LIBERALISATION AND REGULATION IN EUROPEAN NETWORK UTILITIES

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To my family

True as it is one cannot find the philosopher's stone, it should rightly be sought: in the process, some beautiful secrets are found, unlooked-for.

Fontenelle

ABSTRACT

This thesis considers different aspects of the liberalisation and simultaneous economic regulation of network utilities in the European Union. Two groups of arguments justify that regulation is maintained in these industries after the removal of barriers to competitive entry. The first group of arguments is linked to the natural monopoly characteristics displayed by such services. These imply that competition cannot be relied upon to restrain the dominant position of network operators. The second group of arguments relates to the social dimension, or public service nature, of utility services. The essential role played by these services justifies government intervention in form of price controls, universal service obligations and other qualitative regulations.

The thesis has two parts of different nature, each part comprising two chapters. In the first part, an introductory chapter describes the framework within which the economic regulation of network utilities is inscribed, and discusses key trade-offs between different regulatory policy objectives. The second chapter analyses how the regulatory framework for liberalised network industries developed in the UK compares to the framework in place in Germany. Germany has embarked on reform of its network utilities considerably later than the UK, and displays unique characteristics in its industry structures, in particular a strong federal element. The German case illustrates how the general economic principles underlying the liberalisation and regulation process are interpreted in the European environment, and are adapted to national characteristics.

The second part of the thesis focuses on specific aspects of liberalisation and regulation using econometric techniques. In chapter 3, access price elasticities in the

fixed telephony industry are estimated on the basis of a pseudo-panel. The main question addressed is whether the rebalancing of tariffs that has taken place in the wake of liberalisation has had the potential to deteriorate household access to the fixed telephone network. The last and fourth chapter looks at patterns and determinants of supplier switching in the domestic gas and electricity markets in Great Britain using data from a true household panel. Its main conclusion is that the likelihood of supplier switching is influenced more strongly by variables linked to cost savings than by socio-demographic factors such as income.

CONTENTS

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GENERAL INTRODUCTION

The liberalisation of network utilities in the UK began almost 20 years ago, with the corporatisation and privatisation of British Telecom (BT) at the beginning of the 1980s. Parallel to the government's withdrawal from running the fixed telephony business, a system of regulatory controls was conceived to ensure that the anticipated benefits of liberalisation would indeed translate into greater consumer welfare[1]. After the telecommunications industry, other UK network utilities including gas and electricity, public transport and water went down the same road of liberalisation and parallel regulation.

The regulatory reform initiated in the UK in the 1980s has led to a fundamental change in regulatory theory and practice through the implementation of three key ideas—the introduction of competition in formerly monopolistic service supply; the use of incentive price-cap regulation; and, finally, the establishment of independent sector regulators.

The rationale underlying the idea of liberalising formerly monopolistic industries through the introduction of competition is that monopolistic supply should be limited to the core network activities only, that is to the part of the supply chain characterised by veritable natural monopoly features. Typically, this concerns the running of transmission and distribution grids in electricity, of the pipeline network

[1] The role of Professor Littlechild in defining the ideas that were to shape UK utilities regulation needs to be highlighted here. His report for the Department of Industry in 1983 on the subject of regulating BT's profitability set out the principles for regulatory reform that were to be applied across all utility sectors (see Littlechild, 1983).

in water, and of the track system in rail transport. For all other services upstream or downstream of the natural monopoly, or ancillary to its operation, competition is to be introduced wherever possible.

The motivation behind fostering competition is that the incentives provided by the market are the best way to achieve efficiency gains and maximise customer welfare. To a large extent because of information asymmetries between regulator and regulatee, the regulation of economic activities will always be imperfect. Competition is introduced into former monopolistic network utilities in order to minimise the scope of activities where such imperfect regulation is needed. By separating the core monopoly elements of the supply chain from potentially competitive activities, the path to minimising regulatory intervention is set. Naturally monopolistic network activities will always need to be subject to regulation because their nature makes them capable to extract monopoly rents from consumers and other companies. Access to their networks needs to be monitored in order to prevent monopolistic pricing or denial of access to competitors.

However, potentially competitive services—for instance power generation or water metering—should only be subject to sector-specific regulation as long as competition is not fully established, and in particular, as long as entry barriers persist and there is a dominant incumbent likely to abuse its market power. After the transition to firmly established competition is complete, only ex-post regulation following the general competition law should be implemented.

The second key idea of UK regulatory reform is the introduction of price-cap regulation. The aim of regulation is to bring about an outcome as similar to the competitive outcome as possible, and therefore to correct an existing market failure.

The idea behind price-cap regulation is to mimic the incentives to cost reduction that are created in an unregulated market by competitive forces, while at the same time protecting the customer from abusive price increases and provide a stable environment for investors. In order to achieve this, the regulator sets a pricing rule of the general form RPI-X, which is revisited every four to five years in periodic reviews.

Littlechild (1999, pp20-21) summarises the advantages of incentive price-cap regulation in the following manner:

> *'The RPI-X price cap allows prices to increase (or requires prices to decrease) at X per cent below the retail price index, which is a measure of inflation, for a specified number of years. This gives assurance to investors, managers and customers. It also gives greater efficiency incentives to companies in the short term. Customers benefit from the prospect of the resulting increased efficiency being passed to them over time, when the price cap is reset. Where necessary, prescribed minimum standards can ensure that cost and price reductions are not at the expense of quality of service.'*

The last of the three pillars of UK reform is the setting up of independent sector-specific regulators. Their primary duty is the protection of consumer interests, a duty pursued wherever possible through the promotion and protection of competition, and subject to ensuring the financial viability of the regulated company.

This thesis has two parts of different nature, each of them comprising two chapters. In the first part, chapter 1 sets out the key principles of UK regulatory reform and offers an overview of the theory underlying the liberalisation and parallel regulation of network utilities. It also discusses some of the lessons learnt from the UK reform

process and identifies issues critical to the design of successful regulation. Among the latter count the recognition that different types of competition exist and are appropriate for different parts of utility networks and different sectors. In addition, transitional issues, such as sunk costs and the unwinding of cross-subsidies need to be addressed at the outset of reform, and finally, structural issues such as the vertical or horizontal restructuring of an industry need to be considered in order to maximise the potential for competition in the liberalised sectors.

The regulatory regime set up in the 1980s in the UK has had a profound impact on the reform of utility networks in the European Union. The three key principles introduction of competition, incentive price-cap regulation, and independent sector regulators, have shaped EU liberalisation directives in telecommunications, electricity and gas, railways, postal services, and water. However, the exact interpretation of the regulatory principles is constrained by the unique national characteristics of a country. Different historically grown industry structures at the outset of reform, different existing legal and institutional frameworks, and different national reactions to the distributional issues raised by reform, imply that there is no unique European answer to network ownership and restructuring.

European regulators are nevertheless constraint to find a harmonised approach to the regulation of their utility networks if the project of an integrated single European market is to be realised, and co-operation between national regulatory bodies has emerged as important feature.

Chapter 2 of this thesis provides a concrete example of the influence of national characteristics on the implementation of regulatory reform in EU countries. Based on the theoretical principles of UK reform set out in chapter 1, and on the framework

employed in the fundamental review of the regulatory regime undertaken in the UK in 1998 (see DTI 1998a and 1998b), a questionnaire has been compiled. This questionnaire is reproduced in this thesis between chapters 1 and 2. It has been used in order to investigate how key features of regulatory reform have been interpreted in the context of the reform of electricity, telecommunications, and railway services in Germany. In addition to the utilisation of primary and secondary literature sources, a number of key officials and company representatives in Germany have been interviewed on the basis of the questionnaire. A list of the interviewees is given in Appendix 1.

The results of the investigation into regulatory reform in Germany regarding the three utility industries are presented in Chapter 2. While not one of the pioneering countries of utility reform, Germany has in recent years embraced reform measures propelling it among the European countries where liberalisation is most advanced. Germany is a particularly interesting case study not only because of the size of its market, but also because it displays an unusual decentralised market structure in some of its network utilities. This decentralised structure is reflected in the regulatory institutions for the surveyed industries, and has been maintained to a large extent in the process of reform over the past decade.

One of the main conclusions of chapter 2 is that in particular in the case of electricity, the decentralised market structure plays a key role in the liberal approach towards regulation adopted by the German authorities. In this market, full supply competition was introduced in 1998 in a single step for all, even the smallest, consumers. Nevertheless, in a decision unique among European member states, the German government has decided not to set up a sector regulator and to rely on

industry self-regulation. This decision was based on the argument that the fragmented industry structure would mean that a large number of companies would compete against each other from the outset of liberalisation, and therefore only regulation by the general competition authorities would be needed.

Germany illustrates the argument of the diversity of regulatory approaches between countries, but is also an example for different approaches adopted for different industries within a country. In the telecommunications industry, regulatory reform has closely followed the path outlined by the UK and by the European directives, and a sector-specific regulator has been put in place.

Chapter 2 of this thesis has been published in Henry, C., M. Matheu, and A. Jeunemaître (eds.) *Regulation of Network Utilities—The European Experience*, Oxford University Press, Oxford.

Chapter 3 and 4 form the second part of this thesis. The analysis presented in them is based on formal data analysis, and their character differs therefore from the first two chapters which focus on the theoretical and institutional aspects of utility regulation and are more descriptive by nature. Chapter 3 and 4 each concentrate on a specific question raised by the liberalisation of traditionally monopolistic industries. The distributional impact of the transition from monopoly to competition is at the centre of chapter 3, while chapter 4 deals with customer behaviour in a market where the withdrawal of regulation is considered.

The liberalisation of fixed telephony services has put an end to the system of internal cross-subsidies between different services provided by a single company. A rebalancing of tariffs followed the introduction of competition, slowly closing the gap between the costs of efficient service supply and prices charged to customers. In

chapter 3, the question whether this rebalancing of tariffs has had a detrimental effect on marginal, mostly low-income, users is discussed. The annual British Family Expenditure Survey (FES) is used to estimate a demand function for access to the fixed telephone network in the UK. The chapter was motivated by the absence of econometric studies regarding telephone access price elasticities using European data. This absence is caused by the particular form of European data compared to North American data. Econometric studies using North American data can take advantage of price variations across different states due to the fact that a multitude of operators offers telephone access. In contrast, European operators have traditionally applied a policy of uniform access charges for the entire country, making it impossible to estimate price elasticities on the basis of cross-sectional data.

In chapter 3, a pseudo-panel approach based on the FES data is adopted to address this data issue, and access price elasticities for the period 1985 to 1996 are estimated. The results of the analysis corroborate findings of North-American studies and indicate that access demand reacts, albeit weakly, to changes in the tariff structure. Moreover, the elasticity measure is markedly higher for low income than average income households. All other things equal, this results leads to the conclusion that tariff rebalancing does indeed affect marginal user groups. However, a number of caveats apply to this result. The overall reduction in the cost of fixed telephony services brought about by technological progress and increased competition is likely of offset the negative effect of tariff rebalancing. Moreover, the period surveyed precedes the extraordinary success of mobile telephony, and in particular the advent of pre-pay mobiles, which have made access to telephony services affordable at very low prices. Access to the fixed telephony network remains however an issue for

access to the internet, and the possible detrimental impact of high connection charges and their distributional dimension should not be neglected in this context.

Chapter 3 of this thesis has been published, in a slightly abridged version, under the title 'An estimation of UK telephone access demand using pseudo-panel data' in *Utilities Policy* 7(3), 143-154.

The last chapter of this thesis is set in the context of an industry where the transition from monopoly to full competition is considered close to complete. Chapter 4 considers the pattern and determinants of supplier switching in the domestic gas and electricity markets in Great Britain. The analysis is based on data from an ongoing household panel (the Oxera Energy Panel), spanning six quarters from the first quarter of 2000 to the second quarter of 2001, and comprising 2,110 households.

The main question addressed in chapter 4 concerns the determinants of domestic supplier switching and the relative importance of socio-demographic household characteristics compared to other factors, in particular variables linked to cost savings, such as payment method or subscription to dual-fuel deals. A probit model yields the result that the latter group of explanatory variables impacts more strongly on the probability of switching than the former. This result corroborates less formal evidence, in particular the latest competition review results published by the industry regulator Ofgem (Ofgem, 2001c), in two areas. First, the econometric results suggest that marginal customer groups, in particular low-income households, are taking advantage of switching opportunities as much as average households. Second, direct debit users and duel fuel subscribers have a higher probability of switching which suggests that these customer groups have been able to realise the most important cost savings over the period surveyed. However, in the case of gas, the results also show

that pre-payment customers have lower switching probabilities than average. Payment by pre-payment meter in gas still concerns a large proportion of customers in debt, and only recently has the range of competitive price offers for this customer group increased, therefore lowering barriers to switching for this customer group.

Finally, the results of the analysis also show that switching rates are strongly influenced by previous switching experiences, and that households headed by older persons are likely to switch less.

The thesis ends with some general conclusions.

Chapter 1: Liberalisation and Regulation of Network Utilities – An Overview

1. Introduction

Network utilities such as gas, electricity, water, rail and fixed link telephony, occupy an important place in national economies. The value added of the privatized UK network utilities in 1995 was 5% of GDP, employment was 422,000, fixed assets at historic cost were 13% of GDP, and the stock market shares on 10 September 1995 was £90 billion, or 15% of GDP (Newbery 2000, p19).

In addition, network utilities have attracted particular attention in economic literature because they provide some of the clearest examples of natural monopolies, that is, cases where a single firm can satisfy the entire market demand for the range of goods or services at lower total cost than any other combination of firms[2]. For natural monopolies the claim that free markets maximise welfare fails – if the natural monopoly is sustainable, it will exploit the rents offered by its monopoly position and consumers will have to face monopoly prices and restricted output; if it is not sustainable and entry occurs, then the wasteful duplication of facilities occurs, raising costs and prices. Either way, the market will fail to satisfy consumer needs at least costs.

The natural monopoly characteristics of network utilities are therefore intimately associated to the notion of market failure. Market failure in turn justifies state involvement in these industries, either taking the direct form of state ownership, or

the indirect form of regulation of network utilities (public or private). For most of this century, state ownership has been the preferred public policy option and was predominant in most European countries. Establishing protected state monopolies did not only prevent the wasteful duplication of facilities and provided a restraint on prices, it also offered a solution to dealing with a set of additional features that set utilities services apart from other goods and services provided in an economy.

Utility services are seen as essential services, or merit goods, in modern society and governments have made it their aim to provide universal access to water supply and sewage services, to electricity and gas supply, as well as to public transport and communication services. Public ownership resolved the potential conflict between private and public interests in the provision of these services and allowed for the incorporation of distributional objectives. These were often pursued by means of cross-subsidies, allowing geographically balanced prices or subsidised access charges to encourage take-up of services.

Moreover, public network utilities provided an instrument for a number of wide-ranging other social and political aims, often linked to the correction of externalities. So was the pursuit of environmental objectives integrated in the running of water and transport utilities, or public electricity companies were part of industrial strategies seeking to obtain domestic energy independence, e.g. through the exploitation of nuclear power.

[2] See for instance Sharkey (1982) for a discussion of natural monopoly theory.

Today, natural monopoly, distributional objectives, and externalities are still the underlying reasons for state involvement in utility industries (Vass 1999 and 2001). The form this state involvement takes has however undergone profound changes in the past two decades, and state ownership has been replaced by independent regulation of often privatized, and often restructured, industries.

In the 1980s, state ownership in the UK was gradually abandoned for a number of ideological, budgetary and economic reasons[3]. However, the change in ownership is only one element of the fundamental transformation that UK network utilities have undergone. The most outstanding element of the UK regulatory reform is arguably that it has questioned the boundaries of natural monopolies and has introduced the concept of supply competition in utility services.

The basic idea underlying the model that has come to govern UK network utilities is that regulation should be limited to the core natural monopoly service only, typically the 'true' network element, i.e. transmission or distribution wires or pipelines, or the railway tracks. For all other services provided upstream or downstream of the network operation, competition should be introduced where possible. The regulation of the competitive services would arguably be necessary for the transition period only, until the establishment of effective competition between the incumbent and new entrants. In other words, it should only serve as 'stop-gap' and disappear gradually with the advent of competition.

Regarding distributional and other social objectives pursued in the context of utility networks, their aim and scope were to be spelt out in an explicit manner in the new regulatory model, and their funding ensured in such a manner as to minimise distortions to competition.

In the 1990s, the change of policy initiated in the UK[4] has spread to the European Union, and the concept of liberalisation, that is, the abolishion of entry barriers to allow competition in previously protected industries, has become an essential part of EU policy in network utilities. The so-called liberalisation directives for telecommunications, electricity and gas, all provide for the separation of natural monopoly activities and potentially competitive services and make the promotion of competition the main regulatory objective.

The aim of this framework chapter is to outline the main concepts underlying the regulatory reform of network utilities developed in the UK (Section 2), to draw some lessons from the experience so far (Section 3), and to sketch some of the policy issues relevant for the European member states (Section 4).

2. Liberalisation and regulation

The regulatory reform initiated in the UK in the 1980s has led to a fundamental change in regulatory theory and practice through the implementation of three key ideas. The first of these ideas was liberalisation, that is the introduction of

[3] See Newbery (2000, pp5-9) for a comprehensive discussion of the factors leading to the wave of privatisation undertaken by the Conservative government under Margaret Thatcher.

competition into many of the services previously thought of as monopolies. The second was incentive price-cap regulation, to replace the then common rate-of-return regulation; and the third was the establishment of independent sector regulators. In this section we look at each of these key concepts in more detail.

2.1 Regulatory failure and liberalisation

The primary duty imposed on sector regulators in the UK is to protect the interests of all consumers, both existing and potential[5]. Two basic requirements can be identified in this context for any regulatory regime. The first is that regulated utilities should be able to finance their activities, including investments, and meet the demands made upon them by the consumers. The simplest way to ensure an adequate supply of funds would be to give the utility a protected franchise monopoly. However, the second regulatory duty concerns ensuring efficiency in operation, and responsiveness to new technological possibilities in order to make sure customers do not pay more than necessary for the fulfilment of their needs. The most effective way to ensure operational efficiency is competition, but this is in apparent conflict with the franchise monopoly.

One key innovative idea of UK regulatory reform was combining monopoly regulation with liberalisation. In a process of gradually peeling back the different layers of activities in which the network utilities were engaged, and assessing the competitive potential of each of them, the core natural monopoly was exposed. True

[4] Outside Europe, restructuring and privatisation had also started under different guises in the USA and in South-America (Chile).

natural monopoly characteristics of economies of scale and wasteful duplication of facilities are typically limited to the transmission and distribution wires of electricity and fixed telephony, to the pipeline network of gas and water services, and to the tracks of railway services.

As outlined above, regulation of the core monopoly services is necessary because of the market failure they are linked with. However, the supply of services over these networks is potentially competitive, even if the network operation as such is not, and the beneficial incentives of competition on efficiency and innovation can therefore be put to use. It is clear that renewed faith in market forces was a major motivation behind the regulatory reforms in the UK in the 1980s. Perhaps equally important was however that economists had increasingly pointed out that regulation, the response to market failure, could never be free of failure either. Regulation should therefore only be considered when the cost of market failure it addresses exceeds the cost of intervention.

2.1.1 Regulatory failure

Helm (1996) identifies three intrinsic regulatory failures, associated with, respectively, the incentives of regulator and regulatee, and the problem of information asymmetry.

The economic theory of incentives in regulation opposes normative and positive aspects, i.e. it examines the question of how regulators actually behave as opposed to

[5] The primary duty of the protection of consumer interest is stated in the Utilities Act 2000.

how they ought to behave[6]. The basic idea underlying the incentive theory is that, in the same manner as politicians and managers, regulators should be seen as rent-seeking and motivated by more than the objective aim of maximising social welfare. Regulators face direct and indirect rewards. Direct rewards in form of income are often delayed until after leaving the regulatory office, but then substantial benefits can arise from joining the private sector, notably the regulated company. Indirect awards can take the form of public visibility and the gratification of 'trying out' economic theory in the real world[7].

It should be noted that the private incentives the regulator faces are to a large extent compatible with effective regulation of a sector, as both the direct and indirect rewards will increase with a regulator performing well.

The regulated company in turn will act under the incentive of maximum profits. The best way of achieving this will depend on the regulatory rules imposed on it. Under rate-of-return regulation, it is likely that the company will increase its capital base to inefficient levels in order to boost its profit base (the so-called Averch-Johnson effect, after the seminal paper by Averch and Johnson, 1962). Under price-cap regulation, it will try to inflate costs to obtain higher price allowances (see also the next section for a discussion of rate-of-return and price cap regulation).

[6] In the regulation literature, two schools of thought have developed the general theory of self-interest – the Chicago School (Kahn, 1971 and Stigler, 1971) and the Virginian School (Buchanan 1972).
[7] This can be particularly attractive to academics.

The reason why the regulated company can be successful in pursuing rent-maximising strategies is the intrinsic asymmetry of information that exists between the regulator and the regulated company. The regulator will almost always rely on the regulatee for information. However, given the profit incentives, the regulatee will have an incentive to present the information selectively.

In practice, ways to weaken the information asymmetry exist, and they have been extensively used and refined by the British regulators. The most widely accepted means for addressing the information problem is the use of comparator companies, either nationally or internationally. This remedy to the information problem is perfected in the use of yardstick competition[8], where the regulator sets the regulatory rules according to the information revealed by the company's competitors. Another way of improving the information problem is by adjusting future predictions of the company's cost on the basis of the difference between past predictions and actual performance, thereby gradually reducing the scope for uncertainty.

Regardless of the remedy adopted, it is generally admitted that the information problem can be eliminated only partly, and that the remaining bias will allow companies to derive information rents, specially during the initial years of regulation, and thus gain supernormal profits. The second key element of UK regulatory reform, incentive price-cap regulation, has been hailed as remedy to the inherent regulatory failures linked to incentives and information asymmetry. Its basic

[8] The theory of yardstick competition is set out in Shleifer (1985).

principles, as well as some of the remaining difficulties, are discussed in subsection 2.2 below.

2.1.2 The ownership question

The process of liberalisation is often associated with privatisation and, in particular in the UK, the two are intimately linked. Indeed, of all the major UK network utilities, only Consignia, as the former Post Office is now called, has not been privatised yet.

For the basic ideas of regulatory reform privatisation might not indispensable—one can imagine a public firm in a competitive environment and subject to price regulation—nevertheless, for a number of reasons the transfer of ownership can facilitate reform. This is in particular true for the potentially competitive activities. For the regulated core monopoly networks, the ownership question seems somewhat less clear cut.

Competition is introduced into former monopolistic network utilities in order to minimise the scope of activities where imperfect regulation is needed. In market oriented economies, privatisation of the competitive part of the business becomes logical as the argument of public ownership because of market failure no longer applies. Klein (1998) also argues that competition can only be effective if firms can fail. There is therefore a natural complementarity between privatisation and competition, and an important role is played by capital markets. They provide an incentive for efficient management of private companies. Moreover, if policy makers want to avoid distortion between competing private and public companies, privatisation also imposes itself, as the latter are able to gain cheaper access to capital through the public backing they enjoy.

However, Newbery (2000) points out that public ownership can take different forms and that for instance in an environment where municipal or regional public utilities have to compete for capital and customers on a national or international market, the ownership question might be answered differently. Privatisation also seems less of a necessity in the case of the core monopoly services, where competition is per definition not possible. Depending on the particular circumstances, policy makers have sometimes chosen to maintain public ownership of the network assets. One example of continued public ownership is provided by Germany's federal rail track system, where public ownership is inscribed in the Constitution. In the UK, the private versus public debate has come to the forefront in the wake of Railtrack's failure in 2001. Another example of state ownership are the public system operators that have been set up in various liberalised electricity markets in Europe.

Evidence seems to suggest that many utility industries around the world show a markedly improved performance after privatisation. One convincing explanation of this has been linked to the labour market. The corporatisation of utilities that precedes privatisation has often led to increased labour efficiency because staff is no longer granted protected civil servant status. In addition, internal re-structuring programs aimed at increased efficiency are often undertaken before the initial public offering of shares in order to increase the sale revenue for the treasury.

2.2 Price cap regulation

In competitive markets, firms seek to maximise long-term profits via innovation and the acquisition of temporary monopoly, and short-term profits via the minimisation of costs. Entry is prompted by the existence of a profit margin between production costs and retail price, and causes the erosion of the same profits through a decrease in prices.

By definition, in the case of natural monopolies the welfare maximising features of competition cannot be relied upon. The objective of regulation is to bring about the same beneficial outcome as competition and therefore to correct the inherent market failure. In the recent past, this regulatory objective has been pursued notably by the two regulatory regimes of rate-of-return and price-cap regulation.

2.2.1 Price cap versus rate of regulation

Rate-of-return regulation was the traditional way US authorities regulated in the 20th century the private monopolies under which many of their utility services were provided. The logic underlying rate-of-return regulation is to restrain the company from earning supernormal monopoly profits. In this manner, the profit conditions of a company operating in a competitive environment are mimicked, and the exploitation of the captive customers is prevented. The regulator will determine what is deemed the 'normal' rate of return on the assets of the regulated company. Should the utility earn excess returns over and above the set rate of return, these are clawed back by the regulator after the annual examination of accounts.

The US system of rate-of-return regulation has been widely criticised for allowing all cost pass-through, thereby providing little incentive for efficiency. Moreover, the system fosters gold-plating, that is the inefficient expansion of the asset base. A larger base will allow higher nominal profits for a given rate-of-return.

Price-cap regulation was the innovative British response to the inefficiencies of US regulation. It has through its apparent theoretical and practical superiority gradually replaced rate-of-return regulation, even in the US. Price-cap regulation intends to mimic the incentive to reduce costs experienced in competitive markets. In order to achieve this, the regulator sets a pricing rule of the general form RPI-X, which is

revisited every four or five years in periodic reviews[9]. Under the assumption that the cost base of the company is decreasing and that efficiency gains are possible, the pricing rule guarantees a steady price reduction for the consumers of the utility service. In addition, and here lies the novelty of price-cap regulation, the incentive for cost minimisation is maintained. In the years between pricing reviews, the company can keep all profits resulting from its outperforming the regulator's forecasts of its future costs. Only at the review will the rent resulting from efficiency gains be passed on to consumers. Put simply, in a incentive price regulation regime profits today are lower prices for consumers tomorrow[10].

Littlechild (1999, pp20-21) summarises the advantages of incentive price-cap regulation in the following manner:

> *'The RPI-X price cap allows prices to increase (or requires prices to decrease) at X per cent below the retail price index, which is a measure of inflation, for a specified number of years. This gives assurance to investors, managers and customers. It also gives greater efficiency incentives to companies in the short term. Customers benefit from the prospect of the resulting increased efficiency being passed to them over time, when the price cap is reset. Where necessary,*

[9] In the formula, RPI stands for the retail price index, and X for the efficiency factor, the latter representing the cost savings the regulator estimates the company can realise over the review period. The formula implies that the regulated company can raise its prices in tune with inflation, but needs to reduce them in tune with efficiency savings.

[10] For a recent and comprehensive discussion of the mechanisms underlying price-cap regulation, as well as its accounting implications see Vass (2001).

prescribed minimum standards can ensure that cost and price reductions are not at the expense of quality of service.'

More recently however, the infallibility of price-cap regulation has been questioned. Prices must not be set so low that the financial viability of the company is endangered, nor should they be set so high as to allow extraordinary profits that are not the result of efficiency gains. In order to set the prices at the 'right' level, the cost basis used by the regulator is crucial. The key elements included in the assessment of the regulated company's costs are the operating expenditure (OPEX), the capital expenditure (CAPEX), an evaluation of the asset base, a depreciation rule, and, finally, an estimation of the cost of capital. The regulator is obliged to adjudicate on all these elements, and the scope for error is considerable. The information asymmetry will make the exact determination of the key cost elements difficult, specially at the beginning of regulation[11]. Moreover, it has been argued (Newbery (2000), Helm (1996)) that the greater the mistakes made at the moment of the initial price setting, the more difficult it is politically to avoid corrective interventions taking place before the next review. However, once the company anticipates that regulatory interventions to claw back extraordinary profits are possible between set reviews, the incentive to reduce costs is blunted, and the difference between price-cap and rate-of-return regimes vanishes.

[11] The UK regulators have arguably learnt a lot about the costs of the companies they are regulating over the past decade or so, and they have made creative use of yardstick competition to address the information problem.

2.2.2 The scope of regulation

In theory, once liberalisation is complete only the core natural monopoly activities need to be regulated. For the essential network services, the terms of access as well as the level of the access charges need to be closely monitored in order to make sure that all players present in the market benefit from a level playing field[12]. Price caps imposed on access charges are permanent as long as the natural monopoly conditions of the network prevail.

However, one of the characteristics of network utilities at the moment of liberalisation is that the incumbent continues to dominate the market even in the newly competitive parts, and that entry will only gradually lead to effective competition. Because of the dominant position the former monopoly enjoys, regulation to strengthen competition is necessary for a transition period. This implies a range of regulatory tasks from the regulation of retail prices in captive market segments, to abolishing remaining entry barriers and countering anti-competitive practices by the incumbent.

The architects of the new regulatory framework for network utilities intended this pro-competition part of regulation to wither away with the advent of competition[13]. While the transition process has taken longer than many had initially expected, the end of retail price regulation in liberalised services has occurred for large parts of the

[12] The risk of discriminatory behaviour against third parties in industries where the network company has simultaneous interests in the competitive parts of the supply chain and the danger this represents for the creation of a level playing field is one of the main arguments advanced for vertical separation.

[13] Littlechild (1999, p.22) reiterates what he has written in his 1983 government report on BT's regulation, that is, that RPI-X would only be a means of 'holding the fort' until competition arrived.

UK gas and electricity retail market, and is discussed for telecommunications in 2002.

2.3 Independent sector regulators

The third innovative element of UK regulatory reform that has left a profound impression on the current regulation of network utilities in Europe and world-wide, is the establishment of independent sector regulators. In the UK, the privatised utilities were granted licences formalising their obligations. Simultaneously, newly established Director Generals were appointed for each of the reformed sectors. The Director Generals were given statutory duties and powers and became the custodians of the licences. Their primary duties were to ensure that the utilities could finance their functions, and the promotion of competition (except for water). In addition, they pledged to protect customers, promote efficiency and to prevent discrimination on the markets.

When the Labour government came into power in 1997, a fundamental review of the regulatory framework for utilities was undertaken (see DTI (1998a) and (1998b) for an outline of the issues involved). The discussion of the reform process goes beyond the scope of this chapter, but at the end of the review, the regulatory framework in its general principles as it had been established in the 1980s was found to respond in a satisfactory manner to the demands placed on it. In particular, the principles of customer protection as primary regulatory objective and of independent sector

regulators were maintained[14]. The same reasons that ensure the continued existence of the independent sector regulators in the UK, have also led to such institutions being set up by the European governments in their efforts to reform network utilities.

It should be noted that the independence of sector regulators should not be interpreted as independence from all public authority, only independence from the executive powers of the state is required. Regulatory decisions have to be taken within general duties and powers defined by the legislative powers. In order to safeguard the legitimacy of the regulatory institution, the regulator has to be subject to control by the legislator and its decisions should be able to be challenged by the courts.

Among the reasons that have made independent sector regulators the preferred option for liberalised utility sectors count the following (Henry and Matheu, 2001). First (and this is of particular relevance in many European countries where privatisation has not, or not yet, accompanied liberalisation), independent regulators solve the dilemma of 'the State as shareholder and judge' and offer a transparent solution to the inherent conflict of interest. Moreover, the arm's length relationship between the government and independent regulators might make it more difficult for a dominant public operator to capture the regulator. In the case of privatised industries, an independent regulator might be better equipped to arbitrate between newcomers and the former monopoly.

[14] The reform process has resulted in a new Utilities Act to be adopted by Royal Decree in Summer 2000.

The second group of arguments supporting independent sector regulators centres around the assumption that sector specific regulators bringing together specialist skills and working without government interference will be able to investigate regulatory issues and disputes more efficiently and rapidly than, say, the general competition authorities or the legal court system.

Let the following two comments conclude this section. First, despite the general preference for independent sector regulators and their apparent advantages, this option has not been adopted universally. In Europe, Germany has for instance rejected the establishment of an independent sector-specific energy regulator for its liberalised electricity and gas market and has opted for making the general competition authorities the regulatory agency responsible for the sector. New Zealand provides another example, where competition issues occurring in the context of telecommunication services are settled by the courts. Second, questions have been raised about the future of sector specific regulators. Not only is there the issue of dealing with the increasing number of multi-utilities, raising cross-sectoral regulatory questions, and therefore debate about multi-sector regulators. On a more fundamental level, one can also question the continuing relevance of specialised regulators for sectors where liberalisation is close to complete.

3. Lessons from the UK regulatory reform

In the introduction to their 1998 book, Helm and Jenkinson argue:

> *'As with privatisation, the idea of competition has driven politicians to embrace policies frequently without sufficient attention to the details of implementation. [...] Competition is not an end in itself but a means to higher*

welfare. Its applicability to particular circumstances depends upon relevant costs and benefits.'

Amstrong et al. (1994, pp100-101) offer further discussion of the issues surrounding both the normative question of the desirability of competition, and the positive question of its feasibility. They conclude that there are many cases with conflicting interests where careful weighing of the costs and benefits of introducing competition has to occur.

Without attempting to be exhaustive, this section outlines some of the issues that the UK experience has revealed to be critical for the design of successful regulatory reform. First, different types of competition are relevant for different parts of utility networks and different sectors; second, a number of transitional issues need to be considered at the moment reform is designed in order to minimise its costs; and third, the importance of structural reform is highlighted.

3.1 Types of competition

Four basic types of competition applicable to liberalised network utilities can be identified: output competition, input competition, franchise competition and, finally, competition stemming from capital markets (Helm and Jenkinson (1997))[15].

Output competition is the type of competition most clearly identified with the potentially competitive activities of the network utilities. It refers to the abolishion of franchise monopolies in electricity and gas, or the free service provision policy in

telecommunications. Depending on the structure of the industry in question, the definition of output can vary and range from the competitive supply of end customers of energy or telephone services, to competition in upstream generation and between gas shippers.

However, competitive mechanisms can also be put to use in connection with the core monopoly areas of the network utilities. Input competition uses the mechanism of benchmarking, whereby the utility is required to test its own production costs against the market. This form of competition has predominately been used in the UK water industry, where the scope for output competition is limited. Another use for input competition has been found in the context of input procurement. So has for instance Railtrack tendered out maintenance and civil engineering contracts to achieve efficiency savings. Input competition can also be seen as an instrument that helps to overcome the informational asymmetries between the regulators and the regulated companies.

Another form of competition related to the core monopoly services is the competitive bidding for monopoly licences. The competition in this case is for a monopoly right and in theory bidding should transfer the potential monopoly rent to customers or government. Such franchise competition has been applied most extensively in the UK rail reform. Where subsidies are involved, the bids are aimed at minimising the Treasury contributions.

[15] See Klein (1998, pp42-43) for an alternative classification of different types of competition.

The final form of competition is provided by the capital market and applies to both potentially competitive and core monopoly activities. Competing sets of owners and managers can take over assets and licences of utilities, and, given a price-cap, attempt to reduce costs to maximise profits. In the UK, the regional electricity companies experienced a wave of take-overs after 1995, when the golden shares the government still held in these companies expired, and still today the mergers and acquisition activity in the sector is high.

The various types of competition will apply to varying degree in different parts of the network supply chain. Competition is often introduced gradually, but will depend on the underlying structure of services and may change over time with technological progress (see also below). The design of a competitive market will vary from industry to industry, according to the kinds of market failure identified.

3.2 Transitional issues

It is practically impossible to transform instantaneously a state monopoly into a competitive undertaking, whether it is privatised or not. Transitional issues which experience has revealed to be crucial in the reform process include contracting problems and distributional issues due to the unwinding of cross-subsidies. Moreover, technological progress has often played a decisive role in re-defining the scope of competition in different industries.

3.2.1 Contracting problems- stranded contracts and assets

Because of the large sunk capital costs of network industries, vertical integration was the preferred form of organisation of the former state monopolies. Monopoly franchises offered certainty of retail markets, and investments in production units could be undertaken in a relatively risk-free environment, as costs could be passed through to captive customers. In some industries, in particular the electricity and gas

industries, long term vertical contracts took the place of physical integration between upstream and downstream activities.

The introduction of supply competition for utility services removes the certainty regarding the retail market. At the moment of liberalisation, British Gas has found itself burdened with long term contracts with gas shippers, the terms and conditions of which corresponded to monopoly conditions but proved to be extremely onerous in the context of competitive supply. Similarly, state electricity generators have built nuclear power stations the decommissioning of which raised issues that had to be resolved at privatisation.

When deciding on the path regulatory reform should take, governments have to decide how to deal with the stranded contracts and assets of incumbents, and how to distribute the burden of their costs. In the case of British Gas, the shareholders had to shoulder the costs of long-term take-or-pay contracts. The expensive contracts BG was saddled with proved however to be the singularly beneficial for entry as they were easy to undercut. Failure to specify at the outset of the reform process how the distributional issues related to stranded costs are resolved can lead to costly delays in the transition period. Contractual issues were one of the reasons why progress on the European directives concerning the liberalisation of the electricity and gas markets took several years to materialise. In the end, the stranded cost issue received explicit treatment in the directives.

3.2.2. Cross-subsidies

In the quasi-totality of the developed world, utility services are regarded as essential, or merit, goods, i.e. universal access to them is considered part of the more general welfare state. When services were provided by state-owned, vertically integrated

companies, supply could be extended to high cost areas, for instance very remote areas, and to marginal customers, such as rural communities, without recovery of full costs from these areas or customers. With the help of cross-subsidies, for example access charges to utility services were kept deliberately low in order to promote universal access, and policies of geographically balanced tariffs disregarding cost structures could be implemented if so desired.

However, such distribution objectives are only sustainable as long as there is monopoly supply. Cost-oriented entry will undermine the cross-subsidies by making it impossible to over-charge for services where competitive entry is possible. The introduction of competition therefore leads to winners and losers compared to the monopoly situation. The political sensitivity of this distributional issue has in some cases led to great resistance to liberalisation. However, the debate provoked has also resulted in the definition of mechanisms that allow the pursuit of public service obligations in a competitive environment, for example universal service funds in telecommunications. Moreover, part of the debate has been disarmed by the overall lower prices that competition has brought about. The protection of marginal customer groups remains nevertheless one of the most publicised objectives of the regulators[16].

[16] See for instance Ofgem's duties under the Utilities Act 2000. The special regard the regulator needs to have to the interests of customers who are disabled or chronically sick, of pensionable age, of low income or those living in rural areas, is explicitly mentioned.

3.2.3 Technological progress

For many utility services, competition requires complex information technology to make a competitive market possible, that is, a market where customers can switch freely between suppliers. In telecommunication, gas and electricity, only the advent of new technology has made the data handling, metering, and billing services possible that are needed to deal with thousands of customers switching each week. The installation of costly electricity or gas meters for households willing to switch has provoked regulatory debate because of the barrier to switching it represents. The development of standardised load profiles for households, making individual meters obsolete, has presented a solution to this problem.

In the case of electricity, technology has also played an important role for system balancing and the development of spot markets which are seen as alternative to vertical integration and long-term contracts[17]. In telecommunications, where technological progress has perhaps played the biggest role as catalyst for liberalisation, alternative transmission technologies have led to a questioning of the continued relevance of monopoly networks and infrastructure competition is today fast advancing.

3.3 The importance of structural reform

In the previous section, the logic underlying the separation of core monopoly networks and competitive service provision over these networks has been outlined. Structural reform of the often vertically integrated former state monopolies is in this

[17] See Klein (1998) on the subject of spot markets.

context often an essential part of the liberalisation and regulation process in network utilities.

Essentially two ways exist to separate the core monopoly network from competitive activities, the first being the physical vertical separation of the activities, the second liberalisation of access coupled with account unbundling. From a regulatory point of view, the first option of vertical separation will make the task of creating a level playing field for competition easier. As long as the essential network facilities and competitive services are provided by the same company, the incentive for discriminatory behaviour towards third parties requesting access and competing with the integrated company on the liberalised market remains strong and requires extreme regulatory vigilance. Entry can be deterred not only through real discriminatory action from the part of the integrated company, but often through the suspicion of such behaviour alone.

The question whether or not structural reform should take the form of physical separation ultimately depends on the assessment of the costs of such a step compared to its benefits. The costs of disintegration comprise most notably the loss of economies of scale and co-ordination, its benefits an improvement of the conditions for competition and a narrowing down of the need for regulation. There is no unique answer, and in practice different solutions have been adopted in different industries and countries.

In the UK, British Telecom and initially also British Gas, were privatised as integrated companies. BG was split up at a later stage, but the telecommunications industry has remained integrated and access obligations have been imposed on the network parts. One reason for refraining from imposing vertical restructuring on the

telecommunications industry might have been the potential for network competition that had already emerged at the moment of privatisation. In contrast, and partly because of the problems encountered with the continued integrated structure of the gas industry, the UK electricity industry was vertically and horizontally split up before its privatisation. The UK water companies in turn were privatised as integrated regional monopolies.

One important lesson that has been learnt from the British experience is that it is important to solve the question of the industrial structure most likely to bring about efficient competition before privatisation (in so far as this is possible given the uncertainty linked to technological change). With hindsight, it is clear that a lengthy and costly transition period in UK's gas industry would have been avoided had the pipeline business been split from the supply business at the moment of privatisation. In the electricity sector, not so much the vertical industry structure, but the horizontal market power of the near duopoly of NationalPower and PowerGen in the generation market posed regulatory problems.

In companies where the different elements of the supply chain remain integrated, the establishment of separate legal entities within a holding company is often prescribed[18]. Such legal separation provides the second best solution to physical separation, improving the position of third parties with respect to the incumbent. The need to regulate the terms and prices of access to the essential network is a major

regulatory task in network industries and will necessarily be hindered by the information asymmetry between the regulator and the regulated company discussed in section 2. Legal and account separation improve this problem and are intended to help the regulator set up non-discriminatory transfer prices between the activities.

4. Regulatory reform in Europe

The approach European authorities have taken with respect to the reform of network utilities has largely been influenced by the UK experience. The principles of promotion of competition, incentive regulation and independent regulators have been adopted in EU directives covering the liberalisation of all major network utilities, including telecommunications, gas, electricity, postal services, and rail transport.

Despite of the co-ordination of approaches resulting from the adoption of common principles, the directives have left considerable room for national manoeuvre. This reflects the need on European level to take the differences in the institutional, political and cultural environment of each member state into account. At the same time, the national differences have led to additional regulatory requirements regarding the harmonisation of utility networks interconnected to form a single European market.

4.1 The importance of national endowment

The principles of UK regulatory reform have shaped profoundly the European Union approach to reform, resulting in a common framework for the European member

[18] The EU energy directives for instance refrain from imposing mandatory vertical separation, recognising that the costs and benefits of such an act need to be assessed separately for individual national systems. Account

states based on the different sector liberalisation directives. However, regardless of the common reform path, national differences in the exact interpretation of the liberalisation policies remain.

Newbery (2000, p.1) highlights the importance of national differences in the introduction to his recent book:

> *'Network utilities pose special problems of ownership and regulation whose solution is constrained by the institutional endowment of the country. Public policy towards these utilities will inevitably reflect deeper political and cultural features of society, as will the institutions which evolve in response to these factors.'*

In a recent book edited by Henry, Matheu and Jeunemaître (eds, 2001), recent national approaches to the regulation of utility networks are discussed, further elaborating on the evolution of the UK model in other European countries.

The following classification of explanations for national differences between European member countries can be suggested: the first set of explanations centres around different industry structures at the moment of liberalisation, the second around existing legal and institutional frameworks, and the third regards different responses to the distributional issues raised by liberalisation and possibly privatisation.

unbundling and management separation are however mandatory.

The discussions about ownership and industry restructuring in the previous sections have already hinted at the failure to find unique answers to the question regarding the optimal model. Depending on the original industry set-up, the assessment of the costs and benefits of such fundamental issues vary. The reform measures undertaken in Europe's electricity industries illustrate this point. In Germany, the historic strong presence of municipal and regional utilities suggests that public ownership might be less of a problem, because competition between public entities is possible on national level. However, the decentralised structure also makes restructuring of the German electricity industry politically very difficult, as there is no unique public authority to impose vertical separation (see Chapter 2 for a more detailed discussion of the German case).

In France, breaking up the generation monopoly of incumbent Electricité de France was judged by many to be too costly: given the centralised organisation of the industry, rebuilt according to a public plan after World War II, economies of scope and co-ordination are important, and would have been lost in a break up of the industry (see Bureau and Curien, 2001)[19]. Strong union representation has also made privatisation very difficult in France. In contrast, Italy's government decided to divest a large part of incumbent ENEL's generating capacity and to privatise the incumbent in order to encourage entry. In Spain, similar to Germany, the existing industry structure already supported a number of electricity generators, and

[19] The way the 'inseparability' of the French generation industry has eventually been resolved, is by virtual auctions.

abolishing the legal protection of their incumbent positions was deemed sufficient to induce competition between them. Moreover, the companies were already under private management at the moment of liberalisation.

Regarding existing institutional and legal structures in European countries, it rapidly becomes clear that their influence in the reform solutions adopted is strong, in particular with respect to the regulatory institutions. Italy has enthusiastically embraced the idea of independent sector regulators, arguably in part because of the general loss of credibility under which Italy's public offices suffer (see Bavagnoli, 2001). In Germany, the idea of an independent regulator was accepted for telecommunications and postal services—the structure of which resembles the initial UK conditions—, but rejected in the electricity and gas industries, where it was deemed that self-regulation by the industry would be sufficient protection for competition. Spain, despite having established a regulator for the energy sector, has subsequently curtailed its formal powers and independence and the government continues to intervene in industry outcomes (see Curien and Matheu, 2001). In France, winning the battle for independent regulatory offices has required the strong lobbying from the incumbent utilities, with France Telecom and EDF fearing for their international reputation and business if they were going to be perceived as protected by the State (see Bureau and Curien, 2001).

Last, cultural differences and historical accident matter in the context of resistance to reform provoked by the redistribution issues. One particularly poignant example of this is France, where the notion of public service and equal access at affordable cost is deeply embedded in society. The unwinding of cross-subsidies accompanying liberalisation has provoked a public debate that has lasted for close to a decade.

Privatisation proposals have been attacked at every turn by the powerful public sector unions defending their interests, and so far only France Telecom has been partly privatised. On the opposite end of the spectrum lies Germany, where social and redistributional policies have not been pursued by means of utility service prices. The fundamental reform measures adopted in this country were certainly helped by the relative lack of existing cross-subsidies between regions and users[20].

Once the possible interactions between the different economic, institutional and political interests at play are taken into consideration, and the scope of the illustrative examples of the preceding paragraphs is widened to take all fifteen European member states into account, it is easy to see how different combinations of circumstances will account for national differences in the reform path taken. In what follows, one immediate consequence to the diversity of national characteristics is discussed, that is the need for harmonisation and co-operation between national regulators in the pursuit of a single integrated European market.

4.2 The importance of harmonisation and co-operation

With the adoption of regulatory reform in Europe, the need for harmonisation has been added to the regulatory agenda. Not only do European regulators have to address the issues that were at the centre of sections 2 and 3, they also need to work on the construction of a single market and on the abolishment of national frontiers in the provision of utility services. This entails new regulation to ensure the technical

[20] There has however been substantial political resistance linked to the subsidies received by the domestic coal industry in the case of electricity liberalisation.

harmonisation of national sectors and their interoperability in the face of a growing number of operators[21].

One way this demand on the new European sector regulators has been addressed is through the establishment of regulatory fora, the aim of which is to foster co-operation on regulatory matters. Vasconcelos (2001) identifies two fundamental reasons for co-operation between regulators. First, it improves the performance of individual national regulators through the sharing of knowledge and has therefore a direct positive impact on the regulated markets. Co-operation also makes it easier to assess the performance of national industries by means of international benchmarking. Second, the lack of co-operation might hinder the development of competition in national markets by making entry by companies from one European country into liberalised markets in another country difficult. Thus, the customers in the latter country would be prevented from reaping the benefits of liberalisation.

The exchange of information between regulators allows learning from mutual experience and the UK regulators are appreciated members in the co-operation efforts. Working on common solutions ex-ante also eliminates the need for ex-post harmonisation adjustments and improves overall regulatory efficiency. Co-operation can also be beneficial in terms of the internal management of regulatory offices through the sharing of knowledge and resources and through improving the transparency of the regulatory process.

[21] This point is forcefully made in a recent French report on the liberalisation and regulation of network utilities.

The increased importance of harmonisation and of knowledge sharing is also evident in recent developments in the UK. Cross-sectoral working groups including the regulators of all utility industries have been set up, and a common approach has for instance been defined in the area of regulatory accounts, where sector approaches took a very wide range, from very detailed guidelines published by Ofwat, the water regulator, to very little guidance given by Ofgem[22].

In addition to these fundamental benefits to co-operation, recent changes in the industry structures across Europe call for international collaboration. European utilities are at present mutating from national into pan-European players through a series of cross-border mergers and acquisitions. The regulation of such companies requires the exchange of information at the same level. The internationalisation of former national champions however also heralds the emergence of a European market where supra-national utilities compete, a development that certainly raises new regulatory challenges, and strengthens the case for co-operation.

5. Assessment

Partly in recognition of the impossibility to prescribe a complete transition plan, sector regulators in the UK were given the primary duty to protect customer interests, primarily by means of promoting and protecting competition while ensuring that the utility's function could be financed. In practice, the regulators

See Commissariat General du Plan (2000), *Services publics: perspectives de concurrence et régulation*, La documentation française.

found themselves with considerable scope to follow their preferred course of action to obtain these objectives[23].

It has been argued (Helm and Jenkinson, 1998), that regulatory discretion has led to increased uncertainty and risk in the regulated industries and therefore to an increase in the cost of capital. The problem created by regulatory uncertainty is serious as it can have harmful long-run effects through its impact on investment decisions. One of the main recommendations for reform over the past years has been to improve transparency and increase public accountability of regulatory decisions, a recommendation implemented in the Utilities Act 2000.

However, there is also need to recognise that a certain amount of regulatory flexibility is necessary in view of an environment changing with technological progress and new industry developments. Regulatory rigidity would undermine public consent and investor confidence if it were judged that new circumstances warranted a change of approach. In defining regulatory policies, governments and regulators need to weigh the incremental benefits of changing a given approach against the costs in terms of investment uncertainty and sunk costs created by such a change. The key test should be whether the discretion improves regulation tested against the objectives and framework of regulatory principles (i.e. changing the

[22] For information on common regulatory accounting guidelines see Ofgem (2000), Regulatory Accounts Final Proposals, November; or Ofwat (2001), MD171: The 2001 review of the regulatory accounting guidelines, May 16th 2001.

[23] See for instance Hansard Society (1997) for a discussion of the discretionary powers of regulators.

regime was reasonable, necessary and equitable over time in relation to all stakeholders).

The UK experience has also shown that regulation for competition is less transitory than expected by many at the outset, and in many cases has led to more, not less, regulation over time. New regulatory questions keep arising, a point illustrated by two current examples of regulatory debate.

The first example refers to the trend towards re-integration in industries where structural separation was part of the reform, notably the energy industries. Also, multi-utilities are emerging as a new form of utility service provision, integrating for instance telecommunications and electricity supply, or offering dual-fuel (i.e. gas and electricity) deals. A regulator expected to promote competition in the consumers' interest, needs to address the question of whether such re-integration is ultimately good or bad for customer welfare. Vertical integration can be the market's response to the cost structure prevailing in the industry, and lead to overall cost savings. With appropriate regulation, these can then be passed on to consumers in the form of lower prices. On the other hand, regulators have to consider the danger of re-integration leading to diminished competition and barriers to entry. The trade-off is one of decreasing costs and diminished uncertainty regarding supply markets for the utilities on the one hand, and increasing market power on the other. In addition, from an institutional point of view, re-integration raises the question of multi-sector regulators.

The second example of current regulatory debate also concerns ultimately the optimal industry structure of network utilities. In telecommunications, technological progress has fuelled regulatory debate regarding the question whether it is

infrastructure or service competition that will serve the consumers' interests best. The underlying problem is one of incentives to innovation and short term versus long term benefits. Providing open access to all network services, including the local loop, will in the short run create the most favourable conditions for entry and lead to the proliferation of competition in services delivered to the household. Benefits in the form of lower prices can immediately be passed on to consumers. In the longer term however, imposing access obligations and network unbundling might deter investment in network facilities, leading ultimately to an overall deterioration of service quality.

Regulatory decisions regarding the terms and price of network access will influence whether investment occurs rather in the area of network facilities or service provision. The answers to questions of the kind: 'Where does the innovative potential in telecommunications lie – in the network or in services? Is fostering infrastructure competition in telecommunications efficient given the growing economies of scale of optic fibre networks?' are not likely to be universal, and require decisions taken in an uncertain environment.

The above paragraphs make it clear that perhaps one of the most difficult issues that governments and regulators have to re-assess continuously concerns the extent to which regulatory decisions replace market outcomes and therefore make the goal of sunset regulation unattainable.

6. Concluding remarks

Many complex issues need to be solved in the process of transforming markets formerly supplied by incumbent state monopolies into competitive markets. Transition requires acknowledgement that there is no unique solution, but that each

case for reform will need to be considered in its own context. Competition can take on different forms, and which best meets efficiency criteria depends upon the market and government failures which arise in each industry and country. Moreover, transitional pitfalls are many, and technological progress can change the competitive potential of markets along the way. However, despite of all the different individual cases, consensus on many regulatory issues has emerged around the UK model of regulatory reform. The UK experience has provided valuable lessons for the European countries, embarking on the path of regulatory reform in utility networks some 16 years after BT was privatised. The well-founded principles of the UK regulatory reform – introduction of competition, incentive price-cap regulation, and independent sector regulators – are echoed in the European liberalisation directives.

QUESTIONNAIRE REGARDING THE IMPLEMENTATION OF REGULTORY REFORM

In chapter 1 the argument has been advanced that the set of principles underlying regulatory reform in the UK has guided European efforts in liberalisation and regulation, but that unique national characteristics have played an important role in the exact implementation of the principles in individual countries. The importance of national characteristics is illustrated in chapter 2 in the case of Germany.

Based on the theoretical principles of UK reform set out in chapter 1, and on the framework employed in the fundamental review of the regulatory regime undertaken in the UK in 1998 (see DTI 1998a and 1998b), a questionnaire has been compiled and is reproduced in the following pages. It has provided the analytical framework for an investigation of the question how key features of regulation have been interpreted in the context of the reform of telecommunications, electricity, and railway services in Germany. In addition to the utilisation of primary and secondary literature sources, a number of key officials and company employees in Germany have been interviewed on the basis of the questionnaire. A list of the interviewees is given in Appendix 1.

The results of the investigation are presented in Chapter 2.

Questionnaire

0. Preliminary point: Changes in the legal framework

- Have any new laws, decrees, administrative rules, etc., recently been passed (or are they being prepared) in order to liberalise and regulate the sectors considered, i.e. telecommunications, electricity, railways and post?

- Are these texts easily available?

1. Institutional aspects

1.1 Independence of the regulator

- Is the regulator merely an office inside a ministerial department?

- Is it a public body protected from the interference of ministerial departments and politicians? *For example*, how is (or are) the director(s) of such a public body appointed, how are they protected against arbitrary dismissal, how are the necessary resources (staff, funding) provided?

- Is it a 'chamber' within a general competition agency?

1.2 Convergence of sectors and boundaries of regulation responsibilities

- How is the convergence between sectors (electricity with gas, telecommunications with broadcasting and IT, trains and intercity buses) reflected at the level of regulators?

- Are there opportunities for different regulators to compare (and possibly harmonise) their respective methodologies when dealing with similar issues

(for example methodologies to evaluate the cost of capital when setting price-caps)?

1.3 Access to relevant information

- There is an inherent asymmetry of information between the regulator and the regulated firms. How is it overcome? *For example,* by special investigation powers, by specifying accounting systems for regulatory purposes, by changing the incentives firms might have to reveal information?

1.4 Consultation and information procedures

- Who and how does the regulator consult when preparing decisions, in particular affected third parties like consumers? Are there formal duties and procedures of consultation?

- Does the regulator play a specific role (with dedicated staff and other required resources) in informing the consumers about their rights, about changes in services provided and prices charged by the operators, about possible problems in the provision of services, about how to resolve conflicts between a consumer and an operator (possibly intervening as mediator)?

1.5 Accountability and rights of appeal

- To whom is the regulator answerable? *For example*, to Parliament, or public opinion in general, in so far as the regulator has to provide written justification for its decisions.

- How and to whom is it possible to make appeals against its decision?

2. Regulation of the conditions of competition

2.1 Operating licences

- What are the duties and the powers of the regulator concerning the issuing of licences to operators, and their subsequent modifications (if required)?

2.2 Access to essential network facilities and to scarce resources

- How is non-discrimination regarding the access to essential network facilities ensured? What are the roles of the regulator, as mediator, or as decision maker? *For example*, setting technical conditions for access and access charges, or implementing an allocation mechanism for scarce resources?

- Is the regulator in a position to recommend, or even to make decisions, on structural changes, for example vertical separation in order to isolate essential network facilities?

2.3 Promoting competition

- Is the regulator empowered to prevent and sanction specific anti-competitive practices? *For example,* tacit collusion by the main electricity producers in Britain to manipulate the pool price, or excessive switching costs set by an incumbent telecommunication operator?

- Does the regulator share with the competition authorities powers to enforce the general competition law?

- What duties and powers does the regulator have to play an active role in promoting competition? *For example*, in a sector where there is still a largely

dominant incumbent operator and some horizontal separation is feasible, or in activities where competition is feasible but where there are still rules limiting it (as for retail sale in electricity in many European countries).

2.4 Regulation of universal service provisions in so far as they interact with the conditions of competition

- How does the regulator ensure compatibility between universal service provisions and the pursuit of competition? *For example*, through the re-definition of universal service obligations, the way of selecting universal service operators, the rules for allocating financial compensations where universal service provisions create deficits?

3. Regulation as substitute for competition

Here the regulation of the quality and price of services are considered. The services can be under temporary regulation in the sense of potentially competitive services still in the transition between monopoly and competitive supply, or they can be subject to permanent regulation because natural monopoly conditions prevail.

- Has the regulator the power to set quality targets (and impose penalties for non-compliance) and price-caps, or does it only propose to a political authority that retains the power to decide?

- Same question concerning the levels of investment (mainly in infrastructure) by providers of services under monopoly.

- On which grounds and on the basis of which methodology does the regulator choose the levels of quality targets and price-caps?

- How does the regulator control for possible cross-subsidies from activities under monopoly to competitive ones? What role does he play in devising or approving rules for the sharing of common costs?

4. Other goals that the regulator might pursue

- Does the regulator play a role in the definition of universal service obligations, or is it a matter reserved to Parliament and Government?

- Does the regulator try to enforce a more desirable distribution of the benefits of liberalisation, for example in favour of disabled or low income consumers, possibly through specific tariff provisions?

- Does the regulator pursue social and environmental objectives going beyond a narrow definition of universal service provision? For example, geographically uniform prices, environmental policies, or educational goals (for example, internet access for all schools)?

Chapter 2: Contrasts in Germany: Decentralization, Self-regulation and Sector-specific Regulators

1. Introduction

This chapter offers an overview of the recent liberalisation of three German network utilities and the regulatory framework established in these industries. Legal, structural, and institutional changes that have been implemented in the past few years in telecommunications, electricity, and railway services are surveyed and the success of introducing competition into these industries is evaluated.

The introduction of competition into Germany's network utilities is part of the overall European effort to open up these industries with a view to create a single European market. However, besides it obvious size, Germany displays a number of characteristics that make it stand out among the European member states. This chapter discusses in some detail the unusual decentralised approach that has been adopted in the reform both of the electricity and the rail industry. Unlike the integrated, monolithic markets that are observed in many European network industries, these two German industries display a fragmented structure with a relatively large number of companies. Because of this particular initial setting, the regulatory regimes that have been established differ in their design from regimes in place in other countries.

The German case illustrates that the economic principles underlying the introduction of competition into utility networks, such as non-discriminatory access to the network, or price regulation, coexist with and are adapted to unique national environments. In particular, in the German electricity sector, the presence of numerous companies has led to a regulatory framework relying more on self-regulation than on structural reform. In the railways sector, the regulatory institutions

in place reflect the strong regional and local element present in German public transport. So far, an independent, sector specific regulator, modelled after the British example, has only been set up for Germany's telecommunications and postal markets.

The idea of this chapter is to survey the multiple changes that have occurred in Germany's utility industries in the recent past, to highlight unique national characteristics, and to draw attention to remaining structural problems. It is not a goal to explore in great depth any particular issue, but rather to give the reader an impression of the factors that shape the way in which German network utilities have been liberalised.

Despite of this objective, an important aspect of recent German developments has largely been omitted from discussion. Complexity has been added to regulatory reform in Germany by the impact of reunification. The costs of this act and the associated task of rebuilding the utility networks in the former German Democratic Republic were considered by some as reason to request an exceptional status for Germany in the European liberalisation efforts. Germany's policy makers have mostly resisted these calls and went ahead with their liberalisation agenda, while allocating additional public funds to infrastructure investments. Some transitory exemptions to the introduction of competition have also been granted, for instance in the case of mandatory third party access to the electricity grid of the new *Länder*. Nonetheless, the debate surrounding the appropriate treatment of undertakings with substantial investments in the new *Länder* illustrates conflicting regulatory priorities. The introduction of competition needed to be balanced against the protection of investment incentives, as well as against social and political objectives, often linked

to employment issues. The issues raised go beyond the remit of this chapter and are not treated here.

The remainder of this chapter is structured as follows. In the next section, the main market characteristics as well as recent liberalisation measures are surveyed for each of the three industries electricity, rail and telecommunications. The subject of section 3 is the regulatory framework that has been set up in the three sectors. Section 4 provides an account of how the three markets have developed since the introduction of competition and section 5 evaluates the success and potential pitfalls of the reforms. Section 6 concludes.

2. Market structure and liberalisation

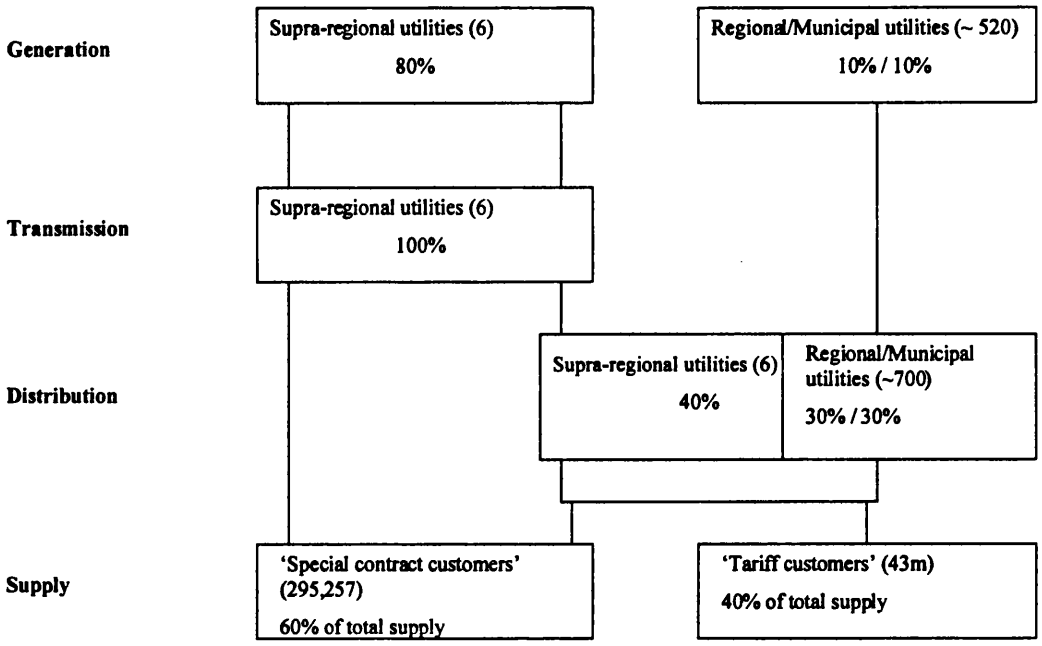
2.1 Electricity

2.1.1 Industry structure

Germany's electricity supply industry (ESI) possesses for historic reasons a decentralised structure which results in a large number of companies on the market[24]. Among the nearly 1,000 German electricity utilities, three different groups can be identified. These are distinguished by size and different core activities, however, all are vertically integrated. Figure 1 gives a schematic overview of the industry structure.

[24] A summary account of the history of the German electricity industry is found in Müller and Stahl (1996). For more detailed discussions regarding the industry structure see also Sturm and Wilks (1997), and IEA (1997).

Figure 1: Structure of the German electricity supply industry



Note: Percentages represent market shares.

Source: Schulz (1996), updated by the author: VDEW (1998) and IEA (1997).

Until two recent mergers, there were eight supra-regional utilities that generated between them 80% of total electricity production. In June 2000, the mergers between the second and third largest of the eight utilities, VEBA and VIAG, and the largest and forth largest, RWE and VEW, were approved by the European Commission (EC) and the Federal Cartel Office (FCO), the German competition authority.

The supra-regional utilities are also solely responsible for the operation of the high-voltage transmission grid. They sell electricity both to large industrial end-users and to regional and municipal distribution companies. At regional level, there are around 80 regional utilities which purchase electricity from the supra-regional producers, but which also generate their own power (around 10% of total production). The regional utilities are mainly active in distribution and electricity supply, with supply activities taking predominantly place in the rural and less densely populated areas.

Finally, there are around 850 municipal electricity companies (*Stadtwerke*) which deal mainly with distribution and supply to residential consumers. However, they also generate a small part of total electricity production (10%). The municipal electricity companies often operate as part of municipal multi-utilities.

Sales to end-users are split evenly between the three categories of suppliers. German end-users of electricity are divided into 'tariff customers' (*Tarifkunden*), mostly households and small commercial users, and 'special contract customers' (*Sondervertragskunden*), mostly large and medium industrial and commercial users. In 1997, supra-regional utilities had a part of 33% of total electricity sales to end-users, regional utilities a part of 36%, and municipal companies a part of 31% (VDEW 1998, p17).

The ownership structure of the industry is mixed, with public owners being overwhelmingly the *Länder* and municipalities and not the federal government. It is also worth noting that the public influence in the industry is often greater than the ownership of capital indicates, as the public owners have frequently secured majority voting rights, even if their capital stake is minor[25].

Another characteristic feature of the German ESI is its high degree of vertical and horizontal integration. Cross-shareholdings between the different companies are common, and long-term contracts have long been an important part of the

[25] An illustration of this is provided by the pre-merger RWE Energie. Its shares were owned 30% by a group of 70 municipalities and 70% by private investors, but municipalities held 60% of the voting rights. IEA (1997, p.96).

functioning of the industry. A large number of regional and municipal companies are directly or indirectly at least partly owned by the supra-regional utilities, which also act as their main suppliers. Because of cross-shareholdings, only four of the pre-merger eight supra-regional utilities were independent from each other. An important condition for the approval of the mergers between VEBA and VIAG, and RWE and VEW by the European and German competition authorities was a commitment by the four companies to divest mutual cross-shareholdings. Significantly, the east German supra-regional utility VEAG was jointly owned by the west German companies. Following the concessions made by the merging companies, VEAG will now be independent from its former owners. VEAG is by size the third largest German utility and its independence is hoped to improve the competitive situation in the industry.

Beyond the integration within electricity supply, the industry is deeply embedded in other sectors of the German economy. There exist vertical links and cross-shareholdings to related industries, notably the coal and lignite industry, but some of the large electricity utilities are also part of industrial conglomerates with interests ranging from the chemical to the telecommunications industries.

2.1.2 Industry reform

Despite the large number of players, the German ESI was far from competitive before liberalisation. The legal framework within which it functioned created an environment of regional and local monopolies, organised in a cartel-like fashion. A

set of private industry contracts taking the form of vertical and horizontal demarcation contracts defined the geographical areas and activities where each company could be active. These anti-competitive agreements had developed historically and were granted an exemption from the general competition laws[26]. In addition to the demarcation agreements, exclusive concession contracts existed at the municipal level. They were grounded in municipal rights of way and created monopolies for the supply of end-users. In exchange for rights of way, concession holders had to pay municipalities a share of their revenues.

The liberalisation policies emanating from Brussels played an important role as catalyst in breaking the long-standing mould of the German ESI. Various previous attempts at reform undertaken by the German federal government were dwarfed by the many vested interests. Above all, the public-private ownership structure and the municipal rights of way are linked to property rights anchored in the Constitution, which had forestalled all attempts at reform.

Following the implementation of the European electricity liberalisation directive in 1997, the new German law for energy markets (*Energiewirtschaftsgesetz*) came into force on 28 April 1998, thereby transcribing the European directive into national law. With the new law, the totality of the German electricity market, including the residential market, was opened to supply competition in a single step.

[26] Sturm and Wilks (1997) offer a comprehensive overview of the legal conditions of the pre-liberalisation industry.

The new electricity law abolished all demarcation agreements with immediate effect, and while concession contracts continue to exist at municipal level, they are no longer exclusive, giving end-users the possibility to bypass the local distribution network. Simultaneously with the abolition of the demarcation contracts, the German Competition Act was amended and the protected status of the industry ended. An essential facilities clause was introduced declaring unlawful the unjustified denial of access to an essential infrastructure. The amendment of the competition law was strongly supported by the Federal Cartel Office, which became the main regulatory institution for the industry (see also section 3.1).

2.2 Rail services

2.2.1 Industry structure

Similar to electricity, an element of decentralisation is present in German rail services, with non-federal rail undertakings playing an important role regionally and locally. Their owners are mostly federal states or municipalities, with a small number of private operators also being present[27]. However, a distinct asymmetry between the federal and regional players exists. The federal rail operator Deutsche Bahn AG (DB AG) is not only by far the largest rail service operator, it also owns over 90% of the public rail infrastructure. One of the most interesting aspects of the reform of the German rail sector undertaken between 1994 and 1996 is arguably that it has strengthened the regional element at the expense of the federal operator in a devolution of responsibilities.

[27] Hass-Klau, C. and Environmental and Transport Planning (1998) provide an extensive account of the history and present structure of the German rail system.

2.2.2 Industry reform

The federal rail industry was the first German network utility to experience far-reaching reform in the 1990s. High subsidy payments and accumulated debt were the main drivers for change. In 1989, a multi-disciplinary government commission was charged with the task of finding a new structural concept for rail transport. Reunification and the investment demands generated by the modernisation of the public transport network in the new federal states accelerated change, as did policy emanating from Brussels. The reform of the German railways sector was implemented in 1994 with a new Railways Act (*Eisenbahnneuordnungsgesetz*). The new Act was possible after a change in the German Constitution had been voted in 1992, abolishing the federal monopoly of Deutsche Bundesbahn.

The rail reform was based on three main elements: separation of commercial activities and public domain obligations; separation of network operation and service provision; and, last, regionalisation of short distance passenger services.

The separation of commercial activities from other obligations falling into the public domain was achieved through the complete re-organisation of the incumbent public federal rail operator Deutsche Bundesbahn. On 1 January 1994, all commercial activities were transferred to the new corporation Deutsche Bahn AG (DB AG), a private company. The capital of DB AG is for the moment entirely held by the federal government, but privatization is planned.

The non-commercial obligations of the federal railways were honoured through the creation of two new public administrations. The first was the Fund of Federal Railways (*Bundeseisenbahnvermögen*), which took over all debt and other public obligations from the former federal operator, which represented at this stage the

merged east and west German operations. The obligations concerned for instance the management of the pension fund of former civil servant staff. Thus, the new commercial undertaking DB AG could start business without being burdened by historic liabilities. The second public body created in the course of the 1994 rail reform was the new Federal Office for Rail Services (*Eisenbahn-Bundesamt, EBA*). It became functional on 1 January 1994 and is in charge of key regulatory tasks such as licencing (see also section 3.2).

While the first element of the reform dealt with reforming the financial basis of the rail sector, the objective of the second element was the creation of an environment favourable to the introduction of competitive forces into the sector. The separation of network operation and provision of services was implemented through the establishment of separate legal units within the new operator DB AG. In 1994, Germany's policy makers decided against structural separation and different owners for network and competitive activities. However, the privatisation of the separate business units of DB AG was always planned for the moment their financial health had stabilised. Only the infrastructure unit, DB Netz, is to remain permanently under public ownership. Continued public ownership can therefore be seen as the strongest regulatory instrument used to constrain the monopoly position of the infrastructure operator.

The third element of the German rail reform reinforces the regional element of the rail service. With the objective of improving overall efficiency, quality, and co-ordination of regional services, the *Länder* have been granted responsibility for regional passenger rail transport in terms of finance and planning.

Traditionally, urban and sub-urban public passenger transport (tram, bus, underground, and light rail) is controlled by a number of local or regional authorities, the most important of which are passenger transport authorities known as '*Verkehrs-Verbünde*'. These are legal bodies co-ordinating, but not owning the public transport operations of their members. A typical *Verkehrs-Verband* comprises the respective local public transport operator or operators, DB AG (who runs and operates 95% of all sub-urban and regional rail passenger services), and possibly a small number of private bus companies[28]. By 1997, Germany had 28 *Verkehrs-Verbünde* covering about 47m people and new authorities were still being created in the new *Länder*.

On 1 January 1996, DB AG transferred all activities related to regional passenger rail service to the *Länder*[29]. Some differences exist in terms of how the *Länder* have then chosen to pass on this newly acquired authority. In some cases, the Land has kept all control over regional transport, or responsibility will be transferred to local authorities only at a later stage. Still other *Länder* have devolved power to the local authorities of the major cities only. However, in most cases the *Verkehrs-Verbünde* have seen their power increase. The reform has notably increased the bargaining position of local and regional authorities vis-à-vis DB AG. Prior to reform, all regional railway costs were reimbursed by the federal government via DB AG. The federal operator was a powerful partner who could veto or amend new investment or

[28] There exist however great differences between different *Verkehrs-Verbünden*. The *Verkehrs-Verbund Rhein-Ruhr* for instance comprises 15 cities covering over 100,000 inhabitants and their respective public transport operators.

[29] Regional passenger services are defined as journeys taking less than an hour or covering a distance of under 50km.

planning decisions. Today, regional rail is integrated into the existing regional transport programs, the funding of which is assured by federal, regional and local finances without passing via DB AG. A substantial share of the tax revenue generated by the energy tax is transferred to the *Länder* to fund regional transport services.

In order to achieve quality and efficiency improvements of regional public transports, the decentralised transport authorities dispose of considerable flexibility and autonomy (see section 4.2 for an example of regional transport initiatives). Funds can be transferred between modes of transport, leaving the local authorities to decide which means of transport services a given route most cost-effectively.

2.3 Telecommunications

2.3.1 Industry structure and reform

While decentralised market structures prevail for German electricity supply and rail, the pre-liberalisation German telecommunications services were organised in an integrated national market. Both telecommunications and postal services were provided by a single operator, Deutsche Bundespost, which formed part of the Federal Ministry of Post and Telecommunications. As a general rule, the liberalisation of the German telecommunications sector has closely followed European legislation in the domain.

The German government proceeded to restructure the Federal Ministry in 1990. Three public companies, responsible respectively for telecommunications, postal services and the financial services of the post, were split from the ministry. In 1994, an amendment to the Constitution, necessary to implement the changes requested by Brussels in view of the liberalisation of the sector, was voted. The three public companies created in 1990 were transformed into private corporations and their

statutory monopoly rights to service the telecommunication and postal markets exclusively were abolished. The private company that took over the telecommunications business from the public operator is called Deutsche Telekom AG (DT AG).

In August 1996, the new German Telecommunications Act came into force. All telecommunication services with the temporary exception of voice telephony were opened to supply competition[30]. The law also abolished the infrastructure monopoly of DT AG with immediate effect and a number of alternative network operators appeared at this stage, often basing their networks on existing facilities such as rail or electricity infrastructures. Competition developed first for services such as data transfer and corporate networks. In 1996, the government sold the first slice of 26% of DT AG in a public offering.

The last step of the liberalisation of the telecommunications market was taken on 1 January 1998. In accordance with European prescriptions, the monopoly for fixed voice telephony was ended. At the same date, the first and so far only sector specific regulatory agency in Germany, the authority for telecommunications and post (*Regulierungsbehörde für Telekommunikation und Post, RegTP*), started its activity.

3. Regulatory framework

For each of the three industries discussed in this chapter, the regulatory institutions monitoring the introduction of competition and regulating monopoly network

operators differ. In electricity, the historically fragmented industry structure with mixed ownership pattern has led to the unique establishment of a system based largely on self-regulation, with the Federal Cartel Office acting as watchdog over competition. In rail, an important regulatory role is still held by the federal government through its continued ownership of the network operator. A federal rail authority has been set up, however, its brief concentrates on technical rather than economic regulation. Perhaps most importantly, reform has strengthened the role of regional transport authorities which foster competition on regional level. Only in telecommunications has a sector-specific regulatory authority been put in charge of regulating DT AG and promoting competition as one of its primary duties.

3.1 Electricity

The decentralised structure of the German ESI is reflected in the existing regulatory institutions. At the federal level, sector policy is devised, and legislation elaborated. The larger part of energy policy is the responsibility of the Federal Ministry of Economics and Technology, although the important area of nuclear energy policy falls under the competence of the Ministry of Environment. Federal and regional legislation is implemented on *Länder* level through regional government offices. The *Länder* authorise new plant, and approve the retail tariff customers are charged. Municipalities, for their part, have retained the right to levy concession charges in exchange for rights of way. This basic regulatory set-up has not changed with the opening up of the industry to competition.

[30] Only fixed telephony services are considered here. Mobile voice telephony had been provided in a duopoly

3.1.1 Network access

The new German electricity law emulates the key ideas of the EU electricity liberalisation directive. It is based on the vertical separation of the different functions of the ESI, that is upstream generation, transmission, and downstream distribution and supply. However, neither the directive, nor the new German electricity law impose structural or ownership separation of naturally competitive and potentially monopolistic activities. Only the management separation of businesses and the functional unbundling of accounts is required, and liberalisation has done nothing to change the integrated nature of the German ESI[31].

In a decision unique in Europe, the German government decided to grant the industry the right to self-regulate in the crucial area of network access. Simultaneously with the elaboration of the new electricity law, the main parties involved in the industry have concluded an access agreement (known as *Verbände-Vereinbarung*, or V-V[32]), which forms the basis for negotiated third party access to the transmission and distribution grids. Only if the self-regulation of the industry fails and the development of competition is judged insufficient, has the Federal Ministry of Economics reserved itself the option to legislate for access, and move *de facto* to a system of regulated third party access.

market since 1990.

[31] Sturm and Wilks (1997, p.22) argue that such a structural reform would have been virtually impossible given the ownership structure in the industry.

[32] The agreement was negotiated between the association of electricity producers (*Vereinigung Deutscher Elektrizitätswerke*, VDEW), the association of German industry (*Bundesverband der Deutschen Industrie*, BDI), and the association of the industrial energy sector (*Verband der Industriellen Energie- und Kraftwirtschaft*, VIK).

The V-V sets out the rules for negotiated third party access[33]. It lists the cost elements to be included in transporation charges, but does not set any price levels. These are the subject of negotiation between the network operator and the third party requesting access. Indicative transportation prices are to be published by all network owners six months after the implementation of the agreement.

The V-V has already been re-negotiated once since 1998, with the new version, V-V2, in place since the beginning of 2000. The V-V2 responds to criticisms of the first agreement, simplifying significantly the structure of the transmission charges. However, initially, the highly contentious distance element in the charges did not entirely disappear with the new agreement. V-V2 divided Germany into two trading zones, North and South, with a surcharge levied on all net traffic between the two zones. The same surcharge was intended to apply to transmissions over the national border, a fact that has angered foreign suppliers. Only the negotiations surrounding the approval of the two big mergers discussed in the previous section have led to the disappearance of the distance charge for transmissions within Germany.

It should also be noted that in parallel to the concessions gained by the competition authorities, negotiations aiming at a harmonised cross-border tariff system for all European countries by the so-called Florence forum took place. Once the Europe-wide cross-border tariff agreement overseen by the European Commission comes

[33] For a very complete analysis of the first V-V, see Brunekreeft (1999).

into force, the German access agreement will lose its relevance for cross-border transactions.

3.1.2 Consumer price regulation

A federal law on electricity tariffs (*Bundestarifverordnung für Elektrizität*) sets out the principles of retail price regulation for tariff customers, but there exist differences in the interpretation of the law between different *Länder*. Moreover, the regulatory process is far from transparent. Utilities submit their tariff proposals and any requested cost information to the relevant regional authorities, but only the approved tariffs are published. Attempts to introduce elements of yardstick regulation into the system have proved only very moderately successful so far.

With the liberalisation of the ESI, the official stance taken by the government with respect to retail price regulation has always been one of abolishing the remaining regulations once competition has taken root. With the fast (and larger than expected) advent of price reductions also for residential customers (see also section 4.1), a representative of the industry association VDEW has confirmed that the regulated prices are maximum prices which have lost their significance.

3.1.3 Environmental and social obligations

An important role in the regulation of the German ESI is played by environmental regulations. Besides the subsidy program for domestic coal[34], it is the increasing

[34] This complex issue goes beyond the scope of this chapter. See IEA (1998) for an overview of the coal subsidy program.

support given to renewable energy sources and severe emission controls that have most influenced the industry in the last decade.

In 1990, the so-called Electricity Feed-in law (*Stromeinspeisegesetz*) was adopted to promote the use of renewable energy sources. It guaranteed access to the public grid for hydro, wind, and solar generators. These received a standard payment of 90% of the tariff customer retail price for all electricity they fed into the public grid. The law has had a particularly significant impact on wind based power generation, making Germany the most important producer of wind based electricity world wide. On 1 April 2000, a new renewables law (*Erneuerbare-Energien-Gesetz*) became effective, replacing the Electricity Feed-in law. The new law expands the range of input fuels eligible for support. Importantly, it also ruptures the link between the price utilities have to pay for 'green' electricity fed into their grid, and the retail price. Under the new renewables law, electricity suppliers are held to purchase renewables generated electricity at fixed prices varying as a function of the generation fuel between 13 and 19 Pf/kWh. In comparison, according to the industry association VDEW, the price for wholesale traded electricity in Germany was below 10 Pf/kWh in April 2000.

In addition to the promotion of renewable energy sources, the imposition of some of the most severe emission controls world-wide have over the last decade played an important role in Germany's notoriously high pre-liberalisation electricity prices. The success of the environmental policies is however also apparent. Between 1987 and 1997, carbon dioxide (CO_2) emissions of public electricity suppliers fell by 23% from 339 mt (million tonnes) to 261 mt (VDEW 1998, p.53).

In contrast to the extensive environmental regulation, no social obligations are imposed on the German ESI. The protection of vulnerable consumers is part of the

general social security policy. Geographical averaging of electricity prices has never been pursued in Germany and a multitude of residential electricity tariffs exist in different areas. It can be argued that this lack of social obligations directly linked to the industry has reduced political resistance to the speedy liberalisation of the industry.

3.2 Rail

A decentralised regulatory structure is also in place in the German rail industry. The federal government continues to hold an important role, and a federal rail agency has been established in 1994. At the same time however, regional transport authorities have seen their responsibilities increase since 1996. Similar to the electricity sector, the Federal Cartel Office acts as ultimate guardian of competition.

3.2.1 The Federal Rail Office

The Federal Rail Office (EBA) is an independent authority under the supervision of the Federal Ministry of Transports. It acts as representative of the government in its function of supervising DB AG's investment projects. The regulatory brief of the EBA comprises foremost technical matters. It issues federal rail licences, which are either service licences needed for operators desiring access to the federal rail network, or network licences, for the operation of a rail transport network. Related to the issuing of licences, the EBA also monitors technical and safety standards and is also in charge of accident investigations.

Moreover, the federal rail agency decides upon request on the closure of rail lines. It is however important to note that political factors play an important role and local and regional pressure groups often prevent the closure of a given route. With the regionalisation, a certain number of financially not viable lines have been purchased from DB AG by regional transport operators (see also section 4.2).

The EBA is also responsible of supervising non-discriminatory access to the federal rail infrastructure, its role is however essentially advisory. It acts as mediator between different rail operators and provides clarifications. The EBA intervenes only on request, and only in the negotiation phase. Non-discriminatory access for third parties is monitored by the agency only with respect to third parties. Preferential treatment between different business units of DB AG is considered a problem by many observers but goes beyond the remit of the EBA. Enquiries of anti-competitive practices are undertaken by the Federal Cartel Office. No price control has been set up for network access charges, which are discussed below.

3.2.2 Network access

Under the new legislation, the infrastructure unit of DB AG, DB Netz, is obliged to provide non-discriminatory access to the federal rail network on the basis of an indicative access price list. DB AG is held to act as commercial undertaking and as such is free to set access prices at a level that allow it to cover maintenance costs of the network. New investment in infrastructure is funded separately by the federal government.

The first track access prices were published in June 1994. Basic charges are cost based and as such depend upon the type of train being operated, its weight, maximum speed and planning quality (the planning quality allows timetabling by attributing different priorities to trains[35]). Important volume discounts are offered by DB Netz with respect to the number of kilometres run, a practice which has been

criticised by competing companies because of the clear price advantage it confers to DB AG. The discounts have subsequently been investigated by the competition authorities.

Track charges are not inclusive, as further payments are levied for electricity costs, using tracks to collect carriages and locomotive, or for leaving a train overnight or reimbursing electricity charges. The overall ratio between track access and other charges is about 65:35 (Hass-Klau et al., 1998, p.60).

The continued influence of political factors in the sector can be seen in the fact that charges for infrastructure services, but also for other services provided by DB AB over the network, may be reduced following negotiations between DB AG and the *Länder*. As outlined in section 2.2, the cost of regional rail services are since 1996 funded by the *Länder*, either directly or via local authorities. All these bodies agree an overall price with DB AG for the services it provides for them regionally[36]. A *Land* or *Verkehrs-Verband* may share the cost of new trains or station improvements, and the price per kilometre for services provided by DB AG varies as a function of a Land's own rail investment. Some bodies conclude annual contracts with DB AG to increase their bargaining power, others renew their contracts every 2-3 years.

At regional level, the network access principle is combined with competitive tendering organised by the regional authorities for exclusive regional or local service

[35] For illustrative examples of the pricing system see Hass-Klau et al. (1998, pp. 57-58).
[36] The passenger transport unit of DB AG still runs 95% of all regional rail passenger services, either on its own or on non-federal tracks. It also operates urban and sub-urban bus services.

licences. The tenders are open to all licenced operators. DB AG has lost several service licences to smaller companies which were better able to cater for specific needs at the local or regional level. Regional operators winning a licence will pay access charges for the use of the tracks, which can be either owned by DB AG, or by local bodies. Since 1996, a number of railway lines have been transferred from DB AG to other network operators, often at a nominal price[37].

Price regulation of regional passenger services (no other prices are regulated) are the responsibility of regional authorities, and take the form of maximum price caps.

3.3 Telecommunications

3.3.1 The Regulatory Authority for Telecommunications and Post

The regulatory authority for telecommunications and post (RegTP) is so far the only sector specific regulatory body in Germany and is in charge of all aspects of telecommunication and postal regulation. Regulatory action in the sector is as a general rule limited to dominant undertakings, which makes DT AG so far the only operator subject to price and quality regulations, both in network and end-user services.

The RegTP has taken over the regulatory tasks of the former Ministry for Post and Telecommunications and the supervisory role for technical harmonisation, formerly the responsibility of the Federal Office for Post and Telecommunications. The new

[37] Such routes were often unprofitable for DB AG and local bodies have purchased them to avoid closure, often finding innovative solutions to future service provision.

authority has a staff of nearly 3,000, most of whom are civil servants taken over from the now defunct federal administrations.

The regulator is organised in five independent 'decision chambers' each of which is in charge of a different regulatory domain, such as price regulation, dispute settlement or network access. This organisational form allows internal independence, increases transparency, and limits regulatory discretion[38]. The role of the *Länder* was a contentious issue during the elaboration of the new regulatory framework, and a compromise was reached through the creation of an advisory council, which works alongside the regulatory chambers. One half of the council's 18 members are appointed by the *Länder*, the other half by the Bundestag, Germany's federal parliament.

3.3.2 Network access and price regulation

The 1996 Telecommunications Act obliges dominant network operators to grant network access and to allow its competitors to interconnect to its network on non-discriminatory terms. The equal network access regulation implies that direct resellers entering the market (offering mostly call-by-call services) are able to offer services without substantial investments. Similarly, the interconnection obligation means that alternative network providers are able to attain universal coverage regardless of the initial size of their networks. From the outset of competition, the regulatory decision that number portability had to be free of charge has helped keeping switching costs low for consumers.

The interconnection tariffs DT AG is allowed to charge are determined by the RegTP. They are cost-based and the initial price levels have been determined by international benchmarking in 1997. Since then, two analytical cost models for national and local network access have been set up and were the object of an extensive public consultation process (WIK 1998).

In addition to network related service prices, the retail prices of DT AG are regulated by a price cap. DT AG was held to reduce the average price level for each of two separate service baskets by 4.3% in the 2-year span 1998-99 (the first basket contains local and long-distance services for private customers, the second for business customers). However, vivid competition has made prices fall considerably faster than the regulatory rule implied and the retail price cap has proved non-binding for DT AG.

3.3.3 Public service obligation

The new German legislation provides for a universal service fund for telecommunications, following the approach advocated in the European directives. The level of service which has to be made available by service providers to all persons requesting it is defined in the Telecommunications Act. Regulatory intervention in the market in order to guarantee this level of service is kept to a minimum. The regulator only intervenes when the provision of services resulting from commercial decisions is insufficient compared to the defined minimal level. In such a case, the dominant operator is given the option to provide the missing service

[38] The organization in 'decision chambers' can also be found in the Federal Cartel Office.

without financial compensation. If it refuses to do so because it judges the cost of the service too high, the right to provide the service in question is granted via competitive tender, and the service is funded through the universal service fund. All telecoms operators above a certain market share contribute to the fund. However, so far, the reimbursement scheme has not been used in practice. DT AG remains the only universal service provider and so far it has requested no financial compensation.

4. Market development since liberalisation

4.1 Electricity

Since the German ESI has been opened up to competition in April 1998, prices have fallen sharply and the industry is consolidating. In a stagnant market, price competition is expected in defence of market shares, so it is not the fact that prices were falling, but rather the speed at which it was happening that has surprised observers.

Germany has for a long time been known for its high electricity prices. This is partly explained by the cartel-like organisation of the industry, and partly by the high costs of coal subsidies and environmental policies borne by German electricity consumers. The abolishment of the protective industry agreements through liberalisation, the disappearance of the coal levy in 1996, and the coming to an end of most of the environmental investment programs, all have coincided to allow price cuts. Moreover, according to a recent report by McKinsey[39], the German electricity

[39] McKinsey (2000) 'A shopper's guide to electricity assets in Europe', *The McKinsey Quarterly*, 2000 Number 2: Europe, 60-67.

industry displays large over-capacities: of a total of 118.0 GW installed capacity, only 66% are necessary to satisfy peak demand. This implies that the marginal cost of generation is close to zero, and companies can sell at very low prices indeed, at least for a limited period.

According to a monthly price survey undertaken by the federal association of energy consumers VEA, German electricity prices for industrial customers have on average, in the 12 months between July 1998 and July 1999, fallen by 13% with some price cuts exceeding 25%[40]. The re-negotiation of contracts is the main instrument through which price reductions are realised for large end-users. One of the most successful instruments to re-negotiate contracts has been the emergence of customer pools, the largest of which is the Hanover-based association of energy consumers VEA with 2,500 participants. It succeeded in 1999 in re-negotiating the power supply of its members with the regional supplier PreussenElektra at a price 30% below pre-liberalisation levels for some of its members.

Price competition has also surprisingly fast reached the residential market, and competition for small tariff customers is fierce, with a wide range of individually tailored tariffs emerging, including 'green' tariffs promising variable content of renewable-generated electricity. Table 1 gives an indication of the tariff offers available to tariff customers in 1999.

[40] Average price for different industrial usage profiles. Net prices excluding all taxes. Bundesverband der Energie-Abnehmer (1999) *VEA-Strompreisvergleich*, Stand 01.07.99.

Table 1: Tariff offers for German residential users

Electricity brand	Unit price[1] (Pf/kWh)	Difference to average price (%)
EnBW 'Yellow'	25.4	-20
PreussenElektra 'Direkt'	26.77	-16
RWE 'Avanza'	28.15	-11.5
Bayernwerk 'Power'	29.09	-8.5
Federal average[2]	31.8	—

Notes: [1] Domestic user with 4,000 kWh annual consumption. [2] Includes eastern German prices.

Source: Power in Europe, February 3rd 2000.

Despite the important price cuts offered by electricity suppliers, switching numbers for residential customers are so far low. In a recent speech, a VEW board member put the number of residential customer switching at 3%. Partly, this low number can be explained by initial uncertainty about the terms and prices at which alternative suppliers can gain access to residential customers. This uncertainty has since been substantially reduced by the pro-competitive stance the Federal Cartel Office has taken, refusing so far to accept the denial of access by incumbents and deciding systematically in favour of competitive entrants[41]. Low residential switching can also be linked to customer loyalty to municipal suppliers. Many end-users are aware of the role revenues for municipal electricity supply companies play in municipal budgets and are arguably willing to accept marginally higher prices on the basis that they cross-subsidise other loss-making local public services, such as public transport. According to a January 2000 report on VEBA/VIAG by Deutsche Bank, price falls

[41] According to the information published on the FCO webpage, of six access cases brought in front of the authority in 1998 and 1999, none were decided in favour of the incumbent refusing to grant access.

for all domestic customers, not only those willing to switch, will be 10% in 2000, 3.6% in 2001 and 1.2% in 2002[42].

As a reaction to the downward price trend, German electricity utilities consolidate to reduce costs. The two biggest mergers were announced at the end of 1999, involving respectively RWE and VEW, and VIAG and VEBA. Both German and European competition authorities expressed their concern that the two mergers would reduce the number of independent supra-national electricity utilities to three (RWE/VEW, VEBA/VIAG, and EnWB), with the two newly merged companies effectively gaining a duopoly position in the market, controlling between them 80% of power supplied over the high-voltage grid. As a consequence, the competition authorities have made the divestiture of cross-shareholdings a precondition for the approval of the mergers. Parallel to the mergers taking place between supra-regional players, many regional and municipal utilities are either being tied in closer with their main upstream suppliers, or form consortia to cut fixed costs, such as marketing costs. A number of foreign investors have also seized the opportunity offered by the profound changes in the industry and have entered the market through acquisitions of large municipal companies in Berlin and Hamburg for instance.

4.2 Rail

In 1998, there existed around 200 licensed rail operators in Germany[43]. About 30 are independent passenger rail operators, many more are involved in freight. Many are

[42] Report cited in *Power in Europe*, February 3rd 2000.
[43] Internal EBA document, 1998.

operational units of DB AG, others are non-federal and private undertakings. A number of new entrants have been recorded, one of the most important being KAP Lock, a logistics company jointly owned by the federal postal operator Deutsche Post AG and UPS. Access to the federal network by national and international rail services (often high-speed services) is increasing. The success of the existing high-speed passenger services has led DB AG to invest heavily in the expansion of its high-speed tracks.

On local level, all of the larger German cities have undertaken substantial investment in urban and sub-urban public transport networks. One of the largest investment projects is the major refurbishment of 25 railway stations (e.g in Stuttgart, München, and Frankfurt), with surface tracks being brought underground to free city centre building pace.

The devolution of responsibility introduced by the regulatory reform has enabled local service providers to display greater initiative in terms of service innovation. An example of regional projects is provided by the local railways in Düren, cited in Hass-Klau et al. (1998). The Dürer Kreisbahn is 45km long and runs between Cologne and Aachen. In 1993, DB AG wanted to close the line but a local campaign prevented this, and instead the line was taken over by the local transport operator in Düren. The operator had so far been running the public bus services in the town of 91,000 inhabitants. The tracks were bought for 1 DM from DB AG. New lighter and cheaper trains were specially developed and build for the route. Moreover, the timetable was changed to an hourly service with interchange facilities to other public transport services along the route. Flexible timetabling was made available for special events. In 1996, a 360% increase in passenger numbers with respect to 1989

had been realised. Funding for the operation was to 60% provided by the state government of North Rhine – Westphalia.

A big problem remaining for entrants in the German rail sector is access to rolling stock. Rolling stock is a large investment for new companies and DB AG is at an advantage disposing of large existing stock and it often entertains preferential relationships with the big rolling stock companies. Nonetheless, two ways to address this problem have emerged. Subsidies of 50% and above are available from the states for the purchase of new rolling stock. Moreover, franchise periods for private firms are generally longer (7-10 years) than those offered to DB AG (2-4 years) to take the greater need to recover fixed set-up cost into account.

4.3 Telecommunications

Every two years the RegTP is held to present a report on its activity to the two chambers of the German parliament, Bundestag and Bundesrat. The first of the regulatory reports was submitted in December 1999 (RegTP 1999), and it highlights the successful introduction of competition in the first two years of the liberalised market.

At the end of June 2000, 150 providers of voice telephony offered their services (RegTP 2000b). Among them, over 90 possess own network facilities, and over 50 specialise in resale[44]. Overall, over 1,800 companies were offering telecommunications services mid-2000. This number includes the growing group of

internet service providers (ISPs). Three new fixed network operators with national scope, o.tel.o, Viag Intercom and Arcor, have entered the market since 1996. Their networks are based on existing backbone infrastructure (electricity transmission in the case of o.tel.o and Viag Intercom and railway infrastructure in the case of Arcor). Other network operators have restricted their infrastructure to a region or city. So-called 'city carriers' include NetCologne or ISIS, but many of these carriers are at present expanding the scope of their operations by connecting their local networks. Competing network operators have mainly invested in optic fibre technology, and by the end of 1999 the combined length of the optic fibre network operated by companies other than DT AG reached over 40% of DT AG's optic fibre network (RegTP 2000a).

The sector regulator also draws attention to the emergence of inter-carrier business as new growing market segment. Revenues from interconnection deals between fixed, and fixed and mobile networks have more than doubled between 1998 and 1999 (RegTP 2000b). Carrier exchanges allow network operators and service providers to optimise their investments in call and transmission capacities. Brunekreeft and Gross (1999) argue that substantial excess transmission capacity exists in the short run as infrastructure entrants have chosen the size of their network in anticipation of strongly increasing demand. This explains in part the aggressive price competition taking place at present (see below).

[44] Considerably more companies have been granted voice telephony network or service licences by the industry

In 1998, the totality of new entrants in the voice telephony market held a market share of 4.9% in terms of call volume[45]. By mid-1999, their part had grown to 14.4%, a year later, to 20%. The market share of new entrants is highest for the group of long-distance, international and calls-to-mobile services: over 40% of call minutes are attributed to competitors of DT AG in July 2000. Traffic growth was 10% in 1997/98 and 17% in 1998/99, due to the strong increase in internet related traffic and fixed-to-mobile calls. The presence of companies other than DT AG in local call services and as providers of access services is considerably weaker, but competition is also increasing for those services. While in 1998 only 0.5% of the former and 0.3% of the latter were attributed to new entrants, these numbers had grown to 4.8% and 1% by mid-1999.

Competitive end-user access is so far largely achieved using lines rented from DT AG, either by city carriers, or by network owners in the process of building universal networks. Germany's regulator has already in 1998 implemented local loop unbundling obligations for DT AG, and by mid-2000 82 local loop contracts had been concluded between the incumbent and competitors for access services. Entrants are also increasingly exploiting two further means of bridging the final link to the end users, the first being the wireless local loop (WLL), the other broadband cable connections. In 1999 and 2000, over 160 WLL frequences were allocated by the regulator.

regulator. However, a great number of licence holders have yet to offer services to end consumers. See RegTP's

Moreover, Germany has one of the world's most developed cable TV networks. In January 1998, 48.2% of all households with TV were connected to broadband cable (WIK 1999)[46]. The percentage of *connectable* households is even higher with 85.0%. While DT AG dominates the trunk cable network, a large number of local providers (between 4,000 and 6,000) are active in the local loop segment. Only a third of households are directly serviced by DT AG. Using local loop unbundling and alternative access techinques, approximately 55 licensed operators offered access services to end users by mid-2000.

In July 1999, the telecommunications consumer price index computed by the Federal Statistical Office was 12.3% lower than 18 months earlier, at the moment of market opening (RegTP 2000a). The price index fell furthest for national long-distance calls: for this call category consumers faced prices that were on average 42.5% lower than in January 1998 and maximum savings of 85% could be realised. Similar maximum savings were realised for the most frequent international call destinations. The cost of local calls and telephone connections by contrast has not changed since liberalisation, because of re-balancing and the slower take off of competition for these services.

Industry turn-over figures show the shift occurring between telecommunications activities very clearly (RegTP 2000b). In 1999, overall turn-over increased by 10%

webpage for the full listing of the 305 licence holders (number as of 30 June 2000).

[45] Figures in this paragraph are drawn from WIK (1999) *Entwicklung der Märkte für Telekommunikationsdienstleistungen*, November 1999, as well as RegTP (2000b).

compared to the previous year. Three new activities drive growth and compensate for the 10% fall in turn-over generated by fixed telephony services. First, mobile services have grown by 34%, second, inter-carrier business has doubled, and third, other activities, including notably internet service providers, have seen their turn-over increase by 25%.

5. Assessment

The introduction of competition in the German utility markets surveyed in this chapter should be qualified as a success. Prices have fallen by double digit figures since the liberalisation of the telecommunications and electricity industries, and new services and tariff options proliferate in all industries surveyed. However, in view of the long-term sustainability of this competition, a number of structural concerns need to be noted, notably in the electricity industry.

The over-capacity in generation assets and the resulting price war makes entry into the German electricity market at present unprofitable and confers a strong position to the consolidating incumbents. While consolidation is driven by the need to reduce costs and is arguably desirable in an industry with close to 1,000 players, the question remains whether the survivors of the price war will be able to dominate the energy market and adopt collusive behaviour and/or errect entry barriers.

We argue that three market developments can help the competition authorities in their task to constrain possible future abuse of market power in the electricity

[46] In comparison, 65% of US households have cable TV, but the number is only 14% in Spain, 13% in Japan, and

market. First, dominant positions in the German market can be somewhat mitigated by competition from abroad. The high degree of interconnectivity of the German grid makes entry by foreign competitors possible, subject to the regulation of non-discriminatory access terms to the interconnectors. The finalisation of a European agreement on trans-border transmission charges by the Florence regulatory forum and the European Commission might also improve conditions for cross-border trade. Among Germany's neighbours count some highly competitive power markets, which will make it harder for German incumbents to raise prices above the competitive level, lest they want to invite competitors from abroad. Second, German consumers have very fast adapted their power purchasing behaviour to competitive markets and successful strategies such as the formation of consumer pools, are likely to persist and keep competition alive as long as there are a sufficient number of offers to choose from. Third, the introduction of competition in European electricity markets has led to the emergence of standardised power exchanges. These facilitate upstream and downstream entry by national or international companies and thus have a beneficial effect on the development of competition. In Germany, power exchanges have taken up operation in Leipzig and Frankfurt. Moreover, the Amsterdam Power Exchange (APX) has opened a regional hub in Germany.

Despite these positive market developments, serious concerns remain regarding the German ESI because of the lack of structural separation between the transmission system operators and upstream and downstream undertakings. The utilities have

11% in France and Great Britain.

unbundled their accounts following the prescriptions of the European directive, but no physical separation has been imposed, and the owners of the monopolistic grid are also active in the competitive generation and supply business. Such a setting leaves room for doubt about the fairness and non-discrimination of grid access with respect to third parties, in particular given the context of self-regulation of grid access by the industry. The FCO has shown its determination to protect competition in electricity supply; however, no systematic information collection for the purpose of benchmarking or cost modelling occurs in the absence of a specialised regulator. Without instruments to overcome the information asymmetry between the industry and the competition authorities, it might be difficult to assess the anti-competitive potential of price and entry strategies in the future market.

The regulation of the monopoly network is also one of the least transparent elements of the reformed German rail industry. The principal safeguard against DB AB abusing its monopoly is the continued public ownership of its infrastructure unit. Access charges are supposed to be cost-based and cover all maintenance costs of the track infrastructure. However, there does not exist any formal price control and incentives for cost reduction are non-existent. Neither have anti-competitive and discriminatory practices—such as volume discounts which favour operational units of DB AG—been addressed in a systematic manner.

The incumbent rail operator is constrained in its actions by political forces the influence of which remains strong, in particular after the devolution of authority for all regional passenger transport services to the *Länder*. The prices published by DB AG are often not those eventually paid by regional authorities. Transport service contracts are subject to negotiations between regional authorities and DB AG and

public service considerations play an important part. It has to be noted, however, that the very flexible approach shows advantages in the emergence of innovative and efficient public transport services at regional level.

It is in the telecommunications market that competition is arguably most firmly established. The incumbent DT AG has lost up to 40% of market share in the first two years of competition and prices are falling rapidly. The entry of numerous operators with own transmission capacity means that the industry is at present displaying over-capacity and price competition is fierce, a development very similar to the electricity market. The significant difference between the two industries is that over-capacity in telecommunications is caused by competitive entry into the infrastructure domain, thus eroding the network monopoly argument[47]. Moreover, the telecommunications market is still expanding rapidly, leaving room for new entrants and services. In electricity, duplication of the grid infrastructure is still considered uneconomic, and over-capacity in generation will only disappear in the medium term to leave room for more efficient generating plant to replace current plant.

6. Concluding remarks

While not one of the pioneering countries of liberalisation in Europe, Germany has in the past decade gone far regarding the introduction of competition into the three network utilities discussed in this chapter, that is, electricity, rail and telecommunications. German reforms embrace the principles of European legislation

for the industries in question, they have however gone beyond the minimal prescriptions of the European directives where electricity and rail are concerned. An important conclusion from the overview provided in this chapter is that unique national features, in particular the decentralised nature of electricity supply and of rail transport services, have shaped the regulatory framework that has been set up in parallel to the introduction of competition. Only in the telecommunications industry has a sector-specific regulatory body been established, emulating what has become the UK model. For both the electricity and rail industries, it is the Federal Cartel Office that acts as guardian of competition. Medium and long-term structural problems remain in electricity and rail, but in the short term, the overall success of the liberalisation measures in bringing about cost savings for the German consumers, at least in electricity and telecommunications, cannot be questioned.

[47] Consolidation because of over-capacities is also occurring in the telecommunications industry. Arcor bought o.tel.o in April 1999 so that only two of the initial three alternative national network operators remained. However, new entrants keep concentration ratios low even in the network activities.

Chapter 3: An estimation of UK telephone access demand using pseudo-panel data

1. Introduction

In recent years, there has been rising concern about the impact of liberalisation on universal service in the telecommunications industry. The gradual removal of internal cross-subsidies as practised in the monopolistic telecom markets has brought about a rebalancing of telephone tariff structures. The opening of the market to competitive forces has forced the alignment of tariffs with costs. There is concern that the increase in connection and rental charges, as well as in local call charges, that has accompanied the fall in long distance and international call prices, may have a negative impact on the universal affordability of the telephone service. Reflecting this concern, national and European regulatory agencies have emphasized the importance of maintaining the high, pre-liberalisation standard of universal accessibility and affordability. The general feeling is that measures are needed to avoid the tendency for lucrative corporate user market benefits to be realized at the expense of some categories of residential customers.

In this chapter we address three questions. First, what is the impact of access price variations on residential telephone access in the UK? Second, which socio-demographic variables influence telephone access beyond the price dimension? And finally, are certain socio-demographic groups – low income, the elderly, single mothers - burdened disproportionately by the rebalancing of prices?

We estimate a telephone access demand model to obtain elasticity measures allowing us to assess the threat of drop-off caused by increased access charges. Earlier studies of telephone access demand commonly find that demand is quite inelastic with respect to price. However, small access elasticities for the population at large might

mask much larger values for specific groups. Evidence from the US based on micro-data seems to support this argument. See for instance Cain and Macdonald (1991). Targeted support programs for these population groups should be considered to improve their access to the telephone. The identification of characteristics which make a household more or less likely to have telephone access facilitates the formulation of targeted subsidy programs. We believe such subsidy programs are an economically efficient tool for maintaining universal service goals and improving telephone penetration among marginalised population groups.

The main objective of this chapter is the estimation of a demand model for telephone access based on UK household data. This objective is motivated by a gap in the literature. Very little evidence in the UK concentrates on access and few studies are based on household data. One explanation for the relative lack of evidence on access demand in the UK compared with North America is the structure of the telecoms market in Europe. In Europe, the monopolistic provision of telecommunication services was accompanied by a uniform pricing policy which has remained in place even after liberalisation efforts. This excludes the use of pure cross-section studies for the purpose of assessing price elasticities (the "North American" model). In order to estimate the impact of price movements on household access despite this market organisation, we construct a data set with a repeated cross-section structure. The estimation method based on pseudo-panels makes it possible to consistently estimate elasticities from this data. Thus we can model the household decision on telephone access in a discrete choice framework where the telephone service decision is related to the cost of connection, household income and a host of other socio-demographic factors. Our results suggest UK price elasticities lying within the spectrum of results reported for North America. We also find evidence of substantially higher access

elasticities for lower income groups thus confirming the marked income sensitivity of access.

The remainder of the chapter is structured as follows: Section 2 gives a brief overview of the evidence on telephone access elasticities in North America and the UK. Section 3 describes our modelling approach and the data used. Section 4 outlines the pseudo-panel econometric technique. In section 5 we summarize and assess the empirical results. Section 6 concludes.

2. Review of the evidence

2.1 North America

One of the main sources of information on telephone demand is Taylor's (1980 and 1994) survey of the theoretical and empirical literature. Taylor notes that the erosion of the internal cross-subsidies in the telecoms industry meant that US research in the 1980's has seen an increase in the number of studies on the demand for residential access. The literature on access remains meagre, however, compared to that on call demand. One of the main reasons for this limited evidence stems from the fact that historically the US market has been characterized by local calls and access being bundled together[48]. Consequently much of the literature analyses this bundled service and not access as a separate service. The empirical debate in the US has centered around the question of whether or not elasticities are significantly different from zero. Taylor (1994) reports of only eight studies which had been published on

[48] In the case of bundled local service, a unique fixed rental charge includes an unlimited number of local calls. Measured local service was gradually introduced throughout the US in the 1980s.

telephone access pre-1980. Five of these use aggregate time-series data[49]. The remaining three use cross-section data, but only Perl (1978) estimates a model based on household data[50]. Taylor (1994) summarizes the evidence on access by giving a range for the basic service charge elasticity of -0.06 to -0.17, with a mean of around -0.1. Considerably smaller figures are quoted for the initial connection charge (-0.02 to -0.04). Income elasticities were centered around 0.5. Taylor suggests that residential access price elasticities have fallen somewhat during the 1980's due to higher penetration rates. Overall Taylor concludes that: "a very small price elasticity and a moderate, but yet decidedly inelastic income elasticity is precisely what one should expect for basic telephone service: access to the telephone system is not a plaything of the rich....but has become a basic necessity for virtually all income groups." (Taylor, 1994, p279).

The small, but nevertheless nonzero, access elasticities obtained pre-1980 have been confirmed and sharpened in the 1980's. See for instance Perl (1983), Taylor and Kirdel (1990), and Cain and Macdonald (1991). More recently, a number of applied studies using increasingly sophisticated quantal choice models have allowed for the fact that today residential users in the US face a multiple tariff choice for telephone access. Studies analyzing access elasticities in the context of multiple tariff options

[49] The five time-series studies mentioned by Taylor are Rash (1971); Davis et al. (1973); Waverman (1974); Pousette (1976); and Southern New England Telephone Co. (1977). Waverman and Pousette use the only European, namely Swedish, data.

[50] The three studies are Alleman (1977) who uses data on a city level, Feldman (1976) who uses data on state level, and Perl (1978) who uses 1970 Census data.

include Kirdel (1988), Kirdel and Taylor (1993), Train, McFadden and Ben-Akiva (1987), Train, Ben-Akiva and Atherton (1989) and Train (1994).

From access demand studies for the US, the consensus emerges that the probability of having a telephone is sensitive to price, but the sensitivity is quantitatively small in aggregated terms. However, early on, Perl (1978) found that access elasticities are sensitive to the level of household income. This result has been confirmed in subsequent studies. Cain and Macdonald (1991) focus on this particular aspect and find that some elasticities are up to twice as high for the poorest income households.

Households most vulnerable to drop-off due to rising local rates are young, low-income, poorly educated households living in rural areas.

2.2 United Kingdom

There is little formal work on access demand in the UK. British Telecom (BT) has conducted a number of studies on telephone demand, the results of which have been published in Cracknell (1982 and 1988), Cracknell and White (1989), and Cracknell and Knott (1995). The models yield estimates of the income and price elasticities for different services, mainly with the aim of improving commercial prediction and assessment of marketing strategies. This focus makes it more difficult to achieve a meaningful direct comparison with other studies in the field.

BT's statistics of residential system growth separately identify demand for new exchange lines, cessations and takeovers of existing lines and therefore allow a more detailed analysis of access behaviour (Cracknell, 1988). A working line was left for take-over in 84% of houses where the previous occupant had moved out. 92% of these takeover offers where taken up by the new occupant. Even among previously untelephoned households take-up was 85%. These rates are much higher than the 7%

of non-movers who joined the network. The statistics show that, in the UK, household mobility provides a substantial impetus to the expansion of the telephone network, while the popularity of taking over service confirms evidence that installation charges can be a powerful deterrent. Analysis of cross-section take-up rates at different prices for different customer groups (e.g. new customers, moved customers, or take-up) gives an implied price elasticity of the order of -0.85 (Cracknell 1988)[51].

BT has also undertaken market research into the reasons for residential cessations (Cracknell and White, 1989). For a sample of 450 household in which there had been a change of telephone service in the previous year, 25% were customers who had not moved and had ceased their lines. In 7% of cases, service was subsequently reprovided to the same number. The majority of disconnections are due to conversion of premises, demolition or delay in re-occupation. A demographic analysis of the non-moving ceasers showed that they tend to be younger households, who are either in unskilled manual work or unemployed with recently born children, living in council accommodation. In a cross-section analysis based on BT's market panel, income proved the most powerful variable to explain residential system growth with a cross-section elasticity of 0.47. Other significant correlations were found between penetration rate and household size, rural versus inner city location, employment status, and number of rooms occupied (a measure of household wealth).

[51] This result is so much higher than others reviewed so far because the price range considered is very different: the connection charge for a new customer is GBP105, while take-ever only costs GBP16 (Cracknell, 1988,

Type of tenancy was not found to be a significant influence. A (non-significant) price elasticity of -0.063 with respect to the annual rental charge was established by a BT study quoted in Cracknell and White (1989).

In an empirical study based on data from the telephone system in Hull (UK)[52], Trotter (1989 and 1996) produces separate demand estimates for access, local and trunk call prices. The focus of his access demand estimation is for access on a particular tariff, rather than for access as a whole. This is due to the fact that the Hull system has had multi-tariff characteristics during a long period and there is thus no single access charge. Trotter uses aggregate time-series data covering the period 1974/75 to 1986/87. The price variables are complemented by aggregate measures of GDP and variables linked to alternative tariff choices (essentially rentals of alternative options available to residential users).

When analyzing the main residential tariff, Trotter (1996) finds that neither levels nor changes in rentals seem to play a meaningful role in explaining the number of customers on the main residential tariff. Nor does the connection charge. This may be because it was relatively stable over the period or because it is lower than the BT equivalent. The lagged number of customers on the tariff is highly explanatory. However, this is to be expected considering the strong time trend present in the

presumably 1987 prices excl. VAT). Other access studies only consider the variation in the connection charge for new customers.

[52] Kingston Communications (Hull) plc is a telecommunications company wholly owned by Kingston-upon-Hull City Council. It holds a licence under the 1984 Telecommunications Act to provide all telecommunications network services in the Hull licensed area. This area has a population of around 350 000 people serviced by some 150 000 exchange connections.

telephone penetration variable. Because of the small number of observations, the results are not very stable. Nevertheless, Trotter reports a short-run access elasticity of 0.6 with respect to income and of -0.1 with respect to the rental charge of the main residential tariff.

Summing up, some general conclusions appear to hold for North America and the UK. Price elasticities for telephone services are small but greater than zero and increase with distance, with access being the smallest in absolute terms and international calls the largest. The assessment of access elasticities and the comparison of US and UK evidence is, however, less than straightforward. Many of the US studies refer to basic local service, i.e. bundled local access and local calls, whereas UK studies are rare and mostly based on time series. Reported rental elasticities ("basic local service") have an average size of -0.1 in the US, their UK counterpart (line rental only) ranges between -0.06 and -0.1. Income elasticities of access center around 0.5 for the US, and vary between 0.5 and 0.6 in the UK. For connection charges, US elasticity estimates are in the range of -0.02 to -0.04, for the UK only Cracknell (1988) gives an estimation of a connection charge elasticity which is -0.85. Unfortunately, the method used in calculating this last number differs too much from the other estimates to allow any direct comparison. Overall, we believe that, despite the similarities in the size of the estimates, a comparison across the Atlantic needs to be done with caution. The differences in the respective telecoms environments have to be taken into account, as have the different definitions for various services. Cracknell and Knott (1995) stress the sensitivity of elasticity calculations with respect to the underlying data.

However, the similarity in the range of the results across the Atlantic is notable. The socio-demographic variables playing a role in determining access include income, age, education and employment status on both sides of the Atlantic.

3. Model and data

3.1 Model

One of the most important features of telecommunications demand is the interdependence between telephone access and telephone usage. Access refers to the consumer's ability to make and receive[53] telephone calls, and logically precedes usage, which refers to calls actually made. Making a telephone call is dependent on a prior decision to subscribe to the telephone network. However, telephone access does not automatically imply usage. Due to option demand, a consumer may desire to have access even though no calls are made. Option demand refers to the benefits that come from being able to make and receive calls which are not in fact made or received. The most quoted example is the ability to call medical or rescue services in an emergency. It is easy to imagine that consumers are willing to pay for this benefit separately.

The theoretical basis for most access demand studies is the consumer surplus framework, in which the demand for access to a telephone network is related to the net benefit from usage of the network, as measured by consumer surplus. Households will decide to have a telephone if the value of consumer surplus from

[53] Note that the distinction between making and receiving calls is increasingly important in the face of regulatory tendencies emerging at present. Disconnection from the telephone service is replaced by a policy of barring outgoing calls due to concerns about universal service.

using a telephone exceeds the price of access. Wenders (1987) argues that the consumer surplus obtained from the surface area below the call demand curve should be augmented by the value to the consumer of receiving incoming calls, plus the "option value" of being able to make or receive further calls if she wishes.

The consumer surplus framework easily lends itself to the formulation of a quantal-choice model by viewing consumer surplus as a random variable whose mean is related to prices, income and other relevant socio-demographic variables. A normal distribution leads to the probit model, while a logistic distribution leads to the logit model. Probit/logit models can alternatively be derived in a random utility framework, as in, for example, the models of Train, McFadden and Ben-Akiva (1987) and Train (1994).

Taylor draws on previous work by several authors to derive a cohesive theoretical structure to model telephone demand. The key elements of his discussion are outlined here[54].

We assume the individual maximizes a utility function:

$$U = u(\delta q, x, \delta N) \qquad (1)$$

where

$\delta = 1$ if the consumer is connected to the telephone system, 0 if not;

[54] See Taylor 1994, pp23-35, for full details.

q = the number of telephone calls;

x = consumption of composite good;

N = number of subscribers to the system

subject to a budget constraint

$$\delta(r + \pi q) + px = \mu \qquad (2)$$

where

π = price of a call;

p = price of a composite good x;

r = price of access to the system[55];

μ = income of the consumer.

The demand functions are derived by a two-step procedure: maximisation of (1) subject to (2) assuming $\delta = 1$, and comparison of the resulting consumer's surplus with that if $\delta = 0$. The first step leads to the following expression for the consumer's surplus (S) from making q' calls, where g(.) is the inverse demand function for calls:

$$S = \int_0^{q'} g(q, p, N, \mu - r)dq - \pi q' \qquad (3)$$

[55] The price of access to the system is the non-traffic sensitive part of the cost of being connected to the telephone network. It is mostly twofold. First, there is a unique connection (or installation) charge to be paid the moment access to the network is desired, then a line rental charge has to be paid with every bill.

In step two these benefits are compared with the cost of access to the system, and the consumer will subscribe if the former exceeds the latter:

$$\delta = \begin{cases} 1 & if \quad S \geq r \\ 0 & if \quad S < r \end{cases}$$

The analysis is then extended to an entire population. The demand for use is now identified with the total number of calls, Q, whereas the demand for access is equated with the proportion of the total population that subscribes to the telephone system. Q is given by

$$Q = Q(\pi, p, r, N, Y) \tag{4}$$

Defining δ_n as either 1 or 0 according to whether individual n is a subscriber,

$$N = \sum_{n=1}^{M} \delta_n \tag{5}$$

The quantity that we wish to explain is the proportion of the population which does subscribe, N/M, where M is the total population.

Define S_n analogously to S above:

$$S_n = \int_0^{q_n'} g_n(q, p, N, \mu_n - r)dq - \pi q_n' \tag{6}$$

Each individual will again compare his or her value of S_n with r. δ_n will vary across individual consumers because of differences in either tastes or income. Taylor assumes that all consumers have the same preferences, so that it is income that varies. More precisely, given a distribution of income, N will be determined by the probability that S_n is greater than r:

$$P(S_n > r) = 1 - f(r)$$
$$= 1 - \int_0^r f(S_n)dS_n \qquad (7)$$

where $f(S_n)$ and $F(S_n)$ are the density and distribution functions of S_n. The distribution of S_n will be related to that of income via the "change of variable" from μ_n to S_n defined in (6). μ is a random variable. In fact Taylor shows that (7) can be rewritten as

$$\frac{N}{M} = p(S_n > r) = P[\mu_n > \mu^*(r)]$$
$$= 1 - \int_0^{\mu^*(r)} h(\mu_n)d\mu_n \qquad (8)$$

where $h(\mu_n)$ is the density function of μ and $\mu^*(r)$ is the income of the marginal subscriber.

Equation (8) gives

$$\frac{N}{M} = \int_{\mu^*(r)}^{\infty} h(\mu_n)d\mu_n \qquad (9)$$

More generally (5) can be rewritten as

$$\frac{N}{M} = \Phi(\pi, p, r, N, Y) \qquad (10)$$

where $\Phi(.)$ is a composite function embodying S_n, the change in variable from f to h, and the integral in (9). Taylor concludes that equations (4) and (10) "comprise, in general form, a bare-bones model of telephone demand for a population of residential consumers" (Taylor 1994, p31).

The presence of N as an argument in both these equations brings out the second feature mentioned above, the role of externalities. These are of two types. One is the call externality, by which one person making a call affects (normally positively) the utility of the person being called. In general this is assumed to be internalised between the two beneficiaries.

The other externality concerns access, and derives from the extra utility accruing to one subscriber if the number of other subscribers in the system increases. Its effect will be to reinforce the access-usage interdependence. The practical consequence is that we would expect demand to be more than unit elastic with respect to the number of customers on the system. Taylor (1980, p16) argues "it [the access externality] gives the telephone the dimension of a public good, since the benefit that a new subscriber confers on existing subscribers is shared in common." This argument has been used to support the case for subsidizing access, as the benefit as perceived by the individual subscriber will tend to understate the total benefit to society.

3.2 Data

The data set we use is based on 12 years of the UK Family Expenditure Survey (FES) spanning the period from 1985 to 1996. The FES is a continuous household survey that generates random samples of the population every year[56]. 10,000 UK households are selected every year. Of these approximately 7,000 complete the survey procedure and are included in the data set. Thus, our original sample comprises some 92,000 UK households. The sample period chosen avoids

complications with respect to structural changes in the UK telephone industry, as 1984 is the year British Telecom was privatized. Moreover, price data becomes very difficult to trace for the pre-1984 period.

Beside very detailed information on expenditure on consumption and investment goods, the FES provides data on household characteristics. The socio-demographic information we use, such as education or sex, refers to the head of household. Other variables, such as income, refer to the household as a unit. In contrast to the US census survey, the FES does not comprise any information about the ethnic origin or the native language of the household, two variables which have been used in US studies on telephone demand to account for the size of the "calling circle" of a household. The FES survey includes a question about telephone access with the wording: "Is there a telephone installed in your accommodation?". We coded the answer in a binary 0-1 mode. Telephone access in this model is therefore defined in terms of access within the home.

4. Method of estimation

The key difference between the US and the UK in terms of modelling telephone demand stems from the different organizational structure of the industry in the two countries. US studies are mainly based on countrywide census data. See, for example, Perl (1983), Cain and Macdonald (1991) , or Taylor and Kirdel (1990). Due to the presence of a multitude of telephone operators created after the divestiture

[56] We are grateful to the ESRC Data Archive in Essex for providing us with the FES data.

of AT&T in 1984[57], different prices for telephone access and call services are charged in different regions and cities of the US at any given moment. Therefore, a single countrywide US data set comprises not only variation in socio-demographic variables, but also variation in price variables. By contrast, most European countries, including the UK, have a long history of monopoly provision accompanied by a policy of uniform pricing at the national level. Even after the liberalisation of the UK telecommunications market in 1984, British Telecom retains almost the entire market of residential access[58]. For this reason, there is still predominantly a unique price for telephone connection and quarterly line rental. Because of this market structure, price variation necessary to estimate the access elasticities of telephone demand is only available across time. Thus, a unique cross-section data set such as generated by one set of census data will not provide the necessary price dimension for our analysis. To remedy this problem, we base our study on a combined time series/cross-section data set. In this way, a simultaneous analysis of the influence of socio-demographic and price variables is possible.

We compile 12 years of the UK FES data to estimate the model outlined in the previous section and to find empirical values for the price and income elasticities of telephone access. In order to consistently estimate a model based on data generated by repeated and independent cross-sections, econometric techniques adapted to this

[57] Known as Regional Bell Operating Companies (RBOCs).

[58] At the same time, the more lucrative corporate and long-distance call market has become increasingly competitive. Also, this assessment of BT's share of the residential access market is valid for the sample period used, i.e. 1985-1996. At the moment of the publication of this paper, cable companies are busy eroding BT's share in the residential market, a phenomenon which would have to be taken into account in future analysis.

data structure have to be employed. In his seminal article, Deaton (1985) shows that a fixed effect model can be identified and consistently estimated from repeated cross-section (RCS) data. He suggests grouping individuals sharing some common observed characteristics, like age or sex, into cohorts. The averages within these cohorts are then treated as observations in a pseudo-panel (or synthetic panel, Verbeek, 1992) to which standard techniques for panel data estimation can be applied. Such synthetic panels might even have certain advantages over pure panel data, notably the preservation of randomness due to the absence of attrition.

4.1 Pseudo panel estimation

Suppose that y_{it} is a 0-1 variable indicating whether a household has access to a telephone or not, and that this indicator variable is a linear function of explanatory variables. We acknowledge this being an unusual assumption as in reality it is not possible for a 0-1 indicator to be a linear function of variables, since the linear function can take any value whereas the indicator is binary. However, the estimation procedure which we have adopted involves subsequent aggregation of the individual data. We need y_{it} to be linear in the explanatory vriables in order for the aggregation to give a relation between the share of 1's and the average of the explanatory variables[59].

Consider now the basic linear individual effect model

$$y_{it} = \alpha_i + X_{it}\beta + u_{it} \qquad i = 1,....N; \quad t = 1,...T \qquad (11)$$

where X_{it} is a (K × 1) vector of explanatory variables which we assume exogenous to the model, index t and i refer to time and individuals respectively. Note that as we are not dealing with a real panel, N can vary from period to period while T is fixed. The disturbances of the model (11) are assumed to be i.i.d., with zero mean and variance σ_u^2. We also assume that the individual effects α_i are i.i.d. with finite mean and variance σ_α^2. If the α_i's are assumed to be the same across all units, OLS provides consistent estimators of α and β. Complications arise from the fact that the individual effects are assumed to be uncorrelated with the disturbances but potentially correlated with the regressors. If the individual effects are uncorrelated with the explanatory variables X_{it}, the model can easily be estimated from RCS by pooling all observations and performing OLS treating $\alpha_i + u_{it}$ as a composite error term. However, in many applications the individual effects α_i are likely to be correlated with X_{it}, so that estimation procedures treating the α_i's as random drawings from some distribution, such as simple pooling or the random effects model, lead to inconsistent estimators, unless the correlation is explicitly taken into account. When panel data are available, this problem can be solved by treating the α_i's as unknown, but estimable, parameters. Obviously this strategy no longer applies if no repeated observations on the same individuals are available. When the model is to be identified by means of RCS data, an additional incidental parameter problem arises: $NT + K$ parameters have to be estimated from NT observations.

[59] We are grateful to an anonymous referee for pointing out this problem of an aggregation bias created by the

Deaton (1985) suggests the use of cohorts to obtain consistent estimators for β in (11) if repeated cross-sections are available and the individual effects are correlated with the regressors.

Define C cohorts, which are groups of individuals sharing some common characteristics like sex or date of birth. These groups are defined in such a manner that each individual is a member of exactly one cohort, and remains a member of this cohort for all periods. For example, a particular cohort may consist of all male individuals born in 1945-1949. Assuming, for simplicity, that there is a unique regressor *(K = 1),* if we aggregate all observations to cohort level, the resulting model can be written as

$$\bar{y}_{ct} = \bar{\alpha}_{ct} + \beta \bar{x}_{ct} + \bar{u}_{ct} \qquad c = 1,...C \tag{12}$$

If we define n_{ct} as being the size of group c at time t, $\bar{x}_{ct} = n_{ct}^{-1} \sum_{i \in c}^{s=t} x_{is}$ is the average value of all observed x_{it}'s in cohort c at time t, and analogously for the other variables in the model. The resulting data set is a pseudo panel with repeated observations over T periods and C cohorts. The main problem with estimating (12) is that $\bar{\alpha}_{ct}$ depends on t, is unobserved and is still likely to be correlated with $\bar{x}_{ct}$. Therefore, treating $\bar{\alpha}_{ct}$ as random error is likely to lead to inconsistent estimators, while treating them as fixed unknown parameters results in an identification problem unless the variations over t can be ignored ($\bar{\alpha}_{ct} = \bar{\alpha}_{c}$). If the cohort averages are

estimation method.

based on a large number of individual observations, this assumption seems reasonable (see for instance Verbeek and Nijman, 1992, on the asymptotic properties of the cohort estimators). Under these assumptions, a natural estimator for β is the covariance, or within, estimator $\hat{\beta}_w$ used on the weighted cohort means[60].

Let $\bar{x}_c = \left(\sum_{t=1}^{T} n_{ct}\right)^{-1} \sum_{t=1}^{T} \bar{x}_{ct} n_{ct}$ be the time average of the observed cohort means for cohort c, and define $\bar{y}_c$ likewise. The weighted within estimator on the pseudo panel observations is, for the case of a single regressor:

$$\hat{\beta}_w = \left(\sum_{c=1}^{C} \sum_{t=1}^{T} n_{ct}(\bar{x}_{ct} - \bar{x}_c)^2\right)^{-1} \left(\sum_{c=1}^{C} \sum_{t=1}^{T} n_{ct}(\bar{x}_{ct} - \bar{x}_c)(\bar{y}_{ct} - \bar{y}_c)\right) \qquad (13)$$

$\hat{\beta}_w$ is biased in small samples but consistent as the size of each group n_{ct} tends to infinity, provided standard assumptions on the second moments of the regressors hold (Moffitt, 1993). When the size of each cohort is large enough, the sample mean of the fixed effects provides a consistent estimator of the time-invariant population mean and the estimator given in (13) is consistent. Consequently, when n_c is reasonably large, most applied studies ignore the errors-in-variables problem caused by the possible time variation in $\bar{\alpha}_{ct}$ and use standard estimators like the within estimator. See for example Browning et al. (1985). Our study falls into this category as the average cohort size for our sample is sufficiently large.

[60] The weights are introduced to account for heteroscedasticity across cohorts.

Note also that there is a trade-off between the number of observations in the pseudo panel and the accuracy of these observations. The larger n_c, the smaller C. In the case of the standard within estimator $\hat{\beta}_w$, this means a trade-off between the bias and variance of the estimator.

5. Empirical results

We model the demand for telephone access as a function of two groups of variables: price variables and socio-demographic variables. These variables determine the calling pattern of the household and therefore its access demand. The model we specify seeks to explain telephone access as a function of real connection charges and real line rental, which we expect to have a negative impact on telephone access, as well as real net household income, which has an expected positive influence. We also introduce household income in squared form to account for possible non-linearities. The total number of household members is equally expected to increase the demand for telephone usage and therefore for telephone access. In addition, we introduce measures for retired and female heads of household. Socio-economic studies about the "untelephoned" (see for instance OFTEL, 1994) find that these groups are more likely to be connected to the telephone, possibly reflecting higher option demand. We include the presence of children under five partly to adjust the household size variable for structural differences in household composition, and partly to test for another possible option demand effect.

Other household characteristics included are variables denoting a single-person household, the presence of an unemployed/unoccupied head of household, the age at which the head of household left full-time education, moreover a variable indicating rented accommodation, a "recent mover" variable, and finally a variable which

denotes an area with low population density. Single household status has been found to have a negative impact on telephone access in studies in the United States. The presence of an unemployed or unoccupied head of household is included to test for an influence beyond the income effect. The age at which the head of household left full-time education should influence the demand for telephone access positively. As far as variables related to the household accommodation are concerned, we expect households living in rented accommodation to have a lower access demand because of the type of housing included in this category. It has also been argued that the calling circle of households living in rented accommodation is smaller than for households owning their accommodation (Cain and Macdonald, 1991). The recent mover variable has been included to account for households not yet having had the time to get connected to the telephone. The final explanatory variable denotes households living in administrative areas with under 3.2 persons per acre (7.9 persons per hectare) and is included to account for spacial patterns in the telephone penetration rate.

For the estimation of our model, we divide the individual households into groups based on the date of birth of the head of household. We include households whose head was born between 1910 and 1963, that is, heads of household who were between 22 and 74 years old in 1985, the initial year of our sample. To form the pseudo-panel cohorts, we regroup the date of birth groups into pairs. Thus, the first cohort comprises households whose head was born in 1910 or 1911, the second households whose head was born in 1912 or 1913, and so on. This guarantees a sufficiently large number of observations in each cohort. In this manner, we create a pseudo-panel comprising 27 cohorts over 12 years, i.e. a sample with 324 observations overall. Our mean cohort size is 226. The total number of households

forming the basis of the overall cohort sample is approximately 73,300. Note that while the original model as defined in theoretical terms in (11) is a binary model in the dependent variable and in a number of the explanatory variables, once the cohorts are formed, the observations take on the value of cohort means and represent proportions. The binary variable indicating a female head of household, for example, is now the proportion of households headed by a woman for a given cohort at a given time. We perform a logarithmic transformation on the dependent variable to make sure that the proportion estimated is bound by the [0,1] interval. The price variables included in the model are the connection charge BT charges new customers as well as BT's annual line rental charge[61]. The connection charge varied between £77.5 and £121 in real terms (1987 prices) between 1985 and 1996, the real annual line rental between £54 and £80. The evolution of the two access prices over time can be seen in Figure 1. The annual mean telephone penetration rate calculated from our sample over the same time period is pictured in Figure 2.

[61] We are grateful to Eurodata, London, for providing us with the telephone price data used in this article.

Figure 1: BT connection charges and annual line rental

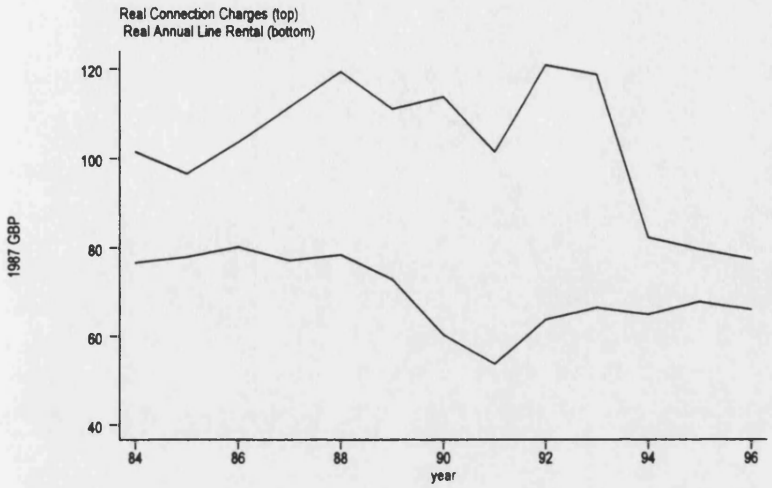
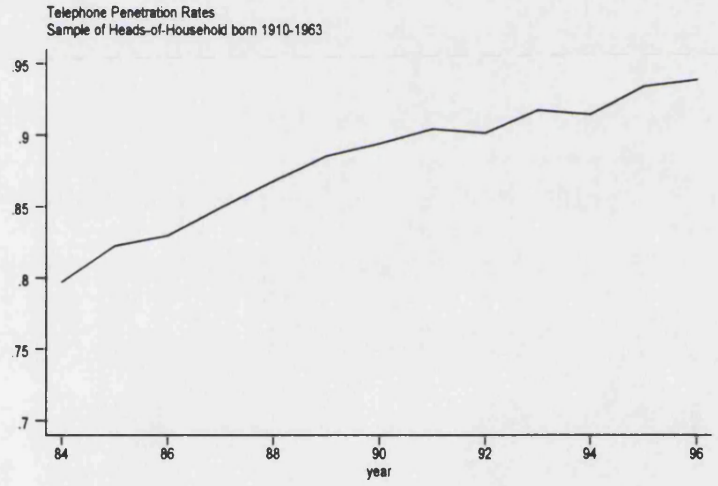


Figure 2: Telephone penetration rates



We estimate the model by means of the weighted within estimator given in (13). The results of the estimation are reported in the second column of Table 1. Given the original form of the data, namely random samples taken from a large population, we have undertaken a Hausman test to test the specification of the model as fixed rather

than random effect model. The null hypothesis of orthogonality of the α_i and X_{it} is rejected and the fixed effect specification is therefore accepted as appropriate.

Table 1: Estimation Results

Indep. variable*	Coefficients (t-stat. in parentheses)			
	Overall sample		Low-Educ. Sample	
connection charge	-0.0056	(-5.01)	-0.0062	(-4.64)
rental charge	-0.0043	(-1.67)	-0.0067	(-2.3)
household income	0.006	(4.32)	0.0065	(3.68)
household income^2	-9.06e-07	(-2.39)	-1.03e-06	(-1.99)
retired HoH	1.27	(5.03)	1.12	(4.17)
female HoH	3.03	(5.00)	2.49	(4.63)
rented accomod.	-4.46	(-8.32)	-3.24	(-7.35)
person total in HH	-0.013	(-0.125)	-0.02	(-0.17)
%age of child <5	-0.574	(-0.585)	-2.24	(-2.1)
unem./unocc.HoH	0.87	(1.75)	0.66	(1.41)
single person HH	-0.774	(-1.24)	-0.21	(-0.35)
left f-t education	0.283	(3.5)	0.33	(2.72)
recent mover	-3.69	(-3.39)	-1.79	(-1.66)
area density	0.89	(2.05)	0.34	(0.834)
const.	-2.92	(-2.16)	-3.2	(-1.8)
F-Test	1.31		1.21	
Adjusted R^2	0.75		0.685	
ε_y	0.14		0.176	
ε_c	-0.065		-0.1	
ε_r	-0.033		-0.07	
mean cohort size	226		129	

*HoH = head of household, HH = household

The coefficients of household income and the connection charge have the expected sign and are statistically highly significant. The coefficient of the annual rental charge is negative, and while the statistical significance level for this price variable is lower, it is still within the 10% confidence interval. The small but negative coefficients for the two price variables confirm the deterrent represented by telephone access charges. Calculated at the sample mean, the coefficient for the

connection charge gives rise to an access elasticity of -0.065 which lies above the range of connection charge elasticities reviewed by Taylor (1980) (-0.02 to -0.04), but within the results quoted by Cain and McDonald (1991). The coefficient for annual line rental in turn suggests an elasticity measure of -0.033 which is lower than the results reviewed earlier in this article. Our results suggest that it is primarily the connection charge which represents a barrier to telephone ownership. This argument is supported by the findings of the 1994 OFTEL report on the untelephoned. For household income, the coefficient leads to an income elasticity of 0.14, which is lower than the average results reported earlier. However, our result is in line with the findings of Waverman (1974) and Perl (1976). In both cases the estimate of the income elasticity is 0.15 (Taylor, 1994, p279). Like Perl's, our elasticity is estimated with a model in which other factors related to income, such as education or type of housing, are taken into account. Thus a smaller income elasticity is probably to be expected. The significant coefficient of the squared income variable suggests that there might be a non-linear effect in this variable.

A majority of the socio-demographic variables included as explanatory variables for access demand have significant coefficients. Households headed by someone with higher education level are more likely to have a telephone in their living quarters, as are households headed by a retired or female person. This seems to suggest a higher option demand for this population group. However, other variables included to account for household structure, such as household size or the percentage of children under five, do not seem to have a statistically significant impact on telephone access demand.

Neither does the single person household status. A household headed by an unemployed person or one without occupation has a positive coefficient indicating a higher probability of telephone access for this population group. This result might partly be due to the definition of this category. In particular the latter group included in the category unemployed/unoccupied might contain households with a high propensity for telephone access. There may also be an effect due to a social security system which accords allowances for utility bills. Living in rented accommodation influences telephone access negatively, which is to be expected as most of the dwellings included in the category "rented accommodation" in the UK are council housing or belong to housing associations. Households living in rented accommodation are therefore likely to have a lower than average income. Having recently moved to the current address has a statistically strong effect and diminishes the probability of the household being connected to the telephone. Living in an area with very low population density also leads to a higher demand for telephone access as could be expected given the higher cost of alternative means of communication, such as personal visits, for households living in remote areas.

Overall, it is income and variables related to income such as education or type of housing, together with variables indicating female or retired heads of household which have the strongest impact on telephone access among the socio-economic variables. This result corroborates the findings of the main US studies surveyed in Section 2. A "recent mover effect" can also be clearly identified.

5.1 Differentiation of the results according to income

Progress toward universal service is generally measured by the percentage of households with telephone service. Despite a high aggregate level of the household penetration rate, an important differential between population groups exists. Cain

and Macdonald (1991) find that price elasticities differ substantially between low and high income groups. The impact of higher fixed charges will therefore be born disproportionately by the low-income part of the population. The (arc) price elasticities for connection charges calculated by Cain and Macdonald (1991) range from -0.04 to -0.2 with greater elasticities in households with lower initial connection probability, mainly low-income households from minority groups. In order to test the sensitivity of the access elasticity with respect to income in our sample, we divide our data into two subgroups. We create cohorts which are not only based on date of birth, but also on the age at which the head of household left full-time education. This latter variable serves as a time-invariant proxy for household income and allows us to partition our sample according to a variable strongly correlated with income. We define people who left full-time education at or below the legal age as belonging to a "lower education" group[62]. We then apply the pseudo-panel technique to the lower education sample to test for differences in the results for this subgroup. The estimation results for the "lower-education" sample are reported in column 3 of Table 1.

The heads of roughly 42,000 households born between 1910 and 1963 left school at or below the legal school leaving age. We regroup them into two-year cohorts following the same procedure outlined above. The mean cohort size is 129. Column

[62] We also need to account for the fact that the legal age for school leavers has changed over time. Our sample includes individuals born between 1910 and 1963. While these were at school, the legal age first changed from 14 to 15 (1946) and then from 15 to 16 (1973). A person born for instance in 1930 is thus "higher-educated'" if they left school at 16, while another, born for instance in 1960, is "lower-educated" if they left school at the same age of 16.

3 shows us that the income and price variables have significant coefficients which give rise to elasticities of 0.176 for income and -0.1 and -0.07 for connection charge and line rental respectively (all calculated at sample mean values). The price elasticities in the lower-education population are therefore 50% and 100% higher than the elasticities calculated for the overall population. We conclude that the lower education/lower income group is indeed more sensitive to changes in telephone access charges than the overall population. The income elasticity is also higher, although its rise by 25% is not quite as marked as that of the price variable elasticities. There is little change of behaviour among the socio-demographic variables. Retirement, gender and education have a statistically significant positive influence on the telephone penetration rate, while living in rented accommodation has a strong negative effect. Household size is still statistically non-significant, but our results suggest that the number of children under five has a negative influence on telephone access among the lower-education population, whereas it did not have a significant impact in the overall sample. This result might be interpreted in terms of a liquidity effect. The presence of infants in low-income households might present a strain on household income which can be seen in lower telephone access rates, a phenomenon which is not apparent in the population at large. Moving into the present dwelling within the last four months still has a negative sign but its significance level has dropped. Living in an area of under 3.2 persons per acre is no longer statistically significant for households in the lower-education sample.

5.2 Assessment of results

The small but mostly significant negative price elasticities for connection and rental charges suggest that a substantial increase in these prices will have a noticeable negative effect on telephone penetration and therefore on the objective of achieving

universal access across all groups of the population. Small elasticities can lead to large numbers when applied to a large population base[63]. The numbers give even more cause to concern if they are higher for disadvantaged, low-income groups as our results suggest. However, the elasticities calculated in this study should not be used in an unconditional manner to quantify drop-off. First, adjustment to increasing residential access charges will take place over time and not instantaneously. Second, telephone penetration is driven by a host of factors other than price which might evolve so as to counteract the effect of rising price levels.

Telephone penetration rates in the UK have risen steadily since the 1984 liberalisation despite changes in connection and line rental charges. One possible explanation is the change in the household structure during the same period. When focusing on the household characteristics which we identified as most influential on telephone access demand, we see that average weekly household income has increased from £183 to £213 (1987 prices) between 1985 and 1996, even though the growth of this variable has slowed in the first half of the 1990s. Also according to the FES data, the proportion of households headed by a retired or female person has increased over the same time period. The former group's share among total households has risen from 22 to 26%, the latter's from 23 to 26%[64]. The average education level measured by the age when full-time education ceased has risen from

[63] According to the 1991 population census there were 21 441 000 households in the UK at this moment. The telephone penetration rate calculated from the FES survey for that year was 90.4%, i.e. 19 383 000 households had in house access to the telephone. According to our elasticity calculation and assuming ceteris paribus, a 25% increase in the connection charge would lead to a 1.625% decrease in the quantity of people connected, which would signify 315 000 households less among those with telephone connection.

15.5 to 16.1 years, in line with the increase in the compulsory schooling age. At the same time the frequency of rented accommodation decreased from 30.4 to 23.6% due to the government sale of council housing to their respective occupiers. To the extent that households with higher incomes, or headed by a retired person or a woman, as well as households living in owned accommodation have a higher demand for telephone access, we will expect rising telephone penetration as the household structure changes over time.

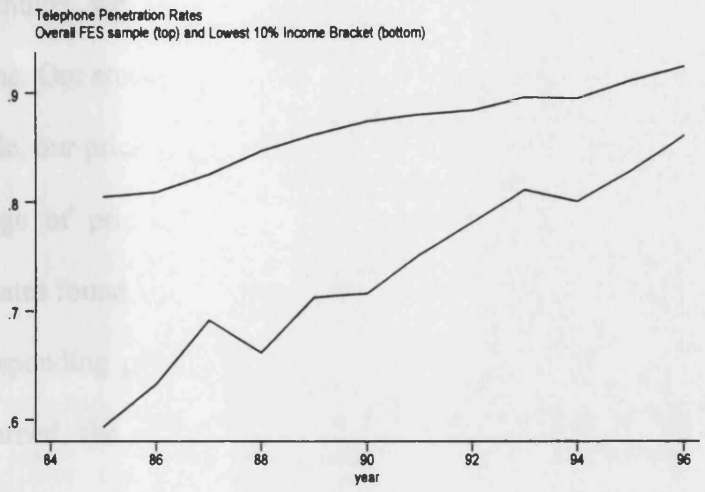
Is the evolution of factors influencing telephone penetration in the overall population mirrored in those parts of the population most likely not to have a telephone? It is the lowest income groups which are most threatened by further marginalisation due to increasing fixed charges. We select those households in the lowest ten percent income percentile for each year in the sample to search for potential differences in the behaviour of the socio-demographic variables for this population group. The most noteworthy difference between the overall sample and the lowest ten percent income group is the difference in their respective age structures. The average age among the lowest income populations is 60.7 years. This is ten years above the average age of all heads of household included in the FES survey between 1985 and 1996. Over the same period, the percentage of households headed by retired persons has risen from 41.6 to 57%, the proportion of those headed by women varied between 59 and 65%. For the greatest part the tendencies observed in the overall population are however mirrored by the households in the lowest ten percent income

[64] There is an obvious overlap between the variables though.

bracket. Average weekly household income has risen from £48 to £52.2 for this income group. The average education level has also increased from 14.4 to 14.9 years. The percentage of households living in rented accommodation has decreased from 48.4% in 1988 to 35.7% in 1995.

In view of the evolution of the variables identified in our model as influencing telephone access demand, we can find no evidence for the UK that there is an increase in the probability of marginalisation for the poorest population group as far as telephone access is concerned. This conclusion is confirmed by Figure 3. It shows the evolution of telephone penetration rates between 1985 and 1996 for the overall FES population sample and for the lowest 10% income households in this sample. The figure suggests a narrowing of the gap between the two groups. This narrowing appears to be mainly due to the increase in income and in the share of households headed by elderly and women in this population group.

Figure 3: Telephone penetration rates differentiated according to income



6. Concluding remarks

The liberalisation of the telecommunications sector and the rebalancing of the tariff structure associated with it has raised questions about the impact the rise in access charges will have on residential customers. The issue is of particular interest in view of universal service objectives proclaimed at national and European level. Through the creation of a repeated cross section data set based on the annual UK Family Expenditure Survey we were able to estimate the impact of tariff variations on residential telephone access demand.

Our work shares one drawback with other studies in this area. Our elasticity measures do not allow us to separate the impact on telephone penetration rates into "drop-off resulting from higher connection and rental charges, and failure to "drop-in" by those still untelephoned. In view of this, our work is, however, useful in establishing two facts. First, the cost of access expressed by connection and rental charges has a negative effect, albeit small, on the probability of a household having a telephone. Second, we have identified a number of socio-demographic and economic household characteristics associated with telephone access.

By creating a subsample of low-education households to approximate low-income households, we also find a strong sensitivity of access elasticities with respect to income. Our study confirms the validity of US experience for the UK. For the overall sample, our price elasticity of -0.06 with respect to connection charges lies above the average of price elasticities summarized by Taylor (1994) but is in line with estimates found by Cain and Macdonald (1991). For the lower education sample, the corresponding price elasticity is -0.1. As far as the impact of the rental charge is concerned, the results show a negative impact on telephone access, the statistical significance of the results is however lower for this price variable, suggesting that the one-off connection charge is the main price barrier to telephone ownership. For the overall sample, we found a price elasticity with respect to the rental charge of -0.033. The measure is statistically more stable for the low-education sample were it leads to an elasticity of -0.07. The income elasticity of access is 0.14 for our overall sample. This is lower than the average estimate of 0.5 reported in studies surveyed by Taylor (1994), but in line with estimates reported by Waverman (1973) and Perl (1976). The fact that our estimate is lower is very likely a consequence of the inclusion of income related variables such as education or type of housing in our estimation model. Taylor (1994) argues that elasticities decrease as the penetration rate increases. If this argument holds for the UK, our results, based on the period 1985-1996, and very similar to results found up to 20 years ago for the US, would suggest that overall the absolute level of telephone access elasticities is higher in the UK than in the US.

Among the socio-demographic and economic household characteristics strongly influencing telephone access demand are household income and variables linked to income such as education and type of dwelling. The presence of a retired or female

head of household also influences telephone access positively and suggests a stronger option demand for these population groups. We also found a clear "recent-mover" effect.

We can see from Figure 2.1 that after initial increases, BT's connection charge has fallen in real terms over the last few years, mainly because of the regulator's concern about disconnections. The negative price elasticities found in this study confirm that such regulatory efforts may help maintain and improve access levels. Nonetheless we believe that containing the access price at a below-cost level for the whole population is not necessary to improve telephone penetration among the low-income population. An economically more efficient way is offered by targeted subsidy programs, which offer lower access charges for those truly threatened by exclusion. In the following chapter, we will review such programs, introduced in the wake of liberalisation of the telecommunications industry in the US and the UK. Targeted subsidy programs can take one of two forms: either they are based on some means-tested criteria (in some US states for instance telephone connection is facilitated for recipients of food stamps), or they take the form of optional (or self-selection) tariffs. This latter category of targeted subsidy programs has very desirable efficiency features. US results suggest that access demand is primarily a function of minimum rather than average access charges (Cain and Macdonald, 1991, and Train, 1994). This suggests that the provision of social tariffs can be expected to maintain relatively high levels of access demand even in the face of overall access charge rises. Tariffs with relatively low access but high usage charges for instance should appeal to low user groups such as certain elderly or lone parents which have a relatively small calling circle but a high option demand.

Finally, we note the following. In his 1994 survey of telephone demand, Taylor observes that while liberalization and technical progress have improved the quality of data on telephone demand, competition and privatisation has led to increased difficulties for researchers in obtaining access to data now considered commercially sensitive. Trotter (1996) confirms this point for the post-liberalization UK. He states in his conclusion that UK work has been hampered by a relative lack of data, partly due to technical reasons, and partly due to most of the UK market being supplied by one monopoly supplier, which makes any cross-section analysis difficult. While we tried to remedy the latter point in this article, we agree with the above observations. There remains a need for further work as an input into UK policy decisions. More detailed work is however likely to depend on the data being specifically collected, as has been the case for several of the main US studies.

Chapter 4: Residential Customer Switching in Electricity and Gas: New Evidence from the UK

1. Introduction

The liberalisation of energy markets has made supplier switching a reality even for the smallest of customers in Great Britain (GB). The gradual phasing in of competition in the domestic gas market started in April 1996 and ended two years later, in May 1998[65]. In the domestic electricity market, competition was first introduced in September 1998 and was complete for all households by the end of May 1999. In this chapter, we use data from an ongoing household panel study (the Oxera Energy Panel) to examine the progress of competition, and analyse the determinants of switching in domestic energy markets[66]. The panel data span a period of six quarters, from the first quarter of 2000 to the second quarter of 2001, and consist of questionnaire responses received from a representative sample of 2,110 households in GB.

The timing of this first analysis of the Oxera panel data coincides with the publication of the results of the most recent review of supply competition in gas and electricity by the energy regulator Ofgem[67]. The key conclusion of this review is that supply competition in domestic gas and electricity markets is well developed and

[65] The gradual phasing in of competition was achieved by increasing in steps the geographic scope of competitive supply areas. So was for instance in the case of gas, supplier choice first available for households in Devon, Cornwall and Somerset.

[66] I am grateful to Oxford Economic Research Associates (Oxera) for allowing me to make use of this data set. However, the views expressed in this chapter are my own and not those of Oxera, and the usual disclaimer applies.

[67] 'Review of domestic gas and electricity competition and supply price regulation – Evidence and initial proposals', Ofgem, November 2001.

sufficiently firmly established across all groups of customers to suggest the removal of all remaining retail price controls in domestic gas and electricity markets in GB. The industry-wide consultation initiated by the publication of the review document will provide input into the decision process on whether the suggested withdrawal of supply price controls will indeed be implemented from April 2002 onwards or not.

The main intention of this chapter is to add formal quantitative data analysis to the body of evidence on energy supply competition. Despite a considerable amount of data in the area (collated primarily by Ofgem for its annual review of the state of competition), formal analysis has taken second place to descriptive surveys[68].

A number of indicators can be used to assess the state of competition in a market, including, *inter alia*, customer awareness of competitive offers, number of active suppliers, perceived barriers to entry, market shares and customer switching.

The data analysis in this chapter reviews evidence from the panel data with respect to some of these competition indicators, but focuses in particular on switching evidence. The ability of customers to switch supplier is a key indicator, since it shows whether competition is firmly rooted in customer behaviour and there is an absence of switching barriers which could keep customers from exercising their choice. Thus, it is important to distinguish between changes in market share that result from customers switching, and changes that are the outcome of consolidation

[68] An exception to this is a study by Parmar, Price and Waterson (2000). However, Parmar et al. focus on the gas sector only, and base their analysis on data collected at the initial stages of competition when the gas market was only partially open.

among suppliers. In the context of retail price regulation, switching evidence allows to draw conclusions on whether suppliers are indeed constrained in their pricing policies by customer behaviour, or whether price-caps are needed to counteract market power.

The main question addressed in this chapter concerns the determinants of domestic supplier switching and the relative importance of socio-demographic household characteristics compared to other factors. The latter concern in particular variables linked to potential cost savings, such as payment method or the subscription to dual fuel deals, as well as variables linked to previous switching experiences. The different variables are tested for their statistical relevance in a probit model. The data allow for a direct comparison between gas and electricity markets, and questions regarding differences between the two sectors are raised.

The main results from the analysis of the Oxera Energy Panel data are: (i) switching rates in both the electricity and gas markets have been increasing over the period covered by the panel, confirming evidence of increased customer awareness and active competition; (ii) market shares of incumbents are decreasing, but a trend towards consolidation is apparent, in particular among electricity suppliers; (iii) according to the econometric results, socio-demographic household characteristics play a less important role in determining the switching decision than variables linked to cost savings and switching experiences in other sectors.

These results corroborate the Ofgem 2001 review findings in that they confirm the establishment of competition across all socio-demographic customer groups, with the only group arguably deserving continued regulatory attention being elderly households. According to the econometric findings, switching is primarily

determined by variables linked to cost savings and by other supply choice experiences. Thus, it is important to note the essential role of continued monitoring of the number of suppliers, as active customer behaviour will only be effective in an environment where the supply market structure offers real choice.

The remainder of this chapter is structured as follows. Section 2 reviews existing evidence regarding supply competition and switching in GB, focussing in particular on the latest Ofgem findings. Based on the evidence reviewed, a theoretical model for switching in domestic energy markets is set out in section 3. Section 4 describes the data used for the subsequent analysis. In section 5, a first descriptive analysis of switching trends, market shares and switcher profile is undertaken. These initial results are formally tested in section 6 in the context of a probit model. Section 7 assesses the overall results of the analysis and section 8 concludes.

2. Review of the evidence

Several recent studies have examined the features of energy supply market competition in GB, and some also allow useful comparisons with other sectors. The most recent discussion of competition in liberalised energy markets is contained in Ofgem's November 2001 'Review of domestic gas and electricity competition and supply price regulation—Evidence and initial proposals' (Ofgem 2001c). The review is based on data gathered by means of two surveys, one among households[69], the

[69] 'Experience of the competitive domestic electricity and gas markets – Research study conducted for Ofgem by MORI', Ofgem, November 2001.

other among gas and electricity suppliers[70]. Earlier articles and studies include Ofgem (2000 and 2001a), Waddams Price and Bennet (1999), and Ofgas (1997, 1998a and b). It should be noted that evidence more particularly related to the determinants of switching is discussed in section 3.

2.1 Market shares

Prior to liberalisation, British Gas Trading (BGT) and the incumbent public electricity suppliers (PESs) had monopoly supply rights nationally (for BGT) and regionally (for the PESs). As can be seen in tables 1 and 2, market shares have changed significantly over the last few years, indicating a loss of market share for the incumbent suppliers, and entry of new suppliers with growing market shares.

Table 1 gives BGT's market share as a function of the three principal payment methods for energy. The most frequent payment method has traditionally been quarterly bill, payable in arrears after a meter reading. This extends credit to customers and thus carries a risk of non-payment. Partly in response to this, an alternative, pre-payment system was developed where smart cards or keys are charged in advance and inserted into meters to release a flow of energy, permitting 'self-disconnection' for consumers unable to afford fuel.

Pre-payment is the most expensive method of payment for a utility to administer. The cheapest system is regular monthly direct debit payments from a bank, with an annual reconciliation. *De facto*, direct debit payment implies that customers extent

[70] 'Domestic gas and electricity supply market survey 2001', Ofgem, July 2001.

credit to the energy supplier. With the onset of competition, energy suppliers have increasingly integrated the cost differences between payment methods in their tariffs, which had hitherto contained some cross-subsidy by the direct debit customers towards those who used pre-payment and quarterly credit. As a consequence of the potential negative impact such tariff re-balancing can have on marginal users, considerable debate on the distributional effects of liberalisation has taken place (see, for example, Price and Young 2001).

The particular status of pre-payment customers in gas is reflected in the relative price regulation regime BGT is currently subject to[71], and Ofgem has paid particular attention to the development of competition in different payment method markets in its review.

[71] The relative price regulation regime for gas implies that the regulator fixes a maximum differential between BGT's LatePay/PrePayment prices and its Direct Debit prices.

Table 1: BGT gas supply market share (%) by payment method

	Monthly direct debit	Standard credit	Pre-payment
September 1999	70	78	88
March 2000	69	75	84
September 2000	67	74	83
March 2001	64	73	82
June 2001	63	71	82

Source: Ofgem (2001c)

According to Ofgem, BGT now has around 67% of the total customers in the market (around 70% of the market in volume terms). However, as table 1 shows, the speed of market share loss in general appears to be slowing and the pre-payment market has seen much less movement than the other payment methods. The explanation for the persistence of a high market share for the incumbent in the pre-payment market is that until recently, suppliers have competed mostly for attractive direct debit customers, and alternative offers for pre-payment customers have been few. However, Ofgem (2001c) notes that over the 12 months to October 2001, the number of suppliers offering lower pre-payment tariffs has doubled to 6, suggesting more active competition in this market segment.

Table 2: Domestic electricity suppliers market share (%) by customers supplied (September 2001)

	Market share
Innogy/Yorkshire/Northern	19
BGT	17
TXU Energi	15
SSE Energy	14
London	10
Scottish Power	10
Powergen	8
Seeboard	6
Other suppliers	<2

Source: Ofgem (2001c)

For the electricity market, the effects of liberalisation are complicated by the recent consolidation amongst suppliers and the former regional structure that means a small national market share can disguise very strong regional market power. As can be seen in table 2, no single company has a market share (by customer number) of more than 19% nationwide, in stark contrast to the position of BGT in the gas market. However, when the regional structures are taken into consideration (table 3), the pattern of market share loss is much more similar to that of BGT in table 1.

Table 3: Average market shares (%) of ex-PES suppliers 'in area' by payment method

	Monthly direct debit	Standard credit	Pre-payment
March 2000	78	85	94
September 2000	72	80	90
March 2001	67	76	85
June 2001	64	73	80

Source: Ofgem (2001c)

Interestingly, BGT is now the second largest electricity supplier, with 17% of the market. In the gas market, the total market share of all suppliers competing with

BGT is only 33%. As will be confirmed on the basis of the panel data in section 5, no one company has succeeded to establish themselves in the gas market as strongly as BGT has in the electricity market.

2.2 Switching trends

The Ofgem review classifies switching into three categories: (a) gross switching (referring to all transfers from one supplier to another); (b) net switching (referring only to switching away for the incumbent gas or electricity suppliers, and abstracting from 'return' switching to BGT or the ex-PESs); and (c) churn, where gross switching is broken up into net switching, return switching and switching among non-incumbent suppliers.

In table 4 gross switching rates in gas and electricity show that weekly transfer numbers have increased in the year to September 2001.

Table 4: Weekly transfers in gas and electricity supply markets

	Gas	Electricity
Sep. 2000 to Sep. 2001	70,000	100,000
Sep. 1999 to Sep. 2000	56,000	94,000

Source: Ofgem (2001c)

Transfers away from the incumbents in gas and electricity are declining as share in total (from 49% to 46% in the case of BGT, and from 79% to 74% in the case of ex-PESs), while churn, i.e. transfers among non-incumbent suppliers is increasing (from 23% to 28% in the case of gas, and from 6% to 9% in the case of electricity). Return switching is more or less stable for both gas and electricity, lying at 26% in the year up to September 2001 for BGT and at 16% for the same period for ex-PESs. The lower numbers for electricity are likely to be due to the fact that the gas market has been opened to competition a year earlier than electricity.

Overall switching numbers in gas have increased from 29% in Summer 2000 to 37% a year later; the equivalent numbers for electricity are 19% and 38% respectively. Among all switchers, the proportion who have switched supplier more than once continues to increase. Ofgem (2001c) only quotes numbers for gas, with the proportion of multiple switchers among all gas switchers being 28%. Most of the multiple switchers have switched just one more time, and nearly half (46%) have returned to BGT.

The Ofgem survey also focuses on the switching behaviour for particular groups of customers—those with special needs and those with outstanding debt problems. The results of this assessment are encouraging. Table 5 shows that, apart from pensioners and, to a somewhat lesser extent, rural customers, the majority of special groups have switching rates in gas and electricity markets similar to the average. Differences found in previous years are evening out, with formerly disadvantaged groups catching up on the average.

Table 5: Proportion of special groups having switched in gas and electricity markets (Summer 2001, %)

	Gas	Electricity
All customers	37	38
Very low income customers	38	43
Disabled	35	44
Single parent families	39	43
Pensioners	29	30
Rural customers	35	32

Source: Ofgem (2001c)

Efforts directed at customers with an outstanding debt, or who have experienced payment difficulties, also show results. Switching rates in this category are no lower

than average in the case of gas (at 35%), and even significantly higher than average in the case of electricity (53% have switched supplier).

3. A switching model

In this section, a theoretical model of supplier switching in energy markets is set out. First, evidence linked to determinants of switching is reviewed, then, on the basis of the conclusions drawn from the evidence, a theoretical cost-benefit model is established.

3.1 Determinants of switching

A research study released by the Department of Trade and Industry (DTI) in 2000 under the title 'Switching suppliers' (DTI 2000) looks at switching in energy services, fixed and mobile telecommunications, mortgages, current and savings accounts, and home and car insurance. In the study, the determinants of switching are identified to be the result of interaction between three factors: first, opportunity, i.e. accessibility of competitors and the extent to which consumers can shift easily; second, inclination, i.e. the perceived benefits of switching and/or the desire to leave a company which has provided unsatisfactory service; third, perception of risk or disinclination.

Whether a person switches to another supplier or not is a function of where the balance lies between these different factors. The DTI study comes to the conclusion that in most markets, the balance of factors is tipped in favour of existing suppliers. There is lack of knowledge and trust in alternative suppliers (in other words, the reputation of a company plays an important role in customer choice), high perception of risk and apathy, and in some cases genuine barriers (e.g. presence of penalty clauses, or fuel debts). Ofgem (2001d) quotes high satisfaction levels with the existing supplier as main reason for not switching, followed by 'too much hassle',

which can be taken to symbolise high searching and administrative costs of switching. In Ventura (1999), an additional reason for not switching is identified as 'waiting to see what happens'.

In terms of information needs, it is interesting to note that the DTI study concludes that consumers have easy access to information on what companies offer, but they do not find it easy to identify the right company or package to suit their individual needs. This is confirmed by Ofgem (2001a) where it is reported that 33% of respondents said that they found it either fairly or very difficult to compare prices[72].

Surveys agree that the main driver of switching counteracting the switching costs listed is cost savings (DTI (2000), Oftel (2000), Ofgem (2001a and c))[73]. In the case of gas and electricity markets, the convenience of dual fuel deals also ranks high on the list of reasons for switching (Ofgem 2001c), it is however disputable whether this refers to veritable convenience reasons rather than further price discounts offered for dual fuel deals[74].

Various studies also seem to concur on the finding that those who have switched do not find the experience inherently difficult. According to the DTI study, 75% of switchers found it easy, and a further 20% found it fairly easy to switch. It should also be highlighted that those who have shifted in one market, are the ones most

[72] This result might suggest a problem of excessive product differentiation in the energy market. On this subject see for instance Mankiev and Whinston (1986).
[73] In view of the reputational effect identified with respect to switching barriers, it is interesting to note that in Venture (1999) the leading factor influencing customer preferences is not price, but the identity of the company or the brand supplying the service.

likely to shift in other markets, a finding confirmed by Oftel (2000)—those who switched their telecoms supplier were also more likely than average to have switched supplier of other utilities. Two possible interpretations of this last result are possible. First, repeated switching experiences reflect inherent consumer characteristics linked to lower risk aversion, and thus overall lower barriers to switching for selected households. Second, the result could also suggest that switching behaviour is 'habit forming', in the sense that a successful switching influence will lower switching barriers through a reduction of the perceived uncertainty.

Among the markets surveyed in DTI (2000), switching levels vary significantly, and specific reasons can be found for the variations. The highest levels of switching were reported in the insurance market, with 53% of consumers having switched their car insurance provider in the 5 year period considered by the survey, and 30% of consumers home insurance. A possible explanation for these high switching rates is that many insurance contracts require active renewal after a given period (e.g. every year). This automatically increases switching opportunities. Moreover, a number of competitive insurance suppliers will contact households about to renew their contract, thus reducing the search costs for the household.

The deregulated energy markets are also reported to have high levels of switching, a fact that is mainly attributed to the highly proactive marketing and sales techniques employed in the industry. Numbers of 37% for gas, and 26% for electricity are

[74] Note for instance that most dual fuel subscribers will still receive separate bills.

quoted in the DTI study, but it should be noted that these numbers are somewhat in contradiction with evidence from Ofgem (2000), where number of 29% and 19% respectively are quoted. The discrepancy is likely to stem from the fact that the reference periods in the two studies are not identical. Moreover, different wordings of the question might have caused different responses.

Financial services have among the lowest levels of switching. Only 12% of respondents have switched mortgage provider in the 5 year period prior to the survey, and only 6% of customers had changed their current account bank in the same period. In addition to particularly high aversion of risk in these services, the result might also be influenced by the fact that penalty clauses are often integrated in mortgage contract, preventing customers from switching.

The telecommunications sector is revealed as a liberalised utility sector with fairly low switching rates in terms of fixed line provider—only 11% of customers had done so[75]. However, the numbers are higher in the mobile sector with 20% of customers having switched. Oftel (2000) broadly confirms the DTI (2000) results for mobile telephone, reporting 25% of mobile network switchers, but also indicates higher levels of switching in the fixed telephony sector.

3.2 A theoretical cost-benefit model

In view of the evidence reviewed in the previous section, a theoretical model of supplier switching can be constructed. In addition to being guided by the conclusions

from the reviewed evidence, the model follows the framework set out in Parmar et al. (2000).

Formally, the probability P that the event 'switching supplier' S occurs can be expressed as a function of switching costs C and switching benefits B for household i.

$$P_i = P(S=1)_i = P(N_i^* \leq N_i) = F(C_i, B_i, \gamma) \qquad (1)$$

where γ represents a set of parameters and F is the distribution of (unobserved) net benefits N. N_i^* is the critical (or threshold) value for household i beyond which switching occurs.

Switching costs can be classified into several categories. First, time costs refer to the search and evaluation costs of finding the most appropriate offer, and possible administrative time for filling in forms. In customer surveys, time costs are most likely to be reflected in the answer that switching is 'too much hassle'. Time costs are likely to be positively related to the opportunity cost of alternative activities, and hence to income (*Y*) and/or employment status (*EM*) and household size (*HS*). The effect of education (*ED*) is ambiguous, since higher education may on the one hand reduce the time required to reach and implement a switching decision, but may on the other signal a higher opportunity cost, falling into the same variable category as income and employment status.

[75] This is likely to be at least partly caused by the possibility of indirect access which allows customers to

In addition to time costs, psychological barriers are likely to be important in terms of switching costs. Psychological barriers are likely to be positively related to household characteristics like age (*A*). Previous experience of switching in turn is likely to lower psychological barriers, in case such experiences have been successful and easy as they are reported to be in the majority of cases. Thus, switching in other markets like telecoms (*T*) or the alternative energy market (*ALT*) are likely to lower the cost of switching.

Finally, 'true' barriers to switching need to be taken into account. Despite recent targeted efforts in this area, one such barrier might still be outstanding debt. In particular in the case of gas, the use of prepayment meters (*PPM*) can be used as proxy for this barrier (Ofgem 2001c)[76]. Another real barrier might according to the latest Ofgem review be present in Scotland (*SCOT*): less door-to-door sales occur in this area, and lower overall switching rates are observed.

The above conceptualisation of switching costs leads to the following cost function:

$$C = C(Y / EM, ED, HS, A, T, ALT, PPM, SCOT) \qquad (2)$$

Regarding switching benefits, the primary driver behind switching is the potential saving in fuel costs. Cost savings will depend on the amount of energy used, and as such on household size (*HS*), and the size of premises inhabited (*HOUSE* and *ROOMS*). Importantly, cost savings are also related to payment method. As

exercise choice without actually having to switch their fixed line provider.

discussed in the previous section, customers using direct debit payment (*DD*) will have benefited from the most attractive price offers. Switching of payment method (*SWIPMM*) can be used as variable capturing customers who have switched payment method in order to benefit from larger price discounts. Last, a variable for zero standing charges is considered: in particular for customers with low usage, price offers considering variable charges only can be attractive in terms of cost savings.

Hence, the following benefit function can be assumed:

$$B = B(HS, HOUSE, ROOMS, DD, DUAL, SWIPMM, STAND0) \qquad (3)$$

The model outlined above will be estimated within a probit framework in Section 6. However, prior to reporting the econometric results, section 4 describes the data set underlying the analysis, and section 5 draws first conclusions from the descriptive analysis of the data.

4. The OXERA Energy Panel

The data analysed in this chapter has been gathered in the context of a panel study designed and set up by Oxford Economic Research Associates (Oxera) in 2001. The field work was undertaken by the market research company Ipsos-RSL.

[76] According to the same Ofgem reference, customers in debt are more evenly spread across all payment methods in the case of electricity.

The study is designed in three waves, with data collection taking place by means of questionnaires mailed to a representative sample of GB households[77]. The data gathered from each household falls into two categories: (a) information related to energy supplier and consumption, and (b) information on socio-demographic household characteristics. Energy-related information concerns in particular the identity of the supplier of gas and electricity in each of the quarters, and payment method used. The socio-demographic control variables collected include household size, income category and social grade, age and education level of head of household, as well as geographic location.

The data gathered by means of the three questionnaires span the eight quarters between the first quarter of 2000 and the fourth quarter of 2001. This chapter refers only to data gathered in response to the first questionnaire, covering the four quarters of 2000, and the first two quarters of 2001. Data from the next two waves was not yet available at the time of writing.

2,110 households have replied to the first questionnaire and are included in the next wave. However, in the subsequent analysis less households will generally form the base of the analysis, as partially completed questionnaires where information on some question or another might not have been recorded need to be considered.

[77] Households residing in England, Wales and Scotland are included in the sample. However, households residing in Northern Ireland or other UK islands are excluded.

5. Data analysis

5.1 Market shares

During the period of time the Oxera Energy Panel refers to, 24 electricity and gas suppliers could be identified as being active in GB[78]. Tables 6 and 7 below summarise the market shares of these suppliers.

The dynamic development of competition in UK domestic energy markets is apparent in the tables. For the ex-PESs, the evolution of market shares reflects a combination of loss of customers in former exclusive supply areas and gains in other newly accessible markets. According to table 6, the combined market share of the former regional monopolies is 58.5% in Summer 2001, which compares to 70% reported by Ofgem (2001c). Explanations for this difference might partly be found in the fact that Ofgem's numbers are based on a survey of suppliers as opposed to a survey of consumers. Moreover, Ofgem surveys the total customer base, while in the case of the panel data, a sample representative of the entire GB population is used, which might lead to survey differences for variables where the regional aspect is very important. The possibility of households not knowing exactly who their supplier is, thus inducing an error in the variables, also needs to be considered.

A difference with Ofgem's figures is also apparent in the gas market (table 7), with BGT having seen a reduction in its market share from 62.6% to 56.77% in the six quarters surveyed. This is ten percentage points lower than Ofgem's figure of 67% in

[78] The difference to Ofgem's lower count of active suppliers (Ofgem 2001c) stems from the fact that here suppliers active in the joint energy market have been considered, and that mergers between suppliers that have occurred over the period are not apparent in the tables.

July 2001 (Ofgem 2001c). However, the relative loss of market share (6% over 6 quarters) is similar to Ofgem's estimates (4% over 4 quarters).

In both the gas and the electricity markets, the data makes the increasing integration of the gas and electricity markets evident, with the former PESs acting as active entrants in the domestic gas market, and BGT having become the largest domestic electricity supplier. It is worth re-iterating that none of the ex-PESs entering the gas market has managed to gain as significant a market share as BGT in the electricity market. This is likely to reflect BGT's ability to attract customers on the basis of a national reputation, while the ex-PESs' reputation and brand attraction is mostly of regional scope. It should also be highlighted that according to table 6, BGT is now the single largest domestic supplier of electricity, while it is classified as second largest after Innogy by Ofgem.

Table 6: Market shares in the electricity supply market 2000/01 (% of respondent households)

Electricity/Gas supplier	Q1 2000	Q2 2000	Q3 2000	Q4 2000	Q1 2001	Q2 2001
Amerada	0.22	0.22	0.22	0.22	0.37	0.82
British Gas/Scottish Gas	13.87	14.41	15.65	17.53	19.37	21.37
Calor/Calortex	0.11	0.11	0.11	0.11	0.11	0.15
East Midlands Electricity	1.47	1.45	1.32	1.02	1.00	0.82
Eastern Gas/Electricity	9.72	9.72	9.17	8.41	8.13	7.85
Independent Energy	0.44	0.45	0.33	0.32	0.26	0.15
LEB/London Electricity	3.44	3.41	3.35	3.18	2.85	2.86
Manweb	3.82	3.69	3.46	3.18	2.9	2.86
Midlands Gas	0.05	0.06	0.00	0.05	0.05	0.10
Midlands Electricity/MEB	2.79	2.29	1.7	1.46	1.27	1.27
National Power	3.66	4.13	4.94	5.93	7.02	6.83
Northern Electric/Gas	6.12	5.92	5.66	5.34	5.17	5.05
Norweb/Energi	7.21	7.15	7.30	7.07	6.28	5.97
Saga	0.16	0.11	0.11	0.22	0.21	0.25
(Scottish) Hydro Electric	2.73	2.74	2.64	2.64	2.48	2.45
Scottish Power	5.19	5.47	5.55	5.23	5.07	5.15
Powergen	8.08	8.27	8.73	9.22	9.29	9.33
Seeboard	6.23	6.2	6.15	5.77	5.54	4.74
Southern Electric(ity)/Gas	9.39	9.44	9.34	9.17	8.76	8.26
Sterling	0.00	0.00	0.05	0.05	0.00	0.00
SWALEC	2.84	2.85	2.86	2.97	3.06	2.55
SWEB	2.95	2.85	2.69	2.54	2.37	2.09
Yorkshire Electricity/Gas	7.86	7.82	7.41	7.17	6.91	6.58
Other	1.64	1.23	1.26	1.19	1.53	2.50
Number of respondent households	**1,831**	**1,790**	**1,821**	**1,854**	**1,895**	**1,961**

Note: Former incumbents are identified through bold italics script. *Source:* Oxera Household Panel

Table 7: Market shares in the gas supply market 2000/01 (% of respondent households)

Electricity/Gas supplier	Q1 2000	Q2 2000	Q3 2000	Q4 2000	Q1 2001	Q2 2001
Amerada	1.64	1.76	1.99	2.33	2.48	2.16
British Gas/Scottish Gas	62.6	62.26	61.52	60.38	58.75	56.77
Calor/Calortex	1.77	1.69	1.48	1.32	1.18	1.14
East Midlands Electricity	0.13	0.13	0.13	0.19	0.19	0.24
Eastern Gas/Electricity	4.49	4.11	3.93	3.79	3.85	3.66
Independent Energy	0.19	0.26	0.32	0.32	0.12	0.06
LEB/London Electricity	0.82	0.78	0.77	0.76	0.74	0.78
Manweb	0.69	0.46	0.39	0.38	0.37	0.36
Midlands Gas	0.32	0.26	0.06	0.06	0.06	0.18
Midlands Electricity/MEB	0.19	0.13	0.13	0.13	0.12	0.12
National Power	2.4	2.54	3.09	4.1	5.21	5.22
Northern Electric/Gas	3.98	4.17	3.73	3.6	3.6	3.42
Norweb/Energi	3.22	3.13	3.35	3.66	3.23	3.48
Saga	0.13	0.13	0.13	0.32	0.25	0.3
(Scottish) Hydro Electric	0.19	0.07	0.13	0.13	0.25	0.42
Scottish Power	3.03	3.19	3.28	3.03	3.04	3
Powergen	3.92	4.5	4.89	5.3	5.83	6.18
Seeboard	1.26	1.37	1.48	1.51	1.8	1.56
Southern Electric(ity)/Gas	3.35	3.32	3.6	3.53	3.6	4.14
Sterling	0.06	0	0.06	0.06	0	0
SWALEC	1.45	1.5	1.48	1.26	1.3	1.26
SWEB	0.44	0.46	0.45	0.32	0.19	0.3
Yorkshire Electricity/Gas	2.34	2.54	2.51	2.33	2.36	2.52
Other	1.39	1.24	1.09	1.2	1.49	2.76
Number of respondent households	***1,583***	***1,534***	***1,554***	***1,585***	***1,612***	***1,668***

Note: Former incumbents are identified through bold italics script. *Source:* Oxera Household Panel

A fact that needs to be taken into consideration in the analysis of the supply market situation is that not all suppliers listed in tables 6 and 7 are independent, and that consolidation is an important feature of the market. Ofgem (2001c) estimates that despite the considerable number of supply licence holders, only 14 gas suppliers and 10 electricity suppliers are active in the market. To illustrate this point, table 8 consolidates for the electricity market the above market shares as a function of common ownership. Companies are ranked according to their relative size, and only the information referring to the second quarter 2001 is considered[79].

Table 8: Consolidated market shares in the UK electricity supply market

Controlling company	Controlled suppliers	Consolidated market share (%)
Innogy	Calor, Independent Energy, Midlands Electricity, National Power, Northern Electric, Yorkshire Electricity	20.05
TXU Europe	Eastern Electricity, Norweb	13.82
Scottish and Southern Electricity	Scottish Hydro Power, Southern Electricity, Swalec	13.26
PowerGen	East Midlands Electricity, PowerGen	10.15
Scottish Power	Manweb, Scottish Power	8.01
EDF	London Electricity, Sweb	4.95
Share of total electricity supply market		***70.24***

Source: Oxera Energy Panel

5.2 Switching evidence

Table 9 summarises the evidence on switching rates provided by the first questionnaire of the Oxera Energy Panel. The numbers indicate a strong uninterrupted upward trend in domestic switching, with quarterly rates for electricity

[79] Further consolidation has occurred since the Summer 2001, e.g. London Electricity (owned by EDF) has

increasing from 2.32% between the first two quarters of 2000 to 10.56% for the equivalent period a year later. For gas, the trend is very similar, with quarterly switching rates increasing from 2.24% between the first two quarters of 2000, to 9.31% for the equivalent period a year later[80]. If switching between any of the six quarters surveyed in the first wave of the panel is considered, switching rates of 33.7% for gas, and 35.6% for electricity are achieved. The comparison with the Ofgem numbers of 37% and 38% quoted in section 2.2 is not straightforward, as the Ofgem numbers refer to switching that has occurred since the completion of the liberalised energy markets, while the panel data takes the first quarter of 2000 as starting point. However, the results seem similar in their range and the increase per quarter.

Table 9 also provides insight into the importance of dual fuel deals in residential energy supply. In particular in the gas sector, an ever increasing majority of switchers change for dual fuel deals, but the trend seems less clear-cut in electricity.

acquired TXU Europe's distribution business.

[80] In the numbers quoted, switching between all available suppliers is accounted for and multiple switchers will be counted at each instance of switching.

Table 9: Switching in the residential energy sector 2000/01 (% of respondents)[1]

	Q1/Q2 2000	Q2/Q3 2000	Q3/Q4 2000	Q4 2000/ Q1 2001	Q1/Q2 2001	Entire period[2]
Electricity	2.32%	4.55%	4.96%	6.53%	10.56%	35.64%
Among these: switching to dual fuel supply	14.63%	8.64%	8.89%	8.26%	15.08%	-
Gas	2.24%	4.85%	5.69%	6.86%	9.31%	33.74%
Among these: switching to dual fuel supply	50.00%	70.27%	70.45%	74.07%	85.23%	-

Note: [1] Switchers are defined as households reporting to use different energy suppliers from one reference quarter to the other. [2] Switching numbers are cumulated across all 6 quarters, i.e. across 5 switching occasions. *Source:* Oxera Energy Panel

The growing prevalence of dual fuel supply is confirmed by the increasing number of respondents reporting identical gas and electricity suppliers set out in table 10. It needs to be highlighted that the numbers calculated on the basis of the panel responses are higher than those reported by Ofgem in its latest market review (Ofgem 2001c). According to Ofgem's estimates, 36% of gas customers, and 30% of electricity customers were subscribing to dual fuel offers in July 2001. However, Ofgem also states that four out of five switchers are now buying gas and electricity from the same supplier, which is very much in line with the panel data in the case of gas switchers.

Table 10: Dual fuel supply in the energy sector 2000/01 (% of respondents)

	Q1 2000	Q2 2000	Q3 2000	Q4 2000	Q1 2001	Q2 2001
Respondents with identical gas and electricity supplier	39.13%	39.68%	42.70%	46.36%	49.87%	55.12%

Source: Oxera Energy Panel

Another interesting feature that can be examined with help of the data gathered in the panel is 'return switching', i.e. households who return to their incumbent energy supplier after having initially switched to a competitor. Return switching implies multiple switching, and it can be expected that, as the period of full energy market liberalisation lengthens, customers become more confident in the switching process and multiple switching increases. In the gas sector, return switching implies switching to BGT, the former incumbent. According to the panel data, over the entire period quarter 1 2000 to quarter 2 2001, 29% of gas switchers were return switchers. This compares to 26% reported by Ofgem (Ofgem 2001c).

Calculating return switching rates from the panel data is more complex in the electricity sector—there is no single incumbent as in gas, but 14 former regional monopoly suppliers (ex-PESs). It is not possible to identify with complete accuracy return switchers as the geographic regions of GB recorded in the panel do not overlap perfectly with the PES regions. Nevertheless, an estimation of the phenomenon has been attempted by matching as closely as possible the regional variable contained in the household data with the incumbent PES regions. The percentage of return switchers calculated over the entire period quarter 1 2000 to quarter 2 2001 is 23.5%, which is significantly higher than Ofgem's estimation of 16%. Given that the domestic electricity market has been opened to supply competition a year less than the gas market, it can be expected that return switching is less frequent in electricity than in gas. However, as in several cases above, the difference between the panel and Ofgem's figures warrants further investigation.

5.3 Payment method

Tables 11 and 12 summarise evidence concerning the use made of the different payment methods in the domestic gas and electricity markets. Direct debit is the

most choice both for gas and electricity bill payment. However, the relative share of direct debit in gas is higher than in electricity, with 59.9% of gas customers and 54.7% of electricity customers making use of this payment method in Summer 2001.

Table 11: Relative share of payment methods in electricity 2000/01 (%)

Payment method	Q1 2000	Q2 2000	Q3 2000	Q4 2000	Q1 2001	Q2 2001
Quarterly payment	29.44	29.26	29.12	28.97	28.27	27.85
Direct debit	52.54	53.11	53.33	53.33	53.22	54.71
Pre-payment meter	18.02	17.63	17.7	17.7	18.51	17.45
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Source: Oxera Energy Panel

Table 12: Relative share of payment methods in gas 2000/01 (%)

Payment method	Q1 2000	Q2 2000	Q3 2000	Q4 2000	Q1 2001	Q2 2001
Quarterly payment	32.12	31.45	30.97	30.64	29.88	29.23
Direct debit	57.24	57.99	58.47	58.67	59.14	59.82
Pre-payment meter	10.64	10.57	10.57	10.38	10.99	10.96
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Source: Oxera Energy Panel

The relative share of direct debit has increased slightly over the period surveyed, having grown from 52.54% to 54.71% in electricity, and from 57.24% to 59.82% in gas. This is consistent with the fact that a number of switchers will combine the change in suppliers with a change in payment method in favour of direct debit where additional discounts can be obtained.

Quarterly payment methods comprise payment by cheque by mail, payment by cheque or cash at the bank or a post office, and also payment by telephone (with a debit or credit card) or payment online on the internet. The share of all these

quarterly payment methods is decreasing in tune with the rise in direct debit. The combined share of pre-payment meters among all payment methods is fairly stable in both electricity and gas, and it is notable that this payment method is significantly more widespread in electricity than gas.

The relative importance of the payment method in the switching process, and in particular the prevalence of simultaneous switching of supplier and payment method to direct debit in order to maximise the savings available is examined in table 13.

Table 13: Switching of payment methods 2000/01

% of respondents recording different payment methods between quarters	Q1/Q2 2000	Q2/Q3 2000	Q3/Q4 2000	Q4 2000/ Q1 2001	Q1/Q2 2001	Q1 2000/Q1 2001
Electricity	0.45%	1.44%	0.76%	1.56%	2.07%	6.16%
Gas	0.65%	0.91%	1.02%	1.13%	2.42%	6.20%
Simultaneous switching of supplier and payment method (% of total switchers)						
Electricity	4.88%	9.88%	6.67%	9.09%	8.04%	-
Gas	14.71%	9.46%	7.95%	6.48%	12.75%	-
Switching to direct debit (% of total payment method switchers)						
Electricity	62.50%	61.54%	57.14%	58.62%	69.23%	-
Gas	80.00%	64.29%	68.75%	83.33%	58.97%	-

Source: Oxera Energy Panel

The numbers in table 13 confirm that overall, switching of payment method is less frequent than switching of supplier, but increases also steadily over the period surveyed. In electricity, 6.16% of respondents have switched payment method between any of the quarters surveyed, in gas, the number is very similar at 6.2%. This similarity confirms a fact already evident in the switching rates: despite the fact that the electricity market has been fully liberalised a year less long than the gas market, there is today very little difference between the two. This implies that

competition in the electricity sector has unfolded more quickly than in the gas sector, a possible explanation for this being the ever stronger integration of the two sectors and a spill-over of customer experience in switching from gas to electricity.

It should also be noted that an increasing proportion of total switchers in electricity are simultaneous switchers of supplier and payment method. Approximately 5% of all switchers in electricity have simultaneously switched payment method between the first and second quarter 2000, a year later, this number has increased to 8%. The absolute proportion of simultaneous supplier and payment method switchers is higher in gas (the equivalent numbers for Q1/Q2 2000 and Q1/Q2 2001 are 15% and 13% respectively), however, the trend in gas seems to be declining rather than increasing.

Last, table 13 shows that the overwhelming majority of payment method switchers change for direct debit, confirming that this payment method in particular has gained in attractiveness since liberalisation. Competing suppliers have initially concentrated their efforts on this customer group, and following unwinding of cross-subsidies between payment categories, customers have been able to realise important cost savings by switching to direct debit.

5.4 Switcher profile

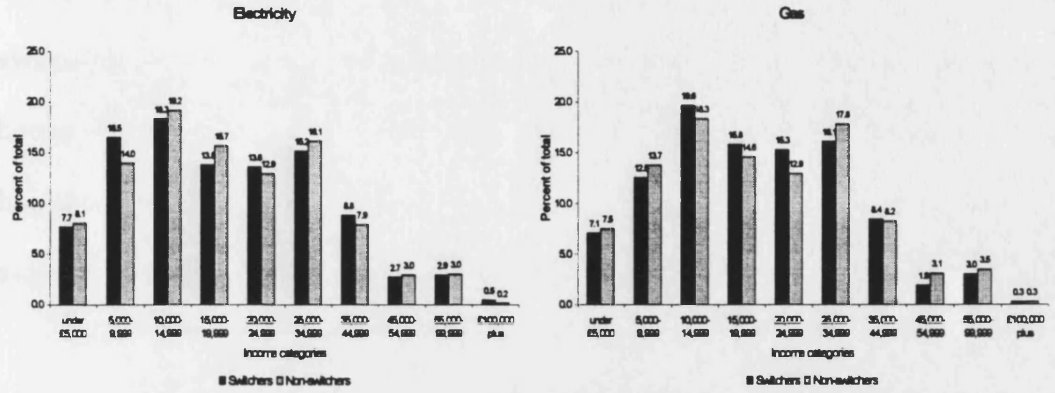
The above paragraphs have highlighted the increased prevalence of domestic energy supplier switching and the importance of supply features such as payment method and dual fuel offers. To complement the picture, figures 1 to 4 below compare graphically some of the most important socio-demographic characteristics between switchers and non-switchers. The variables considered are income category, social

grade, age and household size. Electricity and gas switching rates compounded over the 6 quarter period are considered.

Figure 1 shows the profile of switchers compared to non-switchers by income category for electricity and gas. In electricity, the income category with the highest proportion of switchers compared to non-switchers is the category GBP 5,000-9,999. This is the one but lowest category, and suggests that the option of supplier switching is taken up by less privileged households, a result corroborating the Ofgem (2001c) finding of very low income households catching up with the average (see also table 5). Where the other income categories are concerned, no clear pattern emerges, both the categories GBP 20,000-24,999 and GBP 35,000-44,999 having higher proportions of electricity supplier switchers than non-switchers, but the difference is less marked than for the GBP 5,000-9,999 income category. Looking at the opposite aspect of dominance of non-switchers over switchers, this is strongest in the middle income category GBP 15,000-19,999. Two possible explanations for this result can be offered. First, this population group might have been the first to benefit from switching offers and fewer households are now switching in this category, second the net benefits from switching might be lower for this income group.

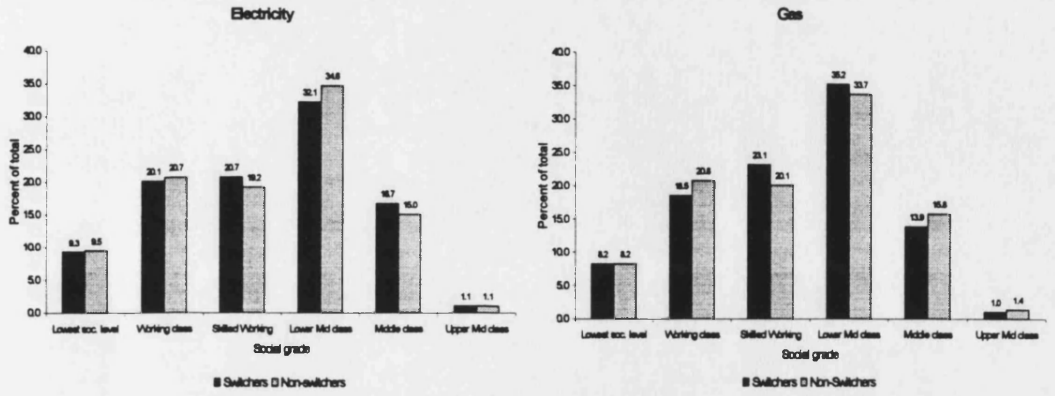
In the gas market, switchers are disproportionately well represented in the three middle income groups GBP 10,000-14,999, 15,000-19,999 and 20,000-24,999. The largest difference between switchers and non-switchers exists for the last of the three categories. Compared to electricity, the two lowest income categories have proportionately less switchers. Again, similar to electricity, the lowest proportion of switchers is observed in a middle income category, i.e. the GBP 25,000-34,999 category.

Figure 1: Switcher and non-switcher profile by income category



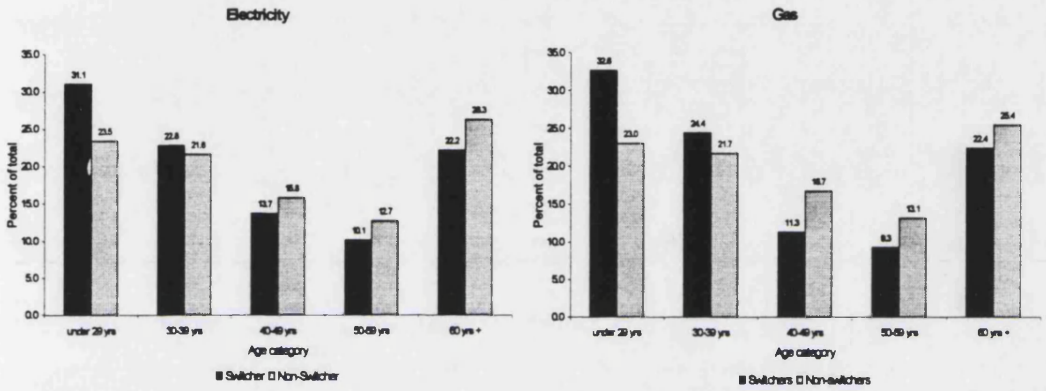
Profiling switchers and non-switchers by social grade in figure 2, overall confirms the results obtained for the income categories. No clear trend is distinguishable in electricity, by contrast, switchers in gas are concentrated in the middle categories of skilled working class and lower middle class. The pre-dominance of poorer households among electricity switchers is less obvious in the categorisation of the population into social grades compared to income categories. The lowest social grades are not showing higher switcher than non-switcher proportions, and the two categories with a disproportionate share of electricity switchers are the skilled working class and the middle class.

Figure 2: Switcher and non-switcher profile by social grade



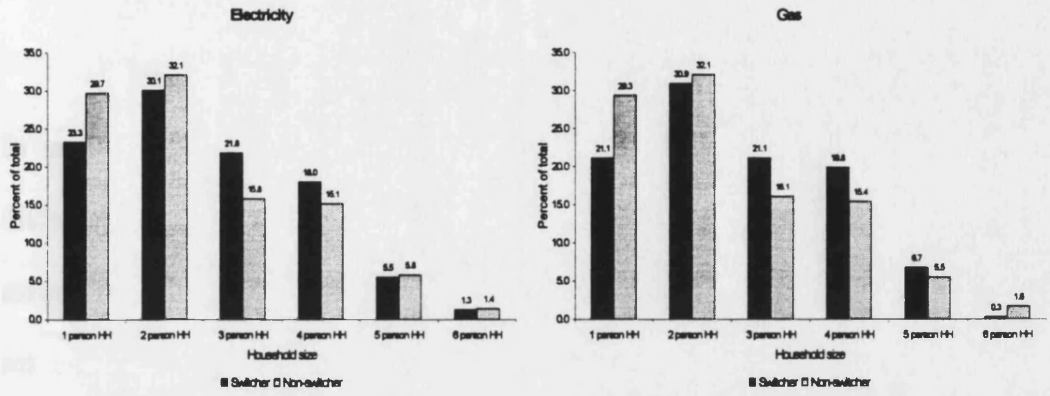
A very clear picture emerges in terms of the age profile of switchers in figure 3. There is a strong predominance of households headed by young persons among switchers. In both the gas and electricity sector, the two categories of heads of household under 29 years, and heads of households between 30 and 39 years are the household categories with a disproportionate share of switchers compared to non-switchers.

Figure 3: Switcher and non-switcher profile by age



Last, switchers and non-switchers are profiled as a function of household size in figure 4. There are similarities between the two sectors, with both gas and electricity showing the highest proportion of switchers in medium-sized households of three to four persons. The trend is slightly more pronounced in the case of gas.

Figure 4: Switcher and non-switcher profile by household size



Summing up, the evidence obtained from a first descriptive analysis of the data suggests several conclusions with regard to the socio-demographic make-up of switchers. Confirming the Ofgem results set out in table 5, there does not seem to be discrimination against lower income groups or lower social grades. On the contrary, middle to higher income households have lower switching rates than the former categories, suggesting, in the context of the theoretical model outlined above, a combination of higher switching costs and lower benefits from switching. There might also be a link to the prevalent form of marketing in the energy sectors: the surveyed evidence seems to suggest that doorstep sales account for a large proportion of switching, and it is possible that lower income households (e.g. headed by unemployed or part-time workers, etc.) are more likely to be at home to receive a salesperson.

Age clearly influences switching, with households headed by younger persons being the predominant switchers in both gas and electricity. Again, this mirrors the Ofgem results set out in table 5. In terms of theory, this confirms the hypothesis that net benefits of switching decrease with age, with perceived benefits less likely to outweigh costs. Last, household size shows no clear linear relationship with

switching numbers, switching seeming to be clustered in medium size households rather than very small or very large households.

6. A probit model of switching in the energy sector

In order to formally test which factors influence switching and whether there are differences between the sectors or between population groups, a probit model is estimated in this section on the basis of the theoretical cost-benefit switching model set out in section 3.

The model has been estimated taking into account switching rates across all quarters included in the panel, i.e. from the first quarter 2000, to the second quarter 2001. The variable to be explained represents actual switching and takes a binary 0-1 form. The model is estimated separately for the gas and the electricity sector.

The explanatory variables considered correspond to those identified in the previous sections. In terms of socio-economic and demographic characteristics of the household, they include household size, age of head of household, income category, educational level attained by head of household, type of housing, number of rooms, and a regional dummy for households resident in Scotland.

A further set of explanatory variables is related to alternative switching experiences. Switching in fixed or mobile telephony and switching in the alternative energy sector are included in this second group of explanatory variables.

The last group of explanatory variables considers aspects related to cost savings. The variables in this group include dummies for the use of direct debit, or the use of a pre-payment meter[81], and whether a household has been subscribing to a dual-fuel deal in the period considered. A further variable takes the fact into account that switching of payment method has occurred over the period considered, implying with some probability that a household will have wanted to reap further price discounts by switching to direct debit. Finally, the possibility that a household pays no standing charge on their energy consumption is included as it can represent cost savings in particular for low volume users.

The results of the estimation are presented in table 14 for both gas and electricity.

[81] The payment method dummies refer to the method used by a household at the end of the survey period, i.e. in the second quarter 2001.

Table 14: Probit estimation results

	Independent variable			
	Supplier switching in gas		*Supplier switching in electricity*	
Dependent variables	***Coefficient[1]***	***DF/dx[2]***	***Coefficient[1]***	***DF/dx[2]***
Household size	NS	NS	NS	NS
Head of household below 29 years[3]	0.20**	0.053**	NS	NS
Income category	NS	NS	NS	NS
Education level of head of household	NS	NS	NS	NS
Living in a house[3]	NS	NS	NS	NS
Number of rooms	NS	NS	NS	NS
Resident of Scotland[3]	NS	NS	NS	NS
Switched in fixed or mobile telephony[3]	NS	NS	NS	NS
Switched in the alternative energy sector[3]	1.5***	0.47***	1.44***	0.47***
Switched payment method[3]	0.99***	0.34***	0.27*	0.08*
Direct debit user[3]	0.19*	0.05**	NS	NS
Pre-payment user[3]	-0.44**	-0.09**	NS	NS
Dual fuel offer subscriber[3]	0.47***	0.12***	1.1***	0.27***
Zero standing charge[3]	-0.48***	-0.11***	0.3***	0.13***
Predicted probability at sample average		*0.17*		*0.18*

Notes: [1] Coefficients with a statistical confidence interval below 90% are not reported and denoted with 'non-significant' (NS). For reported coefficients, the statistical confidence levels are indicated by stars, where * stands for statistical significance within a 10% interval, ** within a 5% interval, and *** within a 1% interval. [2] dF/dx represents the change in probability of a unit change in the dependent variable, all other variables being held at sample average. [3] dF/dx is for discrete change of dummy variable from 0 to 1, all other variables being held at sample average.

The estimation results reported in table 14 suggest a number of conclusions greatly in line with the previous analysis set out in this chapter. In both gas and electricity, socio-demographic characteristics of a household seem to play a less important role in determining the probability of switching than alternative switching experiences and variables related to cost savings. In neither of the two sectors do factors such as

household income, household size or education display significant coefficients. The type of housing (house as opposed to flat) plays no statistically significant role, and neither does the number of rooms occupied by a household. Whether or not a household resides in Scotland also has no significant impact on the switching probability.

One demographic variable impacting the switching probability, but only in the case of gas, is the age of the head of household. The variable has the predicted sign, i.e. households headed by young persons are more likely to switch than others. However, age is not significant in the case of electricity.

The single most important variable to impact switching probability in gas and electricity is switching in the alternative energy sector. Having made the experience of supplier switching in either gas or electricity will increase the average probability of a household switching in the other sector by almost 0.5 (0.47 in gas and 0.46 in electricity). This result can be interpreted as reflecting unobserved household characteristics, with households with low risk aversion and/or high sensitivity to cost savings being likely to be multiple switchers. In addition, a learning or habit formation effect is also likely to influence the result. Moreover, the interaction between the two energy sectors might also play a role. In this context, the separate dual-fuel dummy has a highly significant positive coefficient in both the electricity and gas sectors, confirming the importance of dual-fuel deals in the switching experience. As the evidence reviewed in the previous sections shows, a majority of switchers are now subscribing to dual fuel deals, with the attraction of these deals lying arguably more in the additional discounts offered than in increased convenience for the customer.

It should also be noted that the alternative energy switching experience is more significant than switching experiences regarding telephony suppliers, the former overriding the impact of the latter.

More highly significant coefficients are estimated in both the gas and electricity sector for the variable representing switching of payment method. In the case of gas, having switched payment method over the period considered will increase the average probability of switching by 0.3. The result is less strong in the case of electricity (0.08), but still significant. The switching payment method coefficient is most likely to pick up a cost savings factor linked to direct debit. As the figures in table 13 show, switching to direct debit is the most frequent form of payment method switching, and is motivated by the attractive price offers available to this customer group.

Another interesting result is that, in gas, the fact that a household has a bill structure with zero standing charge decreases the probability of supplier switching, while in electricity, it increases it. A possible interpretation of this result would be that the marketing strategy of zero standing charge introduced by BTG does indeed increase customer retention, in particular among lower volume users. The opposite result in electricity could possibly be caused by electricity customers switching to BGT in order to benefit from its zero standing charge policy.

The impact of payment method on switching probability differs between gas and electricity. The results suggest that users of gas pre-payment meters are less likely to have switched over the period surveyed, while users of direct debit are more likely to have done so. In the case of pre-payment meters, the result in gas might be driven by the fact that the proportion of customers in debt is largely above average among gas

pre-payment customers, and the negative coefficient might pick up real barriers to switching which might have existed for such customers. The debt problem among pre-payment customers is a lot less pronounced for electricity, which might be the explanation why the pre-payment meter dummy is not statistically significant in electricity.

The difference between the two sectors is less straightforward to explain in the case of direct debit. While the positive impact of direct debit usage on switching probability in gas is expected, there does not seem any impact of this payment method in the case of electricity. A possible reason for this might be that the cost savings effect targeted by the direct debit variable is already picked up by other variables.

7. Assessment

There is consensus among survey results about the fact that the main driver behind switching is perceived cost savings, but that customers also display a considerable amount of inertia and risk aversion that need to be overcome in order for switching to take place. The estimation results from the probit model suggest that variables linked to such savings are indeed exerting a significant positive impact on the probability of switching. Among the variables linked to cost savings count duel fuel offers, switching of payment method, and 'zero standing charge' tariffs.

However, according to the estimation results, the variable that has the strongest predictive power for the probability of switching is switching in the alternative energy sector. The impact of this variable is likely to combine several effects, the most important arguably being that it approximates unobserved lower risk aversion for certain households. Arguments of 'habit formation' after successful switching

experiences have also been advanced and can explain the result. It is however also likely to pick up the increased integration of the two sectors, with the positive impact of the separate dual fuel variable confirming this last point.

Supplier switching is often combined with switching of payment method, in particular in favour of direct debit, in order to maximise the savings offered by alternative suppliers. This observation is also supported by the model, with switching of payment method being linked to a higher probability of supplier switching.

The relative insignificance of socio-economic and demographic household variables, in particular income category and variables related to income (such as type of dwelling or number of rooms occupied), seems to confirm that the switching experience is not (or no longer) confined to better-off households. Thus, the latest Ofgem findings suggesting a move towards a more even distribution of switching benefits across the population are corroborated. One demographic variable impacting on the probability of switching in the case of gas is the age of the head of household, with households headed by older persons less likely to switch. Elderly households also count among the few population groups singled out by Ofgem because of their lower than average switching rates. It stands to believe that at lease the psychological costs of switching are higher for these households.

It is interesting to compare the results in table 14 with the probit model results reported by Parmar et al. (2000). In their results, income, age, educational level and employment status did not seem to affect switching levels, thus corroborating the results in table 14. However, switching probability increased with household size, possibly suggesting that household characteristics of switchers in the early periods of liberalisation somewhat differed from later periods.

It should also be noted that the results found by Parmar et al. (2000) suggest some difference between analysing attitudes to switching as opposed to actual switching rates[82]. In the case of attitudes to switching, consumers were found more likely to consider switching suppliers if they had already switched telecom suppliers, and less likely to consider it if they were over 65. The likelihood of switching was also positively related to income.

One of the main reasons given by Ofgem for the proposed withdrawal of all price controls in GB's gas and electricity markets from April 2002 is that the differences between special customers groups have evened out. The market is thus moving to a situation where all customer groups are equally likely to benefit from choice between suppliers. In particular, differentials in competition for different payment method customers have lessened over the past year, and disadvantages faced notably by pre-payment customers are disappearing.

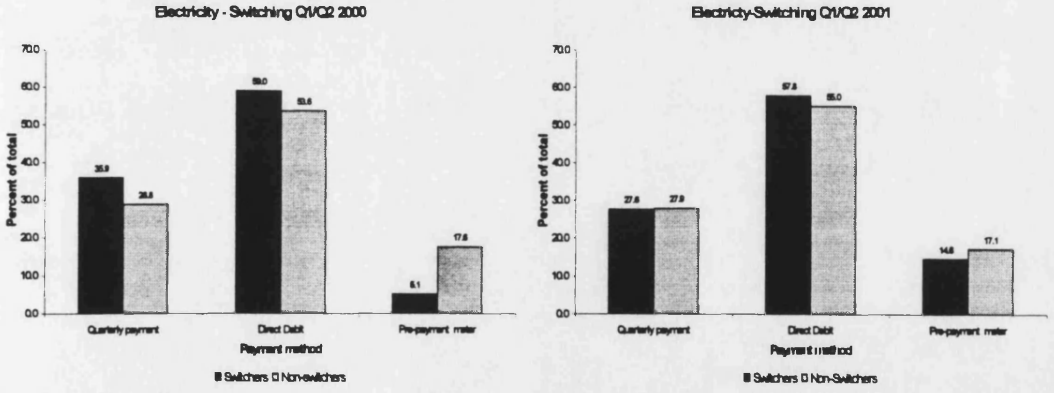
The results from the Oxera panel are mixed with respect to this issue. On the one had, the payment method used by a household does not seems to impact the probability of switching in the case of electricity, on the other, in gas, pre-payment meter customers display a lower likelihood of switching, while direct debit customers display a higher one. A possible explanation for the difference between gas and electricity is that customers in debt are predominantly using pre-payment meters in gas, while they are evenly spread across all payment methods in electricity.

[82] The relevant variable in the former case is the response of customers to the question whether they would

In order to account for the dynamic evolution of switching rates in the context of payment methods, figures 5(a) and 5(b) depict switching rates according to the main payment methods. Figure 5(a) refers to switching at the beginning of the panel period, i.e. switching between the first two quarters of 2000, figure 5(b) to switching at the end, i.e. switching between the first two quarters of 2001.

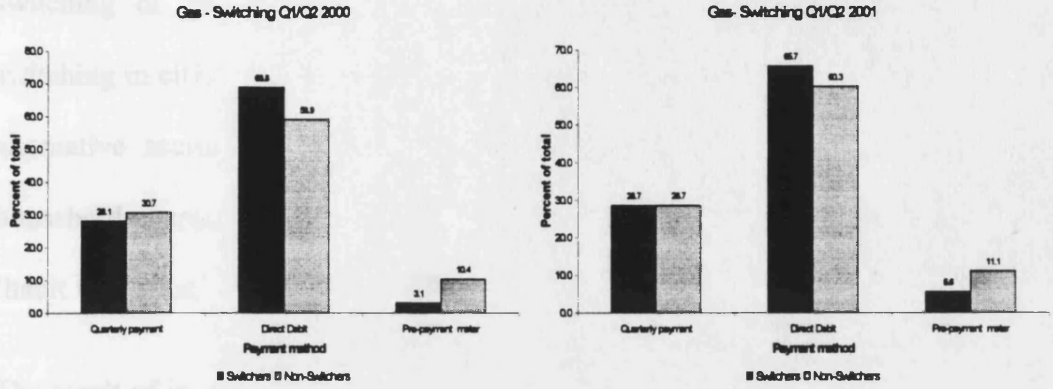
Figures 5(a) shows that at the beginning of 2000 switching was over-represented among customers paying by standard quarterly payment methods and by direct debit, while pre-payment meter customers were a lot less likely to switch. A year later, this has changed according to figure 5(b). While pre-payment customers are still being under-represented in terms of switchers, the difference between payment methods are certainly evening out, and in particular in electricity, and the structural gap between direct debit and pre-payment meter customers is disappearing.

Figure 5(a): Switcher and non-switcher profile according to payment method—Electricity



consider switching supplier in the next year. In the latter case, actual switching numbers are the object of

Figure 5(b): Switcher and non-switcher profile according to payment method—Gas



8. Concluding remarks

In this chapter, determinants of supplier switching in gas and electricity are analysed on the basis of data collated via the Oxera Energy Panel, the data spanning 6 quarters from the first quarter 2000 to the second quarter 2001. The analysis complements recent survey results regarding the state of competition in UK residential energy markets, in particular Ofgem's latest supply competition review (Ofgem 2001c). Using a probit model, formal data analysis is undertaken in order to add to the body of evidence so far dominated by descriptive analysis. The results of the econometric model offer insights regarding the impact of different socio-demographic and energy consumption specific variables on the likelihood of switching of gas and electricity supplier.

scrutiny.

The estimation results suggest that supplier switching in the gas and electricity sector is mainly driven by variables linked to cost savings, including duel fuel offers, switching of payment method, and 'zero standing charge' tariffs. Moreover, switching in either of the two energy sectors is linked positively to switching in the alternative sector. This can be interpreted as picking up intrinsic unobserved household characteristics such as lower aversion to risk, but might also point to a 'habit formation' effect.

The result of importance of cost savings and parallel switching experience is paired with evidence of relative insignificance of socio-economic and demographic household characteristics. The latter result is more particularly important as it corroborates findings that switching has become more evenly spread across all population groups since liberalisation has become fully effective, and that the benefits of competition are distributed so as not to disadvantage marginal customer groups.

The combined evidence of the descriptive and formal panel data analysis presented in this chapter paints a favourable picture of the competitive situation in the domestic energy market in GB. Switching rates both in electricity and gas display an upward trend, and competition seems indeed be driven by customers seeking out the most advantageous offers, with real barriers to switching being very limited.

However, in view of the consolidation witnessed over the past year, in particular in the electricity supply market, the importance of maintaining a sufficient number of suppliers needs to be stressed. The positive assessment of competitive conditions is only valid as long as there is a sufficient number of competing independent suppliers among which customers can exercise their choice. It is therefore of upmost

importance that the energy regulator exercises its competition surveillance powers in the sector and that future consolidation is closely monitored.

GENERAL CONCLUSION

In this thesis the theoretical principles underlying the liberalisation and regulation of network utilities have been reviewed, and some particular aspects of the process of regulatory reform have been analysed in detail. The thesis has two parts, each comprising two chapters.

In the first part of the thesis, chapter 1 sets out the general principles of network utilities reform which started in the UK with the liberalisation of the telecommunications industry and the privatisiation of BT. In the first chapter, the three key ideas of regulatory reform—introduction of competition in all but the core natural monopoly areas, incentive price-cap regulation, and independent sector regulators—are introduced and discussed.

Many complex issues need to be solved in the process of transforming markets supplied by incumbent monopolies into competitive markets. Transition requires acknowledgement that there is no unique solution, but that each case for reform will need to be considered in its own context. Competition can take on different forms, and which best meets efficiency criteria depends upon the market and government failures which arise in each industry and country. Moreover, transitional pitfalls are many, and technological progress can change the competitive potential of markets along the way.

However, despite of all the different individual cases, consensus on many regulatory principles has emerged around the UK model. The UK experience has provided valuable lessons for the European countries, embarking on the path of regulatory reform in utility networks some 16 years after BT was privatised. The principles of the UK model are echoed in the European liberalisation directives. Nevertheless,

unique national characteristics imply that regulatory reform has taken different forms in different European countries, a proposition which is illustrated for the particular case of Germany in chapter 2.

In the second chapter, the theoretical framework set out in chapter 1 is used to examine the transformation three German utility network services have undergone in the recent past—i.e., electricity, telecommunications and rail transport services. While not one of the pioneering countries of liberalisation in Europe, Germany has in the recent past implemented far reaching reform measures in these three sectors. An outstanding feature of the German market is the decentralised character of its electricity industry, and, albeit to a lesser extent, of its rail transport services. It is found that the decentralised structure of these services is reflected in the regulatory framework.

The German electricity industry is characterised by a fragmented market with a great number of players. This market structure is at the origin of the minimal sector-specific regulation Germany's authorities have imposed on the sector at the moment of full liberalisation in 1998. Because of the large number of players, the potential for the rapid emergence of effective competition was judged favourably and the industry was granted a high degree of self-regulation. However, close supervision of the industry by the general competition authorities seems necessary in order to avoid collusion between the major incumbent companies and to address barriers to entry.

In the German rail sector, far reaching reform measures were introduced in 1994. However, much of the regulatory control in the sector is still exercised directly by the federal government, which is still the sole owner of Deutsche Bahn AG. The sector-specific regulator set up during the reform process is responsible primarily for

technical regulations and has an advisory role. However, the rail reform has also strengthened the regional element in the sector, devolving powers to regional and local transport authorities which have considerable scope to shape the form of their public transport services.

Finally, where the telecommunications sector is concerned, the German liberalisation process was largely influenced by European policy. In response to the monolithic pre-liberalisation structure of the sector, similar to the UK situation at the outset of liberalisation, Germany has set up its only independent sector regulator in the area of telecommunications.

In the second part of the thesis, chapter 3 and 4 analyse two specific aspects of utility network liberalisation and regulation, making use of econometric techniques. Chapter 3 of this thesis looks at the impact liberalisation has had on marginal households in the context of fixed telephony access. The liberalisation of the telecommunications sector and the rebalancing of the tariff structure associated with it, i.e. the rise in fixed charges and the fall in call charges, has raised questions about the impact the rise in access charges will have on universal telephone access. Through the creation of a repeated cross section data set based on the annual UK Family Expenditure Survey (FES), the impact of access tariff variation on domestic fixed telephony access demand is evaluated.

The results establish two main facts. First, the cost of access expressed by connection and rental charges has a negative effect, albeit small, on the probability of a household having a fixed-line telephone. All other things equal, the rebalancing of tariffs can therefore have a negative impact on telephone penetration rates. Second, by creating a subsample of low-education households to approximate low-

income households, a strong sensitivity of access elasticities with respect to income is found. The price elasticity with respect to one-off telephone connection charges, identified as main price barrier to telephone ownership, is about 50% higher in the low-education sample than in the overall sample (-0.1 and –0.06 respectively). This suggests that it is notably vulnerable, low income households who bear the burden of rebalancing. The results found on the basis of UK data corroborate evidence from North-American studies.

However, the results of chapter 3 need to be interpreted in the light of several recent developments. First, the data underlying the analysis spans the period 1985 to 1996. Since then, technological progress and, in particular, the rapid rise of mobile telephony have changed the picture of the industry. The fierce competition between mobile operators and the availability of affordable pre-pay mobile handsets have profoundly affected the nature of the debate of exclusion from communication services. The focus has shifted from fixed to mobile telephony. Nevertheless, access to fixed telephony network plays still a role for access to new internet based services.

Similar to chapter 3, the analysis in chapter 4 is based on formal data analysis. In this last chapter, determinants of supplier switching in gas and electricity are analysed on the basis of data collated via the Oxera Energy Panel, the data spanning 6 quarters from the first quarter 2000 to the second quarter 2001. The analysis complements recent survey results regarding the state of competition in UK residential energy markets, in particular Ofgem's latest supply competition review. Using a probit model, formal data analysis is undertaken in order to add to the body of evidence so far dominated by descriptive analysis. The results of the econometric model offer insights regarding the impact of different socio-demographic and energy

consumption specific variables on the likelihood of switching of gas and electricity supplier.

The estimation results suggest that supplier switching in the gas and electricity sector is mainly driven by variables linked to cost savings, including duel fuel offers, switching of payment method, and 'zero standing charge' tariffs. Moreover, switching in either of the two energy sectors is linked positively to switching in the alternative sector. The result of importance of cost-savings and parallel switching experience is paired with evidence of relative insignificance of socio-economic and demographic household characteristics. The latter result is more particularly important as it corroborates findings that switching has become more evenly spread across all population groups since liberalisation has become fully effective.

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