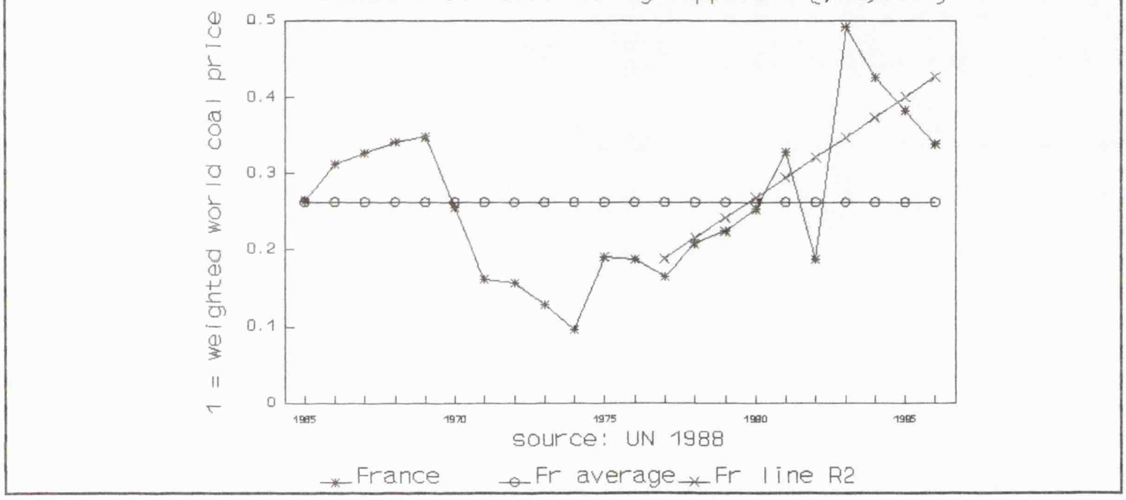


Figure 3.6c: Variation in import prices
- standard deviation among suppliers (>50,000t)

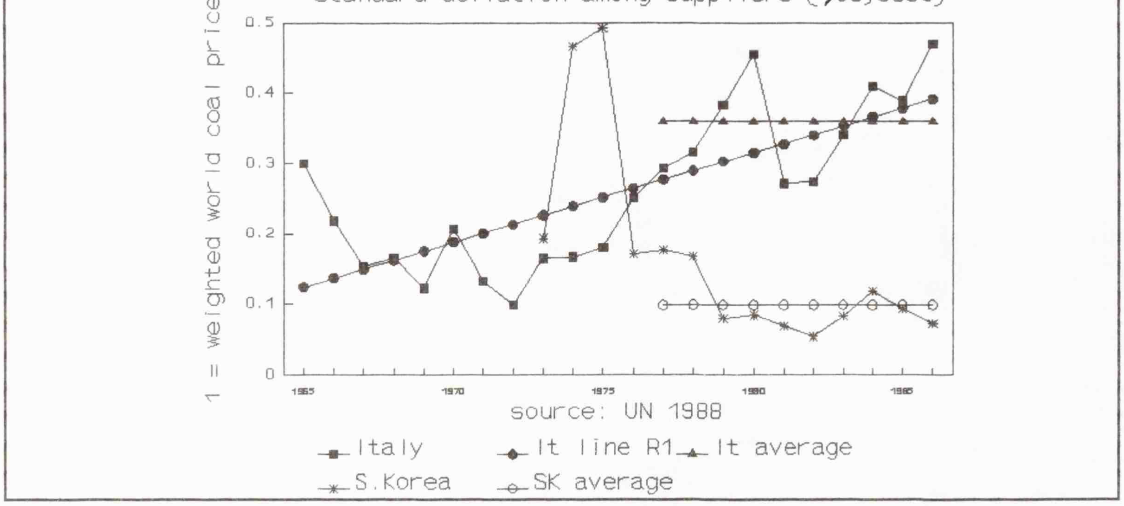


Table 3.6: Analysis of the standard deviation of coal import price ratios for selected countries

country	period / regression equation	mean	standard error	adjusted R-squared
Japan		suppliers <50000tpa		
	1965-86	0.193	0.087 #	
	line R1 = no significant correlations with time			
	1977-86	0.175	0.077	
	line R2 = 35.35 - 0.00178 * T		0.065 #	0.37
France				
	1968-86	0.262	0.100 #	
	line R1 = no significant correlations with time			
	1977-86	0.300	0.104	
	line R2 = -52.08 + 0.0264 * T		0.080 #	0.47
Italy				
	1965-86	0.262	0.108	
	line R1 = -24.91 + 0.0127 * T		0.076 #	0.53
	1977-86	0.360	0.068 #	
	line R2 = no significant correlations with time			
South Korea				
	1973-86	0.165	0.140	
	line R1 = 46.06 - 0.0232 * T		0.106 #	0.43
	1977-86	0.099	0.039 #	
	line R2 = no significant correlations with time			

note: # indicates best description of standard deviation for group
the standard error is of the mean and of the y-estimate on the regression line, respectively
T = year (1965-1986)

Italy and South Korea repeat the differences found in European and Asian coal markets. The standard deviation in cif values for Italian coal suppliers increased over time while that for South Korean suppliers declined (Figure 3.6c). During the last decade the standard deviation for Italian import prices was 36% of the weighted world coal price while the value among South Korean suppliers was 10%. This consistent difference between European and Asian coal markets will be explored further.

One explanation is that importing countries in the two regions rely upon different groups of suppliers and that the differences in price variation are caused by differences in the price of coal from different exporters. For example, European imports from adjacent countries like West Germany and the UK provide high cost supplies (often $70pt) in comparison to South African cif values (typically $40pt). These European suppliers are excluded from the Asian market with the exception of the high price period in the 1970s.

Another important finding of this section is that the variation in coal prices is much larger (typically by a factor of two to three) among the suppliers to a national market than among the average cif prices of different countries in a region. Rather than finding greater price uniformity at the national level, there was less.

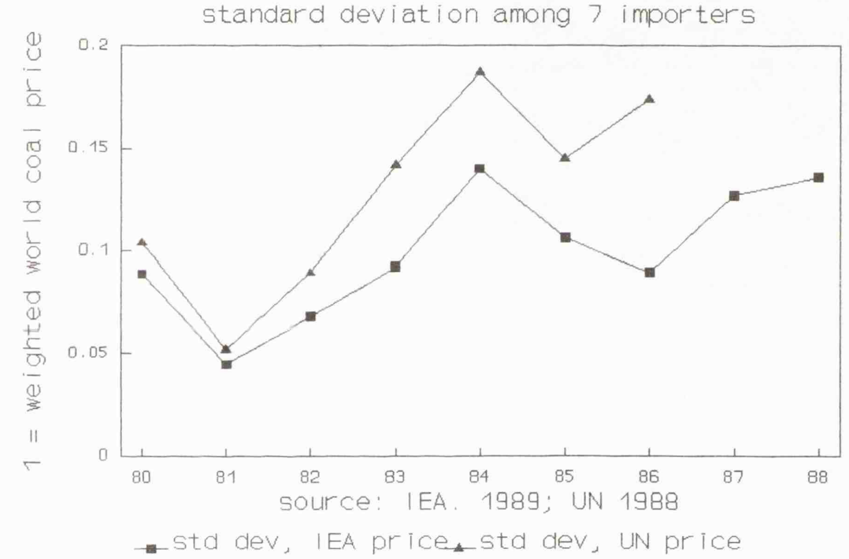
A possible explanation for the differences in coal prices being larger at the national level is differences in coal quality. Coking coal is typically more expensive than steam coal. If countries in Europe are more specialised in taking only one type of coal per supply country, then large price variations could arise within a competitive market structure. An analysis of the import prices of these two general types of coal is required.

3.3.4 Analysis of coking and steam coal prices

Most sources of trade statistics do not differentiate between types of coal (UN 1988). Others provide the separate volumes of coking and steam coal traded, but not the values (Fisher, Rogers and Cox 1989). The IEA (annual) provides a welcome improvement to this trade data by providing separate data for coking and steam coal import volumes and values by export country. Initial presentations of the data set included questionable price data, but the 1989 revision of earlier data is a substantial improvement[14].

A comparison was made between UN and IEA coal price data. Despite many differences in particular values, the pattern of variation among the average import values was very similar for the two data sets (Figure 3.7). The variation among prices increased in the early 1980s as shown in Figure 3.5 and continued into the late 1980s. Over the 1980-88 period, the average price of coal imported into each of the seven largest European coal markets had a standard deviation equal to 10% of the weighted world coal price. This standard deviation increased during the 1980s. However, it should be remembered that the increase in the late 1980s (Figure 3.5) and the overall pattern of the late 1970s - late 1980s shows no significant trend. The standard deviation simply equals 10% of the wwcp.

Figure 3.7: UN and IEA coal price ratios in Europe
standard deviation among 7 importers



The variation in European import prices for coal could be caused by differences in the prices and import levels of steam and coking coal. This hypothesis is tested by separating coal imports into coking and steam coal components and analysing the prices separately.

Average coking coal prices in Europe showed little variation in the 1980s with a standard deviation of just 6% of the weighted world coal price. There was no consistent trend in coking coal price variations over time (Figure 3.8). Instead, the variation was more pronounced among steam coal prices (1980-88 standard deviation averaged 12% of the weighted world coal price - Table 3.7). The conclusion from this comparison is that steam coal prices, rather than being more uniform, were more varied than coking coal prices.

Figure 3.8: European coking and steam coal price ratios standard deviation among 7 importers

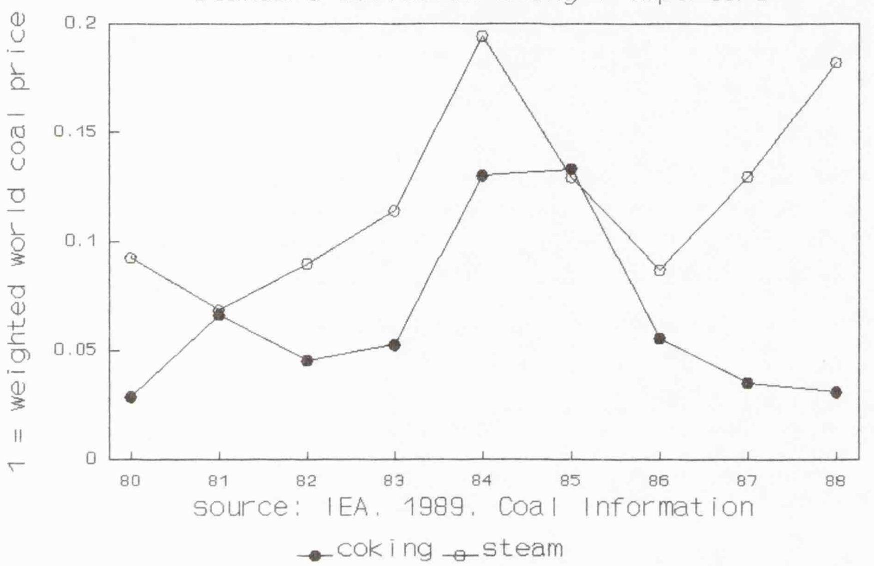


Table 3.7: Analysis of coking and steam coal price ratios in Europe

coal type	period / regression equation	mean	standard error	adjusted R-squared
standard deviation of average cif values among 7 largest importers				
hard coal				
	1980-88	0.099	0.030	
	line R1 = -16.335 + 0.00828 * T		0.024 #	0.44
coking coal				
	1980-88	0.064	0.038 #	
	line R1 = no significant correlation with time			
steam coal				
	1980-88	0.121	0.041 #	
	line R1 = no significant correlation with time			

note: # indicates best description of standard deviation for group
the standard error is of the mean and of the y-estimate on the regression line, respectively
T = year (1980-1988)
Denmark is excluded from the group of major importers of coking coal because it only imported steam coal
hard coal includes coking coal and steam coal

Variations in steam coal prices in the 1980s tended to increase over time like those of hard coal prices, while the variation in coking coal prices remained more stable[15]. The trend in steam coal prices is explained by the uniformly high steam coal prices of the early 1980s and the subsequent differentiated fall in absolute prices in the late 1980s. In comparison, coking coal prices in Europe declined more uniformly.

Given the high variation found in average steam coal prices, these coals should be looked at more closely. The high variation in import values may be caused by different contract types and coal quality. To avoid the effects of possible long term arrangements, the European spot market for steam coal is examined.

3.3.5 The European spot market for steam coal

> 'It is not necessary to examine many copies of publications like the Financial Times International Coal Report to see that there is considerable competition on the markets for coal... even so, this market is a far cry from being perfectly competitive.' (Banks 1989:347)

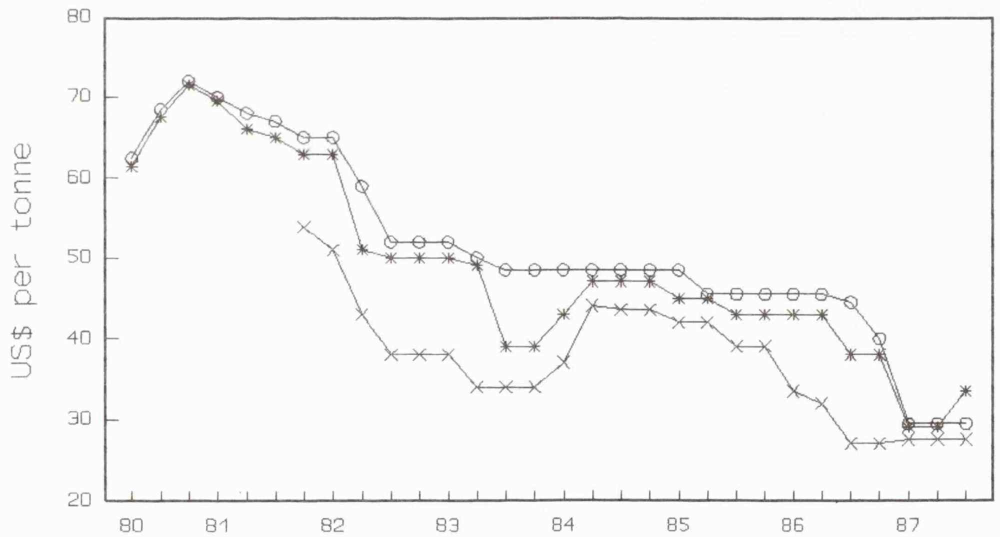
The European spot market for steam coal provides our best opportunity to examine a market where the persistent variations found earlier in average cif prices can be overcome by a competitive market structure. The spot market is generally defined as having contracts of less than one year in duration, but many of these purchases are for a shipment within a few weeks of the agreement (Gaskin 1981, 1986).

The spot market is based on the marginal needs of large consumers and the independent needs of small consumers. However, in the mid 1980s it grew in size as large consumers took a larger share of their total requirements under spot rather than long term arrangements. The port of Rotterdam is the most prominent centre of this trade. Coal is available in small or large allotments. Small lots of 5-10,000 tonnes can be dispatched by barge up the Rhine or large cargoes of 120,000 tonnes can be arranged for large consumers.

Price information is widely available from coal industry newsletters like Coal Week International (CWI), International Coal Report (INCR) and Kings International Coal Trade (KICT) which always include recent quotes from the spot market. Prices for northern Europe are generally quoted in terms of US$ per tonne cif (customs, insurance and freight included) at ARA ports (Amsterdam, Rotterdam and Antwerp). The coal for sale varies in quality with Australian and South African coals generally having less than 1% sulphur while that from the USA is 1-2% sulphur. On the other hand, USA coals usually have higher calorific values. A comparison of the price of three coal types typical of those from South Africa, Australia and the USA is presented in Figure 3.9a.

Figure 3.9a: Spot ARA coal prices

for typical Aus, USA and SAfr coals



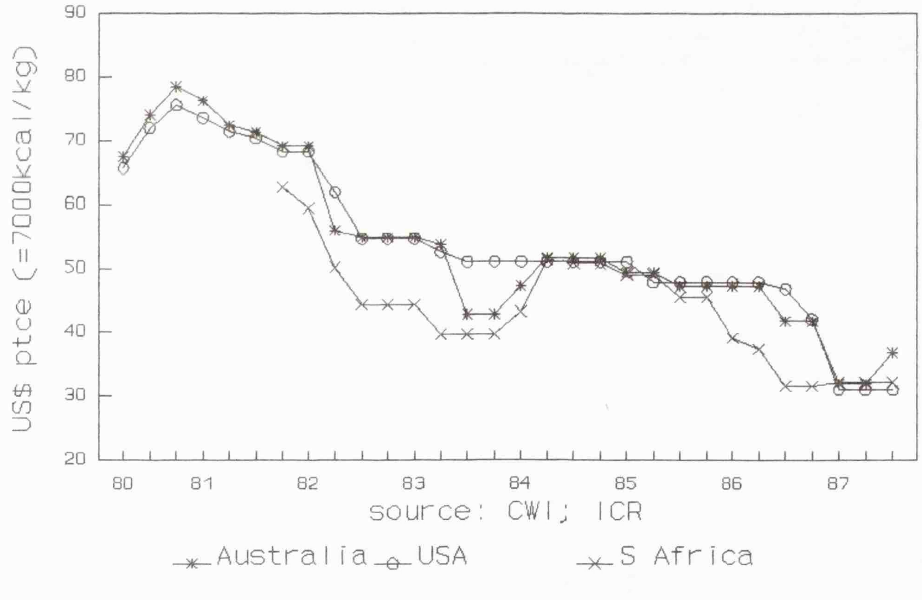
source: CWI; ICR

6400kcal=Aus 6700kcal=USA 6000kcal=SAfr

The patterns reveal an interesting feature of the price formation process. The South African coal was almost always the first to decline in price. This pattern makes sense in terms of the energy content of the coal. Burning low energy coal involves the handling of more material and the disposal of more ash. A preference is thus expected for higher energy coals. When the demand slackens below available supply, the low energy coal would need to offer a price discount to retain its marketshare. Conversely, when prices began to rise in late 1987, it was the higher quality Australian coals which were able to demand higher prices.

To clarify the role of coal quality in price determination, the three types of coal were standardised to uniform energy values (1 tce = 7000 kcal/kg). The result in Figure 3.9b illustrates how the coal prices became almost perfectly uniform in 1985 and 1987. Prices for the USA coal were typically $1 below that for Australian coal, but this difference is to be expected because of the higher sulphur content in USA coals.

Figure 3.9b: Spot ARA coal prices
for standardised coals by source



source: CWI; ICR

The variation in prices for USA, South African and Australian coal is again measured by the standard deviation of price ratios. For the spot prices recorded in the industry newsletters, the average standard deviation for the 1980-87 period was 8% of the weighted world coal price (typically $4 for a price of $50pt). However, when the prices were adjusted for differences in calorific values, the average standard deviation fell to 5% of the weighted world price.

The price data reported in these industry sources demonstrates the uniform price pattern expected from a competitive industry structure and supports the hypothesis that a competitive steam coal market has developed in Europe. However, this conclusion is in direct conflict with the evidence found in the official trade statistics evaluated earlier in this chapter. How can these two opposing conclusions be reconciled? One option is to turn to another information source.

The European Commission also collects detailed coal trade data for both coking and steam coal (ECC annual b). The steam coal data is collected for all imports for power stations in the community from non-community sources. The information collected includes both the duration of the contract covering the coal shipment and the calorific value of the coal. The combination of calorific and contract data should enable an answer to be reached as to whether the government or industry data is correct.

The coal import price series from the Energy Directorate of the European Commission was selected for spot contract data and adjusted to a standard calorific value. The result was a stable level of variation measured by a standard deviation equal to 11% of the weighted world coal price. Despite the adjustments for calorific value and contract duration the two price series were conflicting. Industry sources indicated greater price uniformity (standard deviation = 5%) while the variation found in ECC data (11%) supports other government measures of differences in price levels (standard deviation = 12% without adjustment for quality).

To explain the differences in results, differences in the statistical series need to be recognised. First, the ECC series is the average price for European Community imports in a particular sector, the power generation sector. The industry series was more restrictive in its geographic scope (the northern European region as represented by ARA port prices) but more extensive in its industry coverage. In particular, the cement industry makes substantial purchases from the ARA sources. Still, given the selection of coal from the same three countries (Australia, South Africa and USA) direct competition should have caused the reported prices to be similar in both sets of statistics.

The differences in these price series have been explained by government officials as a function of the selective reporting of the lowest prices by industry sources while the government statistics represent all imports. Conversely, it has been suggested that government data sources are biased. In particular, that the price reported on customs or official forms may be inflated. This controversy requires further elaboration if meaningful comparisons are to be undertaken. The solution adopted in this study is to go beyond government statistics and selected spot prices to compile extensive contract or transaction data wherever possible. This contract data set will be analysed in the next chapter.

3.4 Conclusion

> 'In these circumstances (price differentials and uncertainty), the search for a comprehensive theory of the international coal trade is best not begun, because if such a theory were discovered, someone might make the mistake of believing it.' (Banks 1985:94)

While agreeing with Banks (1985, 1989) that the international coal trade is 'inconsistent with simple competitive market theory' this study does not argue to stop the investigation for an explanation of coal trade. Instead, it uses the inconsistencies between competitive market theory and coal trade practice as proof of the need for an alternative explanation of trade. The standard conditions for a commodity market to operate were shown to be a necessary, but not sufficient basis to form a competitive international coal trade.

The analysis of international coal prices produced unexpected results. The competitive coal trade model predicts uniform coal prices within national markets (competitive equilibrium) and varied prices in different countries (because of differences in transport costs). However, trade data revealed the opposite. Average import coal prices (cif unit values) were more varied in national markets than within the regional markets of either Europe or East Asia. In addition, the pattern of regional prices was one of persistent variation in the late 1970s to late 1980s. The conclusion from this evidence is that international coal markets are fragmented.

Conflicting evidence was found from industry trade journals where competitive prices were quoted for steam coal on the European spot market. However, official European Community data of the spot steam coal purchases for power stations revealed the same price variations as indicated by IEA and UN data. The data sets used are not entirely compatible, yet a persistent story of widely varying rather than uniform pricing emerged. The persistence of this variation in prices indicates that it is caused by stable influences on the market and these need to be examined.

One explanation for the persistent price variations is the fragmentation of competition by trade structures. The domination of price negotiations by a monopsonist is an extreme structural configuration of the market. The evidence for and against the monopolist explanation of price variations is explored next.

Endnotes:

1. This calorific definition is analogous to the definition of one tonne oil equivalent (toe) as containing 10,000 kcal/kg or 10 million kcal (IEA 1988:II5).

2. The data used in Figure 3.1 and Table 3.1 is compiled from several sources. The United Nations Trade Statistics (1988) were used as the base for most 1965-86 national data. Coal trade statistics were collected from importing country data sets for SITC (standard international trade classification) item number 3214. The units used are metric tonnes (not adjusted for quality) and US$ for values. Obvious errors like the duplication of values for more than one trading partner were checked and eliminated. Revisions may be made to the data set in subsequent years, especially for 1986 data. To reduce the likelihood of major revisions, comparisons were made with other sources. Though comprehensive, the data set was also incomplete. IEA (1989a) Coal Information was used for import tonnages for Denmark (1979-88), Israel (1982-88) and Taiwan (1984-88) and the major coal trading partners in 1987-88. IEA (1988) World Energy Statistics and Balances 1971/87 was used for aggregate import tonnages for India (1982-86) and the centrally planned economies (1971-86). These tonnages were adjusted to standard 7 million kilocalorie units (tce or tonne coal equivalent) and thus may vary from those reported in other sources. NEDO (1989) Coal in Asia-Pacific was used for import tonnages for Malaysia (1985-86).

3. An interesting feature of the market is that even the largest producers and exporters often import coal. Canada and the USSR each import over 10mtpa while the USA, Poland and China each import over 1mtpa. The reasons for this pattern are both geographic and quality based. Large countries export coal in one region and import it in another. Canada exports coal from the west coast and imports it from the USA at the Great Lakes. China exports from the north and imports into the south (as required by winter shortages). USA imports coal into the south, especially from Colombia. The Soviet Union imports coal from Poland. Geographic proximity is important in continental coal trade with the result that coal is often cheapest across an adjacent border rather than paying to transport it over a large country. Comparisons of coal prices thus need to be included as an integral part of the overview of international coal trade.

4. Only countries which supplied over 50,000 tonnes in the year are considered. This threshold level was selected because it represents the size of a standard Panamax vessel, commonly used in the trade. Smaller shipments usually involve extra costs for transhipment or represent specialised needs.

5. The 1985 production costs of 15-30 rand equalled $7-14 per tonne.

6. Production costs of A$20-50pt were converted to US$14-35pt (Schulz 1988) and the differences between Queensland and New South Wales noted (Calarco 1987).

7. Above this price, users would switch to oil for their energy requirements. This calculation was based on heavy fuel oil (which competes with coal for fuel uses) having a price of 90% of the crude oil price. At $30 per barrel this equals $140ptce. Given the extra costs of handling and using coal, a further penalty of $25pt is introduced. The result is a maximum coal price of $115ptce (Schulz 1988).

8. For example the 1988 US Department of Energy (DOE) study of long range energy projections constructed a reference case with an oil price of $33 per barrel in 2000. The various scenarios had oil prices in the range $29-37 per barrel (US DOE 1988).

9. Despite the appeal and rational basis of such long term models, they will be shown to fail when compared to the complex reality of the coal trade. The reason is easily illustrated with the example of South Africa. While Schulz estimated that production for exports could be increased 3-6 times, the reality of international politics dictated that South African exports stagnate in the late 1980s despite growing global demand and trade. Major European importers like France and the Scandinavian countries refused to sign new contracts and ceased imports because of the internal political situation in South Africa and their domestic opposition to apartheid. Boycotts to South African coal have been proposed for the entire European Community (SOMO 1989a) and even Japan decided in 1988 not to increase imports from this source.

10. Note that the average unit values of manufactures exported does not take into account the improvement in quality of manufactures over the period (Grilli and Yang 1988).

11. The use of the standard deviation measure does not imply that coal prices are normally distributed. Instead, it is used as a standard measure of the variation (deviation from expected values) in prices. (The standard deviation equals the square root of the variance which is the sum of the squared deviations from the mean divided by the number in the sample.)

12. The weighted world coal price was calculated as the average cif unit value (in US$pt) for the 18 market economies (weighted by volume of annual imports) which were the largest importers of coal in 1985.

13. A prominent route for coal shipments is from Hampton Roads on the US east coast to Japan. The freight rates on this route were very high in 1973-74 and 1979-81 with low values in 1975-78 and slowly declining values in the 1980s. This pattern is similar to that noted for intercontinental coal prices and further examination of price variations is called for (NYK Monthly Report cited in Coal Manual; CWI; ICR; Lloyds Weekly).

14. For example, the UK average cif unit value of coking coal from Australia in 1982 was revised upward by over 100% from $33.26 in the 1988 series to $67.91 in the 1989 series. A comparison of the two series is shown below:

series	1980	1981	1982	1983	1984	1985	1986	1987	1988
	coking coal imported from Australia ($US/t)								
1988	62.45	-	33.26	38.49	-	43.83	-	56.47	
1989	62.45	66.37	67.91	59.37	58.50	60.48	55.32	53.10	50.27
series	steam coal imported from Australia ($US/t)								
1988	62.94	-	42.04	48.41	66.45	43.32	-	62.59	
1989	62.94	63.63	69.31	70.63	67.63	60.24	59.33	58.75	68.13

source: IEA 1988a,1989a.

Despite the improvements in the series, some numbers remained suspicious. For example, the $18 drop in average German coking coal import prices from $58.60 in 1983 to $40.60 in 1984 and 1985 (before rising to $51.80 in 1986) implies that imports from 'other OECD' suppliers like France or the Netherlands had a price cut from $57.20 in 1983 to $34.92 and $30.54 in 1984 and 1985 respectively. This is based on the assumption that the values for other suppliers (Australia, UK, USA, Czechoslovakia, Poland and USSR which supply over 80% total imports) are accurate. Rather than assume that such a price cut occurred among European suppliers, the average value for the six known suppliers was used as the average German import price.

15. The correlation coefficients comparing the standard deviations in European coal prices with the years 1980-88 are: 0.71 for hard coal, 0.58 for steam coal; and 0.02 for coking coal.

Chapter 4

Linking competitive and security interests: Coal prices, quality and sources

4.1 Introduction

Evidence supporting the monopsonistic and competitive models of coal trade is evaluated and found to be inadequate to explain diverse trade patterns. The allegation that Japan exercises strong bargaining power and discriminatory pricing practices is examined in detail. To find out whether Japanese bargaining power is a function of a supply/demand imbalance in the market (relational power) or a function of underlying trade structure (structural power), the Japanese coal trade is examined for changes in contractual pricing patterns from the high price situation of 1976 to those of the low price context of 1987.

To explain the variations found in coal prices, the initial analysis of coal quality variables is extended by introducing security of supply variables. These security variables are based on the objectives of coal consumers which are assessed directly by means of a coal trade survey. The results are compared to actual trade practice. Two detailed sets of data; the consumer survey and coal contracts thus provide new insights into the coal trade process to resolve the debates over the most appropriate type of trade model to use and the importance of relational and structural power in the trade.

4.2 Coal trade models and data requirements

The 'Japan Inc.' model is introduced as an alternative to the commodity market model examined in chapter 3. Detailed transaction data are then used to evaluate the controversy over the relative merits of simple economic or political models to explain the largest coal trade in the world, the Japanese import of coking coals.

4.2.1 Japan Inc.: the monopsony model

The establishment of an extensive and integrated Japanese coking coal procurement structure is widely recognised (D'Cruz 1979; Anderson 1987). The combination of guiding government policies and interlocking corporate structures has given rise to the claim that Japanese companies and government agencies act in a manner which benefits the aggregate interests of Japan rather than those of the individual company. This model of Japanese political economy is often called 'Japan Inc.'[1]. Although the consuming industry does not consist of a single company, industry coordination is achieved by the use of government policies and collective action to create an effective monopsony (Szabo 1985).

A monopsony model of trade involves a single purchaser and numerous sellers[2]. Given the absence of alternative purchasers of their product, the sellers have limited bargaining power and any rent which is generated by the trade is captured by the purchaser. This asymmetry in the distribution of the benefits of trade can raise acute concerns where one side feels penalised. Three possible outcomes of a monopsony purchasing arrangement are evaluated in this study. First, price discrimination could be used to achieve objectives like security of supply and result in variations from competitive pricing based on coal quality. Second, enhanced buyer bargaining power could be used to impose uniform price changes on suppliers whereby all suppliers are forced to accept the price change agreed by the first company to 'break rank'. Third the pricing criteria (coal classifications) may be changed unilaterally by the purchaser and imposed on the suppliers. Each of these results have been alleged to occur and this chapter will examine the data to test the validity of the claims.

The alleged use of discriminatory power in the coal trade has prompted the construction of a conspiracy theory in which Japanese government and industry combine to outwit their trading partners. The coal conspiracy theory became a common topic of concern during the recession of the early 1980s (Byrnes 1982:43). Japanese government forecasts of high future demand were reinforced by new corporate contracts to establish new mines in Australia and Canada and intergovernmental agreements to finance new mines and infrastructure in the USSR and China (Barlow 1982). The new production capacity created by this investment combined with the capacity of existing mines to produce an oversupply situation for the duration of the 1980s. Prices fell and the debate over causes has continued (Anderson 1987).

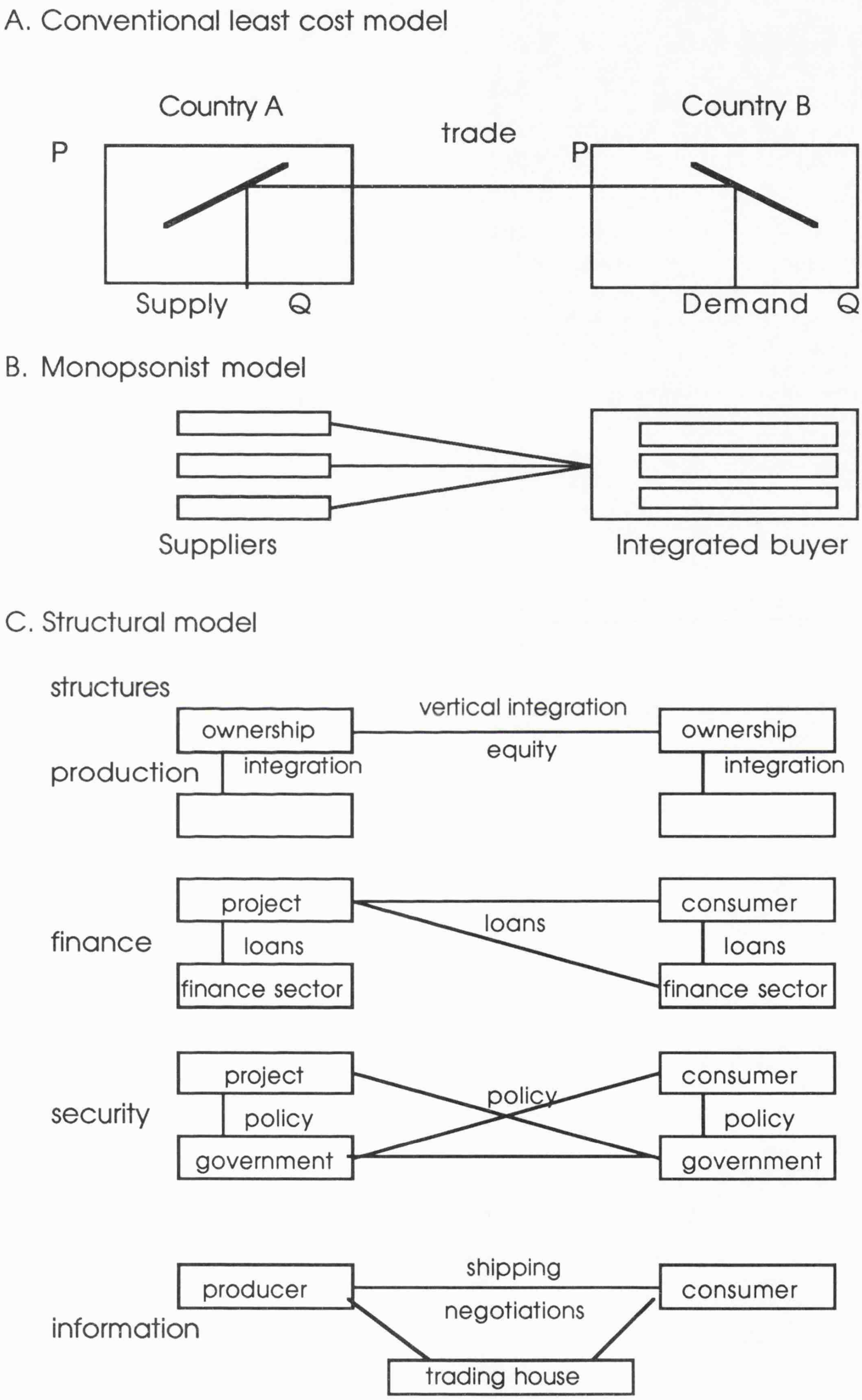
4.2.2 Data adequacy and model assessment

One of the problems encountered in evaluating any trade theory is data availability. As was seen in the last chapter, the assessment of the competitive global coal market model was limited by data aggregation. To overcome this problem, prices need to be evaluated for particular coal transactions where the characteristics of the coal can be compared directly to the price. This shift to the analysis of particular coal brands is also required to compare the alternative models of trade considered in this thesis (Figure 4.1).

The conventional competitive model is based on an equilibrium being formed to balance the supply and demand functions. A trade flow results with exports from the producing country being imported by the consuming country at a price where the marginal cost of production equals the marginal benefit of consumption. The production structure associated with this model is one of many independent producers and suppliers.

In contrast, the monopsonist model presented by the 'Japan Inc.' school has an integrated or single consumer importing coal from many producers. This production structure enables monopoly power to be exercised and can result in discriminatory prices or other trade conditions being imposed upon producers.

Figure 4.1: Alternative trade models



This thesis offers an alternative to both of these models and their emphasis on the production structure (competitive or monopsonistic) as the determining feature which explains trade. Instead, a structural model is developed which argues that the production structure is joined by the financial, security and information structures as the primary determinants of trade (Figure 4.1c).

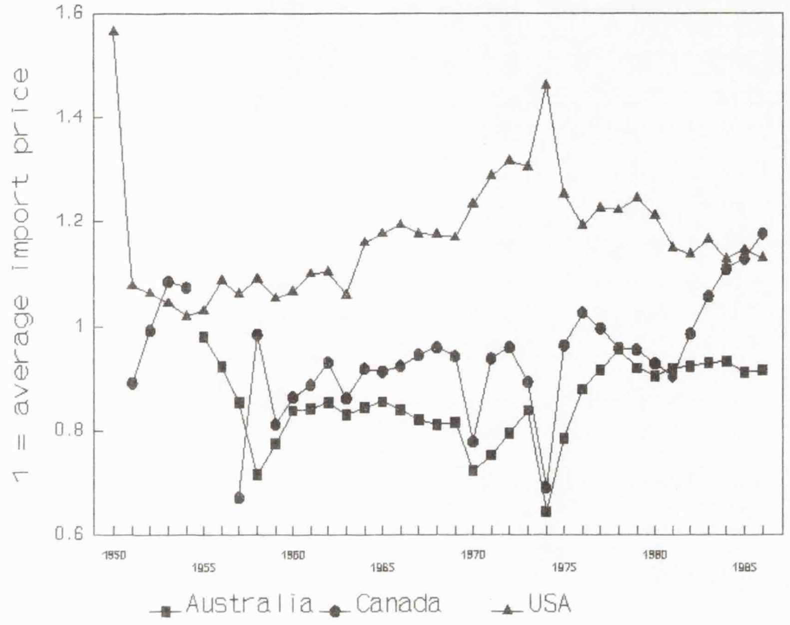
4.3 Price discrimination

4.3.1 Aggregate and transaction price differences

The differences between aggregate and detailed transaction analysis are readily shown by extending the analysis in chapter 3 with a detailed transaction based analysis here. Average coking coal import prices vary among supply countries and Figure 4.2 provides a summary of the pattern for Japanese imports over the last 30 years. American prices have been universally high compared to other major countries. In JFY74 the cif price for American coking coal ($74.45) rose to over double the cif prices of Australian and Canadian coal ($32.87 and $35.20 respectively). Before and after this peak, American coal prices were 15-30% higher than average import prices. Australia provided a lower cost source of coking coal for the Japanese steel mills and Australian imports exceeded American imports in 1969, 1972, 1973 and continually from 1976. Australian prices were typically 10-30% below average import prices. Canadian prices were generally below US prices, but above Australian prices. Only in the late 1980s did Canadian prices exceed American prices as a result of the introduction of high cost coal from north east British Columbia.

Given the high cost of USA coal, new sources in Australia and Canada were desired to both lower import costs and provide diversity of supply. Furthermore, if the Japanese buyers arranged coal supplies on a cost plus basis then price differentiation would be expected (Anderson 1987).

Figure 4.2: JSM coking coal price ratios



In contrast, if a single commodity market existed, then a single price would be expected. An intermediate position between cost plus pricing and single market pricing is possible where the market is fragmented. Firms may be competitive within each fragment, yet the price remains at separate levels.

Before commenting further on coal prices, adjustments need to be made for quality variations in the coal. Coking coal is difficult to standardise for quality for several reasons. Not only does the coal vary on several important characteristics, it is also used for three distinct purposes which place value on different attributes. Coking coal provides the support for the molten mixture in the blast furnace and therefore must have good swelling or coking qualities. It is also the reducing agent and thus needs to provide a readily available source of carbon. Coal is also used as the fuel to supply the heat in the blast furnace and re-substituted oil for this purpose in the late 1970s and early 1980s. Finally, impurities in the coal can affect the quality of pig iron produced and the types and quantities of impurities need to be limited.

The number of coals which meet all of these requirements is limited and premium prices have traditionally been attached to such fuels. However, rather than rely on a single coal with the desired combination of characteristics (like low volatile Appalachian coal from the USA), most Japanese steel mills blend a variety of coals to produce the required balance. This enables lower cost coals to be included in the coking coal blend, including coals previously considered to be only suitable for steam coal. By the late 1980s, 10-15% of the coal used in Japanese blast furnaces was termed semi-soft coking coal. These coals were poorly suited for coking purposes on their own, but were acceptable when pulverised and injected in a coal blend.

Average national coking coal prices thus fail to provide much information about reasons for price differentiation. Price differences may simply reflect variations in quality or they may represent positive policies to ensure diversity of supply or security objectives. By shifting the analysis from the national level to that of particular coal brands, prices can be adjusted for coal quality and the reason for price variation tested.

4.3.2 Coking coal characteristics and price

Coal characteristics are generally assumed to be important in determining the utility of coal for coking and hence its price. The characteristics of coal were studied by first asking the purchasers, Japanese steel mills, what characteristics are important and then analysing the contract data to measure the observed relationship between price and quality.

The attributes most commonly specified in Japanese coking coal contracts, and thus assumed to be of greatest importance, are: total moisture (less moisture, higher value); ash (less ash, higher value); volatile matter (less volatile matter, higher value); total sulphur (less sulphur, higher value); CSN or crucible swelling number (higher CSN, higher value); and fluidity (higher fluidity, higher value). Maximum particle size is also specified in contracts, but tends to have a standard range (30-50mm maximum)[3].

The relative importance of these characteristics in deciding on coal purchases was assessed in the survey of coal consumers introduced in chapter 1[4]. The survey compared buyer objectives in 1980 with those in 1987. In both cases, ash and sulphur were identified as the most important coal characteristics and penalty clauses are included in contracts to ensure compliance with agreed levels. The ranking of other attributes changed between 1980 and 1987. In 1980 the proportion of volatile matter, the CSN and fluidity were also considered as having above average importance. In contrast, the total moisture was ranked as being of less than average importance. By 1987 the CSN was demoted to below average importance while the moisture content increased in relative importance. Fluidity was also considered to be of increased importance in 1987.

Table 4.1 Ranking of coal qualities by buyer and contract

attribute	survey		contract price data		
	1980	1987	1976	1984	1987
ash (%)	1	1	4		
sulphur (%)	1	1			
volatile matter (%)	3	4	3	2	
CSN	4	6	1	1	1
moisture (%)	6	5	2		
fluidity	5	3			

source: Appendix D; initial equations for all Japanese import contracts for coking coals

Studies of the effects of coal quality on prices have been undertaken before, but the conclusion is disputed. D'Cruz (1979) argued that coal quality was not an adequate explanation of price and that the JSM discriminated on the basis of country of origin and quasi-integration linkages. The opposite conclusion was reached by Kittredge and Siverston (1980) who incorporated several coal attributes in their analysis of coking coal prices and concluded that the prices received for Canadian coal was equal to those of USA and other coals under competitive pricing conditions when adjustments were made for coal quality. Anderson (1987) suggested that the discriminatory finding by D'Cruz could be accounted for by his use of a simple fixed carbon index to adjust for coal quality and his lack of attention to other important attributes. This debate over the importance of coal quality in determining price is extended by the following analysis.

The JSM purchase several dozen brands of coking coal annually. By comparing the most important attributes (CSN, ash, volatile matter, total moisture and sulphur) to the price paid in JFY76[5] for the 46 brands of coal contracted for supply during that financial year, a strong feature emerged[6]. The simple regression model of coal characteristics proved to be a very good explanation of fob coking coal prices in 1976[7]. Four of the coal qualities made a significant contribution to the equation for all imports while the fifth (sulphur) was significant in the equation excluding outliers. The proportion of the variation in prices explained by the equation (adjusted R-squared value) was .83[8].

Equations for fob price of coking coals imported into Japan[9]

1987 price fob = 26.54 + 2.40 CSN
n=83 se=6.65 R2=.41

1984 price fob = 51.74 + 2.23 CSN - .49 VM
n=73 se=5.40 R2=.58

1976 price fob = 49.69 + 3.15 CSN - .90 M - .26 VM - .67 A
n=46 se=3.83 R2=.83

fob = price in US$ per metric tonne, (free on board)
CSN = crucible swelling number
A = % ash (air dried basis)
VM = % volatile matter (air dried basis)
M = % total moisture (gross as received basis)
S = % total sulphur (air dried basis)
se = standard error in estimate
R2 = R squared adjusted for number of cases

In contrast to the strong correlation of coal characteristics and fob prices in 1976, the pattern in later years is much weaker. Only two of the attributes (CSN and volatile matter) had a significant correlation with price in 1984 and only one (CSN) in 1987. The proportion of price variation explained by the equation also fell from 83% in 1976 to 58% in 1984 and 41% in 1987.

In addition to the R-squared value, the standard error of the estimate is also informative about how well the equation fits the data. Whereas the standard error in price estimates in the 1976 equation was less than $4pt, it increased to almost $7pt in the 1987 equation. This decline in the role of coal quality as a predictor of price would support the D'Cruz argument of price discrimination based on other criteria [10].

Another striking feature of the equations is that the importance of the coal qualities is quite different from that indicated by the consumer survey (Table 4.1). One explanation for the differences between expressed and measured ranking of coal qualities is that the coal qualities identified as being most important by coal purchasers (ash and sulphur) may be so important as to restrict coals to the acceptable range and contracts are not even offered for coals with qualities beyond this range. Most contracts have specific penalty clauses with price penalties of $1.10 per 1% of ash above the contract specification and $0.55 per 0.1% sulphur (Coal Manual 1985:212). The result could be a restriction of coals to the subset where ash and sulphur are at acceptable levels and other qualities then became more important in determining price.

These initial equations include all coking coal brands and may not meet statistical assumptions about the distribution of the data. To improve the accuracy of the equations one needs to look more closely at the data and the residuals which result from the specification of the equation[11]. Since cases are not likely to be more than three times the standard deviation away from the mean when a population is normally distributed, the appearance of any such outliers needs to be examined. These outlying cases may distort the analysis and have a disproportionate effect on the equation.

When outliers appear several techniques can be used to overcome their effect. The data can be transformed (usually log transformations when the residuals are positively skewed and square transformations when the residuals are negatively skewed), alternative variables used or the cases removed if they belong to a different population because of another factor. In the case of the coking coal data it was decided not to distort the data (through numerical transformations) from the initial variables which provided a good explanation of coal prices in 1976. Instead, other variables associated with the structural model of coal trade will be introduced to explain price variations in a later section.

The existence of outliers is first explored as an indication that not all coals receive fob prices on the same basis. The cases more than three standard deviations from the mean are excluded and considered individually while the equation for the remaining group of coals are compared to the initial equations. The revised equations show a much tighter statistical fit to the data and offer improved predictions of prices. For example, standard errors decline to $3-4pt and the adjusted R-squared value improved (from .41 to .75 in the 1987 equation by the exclusion of 2 outliers). The new equations are as follows:

Revised equations for fob price of coking coal (excluding major outliers)

1987 price fob = 35.11 + 2.08 CSN - .89 A
n=81 se=3.17 R2=.75

1984 price fob = 47.20 + 2.87 CSN - .36 VM
n=70 se=3.45 R2=.74

1976 price fob = 60.66 +2.85 CSN -1.10 M -.28 VM -.99A -7.21S
n=45 se=3.04 R2=.89

This evidence appears to support the Kittredge and Siverton (1980) conclusion of quality-based competitive pricing, but it was only achieved by the exclusion of coals which had the strongest 'quasi-integration linkages' argued to be important by D'Cruz (1979). Rather than simply remove the outliers, one should consider why these cases were outliers in the first place. Yes the price prediction was improved, but what data was lost? Quintette and Bullmoose coals each received prices more than three standard deviations higher than that predicted by the 1987 and 1984 equations (along with the high fluidity coal, Sewanee, in 1984[12]). These cases may reveal as much interesting information about coal prices as the group of more statistically consistent coals portrayed in the revised equations.

4.3.3 The Quintette and Bullmoose cases

The exclusion of the Quintette and Bullmoose coal brands from the 1984 and 1987 equations is significant because these coals are from the new mining region of north east British Columbia. In addition, the contract which set the Quintette price based on a series of escalators related to production costs was the subject of protracted arbitration in 1988-89. The Japanese steel mills called for a settlement at current world coal prices, while the mine operators wanted the original contract, including the price formula based on escalators, upheld[13]. Quintette coal was always high cost coal. Even when the contract was signed in 1981 the base price of C$75/t (referenced to 1 April 1980) was above the prevailing price of $C64/t for comparable south east BC coal. By 1 April 1987 the escalators in the contract had raised the price to C$103.78. Quintette Coal had accepted a price cut of C$8.50 from the contract price in the 1985 and 1986 negotiations with the Japanese steel mills under the inequity review clause (Coal Manual 1988:303). However, in 1987 the Japanese steel mills wanted a reduction to the price of comparable coals ($44/t). The dispute went to arbitration while the coal continued to be traded under the previous year's conditions.

Similar negotiations were held under the smaller Bullmoose contract (1.7mtpa compared to 5mtpa). The Bullmoose price had a slightly higher base (C$75.50 in 1 April 1980) but the company agreed in 1984 to a larger reduction from the escalated price (C$10/t in 1984-86) in return for an increase in tonnage (300,000t). Given the acceptance of the earlier price cut, the 1987 price was cut by C$11.26 to C$91.77/t (Coal Manual 1988:305).

The arbitration is an interesting case, because Quintette is the new mine with the highest JSM direct equity investment (chapter 6). If the coal contract is revised and prices are reduced to prevailing Australian or south east British Columbia levels, the owners will not be able to repay the loans (largely from Japanese banks) let alone profit from their investment. Indeed, the major Canadian investor, Denison Mines, wrote off its C$240 million investment in the project in 1985 to no longer value the mine as an asset (Mining Journal 1986; Mitchell 1986:13). The JSM may not value the mine as a direct asset either (in terms of profit and dividends paid to the steel mills). Despite this lack of direct profit and dividends, Quintette offers the JSM indirect benefits. Its output maintained an abundant international supply position in the coking coal market of the mid 1980s which depressed the price for all other producers.

Ironically from the Canadian point of view, some of the mines hardest hit by Japanese price and tonnage cuts in the mid 1980s were the older Canadian mines. The Balmer, Fording and Luscar mines, for example, had their original contract tonnages cut to 56% in 1985 and 50% in 1986 while the 1986 Quintette tonnage was only reduced to 95%, as allowed in the contract (plus or minus 5%) (ICR 1986 139:2). Quintette and the neighbouring Bullmoose mine could thus be regarded as special cases in the Japanese coking coal pricing system. They can be removed and the data analysed again without such anomalies.

Alternatively, the question can be asked as to why Quintette and Bullmoose are part of the coal trade at all? The answer has broader implications than may be expected. If the answer is to earn profit for the investing parties, then the conventional trade model can be maintained and a conclusion reached that the investors made a bad decision. On the other hand, if the mine is part of the international coal production structure promoted by the Japanese then a different model of trade is required. The 'Japan Inc' model offers one explanation of Japanese bargaining power being used to control prices and trade patterns. The evidence to support these allegations is evaluated next.

4.4 Bargaining power and trade discrimination

> 'Japan is endeavoring to transform herself from her early postwar position of a price taker (or a perfectly competitive buyer) in "open" world resource markets into that of a monopolistic buyer in "closed" resource markets so that she can acquire vital resource supplies " at the marginal cost to the system" (that is, retaining to herself decisions over output, if not decisions over prices).' (Ozawa 1979:236)

Price discrimination can be caused by many factors. The factor most important to this study would be a deliberate decision on the part of Japanese purchasers to discriminate on prices so as to pay higher prices to higher cost mines introduced to improve security of supply while maintaining lower prices to lower cost mines. This pricing arrangement was termed 'cost-plus' by Anderson (1987). Cost-plus pricing can be achieved by the exercise of bargaining power by Japanese buyers. Before considering the source of this power (relational power or structural power), discrimination needs to be demonstrated. Three types of discrimination will be considered, price discrimination, changes in coal classification and changes in contract tonnage.

4.4.1 Uniform price changes

Uniform price changes are alleged to be imposed on suppliers by the JSM and represent a measure of their bargaining power. Negotiations are always held in Tokyo with the eight steel mills represented by a lead negotiator (Nippon Steel for Australia and Nippon Kokan for Canada). The lead JSM negotiator for each country meets with the various national coking coal exporters in turn. The Japanese trading house which imports the coal is also present and helps arrange these meetings. The consumer's objective is to gain the most advantageous price concession from a single producer. This price change will then be used by the Japanese negotiators as the standard price and imposed uniformly on the other producers.

The 1988 negotiations illustrate this practice where the Canadian suppliers Fording and Westar agreed to a price increase of $2.90 for their hard coal. The Japanese negotiators then used $2.90 as the standard increase in coal prices for JFY88. Most Australian and American suppliers accepted this increase within a month of the Canadian deal for fear of volume cuts if they were late signing their contracts (ICR 1988 195:1).

The Canadian companies were in a particularly vulnerable financial position because of the severe cuts (50%) to their contract volumes received in previous years. The negotiation practice of selecting the weakest supplier first is well established and each year one company or another has a good reason for being the first to 'break rank'. Although there may be no apparent economic reason for a price change accepted by one company to be transferred to all others in the market (Gaskin 1983a) the practice is well established. This is argued by coal suppliers as an illustration of the bargaining power which the JSM exercise in the coking coal trade.

The influence of such practices is not restricted to the Japanese trade. The steel mills of South Korea and Taiwan wait until the Japanese have reached an agreement with their suppliers and then impose the same terms on suppliers to South Korea and Taiwan. Indeed, the Korean and Taiwanese negotiators attempt to prove that they are better than their Japanese counterparts by gaining further concessions of a few cents per tonne from the suppliers. An explicit link to JSM prices was also made by the Pakistan steel industry which signed long term contracts with suppliers and set the future price equal to that negotiated by the JSM (ICR 1989).

4.4.2 Coking coal classifications

Coal negotiations generally take place with certain coals classed as being of the same value. These classes change over time and these changes are argued to sometimes form part of the negotiation strategies rather than being an accurate reflection of coal qualities. For example, in the negotiations for JFY84 contracts, the steel mills realigned their hard coking coal classifications. The uniform coking coal price of $54/t in JFY83 was reduced to $52.50 for class A coking coals (Coal Cliff, South Bulli, Tahmoor) and $51.50 for class B coals (Moura and South Blackwater). Class C coals (Wollondilly and Blackwater after its ash content was lowered 0.5% to 7.8%) were priced lower at $51.00/t (Coal Manual 1985:188). Coal Cliff was used as a reference coal with other coals priced lower or higher depending on their quality. While class B and C coals were considered of less value, Gregory coal was priced at $54.50 to reflect its higher quality.

In the following year, JFY85, the NSW soft coking coal producers agreed to a Japanese request to review the division of their eight coal brands into two grades: grade A included Big Ben, Daiyon, Lemmington and Rathluba; grade B included Liddell and Hunter Valley. Four of the coal brands were expected to reduce their ash and sulphur levels with differences in quality taken into account in 1986 pricing negotiations (Coal Manual 1985:148). This attention to quality and classification can be interpreted as part of the Japanese desire to break the collective bargaining whereby the seven

Newcastle soft coking coal producers negotiate as a group. The Coal Manual (1985:148) began its report on JFY85 negotiations by announcing the 'Possible Switchover to Contract-by-Contract Talks from Next Fiscal'. Despite the Japanese desire to divide the Hunter Valley producers, subsequent negotiations continued to be conducted through two joint negotiators representing the seven companies.

The changes in pricing criteria have direct effects on the financial position of particular mines. For example, Wollondilly coal was priced $1.70 below Coal Cliff in the early 1980s, then received the same price in 1983 and then was set $1.50 lower again in 1984 (Coal Manual 1985:188). These changes in the classification of Australian coals are repeated in other countries. One of the more dramatic classification changes was made with Canadian coals.

In the 1988 negotiations Westar and Fording were the first companies to reach agreement with the JSM. Not only did they receive increased contract tonnages of 600,000 and 500,000 t respectively, but the coal which they had sold in 1987 as semi-soft coking coal for $33/t was reclassified as hard coking coal and received a price of $46.90/t in 1988. The price of other Fording and Westar coals was also set at $46.90/t (ICR 1988 194:2). This represented an increase of just $2.90 from the $44.00/t received in JFY87 for hard coking coal and was used as the uniform price rise for other coals noted above.

The general price increase to the JSM suppliers was thus $2.90/t while the first companies to sign, Fording and Westar, received average price rises of $6.23/t and $5.86/t respectively, because of the new coal classification. This price rise combined with the increased tonnage to raise the value of JFY88 contracts to $94 and $150 million for Fording and Westar. In contrast the JFY87 value of the contracts was $61 and $107 million, respectively. This represents a 45% increase in cash flow for the two companies as a result of a reported 6.6% price rise ($44.00 to $46.90)[14].

Coal classification is thus an important element of price negotiations. The price differences paid to coals from different countries are often explained in terms of quality differences. These quality differences should be evaluated to measure whether or not the systematic price differences are based on the country of origin instead. One of the best means to classify a diverse set of items in accordance with several characteristics is by cluster analysis.

The coking coals imported into Japan were classified using cluster analysis to determine the similarity of coals from different countries. The result should either support or question the hypothesis that price discrimination is based on country of origin rather than simply on coal quality. If most of the clusters are based on coals from single countries then the price differences could reflect coal quality rather than national preferences[15].

Seven clusters of coal brands were created by the complete (most distant) cluster analysis technique (which compares the most distant members of clusters to ensure the greatest internal consistency within groups). Five of the seven groups include coal brands from two or more countries. Similarly, the brands from each country are typically distributed among more than one group. Australia provides the most broad ranging example with its coals present in over half of the clusters. USA coals tended to be more isolated and divide into one or two groups (one group with low volatiles and both groups with the distinctive Appalachian attributes of high sulphur and low moisture levels). Canadian, Polish and USSR coals belonged to the same groups as USA coals. In general, most coals tended to have similar attributes to those from another country as well as their neighbouring brands drawn from an adjacent coal seem.

The implication of this extensive mixture of international coals on the basis of their physical attributes (moisture, ash, sulphur, CSN, volatiles) is that price discrimination on the basis of country of origin is not explained by national groups of coals having exclusive qualities.

4.4.3 Annual negotiations - tonnage for price

The annual Japanese coking coal negotiations feature different companies being the first to agree each year. In the JFY85 negotiations, agreement was reached several months earlier than usual when General Coal of the USA accepted the JSM offer in October 1984. They agreed to continue JFY84 prices for Sprague HV Blend coal in JFY85 in return for favourable tonnage consideration. The other American suppliers accepted the price freeze in November. The Canadian and Australian hard coal producers followed, but were not given specified tonnages. Luscar was the first of the Canadian mines to accept the price freeze because it hoped to avoid the 'unfair treatment' received in JFY84 when it was the last Canadian firm to sign its contract (Coal Manual 1985:299).

The Australian soft coking coal producers delayed acceptance of the JSM price freeze in JFY85 until February. They wanted a price rise of $2.50/t and an increase in tonnage to 3.5mt. In the end, they accepted the JSM offer of no price increase and a cut in the base tonnage to 3mt (+-10%) from 3.4mt.

The pattern is repeated each year with better tonnage conditions extended to the first company to sign than those given to others who sign later. For example in December 1985 Bellambi was the first company to sign its JFY86 contract. The price was cut by $4.50, but the volume remained at its 1985 level while other companies had their tonnage reduced (ICR 1985 138:2). Higher tonnage agreements are important for the cash flow position of a mine, especially where much of the cost is fixed or sunk as a capital investment and high volumes are required to make the project viable (Anderson 1987). The high fixed cost nature of coal mining and especially the new open cut mines, leads to the 'destructive competition' where individual suppliers accept a low price in return for improved tonnage despite the increased losses incurred by the rest of the industry. The net result is a transfer of benefits (low cost coal) to the consumer.

4.4.4 Structural or relational bargaining power

The evidence examined in the preceding sections demonstrated the use of discriminatory pricing, classification and tonnage practices by the Japanese steel mills. The mills clearly enjoyed superior bargaining power compared to the suppliers in the 1980s. The next question is whether this power is a relational power where one side is able to force its terms on the other because of its relative strength, or a structural power where one side has control over the trading structures through which the exchanges are made.

The model of relational power can be applied to the market where the equilibrium may be relatively advantageous to either side depending on the current supply/demand balance. According to this view, coal price changes are simply a product of the short term market configuration. Either side can benefit. Prices went up in 1988 after falling in 1987. The fact that prices were halved in real terms in the 1980s is simply an outcome of the surplus production capacity in the system. By the late 1980s many suppliers closed mines. This reduction in supply combined with an increase in demand to raise prices in 1988 and 1989. Far more dramatic price rises occurred in the mid 1970s when acute shortages were perceived. The overall pattern is one of change based on relative bargaining power.

The model of structural power has a different basis. According to this model, Japanese companies are able to practise discriminatory pricing because of their control over the structures which govern the coal trade. Structural power does not eliminate relational power. Instead, it constrains the exercise of relational power. Rather than close all unprofitable mines when prices fall, trade structures may be used to keep select high cost mines in operation. The result is continued abundant supply despite falling prices. This thesis argues that structural power needs to be recognised in order to explain the failure of trade to conform to the pattern predicted by relative shifts in supply and demand alone.

One way to compare the importance of relational and structural power is to consider 1976 and 1987 as the high and low extremes in coal prices. They represent the peaks of supplier and consumer power respectively. In 1976 Japanese coking coal prices were found to be highly correlated with coal quality. By 1987 coal quality was a poor predictor of price. In other words, suppliers were only able to raise their prices in 1976 to a level where all coals were competing directly with each other on a quality basis. Further increases in price could support mines in any of several countries.

By 1987 prices had been discriminately reduced to effectively fragment the market into small supplier niches for particular groups of mines. Lower prices can be caused by the exercise of relational power, however, the discrimination identified above implies the exercise of a more pervasive power.

An extreme model of structural power is advocated in the 'Japan Inc.' model where Japanese interests are tightly integrated and act as a monopsonist. Evidence of trade discrimination were found, but this does not provide conclusive support for the model. Instead, the diversity of Japanese actors with an interest in the coal trade (many companies, industries, government agencies, etc.) is argued to be too complex for reduction to a single monopsonistic structure. The better representation of the Japanese position in the trade is to recognise the influence of multiple structures. When they all cooperate the result equals the 'Japan Inc.' model. However, conflicts can also arise among the different groups. This 'internal' conflict refutes the monopsonist model and supports the multiple structures model.

The IPE model of multiple structures is argued to be a better basis to understand power in the coal trade. The fragmentation of the coal trade was achieved to meet Japanese security of supply objectives through the construction and extension of its trade structures. This hypothesis can be tested by identifying consumer objectives and introducing security of supply variables into the price estimation equations.

4.5 Japanese coking coal trade

The hypothesis that buyers discriminate not simply on the basis of coal quality, but also on the basis of country of origin (to ensure that security objectives are met) is explored in two ways. First coal buyers were asked what criterion they use to select coals for purchase. Second, contract data is re-analysed to measure the importance of security variables.

Several trade models and evaluation methods exist. Each competes for widespread acceptance of its view of reality. Analysts can differentiate between roles assumed by different actors by asking the participants directly what their objectives are. The answers are then evaluated in terms of accuracy of the information gained and how representative it is of similar actors. This self-reporting can be used independently or in association with specified models of behaviour among trading partners. The combined approach of integrating reported objectives with the definition and testing of price formation variables is adopted in this study.

4.5.1 Coal consumer survey

To understand changes in coal trade and price patterns, the first task is to compare the importance of coal purchasing objectives over time. In 1980 the Japanese steel mills considered reliability of supply and the ability to add new suppliers to be very important. This emphasis on security of resource supplies explains the high value assigned to long term contracts and joint ventures as the most suitable arrangements to establish new supplies. These values reflected the attitudes after the second oil shock and before the recession of the early 1980s. The cost and quality of coal was considered of above average importance, but not as important as reliability and security through diversity (Table 4.2, Appendix D).

By 1987 the position had changed with the greatest importance attached to reducing the cost of coal and having flexible supplies in terms of both volume and price. Coal quality and supply reliability were still of above average importance as were diversity of supply and the limitation of marketshares. Predictably, the addition of new suppliers was only a low priority in 1987. This change was reflected in the opinion that no special arrangements should be offered to new suppliers, whereas in 1980 higher prices, long term contracts and joint ventures were considered appropriate (Appendix D).

Table 4.2: JSM coal purchasing objectives 1980-95

objective	1980	1987	1995
least cost	2	1	1
diversity of supply	1.5	2.5	2.5
ability to add new suppliers	1	4.5	3.5
reliability of supply	1	2	4
volume flexibility	3.5	1	1
price flexibility	2.5	1	1
coal quality	2	2	2
limit marketshare of suppliers	1.5	2.5	2.5
bilateral investment agreement	4	4.5	4.5
bilateral trade relations	4.5	4	4
political boycott	4	3	3

1 = very important 2 = above average importance
3 = average importance 4 = below average importance
5 = not important
source: Appendix D

The required purchase of domestic coal and loans from consumers to producers were of average importance in 1980, but of less importance in 1987. Other factors like political boycotts, bilateral trade imbalances and bilateral trade agreements were considered of little importance in 1980 and only boycotts rose to average importance by 1987. The priority placed on low prices and supply flexibility in 1987 was expected to continue in 1995.

This diverse set of objectives indicates that the coal trade is best viewed from more than one direction. The structural model identified four primary structures of importance and each of these needs to be considered. The production structure is of importance because the Japanese steel mills chose to invest directly in some coking coal mines while they used the financial structure to loan money to others. The role of the financial structure is extended when the signing of long term contracts (and the associated future revenue) is recognised as an essential part of project or joint venture funding. The consumers play a critical role in deciding which mines receive such contracts. Both of these financial elements were of less importance in 1987 than in 1980 when the steel mills wanted to establish new suppliers to avoid further price rises and the perceived coal scarcity of the 1970s.

The security structure was of particular importance in the late 1970s and 1980 when the steel mills were determined to ensure a reliable supply to avoid the problems and uncertainty of rapid price rises in 1974-76. As part of this emphasis on security, the marketshare of individual countries, ports and companies was to be restricted. The maximum desired marketshare for an individual country, port and company was 48%, 10% and 10% respectively. To achieve the desired market structure, coking coal should be imported from 40-45 companies through 15 or more ports in 6-7 countries (Appendix D). If such objectives are to be achieved, then an accurate model of the trade needs to consider more than coal quality in identifying factors which affect price.

4.5.2 Coking coal prices, quality and sources

The earlier analysis of coking coal attributes as predictors of price is extended in this section by introducing variables for the geographic source of the coal. A simple dummy variable is created for each of the major supply countries and the new supply region, north east British Columbia. The new analysis of coking coal prices provides a much better description of prices than the initial quality-based analysis.

Equations for all Japanese coking coal cases

1987 fob = 35.06 + 37.30 NEBC + 2.08 CSN - .89 A
n=83 se=3.24 R2=.86

1984 fob = 45.47 + 2.32 CSN + 15.43 NEBC - .33 VM + 4.28 Can
n=73 se=4.28 R2=.73

1976 fob = 37.23 + 2.57 CSN + 8.21 USA + 5.29 Can - .20 VM
n=46 se=3.37 R2=.87

A = % ash (air dry basis)
Aus = Australia
Can = Canada
Chi = China
Col = Colombia
CSN = crucible swelling number
M = % moisture (gross as received basis)
n = number of cases
NEBC = Northeast British Columbia
R2 = R squared adjusted for number of cases
S = % sulphur (air dry basis)
SA = South Africa
se = standard error in estimate
USA = United States of America
USSR = United Soviet Socialist Republics
VM = % volatile matter (air dry basis)

Each of the above equations is an improvement on that based solely on coal characteristics. The 1987 equation demonstrated the greatest improvement, but even the 1976 equation incorporates two country of origin variables. The result is a better prediction of price than the earlier coal quality equations. This indicates that prices were largely competitive when quality and location are used to identify the most important divisions or fragments in the trade.

The special case of northeast British Columbia coal was noted before, but now the difference in price can be measured. The premium paid for these coals was $37 in 1987 and $15 in 1984. The highest premium paid in 1976 was for USA coal, but this premium in fob prices should have the premium paid in higher freight rates added to indicate the much larger cif prices paid for these coals. In short, coal prices demonstrated clear differences according to country or region of origin.

The diversity objective identified in the consumer survey was achieved through the paying of higher prices for coal from a particular supply country or region. This pattern is a product of the contracts and decisions made in the early 1980s as explained by the prevailing set of consumer objectives in 1980. Despite changes in the objectives of consumers in the low price context of 1987, coal was not imported simply on the basis of least cost[16].

Price discrimination was demonstrated to be a persistent feature of trade. This indicates that Japanese coking coal prices were based on persistent diversity of supply objectives and structural power rather than on relational power alone. Certainly, when the coal supply exceeded demand, as in the mid 1980s, the JSM enjoyed a strong bargaining position relative to their suppliers. However, they also exercised structural power over the supply system which enabled them to discriminate on prices not only in the 1980s, but even at the peak of the relational power of suppliers in 1976. Having demonstrated the importance of structural power in the Japanese coking coal trade, the immediate question is whether or not steam coal prices are subject to the same type of variations.

4.6 Japanese steam coal imports

The Japanese steam coal market developed rapidly in the early 1980s. After two decades of phasing out the burning of domestic coal for electricity production, the electric utilities renewed their interest in coal. More dramatically, the cement industry responded to the second oil price rise with an industry-wide conversion of boilers to coal in 1980-81. The result was an increase in consumption of steam coal from 1.6mt in JFY79 to 10.1mt in JFY81 (Cement Association of Japan cited in Coal Manual 1988:398). Most of this demand was met by imports. This transformation of the fuel consumption pattern made the cement industry the largest coal importer in Japan in 1981. Subsequent consumption declined to 7.2mt in

JFY86 because of declining cement production, but coal remained the dominant fuel for the industry.

The conversion to coal was much slower in the electricity industry with the government owned EPDC (Electric Power Development Company) being the largest coal consumer (10mtpa in the mid 1980s). The nine regional electric power companies (EPCs) slowly expanded their coal burn with Hokaido EPC being the largest consumer (5mtpa of domestic imported coal) and Chugoku EPC being the largest coal importer (3mtpa). By the late 1980s the coal consumption of the nine private companies was slightly larger than that for EPDC (12.9 and 10.9mtpa respectively in JFY87; Coal Manual 1988:378). Future plans for electricity generating capacity include substantial investments in coal-fired plant (NEDO 1988), but the rate of implementing these plans is uncertain.

A third group of steam coal consumers are general industry boilers which are smaller in scale, yet important in terms of aggregate energy consumption. These general industry users are diverse and small in comparison to power stations or cement boilers, however, several industries need to be noted in particular. The pulp and paper industry continues to use coal as the fuel in several of its main plants. The chemicals and oil industry have also made conversions from oil to coal. These conversions represent two features of the trade. First fuel substitution and interfuel competition is important. Second, the Japanese oil industry has become a coal consumer as part of its strategy to become a coal supplier. The existing oil trading network is simply used as a basis for expansion into the coal trade.

Unlike the coking coal trade where there were two dominant groups of Japanese actors (the steel mills and the trading houses), the Japanese steam coal trade has five main groups of actors (electric power companies, cement companies, general industry, trading houses and oil companies). This diverse set of actors includes elements extended from the coking coal trade (trading houses with long term connections in the coal industry) as well as new groups. The task of this section is to assess whether the structural features of price variations in the coking coal trade extend to the steam coal trade. Perhaps the participation of more actors and newer nature of the trade reduce structural power. The analysis to answer these questions includes a survey of industry participants and an evaluation of contract data.

4.6.1 Japanese steam coal consumer survey

The responses to the coal consumer survey are divided between the electricity industry and other consumers. The two groups illustrate some interesting differences within the Japanese steam coal market as well as issues of agreed importance. For example in 1987, both groups of consumers agreed that cost minimisation was very important in coal purchasing decisions. However, in 1980 the electric utilities considered the least cost objective to be only above average in importance while the other consumers ranked this objective as very important.

Table 4.3: Japanese steam coal consumer objectives 1980-95

objective	1980		1987		1995	
consumer	EPCs	other	EPCs	other	EPCs	other
least cost	2	1	1	1	1.5	1
diversity of supply	2.5	3	2	2.5	1.5	2
ability to add new suppliers	3	3	3	3.5	3	3.5
reliability of supply						
likelihood of strikes	2	1	2	1	2	1
accurate port deliveries	2	1.5	2	1.5	2	1.5
volume flexibility	2	4	1.5	3	1.5	2.5
price flexibility	2	2	1.5	1.5	1.5	1.5
coal quality	2	3	1.5	3	1.5	3
limit supplier's marketshare	3.5	3.5	2	3	1.5	2.5
bilateral investment agreemt	5	2	5	2	5	2
bilateral trade relations	4	3	4	3	4	3
political boycott	4.5	2	4.5	2	4.5	2

1 = very important   2 = above average importance
3 = average importance   4 = below average importance
5 = not important
source: Appendix D

Differences between the two groups also emerged when the question of supply reliability was asked (Table 4.3). The industrial consumers ranked the likelihood of strikes as very important or equal to cost as a purchasing consideration while the electricity industry ranked the risk of strikes as simply being of above average importance. The reliability of accurate port deliveries was also ranked more highly by the general industry than the electricity industry. This difference is understandable given the smaller scale of operation of most industrial boilers and their limited stockpiles or storage yards. Reliable deliveries are essential for their boiler operation. In contrast, the electricity industry has larger stockpiles and a mixture of other generating plants based on nuclear, gas, oil and geothermal energy sources.

Related to the concern about reliability and their smaller scale of operation, the industrial users placed less emphasis on supplier diversification and limiting the marketshare of suppliers than did the electricity industry. This opinion was reinforced by the desire of the electricity industry to have more suppliers (companies, regions and countries) than the other consumers. Both groups considered the diversification objective to have become more important over time (Appendix D).

The coal quality characteristics were considered above average in importance by the electricity industry and only of average importance to the other industry consumers. Of the seven coal attributes listed, the industrial consumers ranked volatile matter as the most important quality (above average in importance) while other attributes were only average or less than average in importance. The importance of volatiles is attributed in part to their role in fuelling high temperature combustion and is especially important in vertical style boilers where coal replaces fuel oil as the source of energy.

The electricity industry ranked the energy content, ash, moisture and volatiles of equal importance (average in 1980 and above average in 1987) while sulphur was only of average importance. This lower importance of sulphur in 1987 could be explained by the investment in flue gas desulphurisation equipment to meet emission standards.

4.6.2 Steam coal prices and coal quality

Steam coal only became a major component of the Japanese coal trade in the 1980s. Its recent growth results from the emphasis on energy security and a deliberate policy to diversify away from oil (Perkins 1985). The limited nature of earlier steam coal trade in Japan dictated that analysis begin with 1980 data when the trade first expanded rapidly. The three years selected for comparison are 1980, 1984 and 1987.

Steam coal trade has been portrayed as far more competitive than the coking coal trade. Most consumers are primarily interested in the cost of energy and are expected to choose the lowest cost per joule or kilocalorie. Other coal attributes affect emission levels (sulphur, ash) and burning characteristics (volatile matter, ash fusion temperature). Eight characteristics (energy content (kcal/kg), total moisture (%), ash (%), volatile matter (%), total sulphur (%), fixed carbon (%), ash fusion temperature, and Hardgrove grindability index) are commonly used to describe particular coal brands and all of these data are included in the analysis.

Previous studies have shown that moisture has a negative effect on combustion when increased above its desirable range of 5-10%. A 5% increase in moisture reduces boiler efficiency by 0.3% because the moisture absorbs heat which is then lost for generating steam for the turbines (IEA 1985:38). Still, a minimum level of moisture is desired to reduce dust in the handling of coal. A similar relationship is found with sulphur.

Although sulphur contributes to low temperature corrosion of boilers and increases slagging in some coals, if it is reduced to very low levels, the precipitators do not work very well. In addition, if the coal has high chlorine levels then a higher sulphur/chlorine ratio reduces the high temperature corrosion and fouling associated with chlorine. Despite these benefits from small amounts of sulphur during combustion and ash collection, sulphur concentration was found to be correlated with unplanned outage in Tennessee Valley Authority power stations (IEA 1985:37). Furthermore, gaseous sulphur emissions contribute to acid rain precursors, cause environmental damage and are restricted by law.

The ash content of coal is important for many reasons. Its quality and the resulting complex combustion chemistry are only partially understood, but considered of great importance to boiler efficiency and availability. Boilers can be designed to burn coals of varying ash content with little effect on boiler efficiency. However, where ash content is allowed to vary widely and exceed design specifications the result can be shortened life of the boilers and increased outage of plant caused by increased tube wear. The effective increased cost of burning high and variable ash coal can reach $10pt (as occurred in Australia in the early 1980s)[17]. In addition to the increased cost of burning high ash coal, the increased cost of transporting the coal to the boiler, its increased damage to preparation plants and the cost of ash disposal all need to be considered.

In contrast to the negative value of moisture, sulphur and ash, volatile matter adds to the value of steam coal. The volatile matter is the first part of the coal to burn (during pyrolysis) and contributes heat for both steam generation and the combustion of carbon in the devolatised coal. The characteristics of the combustion can thus be predicted by using a fuel ratio of fixed carbon divided by volatile matter as is often calculated by Japanese utilities (IEA 1985)[18].

Price and quality data was compiled for 31 brands of steam coal imported into Japan in 1987 (27 brands in 1984 and 21 brands in 1980). Regression equations were constructed to calculate price on the basis of coal quality. However, complete data for all eight quality characteristics was only available for two thirds of the brands. It should be noted that the complete quality data is only available for Australian, Canadian, South African and USA coals. The following equations for fob prices thus exclude Chinese, Soviet and Indonesian coal brands[19].

Equations for fob price of steam coals imported into Japan
(based on eight coal qualities)

1987 price fob = 34.88 - 7.86 S
n=19 se=3.16 R2=.23

1984 price fob = -1.00 - 8.12 S + .022 AFT + .53 VM
n=16 se=2.96 R2=.71

1980 price fob = -106.21 + 0.209 Kcal
n=13 se=3.28 R2=.54

A = % ash (air dry basis)
AFT = ash fusion temperature
Aus = Australia
Can = Canada
Chi = China
Col = Colombia
FC = % fixed carbon
HGI = Hardgrove grindability index
Ind = Indonesia
M = % moisture (gross as received basis)
n = number of cases
R2 = R squared adjusted for number of cases
S = % sulphur (air dry basis)
SA = South Africa
se = standard error in estimate
USA = United States of America
USSR = United Soviet Socialist Republics
VM = % volatile matter (air dry basis)

The 1987 fob prices are notable because only one of the eight attributes of coal evaluated (sulphur) made a significant contribution to explaining price variation. The adjusted R-squared value was low (.23) and the standard error large ($3.16). Similarly, only one variable was found to have a significant effect on the equation in 1980, but this time it was energy content (kcal/kg) and the adjusted R-squared value was .54. Between these two points of low prices in 1987 and the importance of sulphur in explaining price and the high prices of 1980 when energy content was most important, lies the evaluation of 1984 prices. In 1984, three of the coal quality variables were statistically important and the equation had a much better fit to contract fob prices[20].

The coefficients for the three variables in the 1984 equation (sulphur, volatile matter and ash fusion temperature) are the expected sign and magnitude[21]. The coefficient is largest for sulphur because small changes in its value (for example, 0.5% to 1.0%,) greatly increase the SO_2 emissions of the boiler and have a large impact on the value of the coal. Conversely, the coefficient for volatile matter is smaller because this variable ranges from 25% to 47% for the many brands of coal and each change of 1% has a smaller effect on price.

The above analysis included coal attributes which had no apparent effect on price so a more restricted list of attributes was used for the next evaluation. Rather than use eight attributes, the five characteristics most frequently specified in coal contracts are examined (energy, moisture, ash, volatile matter and sulphur). A larger group of coal brands (21 in 1980, 27 in 1984 and 31 in 1987) had complete data for these attributes and the regression analysis was repeated.

Equations for fob price of steam coals imported into Japan
(based on five coal qualities)

1987 price fob = 33.65 - 6.24 S

n=31 se=3.74 R2=.13

1984 price fob = 45.48 - 8.17 S

n=27 se=5.07 R2=.16

1980 price fob = 23.20 + .37 VM

n=21 se=4.00 R2=.22

The result was that only one of the five coal qualities had a significant correlation with price in each year. The importance of sulphur to price determination is explained by the requirement to meet strict emission standards in the 1980s. However, the standard error for each equation was large ($4-5pt) and the R-squared value low. Once again, coal quality provides an inadequate explanation of coal price.

4.6.3 Coal prices, quality and source variables

Given the importance of country of origin variables to explain price differences among coking coals, the same analysis was repeated for steam coals. Variables were created to account for the country of origin to supplement the coal quality variables and the data re-analysed.

Equations for fob price of steam coals imported into Japan (based on quality and country of origin)

1987 price fob = -17.18 + 14.09 Can + .0076 Kcal - 5.87 S
n=31 se=2.95 R2=.46

1984 price fob = 46.78 - 7.87 SA - 7.15 USSR - 5.93 S
n=27 se=3.64 R2=.57

1980 price fob = 26.14 - 9.92 SA + .29 VM
n=21 se=3.46 R2=.42

All of the equations demonstrated a marked improvement over those for coal quality alone[22]. Each equation accounted for approximately half of the price variations. Source of supply variables were the most important and were introduced to the equation first. Once price differences based on supply country were established, then prices varied on the basis of coal quality. Overall, half of the variables explaining price variations among steam coals imported into Japan are not quality based, but security based. The structural model which incorporates quality and security variables is thus advocated as an explanation of the price pattern in the Japanese steam coal trade just as it was proposed as the best model of the coking coal trade.

The persistence of price variations in the Japanese coal trade was identified in chapter 3 and analysed above to discover that it was caused largely by supply diversity objectives rather than coal quality. Price variations were also found in the European trade, especially for steam coal. The analysis is extended to determine if these variations are caused by security objectives as well.

4.7 European steam coal trade

4.7.1 European steam coal consumer survey

In Europe, the electricity industry is by far the largest consumer and importer of steam coal. The European steam coal trade is much older than its Japanese counterpart with millions of tonnes of coal traded annually since the industrial revolution. Despite the historic nature of the market, the pattern of trade has changed in recent years to reflect international changes. Many large electric utilities import coal from the same mines as their Japanese counterparts and the trade has achieved a degree of global integration.

The analysis of average import prices in chapter 3 illustrated persistent differences between European and East Asian coal trade price patterns. The European reliance upon a greater number of supply countries and its wider variation in prices were contrasted with the Asian and Japanese patterns. The opinions of major consumers were sought to help identify and explain these differences.

The European electric utilities shared some coal purchasing objectives with their Japanese counterparts, but differed on others. In 1987 both groups agreed that cost minimisation was the most important objective. However, the second most important objective for the Europeans was reliability of accurate port deliveries whereas the Japanese utilities were more concerned about volume and price flexibility on the part of suppliers. In 1980, the Europeans considered diversity of supply to be more important than cost minimisation while the Japanese consumers held the opposite view. By 1987 both groups considered price more important (Table 4.4).

The European utilities considered coal quality to be of above average importance, like their Japanese counterparts. However, while sulphur content was only of average importance to the Japanese it increased from above average importance to the

Europeans in 1980 to become very important in 1987 and 1995. This increased attention to sulphur is based on the stricter environmental controls introduced to reduce SO_2 emissions throughout Europe and thereby lessen the environmental damage caused by acid precipitation.

Table 4.4: European steam coal consumer objectives 1980-95

objectives European electric utilities	1980 North	1987 North	1987 South	1995 North	1995 South
least cost	2.5	1.5	1	1.5	2
diversity of supply	1.5	2	3	2	1.5
ability to add new suppliers	4.5	3.5	3.5	3.5	2.5
reliability of supply					
likelihood of strikes	2	2.5	2	2.5	2
accurate port deliveries	2	3	1	3	1
volume flexibility	2.5	1	2	1	2
price flexibility	2	2	2	2	2
coal quality	2	2	2	2	2
limit suppliers' marketshare	3.5	3.5	3	3.5	3
bilateral investment agreement	5	5	5	5	5
bilateral trade relations	5	4	3.5	4.5	3

1 = very important 2 = above average importance
3 = average importance 4 = below average importance
5 = not important
source: Appendix D

Although the Europeans considered limiting the marketshare of suppliers as being of less than average importance (in contrast to the above average importance assigned by the Japanese), their preferred maximum share of supplies drawn from any single company, port or country were very similar to the Japanese preferences. In general, the marketshare of a single company, port or country should be limited to 20%, 30% and 50% respectively. Similarly, the preferred number of supply companies is 5-10 with coal coming from 3-10 ports in 3-7 countries. However, while the Japanese consumers expressed a willingness to pay a premium of 10% to establish a new supply company, port or country, the Europeans offered no premiums for companies and few would pay any premium for a new port or country supplier. Indeed, many Europeans indicated that a new supplier needed to offer price discounts in order to enter the market in 1987. The expectation is thus one of a European market where differences in price based on country of origin are less pronounced than in Japan (Appendix D). This expectation conflicts with the findings of chapter 3 and will be evaluated in more detail in this chapter using contract data.

4.7.2 European steam coal attributes, prices and sources

Italy became the largest European importer of coal in the mid 1980s and the national electricity utility, ENEL, was the principal cause of this growth. By the mid 1980s ENEL was importing over 10mtpa. Their coal supplies were obtained under a series of long and short term contracts with the prices set in annual negotiations. An evaluation of the prices reveals a familiar pattern.

The largest coal suppliers to ENEL are South Africa (4mtpa) and the USA (4mtpa) with smaller amounts imported from Poland, USSR and Australia throughout the 1980s. New supplies were introduced from China and Colombia 1987-88 (IEA 1989a) and Venezuela is also expected to join the list of suppliers. The pricing formula has two components to it. First prices are set for a particular country. At this level all prices are competitive with each coal priced according to its energy content and a standard price for coal of a specified quality. For example in 1987 the South African price was set at $23pt fob for 6200 kcal/kg coal (CWI 1988, ICR 1988). Five different types of South African coal were imported, but each was valued according to the standard price. The 1987 fob price represented a fall of $6.75 from that received in 1984.

USA coals were priced in a similar manner. Several suppliers bid to supply ENEL with coal, but the result was a standard price based on the energy content of the coal. The 1987 price was $39pt for coal exported through Hampton Roads or other east coast ports. This was a $16pt premium over that paid for South African coal (fob). The magnitude of this premium illustrates why the very large variations were found in the analysis of European price data in the previous chapter[23].

The competitive pricing of coals at the national level is contrasted with the different fob and cif prices paid for coals from different countries. In 1987 Polish coal was priced at $32 fob, Chinese coal at $34.40 cif and Colombian coal $33-37 cif (CWI 1987; ICR 1987). A clear diversity strategy was being implemented. USA coals received a premium which is not explained by coal quality. The perception of the USA as a secure supplier has been offered as an explanation for this premium. Other reasons include trade imbalances and strong personal contacts based on previous trade experience. Such reasons can be considered reasons for supporting security and information structures, but our first tasks is to investigate differences in coal prices based on country of origin.

Other major European buyers follow the same practice. For example, the Danish utility coal purchaser, Elkraft, was buying Australian coal for $31.50 cif ($23 fob) in 1987 while USA suppliers were being paid $42 fob (CWI 1987; KICT 1988). This premium of $19 fob or $16 cif almost equalled the price of Australian coal. The price difference is explained by the major supply contracts having higher prices than smaller spot purchases which were made at internationally competitive prices. Even USA coals were occasionally sold at spot prices of $30 cif (for high sulphur, high ash, fines) in 1987 (CWI 1987; ICR 1987). This mixture of price differentiation on major contracts and price uniformity on spot contracts illustrates how a single buyer can use different contracting and sourcing configurations to meet its security of supply objectives.

In general, the observation of price differences and their continuation at both the contract and national level supports the need to add security objectives to the least cost objectives in a conventional trade model. Major consumers in Japan and Europe share these objectives, but exceptions can be found.

4.7.3 Uniform European coal prices

Examples of international competition and uniform European coal import prices can also be found. Although the previous chapter and sections concentrated on price differences, some markets were found to comply with the least cost model.

The UK is a small importer of steam coal. The CEGB is a large coal consumer, but most of its coal is supplied by British Coal. The informal contract between them 'the joint understanding' is considered to be the largest coal contract in a market economy. The coal purchased from international sources is thus a marginal fuel for the CEGB and the lowest cost possible is sought. In 1987 spot contracts were signed for coal from China, Colombia and Australia. The cif price of the delivered coal was set at $34.50 for each supplier. This demonstrates the direct international competition for the sales. These sales were followed with three year contracts for the three suppliers but only the Australian coal received a $2pt price rise for 1988-90. The uncertainty associated with some low cost coal was illustrated by the Chinese coal being delayed in delivery and the designated brand (An Tai Bao) being substituted by another brand (Datong) in 1988 (ICR 1988).

The European cement industry is another example where coal is purchased strictly on a competitive basis. The value of the coal is determined by its energy content so country of origin has little to do with price formation. The spot market in the northern European ports of Amsterdam, Rotterdam and Antwerp exemplify this trade. These competitively priced segments of European steam coal trade demonstrate how the trade is fragmented into many components. Coal suppliers compete for sales in each niche of the market, but prices are not equal because the largest and more specialised consumers are willing to pay more for supply diversity or trade continuity (like regular small shipments of Polish coal to West German consumers).

4.8 Conclusion

This chapter has provided a detailed evaluation of coal contract data and the relationship between coal quality, country of origin and price. Under competitive circumstances, price is expected to be determined by the quality of the coal. These competitive prices were found in particular segments of the market, especially among suppliers from a single country. However, coal quality failed to explain most of the variations in price in the largest international markets and security objectives were identified in consumer surveys and introduced into the numerical evaluation of prices. The result was that both security variables (country of origin) and coal quality variables were required to better explain coal prices.

The Japanese coking coal trade illustrates the importance of both economic and security objectives in establishing coal prices and trade patterns. The simple competitive and monopsonistic models of trade were each evaluated. Japanese consumers were shown to have more bargaining power than their coal suppliers and exercised discrimination as part of their negotiations. This imbalance was argued not to be a simple function of the relative power derived from an imbalance in supply and demand (although that is also important). Instead, consumers were able to fragment the market and negotiate different price levels for each group of suppliers. This market fragmentation and price differentiation is a function of the structural power held by consumers.

The variations in average coal prices found in chapter 3 are thus reinforced by the transaction level evaluation in this chapter. The explanation for these variations are the diversity of supply objectives identified by coal consumers. To avoid dependence upon a single supplier, consumers are willing to pay more for other suppliers to enter the market. However, consumers chose not to rely solely on price differentiation (as a monopsonist might chose) to ensure supply security. They identified several forms of quasi-integration to achieve their supply objectives. The use of international trade structures thus needs to be examined.

Trade structures are argued to be a principal means to achieve supply diversity rather than rely on price differentials alone. The study of these structures is thus important to first identify how they are used to achieve supply diversity and market fragmentation and second to measure their direct impact on coal prices and trade flows. Price variation is accepted as a dominant feature of the international coal trade and a more elaborate model is required to explain its continued importance. The structural IPE model is developed in the next four chapters to provide such an explanation.

Endnotes:

1. The term 'Japan Inc.' was introduced by James Abegglen in 1970.

2. The existence of a monopsonistic structure has been argued to not be reason for concern in itself. A single firm may behave competitively and yield competitive prices and production decisions (Baumol, Panzar and Willig 1982). This theory of contestable markets has been challenged by both conventional analysts and the transaction cost school which emphasises the importance of the fixed costs that were assumed away in the contestible marked model.

3. Coal cleaning or beneficiation improves the quality of the clean coal from that of the raw coal by removing some of the heavy impurities which create ash (for example Balmer coal has its ash content reduced from 17% to 9.5% after cleaning). As a result, the carbon-related characteristics also improve (for example the CSN increases from 5.5 to 6.5) (Coal Manual 1985:322). The amount of beneficiation can be varied to meet the final product requirement. For example, coals from the Hunter Valley are often washed to meet either soft coking coal or steam coal specifications.

4. See appendix D for a copy of the questionnaire and detailed responses.

5. The Japanese financial year (JFY) begins on 1 April and ends on 31 March the following year.

6. Coal quality data was obtained from several sources. The Coal Manual (1976,1985,1988) summary tables of coal qualities was used as the primary reference and compared to the individual contract specifications provided in later sections. Coal News annual reports of the Japanese steelmills contract settlements were used to verify the Coal Manual data. Finally the coal qualities specified by producers were examined (NSWDMR 1985, 1987, 1989; QCB annual) and found to generally either present Japanese contract specifications exactly or else provide a wide range of qualities which are met by changing coal preparation requirments and includes the contract specifications. Obvious errors, like misplaced decimal points were corrected. Where differences among sources could not be resolved, a simple mean was calculated. The same procedure was followed for price data, but in this case more recent referrals to old prices were assumed to be more accurate than the initial report.

7. The equation for cif (cleared insurance and freight) import prices is similar. Only the fob equations are presented because the contracts are almost all set in fob terms (the exceptions are for some Soviet or Chinese coal where the shipping is provided by the supplier). The fob prices are thus more accurate than the cif prices which are based on estimates of the cost of transport from various ports. Given the Japanese control over shipping and the dominant role of the Japanese merchant fleet in carrying coal, fob prices also

reflect the cost of coal when it enters Japanese direct control. The cif value declared on import into the country depends on the freight rate charged by Japanese shippers (frequently affiliated to consumers) as well as the fob cost of the coal.

8. The linear regression equation was constructed using the stepwise method where the variable with the largest correlation with the dependent variable (price) is added first. Partial correlation coefficients are calculated for the remaining variables and the variable with the largest coefficient is added to the equation next. This procedure continues until all excluded variables fail to meet the requirement that the probability of it having no effect on the equation (a coefficient of 0) is greater than 95% (F value less than 0.05). In addition, included variables are checked to see that they contribute to the new equation (with a probability greater than .90 that their coefficient is not equal to 0).

The 1976 equation is especially good because all signs are in the right direction and the coefficients correspond to the levels expected from contract penalty clauses. The strength of the correlation between coal quality and price in 1976 reinforces the findings of Kittredge and Siverston (1980) who used 1977 price data to conclude that prices were competitive for Canadian and other coking coals.

9. Other brands may have been imported, but the data on these brands is incomplete and the size of such transactions is generally small.

10. Another hypothesis to explain the reduced role of coal quality as a predictor of price in the 1980s is the increase in the use of soft and semi-soft coking coal with poor coking qualities. To evaluate this hypothesis, the group of hard coking coals was separated from the soft and semi-soft coking coal for analysis of price over time.

Equations for fob prices of hard coking coals

1987 price fob = no coal quality variables had a coefficient significantly (f value <5%) different from zero

1984 price fob = 66.60 - .43 VM
2 outliers n=52 se=5.70 R2=.14

1976 price fob = 75.80 - 1.57 M - 1.21 A
0 outliers n=29 se=2.97 R2=.69

The hypothesis that the price pattern was distorted by soft and semi-soft coals is rejected because the price pattern for hard coking coals in the 1980s had virtually no correlation with coal quality. The 1987 data suggested no equation while the 1984 equation was an extremely poor predictor of price. In contrast, the 1976 hard coking coal prices were better correlated with coal qualities.

Soft coking coal has been used for the production of formed coke and inclusion in the blast furnace for many years, although its use increased in the 1970s and 1980s as part of the steelmills' programme to use lower cost raw materials. In the case of Japan, most soft coking coal is imported from South Africa and the Hunter Valley, Australia. Semi-soft coking coal was only introduced into the coking coal trade in the late 1980s. It includes a wide variety of coals not suited for coking until pulverised coal injection (pci) and coal blending techniques improved in the 1980s. Several steam coals are included in this group.

Equations for fob price of soft and semi-soft coking coals:

1987 price fob = 32.58 + .97 CSN - .82 A + .15 VM
n=43 se=1.80 R2=.56

1984 price fob = 35.03 + 1.84 CSN
n=21 se=1.57 R2=.78

1976 price fob = 42.94 + 1.53 CSN - 1.40 M
n=17 se=0.92 R2=.90

The soft and semi-soft coking coal equations are very interesting because they explain more of the variations in price than the equations for all coking coals. Rather than reduce the role of coal quality in price determination soft and semi-soft coals enhance the correlation between quality and price. However, the pattern of declining correlation between quality and price found among all coals is repeated by the soft and semi-soft coals. The R-squared value of .90 in 1970 fell to .56 in 1987. The standard error for price prediction also rose over time (from $1pt to $2pt).

One of the surprises in the equations is the positive correlation between price and the percentage of volatile matter in 1987. In conventional coking coal, volatile matter is not wanted because it does not contribute to the coke which supports the molten mixture in the blast furnace. However, volatiles contribute energy and the role of semi-soft coal as a source of energy in the mixture presumably accounts for the change in sign of the coefficient. This change in the valuation of volatile matter may reduce the predictive power of this quality in price estimation in the 1980s, but it does not provide sufficient evidence to endorse the hypothesis that soft and semi-soft coals account for the decline in the correlation between coal quality and price. Instead, soft and semi-soft coals demonstrated a stronger affiliation between quality and price than the hard coking coals. The initial hypothesis is rejected.

11. The residual is the difference between the actual value of the dependent variable (fob price) and the estimate calculated by the equation.

12. Fluidity is considered an important coking coal quality because it measures the ability of the coal to become soft and viscous when heated. This characteristic is desired for some coals in the blend. However, when fluidity was included among the coal quality variables, its contribution to the regession equation was not significant. Certain coals are promoted as high fluidity coals and they may receive higher prices as a result, but the statistical basis of this assertion was not found.

13. The escalation clauses can result in a price decrease as in the case of the cost of diesel oil which declined and resulted in an automatic price cut of C$1.89/t from 1 July 1986 (Coal Manual 1988:303).

14. The semi-soft coking coal prices were set separately from the hard coking coals. Given the tighter supply conditions for steam coal in 1988 than 1987, a larger price rise was achieved. The Australian mines settled for an increase of $3.90 to $36.90/t for JFY88 (ICR 1988 208:8).

15. The cluster analysis was conducted using the complete linkage method whereby each item or group is compared to the most distant member of other groups. It is then merged with the group which it is closest to. This technique constructs groups so as to minimise internal variations. The result should be one of similar coals being grouped together. The groups are merged one after another so that the most similar coals are grouped first. The process continues until all the coal brands are in one group. Before all the coals combine into a single unit, it is useful to examine the contents of the groups. The two class, hard and soft coal division did not fit the cluster analysis results very closely, so a broader range of groups are considered. The geographic source of coal brands is used to summarise the membership of the cluster groups in Table 4.A.

Table 4.A: Cluster analysis of coking coal brands.

group	1976 members	1984 members	1987 members
A	8 Hunter Valley	13 Hunter Valley	7 Hunter Valley
	1 South Africa	3 South Africa	4 South Coast
		2 China	4 Queensland
			5 Canada
			2 China
B	2 Hunter Valley	2 Hunter Valley	13 Hunter Valley
			1 Queensland
			3 South Africa
			1 Colombia
C	2 Hunter Valley	7 Canada	2 Queensland
	1 USA	1 Hunter Valley	2 China
		2 South Coast	
		1 USSR	
D	1 Queensland	13 Queensland	8 Queensland
	1 Hunter Valley	2 South Coast	2 South Coast
	1 Canada	2 China	8 Canada
		1 Canada	2 USSR
			1 USA
E	3 Queensland	1 Canada	2 Queensland
		1 New Zealand	1 Hunter Valley
F	3 Queensland	6 USA	2 Hunter Valley
	3 South Coast	1 Canada	
	4 Canada		
	3 USSR		
G	10 USA	12 USA	11 USA
	1 Poland		1 Canada

regional summary region	1976 # of groups	1984 # of groups	1987 # of groups
Australia	6	4	6
Hunter Valley	4	3	4
South Coast	1	2	2
Queensland	3	1	5
Canada	2	4	3
China		2	2
New Zealand		1	
Poland	1		
South Africa	1	1	1
USA	2	2	2
USSR	1	1	1

note: clusters formed by the complete (most distant) method

The clusters were constructed on the basis of the five coal qualities (CSN, total moisture, ash, volatile matter, total sulphur). Each of the five characterisitics was given equal weighting so rather than use the actual numeric value of the characteristic (which would have made volatile matter far more important than sulphur) Z values were calculated to describe the distribution of each characteristic in standard units. These z values were then used to cluster the coals into seven groups of similar coals.

16. This finding can be evaluated at a more disaggregate level by also constructing new equations for hard and soft coking coal prices which incorporate geographic variables for the source of the coal.

Equations for hard coking coal price

1987 price fob = 45.36 + 34.68 NEBC - 1.28 M + 1.12 CSN
outliers=1 n=40 se=2.97 R2=.87
1984 price fob = 74.79 + 16.37 NEBC - .49 VM - .89 A
outliers=1 n=52 se=4.66 R2=.42
1976 price fob = 63.39 + 7.96 USA - .21 VM -.78 A + 3.58 Can
outliers=0 n=29 se=2.49 R2=.78

The results are a striking contrast with the equations based on coal qualities alone which explained virtually none of the price variations among hard coking coals in the 1980s. By adding variables for source of supply, much more of the price variation is explained. Similar equations were derived for the soft and semi-soft coking coals:

Equations for soft and semi-soft coking coal price

1987 fob = 33.63 +.79 CSN -.88 A -6.63 Col +.17 VM -2.17 SA
outliers=0 n=43 se=1.44 R2=.72
1984 fob = 35.03 + 1.84 CSN
no source variables added n=21 se=1.57 R2=.78
1976 fob = 42.94 + 1.53 CSN - 1.40 M
no source variables added n=17 se=0.92 R2=.90

prices for Colombian and South African coal in part reflect the higher shipping costs of going through the Panama Canal and the longer distance from Japan to South Africa than to Australia.

17. Studies by the Tennessee Valley Authority found that higher ash content reduced boiler efficiency and increased unplanned outage. For a 1% increase in ash above a normal level of 10%, boiler availability declined by 1.2-1.5% while efficiency was reduced by 0.3%. The estimated cost associated with these losses were $0.95 and $0.67 respectively, or $1.62pt in total (IEA 1985:43).

18. These predictions of combustion characteristics can be improved by differentiating between the three main types of volatile matter (vitrinite, exinite and inertinite macerals), but no contracts specify these divisions within volatile matter (Chambers, Knill and Ungarian 1987 summarised in AOCRT 1989:8).

19. Consumers are expected to compare coals on the basis of their cif prices since that is the cost of the energy to them. However, most contracts are written in fob terms (exceptions are some Soviet and Indonesian coals). The fob prices are thus more accurate. To convert fob prices into cif prices the transport cost is assumed to be the same for all coals from a particular country. In 1987 the assumed transport costs to ship coal to Japan were as follows: Australia $8; USA $13; Canada $10; USSR $5; China $5; South Africa $11; and Indonesia $7. Special transport costs and arrangements were overlooked.

20. An even higher R-squared value (.77) and lower standard error was produced by an equation which reversed the expected sign of the coefficient for moisture and energy. The explanation for this anomaly is found in examining the details of each coal brand. All of the coals in this analysis (n=16) had total moisture contents of 8-9% with the exception of Sufco (10%) and Blair Athol (16%). Blair Athol and Sufco are the two highest priced coals in the group ($46.26 and $44.00 compared to the group average of 37.44) so a correlation was created between moisture and price. The conclusion that this relationship is causal is rejected. The high price paid for Blair Athol coal is explained not by its high moisture content, but by its long term contract and the use of escalation clauses to determine price. Similarly, the high Sufco price can be explained by the premium paid for USA coals to ensure diversity of supply. In both of these cases, non-quality variables create anomalies in the analysis which must be addressed to better understand coal prices.

21. Cif prices are also examined to extend the evaluation of the relationship between the eight coal quality variables and price. Comparisons can also be made between the determinants of fob and cif prices for steam coals imported into Japan.

1987 price cif = 47.63 - .65 A

n=19 se=3.01 R^2=.23

1984 price cif = 40.30 + .76 M - 3.82 S + .25 VM - .35 A

n=16 se=1.31 R^2=.84

1980 price cif = -62.77 + .17 Kcal

n=13 se=2.84 R^2=.50

The 1984 cif prices were better explained by coal qualities than the 1980 and 1987 prices, however the concern over the reversed role of total moisture in the equation is exactly the same as that discussed when looking at the fob price equation. The equation for cif coal prices in 1980 again included only one of the eight coal quality variables. Energy content (kcal/kg) accounted for half of the variations in price.

22. Similar improvements were made in the 1984 and 1987 cif equations by adding source of supply variables:

1987 price cif = -14.09 + 17.14 Can + .0077 Kcal

n=31 se=2.97 R^2=.45

1984 price cif = 48.54 - 12.41 USSR - 4.52 SA -6.87 S +.24 VM

n=27 se=3.49 R^2=.69

1980 price cif = no variables significant

n=21 se= R^2=

23. In 1984 the price was $42pt for a fob premium of $12pt. However, import prices were closer because of the higher cost of freight for South African coal - $50pt cif from USA and $45pt cif from South Africa.

Chapter 5
The security structure:
Government policy and supply security

5.1 Introduction

> 'Some will wish to hold to our adopted principles, and leave commerce and the consumption of coal unchecked even to the last; while others, subordinating commerce to purposes of a higher nature, will tend to the prohibition of coal exports, the restriction of trade, and the adoption of every means of sparing the fuel which makes our welfare and supports our influence upon the nations of the world.' Jevons 1865:13

The security structure is the first of four primary structures which alters global coal trade from that expected under the least cost model. The structure includes international (bilateral and multilateral) security and trade agreements as well as domestic policies and institutions designed to protect the interest of a particular country (Siebert 1989). Domestic security interests are represented by both government policies and private procurement strategies. The relative importance of these corporate, national and international components of the security structure changes over time and these changes will be investigated in this chapter.

Military and political alliances are rarely considered in studies of the coal trade, but need to be recognised both for their historic and future importance. Although coal is traded between the major military alliances in both eastern Europe and Asia (predominantly from centrally planned economies to market economies for hard currency or counter trade deals), the pattern and magnitude of this trade will change as alliances and trade barriers are altered. The explicit use of political decisions to shape coal trade was shown in the late 1980s when several European countries stopped importing South African coal because of domestic opposition to apartheid.

Security interests are usually associated with the state assertion of sovereignty over its territory, hence security objectives are often defined in government policies. Examples of these public security interests extending directly to coal trade are illustrated by the interest taken by most governments in energy security during the 1970s and 1980s. Energy policies were devised to promote secure supplies of energy for national industry and consumers. Many governments value their domestic energy supplies as more secure than imports and have actively supported the domestic coal industry. Industrial policies, subsidies and preferred purchasing arrangements of various types have been used for support. These policies will be reviewed and the magnitude of subsidies studied.

Energy policies also relate to the actions of private corporations. Coal consumers create private security structures both as part of the execution of state initiated programmes and as a result of their own objectives. For example, electricity utilities with responsibility to provide uninterrupted electricity must ensure that fuel supplies will not be interrupted by failures in the supply system (Gaskin 1986). Government finance may be used to support diverse international supplies for private consumers.

The security structure and its importance in the coal trade is best illustrated by the largest international coal trade - the import of coking coal by Japan. The details of the associated security structure will be identified and its evolution charted. The extension of this structure to the Japanese import of steam coal is then examined and comparisons are made with European imports. Finally, these national security structures are compared to the international structure constructed at the multilateral level which promotes efficient trade and conflicts with some national structures.

5.2 Private sector and national security objectives

5.2.1 Private sector security objectives

Security is not only a military concern to government, but also a commercial concern to business. Coal consumers seek to ensure a secure supply of inputs to enable them to produce electricity, steel or heat without interruption. Indeed, security objectives provide one explanation for the fragmented coal market pattern identified earlier (chapters 3 and 4). The security of coal supplies can be increased through a variety of means, including stockpiles, long term contracts, capacity to substitute fuels and diversity of supply. The arrangement of a diverse supply of coal is an extensive practice in international trade. The deliberate diversification of sources often implies raising prices so that higher cost mines from alternative sources can be active in the market (Anderson 1987). A trade-off is thus established between the objective of gaining least cost inputs and ensuring diversity of supply.

The relative importance of least cost and diversity of supply objectives to various groups of consumers is presented in Table 5.1. The clearest preference between these objectives is shown by European cement companies which consider cost to be very important and diversity to be not important. Other consumers and traders also considered cost to be more important than diversity. However, they also ranked diversity of supply as having above average importance in most cases.

Although priority was given to least cost supplies in the mid 1980s, many consumers (Japanese steam coal consumers, sogo shosha and southern European electricity companies) expect diversity objectives to become more important in the 1990s. This implies a continued or even enhanced role for security structures in the coal industry.

Table 5.1: Importance of supply diversity and least cost to coal purchases, 1980-95

respondent	least cost 1980	least cost 1987	least cost 1995	diversity of supply 1980	diversity of supply 1987	diversity of supply 1995
Japanese groups						
steel mills	2	1	1	1.5	2.5	2.5
steam coal groups	2	1	2	3	3	2
electricity cos	2	1	1.5	2.5	2	1.5
general industry	1	1	1	2.5	2.5	2
mining companies	3.5	1.5	1.5	2.5	2.5	2
oil companies	1.5	1	1.5	3	3	2.5
sogo shosha	3	1	3	3	4	1
European groups						
electric utilities						
northern Europe	2.5	1.5	1.5	1.5	2	2
southern Europe		1	2		3	1.5
cement companies	1	1	1	5	5	5
trading companies	1	1	1.5	2.5	2.5	2.5

key: 1 = very important 2 = above average importance
3 = average importance 4 = below average importance
5 = not important
source: survey and interviews, Appendix D.

5.2.2 The importance of government objectives

To gain secure and diverse coal supplies, companies are not always left to implement their own purchasing strategy. Governments are also concerned about the security of coal supplies because of its importance to industrial production and energy supplies. As a result, governments often establish energy policies and create structures to assist the secure supply of coal to their industry. One of the most common government policies is the protection of their domestic coal industry by requiring consumers to purchase domestic coal. However, dependence upon domestic suppliers may prevent diversity in supply from being achieved and also raise costs. The importance of these support policies is thus declining in both Japan and Europe (Table 5.2; section 5.5). The development of these coal policies and the implications of their decline on the international security structure will be considered in detail in later sections of this chapter.

Another policy which alters coal trade is the boycott by various countries of the purchase of South African coal.

Although most consumers consider this policy to be of less than average importance in deciding on coal supplies, it creates an absolute restriction for many Scandinavian and French consumers (unless the coal is imported under a different national label) (SOMO 1989a).

Table 5.2: Importance of required domestic purchases and political boycotts to coal purchases, 1980-95

respondent	required domestic purchases			political boycotts		
	1980	1987	1995	1980	1987	1995
Japanese groups						
steel mills	3	4	5	4	3	3
steam coal groups	3	4	5	4	3.5	4
electricity cos	2	2.5	4.5	4.5	4.5	4.5
general industry	5	5	5	2	2	2
mining companies	2.5	4	5	4.5	3.5	4
oil companies	3.5	3.5	5	4	3	3
sogo shosha	2	4	5	5	4	5
European groups						
electric utilities						
northern Europe				5	3	4
southern Europe	5	5	5	5	5	5
cement companies	3	4	5	5	5	5
trading companies	2	3	3			

key: 1 = very important 2 = above average importance
3 = average importance 4 = below average importance
5 = not important
source: survey and interviews, Appendix D.

Other policy debates which influence coal trade include claims that American coal is purchased to help reduce bilateral trade imbalances with Japan, Italy, S. Korea and Taiwan. Most consumers surveyed did not consider this factor important in their trade decisions (Table 5.3). Similarly, the argument that groups like the Japanese steel mills purchased American coal to ensure access to the American market for the sale of their steel products was not verified by the survey. Japanese mining companies were concerned about market access to sell their skills and equipment from affiliated firms, but the issue was generally one of low importance. The priorities among purchasers were clearly cost and supply diversity.

Table 5.3: Importance of trade balance and product market access to coal purchases, 1980-95

respondent	bilateral trade balance			access to product markets		
	1980	1987	1995	1980	1987	1995
Japanese groups						
steel mills	5	4	4	4	5	5
steam coal groups	4	4	4	4	4	4
electricity cos	4	4	4	5	5	5
general industry	3	3	3	4	4	4
mining companies	4	4	4	3	2	3
oil companies	4	4	3	4	4	3
sogo shosha	5	4	5	5	4	5
European groups						
electric utilities						
northern Europe	5	4	5	5	4	4
southern Europe	4	4	3	4	4	4

key: 1 = very important 2 = above average importance
3 = average importance 4 = below average importance
5 = not important
source: survey and interviews, Appendix D.

Politicians frequently add their support to the negotiating position of their coal exporters or importers. In the case of the USA, leaders promote more coal exports to Europe and Asia:

> 'We can promote coal exports by taking a tough negotiating stance against foreign subsidies of coal, and by encouraging long-term contracts with US suppliers. This will reduce the trade deficit, increase the energy security of our allies, and provide more jobs for Americans.' (Bush 1988:16)

Coal trade received similar attention at the 1985 meeting between Prime Minister Nakasone of Japan and Prime Minister Hawke of Australia because of tension over declining prices and tonnages at the time. Prime Minister Nakasone was quoted as saying 'I would like to do my level best to see that the marketshares will be maintained' (AFR 1985.1.16) This was interpreted by Australian advisors as proof that 'Japan had agreed to hold Australia's share in the markets for coal...' (AFR 1985.1.17). However, Nakasone refused to endorse this interpretation and instead said that 'He promised not to sacrifice Australia to third-country pressure - without naming the United States - but warned that Australia would hold its place only if it stayed competitive in price and stable in supply.' (AFR 1985.1.17) The reference to stability in supply pointed to a railway strike which resulted in 28 ships waiting outside of Newcastle for coal. Four months later, Japan was delaying ships which were to be sent to load Blair Athol coal as part of its bargaining strategy to have the price lowered (AFR 1985.4.4).

Political manoeuvring and the creation of policies and security structures to enhance the national position in global coal trade creates opportunities for conflict in the international trading system. Conflicts can arise between the interests of different countries or between national and international structures. Each of these tensions will be examined closely in the following sections.

5.3 Japanese security structure and coking coal

5.3.1 Government-industry relations

Japan is argued to have constructed a security structure based upon a cooperative government-industry relationship. This national structure was built to overcome the insecurity of supply caused by the purchase of standard American coal brands under short term contracts. Instead of accepting this standard practice of the international coal trade, special policies and corporate procurement strategies were adopted.

Japanese coal plans were only one element of the overall strategy to achieve economic growth. Johnson (1982) explains the Japanese economic success as a product of the developmental state. In this model, the government creates complementary policies and structures to promote economic growth. Government directives, financial allocations and corporate investment are expected to be closely coordinated to achieve shared objectives. These elements of the security, financial and production structures are introduced by first reviewing Japanese industrial policies and their effect on coal projects and coal imports.

Industrial policies are defined as the broad range of policies, other than macroeconomic policy, that increase the productivity of factor inputs and influence investment and disinvestment decisions of firms, industries, or sectors (Eads and Yamamura 1987:425). Tresize (1982, 1983) concluded that Japanese industrial policy had no substance because it lost significant economic instruments like direct subsidies and tariffs in the 1970s. However, this narrow definition of policy instruments overlooked many important features of the Japanese policy environment. Eads and Yamamura (1987:426) concluded that 'direct economic aid unarguably influenced the performance and behaviour of Japanese industries'. The narrow economic view of industrial policy was 'faulted for its ignoring past policy and its continuing effects on the Japanese economy since the oil crisis.' (Eads and Yamamura 1987:426) In short, to understand current state-industry relations, the historical context of Japanese policies needs to be reviewed.

Coal is a resource of special significance to Japan because it is one of the few sources of fossil fuels available within the country. Japanese coal had been used extensively to fuel industrial development and was even exported to China in the early twentieth century (Tsurumi and Tsurumi 1984). As industrialisation expanded, so did the demand for energy. Coal imports became important and by 1943 38% of the coal used in the steel industry was imported from China and a few other sources (like Taiwan) (D'Cruz 1979:90). The arrangements governing both domestic and international sources of coal are a product of the interaction between government policy and industrial practice.

The Japanese response to the shortage of coal at the end of World War II is contrasted with the UK response. The fragmented and rundown UK industry was considered in need of investment and coordination so it was nationalised in 1949.

Japanese bureaucrats proposed the same solution to their coal crisis, but direct government control was rejected in favour of a system of government guidance over corporate decisions. The government supported the coal industry in its first postwar industrial policy ('food for coal') by increasing the food rations of coal miners[1]. Investment in the coal industry was then promoted under a 'priority production' system to concentrate assets in a few strategic sectors regardless of the effects on civilian consumption or inflation[2].

The government also used its control over trade and finance to direct investment and industrial development. Several important bureaucratic reforms were made in 1949-50 to facilitate these changes. MITI, the Ministry of International Trade and Industry, was formed by combining the Ministry of Commerce and Industry (MCI) with the Board of Trade (BOT) and the Export Import Bank of Japan was formed to give the government a financial institution to promote trade (Ozawa 1986). An emphasis was placed on international trade and coal trade was one of the recipients of detailed attention.

Imports for the steel industry were permitted to recommence in 1947, but the Occupational Forces Administration specified that the industry had to look for new suppliers outside the old Japanese Empire (Mitsui 1954 cited in D'Cruz 1979:89). The Canadian and European steel mills had established a long term pattern of importing coking coal from the American coal industry of West Virginia, so Japan turned to the same source (D'Cruz 1979:92). The USA became the largest supplier of coking coal to Japan throughout the 1950s and early 1960s.

The JSM demand for coking coal grew and new international supplies were added with Australia emerging as the most important new source in the 1960s and Canada being the largest new source in the 1970s (Figure 5.1). Domestic coal supplies grew slowly in the 1950s and 1960s, yet accounted for a declining share of JSM requirements. In the 1980s imports from South Africa, the USSR and China grew. International supplies were successfully diversified as domestic supplies declined[3].

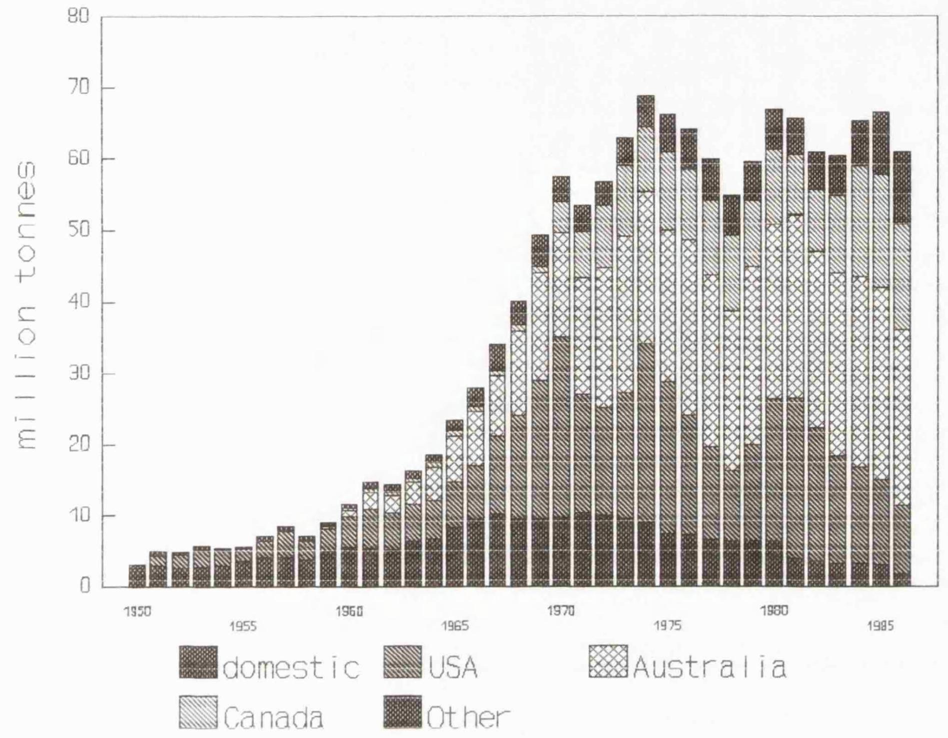


Figure 5.1: JSM coking coal sources

One of the most enduring features of the Japanese economic system was the conformity with which individual companies followed government (typically MITI) directions. In the absence of clear legal obligations, enterprises chose to follow MITI 'administrative guidance'.

> 'Administrative guidance differs from orders issued in accordance with, for example, the Foreign Exchange and Foreign Trade Control Law in that it is not legally enforceable. Its power comes from government-business relationships established since the 1930s, respect for the bureaucracy, the minister's claim that they speak for the national interest, and various informal pressures that ministries can bring to bear.' (Johnson 1982:266)

Companies may prefer not to conform, but MITI generally had the power to persuade them to follow administrative guidance (Yamamura 1982)[4]. The relationship between industry and government ministries was thus a close one with few public breaks in their combined desire to promote economic growth and trade. This study looks beyond the government-industry relationship in domestic Japanese industry to examine the pattern for investment and coordination of overseas projects. In particular, it is argued that the decline of domestic coal supplies and the increased reliance upon imports caused the government to promote structures which would ensure the secure supply of coal for the steel industry.

5.3.2 Coal imports and the 'develop and import' policy

Japanese public and private interests complement their domestic cooperation with the combined application of public and private resources to gain secure supplies of imports. The approach was outlined in 1971 when the Japanese Committee on Coal Imports issued a report which advocated the establishment of a system to ensure a stable and economic supply of coal (Sakamoto 1982:359).

The report provided a series of recommendations to establish a coal supply system:

> '1. Longer-term planning is required to develop a comprehensive and reliable coal chain.
>
> 2. Supply capacity should be substantially strengthened especially by developing overseas coal mines. In particular the following steps should be implemented: long-term contracts with coal exporters with minimum uptake clause; participation in or facilitation of financial support for the development of new mines in exporting countries, and assistance with the improvement of infrastructures in coal-exporting countries.
>
> 3. Diversification of Import Sources. Large dependence on a single country is not beneficial for either exporter or importer. Though currently Japan relies on Australia, for much of its coal there is a need not only to expand existing coal sources (New South Wales, Queensland, China, Canada, etc.), but also efforts should be made to develop new mines in the United States and other areas which may, however, require longer-term contracts and improvement of port and railroad facilities.
>
> 4. Improvement of Receival Facilities in Japan. There is a need to improve facilities to handle larger ships and establish coal centres in several areas.

5. Development of New Techniques for Wider Coal Use. The development of new techniques such as COM, fluidised bed combustion method, coal liquefaction and gasification should be encouraged which will also create new demand in the future.

6. International Cooperation is Essential. The private sector can provide stable demand to exporters with longer-term contracts supported by a group of users and this may also facilitate the maintenance of price stability. The government can assist by providing financial support for the construction of coal centres, the adoption and development of new technology and the development of new mines abroad where private capital cannot provide enough finance.' (Sakamoto 1982:359)

Japanese private investment in and public finance of overseas mines is thus one means to achieve several objectives. It increases supply capacity, but it can also diversify supply sources. Furthermore, the provision of public finance to supplement private capital for coal mine development is regarded as a form of international cooperation. Investment in overseas mines can thus meet three Japanese policy objectives: to increase coal supplies, to diversify supply sources and to provide international cooperation. The 'develop and import' policy provided the specific mechanisms to meet the above objectives.

Although the develop and import (D&I) policy is often cited with reference to projects in developing countries, it identifies several of the general points important to Japanese policy makers when arranging the supply of raw materials (Anderson 1987; Kolenda 1985; Ozawa 1977; Walsh 1982). Long term loans and financial arrangements like soft loans (low interest, long repayment periods) were to be complemented with direct investment in joint ventures and will be studied in chapters 6 and 7. The projects should be large scale to benefit from economies of scale and dispersed in many regions to ensure diversity of supply.

Local infrastructure requirements were to be included in the project as far as practical, but given the cost that infrastructure adds to resource projects those with the lowest overall costs were generally selected. Indeed, mines like

Gregg River in Canada were actively promoted by the JSM precisely because infrastructure costs were low. Facilities were in place to support existing mines and only small extensions to services were required to meet the needs of Gregg River.

The JSM used the general Japanese 'develop and import' project formula to gain access to resources. However, when host governments introduced laws to increase the local returns on mining projects, it was sometimes interpreted as a direct attack on the JSM 'develop and import' initiatives. For example in 1976 the Alberta government announced a new coal development policy which included higher royalties on open cut mining. The Coal Manual proclaimed the Japanese sensitivity to such changes:

> 'Thus, the imposition of high royalties on strip mining may well drastically undermine the international price competitiveness of Alberta coal in not-so-distant future...Alberta's tough coal development policy has also weakened the trust Japanese steel mills have in the province as a stable supplier of coal in the future...there seems to be sufficient ground to believe that the new coal development policy is aimed at the 'develop-and-import' scheme by Japanese mills to a considerable extent.' (Coal Manual 1976:183-4).

The justification for this view was that Japan was the principal destination for Albertan coal exports and new projects involving the JSM (Gregg River mine in particular) were planned to start in the near future (Coal Manual 1976:84,201). The Albertan government approved the Gregg River development in July 1976, but the actual development of the mine was delayed with exports to Japan commencing in 1983 rather than 1976 as initially planned. Despite this delay, the ownership and financing of the mine conformed to the general 'develop and import' model.

In addition to the project oriented 'develop and import' arrangements, the Japanese government also promoted secure coal supplies through a set of intergovernmental trade and investment agreements with centrally planned economies.

5.3.3 Coal projects under bilateral trade agreements

Coal supplies were given central importance in the negotiation of several Japanese bilateral trade agreements. Although the conditions governing the trade have changed markedly, China and Japan share a long history of coal trade. Japanese domination during the interwar years has been replaced with broad bilateral trade agreements. The incentive to promote trade is recognised by governments on both sides.

> '(The) image of China's natural resources fuelling Japan's modern economy with energy and raw materials, while Japan promoted China's modernisation, appealed to both governments' (Newby 1988:8).

Coal is considered poised to become the mainstay of Sino-Japanese energy trade because coal development is less costly and risky than oil exploration. By 1985, 46% of China's coal exports went to Japan (Newby 1988:26; Locatelli 1989:145). This trade was based on long term agreements.

In February 1978 the Long Term Trade Agreement between Japan and China was signed. Significantly, the leader of the Japanese negotiating team was Inayama Yoshihiro the President of Nippon Steel. A $20 billion trade flow was to be created in the first 5 year period, 1978-82, and coal was to play a central role. Japanese imports from China were to include 8-9mt of coal while China imported machinery, construction materials, plant and technology to facilitate coal mining, transport and steel production (Franks 1988). The agreement was revised in 1979 and the trade proposals increased. The 1980 revision called for coal export levels to reach 10mtpa by 1985. In 1982 the planned 1985 export level was reduced to 8mtpa and in 1983 the target was cut to 4-5mtpa. The JSM welcomed these downward revisions because of the decline in steel production and because of the poor quality of the coal received (Newby 1988:24). The Chinese accepted the reductions, in part, because of inadequate transport infrastructure to meet export targets (Locatelli 1989).

To facilitate the planned coal exports to Japan, the Export Import Bank of Japan agreed to loan $1 billion to develop seven new mines (Table 5.4)[5]. These loans totalled Y331 billion and carried an interest rate of 6.25%. The First Credit Agreement of 1979 was followed with a Second Credit Agreement in 1984 for Y479 billion. The interest rate was set at 7.125% and repayments were to be made within 15 years (Newby 1988:42). In 1987 a special addition of Y100 billion was added to the Second Credit Agreement. This investment in new energy projects alone was not sufficient to increase China's role in international coal trade because of the limited transport infrastructure available. Infrastructure investment was required as well.

Table 5.4:Mines financed by the 1979 Export Import Bank Loan

mine tract	location	coal type	production raw	production clean	export date
Xiqu	Gujiao, Shanxi	coking	3.0	1.6	1984
Malan	Gujiao, Shanxi	coking	4.0	2.2	1987
Zhenchengdi	Gujiao, Shanxi	coking	1.5	0.8	1986
Qianjiaying	Kailuan, Hebei	coking	4.0	1.6	1986
subtotal		coking	12.5	6.2	
Baodien	Yanzhou, Shandong	steam	3.0	2.1	1984
Jiangzhuang	Zaozhuang, Jiangsu	steam	1.5	1.1	1984
Sitaigou	Datong, Shanxi	steam	4.0	3.0	1988
subtotal		steam	8.4	6.2	
total			21.0	12.4	

source: Coal Manual 1985:372

The limited capacity of China's infrastructure was recognised and special yen credits were arranged to improve railway and port facilities. Of the eight infrastructure projects proposed by the Chinese in 1979, the Japanese agreed to fund six for a total of $1.5 billion. Of the six projects, five were directly related to transport or port facilities for coal exports and the sixth was a hydro power station which indirectly freed coal for export because otherwise the coal would have to be burned to provide electricity for the Wuhan steel mill. In

1984 a second set of government loans was arranged to finance railway lines, wharf construction and hydro power stations. Annual infrastructure loans to China are shown in Table 5.5.

Table 5.5: Japanese loans for Chinese infrastructure

year	billion yen
1979	50
1980	56
1981	40
1982	60
1983	69
1984	71.5
1985	75.1
1986	80.6

note: the interest rate is 3.25%
repayments are to be made over 20 years
after a 10 year period of grace
source: Coal Manual 1988:351-353

In summary, the government played a leading role in creating the legal framework for bilateral coal trade and financing coal projects and the associated infrastructure to increase China's role as a supplier of coal to Japan.

The Japanese government also played a key role in financing new coal projects in the USSR. A bank loan was agreed in 1974 to finance the development of the South Yakutsky coal basin. The Export Import Bank led a syndicate of 24 Japanese banks to loan Y110 billion ($500 million) for the purchase of Japanese equipment and machinery for coalfield development. The interest rate was set at 6.375% and repayments were to be made from 1983 to 1990. In 1979 an additional loan of Y8.8 billion ($40 million) was agreed to finance the construction of a coal washing plant (Coal Manual 1985:362; ICL 1989 19:5).

In addition to the finance of equipment purchases (largely form Japan), Y16.8 billion ($60 million) was loaned for the purchase of local supplies and consumables. This loan had a higher interest rate of 7.125% and was to be repaid more quickly, 1983-87 (Coal Manual 1985:362).

In return for financing the South Yakutsky development Japan was to import Neliunga K coal starting in 1983 (3.2mtpa) with imports rising to 5.5mtpa for the 1985-98 period. This was in addition to the contracted import of 1mtpa of Kusnetsky coal from 1979 to 1998. The new project thus added a significant new source of coal for the JSM[6]. The Siberian coalfields, the port of Nakhodka and the connecting 2500 km of railway became the newest JSM supply route (ICL 1989 19:5).

The result of these intergovernmental agreements and the associated Japanese finance of Chinese and Soviet coal mines was the planned increase in coking coal export capacity of approximately 6mtpa in each country. These additions to international coking coal supplies made significant contributions to the Japanese objective of diversifying their coal sources. In this way, security of supply would not be lost as domestic production declined.

In summary, industrial policy, government-industry cooperation, long term develop and import projects and international trade agreements have been used by the Japanese government to create a secure structure for the supply of coking coal to its steel industry. Industry was involved in the process of design and implementation of these policies because both companies and the national economy benefited from a secure supply structure.

Bilateral European initiatives, similar to those of Japan, are also found in the European East-West coal trade. Austria agreed to finance the expansion of Upper Silesian mines in Poland ($300m in 1980) in return for a twenty year supply contract (up to 1.5mtpa) from 1984-2003. West Germany provided even larger credits (DM 1.2 billion) for investment in Polish mines (including investment in the Lublin coalfield) and imported 1-2mtpa in return (James 1984:150). The same pattern applied when a 10 year contract to supply steam coal to PGEM in the Netherlands was agreed in return for an intergovernmental loan from the Netherlands to Poland (Gaskin 1981:29). These examples illustrate the independent action of national governments to secure coal for domestic industry by using similar bilateral arrangements. National security interests may also be shared and implemented collectively as demonstrated by the formation of multilateral security structures.

5.4 Multilateral and national security structures

> 'Political economy studies how the processes described by economic theory are shaped by the institutions created by political processes. In this way, institutions are no longer seen as being culturally unique, but as means to institutionalise rules that are favorable to one group or another. Political preferences structure the way in which economic processes work.' (Johnson 1988)

5.4.1 The IEA and international energy security

The International Energy Agency (IEA) represents the increased attention paid to multilateral structures in the 1970s and 1980s. However, conflicts can emerge between national and international security structures and this tension is well illustrated by coal policies in the 1980s. The oil shock of 1973 renewed concerns among consuming countries about the security of energy and especially oil supplies. Many responses were undertaken at the national and international level. The most prominent international response was the 1974 decision by 21 of the 24 members of the OECD to form a new international institution to concentrate on energy issues[7].

The International Energy Agency (IEA) was established to promote:

1. cooperation among IEA Participating Countries to reduce excessive dependence on oil through energy conservation, development of alternative energy sources and energy research and development;

2. an information system on the international oil market as well as consultation with oil companies;

3. cooperation with oil producing and other oil consuming countries with a view to developing a stable international energy trade as well as the rational

> management and use of world energy resources in the interests of all counties;
>
> 4. a plan to prepare Participating Countries against the risk of a major disruption of oil supplies and to share available oil in the event of an emergency. (IEA 1988b:2)

The formation of the IEA has been interpreted as a Kissinger-promoted initiative to support American energy objectives and create an international forum aimed at reducing the price of oil and thereby offsetting OPEC's attempts to raise the price (Strange 1988:198). The IEA itself is a security structure to meet the energy objectives of the mature capitalist economies. The original Agreement on an International Energy Programme signed in Paris in 1974 included coal as one of the alternative energy sources to be encouraged (Articles 41 and 42). Following many meetings and negotiations, the Principles for IEA Action on Coal were adopted by the Governing Board in 1979.

The common objectives adopted in the Principles for Coal Policy are to expand:

1. the use of coal as an alternative fuel;
2. the production of coal to meet this increased demand;
3. international trade in coal to meet increased demand.

All elements of the coal chain from mine face to waste disposal were identified for attention. International trade was given special encouragement.

> 'IEA countries both as producers and consumers will facilitate the expansion of international trade in coal and will do so on a basis which encourages the development of stable relations between consumers and producers, on fair, reasonable and competitive terms, especially by means of long-term contracts. They will ensure that an economic, fiscal and investment climate prevails which is conducive to development of coal production, trade and utilisation as envisaged in these Principles for IEA Action on Coal.' (IEA 1988b:171-172)

The magnitude of the expected role of coal in the energy future of IEA countries was summarised by the 1978 forecast of consumption rising from 475mtoe (680mtce) in 1976 to 900mtoe

(1300mtce) in 1990 and 1500mtoe (2100mtce) in 2000 (IEA 1978). The political support for the production of coal as a secure alternative to oil was symbolised by the 1980 Paris Summit where the leaders of the seven largest western economies called for the doubling of coal use and trebling of coal trade by the year 2000.

By 1988 the earlier forecasts of coal demand had been revised downwards to 1350mtce in 1990 and 1800mtce in 2000 (IEA 1988b:26). Despite these revisions the share of primary energy provided by coal increased from 20.4% in 1973 to 22.4% in 1980 and 24.6% in 1986. By the year 2000 coal was expected to provide 28.7% of total primary energy. Total energy requirements had been revised downward, but coal increased in both absolute and relative importance. In addition, to this increased importance of coal to IEA countries, its role in other countries (China and Eastern Europe for example) was larger and expected to grow even faster (especially in China and other developing countries in Asia) (Fesharaki and Razava 1989; JAPAC 1987). Indeed, the promotion of coal trade in the Asia Pacific region is heralded as an example of multilateral Pacific cooperation (Desai and Phaloprakarn 1987; Drysdale 1985; JANCPEC 1988; Takahashi 1987).

5.4.2 The IEA and national coal security

A direct conflict between international and national security structures emerged in the 1980s when the IEA promoted an open international coal trade which provided security through size and diversity. In contrast, most coal producing countries sought security through domestic supplies and provided financial support to their industry (Gordon 1970). The inconsistency of these two strategies was revealed in the periodic IEA reviews of national coal policies. Improvements in the coal chain (from mine to mill) were proposed, but implementation depended on national priorities. In 1988 the Governing Board recommended that member governments strengthen or develop new policies:

'to reduce, with a view to eliminating, remaining trade barriers, including subsidies, norms or other government controls which impede coal trade. The political sensitivity of this proposal was recognised with the qualification that other policy considerations, including social and regional ones, may make it necessary to deal gradually with some of these barriers' (IEA 1988b:8).

The magnitude of national government support of domestic coal industries was measured by calculating the effective subsidy to the industry from special government grants like the annual payment of operating deficits in the industry or the required payment of higher prices for domestic coal. The IEA definition of 'producer subsidy equivalent' thus provides a good indicator of the extent to which governments supported their domestic coal industries rather than rely on the international trade (Table 5.6; IEA 1988b:61; Steenblik and Wigley 1990)[8].

The estimates of producer subsidies are also shown in comparison to the value of total assistance to the coal industry. The subsidy is calculated on the basis of support for current production, while total support includes programmes to support or retrain miners who have been laid off or the costs associated with the closure of uneconomic mines and rehabilitation of mine sites. In general, total assistance to the coal industry was often twice the size of the subsidy to support current production.

By the late 1980s countries like Japan, Germany and Belgium were paying subsidies to the domestic coal industry ($40-90pt produced) which were up to twice the delivered price of imported coal. This meant that domestic consumers (typically electric power plants) were paying as much as twice the international price of coal to maintain the security of domestic supplies. In terms of absolute size, the coal industries of Germany, UK and Japan received the largest subsidies (over $1 billion per annum). Belgium and Spain also had large subsidy programmes costing $300-400 million in 1987. This short list of the five most subsidised industries is not exclusive as virtually all IEA countries with a domestic coal industry provided some support.

Table 5.6: Coal industry support in selected IEA countries, 1982-87

country	1982	1983	1984	1985	1986	1987
Producer subsidy equivalent (million $)						
Japan	295	543	605	806	1126	1330
Belgium	171	143	169	174	304	425
Germany	1703	2000	2346	1975	3463	5815
Spain	na	na	na	na	na	367
United Kingdom	1025	1997	3193	583	1634	1995
Producer subsidy equivalent ($/t produced)						
Japan	17	33	36	49	74	93
Belgium	26	23	27	28	54	96
Germany	19	24	30	24	43	71
Spain	na	na	na	na	na	19
United Kingdom	9	19	75	6	16	26
Total coal industry assistance (million $)						
Japan	677	1146	1033	1297	1806	2073
Belgium	874	964	910	896	na	na
Germany	na	na	5159	4755	na	na
Spain	na	na	na	na	na	na
United Kingdom	1376	2678	3677	2057	3415	na

note: Japan and UK years refer to financial years beginning 1 April.
The 1987 UK price support was calculated using the IEA methodology: average CECB price less average European power station coal import price less $20ptce for inland transport.
na = no data available
source: IEA 1988b:61,124-158. IEA 1989c:243; EEC 1988b

The Canadian government paid the annual deficit of the Cape Breton Development Corporation which mines coal in Nova Scotia ($20 million for the current production of 2.6mt in 1986-87). The Italian government gave ENI a five year $380 million grant to support a new mine producing 1.7mtpa in Sardinia. The New Zealand government paid the annual deficit of Coalcorp until 1987, supported higher coal prices for electricity production and gave special subsidies to one mine ($10-20 million pa). The Norwegian government supported mines on Spitzbergen ($10-20 million pa). The Portuguese government assisted one small mine (0.2mtpa) and the Turkish government introduced a $10pt import duty on steam coal imports in 1986 to protect domestic producers. Even the American government provided indirect support to its coal industry through the requirement that Department of Defense installations (including those in Europe) use American coal shipped on American ships (the cost of this mandatory coal purchasing programme was estimated to be $26 million in 1988) (IEA 1988b:163-166).

By 1987 the cost of subsidies for the production of 250mt of high cost coal was over $10 billion. This equals one-half of the value of global coal trade (even allowing for the 1986 UN estimate of $16 billion to be an underestimate of the value of global coal trade) and made average subsidies larger than the delivered prices of many coals in 1987.

Despite the widespread practice of domestic support for coal industries, the IEA promotes the elimination of barriers to trade (IEA 1988b). The Energy Ministers of the member countries agreed in 1987 to reduce and eventually eliminate the financial support of their respective coal industries. Despite the popularity of the argument for domestic supplies as a source of energy security, the strength of this argument is weakened by the risk of disruptions to domestic sources (as illustrated by the 1984-85 UK miners strike). Alternative security strategies include stockpiling and fuel substitution capability (Gaskin 1986), but the lowest cost solution was generally to diversify international suppliers.

5.4.3 International coal trade security

The reduction of trade barriers and domestic industry support will cause international coal trade to grow. Both the efficiency and security of international supplies are expected to increase as a result (because of more numerous and diverse suppliers). Fears of a COALPEC forming to raise prices like the OPEC induced rises in oil prices are refuted by the geographic and political diversity of coal suppliers. The two largest global suppliers (Australia and USA) and Canada are members of the IEA and signatories to agreements to honour supply contracts. Poland, the USSR and China also provide substantial coal supplies to IEA member countries. A third group of suppliers is emerging among third world countries and includes Colombia, Indonesia and Venezuela. A fourth significant source of coal exports is South Africa. The likelihood of these diverse countries acting collectively to form a cartel and raise coal prices is remote. In addition, the creation of an institution like the IEA, representing the interests of both producers and consumers, was designed to reduce such interference in energy trade.

One of the strongest advocates of removing coal trade barriers is Australia. More open coal markets would increase the opportunities to sell Australian coal and the argument for removing subsidies has been presented at many multilateral forums. The USA joined Australia in making submissions to the Natural Resource-Based Products Negotiation Group of the Uruguay round of GATT negotiations. They called for energy-related products to be added to the three existing categories under negotiation (forestry, fisheries and non-ferrous minerals and metals). Although the GATT had not traditionally dealt with energy issues, the USA noted that 'trade problems in the energy sector had become more evident, particularly those related to market access and subsidies' (GATT Focus 1989:64/4). The Australian submission proposed 'establishing disciplines to control government support in the coal industry' (GATT Focus 1989:64/4). The Australian perception of distortions shaping international coal trade was summarised by Crowley and Jones (1988).

The removal of domestic support and the substitution of imports for domestic coal is expected to cause much of the growth in European coal imports in the 1990s (IEA 1988b). Institutional changes in Europe are stimulating this change. The formation of a single market in 1992 has stimulated calls for a common energy and coal policy among the member countries (even though coal policy was explicitly reserved for member states under Article 17 of the ECSC) (Maniatopoulos 1989). Deregulation, privatisation and direct competition will also promote change because electricity as well as primary fuels will be sold across borders at competitive prices. This increased competition will force electric utilities to reconsider the security value of domestic coal supplies when diverse imports offer significant savings on fuel costs.

In summary, multilateral and national institutions to promote coal security conflict with each other when international structures call for the removal of elements of national structures (including domestic industry support). National governments will need to balance the economic efficiency and energy benefits of reducing high cost domestic protection against the social and regional costs where mines are closed. Examples of these national policies and practices to promote secure coal supplies are examined next.

5.5 Japanese security structures and steam coal

5.5.1 Steam coal and energy security

Japanese concerns about vulnerability to disruptions in energy imports were reinforced by the oil crises of 1973 and 1979. As a result, the core elements of Japanese energy policy were to secure stable oil supplies, to promote the development and introduction of alternative (non-oil) energy sources and to promote energy conservation. The major preoccupation was to overcome dependence on imported oil from the Middle East and especially the 37% of imports which came through the Strait of Hormuz (Perkins 1985; NEDO 1988; Nemetz et al 1984).

To coordinate government support for the development of alternative energy sources, NEDO (the New Energy Development Organisation, later renamed the New Energy and Industrial Technology Development Organisation) was established in 1980. Its objectives included encouraging the development of Japanese coal resources, promoting the development of overseas coal resources by Japanese companies, promoting Japanese geothermal resources and supporting research to commercialise new energy sources. By the mid 1980s advanced coal-based fuels were given the highest priority in the research programme (Perkins 1985).

Japanese support for the domestic coal industry promoted the continued production of both coking and steam coal under the Seventh Coal Policy. However, the Eighth Coal Policy (which runs for the five year period 1987-91) plans to cut production from the previous target level of 20mtpa to 10mtpa. Existing coal production was supported in part by direct grants to the industry ($160-180 million pa in JFY86-87) and more importantly by price supports ($1130-1330 million pa in JFY86-87). The result is that the price of domestic coking and steam coal was three times that of imports in 1986-87 (IEA 1988b:147).

Given the further reduction in Japanese domestic production, attention turned to the Japanese participation in the development of overseas resources (through develop and import projects and bilateral investment agreements - section 5.3) and the investment in coal-related research and technology.

In 1988 NEDO announced the Coal Renaissance policy to reinforce earlier components of the National Energy Policy[9]. Its primary objective was to diversify energy sources and reduce the relative importance of Middle East oil. Coal was identified as the main alternative to oil, but rather than continue to focus on large consumers like power stations and cement industry boilers, attention was directed to smaller boilers where oil was the dominant fuel.

The electricity and cement industries made significant conversions from oil to coal combustion in the early 1980s and are the largest energy coal consumers in Japan (Table 5.7; Long 1983). The cement industry converted almost its entire boiler capacity from oil to coal following the 1979 rise in oil prices. Consumption jumped from 1.6mt in 1979 to 10.6mt in 1981 before the level of cement production and coal consumption declined in the mid 1980s. In the electricity industry conversions and the commissioning of new coal-fired capacity has been more gradual, but the size of the industry ensures that it remains the largest consumer of steam coal. The rate of increase was illustrated by the trebling of coal consumption from 7mt in 1979 to 23mt in 1987 (NEDO 1988).

Table 5.7: Japanese coal demand by industry, 1973-2000

industry	1973	1979	1981	1987	2000
			million tonnes		
energy coal					
electricity	7.6	7.0	12.9	22.9	43.0
cement	0.3	1.6	10.6	6.5	7.5
chemical	0.1	0.2	0.4	2.5	6.5
textiles				1.0	1.5
pulp & paper	0.2	0.2	0.5	2.0	6.0
oil				0.1	1.0
other	2.5	2.9	2.1	1.8	5.5
sub-total	10.7	11.8	26.4	36.8	71.0
coking coal					
iron & steel	62.5	58.4	64.6	63.0	60.0
other	6.0	6.0	6.2	6.0	5.0
sub-total	68.5	64.4	70.8	69.0	65.0
total	78.5	76.4	97.3	105.8	136.0

note: The IEA estimates Japanese coal consumption for electricity generation to be 17.1, 15.5, 30.9 and 52.1mt in 1973, 1978, 1987, and 2000 respectively. These values include private electricity generation (IEA 1989b).
source:NEDO 1988, 1989; MITI 1988; and Coal Manual 1988.

Fears were expressed that low oil prices would reverse the fuel substitution process away from coal. However, even the low oil prices of 1986-87 failed to cause significant switching among fuels. In general, energy coal prices of $30 per tonne FOB are considered competitive with heavy fuel oil prices of $10-12 per barrel for existing coal-fired power stations. This difference includes allowance for variations in operating costs and plant life for the two fuels. Oil prices would thus need to fall to and be expected to remain at these prices to gain back the share of electricity generating capacity lost to coal (Ryan 1987).

In contrast to the large electricity and cement industry boilers, only 9% of the smaller boilers in other industries were coal-fired. The majority of general industry boilers (73% of total capacity) were oil-fired. In addition, only 12% of the boilers had been installed since 1974 so reinvestment is expected in the near future (NEDO 1988). The selection of the next generation of boilers is thus about to take place. To promote oil substitution a new strategy for clean, convenient coal use was required. However, for coal to contribute to energy security, it also must meet environmental security objectives (to not degrade the sustainability of environmental systems) if these are incorporated into the national security structure through government policy.

5.5.2 Coal, environmental security and technology

The combustion of coal causes many environmental problems. However, the problems caused by SO_2, NO_x and particulate emissions from coal combustion can be largely controlled (post-combustion) by electrostatic precipitators, bag filters, flue gas desulphurisation, and flue gas denitrification. Alternatively, control can be introduced at the preparation or combustion stage by coal cleaning and preparation, fluidised bed combustion, multi-stage combustion and low NO_x burners. Similarly, problems of ash disposal can be overcome by new techniques to use ash (ie. in cement production or road construction) and lower ash fuels. Finally, the scarcity and high cost of technical solutions to the problem of CO_2 emissions needs to be recognised as a major challenge to the environmental acceptability of coal combustion.

The use of selective membrane separation or absorber/stripper systems to extract CO_2 from the flue gas is estimated to double both capital and operating costs of a conventional coal-fired plant (Thurlow 1990). Other environmental problems are solved more cheaply. Variations in coal quality can be overcome by the introduction of fluidised bed combustion boilers, coal-water mixture fuels (CWM) or the coal cartridge system (CCS) which delivers standard ten tonne capsules of pulverised coal and then removes the ash in the same capsule. The lack of delivery systems available for small users is overcome by creating regional coal centres. New delivery techniques (CCS or CWM) enable coal to be handled in a standardised unit or as a liquid and thereby avoid dust emissions (NEDO 1988).

The stage of development varies for each of the above technologies. The emission control technology is well developed and operating in hundreds of plants. Fluidised bed combustion is in operation at over 20 Japanese boiler sites. Ash is being disposed of by direct use in the cement industry and other uses are at the demonstration stage. Demonstration of the CCS system is complete, but it is yet to be put into commercial operation because of the higher handling costs than conventional systems. The COM (coal-oil mixture) technology has been put into operation by Tokyo Electric Power Company after overcoming initial slagging problems. Having successfully initiated COM operations, TEPCO is converting its COM facility to CWM operations (TEPCO 1988). Other companies and industry organisations are also conducting research into these technologies. The above technologies are those identified for the first Coal Renaissance in 1990[10]. They are available for use during the 1990s to enable medium and small sized boilers to burn coal directly (NEDO 1988). The technology is also for sale to consumers in other countries and is listed in Pacific Coal Flow Expansion Initiative documents (NEDO and IEE 1987; Parker 1990).

The result of the first Coal Renaissance is forecast to be an increase in energy coal consumption in Japan of 5mtpa or an extra 8% of energy coal demand by the year 2000. This compares with the forecast doubling of 1986 total consumption levels by the electricity industry burning 43mt and other industries consuming 28mt (including the impact of new technology) at the turn of the century (Table 5.7; NEDO 1988).

The optimistic NEDO forecast of coal use by general industry was not repeated in the IEE energy forecast (Japanese Institute of Energy Economics), despite the total energy coal demand in the year 2000 being almost identical: 70mt and 71mt (Fujime 1989) . Instead, coal consumption by the electricity industry was expected to grow more quickly than previously thought because of the increase in electricity demand and the reduction in the planned role of nuclear power stations. By the year 2000, coal consumption for electricity generation was forecast to reach 51mt in the 1989 IEE study rather than the 43mt predicted in the 1988 NEDO study and the 1987 long term outlook for energy supply and demand released by MITI. Conversely, coal consumption by general industry was expected to reach only 19mt rather than the NEDO forecast of 28mt at the end of the century. The difference can be explained by either the general structure of the IEE model failing to incorporate specific changes in future coal technology or a slower introduction of the new technology than that expected by NEDO.

While the extent and speed of the introduction of new technologies may be disputed, many of the new technologies promoted by MITI in the past were adopted with a consequent change in industrial patterns (Johnson 1982). The collaborative link between government and industry in Japan was shown to have an important role in the postwar expansion of the economy. As in other industries, the success of MITI and NEDO policies promoting energy technology is determined by the extent to which they conform to market pressures or enhance Japan's position within the international market (Eads and Yamamura 1987). In addition, recognition of the cost of environmental damage associated with coal combustion, dictates that for coal to be politically acceptable and not threaten environmental security, prices need to incorporate these costs to promote conservation, substitution and technological change (Pearce, Markandya and Barbier 1989). Alternatively, better technology can be legally required as part of government security objectives. Changes in national security objectives are well illustrated by UK government energy policy.

5.6 UK security structures and coal trade

Coal policies in the UK show a clear distinction between domestic security of supply and international economic efficiency objectives. This distinction is illustrated by the differences between the UK participation in coking and steam coal trade. In the coking coal sector, British Steel is the dominant purchaser. The nationalised steel industry was privatised in the mid 1980s and given strict commercial objectives prior to the privatisation. To promote its international competitive position, British Steel was allowed to purchase coal from the lowest cost international sources. The result was that in 1987 they were able to buy much of their coking coal needs from Canadian and Australian sources at only $36pt fob. The USA and Poland are also major suppliers.

In contrast, the steam coal market is dominated by the CEGB where imports are restricted. Steam coal imports doubled from 2.0mt in 1979 to 4.9mt in 1980 so the government responded in February 1981 by restricting the CEGB's import of 3.2mt in 1980-81 to 0.75mt in 1981-82[11]. Even long term contracts held by the CEGB with Australian suppliers were cut sharply (AFR 1981.6.18; IEA 1989b; Turner 1984:1). These restrictions were later relaxed and the CEGB purchased small quantities of coal on the international market. British Coal (previously the National Coal Board) remained the main supplier to the CEGB and only demands beyond the basic British Coal contract (75mtpa in the mid 1980s) could be purchased from international sources.

The British coal industry was the largest in the world in the 19th century, but production and employment both declined steadily after World War I. British energy policy was concerned with protecting the domestic coal industry from cheap foreign oil in the 1950s and 1960s. The oil price rise of 1973 enabled British Coal's Plan for Coal in 1974 and the Department of Energy's Green Paper on Energy Policy in 1978 to focus on how coal could regain lost markets from oil. The security of domestic energy supplies was promoted as a major objective and a 10 billion pound investment programme was undertaken by British Coal (Economist 1989.3.25:16; Manners 1981).

These policies overlooked the underlying problem of British Coal. The cost of production, especially in some coal districts, was high by international standards (MMC 1983). Annual operating deficits were met by the government despite the contract with the CEGB where the agreed price was equal to the average cost of production for a specified tonnage. The CEGB - British Coal contract was revised in 1986 to set coal prices for three tranches, or categories of coal. Most coal (50mt in 1986 declining to 42mt in 1991) was priced according to the average cost of production. The price of imported coal and fuel oil determined the price for the other two tranches (10mtpa and 12mt in 1986 rising to 20mt in 1991, respectively). British Coal thus faced reduced revenue and a need to match international prices for some of its output. High cost mines were closed and average productivity increased by 75% in the late 1980s, but the effective producer support still rose to $2 billion in 1987 (Economist 1989.3.25; IEA 1989b).

The CEGB and British Coal were both to be privatised by the Conservative government. However, the privatisation of the CEGB, planned for 1990, was to include coal contracts to protect British Coal from international competition. To privatise British Coal at a later date (possibly 1993), as proposed by the Energy Secretary in 1988, a secure market for coal is required and the CEGB is by far the dominant consumer. Continued protection from international suppliers is thus expected for a large, but declining proportion of CEGB demand. The three year contract agreed in 1990 reduced British Coal tonnage to 70mtpa and an expected 65mt in 1992-93 (KICT 1990.3.22:11).

However, the desire of a newly privatised electricity supply industry to reduce costs and meet EEC environmental directives to reduce SO_2 emissions creates a strong incentive to rapidly increase imports (of low sulphur coal) and switch to gas as an alternative fuel. As a result, the new generating companies, National Power and Power Gen (created from CEGB), signed contracts for the import of over 6mt of coal in 1990-91[12]. The pressure is on British Coal to meet international coal prices for a larger share of its output.

Despite the large size of the support to British Coal, not all of its operations are uncompetitive. Many pits have production costs of less than $3/GJ and are competitive (Prior and McCloskey 1988; Prior 1989). Indeed, Robinson and Marshall (1981, 1985) called for the early privatisation of the British Coal and its division into many companies to ensure domestic competition in the industry. The competitive position of the industry is enhanced by the fixed investment and location of existing large power stations on inland coalfields. Transport costs thus offer domestic coal a layer of protection from direct competition. Few UK ports are able to handle the large bulk carriers which operate in the international coal trade. These ships must be unloaded in Rotterdam or an equivalent port and the coal transhipped on smaller vessels to the UK. Added transport and handling costs thus provide geographic protection to the coal industry. However, stations with access to larger ports (like the BSC ports), or at sites served by new ports will not preserve such a strong transport cost advantage for British Coal. Imports will increase and pressures for internationally competitive pricing within the British industry will grow.

The result of these changes is a shift in UK coal policies away from the assumed security of domestic supply to greater reliance upon the international supply network. Long term supply contracts for domestic and imported coal are expected to be the preferred security arrangement used by newly privatised electricity generators (FTEE and ICR), although spot purchases are likely to increase to meet marginal demand. A security structure based on the protection of domestic industry is thus being replaced by one of greater reliance upon the international security structure represented by increased trade and the policies of multilateral forums like the IEA and GATT.

5.7 Conclusion

This chapter investigated several elements of the security structure which alter international coal trade from that expected under the least cost model. Government objectives to enhance the security (military, economic and environmental) of their industry and citizens are shown to affect coal trade in several ways.

The newest security issue of the late 1980s and 1990s is environmental security. Global coal combustion of over 3,000mtpa causes many problems. Although the environmental problems created by SO_2, NO_x, particulates and ash can largely be controlled by existing technology, no viable solution exists to stop the large scale emission of CO_2 and this will continue to be an urgent environmental issue facing the coal industry in the future.

Earlier government policies also shaped coal trade. For example, Japanese industrial policy had a direct impact on the import of coking coal. Domestic production was supported initially, but greater emphasis was then placed on selecting international projects to receive assistance and the negotiation of bilateral trade agreements with China and the USSR. This extensive national security structure was then contrasted with the international structure created by the IEA and multilateral trade agreements.

Conflicts emerged between international calls for the removal of trade barriers and national decisions to protect domestic production. Domestic coal industries were supported with policies based on national security objectives. However, the annual cost of supporting the production of high cost coal industries was estimated to be over $10 billion in the late

1980s. The IEA, with its mandate to improve energy security through international structures, promoted expanded international trade and the removal of domestic barriers to trade like the identified subsidies for domestic coal.

Japan and the UK chose to reduce their old national security structure of domestic coal industry protection. Both countries placed greater importance on international trade and multilateral structures like the IEA and GATT. However, Japan also extended its national structures to include international coal projects. Government policies can thus extend the security structure to influence decisions regarding investment in coal production facilities and the finance of selected projects (see chapters 6 and 7 for details).

Endnotes:

1. At the end of world war II, Chinese and Korean miners were repatriated and the Japanese coal industry collapsed (production fell from over 4.0 mt per month in 1944 to 0.55 mt in November 1945). The disrepair of mines, cessation of imports, purge of entrepreneurs, shortage of food, spiralling inflation and a radical labour movement all created problems for the industry (D'Cruz 1979:89). To address the problems of this essential industry, the government reformed its bureaucracy to facilitate the implementation of coal policies. The Ministry for Commerce and Industry (MCI, later to become MITI) transformed its old Fuel Bureau into the new Coal Agency. The Agency took action by arranging for miners to be transferred from metal mines to coal mines in return for larger food rations. Japan's first postwar industrial policy was thus called 'food for coal' (Johnson 1982:179-80).

2. In 1946 the Prime Minister formed a personal brains trust known as the Coal Committee to advise him on how to avoid the expected economic crisis caused in large part by an acute shortage of coal (Johnson 1982,182). The Coal Committee recommended that a system of 'priority production' be introduced. The coal industry was given first priority to receive reconstruction loans and finance. This concentration of scarce economic resources was justified on the basis that 'a twofold increase in coal production leads to a fourfold increase in general manufacturing' (Economic White Paper 1947 cited in Johnson 1982:185). The outcome of this concentrated effort was a 1947 production level of 29.3 mt or 97.7% of the targeted 30mt (Johnson 1982:183). Coal was not the only priority industry. The steel industry was selected as the second priority industry, in part, because it was important as both a supplier to the coal industry and as a consumer of coal.

3. JSM consumption of domestic coking coal fell from 9mt in JFY74 to 3mt in JFY84 and 1mt in JFY87 (JISF 1988:17; Coal Manual 1988). The government and industry supported domestic production by many measures including compulsory purchases by the JSM and a separate pricing system to insulate domestic producers from international prices. The largest domestic coking coal producers in the 1980s were Mitsui Mining, Mitsubishi Mining and Cement, Hokkaido Collieries & Steamship and Matsushima (2.1mt, 1.4mt, 0.5mt, 0.5mt respectively in JFY83). Despite producing coal for over a century, the high cost of these industries and their financial subsidies was well recognised (IEA 1988b). The Eighth Coal Policy (1987-91) proposed the slow wind down these coal mines.

4. In 1965 MITI recommended a 10% reduction in steel production to prevent a collapse in steel prices. All six of the major steelmills cut their production for the second quarter of JFY65. When MITI recommended a continuation of this cut in the third quarter of JFY65, Sumitomo refused. Sumitomo argued that it was the only company to have met its MITI-assigned export quota for the first half of the year and should not cut production. The Vice-Minister of MITI responded

that if Sumitomo did not comply, then 'he would use the Import Control Ordinance to restrict imports of coking coal for the company to precisely the amount necessary to produce its authorised quota and not a shovelful more' (Johnson 1982:270). Sumitomo complied, but later received an increase in its export quota so that both sides could claim victory.

5. A further $1 billion was for oil exploration projects.

6. The quality of the Kusnetsky coal was considered slightly below that of the standard Australian hard coal, Coal Cliff (Coal Manual 1985:362).

7. The 21 members of the IEA are: Australia, Austria, Belgium, Canada, Denmark, Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States of America. Finland, France and Iceland are the OECD members who decided not to join.

8. Only special government items for assisting the coal industry are included. General measures which assist the coal and other industries like accelerated depreciation or taxation allowances are not included.

9. NEDO initiatives included many types of energy projects, but these were coordinated under two major umbrella projects. The 'Sunshine' project was to obtain technological solutions to problems in new energy use (coal, solar, geothermal, hydrogen, ocean thermal and wind). The 'Moonshine' project promoted the development of energy conservation technology.

10. The second Coal Renaissance involves the introduction of new technologies for coal gasification combined-cycle power generation, coal liquefaction and coal gasification. Research and development work is underway, but the processes are not expected to be in commercial operation before the year 2000.

11. Imports by British Steel were also restricted from 2.6 mt in 1980-81 to 2.5 mt in 1981-82 (AFR 1981.6.18).

12. These 1990-91 contracts include:

purchaser	tonnage (000t)	producer	trader
CEGB	360-400	Coal and Allied	Shell
	360-400	CNCIEC (China)	SSM
National Power	1000	Carbocol	
	300	Westmoreland	
	300	Shell (Marrow Bone)	
	300	Peabody	
	300	BP	
	300	Ashland	
Power Gen	1000	Carbocol	
	240	Massey	
	700	BP	
	500	Drummond	
	360	another US supplier	

source: ICR 235:1

Chapter 6
The production structure: Investment and integration

6.1 Introduction

> 'There have been two very profound changes in the production structure in the last two centuries.... The first change was the change to a capitalist, market-oriented mode of production in the states of North-Western Europe... The second change has been the gradual, uneven but apparently inexorable supplanting of a production structure geared primarily to serve national markets to one geared primarliy to serve a world market.' (Strange 1988:62)

Changes in the production structure alter the power of states to implement the security objectives of the last chapter. The global dominance of the capitalist mode of production is not questioned. However, the relative importance of national and international elements within the production structure is central to this chapter. Structural power was argued to be the ability to create the structures which control trade. Changes in the production structure, like the investment in new mines, thus demonstrate the exercise of this power.

A contrast is made between two types of changes associated with two different models of global coal trade. The increased size of trade and number of active parties implies a greater use of the market and price stimuli as advocated by multilateral forums. The expected outcome is greater price uniformity and security through reliance upon a large and diverse production structure based on efficient, profit-maximising mines. These changes support the competitive market model presented and refuted in chapter 3.

An alternative type of change is the extension of national production structures to include international units within the national structures. The result is greater power for the investing country. Changes of this type were promoted by the Japanese policies identified in chapter 5 and stand in contrast to those promoted by the IEA and European countries.

Many studies have been made of the production structure. In some, structural and market power is associated with the number of firms active in the trade and emphasis is placed on measures of industry concentration and the associated behaviour (McCalla 1981). In the coal industry, the debate over an optimal structure for the industry has arisen repeatedly as proponents of integration and nationalisation compete with proponents of privatisation and decentralisation (Gordon 1987; Robinson and Marshal 1985).

Units of production (mines) may be numerous and independent or integrated into a few large private or public enterprises. Horizontal integration is examined as a measure of market concentration and relative bargaining power. An important distinction is made between concentration at the national and international levels. The answer to questions of market power and concentration is argued to depend on the level of analysis and the segment of the trade being studied.

In other studies, structural power and international investment are argued to produce uneven development through the systematic extraction of profit (Gilpin 1975, Hyman 1972, Vernon 1966). Attention is directed to vertical integration in the coal production, trade and consumption industries. Structures can be based on either the production or consumption side of the market and convey an element of control or power over trade. Forward linkages from mine to consumer are rare. Far more evidence is found of backward integration from consumer to the mine.

The Japanese production structure receives particular attention because of its extensive international linkages. These investments are viewed as extensions of the domestic production structure based on affiliated corporate groups (keiretsu) and the general trading houses (sogo shosha). To explain this pattern the conventional American model of foreign direct investment (FDI) based on profit is contrasted with the Japanese model of investment to increase both economic efficiency and supply security throughout the system.

6.2 Two models of foreign direct investment

Foreign direct investment (FDI) extends production structures across international borders. This investment practice is very common in the global coal industry and two models are examined to determine which better explains the observed patterns. The conventional model of foreign direct investment is based on profit, assumes economic efficiency and explains the experience of most American transnational corporations (Anderson 1983). This model is contrasted with the Japanese model of foreign direct investment which is based on combined security and system efficiency objectives (Vernon 1983; Edgington 1987).

6.2.1 The conventional profit based model of FDI

The conventional model of foreign direct investment explains how investment benefits both host and home (investor) countries because the host country suffers from a scarcity of capital relative to the potentially profitable investment opportunities (Folie 1982). This explanation for FDI is derived from the Heckscher-Ohlin theory of trade based upon specialisation in abundant factors. The mutual benefits of FDI are demonstrated by the Schmitz-Helmberger (1970) presentation of the complementary relationship between factor endowments in two countries. One country is assumed to have a large demand for a resource and is also a capital-surplus country. The other country has a more favourable resource endowment but limited capital and technology. FDI (the transfer of capital) thus creates a new trade in the extracted resource.

This complementary relationship fits the American model of FDI where a transnational corporation invests in low cost resource projects to sell its production on the global market. FDI is undertaken because it is profitable and the global production structure is extended. Corporate or strategic concerns about backward and forward linkages or supply security are not required to explain FDI under this model.

6.2.2 The Japanese security based model of FDI

> 'Japan's primary goal in making overseas extractive investments is to stabilize her supplies of resources. Profitability of a specific extractive investment is rather a secondary consideration.' Ozawa 1979:185.

The second model of FDI is based on the Japanese emphasis on structural linkages among units of production (Ozawa 1979). FDI thus creates an element of control over the supply system. The lower priority given to project profitability was shown by an Export Import Bank of Japan survey of 485 overseas joint ventures in the early 1970s. Two-thirds of the firms had not paid any dividends to their investors and less than half showed any cumulative profits (Heller and Heller 1974 cited in Edgington 1988). Given this low level of profitability, other explanations need to be found to explain Japanese FDI.

Scarcity of domestic resources may generate fears among consumers of vulnerability to foreign supply disruptions. In this case the lack of domestic resources is reinforced by lack of control over foreign supplies and results in dependence upon foreign resources and foreign supply structures. Ozawa summarises this as the dominant Japanese view of investment in resource projects.

> 'The Japanese economy is engaged in a desperate search for a stable supply of overseas resources, having been trapped in an abnormal pattern of heavy resource consumption.' Ozawa 1979:230

> 'The Ad Hoc Committee on Australia-Japan Relations expressed a concern, sometimes reflected in Japanese comments, that Japan would be dependent upon resources, including coal, produced in mines controlled by her global, particularly United States and European, competitors.' Harris 1982:350

The structural interpretation of Japanese FDI has been promoted by Ozawa as an extension of the organisational explanation of FDI articulated by Galbraith (1967). In his review of FDI theories and how they relate to Japanese investment practice, Ozawa (1979:48) concluded that:

> 'The much publicized concept of "Japan Inc." itself reflects the existence of a macroeconomic technostructure in the Japanese economy. The Galbraith organisational theory of technostructures has interesting implications for the analysis of Japan's multinationalism not only as a theory of the organisation of modern corporations but also as a theory of the structure of the economy. The sudden emergence of Japan's multinationalism is not so much a result of the development of technostructures in her individual corporations as a product of her entire economy, which strives to adapt itself to rapidly changing world economic environments, a dynamic adaptive process planned and implemented through close collaboration between industry and government.'

Ozawa (1979:75) identified three major components of the Japanese 'macro-technostructure': the collective economic power of Japan's industrial groups or keiretsu; the global information networks of the sogo shosha; and the guidance and support which the Japanese government provides to industry. These three components are easily transformed into the four primary structures under investigation in this study. Government support and policy are regarded as part of the security structure and the sogo shosha form the basis of the information structure with their specialisation in trade information. Keiretsu are divided into banking and industrial components to form the financial and production structures.

The structural view of FDI has other implications. Even if a company does not profit from a given venture directly, it may profit indirectly through its transformation of the resource in manufacturing (in the case of a steel mill), or through the sale of related products (in the case of a sogo shosha), or through its equity holdings in other affiliated companies (in the same keiretsu) which benefit from the project. These affiliated companies may capitalise on profitable opportunities to supply equipment, machinery, plant, technical, financial or marketing assistance to the mine.

In general, the two models of FDI outlined above (profitable project and secure/integrated production system), are argued to represent the practice of American and Japanese firms, respectively (Edgington 1988). American firms typically invest overseas to supply the international coal market as part of the global production structure. In contrast, Japanese firms invest primarily as minority partners to increase the security of resource supplies for Japanese industry and improve their coordination of the supply system (Ozawa 1979, Vernon 1983). The extension of the global production structure is a secondary objective after national needs are met.

6.2.3 American and Japanese FDI compared directly

The contrast in FDI objectives is well illustrated by the export coal industry in which both Japanese and American companies invested in the 1960s. Japanese demand for coking coal was growing rapidly in the 1960s and the coal resources of Queensland were identified as a good potential source of supply. American and Japanese companies both responded to the opportunity and created the two largest Queensland coal export companies, CQCA and TPM. In the first case, Utah International (USA) joined Mitsubishi Corporation (Japan) in the Central Queensland Coal Associates (CQCA) joint venture on an 85:15 basis. In the second case, Thiess Holdings (Aus), Peabody Coal (USA) and Mitsui & Co (Japan) formed the Thiess Peabody Mitsui (TPM) joint venture on a 22:58:20 basis (Figures 6.1 and 6.2; Appendix C). These investments in the mid 1960s created an annual export capacity to supply Japan with over 10mt of high quality coking coal.

However, by the mid 1970s the Japanese steel mills had ceased to expand exponentially and their demand for raw materials became a stable rather than a growing market. In 1976 Peabody sold its 58% share of TPM to BHP and CQCA changed its ownership structure to increase Australian ownership to 20 per cent[1]. By the early 1980s the price of coal was falling from the high levels of 1980-82. Constrained Japanese demand combined with new international supply capacity to indicate that prices would remain depressed throughout the decade ahead. General Electric, the American owner of Utah International, decided to sell its majority interest in CQCA.

Figure 6.1: American ownership of selected mines

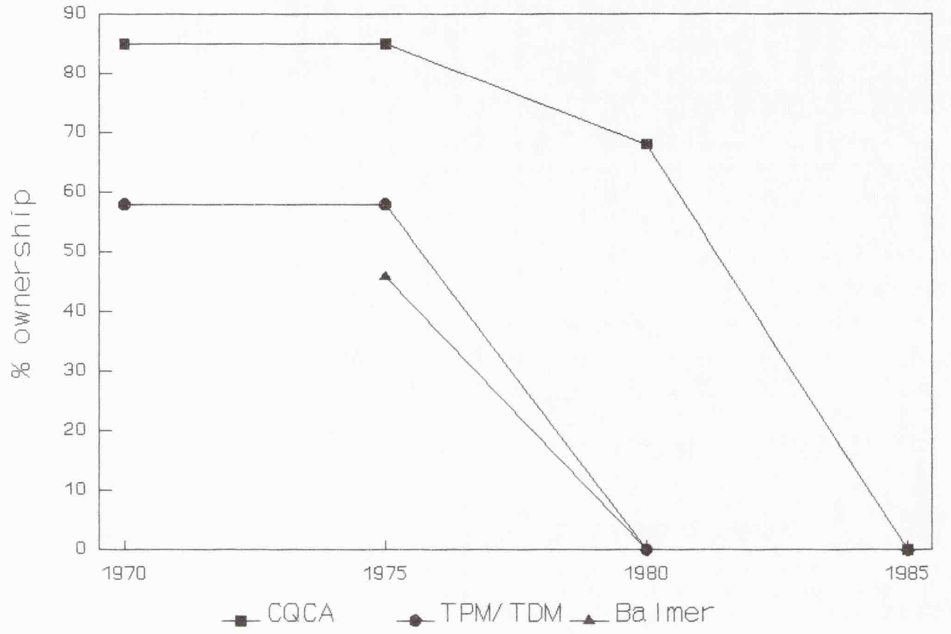
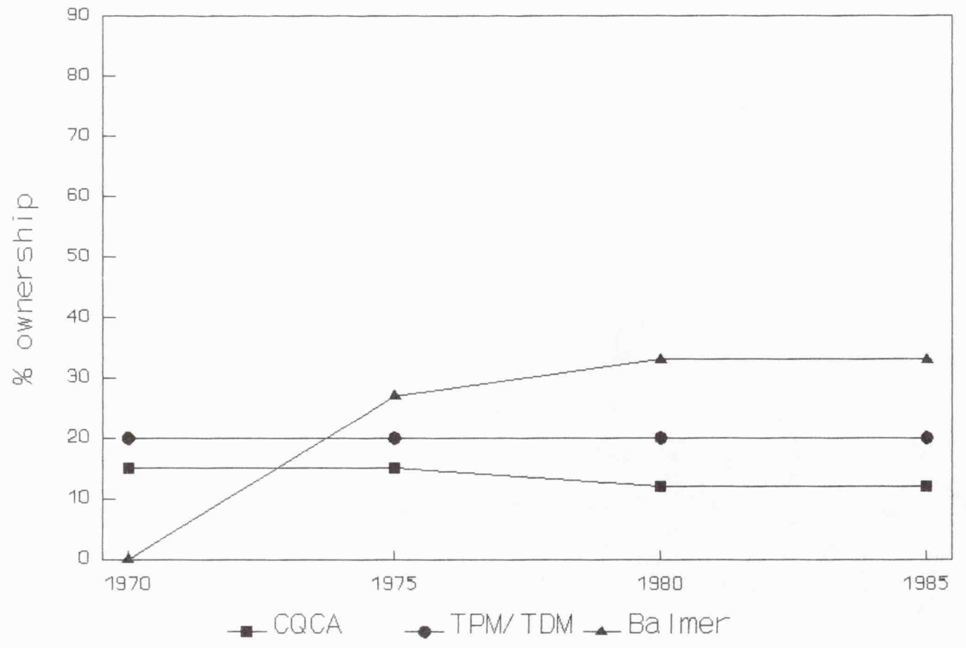


Figure 6.2: Japanese ownership of selected mines



A similar pattern occurred in Canada where the largest export mine, Balmer, was established by Kaiser Resources, a subsidiary of Kaiser Steel (USA). Exports began in 1970, but by 1973 the mine was in financial difficulty and Japanese partners joined the project. The pattern of shared American and Japanese investment in an export coal project reached the same conclusion as in the Australian cases. In 1980 Canadian interests bought the American shares in the project.

The result was that by the mid 1980s, major export coal projects in Australia and Canada had seen the departure of their initial American partners while the Japanese partners retained their minority equity position (Figures 6.1 and 6.2). The contrast between short term profit and long term security motives for buying and selling shares in export coal mines is well illustrated. American and Japanese investors faced the same investment and selling opportunities, but behaved differently. The American investors sold all of their shares while the Japanese companies retained their direct interest.

6.2.4 Japanese minority investment

In addition to the long term and stable nature of Japanese investment in coal projects, this investment is marked by an absence of wholly or majority owned projects. One explanation for this is that during the rapid growth period of the 1950s and 1960s, Japan did not have surplus capital and foreign investment was under strict control until 1971. Only limited forms of investment like joint ventures could be considered. However, limited investment may also restrict control over projects if ownership is the only structure of importance.

Limited FDI can also be an enforced condition if local rules restrict FDI. For example, Australia and Canada applied FDI restrictions to new coal mines in the 1970s and 1980s (Anderson 1983). Both countries aimed to have 50% domestic ownership, but Australia was considered more successful in achieving this objective. The sale of American interests in Australian and Canadian coal mines is only a partial reflection of this policy. The Japanese interests could also have been sold to reduce foreign ownership. Instead the two groups of investors behaved differently under identical conditions.

One advantage of direct investment is that the investor usually receives a position on the management board with the resulting full and prompt access to information (Anderson 1987:52; Smith 1982). However, this benefit may be overstated in the coal trade case. The sogo shosha acquire extensive information on projects for assessment by the JSM, regardless of whether or not they have equity interests in the projects. In addition to the information benefit of FDI, the consumer may be able to influence managerial decisions to improve the producer-consumer relationship. This could result in lower transaction and coordination costs and thus lower input costs to the consumer (Williamson 1975).

6.2.5 FDI and integration

The examples of FDI studied above need to be set within the broader questions of the type of structure governing the international coal industry. Independent units can be integrated into larger structures in various ways. Horizontal integration occurs where multiple units of production in a single industry are owned by a single entity. The marketshare of these entities is increased through horizontal integration and economies of scale may be gained. The level of this type of concentration is generally measured by the proportion of production by the largest four, eight or ten firms. This analysis can be undertaken at either the national or international level.

Another type of integration is vertical integration where units of production and consumption are integrated within a single entity. When a producing company acquires interests in a company which consumes its product, this is termed forward integration. When the consuming company acquires interests in the producing company, the process is called backward integration. Once again, this process occurs at the national and international level. A specialised case of vertical integration is found in Japan where the keiretsu are comprised of many companies in many industries. Product and service transfers are common within the group and major companies have significant interlocking shareholdings. The resulting corporate network will be studied, but first the general pattern of horizontal and vertical integration in the coal industry is investigated.

6.3 Horizontal integration

6.3.1 Horizontal integration in the coal industry

The optimal production structure for the coal industry has been the subject of industry, union and government debate for centuries (Gordon 1987). Existing structures are considered to give one group an advantage over others and opponents lobby for change. Proposals for changes to industry structure range from private mergers, cartels or monopolies and public monopolies on one hand, to privatisation, deregulation and removal of public barriers to entry on the other. Not only have views on the desired structure of the industry varied, but analysts of the actual structure of the industry have reached conflicting conclusions (Abbey and Kolstad 1983; NEDO 1989; Solomon and Pyrdol 1986; Soyster, Gordon, Enscore and We 1985).

The private operation of many mines raised questions about industry structure, competition and the need for horizontal integration back in the 1700s (ILO 1938). The UK industry was argued to have too many mine operators to operate efficiently, invest in new capital equipment and undertake research and development tasks. These issues were still being debated in the 1980s. In the late 18th century, Newcastle coal producers called for protection from the competition of mines at Sunderland by having the government introduce a selective coal tax. The operators subsequently formed a 'combination' or cartel to control output and regulate prices. This was known as the 'Limitation of the Vend' from 1771 to 1844 (ILO 1938:1). A similar pattern emerged in Germany when the 'price wars' of 1873-1893 were resolved by the formation of the Rheinish-Westphalian Coal Syndicate. Given these precedents, the nationalisation or amalgamation of coal industries in several European countries, following World War II was not an unusual response to a politically important industry undergoing change.

Horizontal integration has thus been a question of recurrent interest to coal industry analysts (Gordon 1987). The horizontal 'disintegration' of the industry or the division of existing large producers into smaller units is also an important issue. It has been argued in the British context that the industry has too few mine owners to ensure adequate competition and provide the lowest cost supply of coal or its products to the public (Robinson 1987, 1989).

Private corporations can initiate mergers and take-overs to increase the size of their operations and gain the economies of scale and benefits of centralisation in management, negotiation and specialised services. Examples include the BHP takeover of Peabody's TPM interest in 1976 and Utah Development in 1984; the partial CRA/Howard Smith (part owner of RW Miller) take over of Coal & Allied in 1977-78 and the complete Coal and Allied takeover of RW Miller in 1989; and the many acquisitions by oil companies (Appendix C). The resulting concentration of national and international coal industries has been partially described by several analysts (Abbey and Kolstad 1983; Banks 1985; Gordon 1987; James 1984; Parker 1986).

6.3.2 Horizontal concentration of national export industries

The assertion in chapter 1 that the international coal industry has a diverse and competitive supply is investigated further. The 200 companies actively supplying coal to the international market in the mid-1980s are not all independent.

The links among firms are examined to determine the aggregate size of the largest groups. The importance of horizontal integration is evaluated at the national and then the international level.

In South Africa the industry is dominated by the six large mining companies and finance houses (Anglo American, General Mining, Rand Mines, Johannesburg Consolidated, Lonhro SA and Gold Fields of SA). In 1978 Anglo American and General Mining controlled 67% of the total South African production (James 1984:169). Production for export was more diversified, but the six large mining houses all belong to the Transvaal Coal Owners Association (TCOA) which assigns production quotas and markets to each member. Together these companies produced over 90% of South African coal in 1980 and received two thirds of the export allocations for the mid 1980s (Table 6.1). The remaining major exporters were three oil companies: Shell, BP and Total (Abbey and Kolstad 1983; James 1984).

Table 6.1: South African export allocations, 1987

Company	exports (mt)
TCOA	10.0
Anglo American Coal	7.3
General Mining Union	6.0
BP Coal SA	5.5
Shell SA	5.5
Rand Mines	3.9
Total Exploration SA	2.5
Kangra Coal	1.7
Zululand Anthracite	1.5
Kangra Group	0.9
Duiker Exploration	0.6
Anglovaal	0.5
Rand London	0.4
D & H Coal	0.3
Sevmin Coal	0.3
Tseletis Mining	0.3
Bordex Nominees	0.2
Concor Construction	0.2

source: Coal Manual 1985:386

The American coal industry is much larger both in terms of the size of production and the number of companies producing and exporting coal. For example, 140 companies reported coal exports in 1986 (KICT 1987). Despite the large number of small companies mining and exporting coal, the concentration of the industry has grown. The largest 50 coal mining groups accounted for 76% of total production in 1987, an increase of 10% from the share of the 50 largest groups in 1977 and 1967 (65% and 66%, respectively) (Keystone News 1988.6.27).

The contrast between the large scale of the domestic producers and the smaller operating scale of exporters is demonstrated in Table 6.2. The largest coal producers had most of their output consumed in domestic power stations. The largest exporters were often specialists in coking coal. Only one company, Consolidation Coal, appeared on both the list of top ten producers and top ten exporters. Exports accounted for only 10% of the firm's output. In other cases exports usually accounted for 20-50% of production[2]. The development of dedicated export mines was far less common than in countries where the domestic coal market was smaller.

Table 6.2: Largest USA coal producers and exporters

Rank	Producer	86	87	Exporter	85	86
		(mt)			(mt)	
1	Peabody Group	60	71	Pittston Coal	7.1	6.0
2	Consol Coal	37	47	Consol Coal	4.5	4.0
3	AMAX Group	31	33	Island Creek	3.6	4.2
4	Texas Utilities	27	25	Jim Walters	3.4	3.1
5	Exxon Coal	22	24	US Steel	3.1	2.4
6	NERIC	21	22	Drummond	3.0	2.3
7	ARCO Coal	22	20	Massey, AT	2.8	2.4
8	Elk River	18	19	Ruhrkohle	1.7	1.4
9	North American	22	19	Thyssen Carb	1.6	1.2
10	Western Energy	15	17	Westmoreland	1.6	2.3
11	Arch Mineral	12	17			
12	Island Creek	15	17			
13	Massey, AT	21	16			
14	Shell Mining	8	14			

source: KICT 1987 584:2; Keystone News Bull 1988 6(6):14

The Australian coal industry is a larger exporter than the American industry, but it has some of the ownership characteristics of the South African industry. The largest coal exporter is the integrated steel company, BHP Ltd. BHP combined its own mines (Gregory, Saxonvale, Macquarie, etc) with those of CQCA and TDM to export over 20mtpa in the late 1980s. It is the largest exporter in the international industry and accounts for one third of all Australian exports. Sales are arranged by the subsidiary BHP-Utah.

In contrast to the predominantly hard coking coal sales of BHP, the second largest Australian exporter, Coal and Allied, sells only steam and soft coking coal. The heavy metal mining companies MIM and CRA are also major coal exporters and have mines which supply coking coal (Newlands and KCC) and steam coal (Collinsville and Blair Athol). The oil companies, especially Shell and BP, entered the Australian industry in the 1970s and by the 1980s were among the top exporters.

The ownership structure prevailing among these companies can typically be divided between old mines which were often wholly owned and new mines established in the 1970s and 1980s when several companies combined to form joint ventures. Typically a national mining company, an international mining or oil company, a financial institution and an international trading house were combined in each joint venture (Parker 1986). The result was that by the 1980s the most active companies shared interests in many projects. CSR illustrated this process when it diversified into coal production in the 1970s. It acquired interests in several mining companies (Theiss 100%; Lemmington 100%; Drayton 44%) and was identified by Banks (1985) as a company with market distorting potential. By 1988 the company had sold its major coal assets to BHP, Exxon and Shell and effectively withdrew from the industry.

The formation of joint ventures creates a separate management unit for each mine and often a separate marketing branch or company. The result is the appearance of a more diverse export structure. Given the prevalence of many joint ventures in the Australian industry two views on the production structure can be taken. In the first case each joint venture is viewed as an independent entity. The overall pattern is one of 20 companies exporting over 1.5mtpa and another dozen smaller exporters. Alternatively, the joint ventures can be viewed as part of the company which holds the largest proportion of shares. In this case, larger units are identified on the basis of corporate integration through investment in joint ventures. The 20 largest exporters are thus reduced in number to 13. The integrated companies have larger marketshares, and competition in the industry is considered reduced.

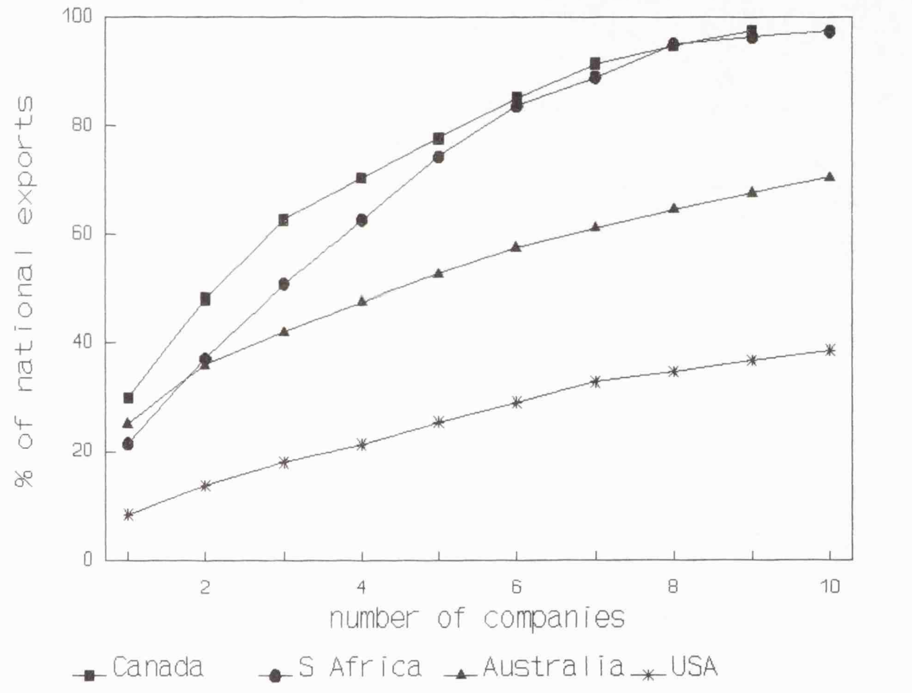
The changing structure of the Australian export industry is well illustrated by the restructuring of 1988-89 as prices revived from their low levels of 1986-87. BHP's increased ownership of TDM and CAID's purchase of RW Miller extended the position of the two largest firms. However, these changes reinforced previous corporate linkages. More dramatic changes in ownership arose when Elders Resources bought a series of Hunter Valley mines from Peko Wallsend and BHP (Saxonvale open cut and Macquarie collieries which included West Wallsend acquired from CAID in 1988). In addition, Elders Resources bid to gain control of Coalex in 1989. The result of these acquisitions is the formation of a new exporter equal in size to CAID and ranked second or third largest in Australia (Appendix C).

The Canadian export coal industry shares several features with the Australian and South African industries. It is dominated by a few major mining and oil companies. Westar is the largest exporter, followed by Quintette and Fording Coal. Each of these operations is export oriented. Gregg River is an export joint venture operated by Manalta who also operate several mines for power utilities in Alberta and Saskatchewan. Luscar also owns or operates mines for domestic power stations as well as operating the Cardinal River joint venture. The oil companies acquired interests in many exploration properties, while Line Creek owned by Shell Canada Resources, Bryon Creek owned by Esso Resources Canada and Obed Marsh owned by Union Oil are the major operating projects.

The overall pattern of concentration among the coal export industries of Australia, United States, South Africa and Canada are compared in the mid 1980s (Figure 6.3; Table 6.3).

The level of concentration is lowest in the USA where many companies export coal as well as supply domestic markets. Australia has the next largest number of exporters, but the industry has a clear group of leaders with BHP dominating coking coal exports and CAID and Elders leading the thermal and soft coking coal sector. The four largest export groups account for over 60% of exports. Even if the groups are divided into individual companies, the largest four account for 49% of exports. The level of concentration is even higher in Canada and South Africa.

Figure 6.3: Concentration of national coal exports



In each of the above countries, no single company monopolised the national coal industry, although BHP and Westar play major roles in their respective countries. The cartel formed in South Africa, however, was considered to have effective control of that industry through its export allocations.

Government structures are also important and the Polish case of a single authority, Weglokoks, controlling exports gives it the ability to act to maximise its benefits from proximity to the European market. Soviet and Chinese authorities had similar power, although several companies sold Chinese coal in the late 1980s. The government of Australia also has power to control exports, but this power was not being exercised beyond a review role in the late 1980s. Colombia also emerged as a major exporter in the late 1980s with Carbocol (government) and Intercor (Exxon) each selling one half of the coal from the El Cerrejon mine (Kline 1987).

The importance of these large national companies is diluted in the international coal market. High national levels of concentration are dramatically reduced because of international competition. Given the diverse production structure identified above, Abbey and Kolstad (1983) concluded that international steam coal suppliers were not capable of forming a cartel[3]. The result is a reinforcement of the earlier conclusion that the supply side of global coal trade is diverse in structure. Even assuming that companies with investment linkages are effectively integrated into single national units, the conclusion holds.

Table 6.3: Export concentration among national and global coal export industries, 1985-86

	% of exports from groups of largest companies		
	top 4	top 8	top 10
Australia			
individual companies	48	65	71
integrated companies	60	82	87
United States	21	35	39
South Africa	63	95	97
Canada	70	95	99
global			
individual companies	21	34	39
integrated companies	30	44	49

source: Appendix C

6.3.3 FDI and horizontal integration

The diverse appearance of the international coal exporters needs to be further evaluated by recognizing the role of FDI in creating horizontal integration across national boundaries. Despite the large scale of global production structures and implied reduction in national and corporate power, transnational corporations can grow, through FDI, to a position where they influence trade directly. In addition to the previously discussed Balmer, CQCA and TMP cases, other early examples of American investment in the coal export sector of other countries include, Ludwig's 1962 investment in the Clutha mines of NSW and Consolidation Coal's 50% interest in Cardinal River. Alsarco also held indirect Australian interests through its dominant share of MIM. These investments enabled American firms to diversify away from existing US mines into new overseas projects with lower production costs (McKern 1976:69). In this way, the companies could participate in the growth of international trade independent from their national base. The global production structure is thus extended on the basis of efficiency and profit.

Australian mining companies with UK parent companies (CRA, or Conzinc Riotinto of Australia, and Consolidated Gold Fields of Australia), also diversified their Australian mining interests by investing in coking coal mines (KCC and Bellambi) in the 1960s. In the 1970s they invested in steam coal projects (Blair Athol and the Glendell proposal, respectively). The motivation for these investments was to profit by diversifying corporate experience gained in ore mining into the coal industry (McKern 1976:69).

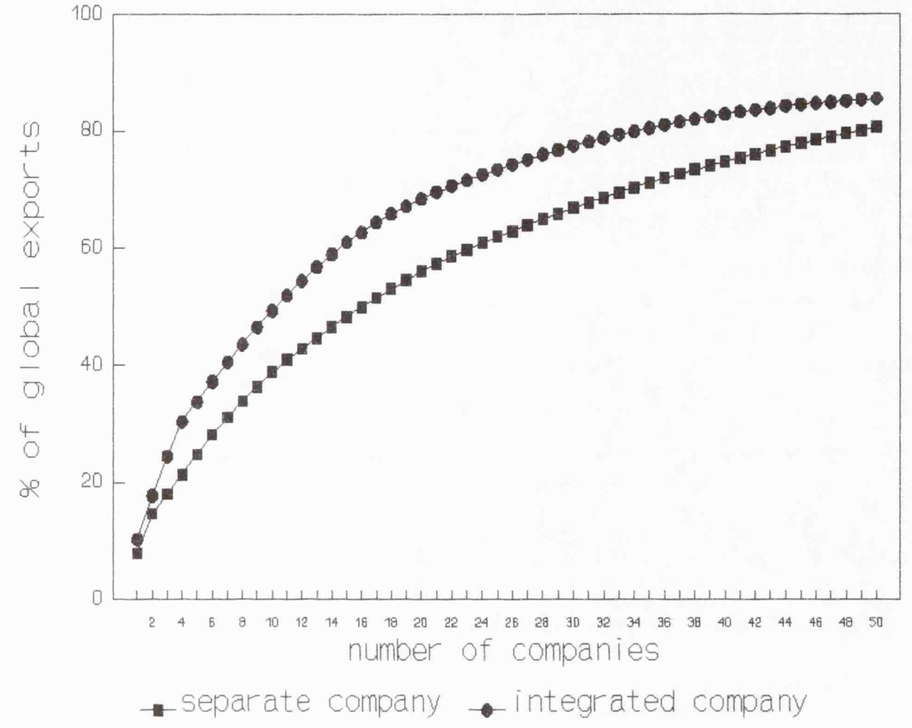
After Australian mining companies grew in size they reversed the direction of FDI by also investing in coal projects in other countries. The BHP partial acquisition of Utah interests in Australia was complemented with its 100% ownership of Utah International Mines in the USA[4]. In South East Asia, BHP and CRA each invested in new coal projects in Indonesia. Finally, MIM holds a nominal interest in Teck Corp, operator of the

Bullmoose mine in Canada. The reverse capital flow occurred when Brascan (Canada) invested in Austen and Butta (25% share). Gencor of South Africa followed the Canadian example of investing in Australian coal companies (20% of Oakbridge), but both Brascan and Gencor later sold their interests. The overall pattern is one of diverse FDI with capital exporting countries like the USA and UK being joined by Australian, Canadian and South African mining companies as sources of investment.

The international investments of large mining companies have resulted in much less concentration in the global coal industry than in several other mineral sectors. The diverse international distribution of the coal endowment and its extraction with readily available technology may account for this. A more systematic investment in the international coal supply system awaited the arrival of the oil companies in the 1970s. Following the rise of energy prices in the early 1970s, Shell and BP lead the wave of oil company investment in coal properties. Both companies acquired extensive portfolios of mines and leases in USA, Australia, Canada, South Africa and elsewhere (Appendix C; Parker 1986). Total, Arco, Caltex and Exxon also invested in coal projects. After deferring coal investments in the 1970s, Exxon moved decisively into the industry in the 1980s. Its huge investment ($3 billion) in El Cerrejon, Colombia (Kline 1987), its 1987 ranking as the fifth largest producer in the USA, a growing collection of Australian projects and Byron Creek in Canada ensured Exxon a prominent position in the coal industry. In the late 1980s Japanese oil companies (Nippon Oil and Idemitsu) also began to invest in overseas coal mines as part of their energy supply system (Idemitsu 1988, Appendix C).

Despite the magnitude of the coal projects acquired by oil companies, the integration of an elaborate international supply network can also be disbanded. The 1989 decision of BP to sell most of its international coal projects reinforced its earlier sales of Clutha mines in Australia and its interest in the Ermelo mine in South Africa (ICR: various issues).

Figure 6.4: Concentration of global coal exports



The impact of oil companies on the international coal supply industry was illustrated by the rapid growth of Shell and BP to enter the list of top ten global exporters in the early 1980s. The BP decision to leave the industry coincides with the arrival of Exxon as a major exporter. The oil companies achieved horizontal integration by linking mines from many parts of the world within a single corporate structure. However, even when the individual units are combined into integrated wholes, the global coal industry remains one with low marketshares. Competition is expected among the many companies and countries active in the global coal production structure (Figure 6.4).

6.3.4 Horizontal integration by Japanese and European coal companies

A special case of horizontal integration that extends national production structures is the investment by Japanese and European coal companies in new overseas projects. These investments can be considered as a clear example of horizontal integration where a firm establishes new mines to offset its declining domestic operation. Expertise gained in the domestic industry is applied to earn profits from international ventures. Alternatively, overseas investments by old coal companies may be part of their selling role to gain access to lower cost coal for established customers. The international investment pattern is reviewed to determine whether the production or selling explanation is stronger.

The traditional Japanese mining companies (Mitsui Mining Co., Mitsubishi Mining & Cement Co., and Sumitomo Coal) are taking action to sustain their corporate life by diversifying into mining consultancy, coal trading and even joint venture partnership in overseas mines. Each of these areas of activity is considered complementary to their established business of mining coal in Japan. Investing in overseas mines enables Japanese management techniques and technology to be implemented in mines where it might not otherwise be available. Mitsui Mining, for example, acquired an interest in the Quintette lease in 1976 and in the final allocation of equity interests in 1983 owned 12.5% of the mine (larger than the 10% interest of all JSM members together).

In several cases, the Japanese mining companies have invested in projects where their affiliated sogo shosha (from the same keiretsu) also invested. For example, Mitsubishi Mining & Cement acquired a 6% interest in the Warkworth joint venture where Mitsubishi Corp had a 19% interest. Mitsui Mining took a 3% share of the Drayton mine where Mitsui & Co owned 2% of the equity. Sumitomo Coal bought a 5% share in the Hermitage mine where Sumitomo Corp was investing in 1978. (Sumitomo Coal later sold its interest in the Hermitage mine and bought a 50% interest in the Wambo mine in the Hunter Valley.) The investment by these mining companies is small, but it provides an interesting parallel to sogo shosha investment and might grow as the companies attempt to extend their corporate position[5].

Some European coal companies made the same investment decision. British Coal and Charbonnages de France (CdF) extended their coal supply system overseas in the late 1970s when they invested in the German Creek (Capricorn Coal Management) and Wambo mines, respectively (Table 6.4). In addition to these Australian projects, Charbonnages also invested in the Quintette mine in Canada. The Dutch chemical firm DSM responded to the closure of its Dutch mines by forming a joint venture, Holland Carbon Fuels, to invest in American coal mines. German companies like Rheinbraun, Saarbergerwerke and Ruhrkohle also invested in coal mines in the USA (Appendix C).

Table 6.4: European energy company participation in coal mines

	year of investment	% equity
British Coal		
Capricorn Coal Mgmt	77	11
Charbonnages de France		
Quintette	81	12
Wambo Mining	77-88	25-17
DSM,Dutch chemicals		
Holland Carbon Fuels		
Scotts Branch mine	82	59
ENI		
Agip Carbonne	8?	100
Enoxy	81	50
Boggabri	87	25
Collinsville	89	25
Ensham	8?	25
Gollin Wallsend	82-84	49-0
Newlands	89	25
United Collieries	81-88	25-30
International Coal	81	100
Carbozulia		
Hamburgicshe Elektricitatswerke		
Veba International	81	50
Rheinbraun		
Ensham	8?	5
Manor, Nineveh coalfield	81	24
Saarbergerwerke WG		
Ashland Coal	81	25
SEP, Dutch electricity cooperative		
Holland Carbon Fuels		
Scotts Branch mine	82	59

source: Appendix C

The striking feature of these Japanese and European investments is their small nature. Shareholdings were generally in the order of 10-25%. This implies that management and control remained with the other partners. Rather than integrating these mines as new components controlled by the home headquarters, the investments were small. Where larger equity positions were taken in USA mines, the mines selected were generally small. The intent of this investment does not appear to be one of integrating large horizontal production structures, as in the case of oil company investments. Instead, small investments are made to gain access to lower cost coal and provide the company with viable coal sources to supply established customers.

6.4 Vertical integration in the coal industry

If horizontal integration in the global coal industry conforms to that of a competitive global production structure, the expected result is a loss of national power. However, vertical integration challenges this conclusion by demonstrating the extension of national production structures to include significant sections of the global coal industry.

6.4.1 Vertical integration attitudes

Vertical integration is common in the coal industry at the national level. Significant sections of domestic coal industries are controlled by integrated public or private structures (Gordon 1987; Nancke 1972). Electric utilities and steel mills frequently own their own mines and sometimes the transport facilities to transfer the coal from mine to mill. This pattern is a specific example of two plants with transaction specific investments (Joskow 1985, 1987, 1988a). The mine or power plant share locational advantages from their proximity, low transport costs, routine coordination and often refined or specially tuned technology. Integration captures these benefits within a single enterprise.

The model of vertical integration within countries is extended to the North American continental market where Canadian consumers invested in American coal companies and then imported coal from the associated mines under long term contracts. Examples of this pattern include the Ontario Hydro 50% ownership of Cumberland mine, the Stelco holding in Mathies Coal and the Algoma ownership of Cannelton Industries (Appendix C).

In the international industry, coals are more frequently interchanged in standard boilers and the fuel-specific advantages of integration are reduced. Nonetheless, vertical integration does exist in the international coal trade and an assessment of its extent and the effect on the production structure is required in order to measure its importance.

The survey of major coal consumers and traders offers an indication of the existing and expected future prevalence of investment to achieve vertical integration between the coal producing and coal consuming industries. Japanese consumers are considered first (Table 6.5).

Table 6.5: Japanese attitudes toward investment in overseas coal mines

Japanese group	St Mill	Oth	Elec Co.	Min Co.	Oil Co.	Sogo Shosha
% respondents who invested in coal mines	100	0	100	100	100	100
% equity holding	2-10	0	3-7	3-25	20-45	5-49
% expecting to invest in coal mines by 1995	50	50	0	100	100	100
% 1995 equity holding	10-20	10-20	0	10-20	10-75	10-40
Importance of forming joint ventures to establish new mines						
1980	1.5	3.5	3	2.5	3	3
1987	3.5	3.5	4	3.5	2.5	4
1995	3.5	3.5	3.5	4	2.5	3

1=very important 2=above average importance
3=average importance 4=below average importance
5=not important
source: survey and interviews, Appendix D

Japanese steel mills, electric power utilities, mining companies, oil companies and soga shosha have already invested in overseas coal mines. Most of these investments are small, but oil companies and soga shosa have taken equity positions of up to 49% in the project. Each of these groups of investors will be considered later in this chapter. First it should be noted that further investments are expected by the oil, mining and trading companies. Even some of the steel mills and general industry consumers believed that their companies would invest in overseas mines by 1995.

The correlation between attitiudes of respondents and actual investment is explored. In 1980 the steel mills thought that participation in a joint venture was very important to establish a new coal mine. (Their decisions to implement this view will be examined shortly.) Mining companies also considered the formation of joint ventures as being of above average importance in 1980. These views changed by 1987 when oil companies were the only group of Japanese companies to consider joint ventures of above average importance. This attitude explains oil company plans to invest in coal mines and correlates with the expected high level of equity participation by oil companies. In contrast, the coal consuming companies considered joint ventures to be of below average importance in 1987 and 1995.

The attitudes and practices of European consumers provide a striking contrast to their Japanese counterparts (Tables 6.5 and 6.6). Carboex was one of the few traders to invest in overseas coal mines on behalf of its parent utility companies in the 1980s. The extensive Japanese intention to invest in mines was replaced by the European consumers' preference to not invest in backward integration. Instead oil (ENI, Total, Shell & BP) or coal mining companies (CdF & BC) invested in mines as part of their horizontal energy portfolio.

Table 6.6: European attitudes toward investment in overseas coal mines

European group	Electric utilities			Traders
	South Europe	North Europe	Cement ind	
% of respondents who have invested in coal mines	0	0	0	20
% equity holding	0	0	0	10
% expecting to invest in coal mines by 1995	0	0	0	0
% equity holding expected	0	0	0	0
Importance of forming joint ventures to establish new mines				
1980	-	5	5	5
1987	-	5	5	5
1995	-	5	5	3

1=very important 2=above average importance
3=average importance 4=below average importance
5=not important
source: survey and interviews, Appendix D

Despite the limited interest among most European consumers to invest in overseas coal mines in the 1980s, several cases of integration remain from earlier investment decisions. Two southern European steel mills (Ensidesa and Italsider) decided to invest in the Oaky Creek mine in the 1970s. Similarly, Anker, Hooghovens, Ruhrkohle, Saarbergerwerke, VEBA and Thyssen from nortern Europe had invested in American or Australian coal projects. The small size of these investments and the small share of trade affected demonstrates the European preference for a competitive global production structure as indicated in the policy statements of chapter 5. A striking contrast is found with the dominant domestic production structure in Japan. The Japanese network of companies integrated within keiretsu and coordinated by sogo shosha extends internationally to include part of the coal industry.

6.4.2 Keiretsu

Keiretsu are Japanese groups of affiliated companies and represent a special case of flexible vertical integration. If keiretsu are considered as single entities, they are the largest corporate entities in the world. Even when considered as many discrete units, the individual companies are among the world's largest (Tables 6.7 and 6.8)[6].

Table 6.7: Selected members of the three largest keiretsu

sector	Mitsubishi	Mitsui	Sumitomo
financial	Mitsubishi Bank	Mitsui Bank	Sumitomo Bank
trading	Mitsubishi Corp	Mitsui & Co	Sumitomo Shoji
steel	Mitsubishi	Nippon Seiko	Sumitomo Metal
mining/cement	Mitsubishi Mining & Cem Asahi Glass	Mitsui Mining Hokkaido C&S Onoda Cement	Sumitomo Coal Sumitomo Cem
chemicals	Mitsubishi Chemical Ind	Mitsui Toatsu Chemicals	Sumitomo Chemical
shipbuilding	Mitsubishi Heavy Ind	Mitsui Shipbuilding & Engineering	Sumitomo Shipbuilding & Machinery
shipping	NYK	Mitsui OSK	
insurance	Tokyo Marine & Fire Ins	Taisho Marine & Fire Ins	Sumitomo Marine & Fire

source: Young 1979:39-41; various companies, annual reports

Keiretsu groupings are distinct from the pre-war corporate structures called zaibatsu. The zaibatsu were dissolved by occupational forces after the war and the keiretsu formed to take their place. Enterprises affiliated with the old zaibatsu began to re-organise their business groups after Japan regained its independence in 1952 and MITI provided financial incentives for the regrouping (Johnson 1982:205). Financial ties between industrial companies and affiliated financial institutions played the key integrating role that direct ownership ties created in the zaibatsu. Mutual stockholdings grew, but not to the dominant prewar levels[7].

Table 6.8: Selected members of three new keiretsu

group category	Fuyo	Daiichi Kangyo Bank	Sanwa Bank
financial	Fuji Bank	Daiichi Kangyo	Sanwa Bank
trading	Marubeni Corp	C. Itoh & Co Kanematsu Gosho	Nissho-Iwai Nichimen
steel	Nippon Kokan	Kawasaki Steel	Kobe Steel Nakayama Steel
mining/cement	Nippon Cement	Furukawa Mining	Osaka Cem
chemicals	Showa Denko	Asahi Denka	Ube Ind Tokuyama Soda Hitachi Chem
shipbuilding		Kawasaki Heavy Industries	Hitachi Shipbdg & Engineering
shipping	Showa Line	Nippon Express Kawasaki Kisen	Nippon Exp Shimo Shin Nippon Shpg
insurance	Yasuda Fire & Marine Ins	Taisei Fire & Marine Ins	

source: Young 1979, 39-41; various companies, annual reports

The role of finance is critical for group expansion and the banks and trading companies occupy a central position in the keiretsu (Edgington 1988; Young 1979). The six largest Japanese city banks (Mitsui, Mitsubishi, Sumitomo, Fuyo, Daiichi-Kangyo and Sanwa) are thus identified as the centre of the six most important keiretsu. Three of the groups are based on the old Mitsui, Mitsubishi and Sumitomo zaibatsu and the other three groups are based on the Fuyo, Daiichi-Kangyo and Sanwa banks. Selected members of these keiretsu are shown in Tables 6.7 and 6.8. Each of these keiretsu can combine the industrial specialisations of member companies to provide a comprehensive support system for any desired trade. For example, arranging the finance, shipping and insurance of coking coal imports to the steel mill which provides steel to the automobile manufacturer or shipyard for production and subsequent product export. Keiretsu thus represent an all-encompassing system of vertical integration where many industries are represented within a single group of companies.

The extensive keiretsu network of affiliated companies is a dominant feature of the Japanese production structure. However, the network also extends to investments in other countries.

> 'Although the keiretsu groups are known for their fierce competition with each other at home, their interests often converge in overseas investments, especially in large scale extractive investments.' (Ozawa 1979:187).

The investment strategy of the six largest steel mills will be investigated in the next section to determine its distinctive features. Do the firms act independently as competitors seeking exclusive access to the best mine or do they invest as a group? Are coal mines integrated into a particular keiretsu like many new Japanese joint ventures or are they examples of the cooperative extension of the Japanese production structure through international investment by all members of the industry? If the latter option is true, then Japan increases its structural power by the extension of its national production structure to include elements of the global structure.

6.4.3 JSM joint ventures

The Japanese steel mills (JSM) are the largest importers of coking coal in the world and together account for 30-50% of the global trade. Their need for raw materials is large and persistent, thereby creating an opportunity to invest in mines and integrate suppliers into their corporate structure. However, the JSM generally decided not to invest in coal projects. The most frequent explanation for the Japanese steel mills not following the 'captive mine' example of their USA and European counterparts is the limited capital available during the postwar reconstruction and rapid industrialisation period. A better explanation may be that they were satisfied with the sogo shosha control over raw material supplies (section 6.4.4; chapter 8), did not consider further action necessary, and concentrated on improving their steel production process.

An important exception to the JSM practice of not investing in coal mines is found in Canada. The first Canadian example of JSM direct investment, resulted not from an initial decision to take equity participation in a new mine, but from a decision to support a recently developed mine. When Kaiser Resources, the forerunner of Westar Mining, encountered financial difficulty at its Balmer mine in the early 1970s, the project was saved by Japanese consumers converting C$10 million loans into equity and providing C$ 17.5 million additional capital in 1973 (Coal Manual 76:188). Mitsubishi and the Japanese consumers thus acquired a 27% interest in their first Canadian coal mine (Table 6.9).

The reason for this unusual injection of capital from the JSM was indicated by the prominent Japanese coal journal, the Coal Manual:

> 'The future of this mine (Balmer) is very promising and there are various plans to develop the huge volume of coal reserves of this mine amounting to 13 billion tons... Thus the significance of this mine will become more and more important to the Japanese steel mills.' (Coal Manual 1976:208)

Given the Japanese desire to diversify their sources of coking coal away from USA and Australian supplies (Sakamoto 1982:359), a small injection of capital enabled them to keep a large current and future supplier of coal operating in a new coal region (south-east British Columbia)[8].

The restrictions on JSM direct investment were eased in the 1970s as the shortage of Japanese investment capital was overcome by substantial annual trade surpluses and the need to invest in domestic steel production slowed because demand ceased its exponential growth path and became static. The steel mills thus found themselves in a position where they could afford to invest in 'develop and import' projects as described in chapter 5.

Gregg River was proclaimed the first 'overseas coal development project' with direct JSM participation (Coal Manual 1985:337). (The earlier Westar investment was for an operating mine.) In 1981 the JSM finalised a 15 year coal contract in return for their direct participation in the new coal mine. The project was to sell 100% of the output (2mtpa) to the JSM at prices 'based on Gregg River Coal's cost of capital, mining, coal transportation, coal storage at port and ship loading, with appropriate adjustments for inflation using agreed indices' (Dalby 1987:935). The price was to be reviewed three times during the 15 year contract and the JSM thus did not need to fear excessive profits being taken by foreign or hostile owners. Indeed, the JSM argue that they did not guarantee Gregg River Coal a profit at all, although this was the clear expectation of their partner, Manalta (Dalby 1987:931).

> 'Their (investment) decision was prompted as this coal project had such advantage over others, as the rail, port and other infrastructural facilities are readily available, the stripping ratio is relatively low, a fairly precise mining condition can be pictured thanks to the Luscar coal operations being carried out in its neighbourhood region, and the coal production proportionate to the 40 percent equity interest can be imported at cost.'(Coal Manual 1985:337)

Later in 1981 another coal investment decision was made by the JSM. Esso Resources decided to pull out of the Quintette project in north east British Columbia where Mitsui Mining and Tokyo Boeki had each invested (21% each) in the initial project development. The JSM 'decided to make their capital participation in this project in a bid to help it tackle the threat of becoming unable to raise its development funds.' (Coal Manual 1985:338)[9].

Quintette is argued to illustrate the importance of direct investment to facilitate project financing in the 1980s. Whereas long term contracts were considered sufficient proof of financial viability for many projects started in the 1970s (chapter 7), by the 1980s long term contracts were shown to be much less secure than previously thought. Prices and volumes were altered in accordance with prevailing market conditions. If a project was to ensure its future cash flow, the participation of consumers may be desired from the start

(Vernon in Anderson 1987). The value banks place on consumer participation has even been taken further and suggested as the banks means to have the maximum degree possible of moral persuasion over the steel mills (Gibb 1984). According to this view, participation by the JSM was necessary to ensure the mine's future cashflow.

Quintette thus became the largest case of JSM direct investment in an overseas coal mine. The project involved more than just the financing of a mine. Unlike Gregg River where other mines and infrastructure existed nearly, Quintette involved the opening of a new coal region in north east BC with investment by the Canadian and BC governments in new port, rail, town and associated facilities estimated to cost C$ 1700 million. In total, the project cost an estimated C$ 3000 million. This investment was extremely large in comparison to that required for a new mine of similar size in Australia. However, the JSM decision to invest in Canada rather than Australia reflects their determination to achieve diversity of supply objectives (Sakamoto 1982:359).

The above examples show the Japanese consumers investing as a group with their participation set at a size comparable to their coal imports. In each case Nippon Steel was the largest JSM investor (Table 6.9). The result of these many small investments is that coal projects accounted for over half of the Japanese investment projects in Canada in 1982-84 (Blain & Narcliffe 1988:148; Wright 1984; Appendix C). This pattern demonstrates the conformity of JSM investment decisions and the collective behaviour to enter projects as a single group[10]. Conformity was achieved even when individual members disagreed with the investment decision, as in the Quintette case where Kawasaki opposed the group decision. The result is the extension of the Japanese production structure to include Canadian coal mines on an integrated industry-wide basis. (Representation on the board of directors or at meetings is generally through a nominated official from one of the two largest companies, Nippon Steel or NKK.)

Table 6.9: Japanese steel mill participation in coal mines

joint venture	Westar (formerly Kaiser Coal)		Gregg River	Quintette Coal		Wallerawang & Baal Bone (Lithgow)
	equity		equity	equity		equity
date	1973	1980	1981	1981	1984	1979
steel company	%	%	%	%	%	%
Nippon St	6.6	6.4	14.0		3.8	
NKK	4.0	6.0	5.9		1.6	
Kawasaki St	2.2	1.6	5.4		1.5	
Sumitomo Metal	2.6	3.9	5.4		1.5	15.0
Kobe St	1.2	0.9	3.2		0.9	
Nisshin St	0.7	0.7	1.1		0.3	
Nakayama St					0.2	
Godo St	0.1	0.1			0.1	
JSM sub-total	17.4	19.5	35.0	0.0	9.9	15.0
Mitsubishi Chem	0.5	0.8			0.1	
Toho Gas	0.1	0.1				
Consumer sub-t	18.0	20.3	35.0	0.0	10.0	15.0
Mitsubishi Corp	9.0	13.1				
Mitsui & Co			5.0			
Sumitomo Corp					5.0	5.0
Tokyo Boeki				21.0	10.5	
Sogo shosha tot	9.0	13.1	5.0	21.0	15.5	5.0
Mitsui Mining				21.0	12.5	
Japanese total	27.0	33.4	40.0	42.0	38.0	20.0
Japanese investment million	C$ 27.5		C$ 74		C$ 134	A$ 7.5
exports to Japan						
JFY75		4.7	0.0		0.0	0.2
JFY80		4.3	0.0		0.0	0.3
JFY85	*	2.9	1.9		4.9	0.1

note: * combines Balmer and Greenhills coal
source: Coal Manual 1976:1988, 1985:319-338

In contrast to this uniform JSM investment pattern, Sumitomo Metal has a reputation for being more independent. Sumitomo reinforced this image in 1979 when they acquired a 15% interest in the Wallerawang mine and its extension, Baal Bone, near Lithgow, Australia. The cost of the investment was only A$5.6 million and gave the firm a long term supply of soft coking coal for use in its production of formed coke (Coal Manual 1985). This illustration of independent action follows the American competitive pattern of direct investment for profitable integration of supply and consumption firms.

Although the Wallerawang example illustrates the model of FDI based on economic efficiency and increased profit motives by a single firm, it remains an anomaly in JSM practice. Another example of independent investment in coal mines occurred indirectly when NKK acquired 50% of National Steel in the USA and thus gained an interest in the associated coal mines. However, this investment was based on steel industry objectives and the associated mines concentrate on the domestic rather than international coal market.

In summary, JSM coal investment has been predominantly in joint ventures in Canada where all JSM members take a share corresponding to their import needs[11]. The relative importance of this backward integration into the coal industry is shown by measuring the proportion of imports from these mines. The Westar investment gave the JSM an interest in the mine supplying over 40% of Canadian coking coal to Japan in the late 1970s. By 1985 the investment in Gregg River and Quintette raised the share of the Canadian exports to the JSM from mines with their investment to 62% of the total. This apparent exception to the JSM practice of not investing in mines became the standard for the Canada-Japan coking coal trade.

The lack of JSM investment in other regions does not imply a lack of Japanese interest in other supply countries. Sogo shosha also invested in overseas coal mines.

6.4.4 Sogo shosha investments in coal mines

> '(R)esource development projects require the extensive organizational skills that a general trading company can provide. ... Mitsubishi Corporation has participated in many successful projects, but the one I remember most clearly is a coal development project in Queensland, Australia. We first started by laying railroads through the

desert. Next, we built roads and then a harbor to ship coal from. New towns were built for the people working in the mines. Today, 10 million tons of high-grade coking coal from these mines are transported to Japan every year and are a valuable energy source. This project is a prime example of our efforts to work together with people throughout the world, and I am extremely proud of our accomplishments in this area.' (Vice President Sonoda in Mitsubishi Corporation 1986:8)

Sogo shosha invest in coal mines to fulfil multiple objectives. They may seek to increase their supply position for Japanese markets, to diversify their supply sources, to enhance their position in related product markets, to increase revenue, to gain profits, and/or to sell the resource in third markets. Each of these objectives is considered as the investment pattern of sogo shosha is revealed.

Sogo shosha are the most important Japanese sources of direct investment in overseas coal projects (Sakurai 1983). Indeed, the sogo shosha are the most important source of all direct foreign investment from Japan. The top five Japanese overseas investors were all trading companies (Mitsui, Mitsubishi, Marubeni, C.Itoh, and Sumitomo) in the 1970s. They accounted for 43% of the value of overseas investments by the top 50 Japanese companies (which included the other major trading houses) (Ozawa 1979:31)[12]. Sogo shosha investment in coal projects strengthens the company's trading role by integrating backwards to have long term supplies for their sales to Japanese and other customers.

The Mitsubishi example quoted above refers to the Central Queensland Coal Associates (CQCA) unincorporated joint venture where Utah Development (85%) and Mitsubishi Corporation (15%) agreed in 1968 to develop the Goonyella and Peak Downs mines in the Bowen Basin of central Queensland. This joint venture was formed following the successful Utah development of the Blackwater mine and the 1965 signing of a 2.2mtpa contract for Japanese consumers represented by Mitsubishi (McKern 1976:217). Subsequent long term contracts were signed to enable CQCA to develop the Goonyella (1969), Peak Downs (1969) and Saraji (1972) mines. The 15 year contracts associated with each of these mines provided for the supply of 13mtpa from the four mines to Japan. This group of mines thus supplied 21% of JSM coal requirements in 1976 (Coal Manual 1976:161). Despite Japanese concerns that such a large proportion of coking coal coming from a single source might cause the JSM to 'lose its independence and flexibility on the purchase of raw materials as well as its demand and supply position of raw material' (Coal Manual 1976:161), a further CQCA mine (Norwich Park) was added in 1980.

The incentive for these investments in mines is only partially explained by the sogo shosha's subsequent certainty of being the trader representing the project in Japan. The commissions paid on coal imports are small (100 yen per ton prior to 1977 and 120 yen per tonne afterward (D'Cruz 1979)). The dividends paid on the equity are small given their small shareholdings. Sogo shosha also benefit from selling equipment and engineering supplies to the mine from other members of the associated keiretsu (Edgington 1988). A stronger incentive for widespread sogo shosha participation is the informal arrangement reported between the JSM and sogo shosha. Under this arrangement the trading houses receive a share of the steel sales and export business in rough proportion to their share of raw material inputs (essentially iron ore and coking coal). Not only are commissions larger on the higher valued steel products, but the sogo shosha perform a wider range of marketing tasks for which they are paid. Coal is thus an integral part of a trading company's position in steel industry marketing (Anderson 1987:53; D'Cruz 1979:152).

To ensure their position as a major seller of steel products, sogo shosha generally want to procure a large supply of coal for the JSM. In many cases, the sogo shosha simply performed their trading role (discussed further in chapter 8) arranging the negotiation of contracts and shipping/customs requirements. However, this role was increasingly reinforced by direct investment in coal projects. The investment was often undertaken prior to project development with the sogo shosha taking an interest in exploration projects. Given the exploration results, the trading house could promote the project with the JSM to gain the long term contract to enable the mine to be developed. The partnership in the joint venture was then finalised, the finance arranged and the mine developed. Sogo shosha thus play a central role in creating the production structure which supplies the Japanese and global coal trade.

Foreign investment by a trading house is the preferred form of FDI in some countries. Given that sogo shosha specialise in global marketing and trade, the host country perceives their investment as providing the project with access to both the Japanese market and that of third countries. In this way, the extensive sogo shosha intelligence network is regarded as an asset to the project. In contrast, FDI by end users, like JSM investment in coking coal mines, involves a conflict of interest in which the mine owners would benefit from high prices and cashflow, while the investor/consumer benefits from low prices[13]. However, the distinction between the role of end users and that of traders when making foreign investments is blurred when the traders act on behalf of consumers (Reich and Mankin 1986).

The Mitsubishi/CQCA example illustrates the early participation of the sogo shosha in project development. The second largest sogo shosha, Mitsui & Co., was not to be left out of this process and in 1965 it joined with Australian and American interests to form the Thiess Peabody Mitsui (later to become Thiess Dampier Mitsui, TDM) joint venture to develop the Moura mine in central Queensland (McKern 1976:218). Mitsui & Co.'s initial 20% interest in TDM was later divided between a direct equity interest (13.3%) and an indirect interest (6.7%) held by its Australian subsidiary, Mitsui Australia. TDM later developed the Riverside mine to increase its export capacity in the 1980s. Mitsui also joined other Queensland joint venture partners to develop the Curragh mine. This time the Mitsui & Co. interest (10%) was held through the subsidiary, Mitsui Coal Development Australia. The equity interests and level of exports to Japan are presented for each of these mines in Table 6.10.

Table 6.10: Sogo shosha investment in Australian coal mines

Sogo shosha coal company/mine	investment year	%	Japanese imports JFY75	JFY80	JFY85
AUSTRALIA			million tonnes		
Mitsubishi Corporation			10.7	11.1	7.2
CQCA (Central Qld Coal)	68	12-15	10.7	11.1	7.0
Blackwater			2.7	2.1	1.1
Goonyella			3.6	3.3	2.2
Peak Downs			2.6	2.5	1.6
Saraji			1.9	2.3	1.4
Norwich Park				1.0	0.7
Warkworth	76	19			0.2
Ulan	76-88	9-49			0.2
Howick	89	40			
Mitsui & Co			2.0	1.8	5.3
TDM	6?	20	2.0	1.8	4.0
Moura			2.0	1.8	1.1
Riverside					2.9
Curragh	82	10			1.3
Drayton	78	2			na
Sumitomo Corp					
Hermitage & Fernbrk	78	6	0.2 pjp	0.3	0.2
Wallerawang & Baalbn	79	5			
Marubeni Corp					
Austen & Butta	71	2.6	0.3	0.2	1.6
Dombarton			0.2	0.1	0.1
Gross Valley			0.1	0.1	0.0
German Creek					1.0
South Bulli			0.6 pjp	0.9 pjp	0.5
Muswellbrook	80	15		na	na
Nisho Iwai					
Howard Smith	79	2	1.4 pjp	1.1	1.1
Liddell			0.6 pjp	0.6	0.2
Hunter Valley				0.2	0.2
West Wallsend			0.1 pjp	0.3	0.3
Big Ben			0.7 pjp	0.8 pjp	0.4
Toyo Menka					
Glennies Creek	89	25			
sub-total			13.0	14.5	15.3
Australian exports to Japan			21.3	24.5	26.9
% from sogo shosha joint ventures			61	59	57

note: some equity is held via subsidiaries; na=not available; pjp=pre-Japanese purchase
source: BIE 1984; Coal Manual 1976, 1988.

In addition to investment in Queensland mines, the sogo shosha also turned to the older mining area of New South Wales. Mitsubishi joined other partners in the Warkworth, Ulan and Howick mines. Sumitomo Corporation invested in the expansion of the Lithgow mines, Hermitage/Fernbrook and Wallerawang/Baal Bone and Toyo Menka joined the Glennies Creek project.

Marubeni Corp. preceded these investments by acquiring a 4.6% interest in the established mining company Austen & Butta when the Japanese foreign investment restrictions were first eased in 1971. In addition to its NSW holdings, Austen & Butta participated in the German Creek development in Queensland during the 1980s. In 1985 Austen & Butta acquired Bellambi as part of the rationalisation of Shell coal interests in New South Wales. (Shell was the largest shareholder in Austen & Butta, Bellambi and German Creek.)

Nissho Iwai created a similar corporate family when it acquired 2 million Howard Smith shares in 1979. Howard Smith and Coal & Allied Industries (CAID) had interlocking shareholdings and in the 1980s Howard Smith increased its 33% of RW Miller to 67% and then 100% (DMR 1986; DME 1989). The 1985 acquisition of all remaining shares in RW Miller was part of the restructuring of these Hunter Valley companies to reduce costs in the face of lower coal prices. CAID and Howard Smith sell most of their coal as steam coal, but the JSM also buy soft coking coal blended from the same mines.

The overall pattern is one of extensive sogo shosha participation in the new mines of Queensland and New South Wales coupled with small equity interests acquired in a few of the old New South Wales coal producers. The result was that approximately 60% of the Australian coking coal exports to Japan were from mines with sogo shosha direct investment. The decline in this share to 57% in 1985 results in part from the decline in Japanese imports of CQCA coal (following the 1984 BHP acquisition of control over CQCA) and the increase in soft coking coal imports from older New South Wales producers.

The pattern of sogo shosha individually investing in coal projects throughout the Australian coalfields is repeated in Canada (Table 6.11). In each of the mines where the Japanese steel mills invested in Canada (Table 6.9), a trading house invested as well. Sogo shosha equity interests were typically 5-10%, but in the case of Quintette, the holdings of Tokyo Boeki and Sumitomo Corp. (15.5%) exceeded those of the JSM (10%). Projects without JSM participation, like Bullmoose, sometimes included sogo shosha investment. Other projects, like Line Creek, negotiated for the direct participation of a trading house (Mitsui in this case), but the arrangement was not finalised. One of the factors limiting direct investment by sogo shosha was the Canadian government objective of having 50% Canadian ownership. Given the large role played by foreign companies in the Canadian coal industry, the allocation of shares to Japanese interests could require the reduction in shareholdings by other foreign companies[14]. The overall pattern is one of extensive sogo shosha participation involving the mines which provided 73% of Canadian coking coal exports to Japan in 1985.

Table 6.11: Sogo shosha investment in Canadian coal mines

Sogo shosha	investment		Japanese imports		
coal company/mine	year	%	JFY75	JFY80	JFY85
CANADA			million tonnes		
Mitsubishi Corporation					
Westar	73	13.1	4.7	4.3	2.9
Mitsui & Co					
Gregg River	81	5			1.9
Nisho Iwai					
Bullmoose	81	10			1.9
Sumitomo Corp					
Quintette	81	5			4.9
Tokyo Boeki					
Quintette	81	10.5			4.9
sub-total			4.7	4.3	11.6
Canadian exports to Japan			11.0	10.4	15.9
% from sogo shosha joint ventures			43	41	73

note: some equity is held via subsidiaries
source: BIE 1984; Coal Manual 1976, 1988

A dominant feature of sogo shosha investment in joint ventures is geographic diversity (Hanink 1987). Rather than have some trading houses specialise in Australian or Canadian projects, most sogo shosha invest in both countries. This enables them to contribute directly to the diversity of supply objectives held by many of their clients. The sogo shosha also take equity interests in coal projects in other countries. For example, Nissho Iwai has a 40% interest in the steam coal project, PT Belau Coal in Indonesia. The result is an extensive network of sogo shosha minority investment in international coal projects and the expansion of the Japanese production structure.

6.4.5 Other cases of vertical integration

The JSM and sogo shosha are not the only cases of consumers and traders integrating backwards by investing in coal mines. Japanese steam coal consumers invested in several mines in the 1980s, following the 1979 lead of the Ube Industries investment in Howard Smith (Table 6.12). The Japanese electricity companies followed two investment patterns. EPDC made direct investments in overseas coal projects, while the nine private electricity companies formed the Japan Coal Development Corporation to invest in overseas projects and import coal on their collective behalf. In this way, the electricity industry followed the collective investment pattern pursued by the steel mills.

Consumers and traders from South Korea also invested in a few mines in Australia, Canada and USA (Table 6.12). Even the pattern of investment by European traders and steel mills in the 1980s, tended to fit the Japanese tradition of minority investments rather than the old model of complete ownership (Table 6.13). In a few cases the Europeans acquired a majority interest, but this was only in small American mines. The extent of South Korean and European investment is much smaller than the Japanese investments and accounts for less than 25% of their imports. The extension of South Korean and European national production structures into the global coal trade and their associated structural power is thus much weaker than that of Japan. Instead, they rely on a global production structure owned by other actors and regulated by the international market.

Table 6.12: Investments by other consumers and traders

	Year of investment	% equity
Japanese steam coal consumers		
Ube Industries		
Howard Smith/CAID	79	2-5
Queensland Allied Ind	88	5
Joban Kosan		
Howard Smith/CAID	86	
EPDC		
Blair Athol	8?	7
Beluga	8?	
MacLeod River	81	15
Japan Coal Development		
Blair Athol	8?	3
Idemitsu		
Boggabri	87	25
Ebenezer	88	49
Ensham	8?	25
Shaunessy,Can	81	20
Wishbone,USA	87	50
Toyota Tsusho		
Camberwell	89	40
South Korean investors		
Daesung		
Drayton	7?	2.5
Lucky Goldstar		
Ensham	8?	5
Hyundai		
Drayton	7?	2.5
Pohang Iron & Steel		
Greenhills	7?	20
Mt Thorley	7?	20
Tanoma	85-88	100-0

source: Appendix C

The prevailing pattern of vertical integration in the coal trade is one of partial integration by minority investment rather than complete control as in some other resource industries. Many mines are integrated into the supply network of particular consumers by minority investments, but few mines are majority owned by consumers. The result is the extension of national, especially Japanese, production structures within a diverse global coal production structure.

Table 6.13: Investments by European consumers and traders

	Year of investment	% equity
European traders		
Anker		
VEBA International	81	50
Anker Energy		
Bronco Mining	8?	100
Carboex		
Ashland Coal	82	10
Ruhrkohle		
Capricorn Coal Mgmt	77-8?	17-11
Thyssen Carbometal		
Thyssen Mining		
Betty B Coal		
VEBA		
Westmoreland Resources	82-87	15-25
European steel mills		
Ensidesa, Sp		
Oaky Creek	7?	5
Hooghovens		
Oaky Creek	7?	8.5
Holland Carbon Fuels		
Scotts Branch mine	82	59
Italsider		
Oaky Creek	7?-89	7.5-0
Romania		
Pocohontas No. 6	85	33

source: Appendix C

6.5 Conclusion

The production structure of hundreds of mines supplying the global coal trade has been shown to include several types of horizontal and vertical integration. Many of the 200 companies exporting coal have links with other companies, but the high degree of concentration found in some domestic industries is absent at the international level. Even the extensive holdings of BHP and the major oil companies are not considered a threat to a competitive global production structure.

Alternative models of FDI based on economic profit or supply security were presented and compared to the investment pattern in the international coal industry. In most cases, the Japanese investment in coal projects was small and the potential to earn profits was therefore restricted. If the JSM investment in Canadian mines was made simply to gain profits, it seems surprising that they waited until two of the projects were in financial difficulty before investing. Alternatively, the security of supply model of FDI and the associated structural IPE model of trade are supported by the diverse pattern of investment. The mines with JSM investment supplied over 40% of Canadian exports to Japan in the late 1970s and 60% of Canadian exports to the JSM in the mid 1980s.

The structural model was further supported by the extensive practice of small shareholdings in numerous joint ventures. The result of diverse investment by trading houses was that 60% of the Japanese coking coal imports from Australia and 70% of those from Canada came from mines with sogo shosha equity shares. A diverse network of mines and trading houses to supply Japanese consumers was created through the extension of the Japanese production structure.

Other consumers and traders in South Korea and Europe also invested in overseas mines. While these investments are important in terms of linking particular mines into the import network of particular consumers, the expansion of their national production structures was much smaller than in the case of Japan. Rather than extend national production structures, they chose to rely on the global production structure with its assumed competitive configuration.

The contrast between the Japanese expansion of its production structure through minority investment and the limited investment patterns of other major consumers raises important questions about the global coal trade. In isolation, these minority investments may have limited importance. However, if quasi-integration in the production structure is reinforced by the extension of other structures then national Japanese structures may include large segments of the global structures. The financial structure is examined next to determine whether or not the pattern is repeated.

Endnotes:

1. The Peabody sale of TPM shares was required as a result of an US anti-trust decision against its parent company, Kennecott Copper. Once again government decisions shaped the pattern of coal investment.

2. The secondary status of the export industry does not imply complacence as the growth in exports in 1988 raised the value of exports to $4 billion, a sharp increase from $3 billion in 1987 (Keystone News 1989).

3. However, they subsequently tested models of duopoly/monopsony behaviour (Kolstad and Abbey 1984) to suggest that this was an appropriate model of the international steam coal trade. Their conclusion was not based on a detailed structural study. Instead, it was based on the compatibility of model results with US Department of Energy forecasts of coal trade in the year 1990 (i.e. low cost South African and Australian exports were constrained to generate higher prices and continued USA exports).

4. Utah International was the 17th largest US coal producer in 1987 with the production of 12 mt (Keystone News Bulletin 1988.6.27:5).

5. The keiretsu structure is argued to have helped the domestic mining companies participate in international joint ventures because their investment was accompanied with that of an affiliated trading house which had more experience in assessing international coal projects (section 6.4).

6. An analysis of Japan's 50 most profitable companies in 1984 found that 19 of these companies belonged to the six major keiretsu: Mitsui, Mitsubishi, Sumitomo, Fuyo, Daiichi-Kangyo and Sanwa (Yamazaki 1988:17). A similar analysis of 1955 and 1973 data revealed that 23 of the 50 most profitable companies belonged to the same six keiretsu. This indicates that keiretsu companies have been persistently among the top companies in Japan.

7. The level of interlocking shareholding within each of the six major keiretsu averaged 22.7% in 1987. This represented a decline from 25.5% in 1981. However, the shareholdings of other corporate investors combined to leave only 25-30% of equity available for actual trading. (Economist 1989.8.19:82) Instead of having a dominant holding company, shareholdings were divided among affiliated finance companies (typically 10-20%), affiliated industrial companies (typically 10-15%), and other corporate investors, especially financial institutions (Yamazaki 1988; Young 1979). Individual shareholders were relatively unimportant (38% of shares in 1981 and 29% in 1987) and this left most decision making power in the hands of professional managers (Economist 1989.8.19:82).

The interest of managers in the group (as well as company) wellbeing is reinforced by the top executives of affiliated companies belonging to a President's Club for that keiretsu. Regular meetings by this informal organisation, reinforce the financial ties with a direct exchange of information and collective consideration of group projects. Several of the members may form a joint venture to promote a particular business opportunity (Marubeni 1984:30). In this way, the keiretsu grows from its base of major companies into an extensive network of many specialised companies.

8. In 1980 the British Columbian government bought the shares in this project from Kaiser and other public shareholders, including some of the Japanese holdings (Kawasaki, Kobe and Godo Steel sold 50% of their shares while Nippon and Nisshin Steel sold 33% of their shares (Coal Manual 1985:319)). The restructured private company, Westar, withdrew its shares from the public stock exchange and increased the relative Japanese interest (steelmills, other consumers and Mitsubishi) to 33% of the equity.

9. Development funds were raised in three ways. First, the capital investment by shareholders was raised to a total of C$325 by the end of 1984. Second, project finance was arranged for C$700 from 55 banks with 4 of the 7 lead banks being Japanese. Finally, special recourse loans (C$250) were arranged. (See chapter 7 for details.)

10. The pattern of many Japanese companies each taking a small equity interest in large overseas resource projects has been called the Asahan formula, based on earlier experience in Indonesia (Ozawa 1980). In developing countries, host governments often take equity positions in the projects, but in the Quintette case government investment was directed into infrastructure.

11. This arrangement remains under active consideration for the future. For example, the proposal to develop the Hosmer-Wheeler mine in Canada (Westar 70%, Mitsui Mining 25%, Mitsubishi Corp 5%) includes a provision for the JSM to take a 10% equity interest when the mine is developed (Coal Manual 1985:352).

12. In 1980 Sumitomo slipped into sixth place leaving the other four sogo shosha as the four largest Japanese investors in overseas projects (Oriental Economist 1981:312).

13. The Foreign Investment Review Board (FIRB) in Australia was reported to hold this view and prefer investment by traders over that by consumers. However, this preference is not all-encompassing as shown by the investment by European consumers in some Australian coal mines.

14. For example, the allocation of Quintette shares required extensive negotiations and renegotiations (Coal Manual, various years; Anderson 1983).

15. calculated as 17% average consumer equity of 41% of Canadian exports to Japan.

Chapter 7
The financial structure:
credit, contracts and risk

7.1 Introduction

By exploring the power of international financial structures, an important new dimension is added to the traditional debate at the core of international political economy. Rather than regard trade as a two-dimensional product of tension between the security and production structures studied in the last two chapters, a third structure is added to the model of trade being developed in this thesis. The financial structure has the ability to create credit and thereby fund new projects independent of the production structure where retained profits or new equity issues are used as the traditional source of investment funds[1]. Coal producers or consumers can also raise corporate loans to fund new projects, but in these cases the finance is used simply to reinforce or extend established production structure interests. The use of credit in this manner is considered to be another form of 'quasi-integration' and will be explored later. First it is considered as an independent source of power in the international coal trade.

Credit plays a central role in the creation of new productive capacity in the coal industry, as it does in most sectors of the global economy. Financial institutions thus offer an independent source of investment capital and means of entry into the coal trade. The use of this independent finance may create conflicts with the interests of prominent members of the production structure examined in the last chapter.

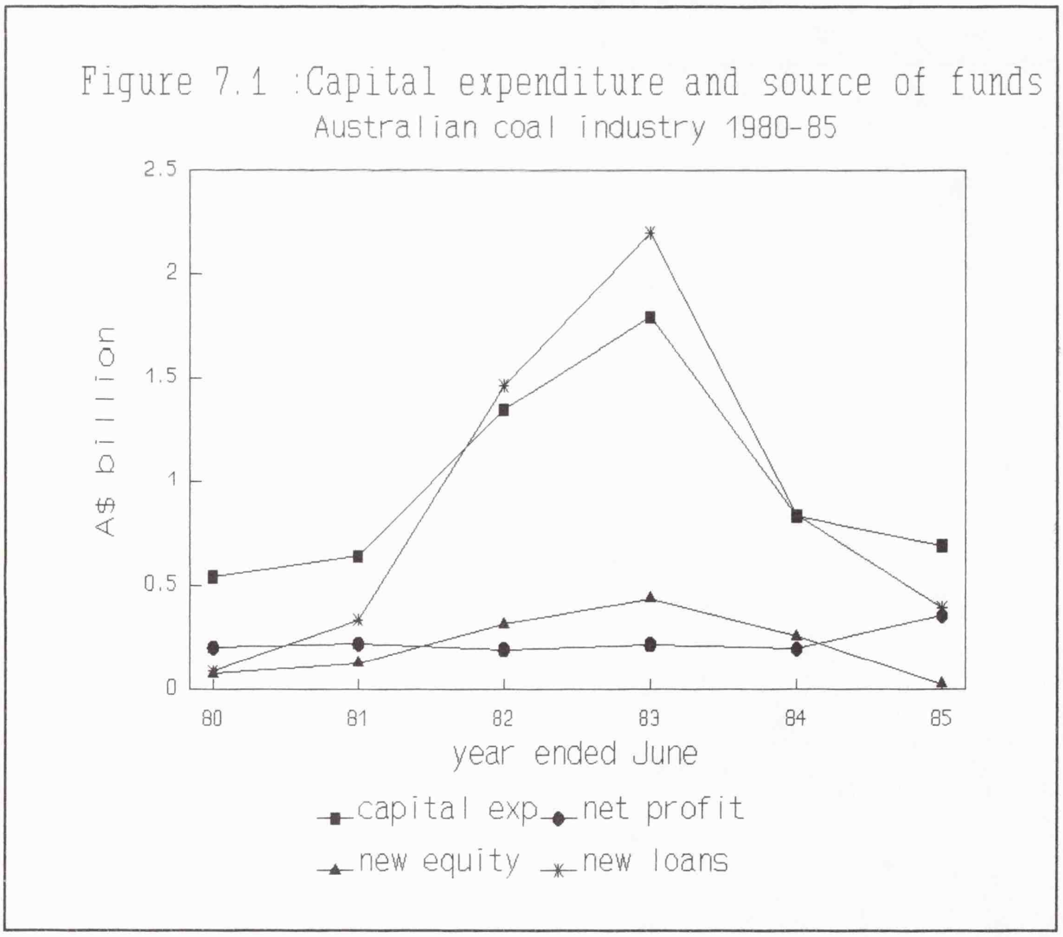
The last chapter identified differences between American and Japanese investment objectives and ownership patterns in resource projects. Yamazawa (1981 cited in Sakurai 1983) introduced two terms to describe the different approaches: 'captive development' was argued to be the prevailing American pattern while Japanese consumers employed 'loan-cum-purchase' arrangements. Rather than rely on large equity investments to gain direct control over resource projects as in the American model, the Japanese approach reinforced the minority equity investments identified in chapter 6 with loans and long term purchase contracts. Despite the tighter integration of American mines and consumers in the metal ore trade, Japanese industry was judged to have achieved lower cost imports (Rodrik 1982). The linkages between these loans, long term contracts, minority equity investments and their effect on price/tonnage are investigated in this chapter.

The use of individual projects as the basis for credit formation can only be accomplished if the lender is assured of the future cashflow of the project to repay the loan. A critical factor in determining future cashflow is the proportion of planned capacity committed under long term contracts. The securing of long term contracts is thus an essential component of project financing. Indeed, long term contracts may be formally linked to loans from the consumer to producer with repayments made by specified reductions in the price of the traded good. Even where loans are not provided directly by consumers, the signing of long term contracts is part of the financial arrangements for new mines. These loans and contracts establish significant links between the producer and consumer which reinforce the trade pattern. The analysis of the importance of these financial linkages in the global coal trade starts by examining the rising role of borrowings as a source of investment funds.

7.2 Finance as an independent source of investment

The increased importance of finance in the global economy needs to be evaluated in the context of the coal industry. Investment in new projects can be closely linked to the production structure through the retention of profits for investment and the issue of new equity. Alternatively, investment funds may be raised as borrowings from banks and other members of the financial sector. Indeed, borrowings accounted for up to 80% of investment funds in new Australian resource projects in the early 1980s (Folie 1982). To find out whether this pattern prevailed in the coal industry, an investigation is made into the source of investment funds for the expansion of the Australian coal industry to become the largest coal export industry in the world.

In response to the second round of oil price rises in 1979-80, annual investment in the Australian coal industry quadrupled from A$ 0.5 billion in 1980 to A$ 1.8 billion in 1983 (Figure 7.1)[2]. The magnitude of this capital expenditure was far beyond the net annual profits made by the industry (A$ 0.2-0.3 billion). New equity was issued to help finance some projects, but the size (A$ 0.1-0.4 billion) of these issues was less than one quarter of the size of the new investments (ACA annual).



New borrowings or loans were by far the most important source of capital for the new coal projects. The magnitude of this shift in industry practice from equity to loan based investment is well demonstrated by the change in the industry's loan/equity ratio. In 1980 total borrowings equalled 34% of the total equity in the industry, but by 1987 borrowings rose to 129% of equity (Table 7.1). The long term nature of this investment and the associated loans is demonstrated by the increase in loans which were to be repaid over a period longer than five years. Whereas less than 15% of the loans outstanding in 1980-81 had repayment periods longer than five years, the financing of capital investments in the early 1980s raised the level of long term borrowing to over 40% of the total debt by 1984-85. Not surprisingly, interest charges became a major component of industry costs, rising from A$ 38 million in 1980 to A$ 108 million in 1982 and $A 458 million in 1987 (ACA 1987).

Table 7.1: Australian coal industry equity and borrowings

year	borrowings	equity A$ billion	loan/equity ratio
1980	0.5	1.6	.34
1981	0.7	2.6	.27
1982	1.6	3.0	.53
1983	2.9	3.3	.88
1984	3.2	3.6	.88
1985	3.6	3.8	.95
1986	4.0	3.6	1.13
1987	4.1	3.2	1.29

source: ACA annual

The source of these borrowings is also of interest. Australian sources were initially by far the most important and by the early 1980s accounted for 4 to 6 times the borrowings from overseas. However, the rapid expansion and reorganisation of the industry in the early 1980s was financed with half of the funds coming from overseas sources. The outstanding overseas borrowings of the Australian coal industry jumped from A$ 0.3

billion in 1982 to A$ 1.9 billion in 1984 and A$ 2.2 billion in 1986 (ACA 1987, Table 7.2). The relative attraction of domestic and overseas sources of loans depended on the interest rate available and expected changes in exchange rates. For example, loans from Japanese banks typically had lower interest rates than loans from Australian sources, but when the Australian dollar was devalued against the yen in the mid 1980s, the cost of repayments (in terms of Australian dollars) rose sharply.

Table 7.2: Australian coal industry borrowings by source

year	borrowings Australian	overseas	duration* > 5 years
	A$ billion		%
1980	0.39	0.14	15
1981	0.60	0.11	12
1982	1.30	0.27	23
1983	1.80	1.13	37
1984	1.30	1.91	47
1985	1.65	1.96	41
1986	1.88	2.15	32
1987	2.08	2.02	24

note: * based on 61-76% of outstanding loans where respondents specified the repayment period
source: ACA annual

The principal source of overseas loans changed over the last two decades. Japan became the major source of Pacific investment funds in the 1980s as it rapidly expanded its national production structure and this pattern was repeated for loans as the Japanese financial structure was extended. The change is well illustrated by the capital intensive, open cut coal mines in central Queensland. When the Moura mine was developed in the 1960s by Thiess-Peabody-Mitsui, the debt (approximately A$ 35 million) was raised from 11 American banks and insurance companies, parent company loans and some Australian bank loans (McKern 1976:218). By the 1980s the mixture of funding sources had changed.

In 1984 the largest takeover or reorganisation of the Australian coal industry to date was initiated by BHP Ltd. BHP was the leading partner in a new joint venture, Central Queensland Coal Associates (CQCA), which combined all of the Australian coal interests of Utah International (the original Blackwater mine, the four old CQCA mines and related leases) and the BHP Gregory mine[3]. The financing of these BHP acquisitions and reorganisation was coordinated by the Bank of Tokyo. The bank's share of the financial arrangements was one half of the total $US 2.5 billion takeover (Edgington 1988:196; Coal Manual 1985:195). BHP initially owned 35% of the new CQCA and 47% of the Gregory project. Its share of the joint venture rose to 40% in 1985.

The BHP takeover of Utah was the biggest financial deal in the Australian export coal industry and it established BHP as the largest exporter in the world. The central Queensland mines had low extraction costs and proven reserves, making them a good investment and it is not surprising that Japanese banks would want to participate in such large scale and promising business. However, this Japanese banking support for BHP did not imply universal Japanese approval of the deal. The steel mills were concerned that the concentration of such a large share of their imports from a single supplier could alter the established bargaining power in the trade.

> 'BHP's actual export of coking coal to Japan in fiscal 1984 is estimated at (9.95mtpa), accounting for about 16 percent of Japanese blast furnace steel mill's imports. Such a big share may be considered as a risky dependence for the buyers.' (Coal Manual 1985:148).

The tonnage of coal under long term contracts for the seven main coking coals exported to Japan by BHP-Utah totalled 16.3mtpa in 1984[4], but actual imports were significantly reduced. The reduction in tonnage was argued to indicate a reluctance on the part of the Japanese steel mills to become too heavily dependent upon a single supplier. However, the surplus capacity in the international coal industry in the mid 1980s was accompanied with reductions in imports from most established coking coal suppliers. The argument that CQCA contracts received disproportionately large cuts is refuted by the similar treatment given to established Canadian suppliers.

The BHP reorganisation of the Australian coking coal export industry illustrates how the sectoral interests of the Japanese economy may be divided rather than universal as assumed under the Japan Inc model. A large loan scheme to one supplier may be beneficial to the banks, yet conflict with the steel mills' interest in maintaining many small suppliers with limited bargaining power.

The Bank of Tokyo's central role in financing the BHP acquisitions was the largest, but not the first participation of Japanese banks in Australian coal industry borrowing programmes. The Industrial Bank of Japan had strong connections to the Japanese government and played the largest role of any Japanese bank in financing Australian resource projects in the 1970s. By 1981 it was estimated to have been involved in A$ 6 billion of loans for Australian resource projects (Edgington 1988:196). The North West Shelf gas project was the largest single project, but the list of projects which it acted as the financial advisor and loan coordinator for included the Saraji, Collinsville and Riverside coal projects in Queensland. This illustrates how a major bank can act as a source of funds for various competing coal producers (CQCA in the 1970s, MIM and TDM in the 1980s). In this way, funds were made available to established (CQCA and TDM) and new (MIM) coal producers alike.

Links between resource projects and banks are not exclusive as banks like to divide the risk of projects among many parties and spread their portfolio of loans accordingly. The entry of MIM into the coal export business in the 1980s illustrates this variety of financial partners. The Japanese bank coordinating loans for MIM's Collinsville coking coal project was the Industrial Bank of Japan, while that associated with MIM's Newlands steam coal mine was the Bank of Tokyo (Edgington 1988:197).

The potential independence of and conflict between financial and production structures is illustrated in Canada as well as Australia. The Canadian coal project with the largest Japanese borrowings is Quintette. An international group of 55 banks provided C$700 million in project finance for the 5mtpa Quintette mine. Of the seven banks coordinating the loans, four were Japanese, two were Canadian and one was French[5]. Four of the largest banks in Japan (Bank of Tokyo, Mitsubishi Bank, Mitsui Bank and Fuji Bank) thus had a prime interest in the economic performance of the project. The JSM signed a long term contract for 5mtpa which included price escalation clauses from a reference price of C$ 75.00 in 1980. However, when the price of coking coal fell in the mid 1980s the JSM demanded a cut in the Quintette price. Quintette refused and the two parties went to arbitration to settle the dispute.

A conflict in interest emerged between the Japanese steel mills and the Japanese banks. The steel mills would benefit from a reduction in the price of coal and the corresponding fall in the cost of their imports. However, if the price was cut sharply (ie. from C$ 95pt to C$ 65pt) then the mine could not meet its operating costs and repay the loans. Either the project defaults on its loans and the bankers accept the loss or the project goes bankrupt. The steel mills and banks have conflicting interests in the upholding or dismissal of existing contract arrangements. Such conflicts reveal the complexity of Japanese structural interests in the coal trade.

7.3 Finance as a form of quasi-integration

7.3.1 Quasi-integration

Having demonstrated the importance of loans for the independent expansion of the coal export industry, other types of borrowing also need to be considered. Loans for coal projects can be raised from purchasing firms or with the help of associated trading houses. In this case, finance may be used to strengthen the trading link between the parties as a form of quasi-integration. Rather than conduct the trade under arm's length negotiations (as in a perfectly competitive market) or within a vertically integrated firm (as between a wholly owned subsidiary and parent company), an intermediate relationship is established.

> 'Quasi-integration exists when a particular buyer is linked to a particular seller by contractual, financial or technological arrangements that both limit the choice of trading partner for a period covering many transactions and tend to replace market intermediation of prices and volumes.' (D'Cruz 1980:3)

Quasi-integration, as defined by D'Cruz, can be seen as a means by which firms respond to market uncertainties and reduce their transaction costs. This is especially important where transaction specific investment is made, as in the case of site proximity, technological specialisation, or where alternative trading partners are limited (Joskow 1988a; Williamson 1975). Quasi-integration occurs in a variety of forms: minority equity investments (chapter 6); transactions coordinated by specialised trading houses (chapter 8); and the financial forms (loans and long term contracts) to be studied in this chapter. The importance that industry groups place on these financial arrangements is also considered.

7.3.2 Consumers survey

The relative importance which consumers and traders attach to the different forms of quasi-integration was measured by conducting a survey of prominent industry actors (Appendix D). The survey had responses from companies responsible for half of the imports of coking and steam coal into Japan (52mtpa) and steam coal into Europe (57mtpa). The answers given to questions enable three types of comparisons to be made. First the relative importance of different arrangements can be compared because a common scale was used. Second, the opinions of respondents in different industries can be studied to identify variations among different groups of consumers. Third, time series comparisons can be made because three different reference years were used: 1980 (when coal prices were high), 1987 (when coal prices were low) and 1995.

Each of these three types of insights can be gained from Table 7.3. The relative importance of consumer loans to suppliers and bilateral investment agreements is examined. The steel mills and mining companies considered loans to producers to be of average importance to coal purchases in 1980 while bilateral agreements were of below average importance. The steel mills considered both arrangements to be less important in the mid 1980s and 1990s; their use was thus likely to decline. The mining companies shared the steel mills' view on the lower importance of loans to producers, but disagreed on the importance of bilateral agreements. The average importance attached to bilateral investment agreements by mining companies is explained by their desire to sell consultancy, management, mining and training skills as part of the exchange offered to centrally planned economies for coal exports.

Table 7.3: Importance of financial arrangements to coal purchases, 1980-95

respondent	consumer loans to producers			bilateral investment agreements		
	1980	1987	1995	1980	1987	1995
Japanese groups						
steel mills	3	4	5	4	5	5
mining companies	3	5	4	4	3	3
steam coal groups	4	4	4	3	3	3
electricity cos	4	4	4	5	5	5
general industry	4	4	4	2	2	2
oil companies	5	5	4	4	3	3
sogo shosha	5	5	5	5	5	5
European groups						
electric utilities						
northern Europe	5	5	5	5	5	5
southern Europe	5	5	5	5	5	5
trading companies	5	5	5	4	3	2

key: 1 = very important; 2 = above average importance; 3 = average importance; 4 = below average importance; 5 = not important

source: Appendix D

Japanese steam coal consumers generally placed below average or no importance on loans to producers when considering coal purchases. Bilateral investment agreements were given a much more varied review. The electricity companies considered them of no importance while general industry placed above average importance on these agreements. The reason is that many of the small consumers in general industry receive their coal in small shipments from China and thus place a high importance on continuing bilateral trade between China and Japan. The oil companies placed average importance on such agreements. They are often directly involved with bilateral agreements because oil is the other major commodity (in addition to coal) in Sino-Japanese bilateral trade negotiations (Newby 1988).

The differences between Japanese and European attitudes toward the coal trade are clearly articulated. European respondents placed no importance on the special financial arrangements which some Japanese counterparts valued more highly. The exception to this pattern was the growing importance attached by European trading companies to bilateral investment agreements. The reason for this European interest in these agreements is that one of the specialised roles for European coal traders is in conducting trade with Eastern European countries. For example, Polish coal supplies are often arranged through specialised traders (like Polkohle in West Germany) and consuming countries like Austria, Netherlands and West Germany have signed agreements to finance coal projects in Poland in return for long term coal imports. Bilateral agreements are important to this trade and the traders expect to play a significant role. The coal trade implications of the rapid political changes in Eastern Europe in 1989 and expected in the early 1990s are difficult to predict. Old production plans have little meaning and new arrangements need to be negotiated.

In summary, Japanese coal consumers placed greater importance on special financial arrangements to support coal trade flows than European consumers. Japanese and European bilateral agreements were reviewed in chapter 5 as part of the security structure where government arrangements were used to ensure diverse and secure supplies of coal. These agreements demonstrate the reinforcing use of the financial and security structure to meet the needs of coal consumers. In contrast to the strong role of government in bilateral investment agreements, corporations in the production structure use finance to facilitate their trade interests in the case of consumer loans to producers. These loans were valued most highly by Japanese coking coal interests and are examined next.

7.3.3 Japanese public finance to support private investment

> 'Special funding was provided by the Japanese Government that was made available to Japanese Companies to find secure quality coal supplies to help meet the future needs of the country's steelmaking and electric power industries.' (Dalby 1987:921).

The higher importance attached to special financial arrangements by Japanese than European consumers is reinforced by a detailed examination of the coal trade. The Japanese consumers arranged long term loans and contracts as part of their develop and import policy to secure the majority of their raw material imports. The importance of financing a large-scale efficient supply chain has remained a high priority throughout the post-war expansion of Japanese industry[6]. By 1969 long term contracts and loans dominated trade arrangements and provided 75% of the iron ore imports and 62% of the coking coal imports (Ozawa 1979:176). A further 14% and 22% of iron ore and coal supplies (respectively) came from domestic mines and less than 10% of supplies were purchased under competitive, spot market conditions. This integrated supply network was achieved not through controlling ownership of mines, but through facilitating financial arrangements.

The link between government security objectives and the financial structure is well illustrated by the bilateral investment agreements which Japan signed with China and the USSR. Government policies were supported with credit from public sector banks like the Export Import Bank of Japan (Ozawa 1986). Private banks were often included in these loan schemes, just as public banks shared in the loans which private banks sourced for coal consumers to support their coal suppliers.

In addition to financing new projects, the Export Import Bank was used as a leading source of Japanese finance to assist operating coal mines. These loans were frequently arranged to construct a new washery or make a similar improvement to existing mining operations. The loans were generally arranged by the sogo shosha which imported coal from the mine, guaranteed jointly by Nippon Steel and the sogo shosha, and financed by a combination of Export Import Bank of Japan and major city bank funds. Guarantees of repayment were also obtained from the parent of the mining company in most cases. Actual repayments were usually a fixed reduction in the coal price for an agreed tonnage of coal to be delivered under a long term contract (Table 7.4). However, if the supplier discontinued deliveries, then the parent company had to repay the loan at a higher rate of interest (for example, interest rates for the Barnes & Tucker loan rose from 8.5% to 14.5% if exports were discontinued, D'Cruz 1979:185).

Other financial transfers were made on an ad hoc basis. For example, in addition to the C$16.5 million loan to Smoky River in 1974, the JSM provided an extra C$7.5 million in a special financial deal. This was done by increasing the coal price by C$11/t (to equal the FOR price for Itman coal in the USA) for the 700,000 tonnes exported that year. This increase in price can be regarded as either a special grant (non-repayable loan) to the mining company (Japanese view) or the recognition of prevailing market prices for coal (Canadian view). The C$16.5 million loan was to be repaid in the usual manner from the revenue generated by the JSM import of 1.5mtpa of coal from the mine for the next three years (Coal Manual 1976:199,215).

Table 7.4: Small Japanese loans to overseas coal mines

date	company (mine) lender	amount $ million	interest %	repayment years	$/t	volume mt
	agreed and implemented					
1970	to ICC (VP no 4) by Nissho Iwai	25	6.5	15	0.92	1.8
1970	to Barnes & Tucker by Tokyo Boeki (Lancashire)	5	8.5	12.5	0.56	0.8
1970	to Kaiser Res (Balmer)	1.9				5.0
1970	to Coleman (Vickery Cr)	1.5				1.0
1971	to FCCI (Cerro)	35				1.0
1972	to CQCA (Saraji)	25				2.7
1974	to McIntyre (Smoky R)	C$16.5		3	C$3.67	2.0
1975	to J.Walter (Blue Cr) by C.Itoh & JSM	40		6		2.7
1975	to Mead Corp (Mulga) by Sumitomo	6.5				1.0
	agreed but not implemented					
1974	to Gregg River	C$20	8	15.5	C$1.00	2.7

source: Coal Manual 1976, 1985: 74-78; D'Cruz 1979:184-219

The financial arrangements for Gregg River illustrate the role of the Japanese government in supplying resource project finance. The initial C$20 million loan agreed (but not implemented) in 1974 was to be financed by the JSM using funds 70% from the Export Import Bank and 30% from city banks. Japanese banks later agreed to finance the majority of the development costs (total = C$185 million). The Japanese equity partners provided a C$30 million farm-in fund and C$74 million in project finance from Fuji Bank and 18 other Japanese banks (floating interest rate and 12.5 year term). In addition, the Japanese partners arranged a C$15 million low interest loan from the Export Import Bank and city banks on behalf of Manalta (their joint venture partner) to finance part of its share of development costs. Manalta raised the remaining C$66 million from a group of Canadian banks led by the Bank of

Montreal (Coal Manual 1985:8). The result was that Japanese sources provided 64% of the project finance despite having an equity position of only 40%.

Loans have also been converted into equity when a mine proved unable to make its repayments. This occurred in the Canadian case of Kaiser Coal in 1973 and was the first case of the JSM taking direct equity participation in an overseas coal project (chapter 6). Rather than force the mine into bankruptcy or harm its financial viability, the JSM demonstrated their flexibility in using either financial or production structures to achieve their supply objectives. They converted their outstanding loans to the project into an equity interest. This replaced the assured interest and principal repayments with uncertain dividends based on mine profits.

Financial concerns were also given as the reason for JSM investment in the Quintette project. When Esso Resources decided to withdraw from the project in 1981, the JSM decided to take a direct equity position to ensure that funds would be found to meet the cost of development. Once again the Japanese banks were involved. The senior loans for project finance (C$700 million) were raised from 55 international banks. Recourse loans were then arranged for a further C$100 million with the C$33 million financed by Mitsui Mining and Tokyo Boeki being endorsed by NEDO. Sumitomo Corporation financed its C$15 million of the recourse loans independent of NEDO.

The above examples of public finance used to support private investment in coal mines are small (with the exception of Quintette) in comparison to the finance provided by Japanese government and city banks for coal development projects in China and the USSR. However, the small size of typical loans to operating coking coal mines in Appalachia is not the only measure of Japanese financial interest in US coal.

In 1981 the Japanese government wanted to diversify its sources of steam coal and avoid dependence on Australia and China. The development of steam coal mines in Utah, Colorado and Wyoming was proposed. The Japanese government decided in principle to underwrite a Y300 billion ($1 billion) loan for investment in infrastructure on the west coast to support the export of 10mtpa of steam coal starting in 1985. A further Y200 billion would be invested, largely in mines, by private interests. The government finance for these projects would be directed through NEDO and the Export Import Bank of Japan. City banks were also expected to participate (AFR 1981.5.21:29). Despite the advanced stage of planning achieved by this proposal, it was never implemented. Instead, the largest amounts of Japanese public finance for coal projects went to China, the USSR and north east British Columbia.

The Export Import Bank of Japan is generally the most important source of finance and coordinator of other government and city banks. In addition to their role in providing the loans described in this chapter, the Export Import and other banks can support the production structure by providing the funds used for equity participation. For example, Nissho Iwai has a 10% equity share in the Bullmoose mine in northeast BC. The C$31 million (10% of total) of development costs financed by Nissho Iwai was drawn not from corporate reserves, but from the Export Import Bank and other city banks (Coal Manual 85:346). In this way, the equity investments by Japanese corporations are reinforced by the financial provisions identified in this chapter.

7.3.4 Coordinated finance and investment integration

The coordination of financial and equity holdings within Japanese keiretsu is well known (chapter 6). This domestic pattern is extended to international coal projects by the large sogo shosha and banks at the centre of each keiretsu.

Four groups of Japanese investors in overseas coal mines were identified: the sogo shosha, consumers (the steel mills, the electricity companies, and Ube Industries), mining and oil companies. Of these groups, the Japanese coal mining companies best demonstrate the combination of financial and ownership structures to achieve international integration for relatively small companies. When Japanese mining companies invest in an overseas coal mine, the importer of the coal is usually an affiliated sogo shosha (belongs to the same keiretsu). This pattern of shared keiretsu interest in a project is reinforced by the finding that the two coal projects where Mitsui Mining invested overseas had Mitsui Bank as a leading bank to arrange project borrowings. In the case of Drayton Coal, Mitsui Bank organised a major project loan through its representative office in Sydney (Edgington 1988:196). In the case of Quintette Coal, Mitsui Bank was one of the seven leading banks which coordinated a group of 55 banks involved in the financing of the project (Coal Manual 1985:8). In each case, the role of the bank can be regarded as reinforcing the equity investment of another keiretsu member[7]. Further financial support is gained by the signing of long term contracts.

7.4 Long term contracts as part of the financial structure

Long term contracts serve several purposes as a means to conduct trade (Daintith 1987; Joskow 1987). The issue of interest in this chapter is how they affect financial structures in coal trade. Financial structures were shown earlier to provide either an independent source of investment funds or to reinforce integration within the production structure. The argument is extended in this section by demonstrating that contracts are used in the same way.

Long term contracts can be used as a means to ensure the future cashflow of a project and its value for independent financing by the financial sector. Projects with known resource endowments and predicted extraction costs can thus enter into the negotiation of long term contracts to ensure the future sale of the resource to meet operating costs and to repay loans. Given the capital intensive nature of mining, most projects seek to have their production capacity committed under contract to consumers and thus achieve the low unit costs required to gain a profit from the mining operation.

The Kaltim Prima coal project in Indonesia was heralded in 1989 as the first new project to be financed on the basis of its long term contracts since the series of new mines which came on stream in the early 1980s (ICR 1989). The project was completing negotiations for three major contracts - with China Light and Power in Hong Kong, GKE in the Netherlands and AES in Hawaii - and was expected to begin exports in 1991. A forecast increase in demand for international coal supplies created the expectation that more projects would be established in the 1990s under financial arrangements similar to those prevailing in the 1980s. An examination of past experience may thus provide some lessons regarding the likely relationship between long term contracts and project finance.

The definition and nature of long term contracts in the coal trade is also subject to debate. Long term contracts were traditionally based on the assumptions that a transaction was to be framed as a legally binding contract and that the contract could be viewed independently from any other links between the parties (Daintith 1987). However, empirical studies found limited recourse to legal proceedings (Macauley 1977) and transaction cost theory pointed to the continuum of transaction arrangements from discrete transactions governed by binding contracts at one extreme to unitary governance under vertical integration at the other extreme (Cheung 1983; Macneil 1981; Williamson 1979). In between these extremes contracts were reinforced by other links (loans, equity, technology, personnel, etc.) between the parties.

Long term contracts cover transactions to be repeated over time and are generally governed by negotiations between the two parties rather than referral to a third party (arbitrator or judge). The study of these various contract and transaction types is incomplete (Daintith 1987) and this study extends current research. Contract data will be evaluated to determine the extent to which global coal trade conforms to the two types of relationships between coal contracts and finance. Are contracts the basis for independent project finance or do they reinforce other forms of quasi-integration?

7.4.1 Contracts and independent financing

Contracts are often used to facilitate independent project financing. The project is typically financed through a small equity investment by the owner or joint venture partners and large borrowings (Folie 1982). To ensure repayment of these loans the lenders require long term contracts for the sale of most mine output. These contracts also provide the operator with an assured market for the coal produced. To reduce the risk of the mine losing sales through an unexpected decrease in the demand by a particular buyer, preference is often given for contracts to be arranged with several buyers (Table 7.5).

Table 7.5: New coking coal mines (1980s) with diverse long term contracts[8]

mine	buyers
BHP (Gregory)	JSM, China Steel, Pohang, China L&P
German Creek	JSM, China Steel, Cockerill, Ensidesa Pohang, Iran, Siderbras, British Steel
Oaky Creek	JSM, Ensidesa, Hoogovens, Italsider
Greenhills	JSM, China L&P, China Steel Kepco, Pohang, Elkraft
Line Creek	JSM, Kepco

source: AFR - Australian Financial Review. Sydney.
ACR - Australian Coal Report. Sydney.
CM - Coal Manual. Tokyo
CWI - Coal Week International.
ICL - International Coal Letter. Brussels.
ICR - International Coal Report. London.
QCB - Queensland Coal Board. Annual Report. Brisbane.

Many new mines in the 1980s had multiple contracts to ensure their future sales and cashflow. New coking coal mines like German Creek, Gregory and Oaky Creek in Queensland and Line Creek and Greenhills in Canada illustrate this pattern (Table 7.5). In each case contracts were signed to account for virtually the full production capacity of the mine.

New steam coal mines like Drayton, Hunter Valley, Mt. Thorley, Saxonvale, Warkworth, Coal Valley and Obed Marsh followed the same pattern. The buyers include steel mills which use the coal as a soft or semi-soft coking coal for blending with higher priced hard coking coals (Table 7.6). In these cases, the mines spread their sales among several industries with buyers typically including electric power companies, steel mills, cement manufacturers and general industry with coal fired boilers. The range of buyers is thus diversified on the basis of country, industry and keiretsu.

Table 7.6: New steam and soft coking coal mines (1980s) with diverse long term contracts[9]

mine	buyers under long term contracts
Drayton	Hokkaido EPC, Mitsui Mining, Shikoku EPC, Toyo Soda, Kepco, CEGB, Kyushu EPC
Hunter Valley	Mitsubishi Chem, W.Germany, Kyushu EPC, NCSC, Ube Ind, Hong Kong Electric, Kepco, NEB, EFO
Warkworth	JSM, Mitsubishi Chem, EPDC, Hokuriku EPC, Mitsubishi MC
Coal Valley	Ontario Hydro, W.Germany, Chugoku EPC, Hokkaido EPC, Ono Cement, Toyo Soda, Ube Ind
Obed Marsh	Kepco, Taipower, ATIC, Denmark, Chugoku EPC
El Cerrejon (Carbocol)	China L&P, Cementos Panama, Electric Fuels C, NCSC, ATIC, Carboex, CEGB, EFO, Finnish Sugar
El Cerrejon (Intercor)	St.Johns RPP, Elkraft, Elsam, ESB, Fincoal
Clarence	Kepco, NCSC, Taipower, ATIC
Newlands	Shikoku, Sumitomo, China L&P, NEB, Taio Paper
Saxonvale	Mitsui Mining, Oji Paper, Shikoku EPC, EPDC, Sumitomo Cement, Onoda Cem, Tepco, Tohoku EPC
Ulan	Chugoku EPC, Denmark, Hokkaido EPC, Kyushu EPC, Mitsubishi MC, Tohoku EPC, Kepco, PNOC
Gencor	Enel, Hokuriku EPC, Volkswagen
Shell SA	Enel, Atic, GKE
Shell (Rietspruit)	EPDC
Kangra	Cementir, Enel

source: as for Table 7.5

Old mines or old mining companies wishing to expand existing operations also used the same range of diverse contracts to support their increase in operations in the 1980s (Table 7.7). The role of the CQCA mines in central Queensland as coking coal supplies to the steel mills of Asia and Europe was well established in the 1970s. In the 1980s new contracts were signed with consumers in the Middle East and Eastern Europe to diversify markets further. At the same time, exports to traditional buyers like the JSM were extended beyond the end of the original contract. In the case of old NSW coal producers the JSM sometimes signed a series of five year contracts, but by the 1980s the more common practice was simply to continue the trading relationship on an annual basis.

The prevalence of signing multiple long term contracts to sell the output of new or expanded mines in the 1980s was expected to guarantee mine operators a future cashflow. However, the prices, volumes and even duration of contracts was found to be variable in the mid 1980s. Supply grew faster than demand and prices fell. In many cases price escalation clauses were abandoned. In some cases, higher cost mines closed as they were unable to cover costs at prevailing price levels. The result of this experience was that long term contracts lost their value as guarantees of future cashflow and only provided a framework for annual renegotiations. The independent value of a contract was under question. Rather than view the contract as the complete definition of a trading relationship, it was increasingly viewed as simply another form of quasi-integration.

Table 7.7: Old mines (pre1980) with diverse long term contracts[10]

mine	buyers under long term contracts
Bayswater	Sumitomo, Chugoku EPC, CEGB, Kepco
CQCA (various)	ATIC, British Steel, Cockerill, Italsider, Mimex
(Blackwater)	JSM, Al Nasr, China Steel, Pohang
(Goonyella)	JSM, Pohang, China Steel
(Norwich Park)	JSM, China Steel, Pohang
(Peak Downs)	JSM
(Saraji)	JSM
Lemmington	JSM, EPDC, Kyushu EPC, China L&P, EFO
Lithgow	EPDC, Chugiku EPC, Hokkaido EPC, Kyushu EPC, ATIC, CEGB, Sumitomo Metal
Moura	JSM, Chugoku EPC, Hokkaido EPC Hokuriku EPC
Balmer	JSM, Energy Factors, Siderbras, British Steel, Elkraft
Balmer ox	Sumitomo Metal
Coal Mountain	Sumitomo Metal, China Cement
Fording R	JSM, Kepco, Pohang, Siderchil, Siderbras
Luscar	JSM, Ontario Hydro
Smoky River	JSM, China Steel, Pohang
Witbank	JSM, NCSC, CdF, CdF Energie, Enel, EPDC
Weglokoks (First Maya)	JSM
Weglokoks	Siderbras, Austrian el, EFO, GKE, Elkraft, Enel, Hoogovens
Cook	Pohang, Ssangyong
Ermelo	EPDC, Hokuriku EPC
Bloomfield	Tohoku EPC, Toyo Soda
A&B (Western Blend)	Nippon Cement
A&B (Invincible)	China L&P, Shell, ATIC, CEGB, Denmark
Macquarie	Idemitsu, Tohoku EPC, Taio Paper
Miller	JSM, EPDC, Kepco, Pohang
Wambo	Chugoku EPC, Hokkaido EPC, Nippon Cement, Shikoku EPC

source: as for Table 7.5

7.4.2 Contracts as a form of quasi-integration

Long term contracts are frequently studied as a form of quasi-integration where they establish a stronger relationship between the buyer and seller than that under arm's length or spot market transactions (D'Cruz 1980; Joskow 1985; Williamson 1979). All long term contracts can be considered to form an extended relationship between the trading partners. However, this section examines those long term contracts where the contract reinforces or supports another form of quasi-integration, especially loans from the consumer or minority equity investment by the consumer.

Another measure of the degree of integration between two trading partners is the proportion of the party's trade which goes to the partner. For example, where coal is exported to many buyers the degree of integration of the mine into a particular consumer's production system is limited. However, where all of a mine's output is purchased under a single contract the level of integration is high. Examples of both of these arrangements are found in the coal trade.

The link between contracts and consumer-producer loans was identified earlier where the repayment of loans from the JSM was implemented by reducing the coal price by a fixed amount. Although the USA-JSM coking coal trade is large and has continued for over four decades, most of it is conducted without long term contracts. Instead, new contracts are negotiated each year. The trading result may be similar to that achieved under long term contracts with some producers exporting coal continuously for many years. The system is generally neither restricted nor secured by long term contractual obligations. Where long term contracts exist between the JSM and American suppliers, they are sometimes associated with producer loans as well (Table 7.8).

Table 7.8: Long term contracts between American coal companies and the Japanese steel mills

mine	buyer	loan	contract start	end	'000t tonnage
Caribbean	JSM		1972	1982	180
CCB (Keystone)	JSM		1967	1981	400
FCCI (Cerro)	JSM	y	1975	1987	1000
Consol (Rowland)	JSM		1977	1979	600
Ellsworth	JSM		1985	1987	
FCCI (Stott)	JSM		1984	1995	600
ICC (Beatrice)	JSM		1974	1988	1000
ICC (Vir. Pocahontas 4)	JSM	y	1974	1988	1800
Jim Walter (Blue Creek)	JSM	y	1979	1993	2600
Kellerman	JSM		1970	1983	800
Lancashire	JSM	y	1972	1986	700
Mulga	JSM	y	1975	1985	900
Pittston MV & BS	JSM		1977	1988	5500
Sewanee	JSM		1970	1981	900

note: y = yes consumer-producer loan arranged
source: as for Table 7.5

In addition to the supporting use of loans and contracts to integrate mines and consumers, small equity holdings are also used. Joint ventures in Australia and Canada were studied earlier to identify where consumers integrated backward by taking equity interests in mines. The signing of long term contracts reinforces this relationship and examples are identified in Table 7.9.

Two groups of mines immediately appear where equity and contracts are used to link coal mines and consumers. In several cases, the mine only has a long term contract with its partial parent. The degree of integration is considered much higher in these cases because of the greater degree of dependence which the mine has on the consumer. The Canadian examples of Gregg River and Quintette demonstrate this type of close relationship. The mines are effectively dedicated to the supply of a single customer.

The JSM were also the dominant purchasers of most Australian coking coals in the 1960s and 1970s. Not surprisingly, new mines in the 1980s like Bullmoose, Collinsville, Curragh and Riverside also depended upon sales to the Japanese steel mills. Other contracts were sometimes gained, but the JSM remained of primary importance.

Table 7.9: Selected mines with single or dominant long term contracts

mine	form of integration	buyer	contract start	end	tonnage
Coal Cliff		JSM	1968	1973	1500
		JSM	1974	1986	2600
Cerrejon (central)		Carboex	1982	1987	700
Collinsville		JSM	1984	1998	1000
Curragh	ET	JSM	1984	1986	1500
		Lukavac	198?	lt	200
Dombarton	ET	Mitsubishi Chem	1969	1976	280
	ET	Mitsubishi Chem	1977	1981	150
	ET	Mitsubishi Chem	1982	1986	105
Huntley		JSM	1971	1975	200
Riverside	ET	JSM	1983	1997	3300
South Blackwater		JSM	1970	1984	1500
		China L&P	1985	1987	250
South Bulli		JSM	1969	1973	1400
		JSM	1974	1978	1300
Wollondilly		JSM	1974	1978	3000
Bullmoose	ET	JSM	1983	1997	1700
Gregg River	ET,EC	JSM	1983	1998	2100
Quintette	ET,EC	JSM	1983	1997	5000
Vickery Creek		JSM	1967	1981	1000
Devco		Siderbras	198?	lt	200
Kuznetsky	L	JSM	1979	1998	1000
Neryungrinsky	L	JSM	1983	1998	5500
Blair Athol	EC	EPDC	1984	1998	3000
	EC	JCD	1984	199?	2000
Clutha		Shikoku EPC	1984	2003	200

note: EC = equity held by consumer, ET = equity by trader
L = loan from consumer or consuming country lender
source: as for Table 7.5

In other cases, a mine might only have one coking coal contract, but also sell its output as steam coal. Numerous Hunter Valley mines fit this pattern[11]. Their dependence upon the single coking coal contract is thus reduced because of alternative sales to other industries (often under different brand names and meeting different quality specifications).

Coal is also sold under annual or spot contracts and in many cases these transactions are repeated year after year. When these transactions are repeated their distinction from long term contracts becomes blurred. This is especially the case in the coal trade where most prices are renegotiated annually, even if a long term contract governs the transaction. Even in the USA domestic steam coal market, Joskow (1987) concluded that coal prices under long term contracts generally followed the market trend (despite noted rigidities or imperfections). In this context, long term contracts become little more than an expression of interest in a specified volume of trade while the price fixing provisions are over-ruled on the basis of an equity review clause.

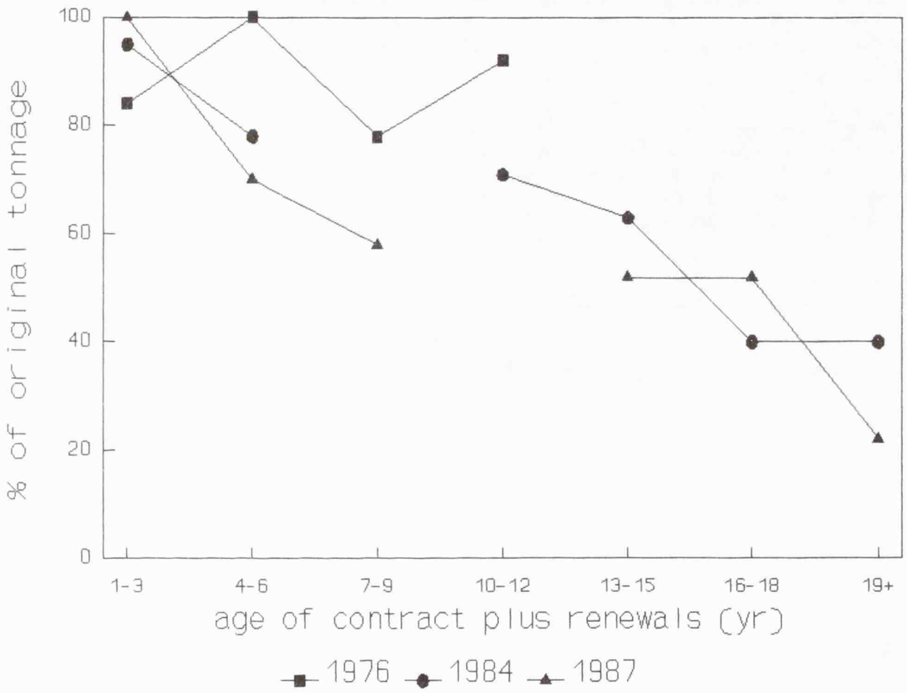
Disputes over long term contracts can arise when prices vary from that prevailing in the market. A difference of $5 between contract and spot prices was argued by the Japanese to be sufficient to invoke an equity review clause (AFR 1984.4.9:17).

Arbitration cases resulted with the JSM and Quintette going to arbitration in Vancouver while Taipower and P&C Bituminous went to the International Chamber of Commerce arbitration centre in Paris. In both cases the buyers sought a substantial reduction in price. More frequently, a solution was negotiated between the two parties. For example, the Blair Athol contract called for EPDC and JCD to import most of the mine's output (up to 5mtpa) from the mine beginning in 1984. Their demand was lower than expected and they wanted both a reduction in tonnage and price. In the end the contract price was paid for the first couple years and then the price was lowered to competitive levels. In addition, EPDC helped find alternative buyers through its contacts in the Asian electricity industry (AFR 1984.4.9:17).

The recession of the early 1980s reduced demand below contracted levels. This combined with increased coal production to reduce international prices. Many long term contracts were renegotiated with both prices and tonnage being cut (Figure 7.2). In the case of JSM contracts, many established suppliers had their volumes cut in half while prices in $US fell by 25 per cent.

Figure 7.2: Contract volume by age of contract

Japanese coking coal contracts



The pattern of trade volumes falling below originally agreed levels is not simply a feature of oversupply in the 1980s. Contracts in the 1970s also had volumes cut. The overall pattern is for performance to decline with age (Figure 7.2), although the reasons for the decline may vary. In the high price context of 1976, suppliers may be able to get higher prices in other markets and want to reduce the tonnage committed under long term contracts. The same argument applies to consumers in the low price setting of 1987 when supplies were abundant. They may seek to lower volume commitments in order to purchase cheaper coal from other sources. Volume reductions may also be used to facilitate the diversification of supply when demand levels are static. Finally, volumes may be cut because of production problems at either the mine or mill.

Despite the mixed experience in the fulfilment of long term contracts, they are expected to remain an important feature of international coal trade in the 1990s. Long term contracts are especially important as part of the financial arrangements for new coal projects. As a result, consumers who expect to expand their demand in the 1990s or who want to increase their supply security also place greater importance on long term contracts in the 1990s (Table 7.10). Steam coal consumers in Japan and electric utilities in southern Europe illustrate the higher (above average) importance attached to long term contracts in the future.

Table 7.10: Suitability of long term contracts and joint ventures to establish new coal supplies, 1980-95

respondent	joint venture			long term contract		
	1980	1987	1995	1980	1987	1995
Japanese groups						
steel mills	1.5	3.5	3.5	1	3	3.5
mining companies	2.5	3.5	4	3	4	3.5
steam coal groups	3	3.5	3.3	2	2.5	2.3
electricity cos	3	4	3.5	1.5	1.5	1.5
general industry	3.5	3.5	3.5	2	2	2
oil companies	3	2.5	2.5	2	1.5	2.5
sogo shosha	3	4	3	2	4	2
European groups						
electric utilities						
northern Europe	5	5	5	3	3	3
southern Europe	5	5	3	1	1	1.5
cement companies	5	5	5	5	5	5

key: 1 = very suitable 2 = above average suitability
3 = average suitability 4 = below average suitability
5 = not suitable

The extensive use of long term contracts and minority equity investments in the coal trade has been demonstrated. These arrangements are argued to form part of the structures which shape trade patterns to the advantage of some parties. The impact of these arrangements on trade prices and volumes needs to be tested to verify or refute these arguments.

7.5 The impact of quasi-integration on trade

The identification of supply location (country or region) was demonstrated to provide a better explanation of coal prices than that based on coal quality alone (chapter 4). Coals from different countries received different prices. The purchase of coal from these diverse supply locations was shown to be a persistent objective of consumers and structures were used to facilitate the investment and finance required to bring new sources into operation. However, not all mines received the loans, long term contracts and minority equity investments identified above. These forms of quasi-integration are argued to be significant in shaping coal trade patterns not only in response to the price differences identified, but also because of the impact they have on trade flows directly.

7.5.1 Quasi-integration and price

The impact of quasi-integration on price is generally expected to depend on whether prices are rising or falling, or the stage of the business cycle (Vernon 1966). In the case of short supply and rising prices quasi-integration may protect the buyer from rapid price increases. The price of coal traded between quasi-integrated companies would be expected to be below that received by independent mines. The opposite pattern is expected when supplies are abundant and prices decline. Quasi-integration should protect producers, at least in part, from rapid price cuts. Their prices should be higher than those received by independent mines. In each case, quasi-integration is expected to delay the impact of market changes on the affiliated firms. The extent of this protection to trade partners is reduced by the transition to shorter term contract periods, like annual price negotiations, instead of longer term quasi-integration arrangements.

To measure the effect of quasi-integration on coal prices a series of quasi-integration variables were defined. The direct investment by Japanese consumers, mining companies and sogo shosha in mines which supply coal to Japan was represented by a series of dummy variables (EQCON, EQJMC and EQJSS, respectively). The size of the investment was represented by a similar series of variables measuring the percentage of equity owned by the Japanese investor (EPCON, EPJMC and EPJSS, respectively). Additional dummy variables were created to represent financial measures like loans, long term contracts, escalation clauses in long term contracts, the extension of trade after long term contracts expire and dependence upon a single or dominant contract (LOAN, LTC, ESP, LTCX, DEP respectively).

Other trade variables included the duration of the trade to date (YR), the original volume of the contract (OVOL) and the current volume of the contract (VOL). The relationship between duration of the trade and price may be positive if a trading partnership is to be extended or supported, or it may be negative if new sources of supply are preferred over established suppliers. Similarly, the relationship between volume and price may be positive if the consumer wishes to promote large projects to achieve economies of scale or negative if the consumer prefers to promote smaller suppliers.

The analysis of coal transaction data thus offers answers to two sets of questions. First, does the data support the argument that quasi-integration affects the coal trade (the variables are significant)? Second, does the data demonstrate that quasi-integration has a negative effect on price in a rising market and a positive effect on price in a declining market?

Quasi-integration was argued to be important to the Japanese coal trade by D'Cruz (1979). He compared coal quality, country of origin and quasi-integration variables to price and concluded that each of the three types of variables had a significant effect on price in the 1970s. Kittredge and Sivertson (1980) discussed the possible influence of quasi-integration, but only included a variable for the term of the contract in their equation. They discussed the reduction of prices (transfer pricing) based on Japanese equity in or loan commitments to particular mines, but rejected this hypothesis indirectly. They concluded that Canadian coal prices were competitively priced (based on coal quality) in comparison to other international suppliers and did not test the impact of quasi-integration directly. The opposing conclusions of D'Cruz (1979) and Kittredge and Siverston (1980) regarding the effect of quasi-integration on coal prices demonstrate the need for further analysis.

This study provides a more detailed analysis of coal prices in the 1970s and the 1980s. More coal brands are included in the analysis than used by Kittredge and Siverston and more detailed variables are constructed than those used by D'Cruz. The D'Cruz conclusion that the effect of integration variables was significant, but small (accounting for 3% of price variation) in the 1970s was not supported by the more detailed analysis conducted in this study. Possible explanations for this difference in findings are that he used data for a longer time period, 1970-77 rather than the single year 1976, and his quality and source variables were more aggregated than those used in this study. In contrast to the aggregate analysis of the contribution of quasi-integration variables by D'Cruz, this study found none of the individual variables to be significant in predicting Japanese coking coal prices in 1976 (Table 7.11). This result supports the Kittredge and Sivertson analysis of 1977 data.

Table 7.11: Comparison of FOB price estimate equations

	attributes	quality	q+source	q+s+integration
1987 n=83	R^2	.41	.86	.88
	se ($/t)	6.65	3.24	3.01
1984 n=73	R^2	.58	.73	.83
	se ($/t)	5.40	4.28	3.39
1976 n=46	R^2	.83	.87	no
	se ($/t)	3.83	3.37	change

equations with integration variables:

1987 FOB = 35.24 + 33.37 NEBC + 1.93 CSN - .92 A + .0015 Vol

1984 FOB = 42.79 + 2.27 CSN + 9.66 ESP + 3.02 Can - .24 VM
+ 8.18 NEBC

1976 FOB = 37.23 + 2.57 CSN + 8.21 USA + 5.29 Can - .20 VM
no integration variables added

A = % Ash
Aus = Australia
CSN = Crucible Swelling Number
EPCON = % equity held by Japanese coal consumer
EPJMC = % equity held by Japanese mining company
EPJSS = % equity held by Japanese sogo shosha
EQCON = equity held by Japanese coal consumer
EQJMC = equity held by Japanese mining company
EQJSS = equity held by Japanese sogo shosha
ESP = price based on escalation clause
LTC = long term contract
LTCX = long term contract extension
M = % total moisture
NEBC = north east British Columbia
Ovol = original contract volume ('000t)
S = % total sulphur
Vol = contract volume ('000t)
VM = % volatile matter

A different conclusion was reached in the 1980s. The D'Cruz finding that quasi-integration variables provided significant explanations of variations in Japanese coal prices was supported by the analysis of transaction data for 1984 and 1987. The use of escalation clauses in several long term contracts resulted in prices above those prevailing in contracts with prices negotiated annually. This result supports the expectation that integration should result in higher prices when market prices fall. The importance of this variable could be understated in the equation because the higher prices received by mines in northeast British Columbia are also based on escalation clauses in contracts. However, the NEBC escalation clauses were being used at the same time as those in other contracts were abandoned and the security priority to diversify supply better explains the abnormally high NEBC prices.

The volume of coal contracted in 1987 also correlated with price indicating that the large scale mines established in the 1980s received preferential treatment. The questionnaire found that mine size and economies of scale declined from above average to below average importance to the JSM in the 1980s, but is expected to return to average importance to the sogo shosha in the 1990s (Appendix D). This is reflected in the relatively small effect the variable has on the equation. (The explanation for price variation is improved by 2%.)

The overall result of including quasi-integration variables in the coal price equation is that over 80% of the variation in prices is accounted for and the estimation of prices is improved markedly. The standard error of the estimated price declined from $5-6/t in the quality only equation to $3/t in the full equation. The result is a more complex equation, but a better prediction of coal prices.

The improved explanation of coal prices by recognising quasi-integration variables is not only found in the equations for all coking coals imported by Japan. The two major groups of coking coals (hard and soft/semi-soft) also demonstrate marked improvements in the fit between the regression equations and prices when quasi-integration variables are included (Tables 7.12 and 7.13).

Table 7.12: Comparison of FOB price estimate equations for hard coking coals imported into Japan

		attributes	quality	q+source	q+s+integration
1987	n=40	R^2	.00	.87	.88
	se ($/t)			2.97	2.82
1984	n=50	R^2	.14	.42	.67
	se ($/t)		5.70	4.66	3.50
1976	n=31	R^2	.69	.78	no
	se ($/t)		2.97	2.49	change

equations with integration variables:

1987 FOB = 45.36 + 30.18 NEBC -1.28 M + 1.12 CSN +.69 EPJMC

1984 FOB = 72.80 + 10.39 ESP - .37 VM - .56 M + 11.00 EQJMC - .65 A

1976 FOB = 63.39 + 7.96 USA - .21 VM - .78 A + 3.58 Can
no integration variables added

Although the 1976 equation for hard coking coal prices was not improved by quasi-integration variables, escalation clauses and the north east British Columbia regional variable were the most important factor to explain price variations in 1984 and 1987, respectively. In addition, the variables for equity investment by Japanese mining companies were significant. Both Quintette and Warkworth received higher prices than that predicted by their coal quality and direct minority investment provides an explanation.

The soft and semi-soft coking coals cover a wide range of coals not conventionally considered as coking coal. An interesting illustration of this change in the role of coal in the blast furnace is demonstrated by the value placed on volatile matter. Whereas volatile matter has a negative value in conventional coking coal because it vaporises and does not form part of the coke to support the blast furnace mixture, it has a positive value as a source of energy because it oxides first. Thus when semi-soft coals replace oil as the source of energy in the blast furnace, volatile matter has a positive value (as in the 1987 equation).

Table 7.13: Comparison of FOB price estimate equations for soft and semi-soft coking coals imported into Japan

	attributes	quality	q+source	q+s+integration
1987	n=43 R2	.56	.72	no
	se ($/t)	1.80	1.44	change
1984	n=21 R2	.78	no	.94
	se ($/t)	1.57	change	0.82
1976	n=17 R2	.90	no	.93
	se ($/t)	0.92	change	0.78

equations with integration variables:

1987 FOB = 33.63 +.79 CSN -.88 A -6.63 Col +.17 VM -2.17 SA
no integration variables added

1984 FOB = 53.15 + .66 CSN + .12 YR - 4.94 SA - .78 M

1976 FOB = 42.81 + 1.64 CSN - 1.37 M - .0089 Ovol

The most important variable to explain price variation was the CSN in each year. However, non-quality variables were also significant. The size of original contract volumes had a negative coefficient in 1976. Premiums were paid for small contracts of extra coal while the large scale mines (often with long term contracts) received lower prices. By 1984 the duration of a contract or trading relationship was positively correlated with price indicating that the positive value placed on new sources of supply had changed and that new semi-soft coking coals had to be offered at a lower price to displace old brands. This numerical finding supports the change in attitudes identified in the consumer survey.

By 1987 no integration variables were significant predictors of soft and semi-soft coking coal prices. This supports the general view that this segment of the market was extremely competitive at this time. Abundant supplies were available and fixed prices offered for a wide range of semi-soft coking coals. However, the differences identified in prices at the national level remained significant. Given these changes in the determinants of soft and semi-soft coal prices, a similar pattern may emerge among steam coals.

Table 7.14: Comparison of FOB price estimate equations for steam coals imported into Japan

	attributes		quality	q+source	q+s+integration
1987	n=31	R2	.13	.46	.71
	se ($/t)		3.74	2.95	2.18
1984	n=27	R2	.16	.57	.67
	se ($/t)		5.07	3.64	3.16
1980	n=21	R2	.22	.42	.58
	se ($/t)		4.00	3.46	2.95

equations with integration variables:

1987 FOB = -35.99 + 15.89 Can + .0089 Kcal + 11.17 Esp + 4.07 USSR + .15 VM

1984 FOB = 33.90 - 7.48 SA - 6.97 USSR + 1.16 EPCON + .25 VM

1980 FOB = 26.35 - 9.49 SA + 6.14 EQCON + .26 VM

The improvements in coking coal price prediction equations made by quasi-integration variables are even more pronounced in the steam coal trade. The poor predictions offered by quality variables were improved by country of supply variables (chapter 4), but the equations created above demonstrate the need for integration variables as well. The use of the escalation clause in the Blair Athol contract was still important in 1987. In 1984 the higher price received by Blair Athol is attributed to the 10% equity holding of the Japanese electricity utilities. Other investments by consumers in CAID mines in NSW were also associated with higher prices. These higher prices were predicted as an outcome of quasi-integration in the context of declining coal prices in 1984. However, the positive influence of equity on price in 1980 conflicts with the expected lower prices in the rapidly growing market. Instead, CAID was able to negotiate higher prices from its Japanese consumers[12].

An even better test of the importance of integration rather than quality alone can be made by comparing coals from the competitive supply countries of Australia, South Africa and Canada. These countries supply most of the steam coal imported by Japan and also provide data on more steam coal qualities (eight rather than five variables). The result is that an equation can be constructed to account for almost all of the variations in coal prices in the 1980s (Table 7.15). However, these equations include quasi-integration variables rather than a longer list of coal qualities. Each equation contained only one or two of the eight coal quality variables. To achieve a 99% prediction of price variation and reduce the standard error of price estimates from $3/t to $0.3/t, country of supply and quasi-integration variables were essential.

Additional integration variables reinforced the escalation clause and consumer investment variables discussed before. In 1984 both the existence of a long term contract and investment by sogo shosha had a positive influence on price. These findings support the argument that quasi-integration reduced the fall in prices for mines with these arrangements. This indicates that the Japanese consumers did not benefit unconditionally from their special investment, finance and contracting arrangements with mines. Benefits were derived from the expansion of supply capacity and the resulting fall in price. However, those mines with quasi-integration connections to Japanese consumers and traders suffered less in terms of price cuts than the independent mines.

The most important variables to predict steam coal prices in the 1980s were location or source of supply variables. This demonstrates the fragmented nature of the trade with the smaller price variations explained by quasi-integration arrangements and coal quality. However, price is not the only feature of interest. Contract duration is also important to the cashflow of a project.

Table 7.15: Comparison of FOB price estimate equations for steam coals with eight quality variables

	attributes		quality	q+source	q+s+integration
1987	n=19	R2	.23	.91	.99
	se ($/t)		3.01	1.06	0.32
1984	n=16	R2	.71	.97	.99
	se ($/t)		2.96	1.01	0.34
1980	n=21	R2	.22	.42	.58
	se ($/t)		4.00	3.46	2.95

equations with integration variables:

1987 FOB = -5.44 +16.23 Can +3.09 Aus +.0047 Kcal +8.91 ESP

1984 FOB = 48.14 - 8.62 SA + 8.34 Can - 2.60 S - .28 A + 6.76 ESP + .70 LTC + .052 EPJSS

1980 FOB = 26.35 - 9.49 SA + 6.14 EQCON + .26 VM

7.5.2 Quasi-integration and contract duration

The linkage between contract duration and sogo shosha investment is strongly demonstrated by the Japanese coking coal trade. Quasi-integration is argued to promote contract duration (Joskow 1987) and the Japanese linkages identified earlier provide a substantive data set to test the hypothesis.

Of the 516 transactions arranged by sogo shosha in 1976, 51% were still active in 1987 (Table 7.16). However, the percentage of transactions remaining active over the 11 year period is much higher among those from mines with sogo shosha investment. Purchases of coal from these mines were still being made in 66% of the cases while only 47% of the transactions for coal from independent mines remained active. This finding supports the argument that sogo shosha promote brands which they have an equity interest in. Alternatively, they may have made good decisions in selecting the most viable mines when investment was made. In either case, the participation of sogo shosha in a joint venture achieved longer term cashflows for the project.

Table 7.16: Contract duration and sogo shosha investment

sogo shosha	equity in mine	# transactions in 1976	active in 1987	duration 1976-87 %
Mitsubishi	yes	57	51	89
	no	52	27	52
Mitsui	yes	12	9	75
	no	89	61	69
Marubeni	yes	1	1	100
	no	79	25	32
C.Itoh	yes	22	6	27
	no	36	11	31
Nissho Iwai	yes	19	6	32
	no	30	8	27
Toyo Menka	yes	0	0	
	no	44	19	43
Sumitomo	yes	1	1	100
	no	36	21	58
Nichimen	yes	0	0	
	no	31	16	52
Kanematsu Gosho	yes	0	0	
	no	7	3	43
sogo shosha	yes	112	74	66
	no	404	191	47
	total	516	265	51

source: contract data

7.6 Conclusion

This chapter has demonstrated the importance of finance in the expansion of global coal trade in the 1980s. The financial structure is used to create credit and provide loans for investment in new projects. These loans can be forms of 'quasi-integration' where they are offered as part of an integrated package which includes minority equity holdings, long term contracts and loans from consumers to producers. In these cases, the mine is often dependent upon a single consumer or national industry. The resulting coal trade thus forms part of an integrated system where elements of the production, security and financial structures are combined to support an integrated trading network. The Japanese policy of develop and import projects based on 'loans-cum-purchases' provides numerous examples of this integrated approach.

These quasi-integration links also contribute to the trade pattern with integrated mines receiving significantly higher prices and longer contract duration in the 1980s. Contract data for hard coking coal, soft/semi-soft coking coal and steam coal all demonstrate the importance of quasi-integration to improve the prediction of coal prices and better understand the persistence of coal trade patterns with significant price differentials.

The financial structure can also offer loans to projects independent of their links with the production structure. Once again long term contracts are considered an important part of the financial package. They are used to ensure future cashflow and loan repayments. Despite the experience of only partial fulfilment of many long term contract provisions in the 1980s, it is expected that they will continue to be an important part of the process of financing new mines in the 1990s.

Finally, the growing importance of the financial structure is demonstrated by its dominant role in financing new capital investment and the takeover of existing coal companies. As a result, the financial structure can also emerge as a conflicting interest group to established parties in the production structure. Both cooperation and conflict were found among the major parties in the global coal trade. This mixture of conflict and cooperation explains how the coal trade is fragmented from a uniform global exchange into specialised sets of transactions meeting different trade objectives.

Cooperation or coordination among trade structures is best illustrated by the sogo shosha who invest in the production structure, arrange loans and contracts as part of the financial structure and promote diversity of supply as part of the security structure. To achieve these many objectives, the sogo shosha specialise as collectors and users of information. This central importance of information in the coal trade is investigated next.

Endnotes:

1. The financial structure was divided into two sections by Strange (1988). The first component creates credit and is exemplified by banks. However, the banks' desire to extend increasing amounts of credit is limited by government regulation (to limit the instability of the credit system and control inflation). Another influence over the creation of credit is the link between the financial and production structures. Loans may be made by consumers to the producers of raw materials which they import. Alternatively, loans may be made independent of the production structure to create new trade partners or new corporate entities with increased market power.

The second component of the international financial structure is the exchange rate system where the relative strength of different currencies is determined by a combination of government and market decisions. In this study, the creation of credit is of more interest than the regulation of exchange rates. Exchange rates affect the competitive position of mines in different countries, but the fragmentation of coal trade prices demonstrated in Chapter 4 indicates that this is not as central a point in the analysis as expected by the conventional least cost trade model.

2. The source of this data is the annual financial survey of the Australian coal industry conducted by Coopers & Lybrand for the Australian Coal Association. Respondents to the survey account for 80-90% of Australian coal production (excluding that from electric utility mines). Although incomplete, it provides the most comprehensive view of industry finance available.

3. In addition to the CQCA joint venture, BHP acquired 100% ownership of Utah International's American coal mines and other international holdings.

4. Blackwater 1.4mtpa, Goonyella 4.1mtpa, Gregory 1.94mtpa, Moura 1.6mtpa, Norwich Park 1.3mtpa, Peak Downs 3.0mtpa and Saraji 2.7mtpa (Coal Manual 1985).

5. The Bank of Montreal and Canadian Imperial Bank of Commerce were the Canadian leading banks while Credit Lyonnais was the French leading bank (Coal Manual 1985:303).

6. Despite the intense demand for capital in Japan for post-war reconstruction, a loan was made to India in 1954 to fund $8 million of Japanese equipment purchases for the $50 million Rourkela iron ore mine (D'Cruz 1979:108).

7. Mitsui Bank was also the leading bank in arranging the finance of the Blair Athol coal mine in Queensland. Neither Mitsui & Co nor Mitsui Mining invested in the project. However, Mitsui & Co was one of the three sogo shosha importing the coal to Japan and the bank's financial activities complemented this trading role (Edgington 1988:197; Coal Manual 1985:465).

8. contract details for Table 7.5 are as follows:

mine	buyer	contract start	end	tonnage
BHP (Gregory)	JSM	1980	1995	1900
	China Steel	1982	1996	250
	Pohang	1980	1994	500
	China L&P	198?	lt	120
German Creek	JSM	1982	1991	1500
	China Steel	1982	1991	300
	Cockerill	1982	lt	100
	Iran	1983	lt	300
	Pohang	1982	1991	200
	Siderbras	1982	1991	200
	British Steel	1982	1991	800
	Ensidesa	1982	1991	300
Oaky Creek	JSM	1983	1985	500
	Ensidesa	1983	1990	500
	Hoogovens	198?	lt	500
	Italsider	1983	1990	700
Greenhills	JSM	1983	1986	750
	China L&P	1983	1985	250
	China Steel	1983	1990	300
	Kepco	1983	lt	350
	Pohang	1983	2002	500
	Elkraft	1982	1991	300
Line Creek	JSM	1983	1997	1000
	Kepco	1982	lt	750

note: tonnage is typical for the period, but does not represent smaller uptakes in the first couple years

9. contract details for Table 7.6 are as follows:

mine	buyer	contract start	end	tonnage
Drayton	Hokkaido EPC	1985	1994	300
	Mitsui Mining	1983	1987	200
	Shikoku EPC	1984	1988	100
	Toyo Soda	1983	1987	150
	Kepco	1983	lt	500
	CEGB	1988	1990	400
	Kyushu EPC	1983	1991	180
Hunter Valley	Mitsubishi Chem	1979	1998	400
	W.Germany	1979	1991	300
	Kyushu EPC	1988	1997	300
	Ube Ind	1979	1998	750
	NCSC	1980	2009	500
	Hong Kong Electric	1981	lt	400
	Kepco	1981	lt	250
	NEB	198?	lt	120
	EFO	198?	lt	500
Warkworth	JSM	1981	1991	500
	Mitsubishi Chem	1981	1991	50
	EPDC	1981	1991	500
	Hokuriku EPC	1984	1987	220
	Mitsubishi MC	1981	1991	500
Coal Valley	Ontario Hydro	198?	lt	1800
	W.Germany	1982	1986	450
	Chugoku EPC	1982	1986	150

9. contd mine	buyer	contract start	end	tonnage
	Hokkaido EPC	1982	1986	200
	Ono Cement	1982	1986	200
	Toyo Soda	1982	1986	100
	Ube Ind	1982	1986	500
Obed Marsh	Kepco	1983	lt	
	Taipower	1983	lt	
	ATIC	1983	1986	500
	Denmark	1983	1985	500
	Chugoku EPC	1984	1988	500
El Cerrejon	China L&P	1987	1996	1000
(Carbocol)	Cementos Panama	1985	1990	36
	Electric Fuels Corp	1985	1989	500
	NCSC	1986	1990	1000
	ATIC	1985	1987	1000
	ATIC	1988	1991	900
	Carboex	1985	1987	600
	CEGB	1988	1990	400
	EFO	1985	1990	300
	Finnish Sugar	1985	1987	25
El Cerrejon	St.Johns RPP	1987	1999	800
(Intercor)	Elkraft	1986	1990	600
	Elsam	1985	1990	2000
	ESB	1986	1992	400
	Fincoal	1985	1987	400
Clarence	Kepco	1982	lt	450
	NCSC	1980	2013	500
	Taipower	1984	lt	300
	ATIC	1980	1986	500
Newlands	Shikoku	1984	1988	200
	Sumitomo	1984	1988	100
	China L&P	1984	lt	400
	NEB	198?	lt	120
	Taio Paper	1988	1990	150
Saxonvale	Mitsui Mining	1982	1991	110
	Oji Paper	1982	1991	40
	Shikoku	1982	1991	50
	Sumitomo Cement	1982	lt	400
	Onoda Cement	1982	lt	200
	Tepco	1984	1988	200
	EPDC	lt	1988	200
	Tohoku EPC	1984	1988	50
Ulan	Chugoku EPC	1980	1987	400
	Den	1981	1986	50
	Hokkaido	1984	2004	200
	Kyushu	1988	2007	200
	Mitsubishi MC	1981	1987	100
	Tohoku EPC	1983	2003	
	Kepco	1982	lt	600
	PNOC	198?	lt	700
Gencor	Enel	198?	lt	300
	Hokuriku	1984	lt	220
	Volkswagen	1985	1989	190
Shell SA	Enel	197?	lt	1000
	Atic	lt	1987	p1000
	GKE	198?	lt	
Shell (Rietspruit)	EPDC	1981	1985	
Kangra	Cementir	198?	+5	
	Enel	198?	lt	400

source: as for Table 7.5

10. contract details for Table 7.7 are as follows:

mine	buyer	contract start	end	tonnage
Bayswater	Sumitomo	1975	1984	300
	Chugoku EPC	1987	1991	80
	CEGB	1982	1986	300
	Kepco	198?	lt	40
CQCA (various)	ATIC	1978	1987	2000
	British Steel	197?	lt	
	Cockerill	197?	lt	300
	Italsider	197?	lt	1500
	Mimex	198?	lt	800
CQCA (Blackwater)	JSM	1968	1977	3200
	Al Nasr	1982	1984	300
	China Steel	lt	1992	150
	Pohang	lt	1986	200
CQCA (Goonyella)	JSM	1971	1984	4000
	JSM	1984	1986	2200
	Pohang	lt	1986	200
	China Steel	1976	1981	150
CQCA (Norwich Park)	JSM	1980	1987	1300
	China Steel	1979	1992	300
	Pohang	1979	1986	200
CQCA (Peak Downs)	JSM	1972	1984	3000
CQCA (Saraji)	JSM	1975	1984	2700
Lemmington	JSM	1974	1983	1100
	EPDC	1983	1986	200
	Kyushu EPC	1988	2013	300
	China L&P	1987	1991	500
	EFO	198?	lt	200
Lithgow	EPDC	1980	1984	300
	Chugiku EPC	1980	1984	400
	Hokkaido EPC	1985	1994	100
	Kyushu EPC	1989	1997	200
	ATIC	1980	1985	300
	CEGB	1980	1984	500
	Sumitomo Metal	1974	1984	350
Moura	JSM	1965	1977	4000
	Chugoku EPC	1984	1988	400
	Hokkaido EPC	1985	1994	150
	Hokuriku EPC	1984	1993	165
Balmer	JSM	1970	1984	4750
	JSM	1985	1990	2400
	Energy Factors	1988	1992	100
	Siderbras	1989	1994	300
	British Steel	1985	lt	150
	Elkraft	1981	1989	300
Balmer ox	Sumitomo Metal	1975	1984	100
Coal Mountain	Sumitomo Metal	1975	1977	100
	China Cement	1982	1987	500
Fording R	JSM	1972	1986	3000
	JSM	1987	1989	1500
	Kepco	1981	lt	200
	Pohang		lt	
	Siderchil	1980	lt	200
	Siderbras		lt	200

10. contd mine	buyer	contract start	end	tonnage
Luscar	JSM	1970	1984	2000
	JSM	1981	1990	2750
	Ontario Hydro	198?	lt	
Smoky River	JSM	1969	1984	
	JSM	1973	1974	1500
	JSM	1975	1978	1500
	China Steel	198?	lt	70
	Pohang	1982	1986	200
	Pohang	1987	1991	300
Witbank	JSM	1972	1986	2700
	NCSC	1983	lt	800
	CdF	198?	lt	400
	CdF Energie	198?	lt	450
	Enel	197?	lt	1000
	Enel	1984	1991	1000
	EPDC	1980	1984	300
Weglokoks (First Maya)	JSM	1974	1976	1000
Weglokoks	Siderbras	1980	lt	2000
	Austrian el	198?		1000
	EFO	198?	lt	300
	Elkraft	197?	1984	1000
	Enel	197?	lt	1000
	GKE	1980	1989	600
	Hoogovens	1977	1986	400
Cook	Pohang	1983	1988	100
	Ssangyong	1983	lt	200
Ermelo	EPDC	1980	1984	300
	Hokuriku EPC	1984	lt	110
Bloomfield	Tohoku EPC	1983	2002	200
	Toyo Soda	1980	1984	80
A&B (Western Blend)	Nippon Cement	1980	1984	500
A&B (Invincible)	China L&P	1982	lt	200
	Shell Aus	1983	lt	500
	ATIC	1983	1987	500
	CEGB	1973	1987	750
	Denmark	1983	1987	200
Macquarie	Idemitsu	1983	1997	400
	Tohoku EPC	1981	1990	150
	Taio Paper	1988	1990	150
Miller	JSM	1969	1974	1500
	EPDC	1980	1984	300
	Kepco	1983	lt	600
	Pohang	1983	lt	500
Wambo	Chugoku EPC	1980	1984	500
	Hokkaido EPC	1985	1994	200
	Nippon Cement	1980	1984	250
	Shikoku	1984	1988	150

source: as for Table 7.5

11. examples include:

coal brand	buyer	contract start	end	tonnage
Big Ben (Hunter Valley)	JSM	1975	1979	900
Daiyon (Hunter Valley)	JSM	1969	1974	
	JSM	1976	1985	2000
Gross Valley (S.Coast)	JSM	1974	1983	100
	CEGB	1976	1982	200
Rathluba (Hunter Valley)	JSM	1969	1974	200
	JSM	1974	1978	350

12. A similar pattern was found in the equations for CIF steam coal prices. Quasi-integration variables improved price prediction in each of the three years studied.

Table 7.A: Comparison of CIF price estimate equations for steam coals imported into Japan

	attributes	quality	q+source	q+s+integration
1987 n=31	R2	no	.45	.65
	se ($/t)	equation	2.97	2.37
1984 n=27	R2	.24	.69	.77
	se ($/t)	5.51	3.49	3.00
1980 n=21	R2	no	no	.20
	se ($/t)	equation	equation	4.21

equations with integration variables:

1987 CIF = -20.04 + 17.97 Can + .0085 Kcal + 9.96 ESP

1984 CIF = 44.39 - 11.79 USSR - 4.02 SA + .97 EPCON + .31 VM - 4.85 S

1980 CIF = 48.04 + 7.73 EQCON

Chapter 8

The information structure:

Trade information and coordination

8.1 Introduction

> 'For too long, many academic economists have indulged themselves with static concepts of the 'comparative advantage theory' of foreign trade, and have totally avoided the importance of international marketing. ...the intricate workings of foreign market intelligence monitoring, as well as the complex logistics and finances of foreign trade ... (that) pose formidable barriers-to-entry to exports.' (Tsurumi with Tsurumi 1984:1)

> 'If any single factor explains Japanese success, it is the group-directed quest for knowledge.' (Vogel 1979:27)

Information has value, even if it is not priced. The acquisition of information and its treatment as a private rather than a public good illustrates this point. Indeed, information may be transferred from the private to public domain, but still hold significant value for the critical period when trade agreements are negotiated. Access to information is thus argued to be of central importance to the determination of trade patterns. This hypothesis stands in contrast to the classical economic assumption of perfect information.

Information and the structure whereby information is collected, organised, transferred and applied to trade are usually ignored in trade studies. One of the notable exceptions is the Gaskin (1981) assessment of the European steam coal trade. He called for improved access to trade information by collecting and publishing contract data. Unfortunately, the recommendation was not implemented and information is rarely made public, but treated as a private commodity with specialised consultants and newsletters providing the best insights into European coal imports. Academic studies rarely incorporate contract details[1]. To overcome this deficiency, this chapter argues that information is a critical component in the trade process and the structures which collect and use market information are of vital concern in any study of trade patterns.

The specialised trade information structures identified in this chapter illustrate the central argument of the thesis; that trade patterns are shaped by several sets of structures rather than simple market or administrative principles alone. Indeed, the information structure is an essential means to achieve both the efficiency and the security/diversity of supply objectives identified earlier.

The information structure can be divided into three levels: beliefs, knowledge/information and channels of communication. As in the case of the financial structure, power in the information structure is important in both the negative and positive direction. The decision to withhold or restrict information is just as important as the positive decision to provide information (Strange 1988:115).

Changes in information channels have received more academic attention than other changes in the information structure[2]. However, this attention has been concentrated on the technology and changing use of satellite communication and computer storage and exchange of information. In this study, European and Japanese trading houses are identified as important information channels in the coal trade.

The structural model of trade incorporates information directly into the model. This stands in contrast to the traditional representation of trade in free market models which assume a frictionless market where transactions meet the objectives of perfectly informed buyers and sellers with no special arrangements. Clear distinctions are also made from the administrative model of internal transfers that are efficiently administered within a fully informed corporate entity. Both of these models are refuted in this chapter. Instead, the information structure can consist of specialised information owners who do not own the commodity traded, but use their information to promote and coordinate trade. The transaction between producer and consumer is argued to be complex, yet mutually beneficial.

The sogo shosha of Japan provide an excellent illustration of a specialised trade structure which coordinates information to create trade flows. They facilitate trade through the reduction of transaction costs, financial risk and trade uncertainty. One of the ways they achieve this is to create and coordinate complete product systems where economies of scale can be achieved to reduce unit costs. To better understand the role of these trading structures, the interaction between trading companies and their clients (consumers and producers) will be explored in detail.

8.2 Incorporating information in the trade model

> '(Sogo shosha are) probably the world's most efficient marketing channel'. (former US Secretary of Commerce Peter Peterson in Young 1979:xix)

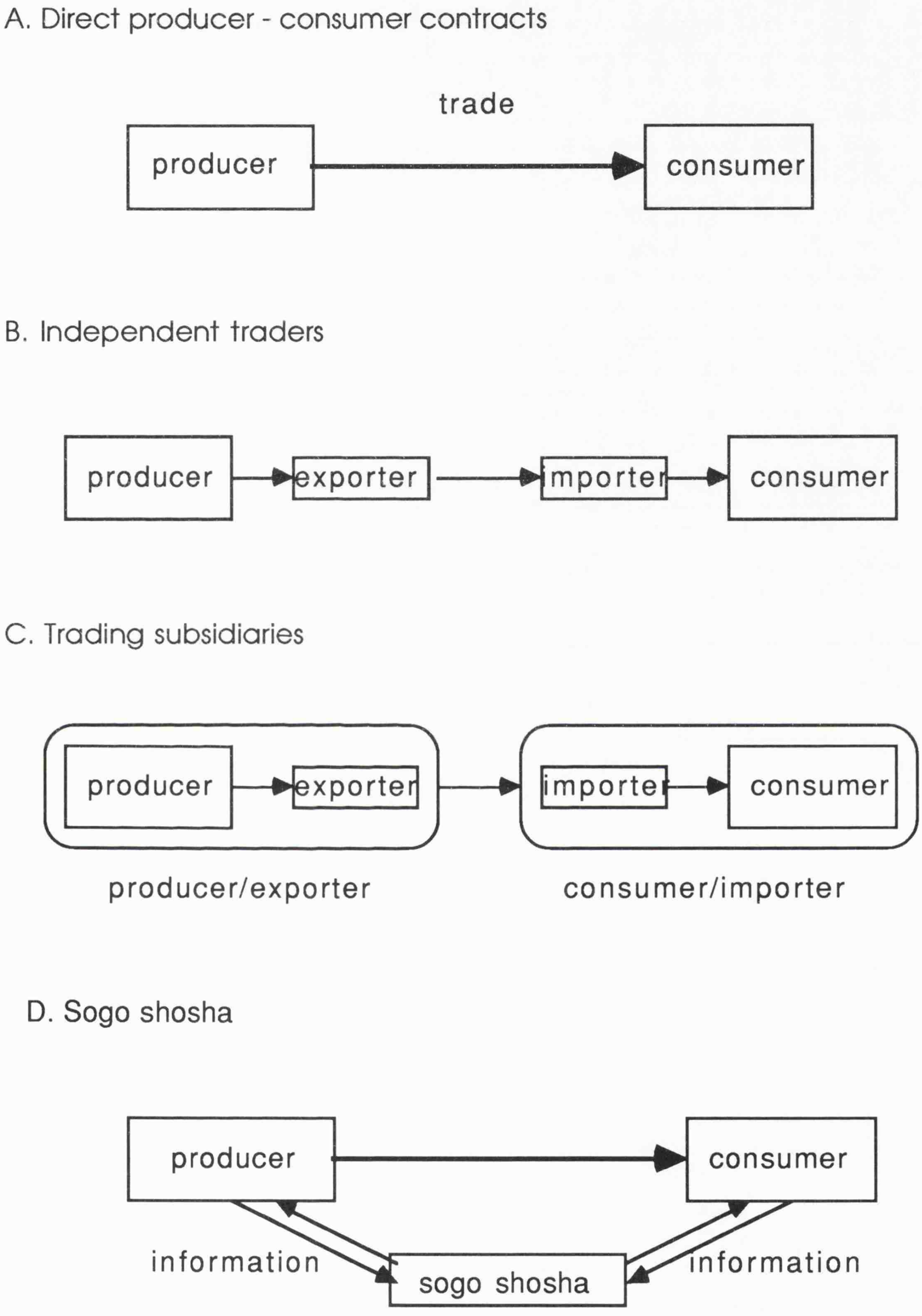
Global coal trade has been shown to conform to neither the commodity market nor captive mine model. Instead, elements of both are found. On one hand, consumers pay different prices for coal from different countries, while on the other hand suppliers compete at the national level and in international spot markets. Some mines are integrated into the supply system of particular consumers, but the integration is not as complete as in domestic coal industries. Instead, several groups of consumers have established 'quasi-integration' systems where minority equity investment, special loans and long term contracts are used to support particular trade partnerships. This variety of structures in the global coal trade is further integrated by the establishment of a specialised trade information structure.

Specialised trading companies are argued to reduce transaction costs and unit (product) costs through the collection and use of information: first to facilitate a deal or agreed transaction and second to coordinate a stable trade delivery system. In this way, they share the interests of both parties to the transaction: costs are lowered and the client's international competitive position enhanced. This specialised use of information for transaction cost reduction and system coordination is best understood by contrasting it with the two conventional trade models of frictionless markets and vertical integration.

Traders can be introduced into the conventional market model as distinct entities which perform the trading function of selling the coal to, or buying the coal from, the international market (Figure 8.1a,b). In this case the trader is a principal who owns the coal for a period of time. Gaskin (1981) illustrated how two types of traders (exporters and importers) are introduced into the conventional trade sequence. The trade process is simply divided into three specialised exchanges rather than the single exchange (from producer to consumer) considered before.

Exporters can buy coal from producers and then sell it on the international market. This pattern of exporters acting as principals in the trade is most common in the American coal industry where coal from several mines may be purchased and exported by a single exporter. Exporters also buy excess coal from large producers in many countries when the mining company has not arranged sales for all of its output. Importers operate in a similar manner by buying coal from international sources and then selling it to many smaller domestic consumers. The house and industrial coal markets of Europe have a long tradition of importers fulfilling this role. Importers may arrange the import of large shipments which are divided among many consumers or they may buy the excess coal from a large shipment when most of the cargo is committed to another buyer.

Figure 8.1: Alternative models of trade and traders



This pattern of dividing the coal trade into a series of transactions is simply a refinement of the market model and illustrates the specialisation of tasks and extension of markets advocated by Stigler (1951). Traders are able to operate profitably because they are able to buy large quantities at low unit costs and then sell to small users at lower unit costs than the consumers could have negotiated on their own (but high enough to create profits for the trader). This type of trader is common in the European coal trade and accounts for their reputation of reaching the markets which no one else can supply.

The problem with increased market fragmentation and specialisation was pointed out by Coase (1937). Each transaction in the marketplace has an inherent cost. By recognising the transaction cost of each exchange in the marketplace, the incentive for creating organisations which integrate rather than separate tasks is found. The gain from integration is the reduction in transaction costs (including information collection, communication and partner searches) (Arrow 1975). The cost of conducting transactions is thus reduced to the internal (within the firm) cost of transfer (Coase 1988b:32). When transaction costs are high the incentive to integrate vertically is also high (Figure 8.1c). In these cases, the trading function is often integrated with the production or consumption functions.

The large Australian, Canadian, South African and American coal producers often act as their own exporters or sellers. A marketing division or affiliated 'Coal Sales Company' is created to market the company's product. Large consumers often make a similar decision and use their purchasing division or an affiliated importer to arrange their supply needs. The increased European demand for steam coal in power stations in the late 1970s and 1980s was accompanied by the formation of several new coal importers to purchase coal on behalf of groups of domestic power companies. The structure of these consumer-importer configurations depended in part on the structure of the domestic power industry. Where the power industry was a domestic monopoly as in the case of the CEGB and Enel, the consumer held direct negotiations with coal suppliers. Where electricity generation was more fragmented, joint purchasing companies or importers like Caralec, Carboex, Elkraft, Elsam, GKE, and Pool des Calories were established to buy coal on behalf of a group of consumers.

In addition to the specialised exporters and importers noted above, many trading companies combine more than one part of the trade sequence. Some traders act as both the exporter and importer in the same transaction. Alternatively they will combine the trading role (typically importing) with shipping and short term financial arrangements. In this case they will buy the coal from the producer at an fob price and sell it to a consumer at a cif price equivalent to fob plus freight and the commission. When this is arranged on a 'back to back' basis the trader has paired contracts with a producer and a consumer and faces no risk (Gaskin 1981). In other cases, the traders assume more risk or market exposure by arranging fob, cif and freight prices independently. They use their market information to judge the best combination to meet consumer needs and generate a profit for themselves.

An alternative to the trader acting as a principal (buying and selling coal) and the integrated trader (part of a producer or consumer company) is the trader acting as an agent:

> '(T)he agent brings the two parties together but is not involved in a contractual capacity in the movement of the coal. He may continue to act for one of the parties in monitoring coal shipments and handling documentation; but in the contract he is not involved as a principal, that is, at no point does he 'own' the coal.' (Gaskin 1981:12).

Because agents do not own the coal Gaskin excluded them from the transaction sequence in Figure 8.1. Instead a line of interest parallel to the transaction was drawn for the agent to illustrate how they connected the exporter to the consumer. The most developed group of agents are the sogo shosha. Although they do not own the coal, they assist in the transaction, frequently arrange the shipping, insurance, quality testing and even provide short term finance for the trade. In short, traders can adopt any of several roles in the coal trade.

The reason for the persistence of traders in the global coal trade is argued to be their ability to provide information services (including coordination) to producers and consumers. These services are important for several reasons. Information is an important means to achieve the consumer objectives identified earlier. In particular, the international information network of traders facilitates security objectives by diversifying supply sources without the consumers having to conduct international searches on their own. In this way, traders reduce transaction costs.

Transaction costs arise from a variety of sources: asset specificity, information costs, etc. [3] The sunk investment in any type of transaction specific asset (technology, plant, human capital, etc.) creates a string of potentially appropriable 'quasi-rents' (the difference between anticipated and second best uses) which can be gained after the investment is made (Klein, Crawford and Alchian 1978; Joskow 1985). One party can then 'hold up' the other to gain a larger share of these rents than that agreed in the original contract. Contracts are often designed to reduce this friction by specifying long term volumes and prices, but these provisions have become increasingly flexible (less binding) (chapter 7).

Given the inability of contracts to overcome the problems created by transaction costs, the role of trading companies reducing these costs warrants attention. For example, trading companies can reduce the information cost of searching for diverse trading partners. Rather than each consumer or producer searching for desired trading partners, they can approach a trading company to use its global network of offices and specialised staff to identify appropriate partners. Once a trading company has invested its human and corporate resources in gaining information about a particular industry, it will want to sell this information to as many clients as possible, and for as long as possible, because of the high initial cost and relatively low incremental cost. Economies of scale can be achieved in the information network and the service provided to clients. Not surprisingly, trading companies try to develop long term trading relations where their assets will be of value in future years rather than just for a single transaction. The success of traders in fulfilling this information role is assessed in Europe and Japan.

8.3 European coal traders

> 'SSM's in depth knowledge and close contacts with the coal market are offered to coal mining companies, which in this way acquire an immediate interface with SSM's well established sales organization and its extensive know-how in operational and logistical services in the downstream markets of most coal importing countries in the world.'
> '(C)ustomers are assured of SSM taking care of all, or part of, the necessary intermediate actions right from locating the required coal until the final delivery at the customer's stockyard. With the increasing costs of energy supplies SSM provides both reliability and flexibility for secured and diversified coal supplies at competitive terms.' SSM (1987).

European coal traders have a long and varied history. SSM provides an example of a major trader active in the coal trade since 1896. They purchase large quantities of coal and distribute it among many small consumers. However, the trading role of commercial market intermediaries has been under pressure in Europe for several reasons. First, coal has continued to lose its marketshare for energy supply to small household and industrial users. Second, the major coal consumers (electric utilities in particular) grew in size to a point where they decided to conduct their own market searches, avoid commissions paid to traders and negotiate their own contracts directly with producers and exporters. Third, the growth in coal demand was in the steam coal sector where the range of coal attributes needing to be monitored was less than in the coking coal sector. Fourth, new sources of trade information emerged in the form of industry newsletters, consultants and frequent conferences. Fifth, the average size of coal shipments increased, especially on the long haul routes from South Africa and Australia.

> 'It is frequently said that larger carriers, involving bigger shipments, have made life increasingly difficult for the small trader for whom a typical contract may be too small to fill even a single hold of a modern carrier.' (Gaskin 1981:13)

The size of vessels active in the European coal trade has shifted progressively from 50-60,000 dwt Panamax vessels to 110,000 dwt Capesize vessels in the 1980s. These larger vessels enable coal to be shipped over long distances at lower unit costs. For example, using 160,000 dwt carriers instead of 60,000 dwt vessels reduces transport costs by an estimated 19% (Kojima cited in Ozawa 1979:90). Small traders find it difficult to handle such large tonnages, especially when their customers have limited stockyards and require regular small shipments.

The result of these pressures on coal traders is the concentration of trading activities in the hands of a few major companies despite dozens of firms maintaining small and specialised roles in the industry[4]. One of the enduring roles of coal traders is the transhipment of coal from large carriers onto small coastal vessels for delivery in northern Europe or onto barges for shipment up the Rhine to German, Austrian and even Swiss customers. The Dutch traders based in Rotterdam illustrate this role. SSM has the largest barge fleet on the Rhine and maintains a prominent position in the continental and international coal trade.

The largest European traders are active not only in Europe but also in other continents. Most large traders have offices in the USA reflecting its traditional role in supplying coking coal to Europe. German traders like Hansen Neuerburg, Ruhrkohle, Stinnes and Thyssen Carbometal are joined by Dutch traders Anker Coal and SSM. Each of these companies has strong interests in trans-Atlantic coal trade (Table 8.1). However, they also have offices or representatives in other supply countries like, South Africa, Australia and Canada. In the

1980s, Colombia and China also became sources of coal for these traders[5]. The result is that the traders can supply coal to European customers from a variety of sources.

Table 8.1: Major coal traders and customers in Europe

traders: consumer	Anker	Hansen	Phibro	Ruhrk	SSM	Stinnes	Thyssen
Belgium				x		x	x
Cockerill				x			x
Denmark		x	x	x		x	x
Elkraft			x	x		x	x
Elsam		x		x		x	x
Finland (IVO)				x			
France	x		x	x		x	
EdF	x		x	x			
Greece (Heracles and Titan cem)							x
Ireland (ESB)							x
Italy					x		
Netherlands	x			x	x		
ACZC					x		
GKE	x			x	x		
Hoogovens				x	x		
Norway (Norsk Kok)			x				
Portugal	x				x		
EdP	x						
Sesil					x		
Spain			x			x	x
Caralec/Carboex			x			x	
Ensidesa							x
Sweden			x	x			x
Malmoe			x				
SSAB			x	x			x
UK	x	x	x	x	x	x	
BSC				x			
CEGB				x	x	x	
NIES					x		
SSEB	x	x					
W.Germany	x			x	x	x	x

note: Phibro is a USA based trader
source: contract data set

European consumers regularly supplied by traders in the 1980s are presented in Table 8.1[6]. Most of the customers identified are in northern Europe. This is explained in part by the need of many consumers in northern Europe to have their coal transferred from large carriers onto small coastal carriers because of the limited port size in most Scandinavian and UK areas. In other cases, it reflects the traditional links which traders have with their national and regional consumers.

The prominent role of European traders as exporters of USA coal enabled them to participate in the supply of many non-European markets as well. For example, Stinnes, Hansen Neuerburg and Thyssen were significant USA exporters to Japan in the 1970s. This export role declined in the 1980s, but they expanded activity in other markets (Table 8.2).

Table 8.2: Major coal traders and non-European customers

traders: consumer	Anker	Hansen	Phibro	Ruhrk	SSM	Stinnes	Thyssen
Eastern Europe							
Albania							x
Romania							x
Mimex							x
Yugoslavia				x		x	x
Lukavac				x		x	
Sisak				x			x
Middle East, north Africa							
Morocco			x	x	x		
cement (Cior, Nador)			x				
ONdE				x	x		
Turkey		x	x	x		x	x
Ankara Mun		x					
cement (Adana)							x
TDCI		x	x	x		x	
Asia							
Hong Kong						x	
Hong Kong Electric						x	
Pakistan		x					
Pasmic		x					
Philippines			x				
PNOC			x				
S.Korea			x				x
Pohang							x
Tongyang			x				
Taiwan		x					
China Steel		x					
South America							
Argentina				x			
Somisa				x			
North America							
Canada	x						x
cement (St. L)							x
Ontario Hydro	x						

note: Phibro is a USA based trader
source: contract data set

The large European trading companies have good contacts in Eastern Europe and are able to facilitate countertrade deals which coal producers may prefer to avoid without the assistance of an intermediary. Similarly, the business practices in some Middle East and north African markets are reported to require special arrangements. In each case, traders have proven their adaptability. Even the Asian and South American markets have been successfully entered by traders selling coal from a variety of international sources.

In some cases traders are the exclusive sellers of selected coal brands, while in other cases many traders may sell the same coal in the same market. For example, the import of Polish coal is typically handled by only one trader per country. In the case of West Germany, where importers held the government allocated import quotas until 1987 (they were transferred to consumers in 1988), a special trading company was established. Polkohle is the sole importer of Polish coal and has eight German trading companies as equity holders along with Weglokoks, the sole exporter of Polish coal.

The role of Polkohle was stable for years, while other traders faced rapid change. For example, the German trader Krupp Handel, was appointed the sole European agent for the import of Cerrejon coal from Carbocol, but many consumers preferred to deal directly with Carbocol or Intercor (CWI 843:8). The result was that Krupp was bypassed with most Cerrejon coal contracts signed directly with the producer.

In addition to the long established European coal traders, new traders entered the market in the 1980s. Sometimes small firms would be started by staff with experience in one of the established companies. More significant was the move by oil companies to use their oil trade experience to establish a coal trade network. Shell and BP were the two most prominent oil companies in the international coal trade in the early 1980s[7], but Total, Agip, Exxon and Arco also became significant actors during the 1980s. Different strategies were adopted by individual companies. Some oil companies restricted their activities to production and export like most coal companies. Others established a complete coal chain of production, export, transport, import and delivery to meet the needs of their clients.

The combined production and trading role of some oil companies demonstrates their belief in the importance of vertically integrated trade systems. The control over international market information and coordination of delivery systems was thus internalised within a single corporate entity. Information services simply became one of the many tasks administered within the corporation. This model of complete corporate integration is assumed to reduce transaction and coordination costs through internal efficiencies rather than the specialised external services offered by conventional European coal traders.

Neither of these models (of information controlled by complete integration or specialised external traders) dominate global coal trade. European oil companies and coal traders illustrate these models, but a different pattern is found in Japan. The Japanese sogo shosha usually act as specialised agents who control and coordinate information related to trade (Figure 8.1d). They combine attributes of both the internal coordination and the external market, information specialist models to create the largest information structure in the coal trade.

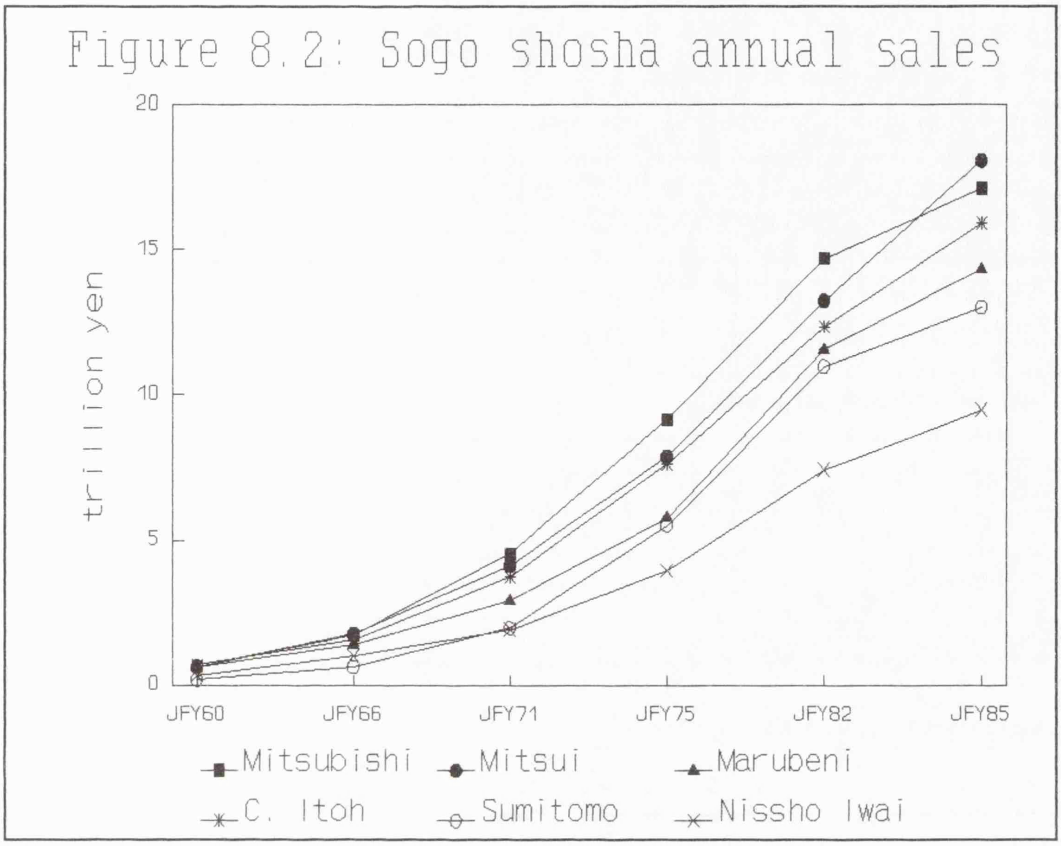
8.4 The sogo shosha

> 'Sogo shosha is usually translated into English as "general trading firm", "trading house", or "comprehensive trader", but these companies do far more than simply buy and sell goods for a profit. They are a unique and significant type of institution that deserves to be understood on its own terms. Rather than utilizing an inadequate translation, we simply call them sogo shosha, with the intention of adding a new word and concept to the English language by borrowing from Japanese.' (Yoshino and Lifson 1986:3).

Sogo shosha use information to facilitate trade at both the transaction and the product system level. At the transaction level, sogo shosha share some of the interests of both parties to the transaction (Figure 8.1d). Sogo shosha profits are generally based on trade volumes with a small commission earned on each unit traded. In the case of raw materials for the steel mills, commissions are generally in the range of 0.5% - 2% of value. Given this small level of commission, priority is placed on trade volumes and the sogo shosha often set their company objectives in terms of maximum value of sales or turnover. Large trade flows are therefore desired and information is used to achieve this end.

Sogo shosha are often defined as the nine Japanese general trading companies with a global trading network which coordinates flows in a diverse range of products. The two largest sogo shosha are Mitsubishi Corporation and Mitsui & Co., each with an annual turnover of 17-18 trillion yen ($100 billion) in JFY85 (Mitsubishi 1986; Mitsui 1986). The range of goods and services traded seems unlimited with 20,000 different products and many services handled. Their global networks typically include over 200 offices distributed among 80 countries. The value of annual sales consistently ranks sogo shosha as 6 of the 10 largest companies in the world (Times 1989). The total turnover of these companies has grown by a factor of 10 in the last 20 years (Figure 8.2).

In terms of aggregate importance, Mitsubishi Corp. and Mitsui & Co. handled nearly 30% of all Japanese import transactions in 1985 (16% and 13% respectively). This pattern has endured with 60% of Japan's imports and 50% of the exports controlled by the nine major trading companies in the 1960s and 1970s (Ozawa 1979:115; Young 1979:87)[8]. Historically, this concentration of trade is well illustrated by Mitsui which accounted for 10-20% of all Japanese imports and exports in the 1900-1930 period (Yoshihara 1982:313)[9].



Sogo shosha specialise in the trading function with operations divided among the domestic Japanese market, Japanese imports, Japanese exports and trade among third countries. The division of JFY85 transactions among the four categories is 39%, 28%, 15% and 18%, respectively for Mitsubishi and 33%, 24%, 17% and 26% for Mitsui. During the 1980s, trade among third countries was the area of fastest growth[10] and often developed from initial experience gained in Japanese trade. In this way experience gained in initial 'transaction-based' services was transferred to integrated 'systems-based' services.

8.4.1 Sogo shosha information services

> 'Because of Mitsui's worldwide marketing capabilities, a natural course of development has been marketing in countries other than Japan the natural resource output of ventures overseas, or what is referred to as offshore trade. This area has shown one of the highest rates of expansion in recent years.
>
> Mitsui's strong international position in resource development and trading has been the result of several capabilities. With its information sources and abilities in compiling and analyzing market information, Mitsui is

in an excellent position to assess long-term market potential and feasibility and therefore can make appropriate decisions on the location and timing of ventures.

Another strength is Mitsui's ability to arrange for various forms of financing because of its own capital base and the excellent relationships it maintains with leading banks in Japan and around the world. Typically, Mitsui will sign long term supply contracts with producers and processors of raw materials to assure the success of these developments.' Mitsui 1984:73

Many analysts have identified services provided by sogo shosha, but their emphasis and classifications vary markedly. The services are listed in Table 8.3 under the major headings assigned by Mitsui (1984:5). The relative importance assigned to each of these services by analysts depends upon the purpose of the study. Yoshina and Lifson (1986) concentrated on the role of sogo shosha as organisers of other firms (integrated services) with a special emphasis on their promotion of product systems and the coordination of new projects. Young (1979) highlighted the transition from their Japanese base to the increased international role of sogo shosha in trade among countries other than Japan.

This study concentrates on the role of sogo shosha as a specialised information structure which reduces transaction costs through the provision of market information, enhancing the reputation of individual parties, facilitating international supply diversification, coordinating contract negotiations, providing trade credits, insurance, transport coordination and stockpile control. The sogo shosha gain economies of scale in these functions through their specialisation, yet the number of competing sogo shosha ensures that costs are controlled. The recurring theme found in the coal trade is one of balancing trade conducted through external (competitive) and internal (administrative) structures.

Table 8.3: Services provided by sogo shosha

- Basic trading services
  - Conduct of transactions
    - linking buyers and sellers
    - arranging trade documentation
    - satisfying legal requirements
    - making collections and payments
    - foreign language skills
  - Physical distribution
    - arranging optimal transport and distribution
    - providing transport
    - insuring goods during transport
    - warehousing
      - providing storage facilities
      - providing stockpiles
    - providing distribution network
  - Finance
    - trade credits
    - equity investments
    - direct loans
    - bridging loans
    - loan guarantees
  - Market information
    - product markets
    - prices
    - trends
- Integrated services, system promotion
  - Investment
    - equity investments
    - loans
    - other forms of finance
  - Organising business ventures
    - corporate integration
      - downstream firms/joint ventures
      - upstream firms/joint ventures
    - project coordination services
      - identify/organise suppliers
      - finance
      - equipment, technology
      - engineering
      - markets
      - transport
      - infrastructure
  - Resource development
    - project investment
    - contractual commitment to market in Japan
    - contractual commitment to market elsewhere
  - Technology transfer
    - provide new technologies
    - promote development of competitive industry

sources: Mitsui 1984; Yoshino and Lifson 1986; Young 1979

In contrast to the decline of western traders[11], sogo shosha continued to grow through a wide range of economic conditions. Various explanations have been offered to explain the successful creation and expansion of sogo shosha[12]. Their success is explained by initial specialisation in trade promoting services (finance, insurance and transport) which reduce transaction costs and then by their organisational skills to coordinate other firms in the creation of new trade and product systems (Yoshino and Lifson 1986). In this way, soga shosha acted as the information network connecting Japanese firms to international markets.

8.4.2 Sogo shosha and Japanese coal consumers

Sogo shosha arranged the coal imports (largely from China) to supply the growing demand of Japanese industry in the 1890s and early 20th century. Not surprisingly, the sogo shosha also organised the first imports of American coking coal for the JSM in the postwar period. The net result is a century of experience in the international coal trade.

The role of sogo shosha in the coal trade can be considered as either being the trading arm of a group of affiliated companies (keiretsu) or as an independent information service. If sogo shosha act as the trading arm of affiliated companies, then their trade would be expected to be concentrated among affiliated companies. If sogo shosha are independent sources of information on global trade opportunities, then their trade would be expected to be spread among many companies. To test the relative importance of these alternative roles, an evaluation of Japanese coal contract data is required. The data can be examined for each of the major consuming industries to determine whether a general pattern emerges or whether it varies from industry to industry.

The relationship between sogo shosha and Japanese industry is thus important to the central argument of this chapter: that information structures influence trade. The steel industry is examined first. If steel was simply produced by a steel mill with its inputs acquired and its products sold by an affiliated trading house, then the pattern would conform to that of an integrated corporation or quasi-integrated group of companies. Alternatively, independent sogo shosha may sell their information services to reduce transaction costs and establish diverse supply sources for each of the companies in the industry.

The Japanese steel industry was built around Nippon Steel (initially called Japan Iron and Steel), a government owned and managed firm, whose primary objective was to supply steel for military purposes (Okazaki 1987). Only excess production was sold to the cilivian sector. In the late 19th century a few trading houses were designated to sell this steel, but the allocations to the traders were made by Nippon Steel. The traders were in an inferior bargaining position. Private steel mills were later established and Nippon Steel was sold to private interests after the war (independent of the six largest keiretsu), but the historical relationship is considered to have continued (Yoshino and Lifson 1986:44).

> 'The steel mills continue to dominate the sogo shosha, even though some sogo shosha are stronger than others in this field. The mills have attempted to maintain a careful balance among the sogo shosha they deal with.' (Yoshino and Lifson 1986:44)

The implication is that there is no corporate obligation to use any or all sogo shosha. They must provide a cost saving service or face being eliminated by direct producer-consumer transactions. To ensure their position in the domestic steel industry, sogo shosha created over 200 specialised steel centres in Japan where manufacturers or fabricators can purchase their steel requirements[13]. On the supply side, the sogo shosha supply raw materials to the steel mills. However, sogo shosha are not principals who buy coal from the mine and then sell it to the consumer under back-to-back contracts as in the European case. Instead, they are the importers who make the arrangements to facilitate the contract and shipment between the producer and consumer.

8.4.3 Sogo shosha coking coal imports for the JSM

Sogo shosha dominate the import of coking coal for Japanese steel mills (80-90% of total imports). A summary of coking coal contracts which nominate sogo shosha as the importer is presented for selected years in Table 8.4[14]. Mitsui and Mitsubishi are by far the largest importers accounting for a total of 52% of coking coal tonnage in JFY76 and 43% in JFY87. The decline in their total share of imports was largely caused by the decline in Mitsubishi tonnage for the JSM from 22.3mt in JFY76 to 9.8mt in JFY87. The Mitsui tonnage declined by a much smaller amount (from 16.6mt to 14.7mt) and Mitsui became the largest importer of coking coal in the mid 1980s.

C.Itoh was the third largest importer with 10% of the total contracted tonnage while Sumitomo and Nissho-Iwai had 7% and 6% of JFY87 contracts, respectively. Each of these three importers kept their import tonnage relatively stable over the 1976-87 period. In contrast, Marubeni's tonnage was cut by 65% from 6.9mt in JFY76 to 2.4mt in JFY87. The smaller sogo shosha (Nichimen, Toyomenka and Kanematsu-Gosho) faced a similar problem with declining tonnage and import shares. The declining role of smaller sogo shosha in the coking coal trade mirrored their slow overall growth in the 1980s when compared to the largest trading companies (Yoshino and Lifson 1986).

Most sogo shosha continued to import coal for all eight steel mills. The exceptions to this pattern were Nichimen which did not have a contract for Sumitomo Metal and the 1% of contracts held by Kanematsu-Gosho which included only three buyers. The implication of these diverse contract holdings is that sogo shosha act as importers for the entire industry rather than any particular company or group of companies. Similarly, consumers chose to divide their trade among all the major importers. In this case, the evidence supports the argument that sogo shosha are valued for their diverse international trade and information services rather than as part of a particular corporate group. This conclusion from the coking coal trade can be tested for the steam coal trade.

Table 8.4: Sogo shosha share of Japanese consumer's coking coal contracts, 1976-87

consumer	NS	NKK	Kaw	Sumi	Kobe	Niss	Naka	Godo	JSM	MitC	oth
importer	% of consumer's contracts										
Mitsui											
1976	31	13	14	19	28	25	21	37	23	na	na
1984	33	22	22	26	32	28	27	35	28	7	27
1987	29	19	21	31	31	25	23	36	26	9	18
Mitsubishi											
1976	29	32	28	35	29	37	28	55	30	na	na
1984	23	26	23	29	18	29	17	36	24	27	16
1987	16	21	15	22	14	22	14	32	18	18	12
C.Itoh (* includes Ataka contracts)											
1976*	7	7	13	8	5	1	0	0	8	na	na
1984	8	7	16	10	7	6	2	2	9	15	14
1987	9	13	12	10	6	5	2	2	10	17	7
Sumitomo											
1976	5	3	1	26	2	2	0	1	7	na	na
1984	5	4	2	16	4	3	4	6	6	4	9
1987	6	5	4	17	4	6	10	8	7	3	18
Nissho-Iwai											
1976	5	0	0	2	10	12	0	0	4	na	na
1984	5	2	2	3	18	10	4	5	5	15	2
1987	5	3	3	3	20	14	7	5	6	16	2
Marubeni											
1976	6	18	9	4	16	10	21	4	9	na	na
1984	4	12	5	4	4	11	7	6	6	24	12
1987	2	11	3	2	4	7	6	4	4	24	7
Nichimen											
1976	5	8	3	1	4	7	2	0	5	na	na
1984	2	9	1	0	1	1	1	0	3	1	0
1987	3	8	6	0	2	4	4	0	4	4	0
Toyomenka											
1976	4	8	2	3	4	3	11	3	4	na	na
1984	2	7	3	2	2	2	10	0	3	5	6
1987	3	7	2	3	2	4	9	0	4	6	8
Kanematsu-Gosho											
1976	3	0	0	0	0	0	18	0	1	na	na
1984	2	0	0	0	2	0	12	0	1	0	0
1987	2	0	0	0	3	0	9	0	1	0	0
Sogo shosha											
1976	94	90	71	98	97	97	100	100	91	na	na
1984	85	88	73	90	88	89	85	90	85	97	85
1987	76	88	66	88	85	87	82	87	80	97	73
million tonnes contracted											
1976	27.0	11.8	8.1	11.5	5.7	1.7	0.6	0.3	66.6	na	na
1984	20.3	9.3	7.3	8.1	5.6	1.6	0.7	0.3	53.2	2.4	1.2
1987	15.2	8.4	6.2	7.9	4.5	1.6	0.6	0.2	44.5	3.2	0.8

note: NS = Nippon St, NKK = Nippon Kokan, Kaw = Kawasaki St
Sumi = Sumitomo Metal Industries, Kobe = Kobe Steel
Niss = Nisshin St, Naka = Nakayama St, Godo = Godo St
JSM = Japanese steel mills, MitC = Mitsubishi Chemical
source: Coal Manual, annual

8.4.4 Sogo shosha and steam coal imports

In the 1980s Japanese electric power companies (EPCs) entered the international coal trade as part of their energy security strategy to reduce dependence upon oil from the Middle East. The government owned EPDC (Electric Power Development Company) and the private Chugoku EPC were by far the largest consumers of imported coal with contracts totalling 3-4mtpa in the late 1980s. Four other regional EPCs (Hokkaido, Hokuriku, Shikoku and Tohoku) each held contracts for over 0.5mtpa and a further four companies signed contracts for smaller tonnages (Table 8.5).

The experience gained by sogo shosha in the coking coal trade placed them in a good position to also become major importers of steam coal. Indeed, 90% of the tonnage of coal contracted by electric power companies was typically imported by sogo shosha. Once again Mitsui and Mitsubishi were the largest importers and coordinated contracts for all six EPCs with contracts of over 0.5mtpa. Marubeni and Sumitomo were the importers for five of these six EPCs. In contrast, the smaller sogo shosha (Nichimen, Toyomenka and Kanematsu-Gosho) were not importers for any of the major EPC contracts.

The general pattern was one of extensive contract holdings. The electricity industry reinforced the earlier argument that sogo shosha are active in the coal trade because of their information and trade services rather than their affiliation with particular companies. Each electric power company used the services of several sogo shosha rather than rely on a single trader[15]. In contrast to the declining share of coking coal imports arranged by sogo shosha, their share of electricity industry contracts remained at 90% in the 1980s.

Table 8.5: Sogo shosha share of Japanese electric company's steam coal contracts, 1980-87

	EPDC	Chug	Hokk	Hoku	Shik	Toho	Kyus	Sumi	JJ	Kan	Tok	tot
% of consumer's contracts												
Mitsui												
1980	63	28										53
1984	15	18	52	17	12	10	41					15
1987	14	16	55	23	12	15	35					18
Mitsubishi												
1980	13	17										14
1984	10	17	48	33	23	14				33		15
1987	10	19	10	31	24	23						15
C.Itoh												
1980												
1984		2		33	23	5		11				5
1987		2		31	24			14				4
Sumitomo												
1980	13	17										14
1984	4	17			12	10		25			50	9
1987	4	18	10		12	23		32			50	11
Nissho-Iwai												
1980												
1984					12			21				2
1987					12			21				1
Marubeni												
1980	13	28										17
1984	4	24		17	17		9			33		10
1987	4	22	20	15	18		15					12
several (Blair Athol)												
1984	37	10				17			54	33		21
1987	51	10				35			55			25
several (China)												
1980	0	10										3
1984	15	12			2	24	8					12
1987	14	12					8					9
Sogo shosha												
1980	100	100										100
1984	85	99	100	100	100	78	59	57	54	100	50	88
1987	97	99	94	100	100	96	58	68	55		50	95
Total tonnage contracted (mt)												
1980	0.8	0.3										1.1
1984	4.3	2.5	0.2	0.7	0.9	1.1	0.2	0.3	.3	.1	.1	10.6
1987	4.3	3.4	1.0	0.7	0.9	0.7	0.3	0.3	.3		.2	11.9

note: Chug = Chugoku EPC, Hokk = Hokkaido EPC,
Hoku =Hokuriku EPC, Shik = Shikoku EPC, Toho = Tohoku EPC,
Kyus = Kyushu EPC, Sumi = Sumitomo Joint EPC,
JJ = Joban Joint PC, Kan = Kansai EPC, Tok = Tokyo EPC
source: contract data set

The other Japanese industry which imported a large tonnage of coal was the cement industry and it is examined next to determine whether or not the pattern of diverse sogo shosha involvement is maintained (Table 8.6). The cement industry had steam coal contracts for 7-9mtpa in the late 1980s. Sogo shosha were the importers for 90% of these contracts, just as they were in the electricity industry in the 1980s and the steel industry in the 1970s. However, Mitsui and Mitsubishi were no longer the largest importers. Instead, Nissho Iwai and Marubeni each arranged over 20% of the 1987 contracts.

The leading import role of Nissho Iwai is based on its large contracts with Coal & Allied for the supply of steam coal to Ube Industries, the largest Japanese cement company[16]. Similarly, the large role of Marubeni is based on its supply of almost 80% of the imports for Nippon Cement under contracts with Muswellbrook, Wambo and Austen & Butta (Western Blend).

The pattern of relatively uniform marketshares among the various steel and electricity companies is replaced in the cement industry with higher degrees of concentration and greater variety in the relative importance of particular sogo shosha. Despite this variety, consumers almost always chose to divide their import requirements among three or more importers. In short, the priority remained one of using numerous trading networks rather than simply rely upon an affiliated firm. The information and diversification roles of sogo shosha thus appear to be more important than the role of an affiliated trader to explain contract patterns.

Table 8.6: Sogo shosha share of Japanese cement company's steam coal contracts, 1984-87

	Chic	Denk	Mitb	NipC	Onod	Osak	Sumi	Toka	Toyo	Ube	tot
sogo shosha				% of consumer's contracts							
Mitsui											
1984					45				81	21	14
1987				4	32	9			76		9
Mitsubishi											
1984		69	53	4		14					10
1987		100	60	4		19					13
C.Itoh											
1984	26		5			21	31			21	13
1987	20		5			28	7			23	11
Sumitomo											
1984							58				7
1987							93	14			10
Nissho-Iwai											
1984			11							52	16
1987			13					14		77	24
Marubeni											
1984	55		11	76		18					17
1987	68		13	84		25					21
Nichimen											
1984			4			14					2
1987			4	3		19					3
Toyo Menka											
1984					23						2
1987					32						3
several (Blair Athol)											
1984				8							1
1987											0
several (China)											
1984	19	31	12	9	9	11	11	16	3	4	10
1987											
Sogo shosha											
1984	100	100	96	97	75	79	100	16	84	100	92
1987	88	100	96	96	63	100	100	29	76	100	92
Total tonnage contracted (mt)											
1984	.4	.1	1.3	1.3	.9	.7	1.1	.2	.4	2.4	8.8
1987	.3	.1	1.2	1.2	.6	.5	.7	.1	.4	2.0	7.1

note: Chic = Chichibu Cem, Denk = Denki Kagaku, Mitb = Mitsubishi Mining & Cem, NipC = Nippon Cem, Onod = Onoda Cem, Osak = Osaka Cem, Toyo = Toyo Soda, Sumi = Sumitomo Cement, Toka = Tokayama Soda, Ube = Ube Industries

source: contract data set

8.4.5 Sogo shosha and trade for affiliated companies

Although most sogo shosha imported coal for all of the steel mills and major electric utilities, the relative importance of each sogo shosha varied among the different companies. This variation in contract tonnage is worth examining to determine whether or not membership in particular keiretsu, or corporate groups, explain the pattern. The marketshare of each sogo shosha for imports by the industry is subtracted from the marketshare for each company (Table 8.7). Positive numbers indicate a larger marketshare than that expected on the basis of industry-wide performance.

Variations from average import shares were identified. Mitsui and Mitsubishi are major suppliers to each of the steel mills, but their share of total imports is greatest for the smallest mill, Godo Steel and lowest for Kawasaki Steel (which relied less on the sogo shosha than any of the other mills). The largest consumer, Nippon Steel relied more on Mitsui than did the industry as a whole. Overall, Mitsui supplied 5-10% more than its industry average to Nippon Steel, Kobe Steel and Godo Steel. Similarly, Mitsubishi typically had a 5% larger share of Sumitomo Metal and Nisshin Steel's import contracts than its industry average. These higher import shares are not explained by keiretsu membership.

In contrast, the 5% higher share of Kawasaki contracts held by C.Itoh could be argued to be a result of their membership in the keiretsu based on the Daiichi-Kangyo Bank. This pattern of stronger ties between trading houses and steel mills in the same keiretsu is even more pronounced in the case of Sumitomo Corporation. Sumitomo's import share of coking coal contracted by Sumitomo Metal is typically 10% higher than its share for the steel industry as a whole. Nissho Iwai has a similar advantage with its extra 15% share of Kobe Steel's JFY87 tonnage, despite having an industry average of only 6% of total import tonnage. Nissho-Iwai also plays a strong role in supplying coal to Nisshin Steel. Marubeni has a fairly uniform import share among steel mills, but it still supplies Nippon

Kokan with twice its average share of imports. This is explained by the membership of both companies in the Fuyo group of companies.

Table 8.7: Differences (>4%) in share of coking coal contracts between consumer and JSM average value, 1976-87

consumer	NS	NKK	Kaw	Sumi	Kobe	Niss	Naka	Godo	JSM	MitC	oth
importer	% of consumer's contracts - average % for JSM										
Mitsui											
1976	8	-10	-8	-	5	-	-	14	0	na	na
1984	5	-6	-7	-	-	-	-	6	0	-21	
1987	-	-7	-5	-	5	-	-	10	0	-17	-8
Mitsubishi											
1976	-	-	-	5	-	6	-	25	0	na	na
1984	-	-	-	5	-6	5	-7	12	0		-8
1987	-	-	-	5	-	-	-	14	0		-6
C.Itoh (* includes Ataka contracts)											
1976*	-	-	5	-	-	-7	-8	-8	0	na	na
1984	-	-	7	-	-	-	-7	-7	0	6	5
1987	-	-	-	-	-	-	-8	-8	0	8	
Sumitomo											
1976	-	-	-6	19	-5	-5	-7	-6	0	na	na
1984	-	-	-	10	-	-	-	-	0		
1987	-	-	-	10	-	-	-	-	0	-5	10
Nissho-Iwai											
1976	-	-	-	-	7	8	-	-	0	na	na
1984	-	-	-	-	13	-	-	-	0	9	-4
1987	-	-	-	-	15	8	-	-	0	11	-4
Marubeni											
1976	-	9	-	-5	6	-	12	-6	0	na	na
1984	-	6	-	-	-	5	-	-	0	18	7
1987	-	7	-	-	-	-	-	-	0	20	
Nichimen											
1976		-		-				-5	0	na	na
1984		6		-				-	0		
1987		-		-				-	0		-4
Toyomenka											
1976		-					7		0		
1984		-					7		0		
1987		-					6	-	0		5
Kanematsu-Gosho											
1976							16		0		
1984							11		0		
1987							8		0		
Sogo shosha											
1976	-	-	-20	7	6	7	9	9	0	na	na
1984	-	-	-11	5	-	-	-	5	0	12	
1987	-	8	-14	8	6	8	-	8	0	18	-6

source: Coal Manual, annual

However, the explanation of increased marketshare based on keiretsu affiliation is not without its exceptions. Nichimen and Toyomenka are also the importers of more coal for Nippon Kokan than would be expected by their share of industry imports. An alternative explanation could be Nippon Kokan's continued high reliance upon the sogo shosha (88% of JFY87 tonnage) when other steel mills turned to other importers. In this case, NKK might seek diverse supply networks by cutting the annual tonnage of smaller sogo shosha less drastically than mills like Nippon Steel.

Coking coal consumers outside the steel industry created an equally interesting pattern. In the case of Mitsubishi Chemical, Mitsubishi Corporation simply supplied its national import share. Significantly less coal was imported by Mitsui & Co (Mitsubishi's traditional rival), while Marubeni, C.Itoh and Nissho Iwai played more significant roles. Mitsui Mining, the gas companies and other coking coal consumers accounted for less than 1mt of imports in 1987. Sumitomo, Marubeni and Toyomenka had larger marketshares for these consumers than their steel industry average.

The pattern of variation in sogo shosha marketshares from the steel industry average can be compared to the pattern found in the major steam coal importing industries (electricity and cement). Given the smaller number of steam coal contracts and the younger nature of the market, larger variations are expected in comparison to those in the steel industry. The electricity and cement industries should also provide further evidence of the extent of consumer imports being arranged by sogo shosha from the same keiretsu.

A clear pattern emerged with each sogo shosha typically having a larger marketshare for two of the electric power companies (Table 8.8). In some cases, this pattern reinforced the relationship between firms in the same keiretsu. For example, Sumitomo had a 20% higher marketshare for Sumitomo Joint Power than its industry average. However, in many cases the larger shares were independent of keiretsu affiliations.

Table 8.8: Differences (>9%) in share of coal contracts between consumer and EPC average value, 1980-87

	EPDC	Chug	Hokk	Hoku	Shik	Toho	Kyus	Sumi	JJ	Kan	Tok	tot
	% of consumer's contracts - average % for EPCs											(ave%)
Mitsui												
1980	10	-25										53
1984	-	-	37	-	-	-	26					15
1987	-	-	37	-	-	-	17					18
Mitsubishi												
1980	-	-										14
1984	-	-	33	18	-	-				18		15
1987	-	-	-	16	-	-						15
C.Itoh												
1980												
1984		-		28	18	-		-				5
1987		-		27	20			10				4
Sumitomo												
1980	-	-										14
1984	-	-			-	-		16			41	9
1987	-	-	-		-	12		21			39	11
Nissho-Iwai												
1980												
1984					10			19				2
1987					11			20				1
Marubeni												
1980	-	11										17
1984	-	14		-	-		-			23		10
1987	-	10	-	-	-		-					12
several (Blair Athol)												
1984	16	-11				-			33	12		21
1987	26	-15				10			30			25
several (China)												
1980	-	-										3
1984	-	-			-10	12	-					12
1987	-	-					-					9
Sogo shosha												
1980	-	-										100
1984	-	11	12	12	12	-10	-29	-31	-34	12	-38	88
1987	-	-	-	-	-	-	-37	-27	-40		-45	95

source: contract data set

The import pattern of the cement industry repeated that found in the electricity industry. Import shares were much more concentrated than in the steel industry with each trader having a stronger position in the import of coal for a couple cement firms (Table 8.9). These concentrations in trading relations sometimes reflected keiretsu affiliations as in the cases of Mitsubishi Corp. importing more coal for Mitsubishi Cement, Mitsui & Co. importing more coal for Onoda Cement and Sumitomo Corp. importing more coal for Sumitomo Cement.

Table 8.9: Differences (>9%) in share of coal contracts between consumer and cement industry average, 1984-87

	Chic	Denk	Mitb	NipC	Onod	Osak	Sumi	Toka	Toyo	Ube	tot
	% of consumer's contracts - average %										(ave%)
Mitsui											
1984					31				67	-	14
1987				-	23	-			67		9
Mitsubishi											
1984		59	43	-		-					10
1987		87	47	-		-					13
C.Itoh											
1984	13		-			-	18			-	13
1987	-		-			17	-			12	11
Sumitomo											
1984							51				7
1987							83	-			10
Nissho-Iwai											
1984			-15							36	16
1987			-11					-10		53	24
Marubeni											
1984	38		-	59		-					17
1987	47		-	63		-					21
Nichimen											
1984			-			12					2
1987			-	-		16					3
Toyo Menka											
1984					21						2
1987					29						3
several (Blair Athol)											
1984				-							1
1987											0
several (China)											
1984	-	21	-	-	-	-	-	-	-	-	10
1987											
Sogo shosha											
1984	-	-	-	-	-17	-13	-	-76	-	-	92
1987	-	-	-	-	-29	-	-	-63	-16	-	92

source: contract data set

Keiretsu affiliations were reinforced, but they did not result in fully integrated import services. The affiliated trading company did not supply all imports, it only held a larger marketshare. The existence of keiretsu affiliations thus provides only a partial explanation of import patterns. A better explanation is that consumers decided to divide their import requirements among multiple sogo shosha to gain the advantages offered by more than one information network and achieve supply security through sogo shosha diversity.

8.4.6 The international diversity of sogo shosha

The success of the sogo shosha in managing the coking coal trading or procurement function for the JSM enabled them to control 80-90% of all coking coal imports. Although steel mills signed their own contracts with coal producers, these contracts were always arranged with the assistance of sogo shosha. Each sogo shosha has a list of mines in different countries whose coal it supplied to the JSM.

The overall pattern of sogo shosha marketshares among the companies in major coal importing industries is one of diverse supply arrangements. Indeed, Nippon Steel, the largest private steel manufacturer and coking coal importer (24.1mt in JFY84) in the world, makes extensive use of all nine sogo shosha. Nippon Steel could avoid using traders and deal directly with producers to avoid the commissions paid to traders. Instead, the network of each trader is used to import coal from several countries. The result is an extensive and diversified supply configuration for coking coal contracts (Figure 8.3).

Rather than specialise in coal from a particular country or region, each sogo shosha competes to provide its own diverse sources. The elaborate international network created by the sogo shosha are not used exclusively by Nippon Steel, but are also made available to other consumers. Kobe Steel used an almost identical combination of traders and international sources as Nippon Steel (Figure 8.4), despite its import of one quarter the tonnage of coal (6.3mt in JFY84).

Even the smallest steel mill, Godo Steel, used six of the nine sogo shosha to import its tiny coal needs (0.3mt in JFY84). Rather than receive its annual coal supply on two or three large coal carriers, it joins the network of many producers and consumers created by sogo shosha to use 19 combinations of international supply countries and coordinating sogo shosha (Figure 8.5). The sogo shosha thus successfully create a large and diverse trading network to facilitate trade for for even the smallest consumers.

Figure 8.3: Sogo shosha coal imports for Nippon Steel, 1984

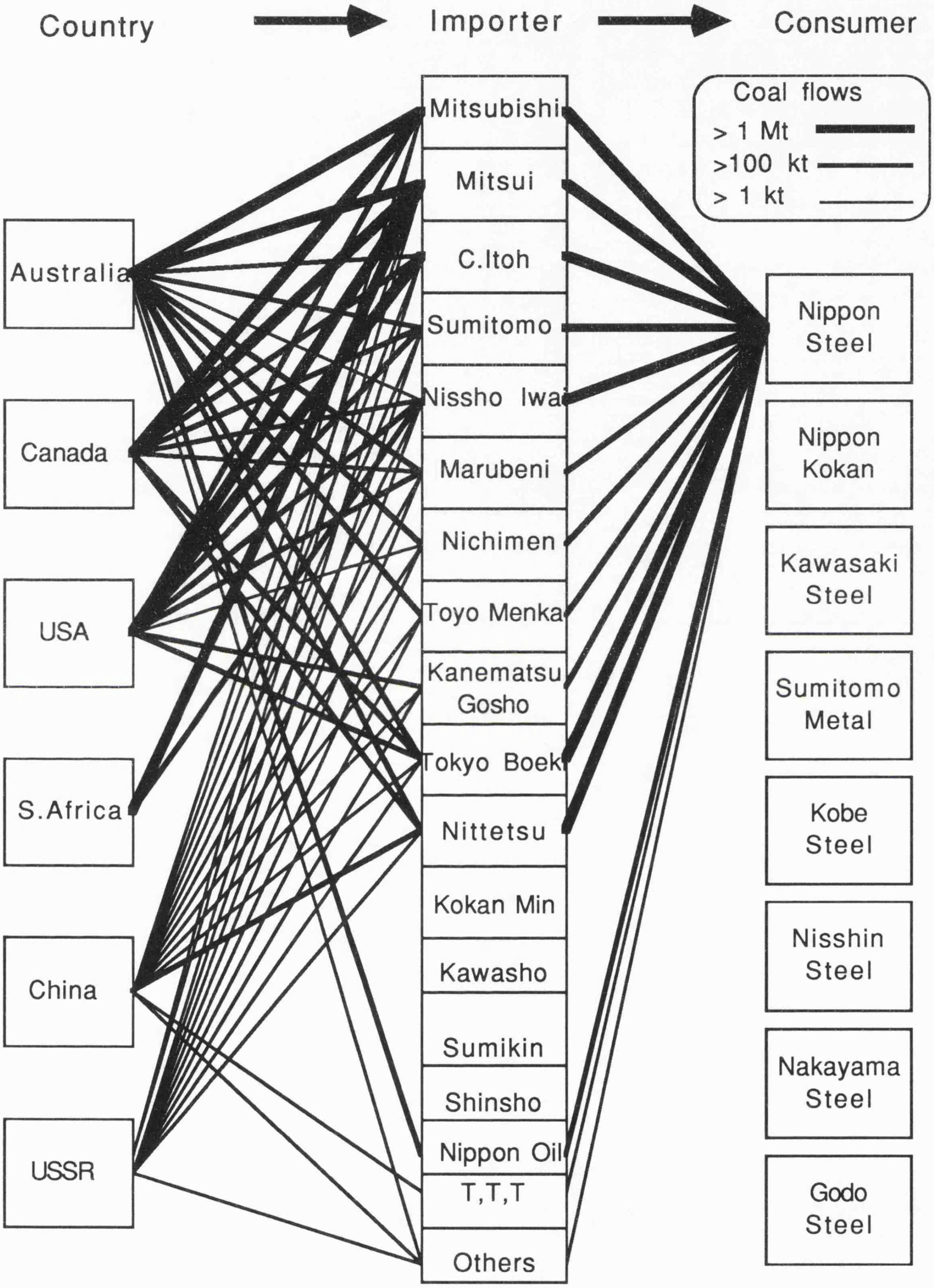


Figure 8.4: Sogo shosha coal imports for Kobe Steel, 1984

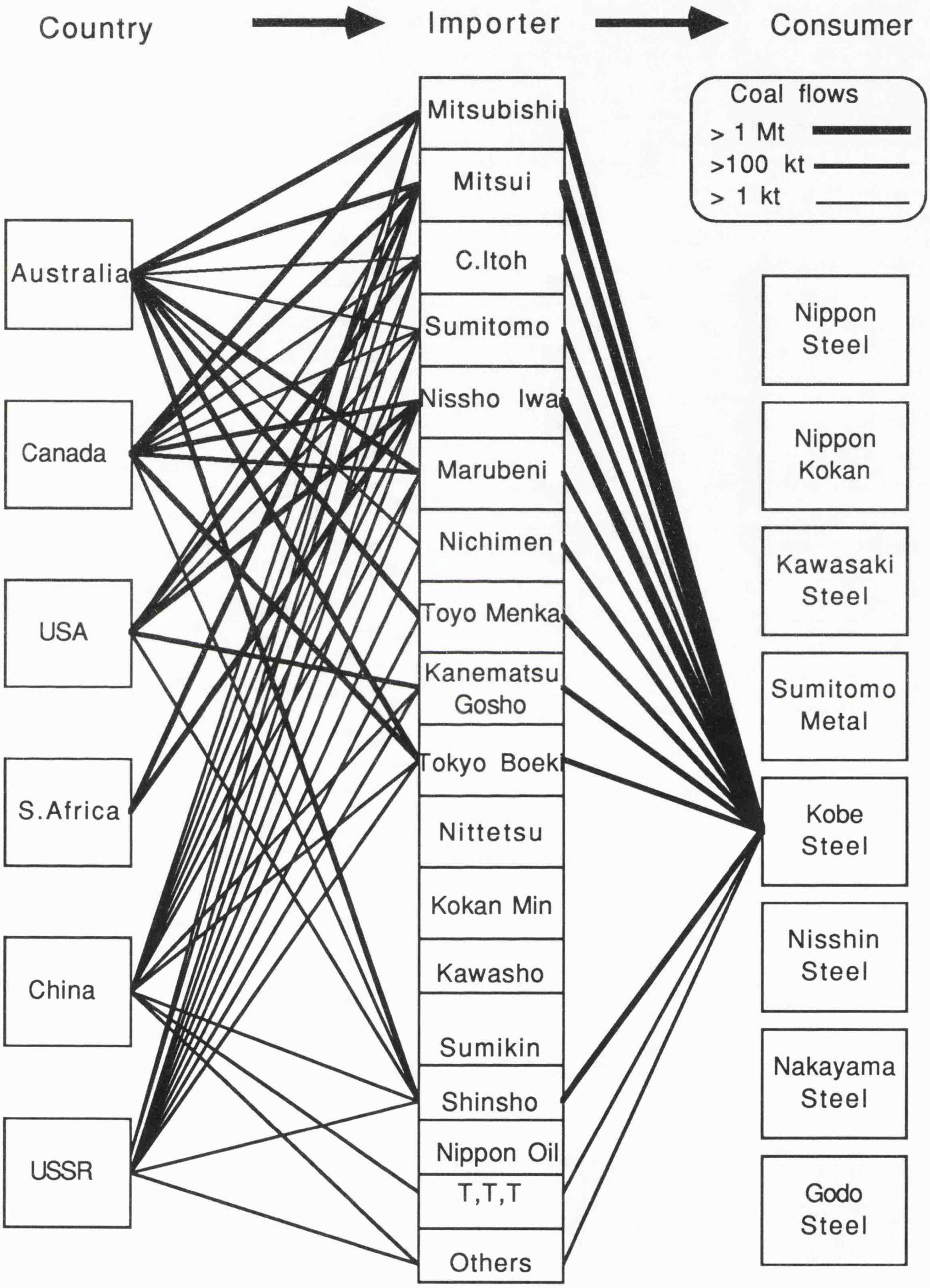
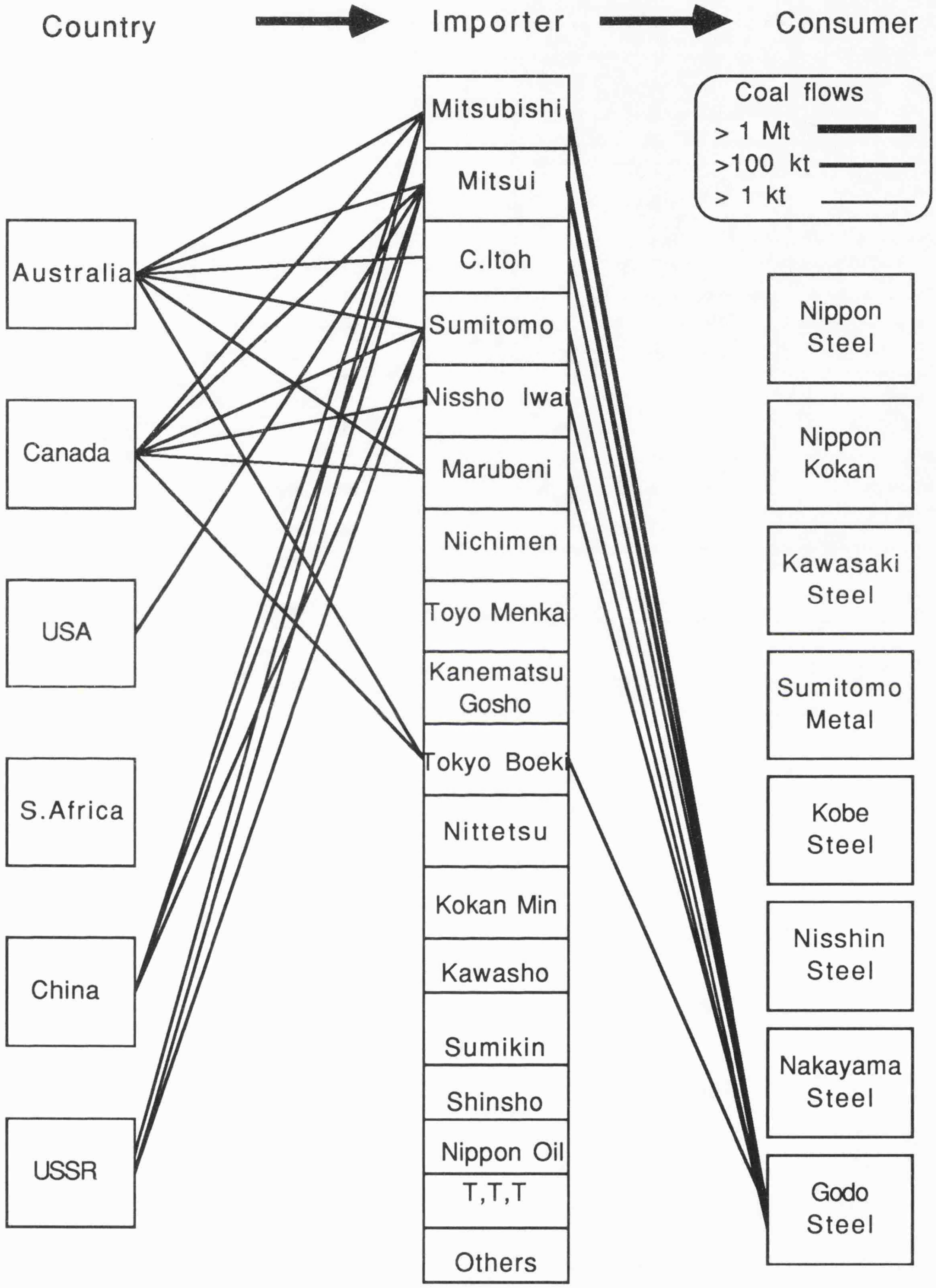


Figure 8.5: Sogo shosha coal imports for Godo Steel, 1984



This pattern of extensive sogo shosha involvement in arranging coal imports is repeated even among the steel mills most tightly integrated into keiretsu (Kawasaki and Sumitomo). The common factor is not ownership or direct integration (although import shares of sogo shosha belonging to the same keiretsu as a steel mill were typically 10% higher than their industry average), but the desire to use the global trade and information services offered by each sogo shosha. The same pattern was found among major steam coal importers. The marketshare between affiliated companies was often 20-40% higher than industry marketshares, but the role of importer was never exclusive as all major companies preferred to use the information and trading services of multiple sogo shosha.

The sogo shosha generally do not own shipping and transport facilities directly (although they may participate in a particular project by taking a minority equity position, negotiating the finance, or arranging a vessel charter). Instead, they use information to coordinate shipping schedules to reduce transport costs and provide optimal levels of stocks. Shipping costs are reduced by promoting large capacity ports and ships. Furthermore, the coordination of shipping enables vessels to haul cargos on more than one leg of the voyage. The savings of large scale facilities and coordinated shipping are especially important for the longer routes to achieve low cost diversity of supply (Ozawa 1979:191). Sogo shosha thus use their information and organisational resources to achieve consumer objectives defined earlier.

8.5 Other Japanese traders

Despite the sogo shosha import of 80-90% of all Japanese coal needs, they face competition from other traders and attention needs to be given to these smaller importers and the service they offer. The first question is who is filling the import role being lost by sogo shosha in the coking coal sector. Given the mature nature of the coking coal trade, the extensive sogo shosha information network may be of less value to consumers. Unlike the early period of rapid growth, consumers in the 1980s have less need to seek new suppliers. The stability of the trade reduces market risk and other traders may compete with sogo shosha for marketshare. Indeed, new importers may be preferred to add to the diversity of supply organisers, just as consumers seek diversity among coal producers.

Examples of sogo shosha and consumers which belong to the same keiretsu having stronger trading links than those among unaffiliated firms were noted earlier. Sogo shosha are not the only traders belonging to keiretsu and small specialised trading companies may perform a similar trading role as sogo shosha for particular commodities. Although nine trading companies are considered to have a sufficiently diverse product range and international trade network to be called, sogo shosha, over 6,000 other Japanese companies are active in international trading. Of these, 37 were listed as importers of coking coal in the 1980s (Coal Manual annual).

The most important specialised trader in coking coal successfully established new trading systems in the 1980s. Tokyo Boeki, an offshoot from Mitsubishi Corporation when it was disbanded after the war, successfully changed from being a small specialised importer of coking coal for Nippon Steel, NKK and Nisshin Steel in the 1970s to become the fourth largest importer of coking coal to Japan in the late 1980s (5.6mt in JFY87). Its import contracts in the 1980s are especially interesting because they follow the sogo shosha pattern with coal going to each of the steel mill (Table 8.10). This transition was achieved by Tokyo Boeki being the dominant importer for coal from two new mines, Quintette in British Columbia and Gregory in Queensland.

The next group of traders clearly reflected the model of vertical integration (internalising trade activities) reviewed at the start of this chapter. In each case, a trading company specialised in supplying the needs of its affiliated steel mill. Kawasho (and before their 1983 merger Kawatetsu Bussan) provides an excellent example of this pattern.

Table 8.10 : Specialised trader's coking coal contracts by consumer, 1976-87

consumer	NS	NKK	Kaw	Sumi	Kobe	Niss	Naka	Godo	JSM	MitC	oth
importer	% of consumer's contracts										
Tokyo Boeki											
1976	6	3	0	0	0	3	0	0	3	na	na
1984	9	7	6	5	7	8	12	10	8	2	13
1987	11	7	10	7	9	11	14	13	9	2	21
Nittetsu											
1976	0								0		
1984	5					3			2		
1987	11								4		
Kawasho (* includes Kawatetsu Bussan)											
1976			29						4		
1984			20						3		
1987			24						4		
Kokan Kogyo (Mining) and Okura Trading											
1976		6			1				1		
1984		4							1		
1987		4							1		
Sumikin											
1976				2					0		
1984				4					1		
1987				5					1		
Shinsho (Shinko Shoji)											
1976	0.03								0.0		
1984					4				0.4		1
1987					5				0.4		
Toyota Tusho, Toko Bussan, Trinity Development											
1976											
1984	0.4	0.3	0.2	0.2	0.3	0.3	2.7		0.3	0.4	0.3
1987	0.8	0.8	0.1	0.2	0.7	0.6	3.7		0.6	0.4	1.6
Other											
1976											
1984	0.4	0.6			1.8				0.4		
1987	0.5	0.6			2.2				0.5		
specialised traders											
1976	6	10	29	2	3	3	0	0	9	na	na
1984	15	12	27	10	12	11	15	10	15	3	15
1987	24	12	34	12	15	13	18	13	20	3	27
million tonnes contracted											
1976	1.7	1.3	3.3	0.2	0.2	0.0	0.0	0.0	6.7	na	na
1984	3.7	1.2	2.6	0.9	0.7	0.2	0.1	0.0	9.6	0.1	0.2
1987	4.8	1.2	3.2	1.1	0.8	0.2	0.1	0.0	11.5	0.1	0.3
Total tonnage contracted											
1976	28.7	13.1	11.3	11.7	5.9	1.7	0.6	0.3	73.3	0.0	0.0
1984	24.1	10.6	9.9	9.0	6.3	1.8	0.8	0.3	62.7	2.5	1.5
1987	20.0	9.6	9.4	9.0	5.2	1.9	0.7	0.3	56.0	3.3	1.1

source: Coal Manual 1976, 1985, 1988

Kawasho provided 20-30% of the coking coal imported by Kawasaki Steel, yet provided no coal to other steel mills. This import pattern matched its equally specialised role in selling steel products. Kawasaki Steel and its affiliated companies produced 63% of all the products sold by Kawasho in JYF85 (Kawasho 1986:1)[17]. Not surprisingly, the principle shareholders in Kawasho are Kawasaki Steel, Kawasaki Heavy Industries, "K" Line (Kawasaki Kisen Kaisha), Daiichi-Kangyo Bank, Bank of Tokyo, Daiwa Bank, and Taiyo-Kobe Bank (Kawasho 1986:27). Kawasho thus illustrates the significant role of a specialised trading company with strong integration into the family of companies existing in the keiretsu. This type of relationship is found frequently in Japanese trade and is wrongly assumed to prevail in the steel industry too. Despite this close relationship between Kawasho and Kawasaki Steel, three quarters of Kawasaki Steel's coking coal came from other trading companies. The desire to promote an affiliated company is balanced by the decision to use the information network of sogo shosha as well.

In the 1980s, Nippon Steel followed the Kawasaki example and its specialised steel-selling subsidiary, Nittetsu, became a coking coal importer. By JFY87, the volume of imports contracted through Kawasho and Nittetsu was equal at 2.2mt. The rapid promotion of Nittetsu accounts for two thirds of the decline in sogo shosha imports for Nippon Steel. The other one third of the decline was attributable to Tokyo Boeki's increased role. These two specialised traders reduced the sogo shosha supply of coking coal to Nippon Steel from 94% in JFY76 to 76% in JFY87 (Figure 8.3).

The other steel mills had similar specialised arrangements with affiliated trading companies. Nippon Kokan acquired 4% of its coking coal through Kokan Mining in the 1980s (Okura Trading had a similar specialised role in the 1970s). Sumikin imported 5% of Sumitomo Metal's coking coal and Shinsho (Shinko Shoji) imported 5% of Kobe Steel's coal requirements (Figure 8.4).

The remaining trading companies each imported less than 0.2mt of the 60mt of coking coal contracted in JFY87. Despite their small size, these firms are of interest because they found a trade and information niche by specialising in trade with centrally planned economies. The three largest importers in this group (Toyota Tusho, Toko Bussan and Trinity Development) each supplied coal to five or more steel mills in the 1980s. Most annual contracts were for less than 10,000t. The entire year's business of each firm could fit in a single ship on the trade routes from Australia or Canada. Instead, these firms specialised in trade with centrally planned economies. Their small trade flows were met by small shipments from China or the USSR. The other 20 or so small traders (<0.1mtpa in coking coal contracts) also specialised in Soviet or Chinese trade[18].

Specialist traders also established a role for themselves in the Japanese steam coal trade, although their market share in the 1980s was small. Tokyo Boeki extended its position in the coking coal trade by also arranging steam coal contracts. These contracts were for Saxonvale coal (to be imported in conjunction with Japan Coal Development Corporation) for Tokyo and Tohoku Electric Power. A similar contract was signed to supply coal to Onoda Cement.

Another specialist coal trader is Mitsui Mining, the established coal mining company which was seeking to diversify its activities. In part this new role as an importer was simply to continue supplying the customers which had previously been supplied from domestic mines. Sumitomo Coal Mining followed a similar pattern through Nomura Trading[19].

A more significant group of specialist steam coal importers emerged in the 1980s with large plans to expand their role in the 1990s. Three Japanese oil companies (Nippon Oil, Idemitsu and Showa Shell) imported coal for electric power companies and cement companies in the 1980s. These imports were linked to the investments in coal mines discussed in chapter 6. Although the oil companies are new to the coal trade, their role is argued to demonstrate the importance of information structures. Their experience in the oil part of the energy industry enabled them to establish strong marketing and consumer information networks. Coal is simply added as another fuel choice in their portfolio of energy supply systems.

Having demonstrated the ability of sogo shosha and other traders to provide a diverse coal supply network for Japanese consumers, the question remains as to why they succeeded.

8.6 Information structure and transaction costs

The basis of the success of sogo shosha is argued to be their ability to reduce transaction costs. Three techniques enable them to use information to reduce transaction costs. Given the high initial cost and low incremental cost of information, sogo shosha maximise the return on their information assets by aggregating multiple transactions for a particular good (coal type), repeating transactions over time, and coordinating the smooth and efficient timing of the supply system. The combined application of these techniques enables them to coordinate a large numer of small transactions as part of their information services.

8.6.1 Coal transaction size and numbers

The Japanese coking coal trade is distinctive because it is the largest international coal trade by tonnage (60mtpa), yet is comprised of very small transaction sizes (75kt on average). The result is that the contracted import of 60mt in JFY87 was based on a total of over 800 transactions. Each transaction consists of the agreement for a producer to supply a consumer with a designated quantity of coking coal for an agreed price. The producer and consumer sign the contract and are the legal parties involved. However, traders take an active part in the transaction despite their lack of legal status as owner of the coal. The largest traders, Mitsui and Mitsubishi, coordinate contracts for over 100 pairs of clients (170 and 135 transactions respectively in JFY87). In comparison, Marubeni participates in 74 transactions, Sumitomo in 67, C.Itoh in 55, Nichimen 44, Nissho Iwai 42, and Toyo Menka 38.

In contrast to this variation in transaction numbers, the average size of each trading house's transactions is generally in the 50-100kt range. Mitsui and Mitsubishi transactions average 89kt and 76 kt each, while C.Itoh contracts average 111kt and Nissho Iwai 90kt. Smaller JFY87 averages were found for Sumitomo (63kt), Toyo Menka (60kt), Nichimen (53kt), Kanematsu (52kt) and Marubeni (44kt). The striking thing about these averages is that they are all smaller in size than a typical Capesize vessel (100-120kt) bringing coal to Japan. Given that deliveries under a contract are normally spread over the year, the average delivery size is quite small. Some means is required to coordinate all of these small transactions. By participating in 40-140 transactions, a sogo shosha can provide this coordination and arrange for a variety of coals to be delivered at the required times throughout the year.

The average values noted above disguise the interests of smaller and larger consumers. Nippon Steel is the largest consumer of coking coal and it enters 120 contracts to import the 20mt required for its annual operation. The average size of each transaction is 165kt. At the opposite end of the spectrum, Godo Steel only imports 280kt of coking coal, or less than two of Nippon Steel's average purchases. However, Godo Steel enters 34 contracts to secure this coal and the average transaction size is reduced to 8kt. The average transaction size for Nippon Steel is thus 20 times that of Godo Steel. The relationship between average transaction size and total coal imports is virtually linear (Figure 8.7).

The most striking feature of coking coal transactions for the steel mills is the similar number and pattern of contracts used by each mill. NKK, Kawasaki, Sumitomo and Kobe each have approximately 100 contracts for their annual supply of coking coal (Figure 8.6).

Figure 8.6: Number of coal contracts by size of steel mill imports

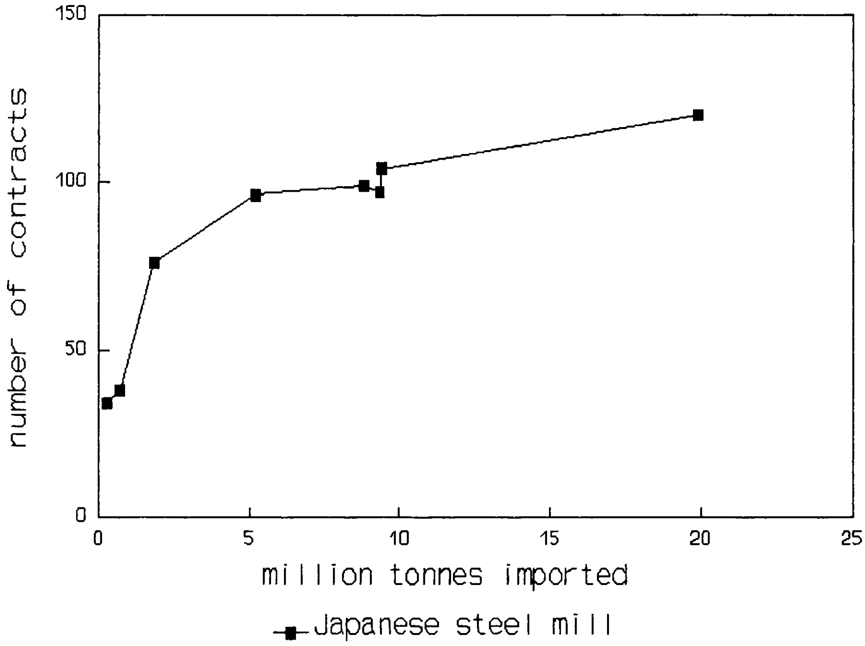
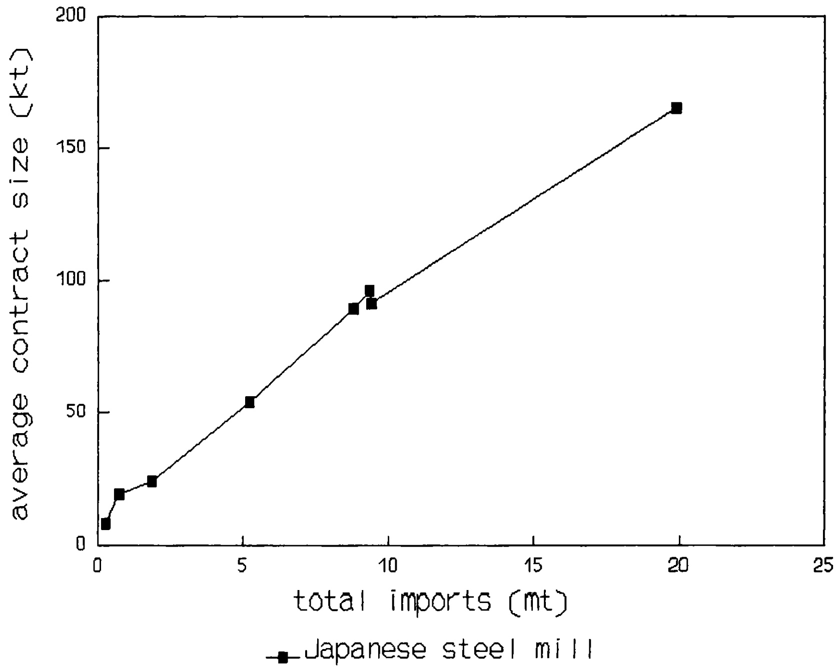


Figure 8.7: Average contract size by total imports



Variation in the quantity of consumer demand is met by varying contract size (instead of varying the number of contracts) once the desired level of approximately 100 contracts is reached. It can be assumed that additional contracts would not add significantly to diversity objectives.

The smaller mills of Nisshin Steel and Nakayama Steel have fewer transactions (76 and 38 respectively) because of their small total demand. The surprising feature is the average size of transactions, only 24kt and 19kt, respectively. To negotiate this large number of small transactions would require a great deal of time, increase transaction costs and result in higher cost coal. How can these costs be reduced?

Rather than deal with small contracts of only 20kt in size, other major steel mills importing coal from the international market operate with average contracts ten times larger. Pohang Iron & Steel in South Korea, China Steel in Taiwan, Siderbras in Brazil and the Steel Authority in India each have an average contract size of approximately 200-400kt rather than the 20kt of small mills in Japan. The average for European steel mills is 360kt per contract (290kt per contract if you count BHP-Utah contracts as four contracts because of the various brands supplied). In each case, these smaller steel mills have larger average contract sizes than Nippon Steel.

To achieve similar transaction sizes, either the Japanese steel mills must purchase as a group or the sogo shosha must procure coal on a scale directed at the entire industry. The selling of a particular type of coal to several consumers is common practice in the coking coal trade. For example, Mitsui is the importer responsible for 170 transactions in 1987, but only 28 brands of coal are involved. In most cases 6 or 8 steel mills plus Mitsubishi Chemical and sometimes 1 or 2 smaller consumers will purchase the same brand of coal. In this way the average Mitsui transaction size is increased from 90kt per transaction to 540kt per coal type. This facilitates larger scale purchasing, gains economies of scale in the transport function and reduces transaction costs.

8.6.2 Traders and incremental demand.

To identify the benefits of aggregating the demands of several consumers within a single procurement system (organised by a trading house) comparisons can be made among selected Japanese consumers and their coal contracts. The largest consumer, Nippon Steel (19.9mt in JFY87) is compared to a steel mill one quarter its size, Kobe Steel (5.2mt), and to the smallest steel mill, Godo Steel (0.28mt).

If the problem of coal procurement is approached from the consumer's perspective, the problem of how to arrange diverse supplies for a mill which consumes less than 0.3mt is considerable. Given that typical mines which supply the international market have a production capacity of 0.5-1.0mt for an underground mine or 2-5mt for an open cut mine, the steel mill could easily be supplied by a single producer. Such an arrangement might be appealing because of its simplicity with only one producer to negotiate with and only one trade flow to arrange. However, if diverse sources are desired to prevent any supply disruptions or promote diversity and competition, then an alternative arrangement is required.

The supply of coal to a small steel mill could be linked as the incremental demand to that of a larger consumer. In this case, the contract arrangements would be expected to be similar. The use of the same sogo shosha supply networks for various steel mills was demonstrated earlier at the international level, but is even better illustrated by identifying the national contracts and coal brands imported by specific sogo shosha. Despite the small tonnage imported by Godo Steel, 16 Australian mines supply the mill with coking coal (Figure 8.8). This small tonnage could only be supplied on such a diverse basis by combining it with the demand of other steel mills. The network of Australian mines supplying larger mills (Kobe and Nippon Steel, for example) is even more elaborate (Figure 8.9 and Figure 8.10).

Figure 8.8: Australian coal contracts with Godo Steel, 1984

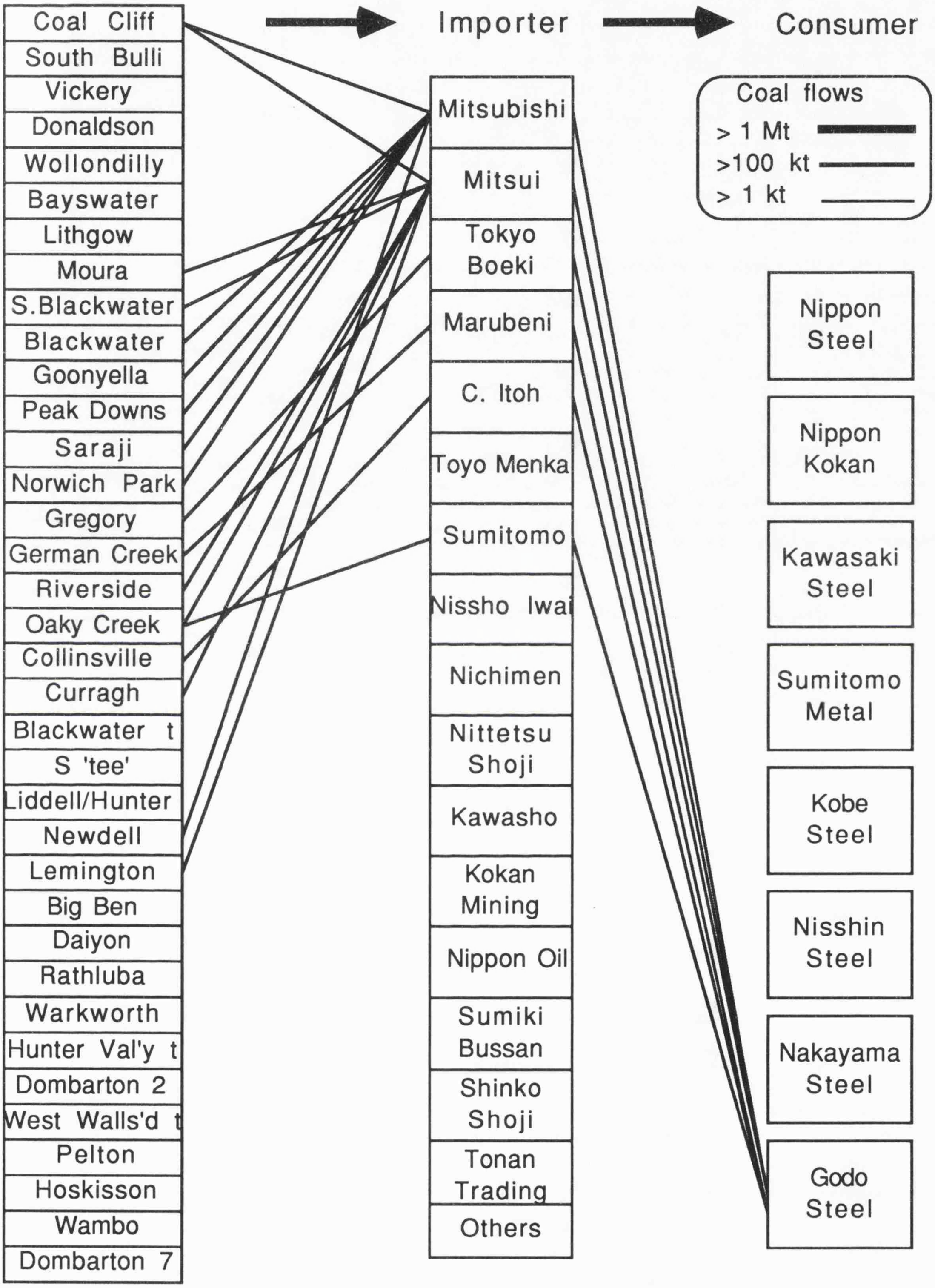


Figure 8.9: Australian coal contracts with Kobe Steel, 1984

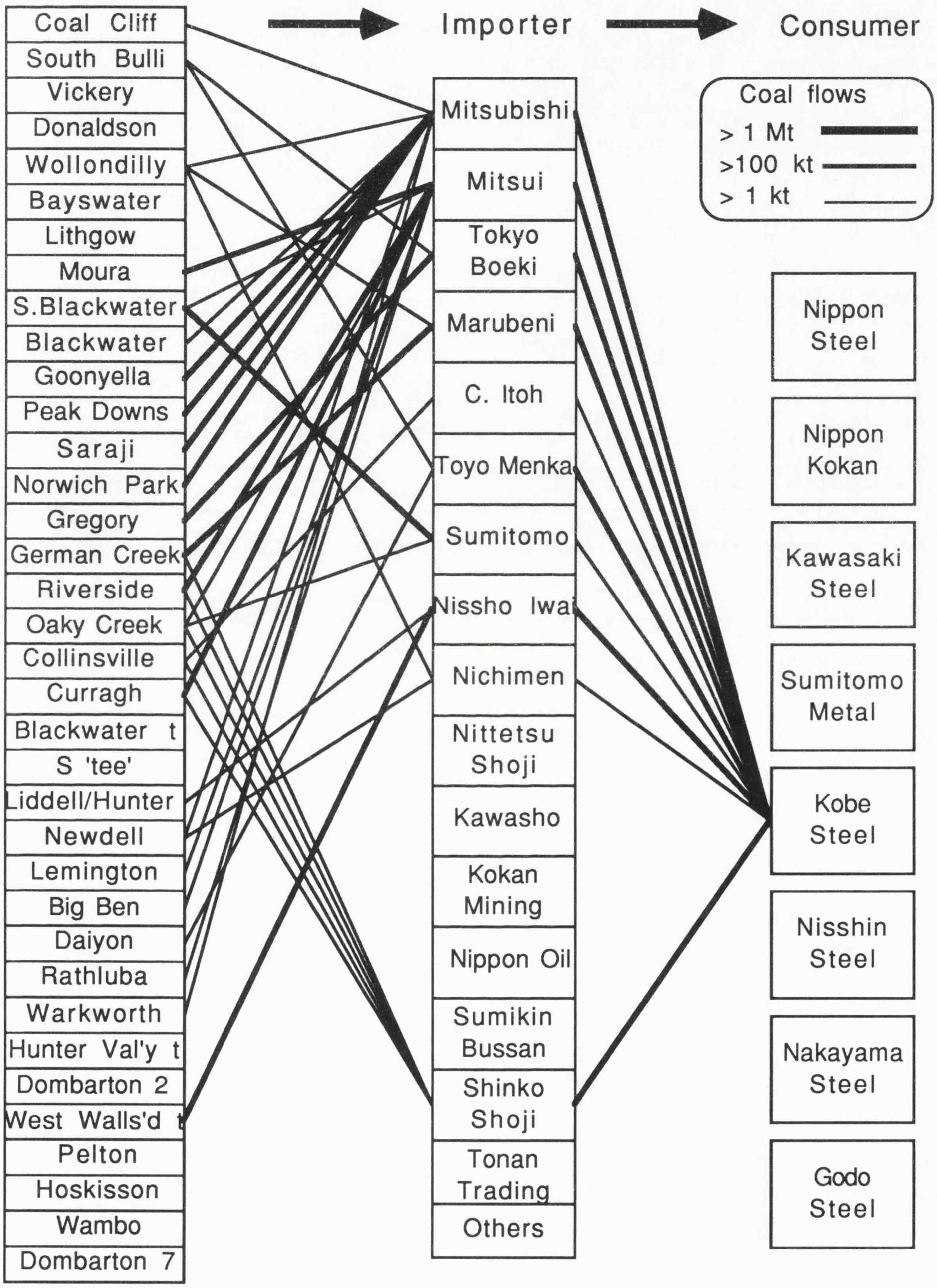
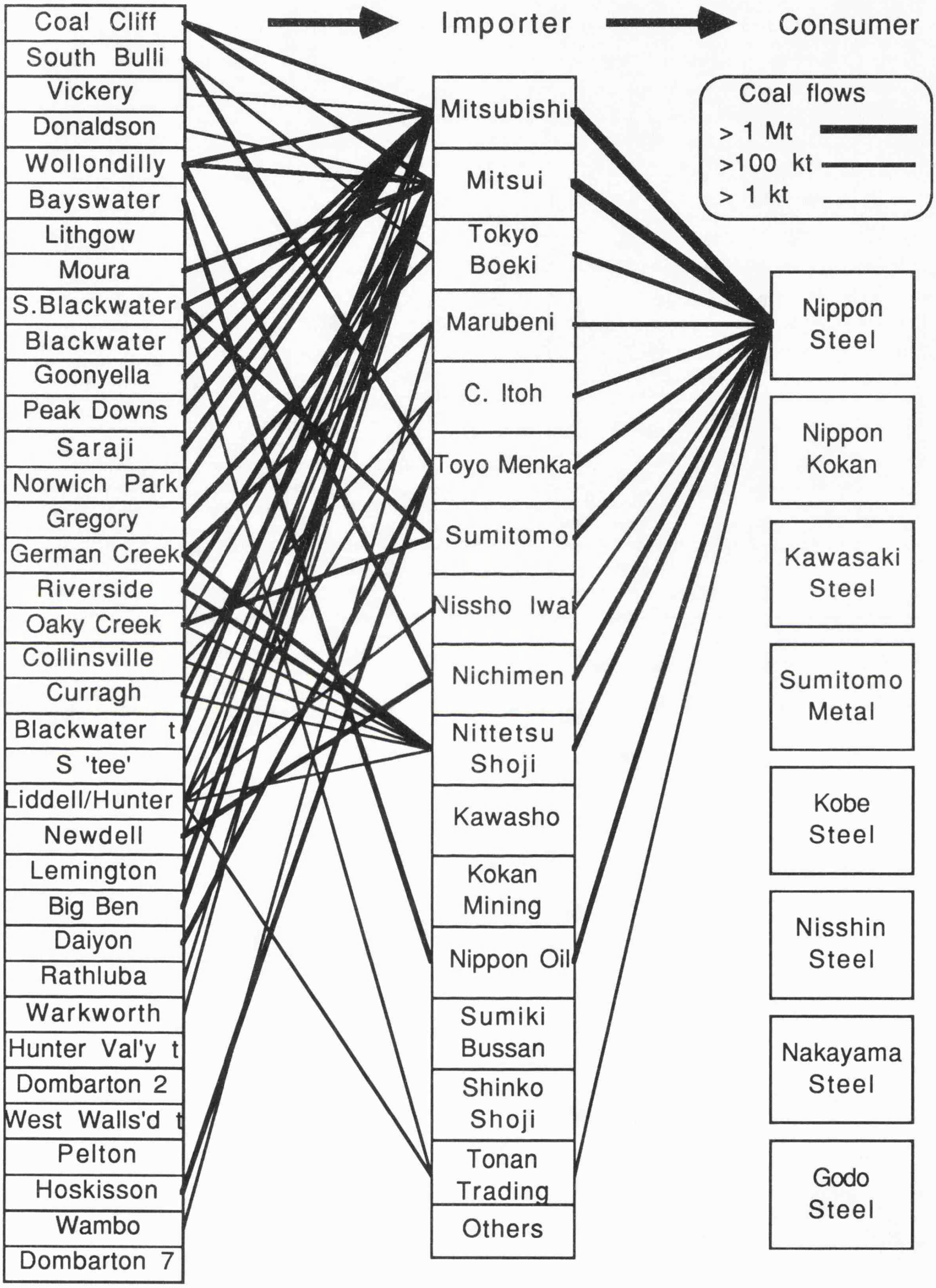


Figure 8.10: Australian coal contracts with Nippon Steel, 1984



The first feature which emerges from the comparison of the three different sized mills is the similarity of their contract arrangements. In each case, the number of contracts with Mitsui or Mitsubishi as the importer is very similar. The contrast is found in the size of each contract. Godo Steel contracts average only 10kt each while most Nippon Steel contracts are over 100kt in size and average 200kt when sogo shosha are the importer[20]. Kobe Steel formed an intermediate position with a similar number of contracts as Nippon Steel, but a smaller average size (50-100kt). The general pattern identified in Figure 8.6 is reinforced.

Other sogo shosha were also active in this trade. The number of their contracts was similar for Nippon and Kobe Steel but smaller for Godo Steel. Presumably, the benefits of further dividing this small trade are limited. For example if the number of transactions doubled, the size of each contract would fall from 10kt to 5kt. With commissions based on contract tonnage, the incentive to further divide the trade is diminished. The Godo case illustrates that the largest sogo shosha extend their trade network to the smallest consumers while other traders are less active in this area.

In contrast to the extension of large sogo shosha networks to the smallest consumers, the smallest traders were found to be most active in providing supplies to the largest consumer. More specialist traders have contracts with Nippon Steel than any other consumer. Despite its complexity the pattern is highly stable. Most trade links are used for several consumers and then repeated in future years.

8.6.3 Traders and repeated transactions

The repetition of transactions was identified as another means to reduce transaction costs. These repetitions can be conducted under long term contracts, evergreen contracts or repeated annual contracts. The extent of contracts remaining active for over a decade is illustrated in Table 8.11. The largest traders had more transactions in 1976 than other traders and also had contracts of longer duration. Mitsubishi and Mitsui arranged over 100 transactions each and 11 years later, 70% of these transactions were still active.

A time series comparison of transaction data for 1976 and 1987 reveals that this pattern is very common in the coking coal trade. Almost exactly one half of the 568 transactions in 1976 were still active with the same coal brand imported by the same trader for the same consumer 11 years later (288 cases = 50.7%). This pattern is only partially explained by the existence of long term contracts. Many of the trading relationships persisted after long term contracts expired (as in the case of Australian hard coking coals from central Queensland and the south coast of NSW, and Canadian coals from mines established in the early 1970s). Alternatively, the trade may persist on the basis of annual renegotiations as in the case of soft coking coal producers in the Hunter Valley.

Table 8.11: Proportion of 1976 transactions still active in 1987

trader	# 1976 transactions	# active in 1987	%
Mitsubishi	109	78	72
Mitsui	101	70	69
Marubeni	80	26	33
C.Itoh	58	17	29
Nissho Iwai	49	14	29
Toyo Menka	44	19	43
Sumitomo	37	22	60
Nichimen	31	16	52
Kanematsu	7	3	43
sogo shosha	516	265	51
Tokyo Boeki	15	6	40
trading subsidiaries	30	8	27
other	7	4	57
other traders	52	23	44
total	568	288	51

source: derived from contract data

8.6.4 Traders and coal brands

The creation of an integrated trading system based upon trade in particular brands being coordinated by sogo shosha is argued to be the Japanese method to reduce transaction costs in a fragmented global coal trade. The relationship between traders and coal brands is important for two reasons. First, it illustrates the general pattern of sogo shosha gaining exclusive rights for trade in particular brands which can be identified with the firm. Second, it illustrates the system approach adopted by sogo shosha whereby they promote particular mines or brands to meet incremental demand and sustain the system during repeated transactions.

To gain insight into this process the coal transactions were classified according to the proportion of the contracts for each brand which involved each trader. If a trader was nominated as the importer for all (100%) of the contracted volume of a particular brand of coal then it was classified as the sole importer. If the trader imported the majority of the contracted volume (>50%,<100%) then it is called the dominant importer. If the share of imports is not dominant, but still greater than 10%, the trader is termed a significant importer. Finally, if the share of imports is less than 10% of the volume for that brand of coal, then the trader is termed a small importer of that coal. Tables 8.12 and 8.13 provide the distribution of coal contracts by classifying the importer as being either the sole, dominant, significant or small importer for that brand.

The pattern of sogo shosha having sole import rights for particular coal brands is present, but Table 8.12 indicates that it is not as extensive as might be expected from the discussion of their control over trade systems. In 1976 and 1987 approximately 50 brands of coal were imported by only one importer. Other arrangements were more numerous with several traders importing the same brand of coal. Despite the numerical diversity of these smaller arrangements, the 50 brands imported by sole traders provided over half of the total contracted tonnage. The conventional sogo shosha practice of controlling trade in its particular lines of products thus forms the basis of the Japanese coking coal trade, but is not an exclusive practice.

Table 8.12: Class of importer in coking coal contracts, 1976 and 1987.

1976 contracts importer class	sole 100%	dominant >50%	significant >10%	small <10%
trader		# of coal brands		
Mitsui	6	4	8	2
Mitsubishi	7	4	2	1
other sogo shosha	32	13	40	13
sogo shosha	45	21	50	16
Tokyo Boeki	5	0	3	2
trading subsidiaries	2	0	11	6
specialised traders	7	0	14	8
total	52	21	64	24
1987 contracts				
Mitsui	9	9	8	3
Mitsubishi	11	4	2	3
other sogo shosha	25	15	26	20
sogo shosha	45	28	36	26
Tokyo Boeki	3	1	0	4
trading subs	1	2	16	51
other	0	0	3	29
specialised traders	4	3	19	84
total	49	31	54	111

source: derived from contract data

The importance of the largest sogo shosha is particularly evident when the continuation of trade in the same brands is compared between 1976 and 1987 (Table 8.13). Of the 6 or 7 brands which Mitsui and Mitsubishi were the sole importer for in 1976, 4 of these brands were still traded in 1987. This continuation of two thirds of their 'exclusive' brands stands in contrast to the position of other sogo shosha. Of the 32 brands which other sogo shosha were the sole importer of in

1976 only 6 were still traded under the same arrangement in 1987. Mitsui and Mitsubishi had the most stable pattern.

Table 8.13: Class of importer in contracts continued from 1976 to 1987

importer class	sole 100%	dominant >50%	significant >10%	small <10%
trader		# of coal brands		
Mitsui	4	3	6	0
Mitsubishi	4	2	1	1
other sogo shosha	6	3	9	11
sogo shosha	14	8	16	12
Tokyo Boeki	1	0	1	1
trading subs	0	0	3	3
other	0	0	0	0
specialised traders	1	0	4	4
total	15	8	20	16

source: derived from contract data

The strength of the bargaining position of steel mills and their strategy of using many importers offers an explanation of the coal trade where particular brands were imported by multiple traders. One of the important developments in the coking coal trade was the rise in the role of specialised traders. This increase in their share of trade will be shown in this section to be a refinement of the dominant sogo shosha pattern rather than a complete replacement. Tokyo Boeki adopted the sogo shosha pattern of investing directly in a new mine and being the largest importer of that coal. This strategy was not followed by the trading subsidiaries of the steel mills.

Nittetsu, Kawasho and the other trading companies affiliated with steel mills did not invest directly in coal mines to form new vertically integrated corporate structures. Instead, they became a new dimension of the dominant sogo shosha trading structure. New coal mines in the 1980s were established under more complex arrangements than their predecessors. The prevalence of joint ventures with several investment partners was discussed earlier. Similar changes occurred in the trading arrangements.

Sogo shosha did not necessarily gain sole import rights in new mines. A new formula was often negotiated where the sogo shosha retained primary responsibility, but other traders were also included. The usual arrangement was for the trading subsidiary of each steel mill to be the importer of a fixed proportion (typically 10, 20 or 30%) of its coal contract from that particular mine. Each contract between a steel mill and its trading subsidiary would rarely exceed 5% of the imports of a particular coal brand. The existence of 3-6 such contracts still left 70-90% of the imports in the hands of the sogo shosha. Their exclusive position was replaced with one of continued primary responsibility (Table 8.12). The decline in sogo shosha share of coal imports does not represent an equal decline in their control over the coal trade.

New mines like Collinsville, Curragh, German Creek, Oaky Creek and Riverside in Queensland each had several steel mill subsidiaries as small importers of their coal while the largest tonnage was still imported by a sogo shosha (C.Itoh, Mitsui, Marubeni, Sumitomo and Mitsui, respectively). The sogo shosha thus retained the dominant role with 70-90% of total trade. However, the steel mills also gained as their trading subsidiaries established a parallel trade network to act as another source of information on the coal and a competitor to the sogo shosha.

The pattern of a uniform share of steel mill imports, typically 20%, being procured by a trading subsidiary emerged in the 1980s[21]. This new pattern replaced the more uneven experience of earlier mines where some of the smaller sogo shosha performed this role of providing a second pathway for the coal (like Nissho Iwai imports for Kobe Steel) or imports were obtained directly from the affiliated trading house (like Sumitomo or Kawasho) instead of the sogo shosha which dominated imports of that brand.

The new pattern for hard coking coal imports from new mines was not universal. The pattern of imports from the USA or semi-soft coking coal imports was much less structured and reflected the needs of individual mills and the best prices which could be negotiated with individual mines. The uniform allocation of American coals among the steel mills in proportion to their total import needs (as in the case of Australian and Canadian coals) was only followed for major brands under long term contracts. Instead, the prevailing pattern of sogo shosha including selected brands in their portfolio of information and trade networks was extended to cover most USA brands available for export. The steel mills still acquire their USA coal through the traders, but the combination of mines is not the same for each mill. Once again the pattern is one of diverse supply arrangements with sogo shosha using their extensive international information network to facilitate trade.

8.7 Conclusion

This chapter made a detailed investigation into coal trade transactions and discovered the extent and effectiveness of the specialised information structure represented by trading companies. In Europe coal traders were shown to extend the coal market by specialising in selling to small consumers, transhipping coal to small ports in northern Europe, arranging East-West trade and meeting special trade arrangements in north Africa. They often supplied large national consumers and maintained extensive contacts in supply countries. Despite their continued activity, the relative importance of European coal traders is in decline. New traders like the oil companies offer alternative fully integrated supply networks and new sources of information grow (newsletters, consultants and conferences). In contrast to the decline of traders in Europe, the sogo shosha continue to dominate Japanese coal trade.

The sogo shosha were shown to reduce transaction costs by aggregating the incremental demand of consumers, especially small consumers, to generate demand volumes which can be efficiently arranged. They also promote the repetition of transactions (beyond the legal requirements of long term contracts) to further reduce transaction costs and increase the benefits gained from their information assets. Finally, they promote the creation of new supply systems (mine, transport and infrastructure) to achieve the diversity and security objectives of consumers as well as enhance their marketshare.

The elaborate network of 100 transactions to supply the annual coking coal needs of each major steel mill provides several opportunities for competition. The large sogo shosha compete with smaller sogo shosha, with specialised traders like Tokyo Boeki, with trading subsidiaries of the steel mills and with specialised traders supplying Soviet or Chinese coal. Contracts are still signed by producers and consumers directly and the opportunity is present to change the sogo shosha based configuration to a conventional market model if the elaborate trade structures fail to benefit the parties involved.

One of the important benefits of sogo shosha activities is their attention to system creation and coordination whereby the costs of trade are reduced and security through diversity is increased. Simultaneous investment is made in production, transport, storage, distribution and consumption systems to gain economies of scale and incorporate advanced technology. The dominance of sogo shosha in Japanese coking coal trade is repeated in Japanese steam coal trade and growing in trade among third countries. In short, the Japanese information structure created by the sogo shosha is used to coordinate the extension of the Japanese production and financial structures to achieve Japanese security objectives. Their technique is to use several complementary forms of quasi-integration rather than the direct control implied by conventional equity based integration. The result is an extensive Japanese trade structure which includes many of the members of the global coal industry.

Endnotes:

1. Daintith and Rogers have a contract-based study of European energy (including coal) imports underway. Their results should provide much greater academic insights into the trade.

2. The three tiered information structure can undergo four types of associated change. First, the perceptions and beliefs which underlie value judgements and political/economic decision making can change (at the belief level). Second, the type of use of information channels can change (at the information level). Third, the provision of and control over information can change (at the information level), and finally the channel itself can be changed in terms of technology, composition or access (at the information channel level). Of these four types of change, the investigation concentrates on the provision of information and changes in the information channel. Information is used to agree on transactions and to coordinate trade at the system level. The control over this trade-related information is reviewed.

3. Asset specificity is the investment in an asset which has greater value in its expected use than in its second best use (Williamson 1975). For example if a mine is constructed to supply raw material to a nearby plant, its second best value may be much smaller if the next consumer is located further away and the transport costs are high. This example of site specificity can be repeated for other types of asset specificity: physical assets, technology (e.g. boiler design for specific coal qualitites), human capital, or dedicated assets where the production capacity is beyond current demand levels outside of the agreed contract.

4. For example, the German Coal Importers Association listed 39 members in 1988.

5. The list of branch offices or subsidiary companies of traders based in supply countries is illustrated by SSM of Rotterdam who have subsidiaries in the USA, Australia, Colombia and South Africa (SSM 1987). A similar list of SSM subsidiaries is found in the importing countries of Belgium, Brazil, Denmark, France, Hong Kong, Switerland, W.Germany and the UK.

6. This list excludes the small household and industrial consumers traditionally supplied by the traders. Similarly, the barge traffic in Europe where traders play an important role is not examined in detail. Instead, the table presents the large consumers whose contract arrangements are monitored by the international coal press.

7. In 1989 BP decided to sell its coal interests (ICR 1989).

8. An exception to the repeated success of the sogo shosha is the tenth sogo shosha, Ataka, which went bankrupt in 1978 after an outstanding loan of $800 million to the oil refinery, Newfoundland Refinery was unable to be repaid. The bankrupt

firm was merged with C.Itoh and its coal contracts are included in the C.Itoh total throughout this study.

9. The origins of the sogo shosha are traced back to the Meiji Restoration of 1868 when Japan was re-opened to international trade. The dominance of foreign traders soon led the government to place a priority on the rapid development of indigenous institutions that would be able to perform foreign trade functions (Yoshina and Lifson 1986:10). The companies were to fulfill three functions: reduce the near monopoly of foreign trade controlled by foreign business; develop external trade to supply materials, equipment and technology for Japanese industry; and build a system where labour was divided between the manufacturing role of domestic companies and the trade specialisation of trading houses (Young 1979:24).

Mitsui & Co. and Mitsubishi Corp. both expanded rapidly in the 1870-90 period and included coal mining and coal exports as two of their principal activities (Tsurumi and Tsurumi 1984:17; Mitsubishi 1986:60). Coal was later imported for Japanese manufacturing firms when domestic demand grew.

10. This represented a major recovery of an area of activity which ceased following the World War II, but had been an important pursuit in the early part of the century. Third country trade comprised 15, 33 and 23% of Mitsui sales in 1910, 1920 and 1930, respectivley (Kunio 1982).

11. Western trading companies typically adapted to industrialisation by either specialising as a particular commodity trader or establishing retail chains (Tsurumi and Tsurumi 1984).

12. Yamazawa (1989) provided a detailed investigation of the early trading activities of the sogo shosha in Japan. He constructed a production function for sogo shosha based on three types of inputs: market information, foreign transaction skills, and trade promotion services. He argued that the lack of trade promotion services (including trade credits and finance, marine insurance, and ocean transportation) were especially important to explain the failure of most of the 75 traders operating in 1878. The Suzuki case of a sogo shosha with weak internal financial institutions supports his theory. The importance of links with government was not considered.

In contrast to Yamazawa's internal assessment of sogo shosha success, Yonekawa (1985) complained that too much attention has been directed toward the financial, information and organisational services of sogo shosha. Instead, he concentrated on the stage of economic development in the national economy and entrepreneurial zeal as explanations of their success. While the stage of economic development may be important in creating opportunities for establishing sogo shosha, this external explanation seems inadequate to explain why similar trading companies did not emerge when other countries were at a similar stage of development. Indeed, the transition from the mercantile to the industrial era in Europe and North America was marked by the decline of traders rather than the growth experienced by their Japanese counterparts.

13. Large volumes of steel are purchased and then sold to many consumers with the sogo shosha maintaining the required stock. Most steel consumers found this system advantageous, although some large steel consumers like shipyards and automobile manufacturers try to avoid the sogo shosha by making direct deals with the mills (Yoshino and Lifson 1986).

14. This contract data is compiled largely from secondary sources. The validity was checked by presenting the contract data to coal traders and consumers and asking them to make any corrections. The result was a verification of the reliability of the data sources. As one sogo shosha official responded: 'We are reluctant to answer this question, but (the contract data is) surprisingly correct except for some minor details.' (response to Appendix D). The firm kindly revised some of the delivery volumes and verified that the enclosed list of coal contracts was accurate.

15. Each of the electric power companies with large import requirements over 0.5mtpa used the services of four or more sogo shosha while the smaller companies used three or fewer. In some cases, the import share of each sogo shosha was not clear because they shared the responsibility for imports from a single mine. The biggest example of this pattern is the Blair Athol mine which commenced exports in 1984. Blair Athol became the largest supplier of steam coal to the EPCs, reflecting their direct investment in the mine. However, the role of importer was divided between Nissho Iwai and Marubeni for the EPDC contract. The contracts for other EPCs involved Mitsui, Nissho Iwai and Marubeni as importers. Rather than make arbitrary allocations among the sogo shosha, the tonnage is presented as a separate item as part of the sogo shosha total. Imports from China are also divided among several traders and are treated in the same way (as a distinct group based on source rather than trader).

16. This large contract is reinforced by the joint shareholdings (1-4%) which Howard Smith (owner of Coal & Allied), Nissho Iwai and Ube Industries have in each other.

17. The success of Kawasho in selling Kawasaki products is demonstrated by its rise to the position of the tenth largest Japanese trading company based on turnover in the 1980s.

18. Those importing Soviet coking coal included Kyoho Tusho, Shinten Jitugyo, Okura trading, Tonan Trading, Hyuka Sangyo and Nomura Trading. Soviet steam coal was imported by Sumitomo, Nichimen, Hokkaido Coal Import Centre, Taiheiyo Kohatsu, Maizuru Koeki, Shinsui, Joban Kosan, Mitsui Mining, Peace Enterprise, Beryoza and Toho Bussan (Coal Manual 1985:427). The China specialists included: Kyoho Tusho, Okura Trading, Tonan Trading, Meiwa Sangyo, Kyoei Shoji, Asahi Bussan, Okaya Koki, Nishinihon Boeki, Tosho, Wako Koeki, Nichien, Hyogoken Boeki, Nishimura Shoji, Nihon Keitokuchin, Sangen Tsukuba, Shin-Nihon Tsusho, Mitsui Mining, Tokai Shoji and Itohman (Coal Manual 1988:94).

19. Table 8.A: Specialised traders' share of Japanese steam coal contracts, 1980-87

	EPDC	Chug	Hokk	Hoku	Shik	Toho	Kyus	Sumi	JobJ	Kan	Tok	tot
specialised trader	% of EPC contracts											
Tokyo Boeki												
1984						2					50	1
1987						4					50	1
Mitsui Mining												
1984	12					5	41					6
1987							35					1
Showa Shell												
1984	3					14		43				4
1987	3		6					32				2
Joban Kosan												
1984									24			.6
1987									24			.6
Taiheiyo												
1984									22			.6
1987									21			.5
Nippon Oil												
1984 & 1987		1										.3
Idemitsu												
1987							8					.2
Specialised traders												
1984	15	1				22	41	43	46		50	12
1987	3	1	6			4	42	32	45		50	5
Total tonnage contracted (mt)												
1980	0.8	0.3										1.1
1984	4.3	2.5	0.2	0.7	0.9	1.1	0.2	0.3	.3	.1	.1	10.6
1987	4.3	3.4	1.0	0.7	0.9	0.7	0.3	0.3	.3		.2	11.9

	Chic	Denk	MitbM	NipC	Onod	Osak	Sumi	Toka	Toyo	Ube	tot
specialised trader	% of cement company contracts										
Tokyo Boeki											
1984					23						2
1987					32						2
Bayswater (Nippon Oil, Sumitomo, Idemitsu)											
1984								84	16		3
1987	12							71	24		3
Showa Shell											
1984			4	4		21					3
1987			4	4							1
Idemitsu											
1987					6						.4
Specialised traders											
1984	0	0	4	4	23	21	0	84	16	0	8
1987	12	0	4	4	37	0	0	71	24	0	8
Total tonnage contracted (mt)											
1984	.4	.1	1.3	1.3	.9	.7	1.1	.2	.4	2.4	8.8
1987	.3	.1	1.2	1.2	.6	.5	.7	.1	.4	2.0	7.1

source: contract data set

20. Table 8.B: Number of coking coal contracts by importer

importer JFY	1976	1984	1987
	Nippon Steel	# of contracts	
sogo shosha			
Mitsui	18	24	22
Mitsubishi	12	18	15
other sogo shosha	47	50	42
sub-total	77	92	79
other traders			
Tokyo Boeki	7	8	8
Nittetsu	0	15	19
others	3	14	14
sub-total	10	37	41
total	87	129	120
		Kobe Steel	
sogo shosha			
Mitsui	9	17	19
Mitsubishi	12	14	15
other sogo shosha	38	38	39
sub-total	59	69	73
other traders			
Tokyo Boeki	1	4	5
Shinsho	3	12	10
others	1	7	8
sub-total	5	23	23
total	64	92	96
		Godo Steel	
sogo shosha			
Mitsui	11	12	13
Mitsubishi	9	12	10
other sogo shosha	5	8	9
sub-total	25	32	32
other traders			
Tokyo Boeki	0	2	2
others	0	0	0
sub-total	0	2	2
total	25	34	34

source: Coal Manual 1976, 1985, 1988

20 contd.

Table 8.C: Average coking coal contract size by importer

importer JFY	1976	1984	1987
Nippon Steel	average size (kt = '000 tonnes)		
sogo shosha			
Mitsui	485	334	262
Mitsubishi	686	308	207
other sogo shosha	215	137	149
sub-total	352	222	191
other traders			
Tokyo Boeki	231	282	278
Nittetsu		72	117
others	33	27	21
sub-total	172	101	116
average	331	187	165
total tonnage	28,800	24,100	19,900
sogo shosha		Kobe Steel	
Mitsui	181	119	85
Mitsubishi	141	83	47
other sogo shosha	63	63	54
sub-total	97	81	61
other traders			
Tokyo Boeki	4	106	94
Shinsho	50	22	25
others	2	5	6
sub-total	31	32	34
average	92	69	54
total tonnage	5,900	6,300	5,200
sogo shosha		Godo Steel	
Mitsui	9	10	8
Mitsubishi	18	10	9
other sogo shosha	5	8	6
sub-total	11	9	8
other traders			
Tokyo Boeki	0	17	18
Shinsho	0	0	0
others	0	0	0
sub-total	0	17	18
average	11	10	8
total tonnage	280	340	280

source: Coal Manual 1976, 1985, 1988.

21. The exceptions to these arrangements are where an affiliated sogo shosha was involved in the project. The affiliation between sogo shosha and steel mills within the same keiretsu was discussed earlier and is reinforced by the new contracting pattern. Each steel mill used its trading subsidiary to import a proportion of the coal from new mines in the 1980s except where the sogo shosha (the dominant importer) was also from the same keiretsu. The affiliations of steel mills, sogo shosha and the trading subsidiaries of steel mills are provided along with the names of mines where the sogo shosha and trading subsidiaries of affiliated steel mills avoid competition (Table 8.D).

Table 8.D: Affiliations among traders and steel mills

steel mill	affiliated sogo shosha	trading house subsidiary	mine without competition
Nippon Steel		Nittetsu	
NKK	Marubeni	Kokan Kogyo	German Cr
Kawasaki Steel	C.Itoh,Sumitomo	Kawasho	Collinsville Oaky Cr
Sumitomo Metal	Sumitomo	Sumikin	Oaky Cr
Kobe Steel	Nissho Iwai	Shinsho	Bullmoose

source: Yoshino and Lifson 1986; Coal Manual 1988

Chapter 9
Conclusion

9.1 Summary

This thesis offers five contributions to the study of resource trade in general and coal trade in particular. It develops an understanding of trade based on multiple structures rather than the single structure selected by most ideologies; it extends our knowledge of market structures, not just as numbers of firms, but as instruments which extend the power and bargaining position of their creators; it demonstrates the advantages of using contract or transaction level data and avoids the weaknesses of studies based on aggregate data; it links micro-economic detail at the transaction level to the international structures which are built to shape them; and it analyses changes in and extensions to the four primary structures (security, production, financial and information). These structures reach beyond the coal trade to also provide a framework for the analysis of other trade relations and the management of international environmental problems.

The theoretical basis of most trade studies is argued to be internally consistent, yet selective in its correlation with reality. The dominant ideologies of neo-classical economics, neo-mercantilism and Marxism offer valuable insights into socio-economic systems, but each suffers from their adherence to a model which values the actions of one dominant type of actor (individuals, states or classes). Each ideology includes normative judgements on how the system operates as well as positive tests (using selected data) to verify its predictions. The result is a consistent theory which correlates with only part of its object of study.

This thesis adopts the opposite strategy and starts with the known details of trade and then develops a structural international political economy model based on the identified dominant structures. The result is that rather than having a simple model derived from one aspect of international trade, a more comprehensive model is developed which can inform the debate in any of the dominant ideologies. For example, the desire of consumers to diversify supply sources was quantified in the consumer survey. The results could be used to define parameters (maximum marketshare, minimum number of supply countries, etc.) in a conventional least cost coal trade model. Instead, this study emphasised how consumers achieved this objective by identifying the quasi-integration linkages and price mechanisms which they considered important.

The most common coal trade models of least cost, efficiency maximising supply and political domination by an all-encompassing 'Japan Inc.' are both judged to be inadequate to represent global coal trade patterns. Instead, economics and politics are both recognised as contributing to international trade patterns. In addition, the conventional political economy approach of measuring the relative strength of market or state forces is replaced by a more comprehensive framework which includes financial and information structures.

The limitations of the conventional commodity market were demonstrated by the failure of least cost trade patterns and a single market price for coal to emerge. New supplies in the 1980s included high cost coal and long distance shipments. Both of these patterns conflicted with the least cost model.

Despite meeting the conditions for a commodity market and the reports in industry journals of competitive prices among coals from different sources, the overall pattern was one of persistent price variation. The expectation that international prices would vary less at the regional or national level (compared to intercontinental price variations) was not found in the data. Instead, prices at the national level showed wide variation based on the country of origin. Adjustments for the quality of coal did not remove this pattern and even steam coal in Europe (a widely publicised competitive market) demonstrated persistent price variations. Indeed, the uniformly high prices of 1980-82 were replaced by much lower and more varied prices in the late 1980s. These price variations equalled those found in the late 1970s and demonstrated a persistent feature of the trade. The conclusion is that global coal trade is fragmented rather than uniform.

One explanation of a fragmented pricing regime is that the market is dominated by a monopsonist which dictates prices to the respective markets. The hypothesis that Japan acts as a monopsonist through its 'Japan Inc.' machinery has some evidence (price, tonnage and classification discrimination) to support it. However, this model of an all-encompassing state based structure is rejected in favour of the more elaborate structural IPE model which better explains variations in the Japanese interaction with suppliers from various regions.

Consumer objectives were identified as a cause of the variation in trade patterns and price. The results of the consumer survey (covering 50% of Japanese and European coal imports) were used to assess the importance placed on different trade structures to achieve objectives like diversity of supply, least cost coal and limiting the marketshare of particular companies or countries.

The four primary structures were investigated in detail to determine how they each influenced global coal trade. Interactions among the structures are recognised and used to explain variations in trade patterns. For example, in some cases finance was used to achieve security objectives rather than the least cost extension of the production structure. Conflict can thus arise among the structures just as readily as support.

The security structure consists of state and private measures to increase the security of the state, its citizens and its industries. Private concerns about the security of supply of essential raw materials are thus included as part of the security structure. Corporate diversity of supply objectives may be reinforced by government policies. In particular, many governments responded to the oil price rises of the 1970s with explicit energy policies to enhance national supplies. National policies to support the coal industry occur in most coal producing countries. However, the annual cost of these policies reached over $10 billion per annum in the mid 1980s as the value of subsidies often exceeded international coal prices. Rather than continue to rely on expensive national sources of supply, governments turned increasingly to the international trade system as promoted by multilateral organisations like IEA and GATT.

The inherent conflict between national protectionist policies and multilateral free trade objectives was slowly resolved with a shift in emphasis from national to international security structures. This shift was most apparent in Europe where price signals were used to gain the desired diversity of supply from the global production structure. Japan also relied on the global production structure for its coal supply, but adopted a more active role to extend its national structures into the international arena.

The convergence of national policies on the acceptance of greater reliance on the international trading system created the need to examine the international production system itself. Hundreds of mines and companies were shown to supply the global coal trade. Measures of concentration were prepared at the national and international level. Despite some companies owning many mines and having dominant positions in a national industry, their position in the international trade was greatly reduced. Even the extensive international holdings of oil companies did not eliminate competition. The horizontal structure of the industry is based on many operators and is therefore considered competitive.

The vertical structure of the international coal industry is of equal interest. The prominent national pattern of mines wholly owned by consumers like steel mills or electric utilities is not repeated in the international industry. Instead, an extensive network of minority investments is found. Japanese consumers and sogo shosha have an extensive range of equity holdings, but European consumers and traders also followed the pattern for some of their imports. The result is not a system of fully integrated mines being controlled directly by a parent/consumer, but the quasi-integration of many mines into the supply network of particular traders or consumers. These investments generally increase the security and stability of trading relationships and thus reinforce the security objectives identified earlier.

Another source of power in the coal trade is the financial structure. Banks can create credit for investment in new mines independent from established members of the production structure (where retained profits and new equity issues are often used for investment). In the 1970s and 1980s the importance of the financial structure increased as new mines were increasingly funded from the financial sector through large project loans based on future cash flows from long term contracts. Contracts thus became an essential part of project finance. Both loans and long term contracts were used to establish new independent projects which compete with established members of the production structure.

In other cases, finance created another form of quasi-integration to reinforce minority equity investments in the production structure. Loans linked to long term contracts were sometimes repaid by fixed reductions in the coal price. Security objectives were reinforced by the use of concessionary funds from public sources like the Export Import Bank of Japan to finance new projects under bilateral trade agreements with China and the USSR. European governments also made loans to Poland in return for long term supply contracts. Even new private mines in Australian, Canada and the USA received loans from public as well as private banks. The result is a supportive combination or linking of the security, production and financial structures.

The extensive use of several forms of quasi-integration in the Japanese trade was proven to have a direct impact on trade. Higher prices were received in the 1980s by mines with Japanese minority investments. Contract duration was also longer (as measured by the percentage of transactions active throughout an 11 year period, 1976-87) for brands where sogo shosha had investments in the mine than for independent coal brands. The quasi-integration variables thus added an important explanation for trade patterns and price variation. Coal quality, country of origin and quasi-integration were each recognised as significant predictors of price.

The information structure added further insights into the global coal trade. The trading process was recognised as more complex than assumed in most studies. Transaction costs were reduced by the introduction of traders with specialised information networks. This reduced the cost of searching for trading partners, establishing diverse supplies, monitoring trade flows, supplying small consumers and conducting repeated transactions. The sogo shosha were especially successful in providing diverse supply networks to small consumers to enable them to achieve diversity of supply objectives at low unit costs. This was accomplished by the economies of scale gained by sogo shosha procurement on an industry scale rather than considering each transaction as discrete and separate. This system-wide view demonstrated that traders used information not only to facilitate particular transactions, but also to arrange and monitor complete trade flows to Japan and other countries.

The use of transaction data for analysis provided evidence and insights which is absent from other coal trade studies. European traders were shown to extend international coal markets with facilities to supply small consumers, tranship coal to small ports, conduct East-West countertrade deals and adapt to the special business arrangements of north Africa. Their extensive networks are also used to supply established national and new international customers. Despite these specialised achievements, the importance of traditional traders in Europe is in decline. More coal is sold by direct consumer-producer contracts and some oil companies act as new traders with integrated production, transport and delivery systems. Specialised sources of industry information (consultants, newsletters and conferences) have also grown to compete with the traders.

Despite widespread opinions emphasising the importance of least cost supplies in Europe, contract data demonstrated a persistent emphasis on price differentiation to achieve supply diversity. Prices for USA coals were almost universally higher than prices for other non-European coals. Only one quarter of European imports were from sources linked to consumers or traders by minority investment or bilateral trade agreements. In Japan, the opposite was true: three quarters of the imports came from such mines. Even long term contracts were less important in Europe than in the Japanese trade.

In contrast to European traders, Japanese sogo shosha dominate the Japanese trade. The common assertion that sogo shosha are the marketing arm for their keiretsu was refuted in the case of Japanese coal trade. Although sogo shosha may have a 10-20% larger marketshare for a fellow member of their keiretsu, the universal pattern is one of consumers using multiple sogo shosha for their import requirements. In this way, consumers can use the information resources of different sogo shosha to further implement their diversity of supply objectives. Sogo shosha actively construct international supply structures in cooperation with other Japanese actors. The result is a network of supportive Japanese trade structures which deliver coal from diverse sources with smaller price differentials than those in Europe.

The outcome of this recognition of four primary structures shaping the global coal trade pattern is a much richer understanding of the processes controlling trade and insights into variations from the standard models. The relative importance of each structure and the interaction among the four structures is used to explain diverse patterns in the trade. The European coal trade has only limited national structures extended internationally and will rely more on the diverse global structures for future supplies. In contrast, the production, financial, and information structures of Japan have been systematically extended to achieve security as well as efficiency objectives. The result is that Japanese industries hold more structural power over suppliers than their European counterparts. This power may be latent and not used or it can be exercised to ensure more reliable supplies.

However, the exercise of power and definition of objectives can create conflicts among the four primary structures. For example, conflict over the contract price for Quintette coal is in part a conflict between the Japanese financial structure where banks want their loans repaid and the Japanese production structure where steel mills want lower input costs. Similarly, the Japanese banks funding of the BHP takeover of CQCA created the largest coking coal exporter in the world and conflicted with the desire of Japanese steel mills to have many suppliers who can not affect market prices.

In other cases, the four structures were used to achieve shared objectives and create new trading systems through: minority equity holdings, loans, long term contracts and supportive government policies. The overall framework is more complex than that used in other studies, but explanations are provided for more of the trade anomalies which do not fit neatly into conventional trade models.

9.2 Future research

The structural international political economy model of trade offers a strong basis for the investigation of trade patterns and processes. Global coal trade demonstrates the insights and explanations offered by the model. The results can be used to improve conventional trade models by providing a better understanding of the institutions and structures which define the parameters required to make conventional models conform to actual trade patterns.

Of the four primary structures studied in the global coal trade, more research is needed into the operation of the financial structure and the increased importance of environmental security. The financial trends identified in this study can be better understood by a more detailed investigation of the project selection and finance negotiation process. Particular coal projects are selected for the funding of development loans and the signing of long term contracts. A variety of factors (including quasi-integration and the support of other primary structures) influence this process and a more complete understanding is required to advise potential participants in the trade.

Equally important is the increased priority attached to environmental security. National and international energy systems affect both the local and global environment. Irreversible changes are being recognised and adjustments in energy systems proposed. The interaction among security, production, financial and information structures are important to analyse the effects of and advise on proposed changes (like the introduction of a carbon tax).

The structural framework thus provides an excellent base for the investigation of global environmental management issues. The problems of resource use and modern energy systems are well illustrated by coal combustion. A decision to reduce the environmental damage (local and/or global) caused by coal combustion is not based on any single criterion and a comprehensive investigation is required.

Issues of environmental security have reached international forums and new policy debates are emerging. The compatibility of these new policies with the interests of dominant members of the production and other structures needs to be examined. Changing energy systems and reducing pollution emissions require massive investments and the financial structure is essential for the creation of credit to make such investments. Information again plays a central role. One of the most important forms of information is that embedded in technology. The development and use of technology which is less environmentally damaging is an essential element of policies to achieve environmental objectives. The investigation of the four primary structures thus offers a clear way to advance our understanding of how global trade and economic systems can be adapted to meet enhanced environmental security objectives.

If changes are desired in the way a particular trade is conducted, a thorough understanding of its operation is required first. The structural IPE model can be used to dissect the complexities of trade. The importance of national and international elements within each of the four primary structures can be used to explain the allocation of power among various groups of actors. If some national structures are developed far more than others, as in the case of the global coal trade, then different approaches need to be used in different sections of the global structure. For example, the future expansion of supply to meet increased demand in Japan will almost certainly involve the extension of sogo shosha supply networks. In contrast, increased European demand for imports, as caused by the privatisation of the CEGB, will be met by independent producers responding in accord with their expectations of future market conditions. The linkages among firms are weaker and trade patterns less certain. The expected result will be more uncertainty over supply sources and increased price variations, in comparison to those experienced in Japan.

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Appendix A: Coal brands and producers/sellers in international coal trade

brand	seller	producer/seller full name	country	source
Aberdare	Aberdare	Aberdare Collieries PL	Australia	ICR169:3
Upshur	Agip USA	Agip USA	USA	ICR164:5
Carbozulia	Agipcoal	Agipcoal	Venezuela	CWI924:3
Kangra	Agipcoal	Agipcoal	SA	CWI824:3
	Allied Indo C	Allied Indonesia Coal	Indonesia	ICQ206:5
New Whitwood	Allied QC	Allied Queensland Coalfields	Australia	QCB85:6
Gunnedah	AMI	Australian Mining Investments	Australia	JCB87:39
	Anadex	Anadex	USA	CWI927:6
Amcor ss	Anglo Am	Anglo American Coal Corp L	SA	CN861017
Bank	Anglo Am	Anglo American Coal Corp L	SA	CM85:382
Bank ss	Anglo Am	Anglo American Coal Corp L	SA	CM88:360
Good Hope	Anglo Am	Anglo American Coal Corp L	SA	CM87:392
Goodhope ss	Anglo Am	Anglo American Coal Corp L	SA	CN860804
Kleinkopje	Anglo Am	Anglo American Coal Corp L	SA	ICR182:3
	ANR Coal	American National Resources Coal Co	USA	CWI843:1
	AOV Coal	Alla-Ohio Valley Coal	USA	ICR1:14
	Arch Min	Arch Mineral Corp	USA	K588:4
Ashland	Ashland	Ashland Coal Co	USA	CM87:390
	Associated C	Associated Coal Sales	USA	CWI860:29
Dombarton	A&B	Austen & Butta L	Australia	CM76:100
Dombarton 2	A&B	Austen & Butta L	Australia	CM85:190
Dombarton 7	A&B	Austen & Butta L	Australia	CM85:222
Grose Valley	A&B	Austen & Butta L	Australia	CM76:122
Invincible	A&B	Austen & Butta L	Australia	ICR184:1
Western Blend	A&B	Austen & Butta L	Australia	CM87:433
	Balis AG	Balis AG	USA	ICR188:3
Paramount	Barber Paramt	Barber Paramount Coal CO	USA	CM85:120
Great Greta	Barix	Barix L	Australia	CM88:405
Lancashire	Barnes&Tucker	Barnes & Tucker Co	USA	CM88:130
Bayswater	Bayswater	Bayswater Colliery Co PL	Australia	CM87:390
	BC	British Coal	UK	ICR170:9
	Beckley	Beckley Coal Mining Co	USA	ICR119:5
South Bulli	Bellambi	Bellambi Coal Co L	Australia	CM88:184
West Bellambi	Bellambi	Bellambi Coal Co L	Australia	CM76:97
	Beth Energy	Beth Energy Mines Inc	USA	CWI843:1
Macquarie	BHP	Broken Hill Proprietary Co L	Australia	CM88:405
Blackwater	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85
Blackwater sc	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	CM85
Blackwater weak	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	CM85:216
Goonyella	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85
Gregory	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85
Gregory ss	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	CM87:7
Harrow Creek	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85
Illawarra	BHP-Utah	BHP-Utah (producer = BHP)	Australia	ICR183:3
Norwich P sc	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85
Norwich Park	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85
Peak Downs	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85
Saraji	BHP-Utah	BHP-Utah (producer = CQCA)	Australia	QCM85

brand	seller	producer/seller full name	country	source
Saxonvale	BHP-Utah	BHP-Utah (producer = BHP)	Australia	CWI828:3
	Big Sandy	Big Sandy Coal	USA	ICR164:5
Blair Athol	Blair Athol	Blair Athol Coal	Australia	CWI841:7
Bloomfield	Bloomfield Col	Bloomfield Collieries PL	Australia	CM87:387
Donaldson	Bloomfield Col	Bloomfield Collieries PL	Australia	CM88:194
Donaldson ss	Bloomfield Col	Bloomfield Collieries PL	Australia	CM88:194
Rathluba soft	Bloomfield Col	Bloomfield Collieries PL	Australia	CM88:175
Charbon ss	Blue Circle SC	Blue Circle Southern Cement L	Australia	CM88:196
Royal Scot	Blue Diamond	Blue Diamond Mining Inc	USA	CM85:126
Goedenhoop	Bordex M	Bordex Mining	SA	CM87:457
Clutha	BP Coal A	BP Coal Australia	Australia	CM87:394
Howick A ss	BP Coal A	BP Coal Australia	Australia	CN87
Howick ss	BP Coal A	BP Coal Australia	Australia	CM88:192
Newdell	BP Coal A	BP Coal Australia	Australia	CM85:211
Newdell ss	BP Coal A	BP Coal Australia	Australia	CM88:176
Tahmoor	BP Coal A	BP Coal Australia	Australia	CM88:185
Western Main	BP Coal A	BP Coal Australia	Australia	CM85:433
Ermelo	BP Coal SA	BP Coal SA	SA	CM85:477
Middelburg	BP Coal SA	BP Coal SA	SA	CM85:480
Kaltim Prima	BP/CRA	BP/CRA	Indonesia	ICR184:7
Coal Mountain	Byron Cr	Byron Creek Collieries L	Canada	CM87:394
	CAEEBrasileras	Companhia Auxiliar de Empresas Electricas B	Brazil	ICR137:8
Abersea	CAID	Coal & Allied Industries L	Australia	CM76:112
Hunter Valley	CAID	Coal & Allied Industries L	Australia	CWI839:5
Hunter Valley ss	CAID	Coal & Allied Industries L	Australia	CM88:9
Liddell soft	CAID	Coal & Allied Industries L	Australia	CM85:209
Maitland A	CAID	Coal & Allied Industries L	Australia	CM76:83
Maitland B	CAID	Coal & Allied Industries L	Australia	CM76:146
Wallarah	CAID	Coal & Allied Industries L	Australia	CM87:394
West Wallsend type	CAID	Coal & Allied Industries L	Australia	CM85:179
Indian Creek	Cannelton	Cannelton Industries Inc	USA	CWI843:1
Maple Meadow	Cannelton	Cannelton Industries Inc	USA	CWI843:1
German Creek	Capricorn	Capricorn Coal Management PL	Australia	CWI825:3
Cerrejon	Carbocol	Carbones de Colombia SA	Columbia	CWI829:2
Cerrejon (C)	Carbocol	Carbones de Colombia SA	Columbia	ICR212
	Carbomin	Carbomin Coal Sales	USA	ICR129:12
Luscar HV	Cardinal R	Cardinal River Co	Canada	CM88:276
Luscar std	Cardinal R	Cardinal River Co	Canada	CM88:276
	Carter Roag C	Carter-Roag Coal	USA	CWI917:5
Fila Maestra	Cavoven	Cavoven		CWI927:6
Big Rock	CCB	Castner, Curran & Bullit	USA	CM76:70
CCB HV	CCB	Castner, Curran & Bullit	USA	CM85:133
CCB LV	CCB	Castner, Curran & Bullit	USA	CM85:125
Keystone	CCB	Castner, Curran & Bullit	USA	CM76:70
Moatise	CCM	Compania Carbonifera de Mozambique	Mozambique	CM76:266
BV Blend	Clutha	Clutha L	Australia	CM85;226
Clutha	Clutha	Clutha L	Australia	ICR186:2
Clutha ss	Clutha	Clutha L	Australia	CM85:217
An Tai Bao	CNCIEC	China National Coal Import & Export Corp	China	ICR186:2
Datong	CNCIEC	China National Coal Import & Export Corp	China	CWI837:3
Fengfeng	CNCIEC	China National Coal Import & Export Corp	China	ICR197:9
Huaibei	CNCIEC	China National Coal Import & Export Corp	China	CM85:442

brand	seller	producer/seller full name	country	source
Kailuan	CNCIEC	China National Coal Import & Export Corp	China	CM85:367
Pingshuo	CNCIEC	China National Coal Import & Export Corp	China	CM85:442
TAISI anth	CNCIEC	China National Coal Import & Export Corp	China	CWI837:3
Xinglongzhuang	CNCIEC	China National Coal Import & Export Corp	China	CM88:10
Zaozhuang	CNCIEC	China National Coal Import & Export Corp	China	ICR197:9
	Coal As	Coal Associates	USA	CWI828:1
	Coal Co of P	Coal Co of P		ICR31:14
Buller	Coal Corp NZ	Coal Corp of NZ	NZ	CM88:374
Strongman ss	Coal Corp NZ	Coal Corp of NZ	NZ	CM88:374
Cook	Coal RQ	Coal Resources of Queensland PL	Australia	QCB85:60
Cook sc	Coal RQ	Coal Resources of Queensland PL	Australia	QCB85:60
lv cc	Coalarbed	Coalarbed	USA	K582:4
Redash	Coalarbed	Coalarbed	USA	CM85:120
Baal Bone	Coalex	Coalex PL	Australia	CWI827:3
Clarence	Coalex	Coalex PL	Australia	CM76:102
Lithgow	Coalex	Coalex PL	Australia	CWI825:3
Wolgan	Coalex	Coalex PL	Australia	CM76:103
	Coastal Coal	Coastal Coal International	USA	CWI860528
Sufco	Coastal States	Coastal States Energy Co	USA	CM85:439
Consol Blend	Consol	Consolidation Coal	USA	CM88:122
Emery	Consol	Consolidation COal	USA	CM85:437
Faraday	Consol	Consolidation Coal	USA	CM76:70
Itman	Consol	Consolidation Coal	USA	IEA89
Jenkinjones	Consol	Consolidation COal	USA	K586:4
Loveridge	Consol	Consolidation Coal	USA	ICR225:6
lv	Consol	Consolidation Coal	USA	CWI811:7
mv	Consol	Consolidation Coal	USA	ICR183:11
Rowland	Consol	Consolidation Coal	USA	CM76:1
Workman's Cr	Consol	Consolidation Coal	USA	CM85:8
Hail Cr	CRA	Conzinc Riotinto of Australia L	Australia	CM76:110
	Cravat	Cravat Coal Co	USA	ICR181:3
Line Creek	Crows Nest	Crows Nest Resources L	Canada	ICR165:12
Line Creek ss	Crows Nest	Crows Nest Resources L	Canada	CM88:97
	CSN	Companhia Siderugica Nacional	Brazil	ICR122:17
Lemmington	CSR	Commonwealth Sugar Refinery L	Australia	ICR162:6
South Blackwater	CSR	Commonwealth Sugar Refinery L	Australia	QCB85:64
W ss	CSR	Commonwealth Sugar Refinery L	Australia	CN860804
Woodlands	CSR	Commonwealth Sugar Refinery L	Australia	CM88:196
Yarrabee	CSR	Commonwealth Sugar Refinery L	Australia	QCB85:70
Curragh	Curragh	Curragh Queensland Mining Ltd	Australia	CWI834:1
Curragh sc	Curragh	Curragh Queensland Mining Ltd	Australia	CWI842:3
Curragh ss	Curragh	Curragh Queensland Mining Ltd	Australia	CM87:7
Bowen	Dacon/CAID	Dacon/CAID	Australia	CM76:83
	Derby Coal	Derby Coal	USA	ICR161:2
hv	Devco	Cape Breton Development Corp	Canada	CWI812:1
Lingan	Devco	Cape Breton Development Corp	Canada	CWI849:3
Phelan	Devco	Cape Breton Development Corp	Canada	CWI849:3
Lundale	Diamond Shamrock	Diamond Shamrock Coal Co	USA	CM85:125
Drayton	Drayton	Drayton Coal PL	Australia	ICR165:12
Alabama blend	Drummond CS	Drummond Coal Sales	USA	CM85:120
Brookwood	Drummond CS	Drummond Coal Sales	USA	ICR139:2
Cedrum	Drummond CS	Drummond Coal Sales	USA	ICR164:5

brand	seller	producer/seller full name	country	source
Drummond HV	Drummond CS	Drummond Coal Sales	USA	CM85:125
Drummond HVII	Drummond CS	Drummond Coal Sales.	USA	CM87:7
Drummond LV	Drummond CS	Drummond Coal Sales	USA	CM88:116
Drummond MV	Drummond CS	Drummond Coal Sales	USA	CM85:125
Drummond ss	Drummond CS	Drummond Coal Sales	USA	CM88:122
Lint	Drummond CS	Drummond Coal Sales	USA	CM85:125
Nebo	Drummond CS	Drummond Coal Sales	USA	CM85:120
PML	Drummond CS	Drummond Coal Sales	USA	CM85:8
Short Creek	Drummond CS	Drummond Coal Sales	USA	CM88:122
lv	Eastern As	Eastern Associated Coal Corp	USA	ICR115:15
Wells-Lightfoot	Eastern As	Eastern Associated Coal Corp	USA	K586:13
Huntley	Elcom	Electricity Commission of NSW	Australia	CM76:100
Saxonvale	Elders	Elders Resources L	Australia	ICR225:9
Upshur	Enoxy	Enoxy Coal Co	USA	CWI309:2
Lemmington	Exxon A	Exxon Australia Resources PL	Australia	ICR170:9
Woodlands	Exxon A	Exxon Australia Resources PL	Aus	CM88:196
Cerro	FCCI	Fetterolf Coal & Construction Ind	USA	CM88:130
Ellsworth	FCCI	Fetterolf Coal & Construction Ind	USA	CM88:130
Stott MV	FCCI	Fetterolf Coal & Construction Ind	USA	CM88:130
Fording HV ss	Fording	Fording Coal L	Canada	CM87:7
Fording LV ss	Fording	Fording Coal L	Canada	CM88:97
Fording R.HV	Fording	Fording Coal L	Canada	CM88:276
Fording R.std	Fording	Fording Coal L	Canada	CM88:276
Fording weaker LV	Fording	Fording Coal L	Canada	CM88:295
mid-vol	Fording	Fording Coal L	Canada	ICR169:4
Foreston HV	Foreston	Foreston Coal Sales	USA	AFR830216
Foreston LV	Foreston	Foreston Coal Sales	USA	CM76
Foreston MV	Foreston	Foreston Coal Sales	USA	CM76
Gem No 7A	Foreston	Foreston Coal Sales	USA	CM85:8
	Foreston CI	Foreston Coal International	USA	CWI860129:7
	Freeman	Freeman United Coal Mining Corp	USA	CWI250:4
Carribbean	Garland Coal	Garland Coal	USA	CM76:78
Ermelo	Gencor	General Mining Union Corp L	SA	CM87:389
Gencor	Gencor	General Mining Union Corp L	SA	CM85:452
Optimum	Gencor	General Mining Union Corp L	SA	CM85:382
Optimum ss	Gencor	General Mining Union Corp L	SA	CM88:360
Plateau	Getty Min.	Getty Minerals	USA	CM85:416
	Gilberton	Gilberton Coal Mining	USA	K594:1
Hoskisson	Golin Wallsend	Golin Wallsend Coal	Australia	CM88:196
Hoskisson ss	Golin Wallsend	Golin Wallsend Coal	Australia	CM88:196
Gregg River	Gregg River C	Gregg River Coal	Canada	CM88:276
Sewanee	Grundy	Grundy Mining Co Inc	USA	CM76:76
Colowyo	Hanna-Grace	Hanna Mining Co - WR Grace Co	USA	CM87:392
Ramsey blend	Harber Param't	Harber Paramount	USA	CM85:125
Ramsey type	Harber Param't	Harber Paramount	USA	CM85:125
	Hawley Fuel	Hawley Fuel	USA	ICR181:3
	Hickman-W	Hickman-Williams	USA	CWI860129:7
	Holand Carb	Holand Carbon Fuels	USA	CWI840:3
Alpine	ICC	Island Creek Coal Co	USA	CM88:122
Beatrice	ICC	Island Creek Coal Co	USA	CM85:118
Bird B	ICC	Island Creek Coal Co	USA	CM76:58
Gualey-Eagle	ICC	Island Creek Coal Co	USA	CM85:122

brand	seller	producer/seller full name	country	source
ICC HV	ICC	Island Creek Coal Co	USA	CM88:122
ICC HV (Upshur)	ICC	Island Creek Coal Co	USA	CM85:8,125
Pocah No6	ICC	Island Creek Coal Co	USA	ICR124:3
Sewell	ICC	Island Creek Coal Co	USA	CM76:60
Tioca	ICC	Island Creek Coal Co	USA	CM76:62
VP No4	ICC	Island Creek Coal Co	USA	CM76:74
	ICCJ	Island Creek Coal Co of Japan	USA	CWI860129:7
UK	ICF London	ICF London	UK	CWI850:3
	IMC CP	IMC Carbon Products	USA	CWI860129:7
	Incontra	Incontra Ltd	USA	CWI850528
Raven	Int Carbon	International Carbon & Minerals Corp	USA	CM85:119
Cerrejon	Intercor	International Colombia Resources Corp	Columbia	ICR188:5
Beverly	Intermountain	Intermountain Coals Inc	USA	CM85:125
	International C	International Coal	USA	CWI860528
Arthur Taylor	JCI	Johannesburg Consolidated Investment Co L	SA	CM85:480
Amberley	Jeebropilly	Jeebropilly Collieries PL	Australia	QCB85:7
Rylance	Jeebropilly	Jeebropilly Collieries PL	Australia	CM85:470
Blue Creek lv	Jim Walter	Jim Walter Resources Co	USA	K584:3
Williams	John Irish M	John K Irish Mining	USA	CWI860129
Madison	Kanawha C	Kanawha Coal Co	USA	CWI839:1
Coal Cliff	KCC	Kembla Coke & Coal	Australia	IEA89
Vickery	KCC	Kembla Coke & Coal	Australia	CM85
Kellerman	Kellerman M	Kellerman Mining	USA	CM76:76
	Kentucky ER	Kentucky Energy Resources	USA	CWI860528
	Koal Ind	Koal Indus.	USA	K593:3
	Koch Coal	Koch Coal International	USA	K586:13
Coal Valley	Luscar St	Luscar Sterco L	Canada	CM87:390
Mettiki	Mapco	Mapco Coals	USA	K586:4
cc	Maran Coal	Maran Coal	USA	CWI841:7
sc	Marcoal	Marcoal	USA	K594:4
cc	Marimpex	Marimpex	USA	K598:4
Charleston HV	Massey	Massey Coal Export	USA	CM88:122
Charleston LV	Massey	Massey Coal Export	USA	CM88:116
Charleston MV	Massey	Massey Coal Export	USA	CM85:125
Clintwood	Massey	Massey Coal Export	USA	CM76:64
Masco	Massey	Massey Coal Export	USA	IEA89
Massey HV	Massey	Massey Coal Export	USA	CM76:64
Massey LV	Massey	Massey Coal Export	USA	CM88:116
Massey MV	Massey	Massey Coal Export	USA	CM76:64
Massey Pocahontas	Massey	Massey Coal Export	USA	CM76:64
Massey ss	Massey	Massey Coal Export	USA	CM88:122
Premier	Massey	Massey Coal Export	USA	CM88:116
Russel Fork	Massey	Massey Coal Export	USA	CM88:120
Slab Fork	Massey	Massey Coal Export	USA	CM88:116
Tenessee Consol	Massey	Massey Coal Export	USA	CWI846:3
anthracite	McCall	Jno McCall Coal Export	USA	K594:1
lv	McCall	Jno McCall Coal Export	USA	K598:4
McCall HV	McCall	Jno McCall Coal Export	USA	CM85:125
Permac	McCall	Jno McCall Coal Export	USA	ICR224:1
Prime	McCall	Jno McCall Coal Export	USA	CM85:125
sc	McCall	Jno McCall Coal Export	USA	K591:4
Smoky R	McIntyre	McIntyre Mines L	Canada	ICR122:10

brand	seller	producer/seller full name	country	source
Smoky R lv	McIntyre	McIntyre Mines L	Canada	ICR169:4
Smoky R ss	McIntyre	McIntyre Mines L	Canada	CM88:295
Mulga	Mead Corp	Mead Corp	USA	CM76:77
	Mercury C&C	Mercury Coal & Coke Inc	USA	CWI115:3
Metropolitan	Metropolitan	Metropolitan Collieries L	Australia	JCB87:39
Coal Basin	Mid-Cont R	Mid-Continental Resources	USA	K595:2
Big Ben soft	Miller	RW Miller	Australia	CM88:175
Big Ben SS	Miller	RW Miller	Australia	CM88:175
Miller blend	Miller	RW Miller	Australia	CM85:417
Mt. Thorley	Miller	RW Miller	Australia	CM85:417
Collinsville	MIM	Mount Isa Mines Ltd	Australia	QCB85:59
Newlands	MIM	Mount Isa Mines Ltd	Australia	ICR181:14
Oaky Creek	MIM	Mount Isa Mines Ltd	Australia	QCB85
Oaky Creek sc	MIM	Mount Isa Mines Ltd	Australia	CM88:97
Oaky Creek ss	MIM	Mount Isa Mines Ltd	Australia	CM88:97
	MMTC	Minerals & Metal Trading Corp	India	
Muswellbrook	Muswellb'k E&M	Muswellbrook Energy & Minerals L	Australia	CM85:458
Muswellbrook ss	Muswellb'k E&M	Muswellbrook Energy & Minerals L	Australia	CM88:197
stoker	National	National Mines	USA	K582:4
Mathies	National St	National Steel	USA	CWI839:1
	Nerco	Nerco Coal Sales	USA	K593:2
Penn-Pocahontas	Neris Int	Neris International	USA	CWI860129
Svonavec	Neris Int	Neris International	USA	CWI860129
New Hope	New Hope	New Hope Collieries PL	Australia	CM87:393
Walloon	New Hope	New Hope Collieries PL	Australia	CM87:406
Daiyon soft	Newcastle Wall	Newcastle Wallsend Coal Co PL	Australia	CM88:194
USA	Newco	Newco	USA	ICR161:2
Gilbert	Newera Res	Newera Resources Corp	USA	KCIM86:678
	Nigerian C	Nigerian Coal Corp	Nigeria	ICR122:17
sc	Noranda C	Noranda Coal	USA	CM87:392
Spitzbergen	Norway	Norway	Norway	CWI841:7
	NSF	National Smokeless Fuels	UK	K598:4
Oakleigh	Oakleigh Col	Oakleigh Colliery PL	Australia	CM88:408
Kitt	Old Ben	Old Ben Coal Co	USA	CM85:125
Old Ben	Old Ben	Old Ben Coal Co	USA	CM88:9
China	Omega	Omega Industries	USA	CWI836:2
	Oneida	Oneida Coal Co	USA	CWI828:1
Cumberland	Ontario H	Ontario Hydro	USA	ICR124:17
	Oremco	Oremco Inc	USA	K584:3
anth	Palmco Corp	Palmco Corp	USA	K594:1
PBS HV	PBS Coals	PBS Coals	USA	CM87:7
PBS LV	PBS Coals	PBS Coals	USA	CM85:118
hv	Peabody	Peabody Development	USA	K588:1
Nebo	Peabody	Peabody	Australia	CM76:110
Ellalong	Peko W	Peko Wallsend L	Australia	ICR197:5
Ellalong hc	Peko W	Peko Wallsend L	Australia	ICR197:5
Ellalong ic	Peko W	Peko Wallsend L	Australia	ICR197:5
Peko blend	Peko W	Peko Wallsend L	Australia	CM85:431
Peko ss	Peko W	Peko Wallsend L	Australia	CM88:194
Pelton-Ellalong so	Peko W	Peko Wallsend L	Australia	CM88:176
Baiduri	Peru Negara	Perusahaan Negara Tambang Batubara	Indonesia	CM85:447
PG&H	PG&H	PG&H	USA	CM87

brand	seller	producer/seller full name	country	source
Bradford	Phipps Co	Phipps Co	USA	CM85:120
US	Pickands M	Pickands Mather & Co	USA	K586:13
Chisholm	Pikeville	Pikeville Coal Co	USA	CWI839:1
	Pittcari	Pittcari Coal	USA	K588:12
Elkay	Pittston	Pittston Coal Export	USA	CM87
Rum Cr	Pittston	Pittston Coal Export	USA	CWI927:6
Grand Baja HV	Pittston	Pittston Coal Export	USA	CM88:128
Pittson BS Blend	Pittston	Pittston Coal Export	USA	CM76:73
Pittson MV Blend	Pittston	Pittston Coal Export	USA	CM88:128
Plateau	Plateau	Plateau Mining	USA	ICR161:2
Ombilin	PN Tambang B	PN Tambang B	Indonesia	CM88:424
	Powellton	Powellton Coal	USA	CWI860129
bit.c	Primary	Primary Coal	USA	K582:4
	Prodeco	Prodeco	Columbia	CWI740:5
Kutai	PT Fajar Bumi	PT Fajar Bumi Sokti	Indonesia	CM87:394
Katima	PT Katima	PT Katima Prima Coal	Indonesia	CWI842:1
Kitadin	PT Kitadin	PT Kitadin Corp	Indonesia	CM85:447
Tanito Harum	PT Tanito H	PT Tanito Harum	Indonesia	CM87:422
	P&C Bit	P&C Bitumous	USA	K586:1
	P&C-Ryan Walsh	P&C-Ryan Walsh	USA	CM88:394
Quintette	Quintette Coal	Quintette Coal	Canada	CM88:294
Quintette sc	Quintette Coal	Quintette Coal	Canada	CM87:453
	Rand	Rand Mines	SA	ICR162:6
Rhondda	Rhondda Col	Rhondda Collieries PL	Australia	CM88:450
	Roch&Pit	Rochester & Pittsburgh	USA	K586:13
Ipswich	Rylance Col	Rylance Collieries & Brickworks	Australia	CM87:406
	Saarbergwerke	Saarbergwerke	W Germany	ICR182:11
	Scancarbon	Scancarbon		CWI921:3
Ingram	Shell	Shell	UK	ICR224:7
Drayton	Shell A	Shell Australia	Australia	CWI817:3
Line Creek	Shell Canada	Shell Canada	Canada	ICR169:2
Kleinkopje	Shell SA	Shell South Africa	SA	CM85:445
Reitspruit	Shell SA	Shell South Africa	SA	CM85:445
Bukachachinsky	Sojuzpromx	Sojuzpromexport	USSR	CM85:427
Cheremkhovsky	Sojuzpromx	Sojuzpromexport	USSR	CM85:427
GSEH	Sojuzpromx	Sojuzpromexport	USSR	CM85:426
Kuznetsky coal	Sojuzpromx	Sojuzpromexport	USSR	CM88:10
Kuznetsky G6	Sojuzpromx	Sojuzpromexport	USSR	CM76:240
Kuznetsky GK	Sojuzpromx	Sojuzpromexport	USSR	K598:4
Kuznetsky GSSH	Sojuzpromx	Sojuzpromexport	USSR	CM85:427
Kuznetsky K	Sojuzpromx	Sojuzpromexport	USSR	ICR169:3
Kuznetsky K10	Sojuzpromx	Sojuzpromexport	USSR	CM76:240
Kuznetsky KJ14	Sojuzpromx	Sojuzpromexport	USSR	CM76:240
Kuznetsky OS	Sojuzpromx	Sojuzpromexport	USSR	CM76:240
Neliungla K	Sojuzpromx	Sojuzpromexport	USSR	CM85:361
Neliungla ss	Sojuzpromx	Sojuzpromexport	USSR	CM85:427
Neryungrinshy G	Sojuzpromx	Sojuzpromexport	USSR	ICR169:3
Neryungrinshy ss	Sojuzpromx	Sojuzpromexport	USSR	ICR169:3
Partizansky J6	Sojuzpromx	Sojuzpromexport	USSR	CM85:427
Partizansky T	Sojuzpromx	Sojuzpromexport	USSR	CM85:427
Shaktersky	Sojuzpromx	Sojuzpromexport	USSR	IEA89
	Solar Int	Solar International Trading		K590:1

brand	seller	producer/seller full name	country	source
Polly	South East	South East	USA	CM85:122
Special Pocahontas	Sprague CI	Sprague Coal International	USA	CM76:58
Sprague HV	Sprague CI	Sprague Coal International	USA	CM85:125
Sprague MV	Sprague CI	Sprague Coal International	USA	CM76:60
Tams type	Sprague CI	Sprague Coal International	USA	CM76:58
West Gulf	Sprague CI	Sprague Coal International	USA	CM76:58
Gilberton CM	Star Energy	Star Energy	USA	K594:1
	Sture Norske	Sture Norske	Norway	CWI927:7
China,sized coal	Sucre Danre	Sucre Danre	France	CWI836:2
Majestic	Summers Fuels	Summers Fuels	USA	CM85:125
Sunedco	Sun Coal	Sun Coal Co Inc	USA	ICR224:1
Usibelli	Suneel	Suneel Alaska	USA	K592:14
MV Blend	Tanoma	Tanoma Coal	USA	K598:4
sc	Taywood	Taywood Coal	USA	CM87:392
Witbank	TCOA	Transvaal Coal Owners Association	SA	ICR162:6
K coal	TDM	Thiess Dampier Mitsui Coal PL	Australia	CM85:217
K ss	TDM	Thiess Dampier Mitsui Coal PL	Australia	CM88:177
Moura	TDM	Thiess Dampier Mitsui Coal PL	Australia	QCB85:65
Moura sc	TDM	Thiess Dampier Mitsui Coal PL	Australia	QCB86
Moura weak	TDM	Thiess Dampier Mitsui Coal PL	Australia	CM85:8,194
Riverside	TDM	Thiess Dampier Mitsui Coal PL	Australia	K598:4
Riverside sc	TDM	Thiess Dampier Mitsui Coal PL	Australia	QCB86
Bullmoose	Teck-Bullmoose	Teck-Bullmoose Coal	Canada	CM88:276
Plateau	Texaco	Texaco	USA	CM87:392
S.Blackwater	Thiess Bros	Thiess Bros PL	Australia	CM85:279
S.Blackwater sc	Thiess Bros	Thiess Bros PL	Australia	QCB86
Tee coal	Thiess Bros	Thiess Bros PL	Australia	CM85:217
Blair Green	Thyssen	Thyssen Carbometal	USA	CM85:125
Green	Thyssen	Thyssen Carbometal	USA	CM85:125
Norton	Thyssen	Thyssen Carbometal	USA	CM85:125
Arthur Taylor	Total	Total Exploration SA	SA	CM88:392
Ermelo	Total	Total Exploration SA	SA	CM85:445
Pinnacle	Tower Res	Tower Resources	USA	CM85:416
Optimum	Transnatal	Transnatal Coal Corp	SA	ICR182:3
Ulan	Ulan	Ulan Coal Mines L	Australia	ICR165:12
Ulan #3	Ulan	Ulan Coal Mines L	Australia	ICR167:3
Obed Marsh	Union Oil	Union Oil of Canada	Canada	CM87:390
McCoy	United Coal	United Coal	USA	CM85:125
sc	United Coal	United Coal	USA	K586:1
Adrian	United Eastern	United Eastern	USA	CM85:126
	United En	United Energy Resource		K592:2
King	US Fuel	US Fuel Co	USA	CM85:416
Corbin	US Steel	US Steel Mining Co	USA	CM87:7
Maple Cr	US Steel	US Steel Mining Co	USA	CM87
Oakgrove	US Steel	US Steel Mining Co	USA	CM88:122
Pocahantas 3	US Steel	US Steel Mining Co	USA	CIR117:10
Cumberland	US Steel (op)	US Steel Mining Co	USA	CWI
Sierra	Utah Int	Utah International	USA	CM87:390
	Veba Int	Veba International	USA	ICR136:13
Vickery Cr	Vickery Cr	Vickery Cr	Canada	CM76:195
Wambo	Wambo	Wambo Mining Corp PL	Australia	CWI832:2
Wambo ss	Wambo	Wambo Mining Corp PL	Australia	CM88:196

brand	seller	producer/seller full name	country	source
Warkworth	Warkworth	Warkworth Associates	Australia	CM87:392
Warkworth ss	Warkworth	Warkworth Associates	Australia	CM88:176
	Watson	AL Watson & Co	USA	CWI860129:8
Commercial Brand	Weglokoks	Weglokoks	Poland	ICR169:2
First Maja	Weglokoks	Weglokoks	Poland	CM85:389
house coal	Weglokoks	Weglokoks	Poland	CWI851:5
Quinsam	Weldwood	Weldwood of Canada	Canada	ICR225:9
Balmer	Westar	Westar Mining L	Canada	ICR169:4
Balmer ox	Westar	Westar Mining L	Canada	CM76:194
Greenhills	Westar	Westar Mining L	Canada	ICR169:4
Westar special	Westar	Westar Mining L	Canada	CM88:295
Westar ss	Westar	Westar Mining L	Canada	CM88:292
Westfalen	Westfalen	Westfalen Colliery PL	Australia	QCB85:6
lv	Westmoreland	Westmoreland Coal Co	USA	K598:4
soft cc	Westmoreland	Westmoreland Coal Co	USA	K584:11
Westmoreland	Westmoreland	Westmoreland Coal Co	USA	CWI829:7

sources:
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CM88:120 = Coal Manual. 1988. p120.
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ICR47:11 = International Coal Report. issue 47. p11.
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KCIM85:11 = Keystone Coal Industry Manual. 1985. US Coal Production by Company. p11.
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KNB7.1:6 = Keystone News Bulletin. vol.7 no.1 p6.
QCB85:70 = Queensland Coal Board. 1985. Annual Report. p70.
SOMO89:12 = SOMO. 1989b. Bijlagen De keten Gebroken. p12.

Appendix B: List of international coal buyers by country and industry

buyer	buyer, full name	industry	country	source
Aalborg Cem	Aalborg Portland Cement	cem	Denmark	IEA88:I95
Acme St	Acme Steel	st	USA	ICR170:9
ACZC	ACZ de Carbonisation	cok	Neth	ICR14:5
Adana Cem	Adana Cement	cem	Turkey	CWI828:3
AES	AES (Hawaii)	el	USA	ICR224:8
Agadir Cem	Agadir Cement	cem		ICR170:15
Agipcoal	Agipcoal	tr	Italy	CWI919:2
AHV	AHV	st	Spain	CM85:86
Al Nasr	Al Nasr steelworks	st	Egypt	ICR164:2
Algoma St	Algoma Steel	st	Canada	CWI843:1
Analiese Zem	Analiese Zement AG	cem	W Germany	ICR156:5
Ankara Mun	Ankara Municipality	el	Turkey	CWI850:5
Anker	Anker Coal	tr	Neth	ICR48:12
Antalya	Antalya		Turkey	K586:4
Asahi Chem	Asahi Chemical	chem	Japan	CM88:403
ASEA	ASEA	mfr	Sweden	ICR182:13
Asia Cem	Asia Cement	cem	Taiwan	CWI927:1
Asland Cem	Asland Cement	cem	Spain	CWI830:3
Aso Cem	Aso Cement	cem	Japan	CM85:427
ATIC	Association Technique de l'Importation Charbonniere	imp	France	K584:11
Atlas CMD	Atlas Consolidated Mining & Development Co		Philippines	CWI908:9
Balis AG	Balis AG		W Germany	ICR
Banbury Fuels	Banbury Fuels	tr	UK	K584:3
Banwal	Banwal		S Korea	ICR182:3
Baoshan	Baoshan steelmill	st	China	ICR225:9
Barcelona Cem	Barcelona Cement	cem	Spain	ACR83
Belbrico	Belgian British Coal Co	tr	Belgium	ICR
BEWAG	Berliner Kraft und Licht	el	W Germany	CWI850:7
BHP	BHP	st	Australia	ICR226:1
Bolu Cem	Bolu Cement	cem	Turkey	CWI810:3
BSC	British Steel Corp	st	UK	ICR169:2
Caralec	Caralec	imp	Spain	ICR136:16
Carbocem	Carbocem	cem	Spain	CWI927:6
Carboex	Carboex	imp	Spain	ICR22:12
Carbomed	Carbomed		Spain	ICR114:12
Carboneras	Carboneras = Litoral de Almeria	el	Spain	ICR
Caribean Cem	Caribean Cement	cem	Jamaica	CWI921:3
Catalan Group	Catalan Group	cem	Spain	CWI839:3
Catalanes	Catalanes		Spain	ICR164:3
CCA	Container Corp of America		USA	CWI
CdF	Charbonnages de France	prod	France	ICR137:5
CdF Energie	CdF Energie	tr	France	ICR137:5
CDL	CDL		Ireland	ICR182:3
CEEB	Compania de Empresas Electricas Brasileras	el	Brazil	CWI922:3
CEGB	Central Electricity Generating Board	el	UK	CWI851:5
Cem dMallorca	Cementos de Mallorca	cem	Spain	ICR216:3
Cem Panama	Cementos Panama	cem	Panama	CWI833:7
Cementir	Cementir	cem	Italy	CWI824:3

buyer	buyer, full name	industry	country	source
Cementos Nac	Cementos Nacionales	cem	Dominican Rep	K587:4
Central P&L	Central Power & Light	el	USA,Texas	K595:1
CEP	Compagnie Francais Petroles	oil	France	CWI232:1
Chekka Cem	Chekka Cement	cem	Lebanon	K584:3
Chichibu Cem	Chichibu Cement	cem	Japan	CM88:407
China L&P	China Light & Power	el	Hong Kong	CWI842:1
China St	China Steel	st	Taiwan	K584:3
Chugoku EPC	Chugoku Electric Power Co	el	Japan	CM87:390
Cim d'Haiti	Ciment d'Haiti	cem	Haiti	K584:3
Cim La Farge	Ciments La Farge	cem	France	AFR850201
Cimpor	Cimpor	cem	Portugal	CWI848:2
Cior Cem	Cior Cement	cem	Morocco	CWI814:3
Co de Elect	Companhia de Electricidad	el	Spain	ICR195:11
Cockerill	Cockerill Sambre	st	Belgium	K584:11
Coe&C	Coe & Clerici	tr	Italy	CM88:463
Columbia Cem	Columbia Cement	cem	USA,Wash	ICR134:8
Cosipa	Companhia Siderugica Paulista	st	Brazil	K582:4
CVG/Sidor St	CVG/Sidor Steel	st	Venezuela	K594:4
Daewoo	Daewoo		S Korea	CWI840:7
Dai Han	Dai Han Coal		S Korea	K594:1
Daicel Chem I	Daicel Chemical Industries	chem	Japan	ICR228:4
Daichi Cem	Daichi Cement	cem	Japan	CM85:427
Daio Sheisho	Daio Seishi	pap	Japan	CM88:440
Daishowa paper	Daishowa Paper	pap	Japan	CM88:408
David Chem I	David Chemical Industries	chem	Japan	ICR228:4
Denki Kagaku	Denki Kagaku	cem	Japan	CM87:428
Dofasco	Dofasco	st	Canada	K584:2
EdF	Electricite de France	el	France	CWI832:1
EdP	Electricidade de Portugal	el	Portugal	CWI843:8
EFC	Electric Fuels Corp	el	USA	CWI922:3
EFO	EFO		Sweden	ICR170:9
Ehime Seishi	Ehime Seishi	pap	Japan	CM88:450
Elkem	Elkem Metal		Canada	K584:11
Elkraft	Elkraft	el	Denmark	ICR169:3
Elsam	Elsam	el	Denmark	K584:11
Endesa	Empresa Nacional de Electricidad	el	Spain	ICR15:16
Endesa,Ch	Empresa Nacional de Electricidad of Chile	el	Chile	CWI846:3
ENEL	Ente Nazionale per l'Energia Electrica	el	Italy	ICR164:5
Enemalta	Enemalta	el	Malta	ICR182:3
Energy Fact	Energy Factors		USA,Cal	CWI840:7
Ensidesa	Empresa Nacional Siderugica	st	Spain	K584:2
EPDC	Electric Power Development Company	el	Japan	ICR184:7
Eregli	Eregli Iron & Steel	st	Turkey	K584:2
ESB	Electricity Supply Board	el	Ireland	K584:2
EVN	EVN		Austria	CWI929:8
Finaminera	Finaminera			ICR198:9
Finncoal	Finncoal	imp	Finland	CWI836:1
Finnc/VantSaeh	Finncoal/Vantaan Saehkoelaitos		Finland	CWI841:3
FinSugar	Finnish Sugar	sug	Finland	CM88:462
Florida Pow	Florida Power	el	USA	CM87:424
Focoex	Focoex			ICR122:17
Fuel Commod	Fuel Commodities	tr	UK	ICR197:5

buyer	buyer, full name	industry	country	source
Genstar Cem	Genstar Cement	cem	USA,Calif	ICR134:8
GKB	Gemeenschappelisk Kolenbureau Electroicitsdrijven	tr	Netherlands	K586:4
GKE	Gemeenschappelisk Kolenbureau Electroicitsdrijven	tr	Netherlands	CWI846:3
Godo St	Godo Steel	st	Japan	CM85:182
Guangdong CPC	Guangdong Central Power Co	el	China	ICR224:1
Hansen N	Hansen Neuerburg	tr	W Germany	K594:4
HBCM	HBCM	st	France	ICR167:5
Heidel Zem	Heidelberger Zement AG	cem	W Germany	CWI848:2
Heracles	Heracles Cement	cem	Greece	CWI841:3
HEW	Hamburgische Elektricitats-werke	el	W Germany	ICR136:13
Hiroshima G	Hiroshima Gas	gas	Japan	CM85:182
Hisalba Cem	Hisalba Cement	cem	Spain	CWI943:3
Hitachi Cem	Hitachi Cement	cem	Japan	CM85:427
Hokkaido CIC	Hokkaido Coal Import Centre	tr	Japan	CWI928:1
Hokkaido EPC	Hokkaido Electric Power Co	el	Japan	CM87:386
Hokuriku EPC	Hokuriku Electric Power Co	el	Japan	CM87:391
Hokuyo Paper	Hokuyo Paper	pap	Japan	CM88:424
Holla/Trond	Holla/Trondheim		Norway	K585:4
Hong Kong El	Hong Kong Electric	el	Hong Kong	CWI832:7
Honshu Paper	Honshu Paper	pap	Japan	CM85:447
Hoogovens	Estel Hoogovens	st	Netherlands	K584:11
Iberduero	Iberduero		Spain	CWI840:3
IBO	IBO		Finland	CWI801:3
Icelandic All	Icelandic Alloys		Iceland	K595:4
ICM	ICM		Luxenburg	K584:3
Idemitsu	Idemitsu Kosan	tr	Japan	CM88:405
IFV Power	IFV Power	el		ICR1:14
Indo Cem	Indonesia Cement	cem	Indo	CWI749:3
Inland St	Inland Steel	st	USA	K598:1
Intercom	Intercom	el	Belgium	K582:4
Intertrade	Intertrade		Yugoslavia	CWI839:2
Int.Anth	International Anthracite Trading CO,UK	tr	UK	CWI837:3
Iskenderum	Iskenderum	st	Turkey	ICR135:13
Italiana	Italiana Coke		Italy	K584:3
Italsider	Italsider	st	Italy	K584:2
IVO	Imatran Voima Oy	imp	Finland	CWI849:3
JCD	Japan Coal Development Corp		Japan	K598:4
JEA	Jacksonville Electricity Authority	el	USA	CWI
Joban Joint PC	Joban Joint Power Co	el	Japan	CM87:393
JSM	Japanese steel mills	st	Japan	ICR168:5
Jujo Paper	Jujo Paper	pap	Japan	CM88:408
Kalundborg	Kalundborg		Denmark	K587:4
Kanai EPC	Kansai Electric Power Co	el	Japan	CM87:389
Kardeljevo	Kardeljevo		Yugoslavia	K587:4
Kawasaki St	Kawasaki Steel Corp	st	Japan	CM85:85
Kelly Coal	Kelly Coal		Ireland	K593:4
Kepco	Korean Electric Power Company	el	S Korea	K598:4
KFK	KFK		Denmark	K585:4
Kipsas	Kipsas		Turkey	CWI810:3
Kobe St	Kobe Steel Ltd	st	Japan	CM85:85
Koper	Koper		Yugoslavia	K585:4
Krupp	Krupp Handel	tr	W Germany	CWI843:8

buyer	buyer, full name	industry	country	source
Kyushu EPC	Kyushu Electric Power Co	el	Japan	CM87:391
La Caruna	La Caruna		Spain	K593:4
Lafarge	Lafarge Moroc Cinorica		Morocco	ICR
Lake Ontario Ce	Lake Ontario Cement	cem	Canada	K586:13
Larco	Larco	ref	Greece	K590:1
Lehigh Cem	Lehigh Portland Cement	cem	USA	ICR134:8
Lucky Go	Lucky Goldstar	tr	S.Korea	CWI928:2
Lukavac	Lukavac	prod	Yugoslavia	K593:4
Malmoe	Malmoe		Sweden	K582:4
Mazda	Mazda Motors Corp	man	Japan	CWI825:3
Mimex	Mimex		Romania	K586:13
Mississippi P	Mississippi Power	el	USA	ICR180:5
Mitsubishi Ch	Mitsubishi Chemical	chem	Japan	CM85:182
Mitsubishi Met	Mitsubishi Metal	st	Japan	CM88:405
Mitsubishi M&C	Mitsubishi Mining & Cement	cem	Japan	CM85:182
Mitsui M	Mitsui Mining	prod	Japan	CM85:182
Mohammedia	Mohammedia Power	el	Morocco	CWI829:3
Moore McCor	Moore McCormack		USA	CWI829:2
Mueller	Otto Mueller	tr	W Germany	CWI812:1
Nador Cem	Nador Cement	cem	Morocco	ICR170:15
Nakayama	Nakayama Steel	st	Japan	CM85:182
Naoshima YGyp	Naoshima Yoshino Gypsum	ref	Japan	CM88:408
NCSC	National Coal Supply Corp	imp	Israel	K589:2
NEB	National Electricity Board	el	Malaysia	ICR181:14
Nepco	New England Power Co	el	USA	ICR128:9
Nescher	Nescher Cement Works Ltd	cem	Israel	CWI
Neste	Neste Coal Corp	tr	USA,NY	ICR185:4
NIES	Northern Ireland Electricity Service	el	Ireland	CWI848:2
Nikko Paper	Nikko Paper	pap	Japan	CM88:424
Nippon Cem	Nippon Cem	cem	Japan	CM87:403
Nippon Yakin	Nippon Yakin		Japan	CM87:422
Nishi Nippon P	Nishi Nippon Paper	pap	Japan	CM88:424
Nisshin	Nisshin Steel Co Ltd	st	Japan	CM85:85
Nittetsu Cem	Nittetsu Cement	cem	Japan	CM85:427
NKK	Nippon Kokan KK	st	Japan	CM85:85
Nomura T	Nomura Trading	tr	Japan	CN85:360
Nonoc MIC	Nonoc Mining & Industry Corp	ref	Phil	CM88:443
Norsk Kok	Norsk Koksverk	st	Norway	CWI841:7
Northern Cem	Northern Cement Group	cem	Spain	CWI839:3
NS	Nippon Steel Corp	st	Japan	CM85:85
NSF	National Smokeless Fuels		UK	K584:3
Oji Paper	Oji Paper Manufacturing	pap	Japan	CM88:408
Onahama S & R	Onahama Smelting & Refining	ref	Japan	CM88:405
Onahama Seiren	Onahama Seiren		Japan	CM85:426
Onahama Y Gyp	Onahama Yoshino Gypsum	ref	Japan	CM88:424
ONdE	Office National d'Electricite	el	Morocco	K584:11
Onoda Cem	Onoda Cement	cem	Japan	CM88:448
Ontario Hydro	Ontario Hydro	el	Canada	CWI828:1
Osaka Cem	Osaka Cement	cem	Japan	CM88:406
Osaka G	Osaka Gas	gas	Japan	CM85:182
Pacific M	Pacific Metals		Japan	CM
Pasmic	Pakistan Steel	st	Pakistan	K594:4

buyer	buyer, full name	industry	country	source
Phibro	Phillip Brothers	tr	USA	CWI808:2
PNOC	Philippines National Oil Company	oil	Philippines	CWI908:9
PNPC	Philippines National Power Corp	el	Philippines	ICR182:13
Pohang	Pohang Iron & Steel Company	st	S Korea	K595:2
Pool dC	Pool des Calories	tr	Belgium	QBC85
Preag	Preussen Elecktra (Prussian Electric)	el	W Germany	K584:11
PSNH	Public Service of New Hampshire	el	USA	CWI849:3
Public Power	Public Power Corp	el	Greece	K592:2
Puerto R Cem	Puerto Rican Cement	cem	Puerto Rico	CWI848:2
QIT	Quebec Iron & Titanium		Canada	K586:13
Qualicement	Qualicement		Italy	ICR190:10
Rautarruukki	Rautarruukki	st	Finland	CM85:86
Rugby Cem	Rugby Portland Cement	cem	UK	ICR170:15
Ruhrkohle	Ruhrkohle AH	tr	W Germany	CWI84:2
Ruhrkolen	Ruhrkolen	tr	Morocco	CWI843:8
SAIL	Steel Authority of India Ltd	st	India	CWI827:3
Scancem	Scancem	imp	Scandinavia	K588:3
SEP	Samenwerkende Electriciteits Productieberdrijven	el	Neth	ICL89:18:
Sesil	Sesil		Port	ICR209:4
SevEl	Companhia Sevilliano de Electicidad	el	Spain	CWI814:3
Sevilliana	Sevilliana	el	Spain	ICR164:3
Shell	Shell Coal	tr	UK,Neth	ICR187:4
Shikoku EPC	Shikodu Electric Power Co	el	Japan	CM87:389
Showa Denko	Showa Denko		Japan	CM85:429
Siam Cem	Siam Cement	cem	Thailand	ICR183:3
Siderbras	Siderbras	st	Brazil	K588:12
Siderchil	Siderugia Nacional (CAP)	st	Chile	K584:2
Siderchil	Companhia de Acero del Pacifico (CAP)	st	Chile	ICR14:17
Sidermex	Sidermex (AHMSA)	st	Mexico	K584:3
Siderport	Siderugia Nacional	st	Portugal	K582:4
Sidmar	Sidmar	st	Belgium	CM85:86
Sidor	Sidor, Orinoco St	st	Venezuela	CWI740:5
Sisak	Sisak		Yugoslavia	K591:4
SNS Charbon	SNS Charbon		Algeria	K584:2
Sococharbo	Sococharbo	imp	Morocco	CWI850:3
Sollac	Sollac	st	France	CWI925:3
Somisa	Somisa	st	Argentina	K584:3
SSAB	Swedish Metals Group (Svensk Stal)	st	Sweden	CWI830:3
Ssanyong	Ssanyong		S Korea	ICR187:3
SSEB	South of Scotland Electricity Board	el	UK	CWI911:1
SSM	Scheepvaart Steenkolen Maatschappij	tr	Netherlands	CWI843:8
SSM-YCF	SSM-YCF	tr	Argentina	CWI843:8
St Mary's Cem	St Mary's Cement	cem		K586:13
Stelco	Stelco	st	Canada	CWI839:1
Stwk Hannover	Stadtwerke Hannover	st	W Germany	ICR157:3
Styrische El	Styrische Electric	el		CWI320
St.Johns RPP	St.Johns River Power Park	el	USA,Florida	ICR188:5
St.L Cem	St.Lawrence Cement	cem	Canada	K584:11
Sucden	Sucres et Denrees	imp	France	CWI843:8
Sumitomo	Sumitomo Metal Industries	st	Japan	CM85:85
Sumitomo Cem	Sumitomo Cement	cem	Japan	CM87:442
Sumitomo JPC	Sumitomo Joint Power Co	el	Japan	CM87:394

buyer	buyer, full name	industry	country	source
Sumitomo Kyodo	Sumitomo Kyodo Karyoku		Japan	CM85:459
Suralaya	Suralaya Power Station	el	Indonesia	ICR182:3
Surefire C	Surefire Coal Co	tr	N Ireland	ICR206:5
Swedish St	Swedish Steel (Svenskt Stal AB)	st	Sweden	K582:3
Sydkraft	Sydkraft	el	Sweden	ICR6:2
Taiheiyo Metal	Taiheiyo Metal	ref	Japan	CM85:429
Taipower	Taiwan Power Corp	el	Taiwan	K595:4
Taiwan Cem	Taiwan Cement	cem	Taiwan	ICR183:3
Tambang Bat	Tambang Batubara	el	Indonesia	ICR
TDCI	TDCI	st	Turkey	ICR161:2
TECSA	TECSA	el	Spain	ICR195:11
Teigin Ind	Teigin Industries		Japan	CM87:429
TEPCO	Tokyo Electric Power Co	el	Japan	CWI828:3
Titan Cem	Titan Cement	cem	Greece	CWI833:7
Toho G	Toho Gas	gas	Japan	CM85:182
Tohoku EPC	Tohoku Electric Power Co	el	Japan	CWI828:3
Tokuyama Soda	Tokuyama Soda	cem	Japan	CM88:405
Tokyo G	Tokyo Gas	gas	Japan	CM85:182
Tomoegawa P	Tomoegawa Paper Manufacturing	pap	Japan	CM85:479
Tong Yang cem	Tong Yang cement	cem	S Korea	ICR168:5
Toray Ind	Toray Industries Inc		Japan	CM88:408
Toyo Soda	Toyo Soda	cem	Japan	CM87:457
Transcor	Transcor Coal	tr	UK	ICR135:10
Tsuruga Cem	Tsuruga Cement	cem	Japan	CM85:427
Tsurusaki Pulp	Tsurusaki Pulp	pap	Japan	CM88:408
Tubarao	Companhia Siderugica de Tubarao	st	Brazil	CWI
Turkey cem	Turkey cement	cem	Turkey	ICR165:3
Ube Ind	Ube Industries	cem	Japan	CM85:453
UEl Fenesa	Union Electra Fenesa	el	Spain	ICR195:11
Unicem	Unicem	cem	Italy	ICR
Union Carbide	Union Carbide		Canada	K584:11
Universal Cem	Universal Cement	cem	Taiwan	ICR206:3
US Def. Fuel	US Defense Fuel Supply Center		W Germany	CWI829:7
Vallenciana	Vallenciana		Spain	ICR182:3
Vattenfal	Vattenfal	el	Sweden	ICR208:9
Veba	Veba AG		W Germany	ICR47:11
VEW	Vereinigte Elektrizitatswerke Westfallen AG	el	W Germany	ICR190:6
Voest Alpine	Voest Alpine	st	Austria	CWI851:3
Volkswagen	Volkswagen	ind	W Germany	ICR93:15
VP	Virginia Power	el	USA	ICR137:15
Weyerhauser P	Weyerhauser Paper	pap	USA	ICR51:11
Yugometal	Yugometal		Yugoslavia	K590:2
Zenica	Zenica		Yugoslavia	CWI

note: cem = cement, chem = chemicals, cok = coke ovens, el = electricity, imp = importer
mfr = manufacturing, pap = paper, prod = producer, ref = refinery, st = steel, tr = trader
source: as in Appendix A

Appendix C: Coal companies, parent companies and selected investments

company name	country	% equity	year	investment $m	parent company name	country	year	source
Aberdare Collieries PL	Aus	100			Allied Queensland Coalfields	Aus	87	CM88:452;J89:5
ACI International	Aus	12			Aust'n Mutual Provident Soc	Aus	84	BIE84:309
ACI Resources L	Aus	100			ACI International	Aus	84	BIE84:309
Addington Bros Mining Inc	USA	100			Ashland Coal Co	USA	84	KCIM85:13
Agip BC mine	Can		80		Agip	It	80	ICR6:9
Agip Carbonne (Coal)	It	100	82		Ente Nazionale Indrocarburi	It	82	ICR49:9
Agip Coal	USA	0	85		Agip Carbone	It	85	ICR134:19
Agip Coal	USA	100	81		Agip Carbone	It	85	ICR134:19
Agip Coal Aus	Aus	100			Agip Coal	Ita	87	Agip87
Agip Coal Intl	Neth	100			Agip Coal	Ita	87	Agip87
Alla-Ohio Valley Coal	USA	100			AOV Industries	USA	81	ICR33:10
Allied Queensland Coalfields	Aus	64			Crusader Oil NL		84	BIE84:312
Allied Queensland Coalfields	Aus	16.1ms			Crusader Oil NL		88	J89:5
Allied Queensland Coalfields	Aus	1.7ms			Suncorp		88	J89:5
Allied Queensland Coalfields	Aus	1.0ms			Genera Sekiyu		88	J89:5
Allied Queensland Coalfields	Aus	1.0ms			AMP Society	Aus	88	J89:5
Amax Coal Co	USA	100	84		AMAX Inc	USA	84	KCIM85:8
American Coal Co	USA	100			Utah Power & Light Co	USA	85	KCIM86:679
American Smelting & Refining	USA	16	84		MIM Holdings L	Aus	84	BIE84:313
American Smelting & Refining	USA	16			MIM Holdings L	Aus	84	BIE84:363
Amherst Coal	USA	100	81	200	Diamond Shamrock	USA	81	ICR20:8
Amoco Australia	Aus	100	84		British Petroleum	UK	85	O&G86:54
Amoco Minerals	USA	100			Amoco Corp	USA	85	O&G86:19
Amoco Minerals	USA				Standard Oil Indiana	USA	81	ICR27:8
An Tai Ba	Chin	loan		475	BA Asia Coordinator		88	ICR197:2
An Tai Ba	Chin	25	85		Island Creek Coal	USA	88	ICR197:2
Anaconda Australia Inc	Aus	100			Anaconda Co L	USA	84	BIE84:313
Anaconda Co L	USA	100	77		Atlantic Richfield Corp	USA	84	BIE84:313
Anaconda Minerals Co	USA	100	77		Atlantic Richfield Corp	USA	84	KCIM85:9
Anglo American Coal Corp L	SA	100			Anglo American	SA	87	CM88:457
ANR Coal Co	USA	100			American Natural Resources	USA	80	ICR38:10
ANR Coal Co	USA	100			Coastal Coal International	USA	85	KCIM84:677
Antelope Coal Co	USA	100			Nerco Inc	USA	85	KCIM86:678
AOV Industries	USA	50			Howard Smith L	Aus	81	ICR33:10
Apex Mines L	SA	100			Gold Fields of SA	SA	87	CM88:363
Aprocar	Sp				Adaro	Sp	82	ICW102:7
Aprocar	Sp				Hunosa	Sp	82	ICW102:7
Arcadia Co Inc	USA	100			Pennsylvania Power & Light	USA	85	KCIM86:678
Arch Mineral Corp	USA				Ashland Oil Co	USA	85	KCIM86:677
Arch Mineral Corp	USA				Hunt Petroleum Corp	USA	85	KCIM86:677
Arco Aust Coal L	Aus	100			Atlantic Richfield Corp	USA	84	BIE84:315
Arco Coal Co	USA	100			Atlantic Richfield Corp	USA	85	KCIM86:677
Arthur Taylor coal	SA	50			Johannesburg Consol Inv CoL	SA	87	CM88:460
Arthur Taylor coal	SA	50			Total Exploration SA PL	SA	87	CM88:460
Arthur Taylor Colliery	SA	100			Johannesburg Consol Inv CoL	SA	87	CM88:362
Aruntmin mine	Indo				BHP-Utah	Aus	89	ICR217:6
Asalco	USA	32			MIM Holdings L	Aus	87	CM88:444

company name	country	equity	year	$m	parent company name	country	year	source
Ashland Coal Co	USA	100	7?		Ashland Oil Co	USA	81	ICR20:8
Ashland Coal Co	USA	10	82	44	Carboex	Spa	82	ICR40:10
Ashland Coal Co	USA	25	81	103	Saarbergerwerke	WGer	81	ICR20:8
Ashland Mining Corp	USA	100			Inspiration Coal Inc	USA	85	KCIM86:678
Associated Porcupine mine	Can	85	80		Esso Resources Canada	Can	80	ICR6:9
Associates Mining Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Austen & Butta L	Aus	17			Aust'n Mutual Provident Soc	Aus	86	NSW86:198
Austen & Butta L	Aus	10	8?		Aust'n Mutual Provident Soc	Aus	88	NSW89:168
Austen & Butta L	Aus	0	77		Brascan	Can	82	DIC82:309
Austen & Butta L	Aus	25	7?		Brascan	Can	76	McK76:69
Austen & Butta L	Aus	5	71		Marubeni Corp	Jap	81	ICR17:8;CM76:11
Austen & Butta L	Aus	3			Marubeni Corp	Jap	87	BIE84:361;CM88:
Austen & Butta L	Aus	5	71		Mitsubishi Chemical Ind L	Jap	81	ICR17:8;CM76:11
Austen & Butta L	Aus	3			Mitsubishi Chemical Ind L	Jap	87	BIE84:364;CM88:
Austen & Butta L	Aus	7	88		Perpetual Trustee Co L	Aus	88	NSW89:168
Austen & Butta L	Aus	20	81	38	Pioneer Sugar Mills	Aus	81	ICR17:8
Austen & Butta L	Aus	7			Riange Investments PL	Aus	86	NSW86:198
Austen & Butta L	Aus	6			Rivon Investments Lithgow PL	Aus	86	NSW86:198
Austen & Butta L	Aus	42	7?		Shell Australia L	Aus	84	BIE84:316
Austen & Butta L	Aus	37	77		Shell Australia L	Aus	81	ICR17:8;Par86:1
Austen & Butta L	Aus	46	88		Shell Australia L	Aus	88	NSW89:168
Austen & Butta L	Aus	45			Shell Australia L	Aus	86	NSW86:198
Australian Mining Investments	Aus	4			ANZ Nominees L	Aus	86	NSW86:198;CM88:
Australian Mining Investments	Aus	5	88		ANZ Nominees L	Aus	88	J89:22
Australian Mining Investments	Aus	8			Darian Sampey PL		86	NSW86:198;CM88:
Australian Mining Investments	Aus	10	88		Liberty Life L		88	J89:22
Australian Mining Investments	Aus	29			NIT Co PL		86	NSW86:198;CM88:
Australian Mining Investments	Aus	25	88		NIT Co PL		88	J89:22
Australian Mining Investments	Aus	5			Toyo Menka Kaisha	Jap	86	NSW86:198;CM88:
Australian Mining Investments	Aus	17			Trafalgar Gold PL		86	NSW86:198;CM88:
Australian Mining Investments	Aus	15	88		Trafalgar Gold PL		88	J89:22
Baal Bone mine	Aus	80			Coalex	Aus	89	ICR226:7
Baal Bone mine	Aus	5			Sumitomo Corp	Jap	89	ICR226:7
Baal Bone mine	Aus	15			Sumitomo Metal Industries L	Jap	89	ICR226:7
Badger Coal Co	USA	100			Pittston Co	USA	84	KCIM85:9
Bailey Hill Mining Corp	USA	100			Cumberland Mountain Coal Co	USA	84	KCIM85:11
Bailey Mining Co Inc	USA	100			Inspiration Coal Inc	USA	85	KCIM86:678
Ballymoney	NIre	50			BHP-Utah	Aus	89	ICL8918:6
Ballymoney	NIre	50			Meekatharra	Aus	89	
Bank Colliery	SA	100			Anglo American Coal Corp	SA	87	CM88:362
Bankhead Mining Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Bargo Collieries	Aus	33	8?		BHP Minerals PL	Aus	84	BIE84:320
Bargo Collieries	Aus	33	8?		Coal & Allied Industries L	Aus	84	BIE84:320
Bargo Collieries	Aus	33	89		Elders Resources NZFPL	Aus	89	ICR217:13
Bargo Collieries	Aus	33	8?		Newcastle Wallsend Coal Co	Aus	84	BIE84:320
Barix PL	Aus	100			Pacific Copper L	Aus	86	NSW86:199;BIE84
Barnes & Tucker Co	USA	100			Alco Standard Corp	USA	87	CM88:116;KCIM86
Bayswater Colliery	Aus	35			Aust'n Mutual Provident Soc	Aus	86	NSW86:199;BIE84
Bayswater Colliery	Aus	55			Caltex Oil (Aust) PL	Aus	86	NSW86:199;BIE84
Bayswater Colliery	Aus	10	88		Nippon Oil (Aust) PL	Aus	88	NSW89:184
Bayswater Colliery	Aus	0	88		Pioneer Sugar Mills	Aus	88	NSW89:184
Bayswater Colliery	Aus	10			Pioneer Sugar Mills	Aus	86	NSW86:199;BIE84

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BC Resources	Can	100			BC Resources Investment Co	Can	87	CM88:286
BC Resources Investment Co	Can	5	80	C55/s	Govt, British Columbia (Can)	BC	80	ICR1:6
BCNR Mining Corp	USA	100			LTV Corp	USA	85	KCIM86:678
BCSC Collieries PL	Aus	100			Blue Circle Southern Cement	Aus	86	NSW86:200
Beaver Creek Coal	USA	100			Arco Coal Co	USA	85	KCIM86:677
Beaver Creek Coal Co	USA	100			Anaconda Minerals Co	USA	84	KCIM85:9
Beckley Coal Mining Co	USA	100			Pickands Mather & Co	USA	85	KCIM86:678
Beckley Lick Run Co	USA	100			CSX Corp	USA	85	KCIM86:677
Bedcor Inc	USA	100			Carbon Industries	USA	85	KCIM86:677
Bell County Coal Corp	USA	100			Transco Coal Services Co	USA	85	KCIM86:679
Bell Coal	Aus	100			Bell Resources	Aus	88	J89:28
Bell Resources	Aus	58			Bond Corp	Aus	89	ICR226:7
Bellambi Coal Co L	Aus	100	85		Austen & Butta L	Aus	86	NSW86:200
Bellambi Coal Co L	Aus	0	85		Aust'n Mutual Provident Soc	Aus	88	NSW89:166
Bellambi Coal Co L	Aus	15	7?		Aust'n Mutual Provident Soc	Aus	84	BIE84:321
Bellambi Coal Co L	Aus	65	64		Gold Fields Australia L	Aus	69	AZ69:69;McK76:6
Bellambi Coal Co L	Aus	0	79		Gold Fields Australia L	Aus	79	Par86:11
Bellambi Coal Co L	Aus	40	79		McIlwraith McEacharn Ltd	Aus	84	BIE84:321
Bellambi Coal Co L	Aus	45	79		Shell Australia L	Aus	84	BIE84:321
Bellambi Coal Co L	Aus	65	79		Shell Australia L	Aus	79	Par86:11
Beluga Coal Co	USA				Placer US Inc	USA	87	CM88:417
BethEnergy Mines Inc	USA	100			Bethlehem Steel Co	USA	85	KCIM86:677
Bethlehem Mines Corp	USA	100			Bethlehem Steel Co	USA	85	KCIM86:677
Betty B Coal Co	USA	100			Thyssen Mining Constrctn Inc	USA	85	KCIM86:679
BHP Co PL	Aus	40			Bell Group L	Aus	88	J89:36
BHP Co PL	Aus	23			Beswick PL	Aus	88	J89:36
BHP Co PL	Aus	23			Elders IXL	Aus	88	J89:36
BHP Minerals	Aus	100			BHP Co PL	Aus	87	CM88:438
BHP-Utah	Aus	100			BHP Co PL	Aus	87	CM88:200
Bienfait Coal Co	Can	100			Luscar L	Can	85	KCIM86:678
Big Bear Mining Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Big Horn Coal Co	USA	100			Peter Kiewit Sons Mining	USA	84	KCIM85::11
Big Mountain Coal Inc	USA	0	84		Armco Steel	USA	87	K590:3
Big Mountain Coal Inc	USA	100	7?		Armco Steel	USA	87	K590:3
Big Mountain Coals	USA	100	84		Peabody Holding Co	USA	87	K590:3
Bishop Coal Co	USA	As			Consolidation Coal Co	USA	84	KCIM85
Black Butte Coal Co	USA	50			Peter Kiewit Sons Mining	USA	84	KCIM85:11
Black Butte Coal Co	USA	50			Rocky Mountain Energy	USA	84	KCIM85:11
Blackwater mine	Aus	100	84		Central Queensland Coal Ass	Aus	75	QCB85:54
Blackwater mine	Aus	90	64		Utah International Inc	USA	75	McK76:216
Blackwater mine	Aus	10	64		Utah Mining Australia L	Aus	75	McK76:216
Blair Athol	Aus	50	85		Coal Cliff Collieries PL	Aus	85	QCB85:56
Blair Athol Coal PL	Aus	100			Coal Cliff Collieries PL	Aus	89	J89:204
Blair Athol Coal PL	Aus	100			CRA L	Aus	87	CM88:442
Blair Athol mine	Aus	0	88		ACI Resources L	Aus	88	CWI88:525
Blair Athol mine	Aus	12			ACI Resources L	Aus	87	BIE84:322;CM88:
Blair Athol mine	Aus	15	85		Anaconda Australia Inc	Aus	87	CM88:442;QCB85:
Blair Athol mine	Aus	15			Arco Aust Coal L	Aus	84	BIE84:322
Blair Athol mine	Aus	38	78	A17	Arco Aust Coal L	Aus	78	Fox81:72
Blair Athol mine	Aus	12	85		Arco Aust Coal L	Aus	88	CWI88:525;QCB85
Blair Athol mine	Aus	28	88	p138	ARCO Coal	Aus	88	ICR208:7
Blair Athol mine	Aus	50			Blair Athol Coal PL	Aus	87	BIE84:322;CM88:

company name	country	equity	year	$m	parent company name	country	year	source
Blair Athol mine	Aus	12	88		Bundaberg Sugar	Aus	88	BIE:322;ICR208:
Blair Athol mine	Aus	4	85		Bundaberg Sugar CoL	Aus	87	CM88:442;QCB85:
Blair Athol mine	Aus	38			Clutha Development	Aus	76	CM76:175
Blair Athol mine	Aus	0	78	A17	Clutha Development	Aus	76	F81:72
Blair Athol mine	Aus	57			CRA L	Aus	76	CM76:175
Blair Athol mine	Aus	60	6?		CRA L	Aus	69	AZ69:15
Blair Athol mine	Aus	7	81		EPDC (Australia) PL	Aus	87	CM88:442
Blair Athol mine	Aus	5	81		EPDC (Australia) PL	Aus	84	BIE84:322
Blair Athol mine	Aus	4	85		Gibson & Howes PL		87	CM88:442;QCB85:
Blair Athol mine	Aus	3	81		JCD Australia PL	Aus	87	CM88:442
Blair Athol mine	Aus	5	81		JCD Australia PL	Aus	84	BIE84:322
Blair Athol mine	Aus	4	85		Millaquin Sugar CoPL		87	CM88:442;QCB85:
Blair Athol mine	Aus	5			Mines Administration PL	Aus	76	CM76:175
Bloomfield Collieries PL	Aus	100			Big Ben Holdings PL	Aus	86	NSW86:201,CM88:
Blossom Coal Co	USA	100			Old Ben Coal Co	USA	85	KCIM86:678
Blue Circle Southern Cement	Aus	41			BHP Co PL	Aus	86	BIE84:323;NSW86
Blue Circle Southern Cement	Aus	41			Blue Circle Industries PLC	UK	86	BIE84:323;NSW86
Blue Circle Southern Cement	Aus	100	87		Boral Ltd	Aus	87	J89;CM88:162
Blue Circle Southern Cement	Aus	2			Natnl Mutual Life Ass A'asia	Aus	86	NSW86:201
Blue Creek Coal Co Inc	USA	100			Unetco Minerals Corp	USA	85	KCIM86:679
Blue Diamond Mining Inc	USA	100			Blue Diamond Coal Co	USA	85	KCIM86:677
Bluestone Coal Co	USA	81			Bluestone Coal Corp	USA	84	KCIM85:10
Bluestone Coal Co	USA	19			Eastern Associated Coal Corp	USA	84	KCIM85:10
Boggabri Coal Co	Aus	25	87		Agip Australia PL	It	87	NSW89:171;CWI81
Boggabri Coal Co	Aus	25			Amax Iron Ore Corp		86	NSW86:166
Boggabri Coal Co	Aus	0	87		Amax Iron Ore Corp		87	NSW89:171;CWI81
Boggabri Coal Co	Aus	13			Amax Iron Ore Corp		87	CWI810
Boggabri Coal Co	Aus	50			BHP Minerals PL	Aus	87	CWI810
Boggabri Coal Co	Aus	50			BHP Minerals PL	Aus	86	NSW86:166
Boggabri Coal Co	Aus	25	87		Idemitsu Boggabri Coal PL	Aus	87	NSW89:171;CWI81
Boggabri Coal Co	Aus	25			Mobil Energy Minerals Inc		86	NSW86:166
Boggabri Coal Co	Aus	0	87		Mobil Energy Minerals Inc		87	CWI810
Boggabri Coal Co	Aus	13			Mobil Energy Minerals Inc		87	CWI810
Bond Corp Holdings L	Aus	3			ANZ Nominees L	Aus	86	NSW86:202
Bond Corp Holdings L	Aus	43			Dallhold Investments PL	Aus	86	NSW86:202
Bond Corp Holdings L	Aus	230ms			Dallhold Investments PL	Aus	89	J89:33
Bond Corp Holdings L	Aus	25ms			Indosuez Nominees PL		89	J89:33
Bond Corp Holdings L	Aus	13ms			FAI Traders Insurance Co L	Aus	89	J89:33
Bond Corp Holdings L	Aus	13ms			ANZ Nominees L	Aus	89	J89:33
Bond Corp Holdings L	Aus	10ms			Bowola PL	Aus	89	J89:33
Boral Ltd	Aus	11			Aust'n Mutual Provident Soc	Aus	88	NSW89:167
Boral Ltd	Aus	13			Aust'n Mutual Provident Soc	Aus	84	BIE84:324
Box Flat Mine	Aus	100	8?		Bundaberg Sugar Co L	Aus	84	ICR194:7
Box Flat Mine	Aus	0	87	p3.2	Bundaberg Sugar Co L	Aus	88	ICR194:7
Box Flat Mine	Aus		87	p3.2	Endeavour Resources	Aus	88	ICR194:7
Box Flat Mine	Aus		87	p3.2	Showa Shell	Jap	88	ICR194:7
BP Canada	Can	57			British Petroleum	UK	89	ICR226:14
BP Coal	UK	100			British Petroleum	UK	85	O&G86:54
BP Coal America	USA	100			BP Coal	UK	88	CWI880525
BP Coal Development Aust L	Aus	100			BP Coal	UK	87	CM88:192
BP Coal South Africa	SA	100			BP Coal	UK	87	CM88:423
Bridger Coal Co	USA	50			Idaho Power Co	USA	85	KCIM86:678

company name	country	equity	year	$m	parent company name	country	year	source
Bridger Coal Co	USA	50			Nerco Inc	USA	85	KCIM86:678
Bronco Mining Co Inc	USA	100			Anker Energy Corp	USA	85	KCIM86:677
Brown Badgett Inc	USA	100			Diamond Shamrock	USA	84	KCIM85:11
Brownies Creek Collieries Inc	USA	100			Cumberland Mountain Coal Co	USA	84	KCIM85:11
Buffalo Mining Co	USA	100			Pittston Co	USA	84	KCIM85:9
Bulkships, TNT	Aus	100			Thomas Nationwide Transport	Aus	75	Fox81:72
Bullmoose coal ujv	Can	39	82		Lornex Mining Corp L	Can	87	CM88:456,304
Bullmoose coal ujv	Can	10			Nissho Iwai Coal Dev (Can) L	Jap	87	CM88:456
Bullmoose coal ujv	Can	51			Teck-Bullmoose Coal Inc	Can	87	CM88:456
Byron Creek Collieries L	Can	100	81		Esso Resources Canada L	Can	84	CM85:350
Caballo mine	USA	100			Exxon Coal USA Inc	USA	85	ICR122:12
Callide Coal	Aus	15			Aust'n Mutual Provident Soc	Aus	87	CM88:450;QCB85:
Callide Coal	Aus	30			Shell Australia L	Aus	87	CM88:450;QCB85:
Callide Coal	Aus	55			Thiess Bros PL	Aus	87	CM88:450;QCB85:
Callide jv	Aus	30	80		Shell Australia L	Aus	80	Par86:11
Caltex Oil (Aust) PL	Aus	2			Aust'n Mutual Provident Soc	Aus	88	J89:39
Caltex Oil (Aust) PL	Aus	2			Aust'n Mutual Provident Soc	Aus	86	NSW86:203
Caltex Oil (Aust) PL	Aus	75			Caltex Petroleum Corp	USA	86	NSW86:202
Caltex Oil (Aust) PL	Aus	88			Caltex Petroleum Corp	USA	88	J89:39
Caltex Oil (Aust) PL	Aus	5			Whitloyd Nominees PL	Aus	86	NSW86:203
Caltex Oil (Aust) PL	Aus	7			Whitloyd Nominees PL	Aus	88	J89:39
Camberwell jv	Aus	50			Southland Coal	Aus	88	NSW89:173
Camberwell jv	Aus	50			Toyota Tsusho Corp	Jap	88	NSW89:173
Camberwell jv	Aus	40			Toyota Tsusho Corp	Jap	89	K752:12
Camberwell jv	Aus	10			Mitsubishi Mining & Cement	Jap	89	K752:12
Cambria Coal Co	USA	100			Gulf Resources & Chemical Co	USA	85	KCIM86:678
Cannelton Industries Inc	USA	100	84		Algoma Steel Corp L	USA	85	KCIM86:677
Cape Breton Development Corp	Can	100	7?		government	Can	87	CM88:412
Capricorn Coal Management PL	Aus	0	8?		ACI Resources L	Aus	87	CM88:164
Capricorn Coal Management PL	Aus	13	7?		ACI Resources L	Aus	84	BIE84:329
Capricorn Coal Management PL	Aus	26			Austen & Butta L	Aus	80	ICR5:13
Capricorn Coal Management PL	Aus	21			Austen & Butta L	Aus	84	BIE84:329;QCB85
Capricorn Coal Management PL	Aus	17	77		British Coal	UK	80	ICR5:13
Capricorn Coal Management PL	Aus	11			British Coal	UK	84	BIE84:329
Capricorn Coal Management PL	Aus	12			Coal Dev'ts (German Cr) PL	Aus	85	QCB85:62
Capricorn Coal Management PL	Aus	2			Commercial Union Assurance		80	ICR5:13
Capricorn Coal Management PL	Aus	1			Commercial Union Assurance		84	BIE84:329;CM88:
Capricorn Coal Management PL	Aus	26	8?		Natnl Mutual Life Ass A'asia	Aus	87	CM88:164
Capricorn Coal Management PL	Aus	13	7?		Natnl Mutual Life Ass A'asia	Aus	84	BIE84:329:QCB85
Capricorn Coal Management PL	Aus	11			Ruhrkohle Australia PL	Aus	84	BIE84:329:QCB85
Capricorn Coal Management PL	Aus	17	77		Ruhrkohle Australia PL	Aus	80	ICR5:13
Capricorn Coal Management PL	Aus	17			Shell Australia L	Aus	84	BIE84:329;CM88:
Capricorn Coal Management PL	Aus	39			Shell Australia L	Aus	80	ICR5:13
Capricorn Coal Management PL	Aus	13			Superannuation Fund Inv Trust	Aus	84	BIE84:329
Caralec	Sp				private electric util.	Sp	80	ICW114:4
Carboex	Sp		80		Electrica de Cordoba	Sp	80	ICW102:7
Carboex	Sp		80		Endesa	Sp	80	ICW102:7
Carboex	Sp		80		National Inst of Industry	Sp	80	ICW102:7
Carbon Industries	USA	100	77		International Tel & Tel	USA	85	ICR115:7
Carbones de Colombia SA	Col	100			government	Col	87	CM88:462
Carbosuleis Spa	Ita	100			Agip Coal	Ita	87	EN187
Carbozulia	Ven		8?		Agip Coal	It	87	CWI838:3

company name	country	equity	year	$m	parent company name	country	year	source
Carbozulia	Ven		8?		Arco	USA	87	CWI838:3
Cardinal River Coals	Can	50			Consolidation Coal Co of Can	Can	87	CM88:287,297
Cardinal River Coals	Can	50			Luscar L	Can	87	CM88:287,297
Carpentertown Coal & Coke Co	USA	100			Sharon Steel Corp	USA	85	KCIM86:679
Carter Mining Co	USA	100			Exxon Coal USA Inc	USA	84	KCIM85:9
Castner Curran & Bullit	USA	100			Eastern Associated Coal Corp	USA	81	ICR14:3
Cedar Coal Co	USA	100			Central Ohio Coal Co	USA	84	KCIM85:10
Central Appalachian Coal Co	USA	100			Central Ohio Coal Co	USA	84	KCIM85:10
Central Queensland Coal Ass	Aus	8	84		Aust'n Mutual Provident Soc	Aus	87	CM88:164;QCB85:
Central Queensland Coal Ass	Aus	8	76		Aust'n Mutual Provident Soc	Aus	76	CM76:160
Central Queensland Coal Ass	Aus	9	89	pA262	Aust'n Mutual Provident Soc	Aus	89	CWI1035:7
Central Queensland Coal Ass	Aus	5	84		Bell Resources L	Aus	84	QCB85:84;CM85:1
Central Queensland Coal Ass	Aus	10	85		Bell Resources L	Aus	87	CM88:164
Central Queensland Coal Ass	Aus	0	89	A262	Bell Resources L	Aus	89	CWI1035:7
Central Queensland Coal Ass	Aus	35	84		BHP Minerals PL	Aus	84	QCB85:84
Central Queensland Coal Ass	Aus	40	85		BHP Minerals PL	Aus	87	CM88:164
Central Queensland Coal Ass	Aus	45	89	pA262	BHP Minerals PL	Aus	89	CWI1035:7
Central Queensland Coal Ass	Aus	0	85		General Electric	USA	87	CM88:164;QCB85:
Central Queensland Coal Ass	Aus	16	84		General Electric	USA	84	CM85:198
Central Queensland Coal Ass	Aus	15	66		Mitsubishi Development PL	Aus	75	CM76:160
Central Queensland Coal Ass	Aus	12	76		Mitsubishi Development PL	Aus	76	CM76:160
Central Queensland Coal Ass	Aus	12	84		Mitsubishi Development PL	Aus	87	CM88:164:QCB85:
Central Queensland Coal Ass	Aus	13	89		Mitsubishi Development PL	Aus	89	CWI1035:7
Central Queensland Coal Ass	Aus	3	84		Pancontinental Mining L	Aus	84	QCB85:84
Central Queensland Coal Ass	Aus	5	85		Pancontinental Mining L	Aus	87	CM88:164
Central Queensland Coal Ass	Aus	6	89		Pancontinental Mining L	Aus	89	CWI1035:7
Central Queensland Coal Ass	Aus	22	84		Queensland Coal Trust	Aus	84	QCB85:54
Central Queensland Coal Ass	Aus	25	85		Queensland Coal Trust	Aus	87	CM88:164
Central Queensland Coal Ass	Aus	28	89		Queensland Coal Trust	Aus	89	CWI1035:7
Central Queensland Coal Ass	Aus	85	66		Utah International Inc	USA	75	CM76:160
Central Queensland Coal Ass	Aus	76	76		Utah International Inc	USA	76	CM76:160
Central Queensland Coal Ass	Aus	4	76		Utah Mining Australia L	Aus	76	CM76:160
Chapperal Coal Co Inc	USA	100			Industrial Fuels Corp	USA	85	KCIM86:678
Charles Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Chestnut Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
China Natl Coal Imp&Exp Corp	China	100			government	China	87	CM88:418
Clarence Colliery PL	Aus	49	77	A35	BP Coal Development Aust PL	Aus	86	NSW86:203;Par86
Clarence Colliery PL	Aus	51	77		Coalex PL	Aus	86	NSW86:203;Par86
Clermont Coal Mines L	Aus	75	89		Exxon	USA		ICR220:3
Clermont Coal Mines L	Aus	25	8?		Mitsubishi Dev PL	Aus		QCB85:86
Clermont Coal Mines L	Aus	75	8?		White Industries L	Aus		QCB85:86
Clermont Coal Mines L	Aus	0	89		White Industries L	Aus		ICR220:3
Clinchfield Coal Div	USA	100			Pittston Co	USA	85	KCIM86:678
Clutha Coal PL	Aus	100			Clutha L	Aus	88	NSW89:173
Clutha Coal PL	Aus	100	85	A30	Royaust PL	Aus	86	NSW86:203
Clutha Development	Aus	100	78	A169	BP Coal & Minerals Aus	Aus	84	BIE84:332
Clutha Development	Aus	50	77	A162	BP Coal & Minerals Aus	Aus	84	Par86:11
Clutha Development	Aus	0	78	A169	Daniel K. Ludwig	USA	84	Par86:11
Clutha Development	Aus	100	6?		Daniel K. Ludwig	USA	84	Par86:11
Clutha Development	Aus	50	77	A162	Daniel K. Ludwig	USA	84	Par86:11
Clutha Development	Aus	0	6?		Rio Tinto Collieries	Aus	76	McK76:218
Clutha Development	Aus	100	62		Rio Tinto Collieries	Aus	76	McK76:218

company name	country	equity	year	$m	parent company name	country	year	source
Coal Cliff Collieries PL	Aus	100			Kembla Coal & Coke PL	Aus	86	NSW86:205
Coal Corp of NZ	NZ	100			NZ govt	NZ	87	CM88:374
Coal Dev'ts (German Cr) PL	Aus				Commercial Union Assurance Co		85	QCB85:62
Coal Dev'ts (German Cr) PL	Aus				National Coal Board	UK	85	QCB85:62
Coal Resources of Qld MarketinAus		100			McIlwraith McEacharn Op PL	Aus	87	CM88:407
Coal Resources of Queensland	Aus	100			McIlwraith McEacharn Op PL	Aus	85	CM88:448:QCB85:
Coal X Inc	USA	100			Gulf Energy Corp	USA	85	KCIM86:678
Coal & Allied Industries L	Aus	3			Aust'n Mutual Provident Soc	Aus	86	NSW86:204
Coal & Allied Industries L	Aus	16	85		Coal & Allied Industries L	Aus	86	NSW86:204
Coal & Allied Industries L	Aus	14	78		CRA L	Aus	84	BIE84:332
Coal & Allied Industries L	Aus	16			CRA L	Aus	84	CM88:189
Coal & Allied Industries L	Aus	0	85		CRA L	Aus	87	CM88:189
Coal & Allied Industries L	Aus	6	88		Howard Smith Industries L	Aus	88	J89:48
Coal & Allied Industries L	Aus	39	6?	4.3ms	Howard Smith L	Aus	77	AZ69:69;Par86:2
Coal & Allied Industries L	Aus	50	78		Howard Smith L	Aus	86	BIE84:332;NSW86
Coal & Allied Industries L	Aus	42	89		Howard Smith L	Aus	89	ICR228:7
Coal & Allied Industries L	Aus	45	88		Howard Smith L	Aus	88	NSW89:174
Coal & Allied Industries L	Aus	36	88		Howard Smith L	Aus	88	J89:48
Coal & Allied Industries L	Aus		8?		Joban Kosan	Jap	87	CM88:189
Coal & Allied Industries L	Aus	1	80		Mitsubishi Chemical	Jap	87	CM88:189;CM85:4
Coal & Allied Industries L	Aus	5	88		Natnl Mutual Life Ass A'asia	Aus	88	J89:48
Coal & Allied Industries L	Aus	7			Natnl Mutual Life Ass A'asia	Aus	86	NSW86:204
Coal & Allied Industries L	Aus	5	88		Nissho Iwai Corp	Jap	88	J89:48
Coal & Allied Industries L	Aus	1	79		Nissho Iwai Corp	Jap	87	CM88:189;CM85:4
Coal & Allied Industries L	Aus	5	8?		Pendal Nominees PL	Aus	88	NSW89:174
Coal & Allied Industries L	Aus	2	79		Ube Industries	Jap	87	CM88:189;CM85:4
Coal & Allied Industries L	Aus	5	88		Ube Industries	Jap	88	NSW89:174
Coal & Allied Operations PL	Aus	100			Coal & Allied Industries L	Aus	86	NSW86:174
Coalex PL	Aus	100			Oakbridge L	Aus	86	NSW86:205
Coastal States Energy Co	USA	100	84		Coastal Corp	USA	85	KCIM86:677
Cobb Coal Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Collinsville Coal CoPL	Aus	25	89	p160	Agipcoal	It	89	ICR208:11
Collinsville Coal CoPL	Aus	100	8?		Mount Isa Mines L	Aus	84	BIE84:367
Collinsville Coal CoPL	Aus	60	75		Mount Isa Mines L	Aus	76	CM76:181
Collinsville Coal CoPL	Aus	75	89	p160	Mount Isa Mines L	Aus	89	ICR208:11
Collinsville Coal CoPL	Aus	40	75		Wood Hall L	Aus	76	CM76:181
Colony Bay Coal Co	USA	50			Bluestone Coal Corp	USA	84	KCIM85:10
Colony Bay Coal Co	USA	50			Eastern Associated Coal Corp	USA	84	KCIM85:10
Colorado Westmoreland Inc	USA	100	84		Westmoreland Coal Co	USA	85	KCIM86:679
Colowyo Coal Co	USA				Hanna Mining Co	USA	85	KCIM86:679
Colowyo Coal Co	USA				WR Grace Co	USA	85	KCIM86:679
Commonwealth Smelting	UK				CRA L	Aus	85	ICR127:14
Compagnie Europeene de Comcl	Belg				Krupp	WGerm	81	ICR23:11
Compagnie Europeene de Comcl	Belg				Petrofina	Belg	81	ICR23:11
Companhia de Acero d Pacifico	Chil	100			govt,Chile	Chile	81	ICR14:17
Consolidation Coal Co	USA	100			Dupont	USA	85	KCIM86:677
Container Corp of America	USA				Mobil Oil Co	USA	82	ICR51:11
Cook Colliery	Aus	100	7?	A11	BHP Minerals PL	Aus	84	CM85:471
Cook Colliery	Aus	0	83	A11	BHP Minerals PL	Aus	84	CM85:449
Cook Colliery	Aus	100	83		Coal Resources of Queensland	Aus	84	CM85:471;QCB85:
Coos Bay lease	USA	0	89		Menasha Corp	Jap	89	ICR217:13
Coos Bay lease	USA	100	89		Sumitomo Coal Mining	Jap	89	ICR217:13

company name	country	equity	year	$m	parent company name	country	year	source
Cordero Mining Co	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Costain Australia PL	Aus	8			Aust'n Mutual Provident Soc	Aus	86	NSW86:206
Costain Australia PL	Aus	67			Costain Investments (Aust) PL	Aus	86	NSW86:206
Coteau Properties Co	USA	100			North American Coal Corp	USA	85	KCIM86:678
CRA L	Aus	53			Rio-Tinto Zinc Corp PLC	UK	86	NSW86:206
Cravat Coal Co	USA	100			Puskarich Bros	USA	85	KCIM86:678
Crows Nest Industries L	Can	100			Shell Canada Resources	Can	85	O&G86:295
Crows Nest Resources L	Can	100			Shell Canada Resources	Can	87	CM88:301,454
CSR L	Aus	7			ANZ Nominees L	Aus	86	NSW86:206
CSR L	Aus	13			Aust'n Mutual Provident Soc	Aus	86	NSW86:206
Cumberland Collieries Inc	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Cumberland mine	USA	50			Ontario Hydro	Can	85	ICR124:17
Cumberland mine	USA	50			United States Steel Corp	USA	85	ICR124:17
Cumberland Mountain Coal Co	USA	100			Cyprus Coal Co	USA	84	KCIM85:11
Cumberland Village Coal	USA	100	89		Massey Coal Co, AT	USA	89	KNB7.1:6
Curragh coal unincorp jv	Aus	30	82		ACI Resources L	Aus	87	CM88:447,BIE84:
Curragh coal unincorp jv	Aus	0	88		ACI Resources L	Aus	88	CWI880525
Curragh coal unincorp jv	Aus	30	82		Anaconda Australia Inc	Aus	87	CM88:447,BIE84:
Curragh coal unincorp jv	Aus	60	88	p138	Arco Australia	Aus	88	ICR208:7
Curragh coal unincorp jv	Aus	10	82		Mitsui Coal Dev Aust PL	Aus	87	CM88:447,BIE84:
Curragh coal unincorp jv	Aus	30	82		RW Miller & Co PL	Aus	87	CM88:447,BIE84:
Curragh Queensland Mining L	Aus	100			ARCO Australia	Aus	87	CM88:447
C&K Coal Co	USA	100			Gulf Resources & Chemical Co	USA	85	KCIM86:678
Dal-Tex Coal Corp	USA	100			United Coal Co	USA	84	KCIM84:11
Dampier Coal (Qld) PL	Aus	100			BHP Minerals PL	Aus	84	BIE84:337
Decker Coal Co	USA	50			Nerco Inc	USA	84	KCIM85:9
Decker Coal Co	USA	50			Peter Kiewit Sons Mining	USA	84	KCIM85::11
Denham Coal Ass	Aus	5	8?		Arco Coal	Aus	89	ICR220:3
Denham Coal Ass	Aus	10	82		John Holland Mgmt Services PL	Aus	84	QCM85:77
Denham Coal Ass	Aus	45	82		Kennecott Expl Aust L	Aus	84	QCM85:77
Denham Coal Ass	Aus	15	82		Lend Lease Resources PL	Aus	84	QCM85:77
Denham Coal Ass	Aus	8	82		New Hope Collieries PL	Aus	84	QMC85:77
Denham Coal Ass	Aus	23	82		State Govt Insurance Office	Aus	84	QCM85:77
Diamond Alaska Coal Co	USA				Diamond Shamrock	USA	85	KCIM86:677
Diamond Alaska Coal Co	USA				Hunt Energy	USA	85	KCIM86:677
Diamond Shamrock Coal Co	USA	100	87	135	Arch Mineral Corp	USA	88	KNB6.10:7
Dombarton Colliery PL	Aus	100			Austen & Butta L	Aus	86	NSW86:207
Donaldson Mine Co	USA	100			Valley Camp Coal Co	USA	85	KCIM86:679
Douglas Colliery L	SA	100			Rand Mines	SA	87	CM88:460
Douglas Colliery L	SA	100			Witbank Colliery	SA	89	ICR228:1
Douglas Pocahontas Coal Corp	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Drayton Coal PL	Aus	7			Aust'n Mutual Provident Soc	Aus	86	NSW86:207
Drayton Coal PL	Aus	0	88		CSR L	Aus	88	NSW89:176
Drayton Coal PL	Aus	44			CSR L	Aus	87	CM88:437
Drayton Coal PL	Aus	3			Daesung Australia PL	SKor	86	NSW86:207
Drayton Coal PL	Aus	3			Hyundai Australia PL	SKor	86	NSW86:207
Drayton Coal PL	Aus	2			Mitsui Coal Dev Aust PL	Aus	86	NSW86:207
Drayton Coal PL	Aus	3			Mitsui Mining (Aust) PL	Aus	86	NSW86:207
Drayton Coal PL	Aus	83	88		Shell Australia L	Aus	88	NSW89:176
Drayton Coal PL	Aus	39			Shell Australia L	Aus	86	NSW86:207
Drummond Coal Co	USA	100			Drummond Co	USA	85	KCIM86:677
Duvha Opencut Services PL	SA	100			Rand Mines L	SA	87	CM88:362

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EAS Coal Co	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Eastern Associated Coal Corp	USA	0	87		Eastern Gas & Fuel Assoc	USA	87	K590:3
Eastern Associated Coal Corp	USA	100	8?		Eastern Gas & Fuel Assoc	USA	87	K590:3
Eastern Associated Coal Corp	USA	100	87		Peabody Holding Co	USA	87	K590:3
Eastern Coal Corp	USA	100			Pittston Co	USA	84	KCIM85:9
Ebenezer coal	Aus	51	88		Allied Queensland Coalfields	Aus	88	CWI924:1
Ebenezer coal	Aus	100			Allied Queensland Coalfields	Aus	87	CWI924:1
Ebenezer coal	Aus	49	88		Idemitsu Kosan	Jap	88	CWI924:1
Elders Resources	Aus	100	88		NZ Forest Products L	NZ	89	J89:68
Elkay Mining Co	USA	100			Pittston Co	USA	84	KCIM85:9
Elkorn Coal Corp	USA	100			International Paper Co	USA	85	KCIM86:678
Elkraft	Den				City of Copenhagen	Den	82	CWI109:2
Elkraft	Den				Isefjordvaerket	Den	82	CWI109:2
Elkraft	Den				SEAS	Den	82	CWI109:2
EMO	Neth	51			Frans Swarttouw Holding BV	Neth	89	SOMO89:9
EMO	Neth	30			Frans Swarttouw Holding BV	Neth	89	SOMO89:9
EMO	Neth	19			Manufrance	Fr	89	SOMO89:9
Empire Coal Co	USA	100			Industrial Fuels Corp	USA	85	KCIM86:678
Empire Energy Corp	USA	100			Cyprus Coal Co	USA	84	KCIM85:11
Emway Resource Inc	USA	100			Cyprus Coal Co	USA	84	KCIM85:11
Endeavour Resources	Aus	39	84		Bond Corp	Aus	84	BIE84:341
Energy Development Corp	USA	100			Ruhr-American Coal Corp	USA	85	KCIM86:679
Energy Fuels	USA	100	7?		Centurian Investment	USA	81	ICR20:8
Energy Fuels	USA	100	81	70	Getty Oil	USA	81	ICR20:8
Enoxy Coal Co	USA	100			Enoxy Holding	USA	85	ICR134:19
Enoxy Coal Sales	USA	100	85		Enoxy Holding	USA	85	ICR134:19
Enoxy Holding	USA	50	81		Agip	It	85	ICR134:19
Enoxy Holding	USA	50	81		Island Creek Coal Co	USA	85	ICR134:19
Ensham coal project	Aus	15			Agip Coal Aust PL	Aus	84	QCB85:76
Ensham coal project	Aus	15			Allied Queensland Coalfields	Aus	84	QCB85:76
Ensham coal project	Aus	23	8?		Bligh Coal L	Aus	84	QCB85:76
Ensham coal project	Aus	23			Idemitsu Queensland PL	Aus	84	QCB85:76
Ensham coal project	Aus	5			Lucky Goldstar Intl Aus PL	Aus	84	QCB85:76
Ensham coal project	Aus	15			Pacific Coal PL	Aus	84	QCB85:76
Ensham coal project	Aus	5			Rheinbraun Aust PL	Aus	84	QCB85:76
Ensham Coal Qld	Aus	25	87		Idemitsu Kosan	Jap	87	CWI810
Enviro Energy Inc	USA	100			Mower Lumber Co	USA	85	KCIM86:678
EPDC Overseas Coal CoL	Jap	100	81		Electric Power Dev Co	Jap	87	CM88:442
EPDC (Australia) PL	Aus	100	81		EPDC Overseas Coal CoL	Jap	87	CM88:442
Ermelo coal	SA	33			BP Coal SA PL	SA	87	CM88:458
Ermelo coal	SA	0	87		BP Coal SA PL	SA	89	ICR228:3
Ermelo coal	SA	50	87		Total Exploration SA PL	SA	89	ICR228:3
Ermelo coal	SA	33			Total Exploration SA PL	SA	87	CM88:458
Ermelo coal	SA	50	87		Trans Natal Corp L	SA	89	ICR228:3
Ermelo coal	SA	33			Trans Natal Corp L	SA	87	CM88:458
Ermelo Mines Services PL	SA	100			General Mining Union Corp	SA	87	CM88:362
Esso Resources Canada L	Can	100			Imperial Oil	Can	87	CM88:320
Estel Delfstoffen BV					Estel (st)	Neth	82	ICR48:8
Expansion Mining Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Exxon Australia Resources PL	Aus	100			Esso Expl & Production Aust	Aus	87	CM88:230
Exxon Coal & Minerals Aus L	Aus	100	8?		Exxon	USA	87	Exxon87:16
Falcoln Coal	USA	100			Diamond Shamrock	USA	81	ICR20:8

company name	country	equity	year	$m	parent company name	country	year	source
Falkirk Mining Co	USA	100			North American Coal Corp	USA	84	KCIM85:9
FCCI Inc	USA	100			Cerro-Marmon Coal Group	USA	87	CM88:131
Federale Mynbou BPK	SA	51	84		SA National Life Assurance	SA	84	BIE84:343
Florence Mining Co	USA	0	84		North American Coal Corp	USA	84	KCIM85:11
Florence Mining Co	USA	100			North American Coal Corp	USA	84	KCIM85:9
Florence Mining Co	USA	100	84		Rochester & Pittsburgh Coal	USA	84	KCIM85:11
Fording Coal Ltd	Can	60	7?		Canadian Pacific Investment	Can	84	CM76:217;CM85:3
Fording Coal Ltd	Can	100	86		Canadian Pacific Investment	Can	87	CM88:299
Fording Coal Ltd	Can	40	7?		Cominco L	USA	84	CM76:217;CM85:3
Fording Coal Ltd	Can	0	86		Cominco L	USA	87	CM88:299
Forestburg Collieries 1984 L	Can	100			Luscar L	Can	85	KCIM86:1225
Fort Union mine	USA	100			Frontier Coal	USA	85	ICR120:16
Frans Swarttouw Holding BV	Neth	60			HEW Beheer NV	Neth	89	SOMO89:9
Frans Swarttouw Holding BV	Neth	40			Internatio Muller NV	Neth	89	SOMO89:9
Freeman United Coal Mining	USA	100			General Dynamics	USA	81	ICR34:9
Fremont Coal Co	USA	100			Utah International Inc	USA	84	KCIM85:9
Frontier Coal	USA	100			Compagnie Francais Petroles	Fr	85	ICR120:16
F&M Coal Co Inc	USA	50			Jno McCall Coal Co	USA	85	KCIM86:678
Gateway Coal Co	USA	100			Diamond Shamrock	USA	84	KCIM85:11
General Mining Union Corp L	SA	7	84		Anglo American	SA	84	BIE84:345
General Mining Union Corp L	SA	51	84		Federale Mynbou BPK	SA	84	BIE84:345
General (Aust) PL	Aus	100	84		General Mining Union Corp	SA	84	BIE84:345
German Creek mine	Aus	op			Capricorn Coal Management PL	Aus	87	CM88:164
Getty Minerals Marketing Inc	USA				Plateau Mining Co	USA	87	CM88:120
Glenharold Mine	USA	As			Consolidation Coal Co	USA	84	KCIM85
Glennies Creek	Aus	50	89		Australian Mining Investments	Aus	89	K752:12
Glennies Creek	Aus	25	89		Nippon Oil Co L	Jap	89	K752:12
Glennies Creek	Aus	25	89		Toyo Menka Kaisha L	Jap	89	K752:12
Glenrock Coal Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Goedenhoop Colliery	SA	100			Anglo American Coal Corp	SA	87	CM88:362
Gold Fields Coal L	SA	100			Gold Fields of SA	SA	87	CM88:363
Gold Fields of SA	SA	100			Fraser Alexander L	SA	87	CM88:363
Golin Wallsend Coal Co L	Aus	49	82		Agip	It	82	Par86:28
Golin Wallsend Coal Co L	Aus	0	84		Agip	It	82	Par86:28
Golin Wallsend Coal Co L	Aus	100	84		Australian Mining Inv	Aus	84	CM85:215
Golin Wallsend Coal Co L	Aus	49	81		Consolidation Coal of Aust	Aus	84	NSW84:163
Golin Wallsend Coal Co L	Aus	0	82		Consolidation Coal of Aust	Aus	84	Par86:28
Golin Wallsend Coal Co L	Aus	49			Gollin Administration PL	Aus	84	NSW84:163
Golin Wallsend Coal Co L	Aus	2			Warman Holdings PL	Aus	84	NSW84:163
Gollin Administration PL	Aus	100			Australian Mining Inv	Aus	84	NSW84:163
Gordonstone mine	Aus	100			Denham Coal Ass	Aus	84	QCM85:77
Greenhills ujv	Can	20	80		Pohang Iron & Steel Co	SKor	87	CM88:305,453
Greenhills ujv	Can	80	80		Westar Mining L	Can	87	CM88:305,453
Greenich Collieries Co	USA	100			Pennsylvania Power & Light	USA	85	KCIM86:678
Gregg River Coal L	Can	100			Manalta Coal L	Can	87	CM88:286,277,30
Gregg River Resources L	Can	100			Manalta Coal L	Can	87	CM88:286,277,30
Gregg River ujv	Can	60			Gregg River Coal L	Can	87	CM88:286,277;Da
Gregg River ujv	Can	40			Japan Gregg River Coal	Can	87	CM88:286,277;Da
Gregg River ujv	Can	5			Kawasaki Steel Can L	Can	87	CM88:277;Dalby8
Gregg River ujv	Can	3			Kobe Steel Can L	Can	87	CM88:277;Dalby8
Gregg River ujv	Can	5			Mitsui Coal Dev Can L	Can	87	CM88:277;Dalby8
Gregg River ujv	Can	14			Nippon Steel Dev Can	Can	87	CM88:277;Dalby8

company name	country	equity	year	$m	parent company name	country	year	source
Gregg River ujv	Can	1			Nisshin Steel Can L	Can	87	CM88:277;Dalby8
Gregg River ujv	Can	6			NKK Coal Can L	Can	87	CM88:277;Dalby8
Gregg River ujv	Can	5			Sumitomo Metal Can L	Can	87	CM88:277;Dalby8
Gregory joint venture	Aus	8	84		Aust'n Mutual Provident Soc	Aus	87	CM88:164;QCB85:
Gregory joint venture	Aus	9	89	pA25	Aust'n Mutual Provident Soc	Aus	89	CWI1035:7
Gregory joint venture	Aus	5	84		Bell Resources L	Aus	85	CM85:198
Gregory joint venture	Aus	10	85		Bell Resources L	Aus	87	CM88:164;QCB85:
Gregory joint venture	Aus	0	89	A25	Bell Resources L	Aus	89	CWI1035:7
Gregory joint venture	Aus	52	85		BHP Minerals PL	Aus	87	CM88:164;QCB85:
Gregory joint venture	Aus	55	84		BHP Minerals PL	Aus	85	QCB85:64
Gregory joint venture	Aus	47	84		BHP Minerals PL	Aus	84	CM88:261
Gregory joint venture	Aus	55	89	pA25	BHP Minerals PL	Aus	89	CWI1035:7
Gregory joint venture	Aus	0	85		General Electric	USA	84	CM88:261;QCB85:
Gregory joint venture	Aus	16	84		General Electric	USA	84	CM88:261;CM85:1
Gregory joint venture	Aus	9	84		General Electric	USA	84	CM88:261
Gregory joint venture	Aus	3	89	pA25	Mitsubishi Development PL	Aus	89	CWI1035:7
Gregory joint venture	Aus	3	84		Pancontinental Mining L	Aus	85	CM85:198
Gregory joint venture	Aus	5	84		Pancontinental Mining L	Aus	87	CM88:164;QCB85:
Gregory joint venture	Aus	6	89	pA25	Pancontinental Mining L	Aus	89	CWI1035:7
Gregory joint venture	Aus	25	85		Queensland Coal Trust	Aus	84	CM88:261
Gregory joint venture	Aus	22	84		Queensland Coal Trust	Aus	87	CM88:164;QCB85:
Gregory joint venture	Aus	28	89	pA25	Queensland Coal Trust	Aus	89	CWI1035:7
Gregory mine	Aus	100	7?		BHP Minerals PL	Aus	85	QCB85:64
Grundy Mining Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Gunnedah Coal Co	Aus	100	85?		Australian Mining Inv	Aus	86	NSW86:198
Gunnedah Coal Co	Aus	100	74		Gollin	Aus	86	Par86:11
Gunnedah Coal Co	Aus	50	7?		Gollin	Aus	86	Par86:11
Gunnedah Coal Co	Aus	51	76		Peko Wallsend L	Aus	86	Par86:11
Guyan Mining Co	USA	100			Occidental Petroleum Corp	USA	85	KCIM86:678
Hansen & Neuerburg AG	WGer	100			Raab Karcher	WGer	89	SOMO89:12
Harbert Corp, Ala	USA	100	81	300	Amoco Minerals	USA	81	ICR27:8
Harman Mining	USA		81		Hudsons Bay Mining & Smelting	Can	81	ICR21:9
Harman Mining	USA		81		Minerals & Res of Bermuda	Ber	81	ICR21:9
Harman Mining Corp	USA	100			Inspiration Coal Inc	USA	84	KCIM85:14
Hawkeye Coal, Ken	USA	100			Frontier Coal	USA	85	ICR120:16
Helen Mining Co	USA	100			North American Coal Corp	USA	84	KCIM85:9
Helen Mining Co	USA	100			Valley Camp Coal Co	USA	85	KCIM86:679
Helvetia Coal Co	USA	100			Rochester & Pittsburgh Coal	USA	84	KCIM85:11
Hermitage Collieries Co L	Aus				Coalex PL	Aus	87	CM88:162
Hermitage Collieries Co L	Aus	0	8?		Sumitomo Coal Mining	Jap	87	CM88:213
Hermitage Collieries Co L	Aus	5	78		Sumitomo Coal Mining	Jap	87	CM88:213
Hermitage Collieries Co L	Aus	10	78	A4.5	Sumitomo Corp	Jap	84	CM85:193
Hermitage Collieries Co L	Aus	6	8?		Sumitomo Corp	Jap	87	CM88:213
Hobet Mining & Const Co Inc	USA	100			Ashland Coal Co	USA	84	KCIM85:13
Holland Carbon Fuels	USA				DSM, Dutch state chem group	Neth	82	ICR48:8
Holland Carbon Fuels	USA				Estel Delfstoffen BV	Neth	82	ICR48:8
Holland Carbon Fuels	USA				Samenwerkende Electriciteits P	Neth	82	ICR48:8
Hopkins Creek Coal Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Howard Smith L	Aus	?	6?	3ms	Coal & Allied Industries L	Aus	69	AZ69:69
Howard Smith L	Aus	22	89		Coal & Allied Industries L	Aus	89	ICR223:19
Howard Smith L	Aus	19	6?		Coal & Allied Industries L	Aus	87	CM88:217
Howard Smith L	Aus		86		Joban Kosan	Jap	87	CM88:426

company name	country	equity	year	$m	parent company name	country	year	source
Howard Smith L	Aus	1ms	80		Mitsubishi Chemical Ind L	Jap	87	CM88:426
Howard Smith L	Aus	1ms	79		Nissho Iwai Corp	Jap	87	CM88:426
Howard Smith L	Aus	2ms	79		Ube Industries	Jap	87	CM88:426
Howick mine	Aus	100	78		BP Coal	Aus	89	ICR235:6
Howick mine	Aus	0	89		BP Coal	Aus	89	ICR235:6
Howick mine	Aus	100	89		CRA	Aus	89	ICR235:6
Howick mine	Aus	60	89		CRA	Aus	89	ICR235:6
Howick mine	Aus	40	89		Mitsubishi	Jap	89	ICR235:6
Hudsons Bay Mining & Smelting	Can				Anglo American	SA	81	ICR21:9
Idemitsu Boggabri Coal PL	Aus	100	87		Idemitsu Kosan	Jap	87	NSW89:171
Idemitsu Intl Res Can	Can	100	81	40	Idemitsu Kosan	Jap	86	CM87:475
Indian Creek	USA	100			Cannelton Industries	USA	87	CWI843:1
Imperial Oil	Can				Exxon	USA	87	CM88:320
Inspiration Coal	USA		7?		Hudsons Bay Mining & Smelting	Can	81	ICR21:9
Inspiration Coal	USA		7?		Minerals & Res of Bermuda	Ber	81	ICR21:9
International Anthracite Corp	USA	100			Frontier Coal	USA	85	ICR120:16
International Coal Trading	SA	100			Agip SA	SA	82	ICR49:9
Internatl Colombia Res Corp	Col	100	8?		Exxon	USA	87	CM88:462
Island Creek Coal Co	USA	100			Occidental Petroleum Corp	USA	85	KCIM86:678;ICR1
Island Creek Coal Sales Co	USA	100			Island Creek Coal Co	USA	87	CM88:116
Italiana Coke Spa	Ita	100			Agip Coal	Ita	87	ENI87
Itmann Coal Co	USA	As			Consolidation Coal Co	USA	84	KCIM85
JCD Australia PL	Aus	100			Japan Coal Development Co	Jap	87	CM88:442
Jeebropilly Collieries PL	Aus	100			Surrey Propeties PL	Aus	84	BIE84:355
Jemm Mining Co	USA	100			Enviro-Fuels Inc	USA	85	KCIM86:678
Jessie Shipley Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Jewell Ridge Coal Corp	USA	100			Pittston Co	USA	84	KCIM85:9
Jewell Smokeless Coal Co	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Jim Walter Resources Co	USA	100			Jim Walter Corp	USA	87	CM88:118;KCIM86
JMJ	UK	100			Anglo International	UK	81	ICR33:13
JMJ/SM jv,Kentucky	USA				JMJ	UK	81	ICR33:13
JMJ/SM jv,Kentucky	USA				Simons Brothers	USA	81	ICR33:13
Jones & Laughlin Steel Corp	USA	100			LTV Corp	USA	85	KCIM86:678
Kaiser Resources L	Can	40			JSM	Jap	80	ICR1:6
Kaiser Resources L	Can	27			JSM + Mitsubishi	Jap	76	CM76:204
Kaiser Resources L	Can	5			Kaiser,Edgar	USA	80	ICR1:6
Kaiser Resources L	Can	46			Kaiser Steel Corp	USA	76	CM76:204
Kaiser Resources L	Can	24			Kaiser Steel of Calif	USA	80	ICR1:6
Kaiser Resources L	Can	27			public	USA	76	CM76:204
Kanawha Coal Co	USA	100			Pickands Mather & Co	USA	85	KCIM86:678
Kangra Coal Corp	SA	100			Kangra Group L	SA	87	CM88:363
Kangra Coal Corp	SA	50	79		Agip Coal	It	87	ENI87
Kanhym	SA	100			General Mining Union Corp	SA	89	ICR228:1
Kawasaki Steel Can L	Can	100			Kawasaki Steel Corp	Jap	87	CM88:277
Kem Coal Co	USA	100			Transco Coal Services Co	USA	85	KCIM86:679
Kembla Coal & Coke PL	Aus	20	6?		Broken Hill South	Aus	78	Rich83:74
Kembla Coal & Coke PL	Aus	50	6?		CRA L	Aus	69	AZ69:14
Kembla Coal & Coke PL	Aus	100	7?		CRA L	Aus	86	NSW86:211
Kembla Coal & Coke PL	Aus	30	6?		North Broken Hill	Aus	78	Rich83:74
Kennecott Explorations	USA	100			Standard Oil Co of Ohio	USA	82	DIC82:351
Kennecott Explorations Aus L	Aus	100			Kennecott Corp	USA	82	DIC82:351
Kent Coal Mining Co	USA	100			Rochester & Pittsburgh Coal	USA	84	KCIM85:11

company name	country	equity	year	$m	parent company name	country	year	source
Kentland Elkhorn Coal Co	USA	100			Pittston Co	USA	85	KCIM86:678
Kentucky Carbon Corp	USA	100			Carbon Industries	USA	85	KCIM86:677
Kentucky jv	USA		81		Compagnie Francais Petroles	Fr	81	CWI232:1
Kentucky jv	USA		81		Diamond Shamrock	USA	81	CWI232:1
Kermit Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Kerr-McGee Coal Corp	USA	100			Kerr-McGee Corp	USA	85	KCIM86:678
Kesscoal Inc	USA	?	89		Massey Coal Co, AT	USA	89	KNB7.1:6
Keystone Coal Mining Corp	USA	100			Rochester & Pittsburgh Coal	USA	84	KCIM85:11
Kitt Energy Corp	USA	100	8?		Old Ben Coal Co	USA	84	KCIM85:10
Kitt mine	USA				Republic Coal	USA	81	ICR41:10
Kleinkopje Colliery	SA	100			Anglo American Coal Corp	SA	87	CM88:362
Kobe Steel Can L	Can	100			Kobe Steel L	Jap	87	CM88:277
Koch Carbon Inc	USA	100			Koch Industries Inc	USA	85	KCIM86:678
La Loma	Col				Drummond C	USA	89	ICL8917:2
La Loma	Col				Drummond C	Col	89	ICL8917:2
Landau Colliery	SA	100			Anglo American Coal Corp	SA	87	CM88:362
Laurel Mines Corp	USA	100			National Mines Corp	USA	85	KCIM86:678
Leeco Inc	USA	100			Transco Coal Services Co	USA	85	KCIM86:679
Lemington Collieries	Aus	50	74		CSR L	Aus	74	Par86:11
Lemington Collieries	Aus	50	86		CSR L	Aus	86	NSW86:211
Lemington Collieries	Aus	100	7?		CSR L	Aus	84	CM85:250
Lemington Collieries	Aus	93	7?		CSR L	Aus	78	Rich83:74
Lemington Collieries	Aus	100	88		Exxon Aust Resources PL	Aus	88	Exxon88:16
Lemington Collieries	Aus	50	86		Exxon Aust Resources PL	Aus	86	NSW86:211
Lemington Collieries	Aus	7	7?		Johnstone, J	Aus	78	Rich83:74
Lemington Collieries	Aus	50	74		Johnstone, J	Aus	74	Par86:11
Leslie Coal Co Inc	USA				Fluor Corp	USA	85	KCIM86:678
Leslie Coal Mining Co	USA				Pickands Mather & Co	USA	85	KCIM86:678
Liddell mine	Aus	100	7?		Coal & Allied Industries L	Aus	89	ICR222:11
Liddell mine	Aus	0	89		Coal & Allied Industries L	Aus	89	ICR222:11
Liddell mine	Aus	38	89		Marion Mining	Aus	89	ICR222:11
Liddell mine	Aus	38	89		Massey Coal Co Inc, AT	USA	89	ICR222:11
Liddell mine	Aus	5	89		private	Aus	89	ICR222:11
Liddell mine	Aus	20	89		Savage Resources	Aus	89	ICR222:11
Line Creek coal mine	Can	100			Crows Nest Resources L	Can	87	CM88:286,301
Lithgow Valley Colliery CoL	Aus	94			Coalex PL	Aus	86	NSW86:211
Lithgow Valley Colliery CoL	Aus	6	78		Sumitomo Corp	Jap	86	NSW86:211
Lornex Mining Corp L	Can	68			Rio Algom		87	CM88:304
Lornex Mining Corp L	Can	22			Teck Corp	Can	87	CM88:304
Luscar coal	Can	op			Cardinal River Coals L	Can	87	CM88:286
Luscar-Sterco L	Can	25			Alberta Energy Co	Can	87	CM88:452
Luscar-Sterco L	Can	75			Luscar L	Can	87	CM88:452
Macquarrie	Aus	100	89	A125	Bell Resources L	Aus	89	ICR226:7
Macquarrie	Aus	100	7?		BHP Co PL	Aus	89	ICR226:7
Macquarrie	Aus	100	89		Elders Resources NZFPL	Aus	89	ICR226:7
Maitland Main Collieries PL	Aus	100			Australian Mining Inv	Aus	86	NSW86:198
Majestic Collieries Co	USA	100			Inspiration Coal Inc	USA	84	KCIM85:14
Manalta Coal L	Can	100			Mancal L	Can	87	CM88:286,277,30
Mancal L	Can	100			Loram L		87	CM88:286,277
Manitoba & Saskatchewan 1984	Can	100			Luscar L	Can	85	KCIM86:1225
Manor/Nineveh coalfield	USA	100	7?		Consolidation Coal Co	USA	81	ICR22:16;32:9
Manor/Nineveh coalfield	USA	76			Consolidation Coal Co	USA	81	ICR22:16;32:9

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Manor/Nineveh coalfield	USA	24	81		Rheinbraun	WGer	81	ICR22:16;32:9
Maple Meadow Mining Co	USA	100			Cannelton Industries	USA	85	KCIM86:677
Marion Coal Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Martin County Coal Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Mary Lee Coal Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Massey Coal Co	USA	50			Royal Dutch Shell	UK/Ne	85	O&G86:294
Massey Coal Co Inc , AT	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Massey Coal Export Corp	USA	100			Massey Coal Co, AT	USA	87	CM88:118
Mathies Coal Co	USA	As			Consolidation Coal Co	USA	84	KCIM85
Mathies Coal Co	USA	As			Stelco	Can	87	CWI839:1
Mathies Coal Co	USA	As			National Steel Corp	USA	87	CWI839:1
Matla Coal L	SA	100			General Mining Union Corp	SA	87	CM88:362
McCoy Caney Coal Co	USA	100	84		Coastal Corp	USA	85	KCIM86:677
McCoy Elkhorn Coal Corp	USA	100			Transco Coal Services Co	USA	85	KCIM86:679
McIlwraith McEacharn L	Aus	46			Thomas Nationwide Transport	Aus	84	BIE84:361
McInnes Coal Mining Co	USA	100			Pickands Mather & Co	USA	85	KCIM86:678
McIntyre Coal Mines L	Can	100			McIntyre Porcupine L	Can	76	CM76:213
McIntyre Porcupine L	Can				Superior Oil Co L	USA	76	CM76:213
Medicine Bow	USA	50	8?		Arch Mineral Corp	USA	88	KNB7.1:5
Medicine Bow	USA	100	88		Arch Mineral Corp	USA	88	KNB7.1:5
Medicine Bow	USA	0	88		Union Pacific Mineral Co	USA	88	KNB7.1:5
Medicine Bow	USA	50	8?		Union Pacific Mineral Co	USA	88	KNB7.1:5
Mercury Coal & Coke Inc	USA	100			Valley Mining Co Inc	USA	85	KCIM86:679
Middelburg Mines Services PL	SA	89			BP Coal SA PL	SA	87	CM88:460
Middelburg Mines Services PL	SA	5			Douglas Colliery L	SA	87	CM88:460
Middelburg Mines Services PL	SA	12	89	7	Douglas Colliery L	SA	89	ICR228:1
Middelburg Mines Services PL	SA	7			Kanhym	SA	87	CM88:460
Middelburg Mines Services PL	SA	0	89	7	Kanhym	SA	89	ICR228:1
Midland Coal Co	USA	100			American Smelting & Refining	USA	85	KCIM86:677
MIM Holdings L	Aus	49			American Smelting & Refining	Aus	87	CM88:444
MIM Holdings L	Aus	32			Mount Isa Mines	Aus		
Minerals & Res of Bermuda	Ber				Anglo American	SA	81	ICR21:9
Mingo-Logan Coal	USA	100	8?		BP Coal America	USA	88	CWI880525
Minsarco Resource PL					General Mining Union Corp	SA	87	CM88:437
Missouri Valley Properties Co	USA	100			North American Coal Corp	USA	85	KCIM86:678
Mitsui Coal Development Aust P	Aus	70			Mitsui & Co L	Jap	84	BIE84:365,CM88:
Mitsui Coal Development Aus PL	Aus	30			Mitsui & Co (Aust) L	Aus	84	BIE84:365,CM88:
Mitsui Coal Development Can L	Can	100			Mitsui & Co L	Jap	87	CM88:277
Mitsui & Co (Aust) L	Aus	100			Mitsui & Co L	Jap	84	BIE84:365
Mobil Coal Producing	USA	100			Mobil Corp	USA	85	KCIM86:678
Monterey Coal Co	USA	100			Exxon Coal USA Inc	USA	84	KCIM85:9
Mount Isa Mines L	Aus	100			MIM Holdings L	Aus	84	BIE84:367
Mount Thorley Colliery	Aus	20			Pohang Iron & Steel Co	S.Kor	86	NSW86:217
Mount Thorley Colliery	Aus	80			RW Miller & Co PL	Aus	86	NSW86:212
Mountain Clay Inc	USA	100			Transco Coal Services Co	USA	85	KCIM86:679
Mountain Coals Inc	USA	100			Cyprus Coal Co	USA	84	KCIM85:11
Mountian Drive Coal Co	USA	100			Cumberland Mountain Coal Co	USA	84	KCIM85:11
Mulga Coal Co	USA	100			Drummond Co	USA	85	KCIM86:677
Muswellbrook Coal Co	Aus	100			Muswellbrook Energy & Minrls	Aus	86	NSW86:212
Muswellbrook Energy & Minls L	Aus	62	80		Consolidated Press Res	Aus	86	NSW86:212;CM88:
Muswellbrook Energy & Minls L	Aus	15	80		Marubeni Corp	Jap	84	CM85:458
Nacco Mining Co	USA	100			North American Coal Corp	USA	84	KCIM85:9

company name	country	equity	year	$m	parent company name	country	year	source
National Coal Supply Corp	Isr		80		govt,Israel	Isr	80	ICR9:12
National Coal Supply Corp	Isr		80		Israel Electric Co	Isr	80	ICR9:12
National Mines Corp	USA	100			National Steel Corp	USA	85	ICR123:17
National Smokeless Fuels	UK	100			British Coal	UK	87	K584:2
National Steel Corp	USA	50	84	292	National Intergroup Inc	USA	84	AFR840427:18
National Steel Corp	USA	100	7?		National Intergroup Inc	USA	84	AFR840427:18
National Steel Corp	USA	50	84	292	Nippon Kokan KK	Jap	84	ICR123:17;AFR84
Neptune Terminal	Can	20	80	C4	Consolidation Coal Co of Can	Can	80	ICR5:15
Neptune Terminal	Can	79	7?		Federal Industries	Can	80	ICR5:15
Neptune Terminal	Can	20	80	C4	Luscar L	Can	80	ICR5:15
Neptune Terminal	Can	20	80	C4	McIntyre Mines	Can	80	ICR5:15
Nerco	USA	100			Pacific Power & Light	USA	80	ICR9:12;KCIM86:
Nerco Coal Sales	USA	100			Nerco Inc	USA	80	ICR9:12
Nerco Eastern Coal Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Neste Coal Corp		100			Neste Oy	Fin		O&G86
Neste Coal Ltd		100			Neste Oy	Fin		O&G86
New Hope Collieries	Aus	100			Surrey Propeties PL	Aus	84	BIE84:389
New River Co	USA	100			CSX Corp	USA	85	KCIM86:677
Newcastle Wallsend Coal Co PL	Aus	100	88		Elders Resources NZFPL	Aus	88	NSW89:177
Newcastle Wallsend Coal Co PL	Aus	100			Peko Wallsend L	Aus	86	NSW86:215;CM88:
NewEra Resources Corp	USA	100			Mower Lumber Co	USA	85	KCIM86:678
Newlands Coal PL	Aus	25	89	p160	Agipcoal	It	89	ICR208:11
Newlands Coal PL	Aus	75	89	p160	MIM Holdings L	Aus	89	ICR208:11
Newlands Coal PL	Aus	100	78		MIM Holdings L	Aus	84	BIE84:363
Newmont Mining		22	84		Consolidated Gold Fields PLC	SA	84	BIE84:369
Newmont Mining		8			Consolidated Gold Fields PLC	SA	81	ICR30:12
New Whitwood Collieries PL	Aus	100			Allied Queensland Coalfields	Aus	88	J89:5
Nippon Steel Dev Can L	Can	100			Nippon Steel Corp	Jap	87	CM88:277
Nisshin Steel Can L	Can	100			Nisshin Steel Co L	Jap	87	CM88:277
Nissho Iwai Corp	Jap	.5ms	79		Howard Smith L	Aus	87	CM88:426
NKK Coal Can L	Can	100			Nippon Kokan KK	Jap	87	CM88:277
North Antelope Coal Co	USA	50			Paneastern Coal Co	USA	85	KCIM86:678
North Antelope Coal Co	USA	50			Powder River Coal Co	USA	85	KCIM86:678
North River Energy Co	USA	50			LTV Steel Co	USA	84	KCIM85:10
North River Energy Co	USA	50			Pittsburg & Midway Coal Co	USA	84	KCIM85:10
Northwestern Resources Co	USA	100			Western Energy Co	USA	85	KCIM86:679
Norton mine	USA	100	87		Diamond Shamrock Coal Co	USA	88	KNB6.10:7
Norton mine	USA	100	88		Zielinski Construction	USA	88	KNB6.10:7
NuEast Mining Corp	USA	100			Eastern Associated Coal Corp	USA	84	KCIM85:10
Oak Grove Coal Co	USA	100			Pyro Energy Corp	USA	84	KCIM85:12
Oakbridge L	Aus	19			ANZ Nominees L	Aus	86	NSW86:215
Oakbridge L	Aus	23.9ms			ANZ Nominees L	Aus	89	J89:137
Oakbridge L	Aus	11			Aust'n Mutual Provident Soc	Aus	86	NSW86:215
Oakbridge L	Aus	5	81	11	Aust'n Mutual Provident Soc	Aus	81	ICR10:8
Oakbridge L	Aus	12			Bankers Trustees	Aus	88	NSW89:185
Oakbridge L	Aus	49	89		Elders Resources NZFPL	Aus	89	ICR226:7
Oakbridge L	Aus	20	8?		Gencor (Aust) PL	Aus	89	ICR226:7
Oakbridge L	Aus	14	84		Gencor (Aust) PL	Aus	84	BIE84:344
Oakbridge L	Aus	0	89		Gencor (Aust) PL	Aus	89	ICR226:7
Oakbridge L	Aus	13	89		Japan consumer?	Jap	89	ICR226:7
Oakbridge L	Aus	8	89		Mapp, G	Aus	89	ICR225:15
Oakbridge L	Aus	5	7?		Mapp, G	Aus	81	ICR10:8

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Oakbridge L	Aus	20			Minsarco Resource PL		88	NSW89:185
Oakbridge L	Aus	14			Minsarco Resource PL		86	NSW86:215
Oakbridge L	Aus	7.1ms			Pendall Nominees	Aus	89	J89:137
Oakbridge L	Aus	6.4ms			S&A Nominees	Aus	89	J89:137
Oakbridge L	Aus	3.6ms			Sumitomo	Jap	89	J89:137
Oakbridge L	Aus	8.0ms			Superannuation Investment Fund	Aus	89	J89:137
Oaky Creek joint venture	Aus	5	7?		Empresa Nacional Siderugica	Sp	84	BIE84:372;QCB85
Oaky Creek joint venture	Aus	9	7?		Hoogovens Delfstoffen BV	Neth	84	BIE84:372;QCB85
Oaky Creek joint venture	Aus	0	80	A45	Houston Oil & Min of Aus Inc	Aus	87	CM88:264
Oaky Creek joint venture	Aus	38	7?		Houston Oil & Min of Aus Inc	Aus	87	CM88:266
Oaky Creek joint venture	Aus	0	89		Italsider SPA	It	89	ICR218:5
Oaky Creek joint venture	Aus	8	7?		Italsider SPA	It	84	BIE84:372
Oaky Creek joint venture	Aus	79	80	A45	Mount Isa Mines L	Aus	80	ICR5:12;QCB85:6
Oaky Creek joint venture	Aus	87	89		Mount Isa Mines L	Aus	89	ICR218:5
Oaky Creek joint venture	Aus	40	7?		Mount Isa Mines L	Aus	87	CM88:266
Obed Marsh	Can	3			Norcen Energy Resources L		87	CM88:453
Obed Marsh	Can	97			Union Oil Co of Canada L	Can	87	CM88:453
Old Ben Coal Co	USA	100	8?		Standard Oil of Ohio (Sohio)	USA	87	KCIM86:679;CM88
Omar Mining Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Oneida Coal Co	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Optimum Collieries PL	SA	40			Sir Alfred McAlpine and Son	UK	87	CM88:458
Optimum Collieries PL	SA	60			Trans Natal Corp L	SA	87	CM88:458
Ora Mae Coal Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
O'Donnell Coal Co	USA	100			Rochester & Pittsburgh Coal	USA	85	KCIM86:679
Pacific Coal	Aus	100			CRA L	Aus	88	ICR208:17
Pacific Copper L	Aus	100			Bond Corp	Aus	86	NSW86:202
Patrick Coal Corp	USA	100			Patrick Petroleum Corp	USA	85	KCIM86:678
Patton Coal Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Peabody Coal Co	USA		85		Bechtel Corp	USA	85	KCIM86:678
Peabody Coal Co	USA		85		Boeing Co	USA	85	KCIM86:678
Peabody Coal Co	USA		85		Equitable Life Assurance Soc	USA	85	KCIM86:678
Peabody Coal Co	USA	10	84		Fluor Corp	USA	84	BIE84:344
Peabody Coal Co	USA	100	68		Kennecott Copper Corp	USA	75	McK76:218;Fox81
Peabody Coal Co	USA		85		Newmont Mining Co	USA	85	KCIM86:678
Peabody Coal Co	USA		85		Williams Cos	USA	85	KCIM86:678
Peabody Development	USA	27	80		Newmont Mining		81	ICR30:12
Peabody Development	USA	28	84		Newmont Mining		84	BIE84:369
Peabody Development	USA	50	89		Newmont Mining		89	ICR227:9
Peabody Holdings	USA	0	86		Eastern Gas & Fuel Assoc	USA	87	K590:3
Peabody Holdings	USA	15	87		Eastern Gas & Fuel Assoc	USA	87	K590:3
Peerless Eagle Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Peko Wallsend L	Aus	19			ANZ Nominees L	Aus	86	NSW86:216
Peko Wallsend L	Aus	0			ANZ Nominees L	Aus	88	NSW89:185
Peko Wallsend L	Aus	0			Aust'n Mutual Provident Soc	Aus	88	NSW89:185
Peko Wallsend L	Aus	21			Aust'n Mutual Provident Soc	Aus	86	NSW86:216
Peko Wallsend L	Aus	100	88		North Broken Hill PL	Aus	88	NSW89:185;J89:1
Pembroke Coal Co	USA	100			Utah International Inc	USA	84	KCIM85:9
Permac Inc	USA	100			Jno McCall Coal Co	USA	85	KCIM86:678
Permac Inc	USA	0	89		Jno McCall Coal Co	USA	89	ICR2335:6
Permac Inc	USA	100	89		Mapco	USA	89	ICR2335:6
Perry County Coal Co	USA	100			Blue Diamond Coal Co	USA	85	KCIM86:677
Peter Cave Coal Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678

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Peter White Coal Mining Corp	USA	100			National Mines Corp	USA	85	KCIM86:678
Phillips Coal Co	USA	100			Phillips Petroleum Corp	USA	85	KCIM86:678
Pickands Mather & Co	USA	100			Moore McCormack Resources	USA	85	KCIM86:678
Pike Coal	USA	100			BP Coal America	USA	88	CWI880525
Pikeco Mining Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Pikeville Coal Co	USA	100			Pickands Mather & Co	USA	85	KCIM86:678
Piney Creek Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Pioneer Sugar Mills	Aus	29			CSR L	Aus	86	NSW86:216
Pioneer Sugar Mills	Aus	16			Thiess Holdings L	Aus	86	NSW86:216
Pittsburg & Midway Coal Ming	USA	100			Chevron Corp	USA	85	KCIM86:677
Pittston Coal Export Corp	USA	100			Pittston Co	USA	87	CM88:128
Placer Coal Inc	USA	100			Placer US Inc	USA	85	KCIM86:678
Plateau Mining	USA	100			Getty Oil	USA	85	CM85:439
Pocahontas No6	USA	67			Island Creek Coal Co	USA	85	ICR124:3
Pocahontas No6	USA	33			Romania	Rom	85	ICR124:3
Polkohle	WGer	15			Weglokoks	Pol	80	Gas81:16
Pond Creek Mining Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Prater Creek Processing	USA	100			Industrial Fuels Corp	USA	85	KCIM86:678
Premier Coal Sales	USA	100			Peabody Development	USA	85	ICR115:7
Preussen-Elektra AG	WGer	95			Veba AG	WGer	89	SOMO89:12
Price River Coal Co	USA	100			Central Ohio Coal Co	USA	84	KCIM85:10
Prospect Point Coal CO	USA	100			Rocky Mountain Energy	USA	85	KCIM86:679
PT Belau Coal	Indo	60			Mobil Oil Co	USA	87	CM88:478
PT Belau Coal	Indo	40			Nissho Iwai Corp	Jap	87	CM88:478
PT Kaltim Prima Coal	Indo	50			BP Coal	UK	87	CM88:424
PT Kaltim Prima Coal	Indo	50			CRA L	Aus	87	CM88:424
PT Tambang Batubara	Indo				government	Indo	87	CM88:478
PV Mining Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Pyro Mining Co	USA	100	89		Costain Holdings L	UK	89	ICL8917:2
Pyro Mining Co	USA	50?			Costain Holdings L	UK	85	KCIM86:678
Pyro Mining Co	USA	50?			Pyro Energy Corp	USA	85	KCIM86:678
Pyro-Alcoa Coal Co	USA	100			Pyro Energy Corp	USA	85	KCIM86:678
Quarto Mining Co	USA	100			North American Coal Corp	USA	84	KCIM85:9
Queensland Allied Industries	Aus	5	88		Nissho Iwai Corp	Jap	88	ICR208:15
Queensland Allied Industries	Aus	5	88		Ube Industries	Jap	88	ICR208:15
Quinsam Coal L	Can	50	81		Brinco Mining L		86	CM87:473
Quinsam Coal L	Can	0	81		Luscar L	Can	86	CM87:473
Quinsam Coal L	Can	50	7?		Luscar L	Can	86	CM87:473
Quinsam Coal L	Can	50	7?		Weldwood of Can L	Can	86	CM87:473
Quintette Coal L	Can	0	76	C22.5	Alco Standard Corp	USA	76	CM76:222
Quintette Coal L	Can	37	7?		Alco Standard Corp	USA	76	CM76:222
Quintette Coal L	Can	12	81		Charbonnages de France	Fr	87	CM88:278,455
Quintette Coal L	Can	10	7?		Charbonnages de France	Fr	87	ICR13:10
Quintette Coal L	Can	38	76		Denison Mines L	Can	81	ICR13/10;CM76:2
Quintette Coal L	Can	50	81		Denison Mines L	Can	87	CM88:278,455
Quintette Coal L	Can	17	7?		Esso Resources Canada	Can	81	ICR13:10
Quintette Coal L	Can	0	81		Esso Resources Canada	Can	81	ICR13:10
Quintette Coal L	Can	0	81		Godo Steel	Jap	87	CM88:278,455
Quintette Coal L	Can	2	81		Kawasaki Steel Corp	Jap	87	CM88:278,455
Quintette Coal L	Can	1	81		Kobe Steel L	Jap	87	CM88:278,455
Quintette Coal L	Can	0	81		Mitsubishi Chemical Ind L	Jap	87	CM88:278,455
Quintette Coal L	Can	31	76	C11.2	Mitsui Mining Overseas Dev Co	Jap	76	CM76:222

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Quintette Coal L	Can	18	7?		Mitsui Mining Overseas Dev Co	Jap	87	ICR13:10
Quintette Coal L	Can	13	81		Mitsui Mining Overseas Dev Co	Jap	87	CM88:278,455
Quintette Coal L	Can	13	7?		Mitsui Mining Overseas Dev Co	Jap	75	CM76:222
Quintette Coal L	Can	21	7?		Mitsui Mining Overseas Dev Co	Jap	80	CM85:380
Quintette Coal L	Can	0	81		Nakayama Steel	Jap	87	CM88:278,455
Quintette Coal L	Can	2	81		Nippon Kokan KK	Jap	87	CM88:278,455
Quintette Coal L	Can	4	81		Nippon Steel Corp	Jap	87	CM88:278,455
Quintette Coal L	Can	0	81		Nisshin Steel Co L	Jap	87	CM88:278,455
Quintette Coal L	Can	5	81		Sumitomo Corp	Jap	87	CM88:278,455
Quintette Coal L	Can	1	81		Sumitomo Metal Industries L	Jap	87	CM88:278,455
Quintette Coal L	Can	13	7?		Tokyo Boeki L	Jap	75	CM76:222
Quintette Coal L	Can	21	7?		Tokyo Boeki L	Jap	80	CM85:380
Quintette Coal L	Can	11	81		Tokyo Boeki L	Jap	87	CM88:278,455
Quintette Coal L	Can	31	76	C11.2	Tokyo Boeki L	Jap	76	CM76:222
Quintette Coal L	Can	18	7?		Tokyo Boeki L	Jap	87	ICR13:10
Raab Karcher Ag	WGer	96			Veba Oil AG	WGer	89	SOMO89:12;Gas81
Race Fork Coal Corp	USA	100			Jno McCall Coal Co	USA	85	KCIM86:678
Race Fork Coal Corp	USA	0	89		Jno McCall Coal Co	USA	89	ICR235:6
Race Fork Coal Corp	USA	100	89		Mapco	USA	89	ICR235:6
Rand London Coal	SA	100			Rand London Corp		87	CM88:363
Ranger Fuel Corp	USA	100			Pittston Co	USA	84	KCIM85:9
Rawhide mine	USA	100			Exxon Coal USA Inc	USA	85	ICR122/12
Ray Coal Co	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Red Ash Sales Co	USA	100			Coalarbed Inc	USA	85	KCIM84:677
Republic Coal	USA	?	8?		Sohio Petroleum Co	USA		ICR41:10
Republic Steel Corp	USA	100			LTV Corp	USA	85	KCIM86:678
Rhondda Collieries PL	Aus	100	80	20	Endeavour Resources	Aus	80	ICR5:12
Rhondda Collieries PL	Aus	20	88		Showa Shell	Jap	88	ICR194:7
Rietspruit coal	SA	50			Rietspruit Opencast Serv PL	SA	87	CM88:456
Rietspruit coal	SA	50			Shell South Africa PL	SA	87	CM88:456
Rietspruit Opencast Serv PL	SA	100			Transvaal Consol Land & Exp	SA	87	CM88:456
Robinson Phillips Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Rockcastle Inc	USA	100			Ryan Inc	USA	85	KCIM86:679
Rocky Holly Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Rocky Mountain Energy	USA	100			Union Pacific Corp	USA	87	CWI810;KCIM86:6
Rose Branch Development Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Rosebud Coal Co	USA	100			Peter Kiewit Sons Mining	USA	84	KCIM85::11
Royal Dutch Shell	Neth/	60			Royal Dutch Petroleum Co	Neth	86	O&G86:310
Royal Dutch Shell	Neth/	40			Shell Transport & Trading Co	UK	86	O&G86:310
Ruhrkohle AG	WGer		7?		Harpener	WGer	87	Gor87:78
Ruhrkohle AG	WGer	8	85		Hoesch	WGer	87	Gor87:78
Ruhrkohle AG	WGer		7?		Hoesch	WGer	87	Gor87:78
Ruhrkohle AG	WGer		7?		Klockner	WGer	87	Gor87:78
Ruhrkohle AG	WGer		7?		Krupp	WGer	87	Gor87:78
Ruhrkohle AG	WGer		7?		Mannesmann	WGer	87	Gor87:78
Ruhrkohle AG	WGer	8	85		Sidechar	WGer	87	Gor87:78
Ruhrkohle AG	WGer		7?		Sidechar	WGer	87	Gor87:78
Ruhrkohle AG	WGer	13	85		Thyssen	WGer	87	Gor87:78
Ruhrkohle AG	WGer		7?		Thyssen	WGer	87	Gor87:78
Ruhrkohle AG	WGer	39	85		VEBA	WGer	87	Gor87:78
Ruhrkohle AG	WGer	37	8?		VEBA	WGer	89	SOMO89:12
Ruhrkohle AG	WGer		7?		VEBA	WGer	87	Gor87:78

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Ruhrkohle AG	WGer		7?		Vereinigite Elektzk Westfalen	WGer	87	Gor87:78
Ruhrkohle AG	WGer	22	85		Vereinigite Elektzk Westfalen	WGer	87	Gor87:78
Ruhrkohle Australia	Aus	100			Ruhrkohle Trading Pacific PL		89	J98:212
Ruhrkohle Trading Pacific PL		100			Ruhrkohle Handel Intl GmbH	WGer	89	J98:212
Rushton Mining Co	USA	100			Pennsylvania Power & Light	USA	85	KCIM86:678
RW Miller & Co PL	Aus	33	72		Ampol Australia	Aus	72	Par86:11
RW Miller & Co PL	Aus	0	79		Ampol Australia	Aus	72	Par86:11
RW Miller & Co PL	Aus	33	78	A28	Arco Aust Coal L	Aus	84	CM88:193
RW Miller & Co PL	Aus	0	86		Arco Aust Coal L	Aus	84	CM88:193
RW Miller & Co PL	Aus	0	78		Bulkships	Aus	72	Par86:11
RW Miller & Co PL	Aus	33	72		Bulkships	Aus	72	Par86:11
RW Miller & Co PL	Aus	100	89		Coal & Allied Industries L	Aus	89	ICR222:19
RW Miller & Co PL	Aus	33	72		Howard Smith L	Aus	72	Par86:11
RW Miller & Co PL	Aus	67	79		Howard Smith L	Aus	84	CM88:193
RW Miller & Co PL	Aus	100	86		Howard Smith L	Aus	88	NSW89:180
RW Miller & Co PL	Aus	0	89		Howard Smith L	Aus	89	ICR222:19
R&F Coal Co	USA	100			Shell Mining Co	USA	84	KCIM85:11
Saarcar Coal Inc	USA	100			Ashland Oil Co	USA	85	KCIM86:677
Sabine Mining Co	USA	100			North American Coal Corp	USA	84	KCIM85:9
San Juan Coal Co	USA	100			Utah International Inc	USA	84	KCIM85:9
Sand Mountain Minerals	USA	100			Nerco Inc	USA	85	KCIM86:678
Saxonvale	Aus	100	8?		BHP Minerals PL	Aus	87	CM88:162
Saxonvale	Aus	100	88		Elders Resources NZFPL	Aus	88	ICR208:19
Saxonvale	Aus	100	87		Peko Wallsend L	Aus	87	K593:11
Scotts Branch Co	USA	41	82	10	Pickands Mather & Co	USA	82	ICR48:8
Scotts Branch Co	USA	20	7?		Pickands Mather & Co	USA	82	ICR48:8
Scotts Branch mine	USA	59	82		Holland Carbon Fuels	USA	82	ICR 48:8
Sequatchie Valley Coal Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Sevmin Coal Mining PL	SA	100			Kangra Coal Corp	SA	87	ENI87
Sewell Coal Co	USA	100			Pittston Co	USA	84	KCIM85:9
Shamrock Coal Co	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Shannon Coal Co	USA	100			Gulf Resources & Chemical Co	USA	85	KCIM86:678
Shannon Pocahontas Mining Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Shaunessy Coal	Can	80	81		Fording Coal L	Can	86	CM87:475
Shaunessy Coal	Can	20	81		Idemitsu Intl Res Can	Can	86	CM87:475
Shell Australia	Aus	100			Royal Dutch Shell	Neth/	86	O&G86:310
Shell Canada	Can	79			Royal Dutch Shell	Neth/	86	O&G86:310
Shell Canada Resources	Can	100			Shell Canada	Can	86	O&G86:310
Shell Coal International L	UK	100			Royal Dutch Shell	Neth/	86	O&G86:310
Shell South Africa	SA	100			Royal Dutch Shell	Neth/	87	CM88:422
Showa Shell	Jap	50	85		Royal Dutch Shell	Neth/	88	ICR218:8
Showmass Coal Co	USA	100			Western Associated Coal Corp	USA	85	KCIM86:679
Shrewsbury Coal Co	USA	100			Valley Camp Coal Co	USA	85	KCIM86:679
Sierra Coal	USA	100			Utah Development	USA	85	ICR135:14
Simron Fuel Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Smith J. Coal	USA	100			Costain	UK	89	ICL8917:2
Smoky River Holdings L	Can	100			McIntyre Coal Mines L	Can	76	CM76:213
Smoky River mine	Can	100			Smoky River Holdings L	Can	87	CM88:286,295
Sojuzpromexport	USSR	100			government	USSR	87	CM88:338
Soldier Creek Coal Co	USA	100			California Portland Cement	USA	85	KCIM86:677
South Blackwater	Aus	50	88		John Holland Holdings	Aus	88	ICR228:7
South Blackwater	Aus	0	89	A15	John Holland Holdings	Aus	89	ICR228:7

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South Blackwater	Aus	51	89		Pennant Holdings L	Aus	89	ICR228:7
South Blackwater	Aus	50	88		Pennant Holdings L	Aus	88	ICR228:7
South Blackwater	Aus	49	89	A15	R Balcock	Aus	89	ICR228:7
South Blackwater	Aus	0	88		Thiess Bros PL	Aus	88	ICR228:7
South Blackwater	Aus	100	84		Thiess Bros PL	Aus	84	CM85:200
South Ohio Coal Co	USA	100			Central Ohio Coal Co	USA	84	KCIM85:10
South Utah Fuel Co	USA	100	84		Coastal States Energy Co	USA	85	KCIM86:677
South Witbank Coal Mines	SA	100			Johannesburg Consol Inv CoL	SA	87	CM88:362
South Atlantic Coal	USA	100	89		Mapco	USA	89	ICR235:6
South Atlantic Coal	USA	0	89		McCall, Jno	USA	89	ICR235:6
South Atlantic Coal	USA	100			McCall, Jno	USA	89	ICR235:6
Southland Coal	Aus	100			Devec L	Aus	88	NSW89:188
Southland Coal PL	Aus	100			Southland Mining L	Aus	86	NSW86:218
Sovereign Coal Corp	USA	100			Inspiration Coal Inc	USA	84	KCIM85:14;ICR21
Spaque Coal	USA	100			General Coal		83	AFR830216
Spitzkop Colliery PL	SA	100			Kangra Coal Corp	SA	87	ENI87
Spring Creek Coal Co	USA	100			Nerco Inc	USA	84	KCIM85:9
Spring Ridge Coal Co	USA	100			Jno McCall Coal Co	USA	85	KCIM86:678
Spur Coal Co Inc ,James	USA	100			Mountain Inc	USA	85	KCIM86:678
Scheepvaart Steenkolen Maatsch	Neth	100			Steenkolen Handels Verenining	Neth	80	SSM87:9
Stahlman Coal Co	USA	100			Gulf Resources & Chemical Co	USA	85	KCIM86:678
Standard Oil	USA	100	87		British Petroleum	UK/Ne	88	CWI880525
Standard Oil	USA	55	8?		British Petroleum	UK/Ne	87	BP88:2
Stansbury Coal Co	USA	100			Union Pacific Corp	USA	85	KCIM86:679
Stansbury & Co Inc	USA	100			Transco Coal Services Co	USA	85	KCIM86:679
Steenkolen Utrecht BV	Neth				Ruhrkohle AG	WGer	89	SOMO89:9
Steenkolen Utrecht BV	Neth				Shell - Netherlands	Neth	89	SOMO89:9
Steenkolen Utrecht BV	Neth				Shell - West Germany	WGer	89	SOMO89:9
Steenkolen Utrecht BV	Neth				SHV Holding	Neth	89	SOMO89:9
Steenkolen Utrecht BV	Neth				Thyssen AG	WGer	89	SOMO89:9
Sterling Smokeless Coal Co	USA	100			Eastern Associated Coal Corp	USA	84	KCIM85:10
Stinnes AG	WGer	99			Veba AG	WGer	89	SOMO89:12;Gas81
Stott Coal Co	USA	100			Marmon Grove	USA	85	KCIM86:678
Straight Creek Mining Co	USA	100			Cyprus Coal Co	USA	84	KCIM85:11
St.Joe Minerals Corp	USA	100	84		Fluor Corp	USA	84	BIE84:344
Sukunka lease	Can	100			BP Canada	Can	89	ICR226:14
Sumitomo Metal Can L	Can	100			Sumitomo Metal Industries L	Jap	87	CM88:277
Sun Coal Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Sunedco Coal Co	USA	100			Sun Co	USA	85	KCIM86:679
Sunland Mining Corp	USA	100			Pyro Energy Corp	USA	85	KCIM86:678
Surrey Properties PL	Aus	59			WH.Soul Patterson & Co L	Aus	84	BIE84:389
Tanoma Coal	USA	100	85		Alco Standard Inc	USA	85	KCIM86:677
Tanoma Coal	USA	100	88		American Metals & Coal Inc	USA	88	CWI918
Tanoma Coal	USA	0	88		Pohang Iron & Steel Co	S.Kor	88	CWI918
Tanoma Coal	USA	100	85?		Pohang Iron & Steel Co	S.Kor	88	CWI918
Tarong Coal	Aus	100			Pacific Coal PL	Aus	85	QCB85:69
Tavistock Collieries	SA	100			Johannesburg Consol Inv CoL	SA	87	CM88:362
Taywood Coal, WV	USA	100	84		Taylor Woodrow Group	USA	84	KCIM85:41
Teck Corp	Can	51			Copper Fields Mining Corp	Can	87	CM88:305
Teck Corp	Can	20	7?		Metallgesellschaft Canada	Can	87	CM88:305
Teck Corp	Can	18	84	4	Metallgesellschaft Canada	Can	87	CM88:305
Teck Corp	Can	2	84	4	MIM Holdings L	Aus	87	CM88:305

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Teck-Bullmoose Coal Inc	Can	100			Teck Corp	Can	87	CM88:456
Theodore jv	Aus	40	80		Shell Australia L	Aus	80	Par86:11
Thiess Bros PL	Aus	100			Thiess Holdings L	Aus	84	BIE84:390
Thiess Dampier Mitsui Coal PL	Aus	58	77	100	Dampier Coal (Qld) PL	Aus	87	CM76:169;CM88:2
Thiess Dampier Mitsui Coal PL	Aus	80	85	A140	Dampier Coal (Qld) PL	Aus	87	CM88:245,444
Thiess Dampier Mitsui Coal PL	Aus	13	81		Mitsui & Co L	Jap	87	CM88:444
Thiess Dampier Mitsui Coal PL	Aus	20	65		Mitsui & Co L	Jap	87	CM76:169;CM88:2
Thiess Dampier Mitsui Coal PL	Aus	7	81		Mitsui & Co (Aust) L	Aus	87	CM88:444
Thiess Dampier Mitsui Coal PL	Aus	22	66		Thiess Holdings L	Aus	84	CM76:169;CM88:2
Thiess Dampier Mitsui Coal PL	Aus	0	85	A140	Thiess Holdings L	Aus	87	CM88:245,444
Thiess Holdings	Aus	100	79		CSR L	Aus	87	CM88:440
Thiess Holdings	Aus	0	77		MIM Holdings	Aus	77	Fox81:74
Thiess Holdings	Aus	17	7?		MIM Holdings	Aus	77	Fox81:74
Thiess Holdings	Aus	17	77		Shell Australia L	Aus	77	Par86:11
Thiess Holdings	Aus	0	79		Shell Australia L	Aus	79	Par86:11
Thiess Peabody Mitsui PL	Aus	20	65		Mitsui & Co L	Jap	75	CM76:157;McK76:
Thiess Peabody Mitsui PL	Aus	58	65		Peabody Coal Co	USA	75	CM76:157;McK76:
Thiess Peabody Mitsui PL	Aus	0	76	A90	Peabody Coal Co	USA	75	CM76:157
Thiess Peabody Mitsui PL	Aus	22	65		Thiess Holdings L	Aus	75	CM76:157:McK76:
Thunder Basin Coal Co	USA	100			Anaconda Minerals Co	USA	84	KCIM85:9
Thunder Basin Coal Co	USA	100			Arco Coal Co	USA	85	KCIM86:677
Total Exploration SA	SA	100			Compagnie Francais Petroles	Fr		CM88:423
Trace Fork Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Trail Mountain Coal Co	USA	100			Diamond Shamrock	USA	84	KCIM85:11
Trans Natal Corp	SA				General Mining Union Corp	SA	87	CM88:362
Trans Natal Corp L	SA	100			General Mining Union Corp	SA	87	CM88:458
Transvaal Consol Land & Expl C	SA	100			Rand Mines L	SA	87	CM88:362
Triton Coal Co	USA	100			Shell Mining Co	USA	84	KCIM85:11
Tug River Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Tunnelton Mining Co	USA	100			Pennsylvania Power & Light	USA	85	KCIM86:678
Turris Coal Co	USA	100			Shell Mining Co	USA	84	KCIM85:11
Tuscaloosa Energy Corp	USA	100			LTV Corp	USA	85	KCIM86:678
Ube Industries	Jap	0.4=2m	79		Howard Smith L	Aus	87	CM88:426;CM85:4
Ulan Coal Mines L	Aus	36	89		Exxon	USA	89	ICR217:3
Ulan Coal Mines L	Aus		76	0	HC Sleigh L	Aus	76	CM76:145
Ulan Coal Mines L	Aus	9	76	0	Mitsubishi Development PL	Aus	80	ICR5:12;CM76:14
Ulan Coal Mines L	Aus	15	80		Mitsubishi Development PL	Aus	80	ICR5:12
Ulan Coal Mines L	Aus	49	8?		Mitsubishi Development PL	Aus	86	NSW86:220
Ulan Coal Mines L	Aus	15			State Superannuation Board	Aus	86	NSW86:220
Ulan Coal Mines L	Aus	0	89		White Industries PL	Aus	89	ICR217:3
Ulan Coal Mines L	Aus	36			White Industries PL	Aus	86	NSW86:220;NSW89
Union Oil Co of Canada	Can	87	7?		Union Oil	USA	80	ICR15:12
United Collieries L	Aus	25	8?		Agip Australia PL	Aus	86	NSW86:196
United Collieries L	Aus	30	88		Agip Australia PL	Aus	88	NSW89:190
United Collieries L	Aus	57	89		Agip Australia PL	Aus	89	ICR222:7
United Collieries L	Aus	50			Aust Coal & Shale Empl Fed	Aus	86	NSW86:220
United Collieries L	Aus	5	89		Aust Coal & Shale Empl Fed	Aus	89	ICR222:7
United Collieries L	Aus	38	89		Exxon	USA	89	ICR222:7
United Collieries L	Aus	0			Wambo Mining Corp PL	Aus	88	NSW89:190
United Collieries L	Aus	25			Wambo Mining Corp PL	Aus	86	NSW86:220
United Collieries L	Aus	20			White Industries PL	Aus	88	NSW89:190
United Collieries L	Aus	38	89		White Industries PL	Aus	89	ICR222:7

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United Collieries L	Aus	0	89		White Industries PL	Aus	89	ICR222:7
United States Fuel Co	USA	100			Sharon Steel Corp	USA	85	KCIM86:679
United States Steel Mining Co	USA	100			United States Steel Corp	USA	85	KCIM86:679
Upshur Coals Inc	USA	100	84		Alco Standard Inc	USA	85	KCIM86:677
Usutu Collieries	SA	100			General Mining Union Corp	SA	87	CM88:362
Utah Development Co	Aus	100	6?		Utah International Inc	USA	75	CM76:159
Utah Development Co	Aus	89	7?		Utah International Inc	USA	76	CM76:162;McK76:
Utah Development Co	Aus	11	?		Utah Mining Australia L	Aus	76	CM76:162;McK76:
Utah Fuel Co	USA	100	84		Coastal States Energy Co	USA	85	KCIM86:677
Utah International Inc	USA	100	84		BHP Co PL	Aus	84	KCIM85:41
Valley Camp Coal Co	USA	100			Quaker State Oil Refining	USA	85	KCIM86:678
Valley Camp of Utah Inc	USA	100			Quaker State Oil Refining	USA	85	KCIM86:678
Veba AG	WGer	30			government	WGer	89	SOMO89:12
Veba Energy & Petrochemical		100			Deutsche BP	WGer	82	CWI101:7
Veba International	USA	50			Anker	Neth	81	ICR
Veba International	USA	50	81	35	Hamburgische Elektr	W.Ger	85	ICR136:13
Veba Oil Ag	WGer	100			Veba AG	WGer	89	SOMO89:12
Vickery Coal	Aus	100	87		Coal Cliff Collieries PL	Aus	87	CM88:233
Vickery Coal	Aus	80	?		Coal Cliff Collieries PL	Aus	87	CM88:233
Vickery Coal	Aus	20	?		Vickery Coal PL	Aus	87	CM88:233
Victoria Coal Co	USA	100			Utah International Inc	USA	84	KCIM85:9
Virginia Crews Coal Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Virginia Iron,Coal & Coke Co	USA	100			ANR Coal Co	USA	87	CM88:120
Virginia Mining Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Volkswagen AG/Preag OHG	WGer	95			Preussen-Elektra AG	WGer	89	SOMO89:12
VP-5 Mining	USA	100			Occidental Petroleum Corp	USA	85	KCIM86:678
Wallamaine Joint Venture	Aus	38	89		Elders Resources NZFPL	Aus	89	ICR217:13
Wallamaine Joint Venture	Aus	25			Marubeni Corp	Jap	86	NSW86:221
Wallamaine Joint Venture	Aus	0	89		Peko Wallsend L	Aus	89	ICR217:13
Wallamaine Joint Venture	Aus	38			Peko Wallsend L	Aus	86	NSW86:221
Wallamaine Joint Venture	Aus	38			Wallamaine L	Aus	86	NSW86:221
Wallerawang Collieries L	Aus	80			Coalex PL	Aus	86	NSW86:221
Wallerawang Collieries L	Aus	5	79		Sumitomo Corp	Jap	86	NSW86:221
Wallerawang Collieries L	Aus	15	79		Sumitomo Metal Industries L	Jap	86	NSW86:221
Walnut Coal Co Inc	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Wambo Mining Corp PL	Aus	5	7?		Austen & Butta L	Aus	76	CM76:152
Wambo Mining Corp PL	Aus	0	77		Austen & Butta L	Aus	81	ICR13:6
Wambo Mining Corp PL	Aus	0	77		Bendors	Aus	81	ICR13:6
Wambo Mining Corp PL	Aus	10	7?		Bendors	Aus	76	CM76:152
Wambo Mining Corp PL	Aus	35	7?		Challenger Mining	Aus	76	CM76:152
Wambo Mining Corp PL	Aus	0	77		Challenger Mining	Aus	81	ICR13:6
Wambo Mining Corp PL	Aus	25	77		Charbonnages de France Intnl	Fr	81	ICR13:6
Wambo Mining Corp PL	Aus	41	82		Charbonnages de France Intnl	Fr	86	NSW86:221
Wambo Mining Corp PL	Aus	17	88		Charbonnages de France Intnl	Fr	88	NSW89:173
Wambo Mining Corp PL	Aus	50	82		Govt Insurance Office NSW	Aus	86	NSW86:221
Wambo Mining Corp PL	Aus	17	88		Govt Insurance Office NSW	Aus	88	NSW89;190
Wambo Mining Corp PL	Aus	50	7?		Hartogen Mining & Investment	Aus	81	CM88:231
Wambo Mining Corp PL	Aus	0	82		Hartogen Mining & Investment	Aus	84	CM88:231
Wambo Mining Corp PL	Aus	25	77		Imetal	Fr	81	ICR13:6
Wambo Mining Corp PL	Aus	0	88		Societe Miniere&Met Penanoya	Fr	88	NSW89:190
Wambo Mining Corp PL	Aus	9	82		Societe Miniere&Met Penanoya	Fr	87	CM88:231
Wambo Mining Corp PL	Aus	50	88		Sumitomo Coal Mining	Jap	88	ICR207:6

company name	country	equity	year	$m	parent company name	country	year	source
Wambo Mining Corp PL	Aus	17	88		Total Holdings (Aust) PL	Aus	88	NSW89:190
Warkworth Coal Sales L	Aus	100			Warkworth Mining L	Aus	86	NSW86:221
Warkworth Mining L	Aus	10	76		Australian Resources Dev Bank	Aus	76	CM76:134
Warkworth Mining L	Aus	30	76		Costain Australia PL	Aus	76	CM76:134
Warkworth Mining L	Aus	25	7?		Costain Australia PL	Aus	86	NSW86:221;CM88:
Warkworth Mining L	Aus	45	76		HC Sleigh Res L	Aus	76	CM76:134
Warkworth Mining L	Aus	15	7?		HC Sleigh Res L	Aus	86	NSW86:221;CM88:
Warkworth Mining L	Aus	19	7?		Mitsubishi Development PL	Aus	86	NSW86:221;CM88:
Warkworth Mining L	Aus	15	76		Mitsubishi Development PL	Aus	76	CM76:134
Warkworth Mining L	Aus	6	7?		Mitsubishi Mining & Cement,Aus	Aus	86	NSW86:221;CM88:
Warkworth Mining L	Aus	20	7?		T&G Mutual Life Society Ltd	Aus	86	NSW86:221;CM88:
Warkworth Mining L	Aus	15	7?		Wales Resource Fund	Aus	86	NSW86:221;CM88:
Welco Mining Co	USA	100			Island Creek Coal Co	USA	85	KCIM86:678
Welge Dacht Expl CoL	SA	100			Rand Mines L	SA	87	CM88:362
West Elk Coal Co	USA	100			Anaconda Minerals Co	USA	84	KCIM85:9
West Elk Coal Co	USA	100			Arco Coal Co	USA	85	KCIM86:677
West Wallsend	Aus	100	88		BHP Co PL	Aus	89	ICR217:13
West Wallsend	Aus	100	7?		Coal & Allied Industries L	Aus	89	ICR217:13
West Wallsend	Aus	0	88		Coal & Allied Industries L	Aus	89	ICR217:13
West Wallsend	Aus	100	89		Macquarrie Collieries	Aus	89	ICR217:13
Westar Mining Intl L	Can	100			Westar Mining L	Can	87	CM88:296
Westar Mining L	Can	67	80	600	BC Resources	Can	87	CM88:296
Westar Mining L	Can	0	80		Godo Steel	Jap	87	CM88:296
Westar Mining L	Can	0	80	600	Kaiser Steel	USA	87	CM88:296
Westar Mining L	Can	2	80		Kawasaki Steel Corp	Jap	87	CM88:296
Westar Mining L	Can	1	80		Kobe Steel L	Jap	87	CM88:296
Westar Mining L	Can	1	80		Mitsubishi Chemical Ind L	Jap	87	CM88:296
Westar Mining L	Can	13	80		Mitsubishi Corp	Jap	87	CM88:296
Westar Mining L	Can	6	80		Nippon Kokan KK	Jap	87	CM88:296
Westar Mining L	Can	6	80		Nippon Steel Corp	Jap	87	CM88:296
Westar Mining L	Can	1	80		Nisshin Steel Co L	Jap	87	CM88:296
Westar Mining L	Can	4	80		Sumitomo Metal Industries L	Jap	87	CM88:296
Westar Mining L	Can	0	80		Toho Gas	Jap	87	CM88:296
Westar Mining L	Can	30	89	C150	Whitman Heffernan Rhein & Co	USA	89	CWI1032:1
Western Associated Coal Corp	USA	100			Eastern Associated Coal Corp	USA	85	KCIM86:679
Western Collieries	Aus	100	7?		CSR	Aus	89	CWI1026:3
Western Collieries	Aus	0	89	A130	CSR	Aus	89	CWI1026:3
Western Collieries	Aus	100	89	A130	Rothwells L	Aus	89	CWI1026:3
Western Collieries	Aus	0	89	A130	Rothwells L	Aus	89	CWI1026:3
Western Collieries	Aus	100	89	A130	Wesfarmers	Aus	89	CWI1026:3
Western Plains Mining Co	USA	100			North American Coal Corp	USA	85	KCIM86:678
Westfalen Colliery PL	Aus	0	87	p3.2	Bundaberg Sugar Co L	Aus	88	ICR194:7
Westfalen Colliery PL	Aus	100	8?		Bundaberg Sugar Co L	Aus	84	BIE84:397
Westfalen Colliery PL	Aus		87	p3.2	Endeavour Resources	Aus	88	ICR194:7
Westfalen Colliery PL	Aus		87	p3.2	Showa Shell	Jap	88	ICR194:7
Westmoreland Coal Sales	USA	100	84		Westmoreland Coal Co	USA	84	CM88:120
Westmoreland Resources	USA				Morrison-Knudsen Co	USA	85	KCIM86:679
Westmoreland Resources	USA				Penn Virginia Corp	USA	85	KCIM86:679
Westmoreland Resources	USA	25	87		VEBA	WGer	87	Gor87:79
Westmoreland Resources	USA	15	82	33	VEBA	WGer	82	ICR47:11
Westmoreland Resources	USA		84		Westmoreland Coal Co	USA	85	KCIM86:679
Wheelwright Mining Co	USA	100			Inspiration Coal Inc	USA	84	KCIM85:14

company name	country	equity	year	$m	parent company name	country	year	source
Whitaker Coal Co	USA	100			Elk River Resources Inc	USA	85	KCIM86:677
Windsor Power House Coal Co	USA	100			Central Ohio Coal Co	USA	84	KCIM85:10
Winston Coal Co	USA	100			Robinson-Phillips Coal Co	USA	85	KCIM86:679
Wishbone Alaska	USA	50	87		Idemitsu Kosan	Jap	88	CWI924:1
Wishbone Alaska	USA	50			Rocky Mountain Energy	USA	88	CWI924:1
Witbank Colliery	SA	100			Rand Mines	SA	89	ICR228:1
Witbank Colliery L	SA	100			Rand Mines L	SA	87	CM88:362
Wolf Creek Collieries Co	USA	100	85		Fluor Corp	USA	85	KCIM86:678
Wolverine Coal Co	USA	100			Industrial Fuels Corp	USA	85	KCIM86:678
Yarabee mine	Aus	100			Thiess Bros PL	Aus	85	QCB85:70
York Canyon	USA	100	7?		Kaiser Coal Corp	USA	89	KNB7.1:6
York Canyon	USA	0	89	24	Kaiser Coal Corp	USA	89	KNB7.1:6
York Canyon	USA	100	89	24	Pittsburg & Midway Mining	USA	89	KNB7.1:6

note: A = Australian dollars, C = Canadian dollars, p = investment is part of total shown

sources:

ACR = Australian Coal Report.
AFR830216 = Australian Financial Review. 16 Feb 1983.
AZ69:28 = The Australian's A to Z of Mining and Oil Companies. 1969. p28.
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DIC82:309 = Dept of Industry & Commerce, Aust. 1982. Major Manufacturing and Mining Projects. p309.
Gas81 = Gaskin, Max. 1981. Market Aspects of an Expansion of Int Steam Coal Trade.
Gor87:87 = Gordon. 1987. World Coal: economics, policies and prospects. p87.
ICL8917:2 = International Coal Letter. 1989. Number 17. p2.
ICR47:11 = International Coal Report. issue 47. p11.
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K590:3 = King's International Coal Trade. issue 590. p3.
KCIM85:11 = Keystone Coal Industry Manual. 1985. US Coal Production by Company. p11.
KCIM86:678 = Keystone Coal Industry Manual. 1986. p678.
KNB7.1:6 = Keystone News Bulletin. vol.7 no.1 p6.
McK76:218 = McKern. 1976. Multinational Enterprise & Natural Resources. p218.
NSW89:190 = New South Wales, Dept of Minerals and Energy. Coal Industry Profile 1989. p190.
O&G86:64 = Oil and Gas Yearbook 1986. p64.
Par86:11 = Parker. 1986. Rural to resource town. p11.
QCB85:70 = Queensland Coal Board. 1985. Annual Report. p70.
Rich83:74 = Richmond and Sharma. 1983. Mining and Australia. p74.
SSM89:12 = SSM Coal. 1987. Coal from anywhere to everywhere. Rotterdam. Neth.
SOMO89:12 = SOMO. 1989b. Biljagen De keten gebroken. p12.

Appendix D: International coal trade survey

Officials in the following companies provided partial or complete data for the international coal trade survey. These data are not the official policies of the associated companies, but are valued as the opinions of prominent individuals active in the trade.

Agip Carbonne, Milan
Anker Coal, Rotterdam
Association Technique de l'Importation Charboniere (ATIC)
BP Coal, London
Caralec, Madrid
Carboex, Spain
Cembureau, Brussels
Ente Nazionale per l'Energia Electrica (ENEL), Rome
Electricite de France (EdF), Paris
Elkraft, Copenhagen
Elsam, Fredericia
Exxon Coal, Netherlands
Gemeenschappelijk Kolenbureau
    Elecktricieitsproduktiebedrijven (GKE), Utrecht
Idemitsu Kosan, Tokyo
Japan Coal Development Corporation, Tokyo
Japan Pulp and Paper Association members
Mitsubishi Corp, Tokyo
Mitsubishi Mining and Cement, Tokyo
Mitsui Mining, Tokyo
Nippon Kokan, Tokyo
Nippon Steel, Tokyo
Polkohle, Hamburg
Pool des Calories, Brussels
Scheepvaart en Steenkolen Maatschappij bv (SSM), Rotterdam
Showa Shell Sekiyu, Tokyo
Stinnes AG, Mulheim
Tokyo Electric Power Corporation, Tokyo

A copy of the covering letter and questionnaire is attached, followed by the results of the survey. The questionnaire was translated into French, Italian and Japanese for use in those countries. Copies of the translations are available from the author.

INTERNATIONAL COAL TRADE IN EUROPE AND ASIA

Different import strategies (direct investment, long term contracts, loans, import policies, etc.) have been used by consumers to secure a stable and/or low cost supply of coal. This questionnaire forms part of a research project to evaluate the effectiveness of these arrangements by comparing the international coal trade in Europe and Asia. The results will be used to construct better coal trade models for use by consumers, suppliers, traders and researchers. To facilitate this research, please complete the attached questionnaire. Your responses will be treated in confidence as only aggregate responses will be reported in the research findings.

The project is being undertaken by Paul Parker at the London School of Economics, UK. Financial and/or advisory support has been provided by the Institute for Energy Economics, Japan; the National Institute for Environmental Studies, Japan; the Australia-Japan Research Centre, Australia; the Social Science and Humanitites Research Council of Canada and the London School of Economics, University of London.

Coal Trade Questionnaire

Please assist this study by answering the following questions:

1a. Has your company invested in any international coal projects?

(please circle) Yes No

If yes, could you please give the name(s) of the project(s), location(s), date(s) of investment, share(s) of equity and quantity of coal imported from the project(s)?

project name	location	date	equity %	imports (000mt) 80	85	87
A______________	_________	____	_____	____	____	____
B______________	_________	____	_____	____	____	____
C______________	_________	____	_____	____	____	____
D______________	_________	____	_____	____	____	____

1b. In your opinion, do you expect your company to invest in overseas coal projects by 1995? Yes No

If yes, what equity share do you expect your company to have? __%

2. What share of your company's coal imports were (will be) received under the following types of contracts in 1980, 1987 and 1995?

contract type	1980	1987	1995
	% of trade		
long term contracts (>5yr)	___	___	___
fixed volume & fixed or indexed price	___	___	___
fixed volume & renegotiated price	___	___	___
medium term contracts (2-5yr)	___	___	___
fixed volume & fixed or indexed price	___	___	___
fixed volume & renegotiated price	___	___	___
annual extension of old long term contracts	___	___	___
fixed volume & renegotiated price	___	___	___
renegotiated volume & renegotiated price	___	___	___
renewable annual contracts	___	___	___
fixed volume & renegotiated price	___	___	___
renegotiated volume & renegotiated price	___	___	___
new annual contracts (1yr)	___	___	___
spot contracts (<1yr)	___	___	___
total	100	100	100

3. In your opinion what was (will be) the relative importance of the following objectives in purchasing coal in 1980, 1987 and 1995? Please indicate by using the scale shown below.

1	2	3	4	5
very important	above average importance	average importance	below average importance	not important

	1980	1987	1995
	(indicate by number 1-5)		
least cost	____	____	____
diversity of supply	____	____	____
ability to add new suppliers	____	____	____
required domestic purchases	____	____	____
volume flexibility	____	____	____
price flexibility	____	____	____
desirable qualities (combined)	____	____	____
calorific value	____	____	____
total ash	____	____	____
total sulphur	____	____	____
total moisture	____	____	____
volatile matter	____	____	____
Crucible Swelling Number	____	____	____
fluidity	____	____	____
other __________	____	____	____
reliability of supply	____	____	____
likelihood of strikes	____	____	____
accurate port deliveries	____	____	____
other (please specify) ______	____	____	____
______	____	____	____

4a. In your opinion, what was (will be) the relative importance of the following characteristics in the selection of suppliers in 1980, 1987 and 1995? Please indicate by using the scale of numbers 1-5 as in question 3.

	1980	1987	1995
	(indicate by number 1-5)		
low cost mine	____	____	____
large mine: economies of scale	____	____	____
established supplier	____	____	____
proven reliability of company	____	____	____
proven coal quality control	____	____	____
low risk of strikes	____	____	____
high reliability of delivery	____	____	____
limit supplier marketshare	____	____	____

4b. Please indicate the preferred limit (max % of total imports) to the marketshare of any single:

	1980	1987	1995
	max % of total imports		
company	____	____	____
port/region	____	____	____
country	____	____	____

4c. Please indicate the preferred minimum number of suppliers.

	1980	1987	1995
	number		
companies	____	____	____
ports/regions	____	____	____
countries	____	____	____

4d. Please indicate the increase in price (% above average price) willing to be paid to establish a new supplier.

	1980	1987	1995
	% above average price		
company	____	____	____
port/region	____	____	____
country	____	____	____

5. In your opinion, what arrangements were (will be) most suitable to establish new coal supplies? Please use the scale:

1	2	3	4	5
very suitable	above average suitability	average suitability	below average suitability	not suitable

	1980	1987	1995
	(indicate by number 1-5)		
long term contract	____	____	____
joint venture	____	____	____
other ______	____	____	____
no special arrangements	____	____	____

6. In your opinion, how was (will) the shipping of coal imports (be) arranged?

	1980	1987	1995
	% of total imports		
by your company (total)	____	____	____
in directly owned vessels	____	____	____
in long term charters (>1yr)	____	____	____
in short term charters	____	____	____
in spot charters (1 voyage)	____	____	____
by the supplier	____	____	____
by the trader	____	____	____
by an independent shipper	____	____	____

7. In your opinion, what was (will be) the relative importance of other factors on coal purchases in 1980, 1987 and 1995?

1	2	3	4	5
very important	above average importance	average importance	below average importance	not important

	1980	1987	1995
	(indicate by number 1-5)		
loans from consumer to producer	____	____	____
bilateral investment agreement	____	____	____
(ie. capital/technology for coal)	____	____	____
bilateral trade relations (balance)	____	____	____
access to product markets	____	____	____
other ______________________	____	____	____

8. In your opinion, what quantity of coal is your company likely to import in 1990 and 1995?

	1990	1995
thousand tonnes (1000 mt)	____	____

Thank you for taking the time to fill out this questionnaire.

Please retain questionnaire for the interview with Paul Parker.

Paul Parker tel.(01) 405-7686 x2613
International Resources Programme
London School of Economics
S504 Houghton St.
London WC2A 2AE UK

Coal Trade Questionnaire

Answers by Japanese consumers and traders

1a. Has your company invested in any international coal projects?

Yes 75%   No 25%

If yes, could you please give the name(s) of the project(s), location(s), date(s) of investment, share(s) of equity and quantity of coal imported from the project(s)?

project name	location	date	equity %	imports (000mt) 80	85	87
A see Appendix C	______	____	_____	____	____	____
B______________	______	____	_____	____	____	____
C______________	______	____	_____	____	____	____
D______________	______	____	_____	____	____	____

1b. In your opinion, do you expect your company to invest in overseas coal projects by 1995?   Yes 65%   No 35%

If yes, what equity share do you expect your company to have?   10-75%

2. What share of your company's coal imports were (will be) received under the following types of contracts in 1995?

contract type	1995 % of trade					
	ss	JSM	min	EPC	oil	oth
long term contracts (>5yr)	35	25	10	65	10	15
fixed volume & fixed or indexed price		10	4			
fixed volume & renegotiated price		15	6		10	15
medium term contracts (2-5yr)	30	15	35	15	45	50
fixed volume & fixed or indexed price		15	10			
fixed volume & renegotiated price			25		45	50
annual extensions of old long term contracts		60	10		20	7
fixed volume & renegotiated price					3	7
renegotiated volume & renegotiated price		60	10		17	
renewable annual contracts	30		20	10	10	5
fixed volume & renegotiated price					5	2.5
renegotiated volume & renegotiated price					5	2.5
new annual contracts (1yr)			10	5	5	5
spot contracts (<1yr)	5		15	5	10	18

note: ss = sogo shosha, JSM = Japanese steel mills,
min = mining company, EPC = electric power company,
oil = oil company, oth = other steam coal consumer

3. In your opinion what was (will be) the relative importance of the following objectives in purchasing coal in 1980, 1987 and 1995? Please indicate by using the scale shown below.

1	2	3	4	5
very important	above average importance	average importance	below average importance	not important

	1980			1987			1995		
	ss	JSM	min	ss	JSM	min	ss	JSM	min
least cost	3	2	3.5	1	1	1.5	3	1	1.5
diversity of supply	3	1.5	2.5	4	2.5	2.5	1	2.5	2
ability to add new suppliers	3	1	2	4	4.5	3.5	1	3.5	3.5
required domestic purchases	2	3	2.5	4	4	4	5	5	5
volume flexibility	3	3.5	3.5	2	1	2.5	2	1	3
price flexibility	3	2.5	3.5	2	1	2.5	3	1	3
desirable qualities (comprehensive)	2	2	2.5	2	2	2	3	2	2
calorific value	3	4.5	2.5	3	4.5	2.5	3	4.5	2
total ash	3	1	2.5	3	1	2	2	1	2
total sulphur	3	1	2	4	1	2	4	1	2
total moisture	4	3.5	3	4	2.5	3	4	2.5	3
volatile matter	3	3	3	3	2.5	3	3	2.5	3
Crucible Swelling Number	5	2.5	3.5	5	3.5	3	5	3.5	3
fluidity	5	2.5	3	5	1.5	3	5	1.5	2.5
other __________	3	3	3	3	2	2.5	3	2	2.5
reliability of supply									
likelihood of strikes	1	1	3	3	2	3	1	4	3
accurate port deliveries	1	1	3	3	2	3	1	4	3
other (please specify) ______									

3. In your opinion what was (will be) the relative importance of the following objectives in purchasing coal in 1980, 1987 and 1995? Please indicate by using the scale shown below.

1	2	3	4	5
very important	above average importance	average importance	below average importance	not important

	1980			1987			1995		
	EPC	oil	oth	EPC	oil	oth	EPC	oil	oth
least cost	2	1.5	1	1	1	1	1.5	1.5	1
diversity of supply	2.5	3	3	2	3	2.5	1.5	2.5	2
ability to add new suppliers	3	2.5	3	3	2.5	3.5	3	2	3.5
required domestic purchases	2	3.5	5	2.5	3.5	5	4.5	5	5
volume flexibility	2	2	4	1.5	3	3	1.5	2.5	2.5
price flexibility	2	1.5	2	1.5	1.5	1.5	1.5	2	1.5
desirable qualities (comprehensive)	2	3	3	1.5	2.5	3	1.5	2	3
calorific value	3	2	4	2	2.5	3.5	2	2.5	3
total ash	3	3	3.5	2	3	3.5	2	3	3.5
total sulphur	3	1.5	3	3	1.5	3	3	2	3
total moisture	3	3	3	2	2.5	3	2	2.5	3
volatile matter	3	2	2	2	3	2	2	4	2
Crucible Swelling Number	5	4.5	5	5	4.5	5	5	3.5	5
fluidity	5	4.5	4	5	4.5	4	5	3.5	4
other ________	3			3			3		
reliability of supply									
likelihood of strikes	2	2	1	2	2	1	2	2	1
accurate port deliveries	2	2.5	1.5	2	1.5	1.5	2	1	1.5
other (please specify) _____	1			1			1		

7. In your opinion, what quantity of coal is your company likely to import in 1990 and 1995?

	ss	JSM	mining	EPC	oil	other
1990 (million tonnes)	4	13	3	2.2	4.5	1.4
1995	6	13	5	2.2	6.8	1.9

4a. In your opinion, what was (will be) the relative importance of the following characteristics in the selection of suppliers in 1980, 1987 and 1995? Please indicate by using the scale of numbers 1-5 as in question 3.

	1980			1987			1995		
	ss	JSM	min	ss	JSM	min	ss	JSM	min
low cost mine	3	1.5	3.5	3	1	1.5	2	1	2
large mine - economies of scale	4	2.5	4	4	4.5	3.5	3	4.5	3.5
established supplier	3	4.5	3.5	3	3.5	3	4	3.5	3
proven reliability of company	2	1.5	3	2	1	3	2	1	3
proven quality control for coal	3	2	3	3	2	2	4	2	2
low risk of strikes	2	1	3.5	3	1.5	3	2	1.5	3
high reliability of delivery dates	2	1.5	3.5	3	2	3	2	2	3
limit marketshare of suppliers	4	1.5	3.5	4	2.5	3	3	2.5	2.5

4b. Please indicate the preferred limit (max % of total imports) to the marketshare of any single:

	1980			1987			1995		
	max % of total imports								
company	10	10	15	15	10	10	10	10	10
port/region	55	10	25	45	10	20	20	10	20
country	70	45	40	60	45	40	45	45	40

4c. Please indicate the preferred minimum number of suppliers.

	1980			1987			1995		
	number								
companies	30	40	20	35	45	25	45	45	30
ports/regions	7	15	10	9	15	15	12	15	15
countries	5	6-7	5	7	6-7	5	9	6	5

4d. Please indicate the increase in price (% above average price) willing to be paid to establish a new supplier.

	1980			1987			1995		
	% above average price								
company	0	10	10	0	0	0	0	0	5
port/region	0	15	10	0	2	0	0	2	5
country	0	0	10	0	0	0	0	0	5

4a. In your opinion, what was (will be) the relative importance of the following characteristics in the selection of suppliers in 1980, 1987 and 1995? Please indicate by using the scale of numbers 1-5 as in question 3.

	1980			1987			1995		
	EPC	oil	oth	EPC	oil	oth	EPC	oil	oth
low cost mine	1.5	2	3	1.5	1	2.5	1	1.5	2
large mine - economies of scale	2.5	2	3.5	2.5	1.5	3.5	2.5	1	3.5
established supplier	3	2.5	3	2.5	2	3	2.5	2	4
proven reliability of company	2.5	2	2.5	2	1	2.5	2	1	2.5
proven quality control for coal	1.5	2	3	1.5	1.5	2.5	1.5	1.5	2.5
low risk of strikes	2.5	1.5	1.5	2.5	1.5	1	2.5	1.5	1
high reliability of delivery dates	2	1.5	2	2	1.5	2	2	1.5	2
limit marketshare of suppliers	3.5	3	3.5	2	2.5	3	1.5	1.5	2.5

4b. Please indicate the preferred limit (max % of total imports) to the marketshare of any single:

	1980			1987			1995		
	max % of total imports								
company	20	30	25	20	20	25	20	10	25
port/region	30	35	40	30	30	35	30	20	30
country	50	45	65	50	45	65	50	35	60

4c. Please indicate the preferred minimum number of suppliers.

	1980			1987			1995		
	number								
companies	4-10	4-10	5-6	4-10	4-10	5-6	4-10	30	5-6
ports/regions	7-8	4-5	4	7-8	4-5	4	7-8	20	4
countries	5-6	2-3	2-3	5-6	2-4	3-4	5-6	10	3-4

4d. Please indicate the increase in price (% above average price) willing to be paid to establish a new supplier.

	1980			1987			1995		
	% above average price								
company	10	10	20	10	2	10	10	0	10
port/region	10	7	10	10	2	5	10	0	5
country	10	7	0	10	2	0	10	0	0

5. In your opinion, what arrangements were (will be) most suitable to establish new coal supplies?

1	2	3	4	5
very suitable	above average suitability	average suitability	below average suitability	not suitable

	1980			1987			1995		
	ss	JSM	min	ss	JSM	min	ss	JSM	min
long term contract	2	1	3	4	3	3.5	2	3.5	3.5
joint venture	3	1.5	2.5	4	3.5	4	3	3.5	4
other ______									
	EPC	oil	oth	EPC	oil	oth	EPC	oil	oth
long term contract	1.5	2	2	1.5	1.5	2	1.5	2.5	2
joint venture	3	3	3.5	4	2.5	3.5	3.5	2.5	3.5
other ______									

6. In your opinion, what was (will be) the relative importance of other factors on coal purchases in 1980, 1987 and 1995?

1	2	3	4	5
very important	above average importance	average importance	below average importance	not important

	1980			1987			1995		
	ss	JSM	min	ss	JSM	min	ss	JSM	min
loans from consumer to producer	5	3	3	5	4	4.5	5	4.5	3.5
bilateral investment agreement	5	4	3.5	5	4.5	3.5	5	4.5	3.5
(ie. capital/technology for coal)	5	4.5	4	5	4.5	3	5	4.5	3
bilateral trade relations (balance)	5	4.5	4	4	4	3.5	5	4	3.5
access to product markets	5	4	3	4	5	2	5	5	2
political boycott	5	4	4.5	4	3	3.5	5	3	4
	EPC	oil	oth	EPC	oil	oth	EPC	oil	oth
loans from consumer to producer	4	5	3.5	4	4.5	3.5	4	4	3.5
bilateral investment agreement	5	4	2	5	3	2	5	3	2
(ie. capital/technology for coal)		4	2		3	2		2	2
bilateral trade relations (balance)	4	4	3	4	3.5	3	4	3	3
access to product markets	5	3.5	4	5	3.5	4	5	3	4
political boycott	4.5	4	2	4.5	3	2	4.5	3	2

Coal Trade Questionnaire

Answers by European consumers and traders

1a. Has your company invested in any international coal projects?

Yes 15% No 85%

If yes, could you please give the name(s) of the project(s), location(s), date(s) of investment, share(s) of equity and quantity of coal imported from the project(s)?

project name	location	date	equity %	imports (000mt) 80	85	87
A see Appendix C	____	____	____	____	____	____
B____	____	____	____	____	____	____
C____	____	____	____	____	____	____
D____	____	____	____	____	____	____

1b. In your opinion, do you expect your company to invest in overseas coal projects by 1995? Yes 0% No 100%

If yes, what equity share do you expect your company to have? __%

2. What share of your company's coal imports were (will be) received under the following types of contracts in 1980, 1987 and 1995?

contract type	1980			1987				1995			
	% of trade										
	utilities			utilities				utilities			
	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad
long term contracts (>5yr)	80		5	60	30			50	25		
fixed volume & fixed or indexed price			5								
fixed volume & renegotiated price	80			60	30			50	25		
medium term contracts (2-5yr)		2	10	15	20		10	20		5	
fixed volume & fixed or indexed price		2	3								
fixed volume & renegotiated price			7	15	20		10	20		5	
annual extensions of old long term contracts											
fixed volume & renegotiated price											
renegotiated volume & renegotiated price											
renewable annual contracts	20	20	70		10	15	70		20	30	80
fixed volume & renegotiated price											
renegotiated volume & renegotiated price	20	20	70		10	15	70		20	30	80
new annual contracts (1yr)		10	5		5	10	10	10	15	10	10
spot contracts (<1yr)		68	10	25	35	75	10	20	40	55	10

3. In your opinion what was (will be) the relative importance of the following objectives in purchasing coal in 1980, 1987 and 1995? Please indicate by using the scale shown below.

1	2	3	4	5
very important	above average importance	average importance	below average importance	not important

	1980			1987				1995			
	utilities			utilities				utilities			
	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad
least cost	2.5	1	1	1	1.5	1	1	2	1.5	1	1.5
diversity of supply	1.5	5	2.5	3	2	5	2.5	1.5	2	5	2.5
ability to add new suppliers	4.5	3	1	3.5	3.5	3	2	2.5	3.5	3	1
required domestic purchases	5	3	2		5	4	3			5	
volume flexibility	2.5	1	2	2	1	1	2	2	1	1	2
price flexibility	2	1	2	2	2	1	2	2	2	1	2
desirable qualities (comprehensive)				2	2			2	2		
calorific value	2			2	3		2	2	3		1
total ash	1.5		1	3	2.5		1	3	2		1
total sulphur	2.5		2	1	1		1.5	1	1		1
total moisture	2		3	2	3.5		2	2	3.5		2
volatile matter	3.5		3	3	3		1	3	3		1
Crucible Swelling Number	3		1	4.5	5		1	4.5	5		1
fluidity	5		1	4	5		1	4	5		1
other _________	5	4	2	2.5			1.5	2.5			
reliability of supply											
likelihood of strikes	2	4	2	2	2.5	4	2	2	2.5	4	2
accurate port deliveries	2	4	2	1	3	4	2	1	3	4	2
other (please specify) _____											

4a. In your opinion, what was (will be) the relative importance of the following characteristics in the selection of suppliers in 1980, 1987 and 1995? Please indicate by using the scale of numbers 1-5 as in question 3.

	1980			1987				1995			
	utilities			utilities				utilities			
	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad
low cost mine	4	5	1	1	3.5	5	1.5	1.5	3	5	1
large mine - economies of scale	4	3	2	3	3.5	3	2	3	3.5	3	2
established supplier	1.5	4	2	2.5	2	4	3	2.5	2	4	2
proven reliability of company	1.5	4	1	1.5	1.5	4	1	1.5	1.5	4	1
proven quality control for coal	1.5	3	2	1.5	2	4	2	1.5	2	4	2
low risk of strikes	3.5	1	3	2	3.5	1	2	2	3.5	1	2
high reliability of delivery dates	2.5	2	2	1.5	3	3	1	1.5	2.5	4	1
limit marketshare of suppliers	3.5	1	2	3	3.5	1	2	3	3.5	1	1

4b. Please indicate the preferred limit (max % of total imports) to the marketshare of any single:

	1980			1987				1995			
	max % of total imports										
company	15			30	10			15	10		
port/region	60			50	30			40	30		
country	60		30	50	40		25	40	40		25

4c. Please indicate the preferred minimum number of suppliers.

	1980			1987				1995			
	number										
companies	5			5-10	10			5-10	10		
ports/regions	6			3-5	6			5-10	6		
countries	4-7			3-5	4-8			3-7	4		

4d. Please indicate the increase in price (% above average price) willing to be paid to establish a new supplier.

	1980			1987				1995			
	% above average price										
company				0	-5		-5	0	-5		-5
port/region				7	-5		-5	7	-5		-5
country				7	-5		-5	7	-5		-5

5. In your opinion, what arrangements were (will be) most suitable to establish new coal supplies? Please use the scale:

1	2	3	4	5
very suitable	above average suitability	average suitability	below average suitability	not suitable

	1980			1987				1995			
	utilities			utilities				utilities			
	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad
long term contract	3			1	3			1.5	3		
joint venture	5				5			3	5		
other ______											
no special arrangements											

6. In your opinion, how was (will) the shipping of coal imports (be) arranged?

	1980			1987				1995			
				% of total imports							
	utilities			utilities				utilities			
	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad
by your company (total)	0	0	100	40	0	0	100	55	0	0	100
in directly owned vessels											
in long term charter vessels (>1yr)			25				5	10			5
in short term charter vessels			50				65	35			70
in spot charter vessels (1 voyage)			25	40			30	10			25
by the supplier	100	60		60	90	50		45	50	40	
by the trader		30				30				30	
by an independent shipping company		10			10	20			50	30	

7. In your opinion, what was (will be) the relative importance of other factors on coal purchases in 1980, 1987 and 1995?

1	2	3	4	5
very important	above average importance	average importance	below average importance	not important

	1980			1987				1995			
	utilities			utilities				utilities			
	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad
loans from consumer to producer	5		5	5	5		5	5	5		5
bilateral investment agreement	5			5	5			5	5		
(ie. capital/technology for coal)			4				3				2
bilateral trade relations (balance)	5			3.5	4		2	3	4.5		
access to product markets	5		1		4				3		2
other ____________________											

8. In your opinion, what quantity of coal is your company likely to import in 1990 and 1995?

	1990				1995			
	utilities				utilities			
	S.Eur	N.Eur	cem	trad	S.Eur	N.Eur	cem	trad
million tonnes	2	10	22	14	3	11	21	18

Thank you for taking the time to fill out this questionnaire.