# A POLITICAL ECONOMY APPROACH TO PRIVATISATION OF PUBLIC FIRMS

Gustavo Nombela

Thesis submitted for the degree of
Doctor of Philosophy (Ph.D.)

on

August 1998

at

London School of Economics & Political Science

University of London





ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

*To all the people who helped and*
*encouraged me during these years:*
*those who were near,*
*the others from the distance.*

# ABSTRACT

The economic policy named as privatisation has been one of the most popular among governments around the world since the early 1980's. Initially defined as the sale of state-owned enterprises to private owners, the meaning of the term 'privatisation' has been thereafter extended to encompass all kind of transfers of public sector activities to private hands.

Economic analysis of privatisation started in the late 1980's, well after many countries had already put in practice their first privatisation programmes. Most of the empirical work on the topic is based on comparisons between public and private firms in terms of productive efficiency. The general conclusion obtained is that private firms are usually more efficient than public firms, especially when working in competitive markets.

The literature has then been focussed on explaining why this inefficiency gap appears and how privatisation may contribute to its elimination. A result which may be called the 'irrelevance proposition' has been pointed out by different authors: under perfect conditions, the type of ownership (public or private) should not matter. Were this result to hold, governments could obtain the same outcomes either owning or regulating firms. Papers on privatisation have searched for reasons to justify why this irrelevance result does not hold. The most common approach has been to consider the existence of asymmetric information between governments and firms' managers, which distorts incentives and generates the inefficiency gap.

Although this approach is useful to understand some important features of the problem, it seems that a more complete theory of public firms' inefficiency and privatisation is required, since some relevant factors have been left aside. Little attention has been devoted to the political side of this problem, while it seems that a very important point should be to fully understand governments' incentives and behaviour.

This thesis tries to be a contribution to the development of this approach to privatisation, able to explain the fundamental causes of the inefficiency gap and the reasons why the present trend towards privatisation is being observed across the world. After a thorough revision of the existent literature, two theoretical models analyse different aspects of the problem. A common basic framework is used in both of them: the usual assumption of benevolent welfare-maximising governments is replaced by a more realistic approach to governments as non-benevolent vote-seeking agents. In addition, two empirical contributions are presented to examine how predictions from the political approach to privatisation are related to actual observations from public firms.

The first theoretical model (chapter 2) studies how governments' ideologies can influence privatisation decisions. A voting game between two political parties is studied, showing that although ideology plays a role, strategic considerations are of greater importance to governments when taking decisions about public firms and privatisation. Results derived from this model explain the actual observation about privatisation being performed by governments of very different type of ideologies. The role that tight public budget constraints may have played on privatisations is also examined.

The second model (chapter 3) analyses the problem of overstaffing of firms and its relationship to ownership structure. A non-benevolent government is assumed to take decisions under uncertainty over the size of a project or the level of a service to be publicly provided. Three types of firm can produce the good: a publicly-owned firm or a contracted-out private firm, regulated either with a complete or an incomplete contract. Outcomes are compared, showing that the public firm tends to be inefficiently larger in more states of nature. However, private firms may provide lower than optimal levels of service in more cases, the problem being more severe under incomplete contracting. These results help us to understand three key points: one fundamental cause of the inefficiency gap, how privatisation may solve the problem, and some of the potential drawbacks of the policy.

The first empirical contribution (chapter 4) is a case of study for the Spanish urban bus industry. Using data from a sample of firms, a translog cost function is estimated to evaluate

the relative inefficiency of public firms. Results indicate that public firms are highly overstaffed and pay high wages to their workers, even if labour productivity is low. Since private firms are also regulated by city councils and subject to the same laws, this case is presented as an example of the preference of politicians for direct control of firms instead of pursuing personal agendas through regulated firms.

The second empirical contribution (chapter 5) estimates political effects over employment and wages using data from US local governments. A bargaining model between a non-benevolent government and a union is proposed and solved. First-order conditions and reduced-form equations of this model are then estimated using data from several services provided directly by US local authorities. Results indicate that looser controls over politicians lead to a larger number of workers employed and to higher wages. Unions' effects on wages are significant, while not so relevant impact on employment is observed. This empirical evidence supports the idea that political factors are highly relevant in explaining public firms' inefficiency, specially when they are combined with trade unions' effects.

# TABLE OF CONTENTS

CHAPTER 3: EFFECTS OF PUBLIC OWNERSHIP OVER FIRMS' SIZE AND OVERSTAFFING PROBLEMS



CHAPTER 4: PRODUCTIVE INEFFICIENCY OF PUBLIC FIRMS: THE SPANISH URBAN BUS INDUSTRY

CHAPTER 5: POLITICAL EFFECTS OVER EMPLOYMENT AND WAGES: EVIDENCE FROM US LOCAL GOVERNMENTS

# LIST OF TABLES

# LIST OF FIGURES

# ACKNOWLEDGEMENTS

I must express here my gratitude to the long list of people who has contributed to this thesis. In the first place, my special thanks go to my supervisor, John H. Moore, who helped both academic and personally, and knew how to advice me in the ups and downs of the Ph.D. student life. On his suggestion, I spent some time as a visiting student at Harvard University, where I am indebted to Oliver Hart and Andrei Shleifer, for helpful conversations about governments and public firms. Many others helped by reading my drafts and with comments at seminars. I specially thank Tim Besley, Stephen Glaister, Florencio López de Silanes, and my fellow students at LSE for all their suggestions.

I would also like to thank my colleagues at University of Las Palmas, Spain, for providing me with support and encouragement in the final stage of this research. My special thanks there to Ginés de Rus, who is in great part responsible for my interest in public firms. The remote origin of chapter 4 of this thesis was a project supervised by him, which finally resulted in a joint work. I must also thank professors and teachers from CEMFI (Spain), and specially Rafael Repullo, Jorge Padilla, Manuel Arellano and Samuel Bentolila, who encouraged me to go abroad to study for a Ph.D. degree. Financial help from Bank of Spain is also gratefully acknowledged.

Finally, I would like to thank my family, for their help during all these years, and all my friends, to some of whom I will be indebted for life: Maite, Txuni, Jan (and Pitu), who were my 'second family' during my time in London.

# INTRODUCTION

> *"... Losses, not profits, in nationalised undertakings, losses becoming an increasingly heavy burden on the taxpayer. In some cases, the employment of methods of accountancy that would never be tolerated in a privately-owned enterprise. A general over-all decrease in efficiency, resulting from State control. Very few State-controlled industries or services can claim to be more efficient than the privately-owned enterprises operating under comparable conditions."*
>
> —John B. White (1946): *'Nationalisation: Chaos or Cure?'*

Privatisation of publicly-owned firms has constituted one of the more widespread policies across the world in the last fifteen years. Although even the term 'privatisation' did not appear as an entry in the dictionaries before the 1980's, it has become by now one of the more popular words making the headlines of the economic press almost daily. Sales of public firms have been observed all around the world: from developed countries to developing or eastern European countries, governments have been increasingly transferring the ownership of firms to the private sector[1].

Even if this process has only recently started, the debate about the optimal boundaries between public and private sectors is very old. The date of the quote above reveals that the relative efficiency of public firms was already in question more than fifty years ago. At the time when that quote was written, the popular word was 'nationalisation' and the debate was then about the convenience of increasing the presence of the State in the economy, while now we are witnessing the reverse process. Although the arguments presented in 1946 by the quoted author were more based on ideological rather than on empirical grounds –since at that time

[1] The term 'privatisation' is starting now to be applied to very different contexts, to refer to any form of reduction of government involvement in the economy (sometimes the term is used to actually mean de-regulation or liberalisation of markets). However, throughout this work, I use the word in its original meaning: the transfer of firms' ownership from public to private sector. Another terminological clarification: what I refer to as a 'public firm' is a State-owned enterprise (SOE), or any other type of firm owned by municipal or local governments, and not to the concept of a firm with shares which are publicly traded.

there were not many publicly-owned firms in Britain[2] nor in other countries, and the writer was a British Conservative MP– he used then the same basic argument that governments present nowadays to justify the sale of public firms: efficiency improvements.

Is it really such concern for efficiency which has essentially motivated the escalating process of privatisation around the world? Although efficiency is surely playing a role in the decisions of governments, it is unlikely to be the only explanation. Public firms have probably suffered from inefficiency problems almost since they started to operate, therefore it is not clear why governments decided to keep firms in the public sector for decades and have only recently started to make them private. Moreover, public firms have been active in some industries (specially in Europe) where no arguments existed at all to justify the presence of public ownership in the first place. Although some utilities could have had in the past some features of natural monopolies (e.g. phone or electricity), no clear basis existed for the State to be the owner of mining, shipbuilding, steel, car-making, building or insurance companies. However, examples of public firms operating in all these industries, and many others, abounded and there were no proposals to sell these firms to private owners.

The British privatisation programme initiated in the 1980's was the first relevant experiment of transfer of large public firms to the private sector. A strong ideological belief of Thatcher governments in the efficiency of market forces is usually pointed out as the main reason that initiated the process, but there were also other reasons. First, the British conservative governments during the 1980's committed to a substantial reduction of the public sector borrowing requirement (PSBR), which was politically easier to achieve thanks to the substantial revenue obtained from the sale of public firms (£44.5 billion, period 1979-1991). And second, another objective was to break trade unions' power, to ease the problem of public sector pay determination and to obtain some indirect political benefits (for revisions of the British privatisation programme, see Vickers and Yarrow (1988) and Bishop et al (1994)).

[2] It was actually in 1946 when a Labour government passed a Coal Nationalisation Bill, which had first been laid before the Commons in 1893. The Coal Bill was the first step on a wide nationalisation plan, which included many industries as cables and wireless, road and rail transport, gas and electricity, and docks and harbours. See Millward and Singleton (1995) for a detailed description of that process of nationalisation.

Privatisation in Britain was extremely successful in terms of financial revenue. After some timid initial sales of government stakes at British Petroleum, British Aerospace and others, the policy gathered pace in 1984. In that key year, privatisation of British Telecom showed the possibility of selling much larger firms (as public utilities' firms like gas, electricity or water) without saturating the market. Although in all these sales relevant fractions of shares were sold to nonresidents, the Thatcher governments also succeeded in enlarging the base of share-owners –creating what has sometimes been called the 'popular capitalism' (Bös, 1991)– by selling significant proportions of shares to managers, workers and the general public.

However, there is some evidence that at least part of the success of the British privatisation programme, and the expansion in the number of share owners was achieved by a certain degree of underpricing[3], which added to the pre-privatisation investments in firms' restructuring, raises ex-post questions about the overall benefit from this process (Clarke, 1993). However, even though it was criticised by many at home, the impact of the first large British privatisations on other countries was immediate. Many European countries started soon to prepare plans for some reduction of their public sectors, and outside Europe, the policy was extensively applied in countries like New Zealand and Japan.

What motivated that the British initiative sparked this chain of privatisations across the world? An overview of descriptive works on the experience of different countries[4] reveals that each case has its own characteristics, but the basic argument used by most governments is the need to improve the efficiency of public firms. However, as mentioned above, it is hard to believe that the hypothesis of efficiency improvement can explain *per se* the worldwide trend to privatisation, since that argument should be able to justify the timing of the process, i.e. why all governments have realised *now* about the existence of substantial inefficiencies while they

[3] Apart from the market expansion generated by offering shares at good prices, which paved the way for next privatisations, the creation of a new base of share owners constituted a strategic movement to limit the possibility of future Labour governments reversing the process. See Grout (1987), Jenkinson and Mayer (1988) and Hyman (1989) for interesting discussions on the techniques and shares' pricing policies of British privatisations.

[4] A number of collective volumes have been compiled, describing and comparing different national experiences, see for example Heath (1990); Suleiman and Waterbury (1990); Ott and Hartley (1991); Ramanadham (1993),(1994); and Clarke and Pitelis (1993).

have been enduring that situation for decades. Some other reasons, as public sector financial needs or ideological motivations, must be generally present across countries, which may explain the actual world trend towards privatisation. The financial argument may be studied using some data on revenues generated by public firms' sales in different OECD countries and their public finances' situation during the pre-privatisation period:

**Table 1: Privatisation Proceeds and Public Finances in selected OECD countries**

| | Privatisation Proceeds (1990-95) | | Av. Deficit (1981-85) | Av. Debt (1981-85) |
|---|---|---|---|---|
| | Mill. US$ *(a)* | % GDP *(b)* | % GDP *(c)* | % GDP *(d)* |
| UK | 49878 | 4,9 | -3,7 | 45,4 |
| Germany | 38092 | 1,8 | -1,9 | 20,4 |
| France | 27379 | 2 | -2,9 | 19,2 |
| Mexico | 19316 | 5,3 | -7,6 | - |
| Italy | 18450 | 1,7 | -13,4 | 68,5 |
| Australia | 13945 | 4,4 | -2,1 | - |
| Japan | 10700 | 0,2 | -6,1 | 49,9 |
| Canada | 9362 | 1,7 | -5,3 | 35,4 |
| Netherlands | 9202 | 2,6 | -7 | 44,7 |
| Spain | 7834 | 1,5 | -7,4 | 30,3 |
| Portugal | 6404 | 7,2 | -11,3 | - |
| New Zealand | 5068 | 9,9 | -7,4 | 63 |
| Sweden | 5020 | 2,5 | -8,4 | 47,4 |
| Denmark | 4263 | 2,8 | -5,1 | - |
| Belgium | 4120 | 1,7 | -12,2 | 82,1 |
| Austria | 2304 | 1,1 | -4,6 | 33,8 |
| Finland | 1549 | 1,5 | -1,6 | - |
| Ireland | 1264 | 2,3 | -13,2 | - |
| Greece | 1216 | 1,2 | -9,3 | - |
| Norway | 719 | 0,6 | 2,2 | - |

*Sources*: Privatisation Yearbooks (1994-96) and IMF Financial Statistics (1995).

Information included in table 1 is the following: first, countries are ranked by total revenue obtained by sales of public firms during the period 1990-1995 (column *a*). Although it is known that some countries sold public firms before 1990, only revenues from this six-year period are considered, in order to have homogeneous information for the cross-section of

countries in the sample[5]. Column *b* indicates the relative importance of these revenues, by expressing them as a percentage of average GDP during the period 1990-95. The second type of information corresponds to indicators about public finances in each country in the early 1980's. Column *c* is the average public deficit and column *d* the average amount of debt, both over GDP. The period 1981-1985 has been chosen since most countries had not started privatising firms on the first half of that decade, therefore figures reflect financial needs *before* countries received any substantial revenue from privatisations (with the exception of UK).

A simple test of the hypothesis of privatisations being originated by governments' financial needs may be performed from table 1 by computing correlation coefficients between privatisation activity and the situation of public finances' before the process started. Results indicate that some connection between these two variables exists, though it is relatively weak: those countries with higher deficits in 1981-85 obtained higher revenues from privatisations in 1990-95, (correlation [ *b,c* ] = -0.175), and the same effect is found if debt levels were high in 1981-85 (correlation [ *b,d* ] = 0.271). Although this test is performed using only some rough and incomplete estimators, it provides some evidence to support the financial hypothesis as an explanation for the wave of privatisations around the world. However, correlation coefficients are sufficiently small to discard this reason as the only origin of the process.

What other reasons apart from efficiency gains and financial needs may then be behind the process of privatisation? When governments in developed countries started to quickly sell public firms in the mid-80's, economists did not have sufficiently developed theories to justify this process or predict its effects. On this field, as in many others, economic policy was not implemented on the basis of theoretical work, but it was the other way around: privatisation theories were developed after the process was already in motion, as the titles of some of the first papers on this topic reveal[6].

---

[5] The most comprehensive source of reliable information available about sales of public firms around the world are the *Privatisation Yearbooks* used to compile table 1, which only offer information from 1990 onwards.

[6] As an example, Kay and Thompson (1986): "*Privatisation: A Policy in Search of a Rationale*".

In the 1980's, the existent economic theory on the field was of little help to provide explanations for the process of privatisation. Economic theory about public enterprise had traditionally been reduced to a normative approach (see Atkinson and Stiglitz, 1980). Public ownership was usually presented as a remedy for the existence of some market failures. In particular, it was regarded as a good option for the case of natural monopolies, where increasing returns to scale over all the relevant range of an industry's output imply that a single firm can dominate the market. In that context, public ownership was considered an optimal solution, arguing that it would be easier to maximise social welfare through a public firm than by regulating a privately-owned monopolist. A good deal of work from this normative literature was devoted to derive optimal pricing systems and other regulatory issues (for general overviews, see Turvey, 1968; Rees, 1976; Bös, 1981; and Marchand et al, 1984).

However, before 1980, there was almost no economic literature studying the problem of public firms' inefficiency from a positive perspective. Neither was it clear how privatisation was likely to affect the overall performance of firms (both on productive and allocative efficiency). In this sense, it might be said that the policy of privatisation started to be applied by governments on the intuition that its positive effects were likely to offset its (unknown) potential negative effects. Since the origins of the policy in the mid-80's, the topic has attracted much attention from researchers, and the literature has grown exponentially. A search on a bibliographic database (EconLit) provides the following outcome: between 1984 and 1996, more than 950 journal articles and 350 books about privatisation have been published on this topic. Probably not many fields within the economic literature have contemplated these vast and quick development in such a short period of time.

After all these efforts, what theories do we have now to understand the phenomenon of privatisation? A brief survey of the literature on privatisation is presented in chapter 1 of this thesis, where it is shown that different approaches have been used, but probably the most successful has been the study of managers' role in the performance of public and private firms. A significant advance from this 'managerial' approach has been to identify a trade-off faced when opting between a publicly-owned firm and a (regulated) private firm. While privatisation generally improves the productive efficiency of a firm, it may result in sub optimal outcomes

in terms of prices charged to consumers. Informational asymmetries and differences on incentives' schemes of managers in public or private sectors are identified as the main factors originating this trade-off.

Even if this result constitutes a relevant step in our understanding of questions about public ownership and privatisation, the managerial approach does not seem to fully explain all the features of the actual privatisation process across countries (reasons, timing, industries involved). A political economy approach seems to be a more adequate framework to analyse questions on privatisation, since politicians are the more relevant agents taking decisions over public firms, therefore they should not be left aside from models. Some papers have already started to analyse how the political process interacts with and determines the results of publicly-owned firms (see Shleifer and Vishny, 1994; Boycko et al, 1996; Laffont, 1996; and Bennedsen, 1997).

This thesis tries to contribute to this 'political' line of research on the topic of privatisation. The basic objective is twofold: first, some theoretical questions regarding the process of privatisation of public firms are analysed from a positive political economy perspective. Hence, it is assumed that governments are not simply interested in social welfare, but instead they pursue private agendas (basically re-election). And second, the relevance of political factors in the inefficiency problems of public firms is tested empirically in two particular case studies.

The set of questions regarding public firms and privatisation which are aimed to be answered may be summarised in the following three points:

1) Why governments have endured inefficient public firms for long periods and have started only recently to transfer them to the private sector in a worldwide global trend?
2) What is the role that political ideology and increasing public deficits have played in privatisation decisions?
3) Are there any fundamental reasons linked to public ownership which generate the inefficiency problems observed in public firms?

Although the analysis is intended to be kept as general as possible, the basic aim of this work is to understand the process of privatisation of an 'industrial' type of public firm. Thus, goods and services which are dealt with are 'private goods', in the sense that there exists or may exist a market for them: utilities, airlines, coal, steel, car-building, and urban transport would be some typical examples of economic sectors where public firms were traditionally present, and which have been subject to important privatisations. Other public services provided by governments, like administration, defence, health, prisons, etc. are also being subject to privatisation experiments in some countries, but they involve more complex features than those of private goods. Although some of these latter privatisations may be accommodated within the frameworks proposed here, it is out of the scope of this work to try to encompass any type of industry which may be subject to some form of privatisation (sale of firms, contracting out, tendering, etc).

An outline of the work is the following. Chapter 1 presents a review of the literature on privatisation, making some reference to the available empirical evidence on public firms' inefficiency. Since the concept of efficiency has various interpretations, this chapter presents the most accepted economic interpretations, as they are used throughout this work. In chapter 2, a voting model studies the role of political ideology and the financial hypothesis as causes of privatisation. Chapter 3, again in the context of a voting model tries to explain what are the effects of public ownership over the size of public firms and the problem of overstaffing.

Empirical contributions are presented in the next two chapters. First, chapter 4 presents a case of study for the Spanish urban bus industry, where significant efficiency differences between public and private firms are detected. In chapter 5, the relevance of political factors over public firms' efficiency is evaluated using data from services provided by US local governments. Results offer substantial support to the intuition that public firms' excessive use of labour and its associated inefficiency may have a political origin. Finally, the main findings and conclusions are summarised in a brief closing section.

# CHAPTER 1: REVIEW OF THE LITERATURE ON PRIVATISATION

## 1. Concepts of efficiency

In the economic literature, there is a long tradition of studies on the efficiency of firms, which goes back to the seminal works of Farrell (1957) on measurement of efficiency, and to Leibenstein (1966) and his theory of X-efficiency. At present, there are well-established concepts regarding efficiency which are specially relevant for the privatisation debate. However, since these concepts are sometimes used rather loosely and with different names, this section is devoted to define them briefly as they are used in this work.

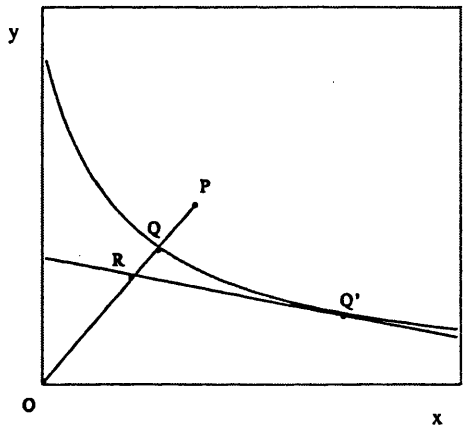
On the question of a firm's efficiency, we may first establish a division between *efficiency in production* and *efficiency in consumption.* If we analyse efficiency in production, the relevant question is whether the firm is obtaining the maximum attainable output with the amount of inputs that it is using. Only if the answer to this question is affirmative, we may regard that firm as efficient, otherwise it would not be using resources optimally. An alternative approach to analyse efficiency in production, based on the dual problem of the firm, is to ask whether the firm is minimising costs to obtain the level of output that it is producing, and if that is the case, the firm is regarded as cost efficient. Since both approaches are equivalent, regardless of which of the two is used, this concept is named throughout this thesis as *productive efficiency* of a firm.

A different idea is used when efficiency in consumption is investigated. In that case, the question is whether a consumer must pay a price that is equal or above the marginal cost associated to production. Since marginal costs accurately reflect the social costs of those resources used to produce outputs, the optimal rule to guarantee that the adequate amounts of goods are produced and consumed is to set prices equal to marginal costs. Therefore, if a firm

charges a price above its marginal cost, it is considered as inefficient regarding consumption. This concept is generally named as *allocative efficiency* of the firm.

Within the analysis of productive efficiency, there are two distinct concepts that need to be properly defined. If a firm is productively inefficient, i.e. it is not a cost-minimising unit, that may be due to two reasons: either it is not using the right combination of inputs given a vector of input prices, and/or it is not obtaining the maximum productivity from the used inputs. In order to illustrate these ideas, it is helpful to consider a simple case of one output and two inputs (Farrell, 1957). Figure 1.1 presents a textbook diagram in which an isoquant line shows the required combinations of two inputs x and y to obtain a given level of output $z_0$. A vector of exogenous input prices determines the slope of the isocost line, represented by RQ', and the optimal solution to produce $z_0$ is then to have a firm located at point Q'.

**Figure 1.1: Types of productive inefficiency of a firm**




However, a firm must not necessarily be producing at the optimal point, specially if we are considering a monopolistic or oligopolistic type of industry. In that case, we may observe a firm producing at Q, where it would not be minimising cost given the input prices, since its corresponding isocost would be a line parallel to RQ' passing through Q. Thus, a wrong combination of inputs is the reason why this firm would be regarded as productively inefficient, even if it is located on the efficient frontier. Furthermore, a firm might not necessarily be located on the isoquant line, but instead it could be above that level. In that case,

the firm would be overusing inputs since the isoquant conveys the information of the minimum amounts of inputs that are technically required to obtain the output level $z_0$. In his original work, Farrel labelled the first type of inefficiency as allocative and the second one as technical. In order not to confuse the first type of inefficiency with that of consumers' price being above marginal cost, I would refer to the inefficiency due to a wrong combination of inputs as *input-mix inefficiency*, and to the problem of a firm overusing inputs as *technical inefficiency.*

A firm that is productively inefficient may present a combination of both types of sub optimal behaviour. If there is sufficient information on technology and input prices, it may be possible to obtain separate measures for each type of productive inefficiency (technical and input-mix). As an example, consider in Figure 1.1 that a firm is located at point P, where its total cost to produce a level of output $z_0$ would be given by an isocost parallel to RQ' passing through P. In that case, the ratio OQ/OP would provide information on the degree of technical efficiency, with small values of this ratio indicating a poor performance. It must be observed that when defining technical inefficiency, the proportion at which inputs are used is kept constant regardless of which is the actual optimal input combination (actually, point Q is obtained from a ray from the origin to point P, crossing the isoquant). Meanwhile, the ratio OR/OQ would be a similar measure for the degree of input-mix efficiency. Following the same logic, an index of total productive efficiency would be OR/OP and it could be expressed as the product of the former two. Thus:

*Total inefficiency (OR/OP) = Technical inefficiency (OQ/OP) × Input-mix inefficiency (OR/OQ)*

There are several techniques which are used to try to implement these efficiency measurements in practice. These may be generally categorised in three groups: parametric, stochastic-parametric and nonparametric or data-envelopment (DEA) frontiers (for a comprehensive review on all these techniques, see Lewin and Lovell, 1990). All of them are based on a similar idea, namely to compare the observed performance of firms with what would constitute an efficient frontier. In order to represent this efficient frontier some studies use a production function approach, while others rely on cost functions. In both cases, the aim is to identify inefficient firms, which are those whose performance lies below (above) the production (cost)

function frontier. Chapter 4 of this thesis presents an example of an empirical test which evaluates the performance of urban bus companies, using a parametric cost function approach.

Therefore, summing up the concepts of efficiency revised in this section which are used throughout this work, these are: 1) allocative efficiency (price paid by consumer equal to marginal cost of production); 2) technical efficiency (firm located on the frontier, either a production or a cost frontier); 3) input-mix efficiency (firm located on the optimal point within the frontier, according to a given vector of input prices and the level of output produced); and 4) productive efficiency (a firm is productively efficient if it does not suffer from any technical or input-mix problems).

Finally, a brief comment on the usually mentioned concept of X-inefficiency is required. The theory of X-inefficiency developed by Leibenstein was initially aimed to provide some arguments for the misallocation of resources generated by monopolies, after the surprising results of Harberger (1954) and other authors about the small global impact over social welfare of allocative inefficiency generated by market power (prices above marginal costs). The basic idea of X-inefficiency is that firms do not always necessarily minimise their costs, since they are generally run by professional hired managers who respond to the pressure from the environment. In non-strict competitive market conditions, firms' managers do not exert maximum levels of effort, which results in firms' costs being higher than optimal. This was pointed out by Leibenstein as another form of monopolies' inefficiency different from pricing above marginal cost, since higher costs eventually result in losses of social welfare through higher prices, even if a marginal cost pricing policy is followed.

Although there exist some subtle differences in the foundations of both concepts, X-inefficiency is observationally equivalent to technical inefficiency (a given set of inputs not obtaining the maximum output), and thus it is common to refer to the same concept under both names (for a discussion, see Button and Weyman-Jones, 1993). Differences stem from the origins of both concepts, since X-efficiency tries to investigate which are the causes of the problem (lack of maximum effort from individuals), while technical efficiency is simply concerned with measurement of results. If a firm is found to be technically inefficient, this

might be due to a variety of reasons, and one of them may be an inadequate supply of effort from managers. In this work, I preferably use the term 'technical inefficiency', unless when referring to contexts where inefficiency is known to be generated by lack of effort from public firms' managers or workers.

## 2. Empirical evidence on public firms' inefficiency

There exist many empirical studies which have investigated the relative performance of public firms versus private firms in a diversity of industries. In order to summarise the existent evidence on the relative efficiency of state-owned enterprises (SOE's) for the 'industrial' types of goods and services studied in this thesis, I present here the main conclusions from two extensive surveys which have reviewed numerous published papers: Borcherding et al (1982) and Vining and Boardman (1992).

Borcherding et al (1982) report the evidence found from more than 50 studies from US, Germany, Australia, Canada and Switzerland. The surveyed studies cover a wide range of industries of the type that it is intended to study here: airlines, railways, banks and insurance, utilities, refuse collection, house-building, and also some public services as fire protection, hospitals and forestry. In almost all papers, a striking conclusion is reached: public firms have higher unit costs compared to private firms, therefore their productive efficiency is lower. Only in some cases it is found that unit costs have similar levels, and these usually belong to industries where public firms faced brisk competition. There are also three studies which obtain that public firms are more efficient than private counterparts. However, these are criticised by the authors of the survey, on the grounds that not enough control was included for relevant variables such as quality. Other additional findings from this set of studies are the following: public firms adopt innovations and cost-savings procedures more slowly, they offer managers longer tenure periods, and favour voters to nonvoters in their decisions.

From all this evidence, the authors extract two main conclusions: first, that public firms have higher costs than comparable private firms (i.e., they are productively or cost inefficient); and

second, that ownership is not so important as competition, since when the second is present, public firms may be as efficient as their private counterparts. While the first conclusion seems to be well-founded at the view of the results they report from the studies surveyed, it is not completely clear where they extract the second conclusion from, since only in a very reduced number of cases they find equal performance from both types of firm.

After presenting this evidence, which they use to support the 'property rights approach' to the question of public firms' inefficiency (basically the idea that in the public sector, property rights are imperfectly defined, therefore it is more difficult to monitor agents, i.e. managers and bureaucrats), they go on to examine a 'public choice approach'. For this second approximation, they use some results from De Alessi (1969) about managers in public firms having firms' growth and not welfare maximisation as an objective, which leads to overstaffing and overcapitalisation of firms. Some (old) evidence is presented about wages in the public sector in US and Canada, where different studies from the 1970's showed the existence of wage premia between 10-20% over comparable jobs in the manufacturing private sector.

The reading that Borcherding et al (1982) make from the combination of their two 'approaches' to the problem is rather awkward: the excess of unit costs detected for public firms is likely to be generated by the public choice effects (self-interested managers, bureaucrats and unionised workers extracting rents), but the authors view these higher costs simply as transfers that redistribute income. These transfers are the costs of having public firms as instruments to pursue policies which could not be attained (or it would be more costly) by contracting private providers. All these arguments lead the authors to reach an unfortunate conclusion if one evaluates the scope that privatisation has finally had: "...We expect that the claim for 'more market and less government' has no real addressee and that the chance of most proposals of how to decrease public production or to increase its efficiency is rather modest" (p. 147).

The second significant survey on the topic of public firms' efficiency is Vining and Boardman (1992) (from now on, V-B), which is actually a revision of a previous work by the same

authors (Boardman and Vining, 1989). In this survey, 91 works are reviewed in order to test the hypothesis that public firms are less efficient than private firms, and whether competition in the market is more relevant than ownership in determining the degree of efficiency. Industries covered are: electricity, refuse collection, water, health, airlines, railroads, bank and financial services, fire services and non-rail transit. Most of these industries have the 'private goods' characteristics sought here, although for some others, quality aspects can make the interpretation of results more complicated (e.g., health services).

Results seem to indicate that ownership generally matters: even in those industries where there is a high degree of competition, more studies obtain that public firms perform worse than private firms. As in Borcherding et al (1982), it is found that when competitive pressure is imposed to public firms, efficiency improvements are observed. Again, there are studies where ambiguous results are found, or even SOE's can outperform private firms. However, V-B discard these cases as not being representative, since they are usually circumscribed to industries where, according to the authors, no real competition existed (utilities, airlines, railways or health services). Consequently, these results cannot be used as evidence that in competitive sectors the efficiency of SOE's is equal to that of private firms.

On the basis of this evidence, V-B refute then the hypothesis of competition being more important than ownership in determining efficiency levels. This hypothesis proposed by some authors would imply that in those industries where no relevant market failures existed, privatisation would be unnecessary, since public firms could produce as efficiently as private firms. V-B point out that this hypothesis is proposed by public firms' advocates, and it is based on two fallacies. First, it is argued that private firms do not necessarily always have the maximum levels of efficiency, since they are controlled by managers who may also pursue personal objectives, as it is the case in public firms. Second, the inefficiency of SOE's may be simply apparent, since these firms produce additional socio-political outputs, which are produced efficiently since if they would not, the political market would force a change (Wintrobe, 1987).

The first argument is empirically tested by V-B by surveying 31 papers that analyse the existence of differences in efficiency between owner-controlled and manager-controlled private firms. Although it is indeed observed that efficiency levels are higher in the former, this does not imply that inefficiencies generated by managers pursuing personal agendas must necessarily be equal or higher to that of public firms. Using the terminology defined in the previous section, these results would support the hypothesis of the presence of X-inefficiency both in private and public firms, since when pressure on managers is reduced, firms' outcomes are worse. However, the evidence that there also exists X-inefficiency in private firms does not imply that it reaches the same levels of comparable public firms. Thus, the relevant question of why the observed inefficiency of public firms is higher than that of private counterparts remains unanswered.

The second argument about the inefficiency of public firms being generated by the production of 'desirable' social outputs is an easy shortcut to justify the higher costs observed in these firms. For this hypothesis to be valid, it would be necessary to demonstrate that the social objectives cannot be pursued by contracting (and possibly subsidising) private firms. Furthermore, the actual working of political markets (with pressure groups, lobbying activities and uninformed dispersed voters) does not always guarantee that the most efficient outcomes are reached[7].

Therefore, summing up the joint evidence from the two extensive surveys revised here, it seems that it is sufficiently demonstrated that public firms generally present productive inefficiency problems, in all countries and in all sectors where they operate. Many studies report problems of overstaffing, low labour productivity, and high wages in public firms as important causes of inefficiency. Therefore it seems that the productive inefficiency of public firms is likely to be the result both from an incorrect input-mix (too much labour is generally used in relation to other inputs) and also from a technical type of inefficiency (inputs are less productive than optimal). The introduction of competition *in* the market (e.g. by allowing the entry of competitors with the break of legal monopolies) or *for* the market (e.g. by forcing

[7] As an example, the voting model presented in this thesis in chapter 2 exhibits many equilibria where deviations from optimal social outcomes are found.

public firms to participate in tender offers in competition with private firms) somehow alleviates the problem and it forces public firms to improve their efficiency records. However, it is difficult to find examples where public firms have the same efficiency levels or outperform private firms in comparable industries.

## 3. Privatisation theories: the fundamental issues

### 3.1 The 'irrelevance proposition' about ownership

The existence of the problem of public firms' productive inefficiency is an evidence of the lack of validity of a result which is derived in theoretical models under abstract conditions. This result, which I name here as the 'irrelevance proposition', following Schmidt (1995), is something close to a folk theorem in the literature of privatisation. Many authors find in their models that, under perfect conditions, ownership should not matter at all on the outcomes obtained by firms. That is to say, a publicly-owned firm could produce the same outcomes as a private firm by following the idea of 'selective intervention' (Williamson, 1985): a government could instruct a public firm to replicate the results of a private firm, and deviate only if it is possible to improve its outcome. Conversely, a private firm could be regulated in such a way that exactly the same objectives that can be pursued with a public firm could be achieved by a private provider (for example, the so-often claimed social objectives pursued by public firms could also be implemented through regulated private firms).

Under different conditions and using various names, this 'irrelevance proposition' is present in many of the best contributions to the privatisation literature: Sappington and Stiglitz (1987), who called it the 'Fundamental Privatization Theorem'; Shapiro and Willig (1990); Schmidt (1990, 1995); and Shleifer and Vishny (1994).

Since we observe in reality that the relative efficiency of public and private firms is different, this suffices to prove that ownership matters and that it is clear that this theoretical 'irrelevance proposition' does not hold in practice. The concern of theorists has then been to try to explain

why is this so, i.e. which are the ownership features that make public firms generally to exhibit poor efficiency levels.

In order to answer this question, public and private firms should be compared on equal grounds, since the usual assumed differences in objectives that both types of firms pursue may lead to confusion between what differences are due to change of objectives (firm size, pricing policies) and which are the inefficiencies caused by public ownership. The relevant question when analysing if there are fundamental reasons linked to ownership which make SOE's to be inefficient must be stated in the following terms: whether a private and a public firm to operate with the same objective function, how likely would we observe the same outcomes in terms of efficiency from both of them?

Most of the theory that we have about privatisation has focussed on the role of information and managers' incentives in determining fundamental differences in private and public ownership of firms. The core papers on this approach and their conclusions are summarised in the next subsection. Even if these works have proved to be useful in finding sources of public firms' inefficiency present at public firms, I consider that a more fundamental approach to explain the non-holding of the irrelevance proposition is to analyse political factors linked by definition to public ownership. The existent studies on this political approach are collected in subsection 3.3, while section 3.4 summarises other alternative lines of research.

### 3.2 The 'managerial' approach

The intuition behind those privatisation models that study the effect of managers over outcomes is rather simple. Basically, these papers draw on the general theory of principal-agent, adapting it to the question of public/private firm. One general result obtained in this literature may be observed in the following stylised version of a model from Bös (1991), who uses some ideas from Gravelle (1982).

Consider a market with demand z(p), in which there is a single supplier with cost function $C(z,e,\theta)$, where e is a variable level of effort that a manager can exert and $\theta$ is some parameter affecting costs. Both e and $\theta$ are private information for the manager, and the owner of the firm (principal) may only observe the realised cost C, and he knows the distribution $f(\theta)$. The manager has a utility function V(I,e), where I is income, with $V_I > 0$, $V_e < 0$, and a reservation utility level $\bar{V}$.

As a first-best benchmark of reference, it is considered that if the principal were able to observe $\theta$ and e, she would ask the manager to exert the optimal level of effort $e^*$ at which the condition $V_e / V_I = C_e$ is satisfied. This condition relates optimally marginal cost of manager's effort with the marginal benefit in terms of cost reduction. Only when the effort level satisfies that condition, the firm is said to be X-efficient. Regarding the pricing policy, it is assumed that the optimal rule is to set price equal to marginal cost ($p=C_z$), and in that case the firm is said to be allocatively efficient.

A comparison is then performed between a private firm with a profit-maximising objective ($\Pi = p\, z(p) - C(z,e,\theta) - I$) and a welfare maximising public firm, where social welfare is defined as the sum of profit and consumer surplus ($W = \Pi + S(p)$). It is shown that a private firm's manager working on an incentive scheme $I = I_0 + a\,\Pi$, $a \leq 1$, exerts a sub optimal level of effort determined by $V_e/V_I = a\,C_e$, but the problem eases as the participation of the manager on profits is higher, and in the extreme case where the manager is the residual claimant and the owner receives a fixed payment, the optimal $e^*$ would be set. Regarding the pricing condition, the private firm would typically be inefficient, since it is going to set a price $p^M$ above marginal cost, so that the usual inverse elasticity condition of a monopolist is satisfied, $(p^M - C_z)/p^M = -1/\varepsilon$.

Meanwhile, a manager working for a public firm will typically set the optimal price level p = Cz. Therefore, the firm will be allocatively efficient, but he generally will exert an effort level below the optimal $e \leq e^*$. This last result is almost imposed exogenously, since it is assumed that governments are limited to use low-powered incentive mechanisms to determine managers' payments, either by laws regulating wages in the public sector or any other

limitation. Bös (1991) argues that even if these exogenous limits were lifted, it would be difficult to implement optimal incentive schemes, since in that case the manager should be given a participation on welfare levels achieved ($I = I_0 + a\ W$), which would create serious evaluation problems.

A basic trade-off which is obtained in most papers using this managerial approach may be easily observed in this simple model. Technical or X-efficiency, which in this model stems from managers exerting optimal levels of effort, is typically higher in private than in public firms, due to the possibility of employing better incentive schemes in the former. But, on the other hand, public firms are more allocative efficient, since they set prices closer to optimal social levels. More refined versions of this type of model consider the possibility of imposing some regulation on the private firm, in order to avoid monopoly outcomes, but since $\theta$ is generally private information for the regulated firm, it is always feasible for it to extract some rents.

Sappington and Stiglitz (1987) argue that a government might reduce the distortion of informational rents by an optimally designed auction, in which several private firms bid for the right to supply a good or service. In that case, under perfect conditions, the auction winning firm would be paying to the government a fixed fee equal to the informational rents and it would be possible for the government to achieve optimally its social objectives, even without information on the production technology. This result, that the authors call the '*Fundamental Privatisation Theorem*', is mentioned to be valid only under very restrictive conditions. In particular, the presence of risks, contracting costs, government's commitment requirements and contract implementation problems would make it difficult for a government to completely avoid rent extraction by the private firm. Many other issues related to optimal mechanisms of regulation of private firms are discussed in Caillaud et al (1988).

Pint (1991) develops a regulation model to analyse the effects of privatisation over levels of output and factor demands. In the proposed framework, the firm's manager does not choose an effort level, but she can use private information over parameter $\theta$ to obtain some non-monetary compensation (unnecessary travels, private use of company's car, etc.), and she must

decide on the amount of capital and labour to be hired by the firm. A government is assumed to be interested in maximising a weighted sum of consumer surplus, producer surplus and total expenditure on labour. This last element is included since the government might be indirectly pursuing electoral objectives (vote buying) up to some degree. The two options analysed are a publicly-owned firm and a regulated private firm owned by shareholders interested in maximising profits. Regulation is based on a rate-of-return constraint imposed by the government on the firm. Results indicate that the public firm will be typically producing a larger output than the private firm, even above second-best efficient level. Moreover, it will be relatively biassed towards labour, while the private firm will be biassed towards capital (an Averch-Johnson effect derived from the assumed system of regulation).

Schmidt (1990, 1995) builds a more elaborated model, in which a government may influence the outcomes of a private supplier by the use of a mechanism based on transfers (subsidies). In this framework, it is possible to examine which are the consequences of incomplete contracting over outcomes of a public and a regulated firm. The argument of this author to explain why the irrelevance proposition does not hold is that this result relies on two implicit assumptions to be valid. First, the government must have the possibility of using unlimited side payments, since in many instances the objectives pursued may involve the payment of subsidies to the producer. And second, in order for a government to achieve the same outcomes with a private or public firm, it would be necessary that complete contingent contracts could be written.

Incomplete contracting is then pointed out by Schmidt as the fundamental reason which creates differences between public and private firms. In a context of uncertainty, future surpluses may depend on individual non-contractible investments (in this literature, managers' effort constitutes this type of investment), and since public and private ownership provide different incentives to these investments, it is predictable that outcomes rarely coincide. The question of public vs private ownership of firms may then be regarded as a particular case within the general theory of property rights and effects of ownership structures (Grossman and Hart, 1986; Hart and Moore, 1990).

In order to illustrate the incomplete contracts' analysis of privatisation, a sketch of Schmidt (1995) is presented here. A monopolistic firm is assumed to be producing a quantity y of a public good, which renders a social benefit b(y), with b(·) increasing and concave. Production costs are given by c(y,θ), where θ is private information to the firm's owner, and may take only two values $\theta = \{\underline{\theta},\bar{\theta}\}$, so that $c(y,\underline{\theta}) < c(y,\bar{\theta})$. The firm is run by a manager who works as an employee if the firm is public and owns the firm if it is private (eliminating thus the agency problem within the firm). This manager exerts a privately observed effort level e that determines the probability distribution of θ. Let q(e) be the probability of the low cost state $\underline{\theta}$, with q(·) strictly increasing and concave.

The time structure of the model is the following. First, the manager chooses its investment level e, before θ is realised. Once the value of θ is observed by the owner of the firm, the level of output and the subsidy to be paid to the firm (s) are decided upon. In the case of a public firm, the government directly observes θ, and it chooses the level of y and s. If the firm is privatised, the government loses the information about θ and it cannot decide on the level of y except by offering a level of subsidy s. The government will be interested in both cases in maximising social welfare, defined as W(y) = b(y) - c(y,θ) - e.

In a first-best situation, in absence of information problems, the optimal levels of effort and output would be given by conditions:

$$q_e(e^*)\left[W^*(\underline{\theta}) - W^*(\bar{\theta})\right] = 1 \qquad \textbf{(1.1)}$$

$$b_y\left(y^*(\theta)\right) = c_y\left(y^*(\theta),\theta\right) \qquad \textbf{(1.2)}$$

Condition 1.1 determines the optimal level of effort, where the expected gain from an additional unit of effort equals its unitary cost. Given that level of effort, condition 1.2 sets the level of output to be produced, by making marginal cost equal to marginal benefit at each level of θ. Since $c(y,\underline{\theta}) < c(y,\bar{\theta})$ and b(y) is concave, necessarily $y^*(\underline{\theta}) > y^*(\bar{\theta})$, i.e. in the high cost state it is optimal to produce less output.

The solution of the model under public ownership yields similar results to the simple model of Bös (1991) presented above. As the government observes the value of $\theta$, it always sets the output at the optimal level. However, the problem of observing $\theta$ is that the government cannot offer the manager an optimal incentive system since it cannot commit to reward or punish him. Since his wage is fixed, the manager will then set his effort level to a minimum. The problem of the public firm is again a high allocative efficiency but a low technical or X-efficiency.

Meanwhile, the problem that the government solves to regulate optimally the private firm is a standard mechanism design problem, similar to the regulation of a monopolist with incomplete information on costs (Baron and Myerson, 1982). Results indicate that the manager-owner chooses an effort level lower than the optimal level $e^*$ determined by condition (1.1), but higher than the case of a public firm. With respect to output, the usual 'no distortion at the top' property is obtained: $y(\underline{\theta}) = y^*(\underline{\theta})$, and $y(\bar{\theta}) < y^*(\bar{\theta})$; i.e. the system of subsidies offered by the government is designed in such a way that in the high-cost state the level of output is lower than optimal. This distortion is necessary to achieve the optimal level in the low-cost state. Therefore, the overall evaluation is that the allocative efficiency achieved by the regulated private firm is lower than under the public firm, since in some states a too low output is produced.

The main conclusion of Schmidt (1995) concerning the privatisation decision is then a question of evaluating costs and benefits. A firm should be privatised if the higher X-efficiency generated by the manager exerting high levels of effort outweighs the welfare losses due to its ex-post inefficient choice of output level (lower allocative efficiency).

Shapiro and Willig (1990) consider a model similar to that of Schmidt, but including some positive features. In their model, firms are run by professional managers, both in the public and the private case, who have private information $\theta$ about cost structure or demand conditions, which affects to the profit level $\pi(x,\theta)$, where x is generally defined as the 'action' taken by the manager (e.g. level of output). In the case of a public firm, the manager depends on a minister who has information $\psi$ about the social impact of firms' output, defined as $S(x,\psi)$. Additionally, this minister may have some personal agenda $J(x,\varepsilon)$ or be subject to short-run

political pressure which makes her depart from long-run social optimal outcomes. Both $\psi$ and $\varepsilon$ would be private information for the minister, and not observable by the 'framer' or social planner who has to decide on the optimality of privatisation. In the case of a private firm, the minister is then transformed into a regulator, who still has the same information and objectives about $S(x,\psi)$ and $J(x,\varepsilon)$, but loses the possibility of observing $\theta$, an information that is only available to the owner of the firm. In this case, regulation is based on the offer of a subsidy level $T(x,\psi,\varepsilon)$, designed by the regulator for the private firm to choose x optimally.

The choice of the adequate ownership structure is then left to the 'framer', who has the objective of maximising social welfare, defined as $W = S(x,\psi) + k\,\pi(x,\theta)$, where $k > 1$ reflects the cost of raising public funds. Meanwhile, the objective functions of the minister and regulator does not exactly coincide with that of the planner, since both these agents will seek to maximise $V = W+\alpha\,J(x,\varepsilon)$.

The first remarkable result is what Shapiro and Willig call a 'neutrality theorem': the framer will be indifferent between public and private ownership if (a) there is no private information at all; (b) all eventualities are contractible; (c) all the private information is revealed after the action x is taken; or (d) the framer is unconcerned about transfers of funds from the Treasury.

If these conditions are not satisfied, ownership will introduce the following effects. First, as usual, it is found that if $\theta$ is only observable by a private owner, she can extract some information rents from the transfer system. Given that, activity levels required by the regulator from the private firm will be generally lower than levels from the public firm (e.g. less output will be produced), in order to avoid an excessive rent extraction from the private owner.

Results of Shapiro and Willig's work concerning costs and benefits of privatisation stem then from the introduction of an informational barrier between the firm and the political agent who decides upon it and who may have some personal objectives linked to the firm's activity. When this agent acts as a regulator, it sets low action levels to avoid the private owner extracting substantial rents, while when he acts as minister, the action is set to larger values, since all the information is known and there are no information rents to be avoided.

Evaluation of optimality of privatisation in social terms must then be left as a function of parameter $\alpha$. For large values of $\alpha$, the political agent tends to set x at high levels, since he obtains a relatively large personal benefit. In this context, privatisation improves outcomes, since x is reduced to avoid rent extraction. On the other hand, for small values of $\alpha$, it could be preferable not to privatise, since the distortion generated by a private owner can be more important to that of the political agent.

Laffont and Tirole (1991) present a 'managerial approach' model to the problem of privatisation, focussing on a different aspect. In this case, the cost function of the firm is modelled as $C = \beta - e$, where the manager has private information about the cost level $\beta$ and can make an effort level e. In addition, the manager can make some investment level *I* which, if kept internally in the firm, renders a benefit $D > I$ for the manager (personal objectives or higher benefits for the firm), but it may also be used externally, in which case the firm does not obtain any benefit. Private ownership provides better incentives for this investment to be chosen optimally, since in the case of a public firm, the government cannot commit not to expropriate the investment once is made to redeploy it to seek other objectives. Contrary to other works surveyed in this section, the effort level from the manager is lower in the case of the private firm in this case, a result that arises from the fact that in a regulated firm, the manager is subject to two principals (shareholders and regulator), a situation which provides him with worse incentives that in the public firms' case when he responds to a single principal.

A similar result is obtained in a model by De Fraja (1993a), who argues that a government interested in maximising social welfare may be more interested in providing optimal incentives to a manager to achieve productive efficiency than a private owner who seeks to maximise profits. The effect arises in this case from the fact that the government is concerned about profit level and consumer surplus, and the overall utility it obtains from a more efficient firm is higher than the case of a private firm. Even if this argument seems reasonable, it does not offer proper evidence on the question of ownership, since the public and the private firm seek very different objectives by definition and therefore they are not comparable (for example, output levels will typically differ simply due to the change of objective function).

### 3.3 The 'political' approach

One of the common features in all managerial models described in the previous subsection is that they generally obtain that inefficiency of public firms is generated by managers not exerting optimal effort levels in cost reduction. According to this general conclusion, we could expect public firms to be X-inefficient (or equivalently, technically inefficient), but not necessarily to suffer from problems of overstaffing and high wages.

These two latter problems have been shown to be present in public firms, according to the empirical evidence presented above, while they are not so relevant when regulated private firms are studied. Hence, it must be the case that public ownership has some intrinsic features which generate these problems. This type of productive inefficiency, which may be regarded as an input-mix inefficiency added to potential problems of technical inefficiency in public firms, is not satisfactorily explained by the managerial approach. In principle, a manager should not be biassed towards the excessive use of any input unless she derives some utility from that behaviour. Political interferences in the running of publicly-owned firms appear then as a likely explanation for excess of labour and high wages.

Even though some of papers reviewed in the previous section already contain some political motives in the definition of objective functions (e.g. Pint, 1991; Shapiro and Willig, 1990), the works that use a 'political' approach to privatisation make a substantial change of focus, by trying to model more explicitly which are the positive objectives of politicians when interacting with public firms, as opposed to the usual assumption of normative objectives.

Shleifer and Vishny (1994) propose a model in which politicians may try to influence both public and private firms to hire an excess of workers in order to obtain votes. The mechanism to try to alter firms' decisions is to offer some subsidies, which are drawn from the Treasury. A game is then established between three agents: a firm's manager (who is also considered to be the owner), a politician and the Treasury, the latter being supposed to be concerned about social objectives. An excess of staff L is bargained over, with a total cost of w L, where w is the wage per worker. These extra employees allow the politician to obtain a benefit B(L). The

firm is supposed to be partly owned by the Treasury and partly private, with a coefficient $\alpha$ determining the share of profits of the private sector.

The politician may try to convince the firm to hire extra workers by offering a subsidy T (net of the part that accrues to the Treasury as a result of its participation 1-$\alpha$ on profits). This subsidy has a political cost C(T) to the politician, which may be interpreted as votes' losses due to taxes to finance T, or to a potential conflict with the Treasury (who is likely to oppose to the subsidy). The social optimal values in this game would be to set L = T = 0, but departures from that outcome are likely to be observed, since politician and manager may obtain benefits from privately bargaining between them, without the rest of the society being able to respond to the resulting inefficiency (due for example to dispersion of voters and small individual losses).

Utilities are then the following: the politician obtains $U_p = B(L) - C(T) + b$, while the manager receives $U_m = \alpha \pi + T - w L - b$, where $\pi$ is the profit level without excess of employment, and b is a monetary transfer between manager and politician (allowing for the possibility of existence of 'corruption'). A Nash bargaining is then proposed between both agents under different scenarios depending on who has control over L and over profits.

Results indicate that in the absence of restrictions over the size of transfers, the irrelevance proposition will hold, in this case in the context of a privately-owned firm being as susceptible as a public firm to be overstaffed due to political interference. However if the level of corruption and the amount of subsidies are limited (due for example to a tougher external control by the press or other institutions) ownership matters. First, levels of L tend to differ from the equilibrium level $L^*$ obtained in the full corruption case. Second, it is possible to find cases where privatised but highly regulated firms may end up with higher level of overstaffing than public firms. Third, it is obtained that profitable firms would be more likely to be privatised when limits on subsidies are imposed, since it would be more difficult to obtain political benefits from them. Meanwhile, loss-making firms would tend to stay in the public sector, not from the fact that they may be less attractive to private investors, but on the possibility of offering more benefits to politicians.

Laffont (1996) presents what he labels as an 'exploratory' paper to study the interaction between political and informational inefficiencies, stressing the potentiality of this line of research. The cost of implementing a public project is modelled as $C = \beta - e$, where e is managers' effort, with disutility $\psi(e)$. The political side of the model is rather simple: society is assumed to be divided in two groups of consumers with valuations $S_1$ and $S_2$, and relative sizes $\alpha$ and $1-\alpha$, respectively. If a transfer t is paid to the firm, the utility that it obtains is defined as $U = t - C - \psi(e)$, while the social welfare function is the sum of net utilities from consumers.

After defining a first-best benchmark of reference in a situation without asymmetries of information, several alternative scenarios are studied, depending on which group of consumers constitutes a majority and who controls the firm. Departures from optimal levels of effort and rent distribution are likely to arise. A surprising result is that incentives to exert higher levels of effort are higher for public than for private firms, again in the line of Laffont and Tirole (1991), due to the multi-principal structure assumed for the case of private firms.

Other contributions to this political approach to the question of privatisation are Boycko et al (1996), who present a model in the line of Shleifer and Vishny (1994); and Bennedsen (1997), who considers ownership effects in a political model with influence groups. Hart et al (1995) discuss positive approaches to a government, in a model of incomplete contracting studying the case of prisons.

As it is noted by many authors, this political approach seems to be the most promising approach to answer questions regarding ownership and privatisation, although it has not been sufficiently explored yet. Difficulties arise in the modelling work when defining governments' objectives, since ideally one should be able to derive endogenously which is the objective function of the government, as indicated by Hart (1995), but this is not always an easy task. The voting models proposed in chapters 2 and 3 of this thesis try to explore how governments take decisions on privatisation and have an influence on the size of public firms, when trying to maximise the number of votes at elections.

### 3.4 Alternative lines of research on privatisation

There are other approaches in the economic literature that analyse questions related to privatisation. Only brief references are made here since they generally do not compare public and private firms on the basis of common objective functions. Hence, although papers not considering this fact are able to show interesting results about empirical observations, and can make accurate predictions about the effects of a change of ownership in practice, they are not so useful to analyse fundamental issues of the problem (i.e. the links between inefficiency and public ownership and the non-holding of the irrelevance proposition).

Some works have studied the effects of privatisation of public firms on outcomes of other rivals operating in the same industry, as De Fraja and Delbono (1989), De Fraja (1991) and Anderson et al (1997). Results are mixed: public firms, may have a positive impact on oligopolistic markets by introducing a price-lowering effect, but they may reduce entry. De Fraja (1993b) considers the interaction between industry structure, wage determination and privatisation. Other papers presenting bargaining models between unions and public/private firms are Gravelle (1984), Haskel and Szymanski (1993) and Haskel and Sanchís (1995).

Practical aspects on how firms have been actually privatised in different countries may be studied in detail in the numerous collective volumes existent on the topic (see footnote 4, p.3, for references). Some theoretical aspects about pricing are discussed in López-de-Silanes (1995), and a general cost-benefit analysis is presented in Jones et al (1990).

There are many papers dealing with the question of the speed at which privatisation should take place, see on this Dewatripont and Roland (1992), Fernandez and Rodrik (1991), Roland (1994), Perotti (1995), and Glaeser and Scheinkman (1996). This issue is specially important for ex-communist countries, whose privatisation processes have been extensively examined on a diversity of approaches. Only as an introduction to Eastern Europe privatisation, see Boycko et al (1993), Bös (1993), Schmidt and Schnitzer (1993), Roland and Verdier (1994), and Aghion et al (1994).

# CHAPTER 2: PRIVATISATION OF PUBLIC FIRMS AND POLITICAL IDEOLOGY

## 1. Introduction

Political ideology is often cited as one of the reasons why governments have decided to start privatising public firms. This ideological motive has been regarded as specially important in the case of British privatisations, since when the process started there was almost no previous experience on the transfer of large public firms (utilities, telecommunications) to the private sector. It is argued that public firms were sold only on the belief that this policy would have a positive impact over social welfare, but without certainty about what effects were likely to be caused. Initially, the Thatcher's privatisation programme was labelled by its critics as a 'right-wing' policy experiment, likely to be reversed in the future if the British Labour Party was successful in winning an election.

Events turned out to be quite different and privatisation of public firms became a popular economic policy around the world, practised both by right- and left-wing parties. In the UK, even the Labour party changed its approach towards public ownership (the old clause IV of its constitution, referred to the party commitment to common ownership of means of production, was reformed accordingly). Furthermore, the 'New Labour' government formed after the 1997 elections decided not to modify at all the industries' structures generated after Tories' privatisations[8], and no 're-nationalisation' has been observed so far.

The term 'ideology' may be broadly defined in this context as a set of beliefs that make a political party to be oriented towards a certain type of policy, but without having sufficient grounds to assess its overall effect. Another additional interpretation of ideology is the existence of a certain degree of attachment of some individuals to a political party, again based on a belief that this party represents them better than other alternative parties.

---

[8] As it was mentioned above, the policy of enlarging the base of share owners, may have had an additional non-declared objective of reducing incentives for re-nationalisation of firms, see footnote 3 (p. 3).

What is the real importance of ideology in the worldwide process of privatisation? Some contradictions arise if we are to believe the argument that ideology has been a determinant factor. First, it is not clear why in some countries the policy is being implemented or accepted by left-wing political parties that have been traditionally supporting the presence of public firms in the economy. Second, it needs to be justified why right-wing parties did not propose before 1980 to privatise public firms, if apparently their ideologies regarding public ownership have not been substantially modified after this date with respect to previous decades. A third important question that remains unsatisfactorily unanswered by the hypothesis of ideology is the trend to privatise firms simultaneously around the world, even though political circumstances are very different across countries practising this policy. At the light of these observations, a more reasonable conclusion would be to affirm that political ideology *does not matter* for privatisation, since governments supported by parties from all the political spectrum are privatising firms.

Although it has been previously studied in other topics (Grossman and Helpman,1996; Lindbeck and Weibull, 1993), the issue of ideology has not been formally addressed to analyse questions related to privatisation. The objective of this chapter is to study what is the real role of ideology in the process of privatisation, and to try to provide possible explanations to those apparent contradictions pointed out above.

Ideology is modelled in a twofold way, according to the definition provided above. First, two political parties are considered, which have opposite preferences regarding firms' ownership. Second, particular groups of voters may have some 'party identification', regardless of what the actual parties' offers are. Political parties compete for office at an election where they present proposals on the price to charge for a good produced by a public firm (what here is equivalent to determine the level of output and the corresponding size of the firm). When acting as government, the winner party may decide to transfer the firm to the private sector if that is considered optimal.

The behaviour of political parties and candidates has been one of the central issues in the voting literature, since the first works of Downs (1957). A robust result of this literature is

known as the Median Voter Theorem: under majority rule, candidates seeking to maximise the number of votes tend to converge in their positions to the median voter preferences. More sophisticated definitions are obtained when the space of political options is enlarged to more than one dimension (see Enelow and Hinich, 1989), but the same flavour of the one-dimension definition is maintained.

Notwithstanding the robustness of the median voter result and its practical implications, it is relatively easy to obtain departures from it, specially when voters have some form of ideology. As an example, Lindbeck and Weibull (1993) show that when political parties have preferences on policies, and voters have some 'party identification', proposals from parties do not necessarily converge to the median voter. Results indicate that if the policy space is continuous, voting equilibria may not exist at all, or the more popular party wins on its preferred policy. Other examples of models without ideology from voters where departures from the median voter result are obtained are Hinich et al (1972), Wittman (1977), Hansson and Stuart (1984), Coughlin (1986), Lindbeck and Weibull (1987) and Myerson and Weber (1993). Similarly, the model proposed in this chapter exhibits equilibria that in general do not coincide with the median voter's preferred outcome.

According to the empirical evidence presented in the previous chapter, the public firm analysed here is considered to be productively inefficient compared to a private firm. This inefficiency is exogenously assumed, since it is not the intention of this model to derive how public firms' productive inefficiency is generated, but to study how it may affect the decision to privatise firms. Different types of productive inefficiency are considered, since it is interesting to study which are the more relevant factors generating productive inefficiency which may lead a public firm to be privatised.

An outline of the chapter is as follows: section 2 presents a complete description of the model features. Section 3 solves for equilibria in prices proposed by parties, while results on privatisation are studied in section 4. A brief discussion on the social optimality of the obtained equilibria is presented in section 5. Finally, section 6 summarises the main findings and concludes.

## 2. Description of the model

### 2.1 General features

Consider an economy formed of a continuum of individuals, normalised to one. These agents consume a good x produced (initially) by a public firm, and a composite good y. Good x is a pure private good, so there are no problems of excludability or non-rivalry associated with its consumption. Examples of private goods being produced by public firms are not scarce: airlines, mining companies or car manufacturers were traditionally in the public sector in many European economies.

Individuals differ in two aspects: income and preferences on good x. There are three groups of individuals, in proportions $n_1$, $n_2$, $n_3$, with $\sum n_i = 1$. Each individual belongs exclusively to one of the groups, and all agents within a group are equal. It is assumed that each individual is endowed with a unit of labour that she sells in the market. Wages are different for each group of individuals, with $w_1 > w_2 > w_3$. Since wages are the only source of income for individuals, it may be considered that income differentials arise from the existence of individuals with different abilities. All members of an income group have the same preferences on good x, but there is no established correlation between income and preferences, i.e it is possible to consider cases in which good x is a normal or an inferior good.

Agents are fully characterised by their utility functions[9]:

$$U_i(x,y,\eta_i,\alpha_i) = \eta_i x - \frac{x^2}{2} + \alpha_i y \quad ; \quad i=1,2,3. \tag{2.1}$$

where x is the amount consumed of the publicly produced good, with price equal to p, and y is the composite good with price normalised to 1 (numeraire). In order for the marginal utility of good x to have economic meaning, the feasible range of consumption for each group is

[9] It is assumed this particular functional form to represent individuals' preferences for simplicity. Other specifications would yield similar results, provided a degree of substitution between x and y.

restricted to be $0 < x < \eta_i$. With respect to parameters, $\eta_i$ represents individuals' preferences on good x, while $\alpha_i$ is the marginal utility of income. It is assumed that marginal utility of income is decreasing, therefore $\alpha_1 < \alpha_2 < \alpha_3$.

The only available fiscal instrument is a direct tax over income with a rate *t*, common to all three groups. Resources levied by taxes are used by the government to attend some exogenous fiscal needs *F*, plus any subsidy which might be paid to the public firm if required. Government also decides on price to charge for good x, what amounts to determine the size of production (and firm's size).

From expression (2.1), demands for goods x and y can be derived for each group of individuals. Demands are equal to $x_i(p, w_i, \eta_i, \alpha_i) = \eta_i - \alpha_i p$, and $y_i = w_i(1-t) - \eta_i p + \alpha_i p^2$, (with $0 \leq p \leq \min_i \{\eta_i / \alpha_i\}$ to guarantee that a single price paid by all individuals does not result in values $x<0$ for any of the groups). Indirect utility functions are then given by:

$$V_i(p, w_i, t, \eta_i, \alpha_i) = \frac{1}{2}(\eta_i - \alpha_i p)^2 + \alpha_i w_i(1-t) \qquad (2.2)$$

Total market demand for good x, X(p), is simply the sum of all individual demands, given by $X(p) = \bar{\eta} - \bar{\alpha} p$, where $\bar{\eta} = \sum n_i \eta_i$, and $\bar{\alpha} = \sum n_i \alpha_i$.

Production of good x involves the use of labour and capital[10], and costs are considered to be perfectly separable in these two inputs. Constant returns to scale are assumed. The minimum number of workers required to produce X(p) is modelled as $L = z\,X(p)$, with a constant inverse productivity z. It is assumed that the requirement of job types or abilities to produce good x matches that of the society, therefore within L there are $n_i L$ workers who belong to group i, i=1,2,3. Alternatively, it might be considered that the L workers are hired at random from candidates without knowledge of their type, which is only discovered after they enter the job,

[10] The input labelled here as 'capital' may be regarded as a composite input comprising all required inputs other than labour. The idea is to separate labour as the more relevant factor from the rest of inputs, but keeping the analysis as simple as possible. All the L workers considered as labour are production workers, with independence of their skill. Hence, any activity of managers is not explicitly modelled, although it could be interpreted to be embedded as part of the input named 'capital'.

and they are paid according to ability. If marginal cost of capital is constant and equal to c, total cost of production is then:

$$C(X(p)) = (\bar{w}z + c)\ X(p) \qquad (2.3)$$

where $\bar{w} = \sum n_i\ w_i$.

There are three potential sources of inefficiency which have been observed in practice to be present in the 'industrial' type of public firm considered here. First, the number of workers is not necessarily kept to a minimum requirement, but on the contrary, overstaffing is often observed. Using the terminology defined above, this would be a typical 'input-mix' type of productive inefficiency. Second, wages paid by public firms are generally above average levels for similar jobs in the private sector[11]. And third, there may exist X- or technical inefficiencies in the use of inputs other than labour. All three sources of inefficiency may be indistinguishable in their final effect (productive inefficiency), however it is considered interesting to analyse what is the separate effect that they might cause on the potential privatisation of the firm.

It is not the objective of this work to try to derive how inefficiencies are generated, but only to analyse their effect over privatisation. Thus, the three sources of inefficiency are modelled here exogenously with the use of parameters that may take different values for different economies, or they may evolve over time:

a) Overstaffing: the number of workers employed by the public firm to produce a level of output X(p) is equal to $L^p = L + L^e$, with $L = z\ X(p)$ and $L^e \geq 0$.

b) High wages: each public firm worker is paid a premium $0 \leq s \ll 1$ over her market wage $w_i$, whatever her type. The size of this premium s can be regarded as a measure of the influence of public sector unions, which may achieve better wages at collective

[11] Chapters 4 and 5 present two case studies where significant overstaffing is found in publicly-owned Spanish bus firms, and publicly provided municipal services in USA, respectively. In both examples, there is also evidence that substantial wage premia are paid to public workers.

bargaining with public firms than in private sector[12]. Other interpretation of s may be the value of holding a public sector job, if it provides equal payment but more security than a private sector job. This last interpretation may be especially relevant in conditions of high unemployment.

c) Technical inefficiency: inefficiency related to capital is summarised in a parameter which increases the minimum feasible marginal cost, following the definition of a technically inefficient firm as not minimising costs. Public firm's marginal cost of capital is then equal to (c+e), with $e \geq 0$.

Adding the three components, the total cost of a public firm $C^p(X(p))$ may be expressed as:

$$C^p(X(p)) = C(X(p)) + e\ X(p) + L\ \overline{w}\ s + L^e\ \overline{w}\ (1+s) \qquad (2.4)$$

where C(X(p)) is the minimum cost of an efficient private firm given by (2.3). Observe that if $e = s = L^e = 0$, the public firm would be as efficient as a private firm.

Profits (positive or negative) of public firm are $\Pi^p = p\ X(p) - C^p(X(p))$. Adding these profits $\Pi^p$ to those resources obtained by the government from tax revenues, it is possible to determine what is the public sector budget constraint:

$$t\ \overline{w} + (L+L^e)\ t\ s\ \overline{w} + \Pi^p = F \qquad (2.5)$$

where F are some other fiscal needs of the government, net of any issued public debt. Observe that the first term on the LHS of (2.5) is the main part of revenue from income tax, while the second term is a secondary source of revenue from the extra income earned by public firm workers. Finally, observe that if the public firm has losses, then $\Pi^p < 0$ and this term would be added to F as a burden to public budget, which was the usual situation for most European economies in the 1980's. From the condition of a balanced budget constraint, it is possible to derive an expression for the tax rate t as a function of the price of good x:

---

[12] This assumption is based on the general conclusion extracted from the existent empirical evidence on the type of public firms which are intended to be represented here. There may exist other particular services provided by public agencies or firms, where public sector can have some monopsonistic power resulting in public workers' wages being actually below instead of above comparable private jobs (e.g. teachers or nurses).

$$t(p) = \frac{F + L^e(1+s)\bar{w} + \left[z(1+s)\bar{w} + (c+e) - p\right] X(p)}{\left[1 + (L+L^e)s\right]\bar{w}} \qquad (2.6)$$

It may be easily shown that $(\partial t/\partial p) < 0$, therefore individuals do not necessarily always prefer low prices for good x, since public firm losses, if they exist, must be financed through taxes. As a matter of fact, if t(p) is substituted into the indirect utility function given by expression (2.2), it is possible to observe that each group will have an optimal desired price $p_i^*$. In order to compute these optimal prices, consider the minimum feasible tax rate $t^*(p)$ which is obtained in the case of no inefficiencies ($e=s=L^e=0$). The indirect utility function is in that case:

$$V_i^*(p) = \alpha_i\left(\frac{\alpha_i}{2} - \frac{w_i\bar{\alpha}}{\bar{w}}\right)p^2 + \alpha_i\left(\frac{w_i[(z\bar{w}+c)\bar{\alpha}+\bar{\eta}]}{\bar{w}} - \eta_i\right)p + \frac{\eta_i^2}{2} + \frac{w_i\alpha_i}{\bar{w}}\left[\bar{w} - F - (z\bar{w}+c)\bar{\eta}\right] \qquad (2.7)$$

In order to guarantee the existence of a single preferred price for each group, it is assumed that marginal utilities of income verify $\alpha_i < (2w_i\bar{\alpha})/\bar{w}$, i=1,2,3; therefore indirect utility functions $V_i^*$ are concave in p. The optimal preferred price for each group is then the value that maximises its corresponding function $V_i^*(p)$:

$$p_i^* = \frac{w_i\left[(z\bar{w}+c)\bar{\alpha} + \bar{\eta}\right] - \eta_i\,\bar{w}}{2\,w_i\,\bar{\alpha} - \alpha_i\,\bar{w}} \qquad (2.8)$$

*Proposition 2.1: Optimal preferred prices $p_i^*$ are:*

*(a) decreasing in $\eta_i$ (preferences);*

*(b) increasing in $w_i$ (income), if the condition $\eta_i > \alpha_i\,[(z\bar{w}+c)\bar{\alpha}+\bar{\eta}]/2\bar{\alpha}$ is satisfied.*

Expressed in words, proposition 2.1 implies that individuals with higher preferences for good x have a lower preferred price (or equivalently, a higher tax rate), while those with higher income prefer a higher price (a lower tax rate).

*Proof:* Part (a) is obvious from expression (2.8). For part (b), noting that $(\partial \bar{w}/\partial w_i) = n_i$ and rearranging, it is possible to conclude that:

$$sgn\left(\frac{\partial p_i^*}{\partial w_i}\right) = sgn\left[(\bar{w} - n_i w_i)\left(2\bar{\alpha}\eta_i - \alpha_i[(z\bar{w} + c)\bar{\alpha} + \bar{\eta}]\right) + n_i z \bar{\alpha} w_i (2\bar{\alpha} w_i - \alpha_i \bar{w})\right]$$

The second term of the sum in the RHS of the expression above is always positive given the assumption used to ensure concavity of the indirect utility functions $V_i^*$. Therefore, if the condition presented in part (b) of the proposition is satisfied, then $(\partial p_i^*/\partial w_i) > 0$ in any possible case. Even if this condition were not satisfied, it is still likely that the effect of income on preferred price is positive, since in order for the result of the proposition to be reversed, the overall RHS of the expression above should be negative. □

Following a traditional normative approach, if we are interested in obtaining a socially optimal price as a benchmark of reference, it is required to define a social welfare function W. An utilitarian function is used here for W, defined as the sum of all indirect utility functions:

$$W = \sum_{i=1}^{3} n_i \, V_i^*(p, w_i, \eta_i, \alpha_i) \qquad (2.9)$$

Optimal social price $p^*$ is by definition the value that maximises the social welfare function. As indirect utility functions $V_i^*$ are concave by assumption, it is guaranteed that W is also concave and a maximum exists. This socially optimal price is the following:

$$p^* = \left( (z\bar{w} + c) + \frac{\bar{w}\left(\frac{\partial X(p)}{\partial p}\right)^{-1} \sum_i n_i \alpha_i x_i(p)}{\sum_i n_i \alpha_i w_i} \right) \left(1 - \frac{1}{\varepsilon_{X,p}}\right)^{-1} \qquad (2.10)$$

Expression (2.10) is the Ramsey-Boiteux price in this model, a typical result of the normative approach to optimal pricing policy of public firms. The optimal rule in this case would not be to set price equal to marginal cost, but to consider the redistributive possibilities offered by the publicly produced good x. Observe that the first term of the RHS in (2.10) is equal to minimum marginal cost ($z\,\bar{w} + c$) plus a correction term.

This correction term is usually negative, since $\partial X(p)/\partial p < 0$, and it reflects the link between demand and income, represented by the term $\Sigma_i n_i \alpha_i x_i(p)$. This last expression is higher for inferior goods than for normal goods, therefore when good x is more demanded from low income individuals, optimal social price will be smaller. In addition, the overall expression is weighted by a term related to the elasticity of aggregated demand. Given this expression for $p^*$, the optimal social price will always be smaller than the price charged by a private monopolist ($p^M = (z\,\bar{w} + c)\,(1-1/\varepsilon_{X,p})^{-1}$), but it must not necessarily be equal to marginal cost.

It is possible to express the socially optimal price as a weighted sum of the preferred prices by each of the three groups, i.e. $p^* = \Sigma_i \lambda_i p_i^*$, where the weights $\lambda_i$ are given by the following expression (observe that by definition $\Sigma_i \lambda_i = 1$):

$$\lambda_i = \frac{\dfrac{n_i\ \alpha_i}{\prod_{j\neq i}(2w_j\bar{\alpha} - \alpha_j\bar{w})}}{\sum_{i=1}^{3}\left(\dfrac{n_i\ \alpha_i}{\prod_{j\neq i}(2w_j\bar{\alpha} - \alpha_j\bar{w})}\right)} \qquad \textbf{(2.11)}$$

In the presence of inefficiencies of any of the three types considered (i.e., e>0, s>0, $L^e$>0), the actual indirect utility functions of individuals and desired prices would be different from those given by $V_i^*(p)$ and $p_i^*$ (see expressions (2.7) and (2.8), respectively). In particular, the actual utility function $V_i(p, e, s, L^e)$ would be:

$$V_i(p,e,s,L^e) = \alpha_i\left(\frac{\alpha_i}{2} - \frac{w_i\bar{\alpha}}{[1+(L+L^e)s]\bar{w}}\right)p^2$$

$$+\ \alpha_i\left(\frac{w_i[(z\bar{w}(1+s)+c+e)\bar{\alpha}+\bar{\eta}]}{[1+(L+L^e)s]\bar{w}} - \eta_i\right)p \qquad \textbf{(2.12)}$$

$$+\ \frac{\eta_i^2}{2} + \frac{w_i\alpha_i}{\bar{w}}\left[\frac{[1+(L+L^e)s]\bar{w}}{w(1+Ls-L^e) - F - (z\bar{w}(1+s)+c+e)\bar{\eta}}\right]$$

Since the value of s will be typically small (s = percentage of wage premia paid to public firm workers above average wages), actual preferred prices $p_i$ will not be very different from $p_i^*$ unless technical inefficiency of capital (e) is very high. In order to facilitate notation for the analysis of price equilibria and privatisation, it is proposed to approximate the actual indirect utility function of each group by a concave function around its corresponding optimal preferred price $p_i^*$, plus a term on income ($w_i$) weighted by its marginal utility of income ($\alpha_i$) and a constant dependent on the inefficiency parameters. Thus:

$$V_i(p,e,s,L^e) \cong -p^2 + 2\,(p_i^*)\,p + \alpha_i\, w_i\, f \qquad (2.13)$$

Another further simplification for the rest of the chapter is to normalise preferred prices. As shown by proposition 2.1, under general conditions optimal preferred prices are increasing on income, therefore it is assumed that the price preferred by group 1 (higher income) is equal to $p_1^* = \bar{p} > 0$, while that of group 3 (lower income) is set to $p_3^* = 0$. Meanwhile, a variable preferred price is considered for group 2, with $p_2^* = \delta\,\bar{p}$, $0 < \delta < 1$, in order to have the possibility of analysing different types of economies with group 2 being closer to groups 1 or 3. Summing up, actual indirect utility functions for each group are approximated by the following expressions:

$$\begin{aligned} V_1(p,f) &= -p^2 + 2\,\bar{p}\,p + \omega_1 f \\ V_2(p,f) &= -p^2 + 2\,\delta\,\bar{p}\,p + \omega_2 f \\ V_3(p,f) &= -p^2 + \omega_3 f \end{aligned} \qquad (2.14)$$

where $\omega_i = \alpha_i\, w_i$, i=1,2,3. Expressions in (2.14) fairly approximate actual indirect utility functions given by (2.12), apart from a constant idiosyncratic term $\eta_i^2/2$ for each of the groups, which is dropped out to reduce notation. Since this preference-related term is simply added to the utility function, it does not alter the analysis of individuals' decisions in next section.

Parameter f in expressions (2.14) is equal to the constant term in brackets at the end of (2.12). This value is common to all groups and it depends on the three types of productive inefficiency considered (e, s, $L^e$) and the fiscal needs (F). The effects of each of these parameters on f can be easily checked by a little re-arranging:

$$f = \frac{\overline{w} - (z\overline{w}+c)\overline{\eta} - F + \overline{w}(L-\overline{\eta}z)s - L^{e}\overline{w} - \overline{\eta}e}{[1+(L+L^{e})s]\overline{w}} \qquad (2.15)$$

It may be directly observed that $(\partial f/\partial F) < 0$, $(\partial f/\partial e) < 0$ and $(\partial f/\partial L^{e}) < 0$. The sign of $(\partial f/\partial s)$ is also easily determined, recalling that the minimum efficient number of workers is related to the level of total demand by $L = z\,X(p)$, and $X(p) = \bar{\eta} - \bar{\alpha}\,p \leq \bar{\eta}$, $\forall\, p \geq 0$. Therefore, $L = (\bar{\eta} - \bar{\alpha}\,p)\,z \leq \bar{\eta}\,z$, from which it can be concluded that the sign of $(\partial f/\partial s)$ is unambiguously negative.

## 2.2 Definitions of ideology

As described in the introduction of this chapter, ideology is considered in a twofold way, affecting both to political parties and to voters. This section describes how ideology is introduced in the behaviour of agents.

There exist only two political parties that compete for office, with opposite views on the question of public ownership of firms. One of the parties is a pro-private ownership, in the sense that it has some exogenous preference for the firm producing good x to be in the private sector. On the other hand, its rival has a preference for public ownership, therefore it obtains more utility if the status quo regarding ownership is maintained (remember that it is assumed that the firm producing good x is initially public). Parties will be denoted by R (pro-private ownership party) and L (pro-public ownership).

The basic objective for both political parties is to reach office in such a stronger position as feasible. Therefore, I will consider that this aim may be modelled by parties being interested in maximising the difference of votes in their favour. Other objectives may be thought of (e.g. obtaining at least a 51% of votes), but since in practice it is usually important for political parties not only to obtain a majority but also its size, the option of parties interested in maximising the difference of votes is chosen.

Let $B_R$ and $B_L$ be the number of ballots obtained by parties R and L, respectively, at elections and let $d = B_R - B_L$ be the difference of votes in favour of party R. The utility function of each political party is then defined as:

$$U_R = \begin{cases} d + \Gamma & ; \quad \text{if firm ownership = private} \\ d - \Gamma & ; \quad \text{if firm ownership = public} \end{cases}$$

$$U_L = \begin{cases} -d - \Gamma & ; \quad \text{if firm ownership = private} \\ -d + \Gamma & ; \quad \text{if firm ownership = public} \end{cases}$$

Parameter $\Gamma$ reflects the importance of ideological motivation for parties in the question of ownership. The size of $\Gamma$ is completely exogenous to the model, playing thus the role assumed by the definition of ideology used here: an exogenous bias towards a determined type of policy. Symmetric positions for parties R and L with respect to their beliefs are assumed for simplicity. Utility obtained by each party is not directly related to the utility level obtained by its voters: individuals have no established preferences for either type of ownership, but only for the price they must pay for good x. Hence, the bias $\Gamma$ must be interpreted in terms of some form of reward that a political party receives when its preferred position is implemented. This reward may be regarded as some form of financial contribution or, more generally, as any other form of support received when succeeding in implementing the desired policy. For example, it could be considered that if party R privatises the public firm, it might be offered some monetary contributions from business associations for its political campaigns; or if party L keeps the firm as public, it might receive more support from trade unions.

The second form of ideology introduced in the model is voters' ideology. It is considered that individuals have certain preferences for parties when deciding their votes, with independence of actual parties' offers. This preference is not directly linked to the question of ownership of firms, but instead it is a general preference for the party. The only variables that determine voters' choice are price of good x and their income level, which are the factors affecting their utility functions, plus this ideological bias. The reason for the existence of this bias is, as in the case of parties, exogenous. Ideology here can be interpreted as the belief that one party represents better than the other the own interests, due to the party's past history of policies and

proposals. This 'attachment' of individuals to parties is not complete: if a proposal from the rival party is sufficiently attractive to a voter, she may switch to vote for the non-preferred party (for this similar idea in other contexts, see Lindbeck and Weibull, 1993; and Grossman and Helpman, 1996).

According to the usual association between high-income individuals to political parties promoting low intervention from the State in the economy (since this type of policy generally implies lower taxes), it is considered that individuals in group 1 are inclined to vote for party R, those in group 3 for party L, while individuals in group 2 are ideologically neutral. Ballots are then decided according to the following criteria by each group. Individuals vote for party R if the respective utilities offered by each party, $V_i^R$ and $V_i^L$, i=1,2,3; are such that:

(a) Group 1: $V_1^R - V_1^L > -\sigma$
(b) Group 2: $V_2^R - V_2^L > 0$
(c) Group 3: $V_3^R - V_3^L > \sigma$

Parameter $\sigma > 0$ represents the degree of attachment of ideologically oriented individuals, which is assumed to be symmetric for groups 1 and 3 towards parties R and L, respectively. The larger the value of $\sigma$, the more difficult for party R to attract votes from group 3 voters who are biassed towards its rival, and conversely for party L to attract group 1.

### 2.3 The two 'political games'

Decisions on the pricing policy to be followed by the public firm producing x, and on its potential privatisation are the result of a political process. This process is modelled here as two independent games. Firstly, political parties are going to compete for office at an election where they present proposals to voters on the price to charge for good x. By offering a determined price for the good, parties are indirectly positioning themselves about the level of output to be produced and the corresponding size of the public firm. And secondly, once the winner party is in office, it may decide to transfer the firm to the private sector if that is estimated convenient.

However, this second decision on privatisation cannot be anticipated when choosing the initial pricing proposal, since the lapse of time between both decisions might be relatively long. Some events may take place after the election which cannot be predicted in advance by political parties, nor by voters. Consequently, the framework proposed is not a two-stage game, but instead it must be better regarded as two independent games, although the second game relies on the equilibria obtained in the first one.

In the initial game, parties choose their positions on pricing of good x, and the resulting equilibrium determines the public firm's size and which is the party that wins the election. Keeping constant the values obtained in this equilibrium, in the second game political parties establish their positions with respect to potential privatisation of the firm, with a future next election in perspective, but without explicitly allowing voters to decide on that matter. Ideology from voters plays a role in the first game, by providing each party with some relative advantage over its rival, while ideology from parties on ownership –which is the more relevant type of ideology for the question of privatisation– plays a role in the second game.

The logic for using this particular structure for the model is to try to reflect actual processes of privatisation. First, the usual status quo from which privatisations started was to have relatively large firms in the public sector, but political parties not offering the electorate any proposal to vote over the possibility of selling these firms. However, in electoral platforms presented at elections there existed indeed proposals about the optimal size of the public sector (reductions or enlargements) and also on public firms' charging practices (cuts or rises on the level of subsidies paid). Second, privatisation decisions have been usually taken by governments without previous consult to the electorate on the matter. Therefore, it seems adequate to model the position of parties with respect to the size of a public firm with independence of its future potential privatisation, and to model the decision on transfer of ownership as a separate game between political parties, but without explicit reference to an election with political platforms on that issue.

Two strong simplifying assumptions are used to solve the model. First, it is considered that the only issue on which voters decide their ballots concerns good x, leaving aside any other

matter which in principle could constitute part of electoral platforms. And second, it is considered that whether the public firm to be privatised, inefficiencies associated to excess of employment, wage premia and any other technical inefficiency may be driven down to zero[13]. The government may still have an influence on the private firm producing good x through regulation (in the model, it would keep the right to determine good x's price), but it leaves initiative to the private sector to organise production. The assumption on the higher productive efficiency of the privately-owned firm is based on the empirical evidence on public/private firms, which usually finds a performance gap favouring the latter.

## 3. Equilibria in prices proposed by parties

As described above, the first decision about the public firm is the result of an electoral competition between political parties, in which they make offers to voters about price p to charge for good x. Since there are no informational asymmetries, this is a simple game in which parties anticipate how voters decide their ballots, and also each party may infer about the rival's strategy. In this section I solve the game for equilibria on strategies $(p_R^*, p_L^*)$ for parties to pursue, where $p_i^*$ is the electoral platform of party i.

In order to solve the game, optimal strategies for each of the voters' groups are analysed separately. Thus, the rule for voters in group 1 is to evaluate proposals from parties $(p_R, p_L)$ and vote for party R only if $V_1^R - V_1^L > -\sigma$, where according to approximated expressions in (2.14) $V_1^k = V_1(p_k, f) = -p_k^2 + 2\,\bar{p}\,p_k + \omega_1 f$, $k=\{R,L\}$. Therefore, solving the inequality it is possible to derive conditions for parties to choose prices optimally to attract voters in this group:

$$\text{Party R wins in group 1 if:} \quad p_R > \bar{p} - [(\bar{p} - p_L)^2 + \sigma]^{1/2}$$

$$\text{Party L wins in group 1 if:} \quad p_L > \bar{p} - [(\bar{p} - p_R)^2 - \sigma]^{1/2} \qquad \textbf{(2.16)}$$

---

[13] It may seem too extreme to assume that a private firm can be completely efficient by setting $L^e = s = e = 0$. In fact, it would be enough to consider that values for these parameters are lower for the case of a private firm than for a publicly-owned firm, but additional notation should be added without substantially changing the obtained results.

Similarly, ideologically neutral individuals from group 2 cast their ballots for party R only if the condition $V_2^R - V_2^L > 0$ is satisfied, with $V_2^k = V_2(p_k, f) = -p_k^2 + 2\delta\bar{p}p_k + \omega_2 f$, $k=\{R,L\}$. Conditions are then the following:

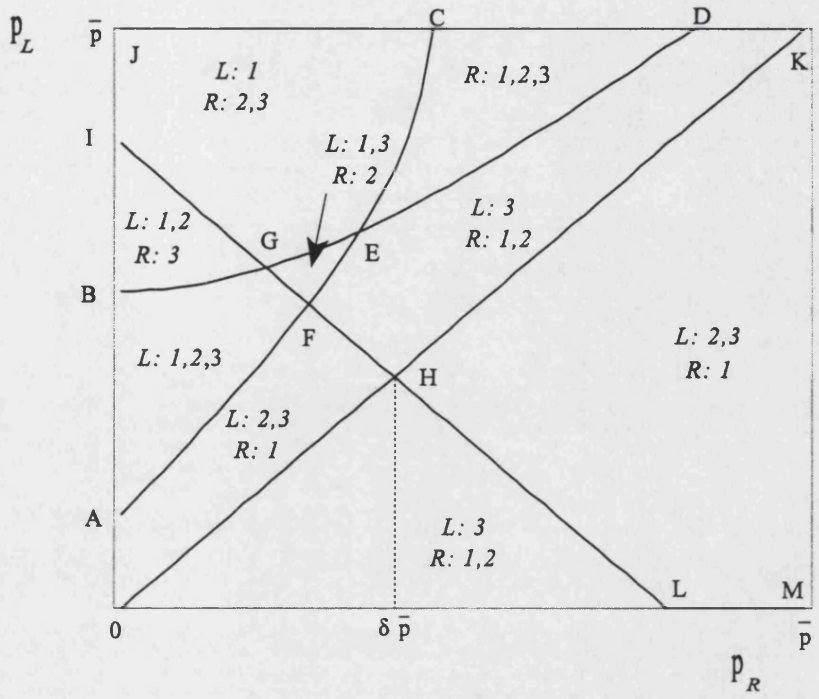
$$\begin{aligned} &\text{Party R wins in group 2 if:} && p_L < p_R < 2\delta\bar{p} - p_L \text{ ; if } p_L < \delta\bar{p} \\ & && p_L > p_R > 2\delta\bar{p} - p_L \text{ ; if } p_L > \delta\bar{p} \\ &\text{Party L wins in group 2 if:} && p_R < p_L < 2\delta\bar{p} - p_R \text{ ; if } p_R < \delta\bar{p} \\ & && p_R > p_L > 2\delta\bar{p} - p_R \text{ ; if } p_R > \delta\bar{p} \end{aligned} \qquad (2.17)$$

Finally, individuals from group 3, who are by definition somehow inclined to vote for party L, may decide to vote for R if $V_3^R - V_3^L > \sigma$, with $V_3^k = V_3(p_k, f) = -p_k^2 + \omega_3 f$, $k=\{R,L\}$:

$$\begin{aligned} &\text{Party R wins in group 3 if:} && p_R < (p_L^2 - \sigma)^{1/2} \\ &\text{Party L wins in group 3 if:} && p_L < (p_R^2 + \sigma)^{1/2} \end{aligned} \qquad (2.18)$$

The interpretation of these sets of conditions may be easily observed in graphical terms. Figure 2.1 represents the space $(p_R, p_L)$ relevant for the analysis, since we are never going to observe outcomes with offers above the maximum price $\bar{p}$ preferred by high income individuals. It may be checked that the two conditions in (2.16) are reciprocal, therefore they are alternative ways of expressing a single condition that divides this space $(p_R, p_L)$ in two regions. This condition is represented by the curve AFEC in figure 2.1. Points above this curve correspond to the region where party L wins in group 1, while in the complementary region R wins. For those points forming the curve, group 1 voters would be indifferent between proposals, therefore we may assume they randomise between parties and votes are split equally between R and L.

**Figure 2.1: Electoral outcomes(*) as function of parties' price proposals**




(*) *Note*: in each of the regions delimited by curves in the graph, it is indicated for each party which are the groups in which it wins.

The position of this curve AFEC on the figure is indicative of the ideological position of voters in group 1. We observe that party L may obtain the votes of this group, but for achieving that, its proposed price must always be above that of R. For example, observe that if $p_R = 0$, in order for L to win it must offer a price $p_L$ above point A (co-ordinates[14] of A: $[\,0,\ \bar{p} - (\bar{p}^2 - \sigma)^{1/2}\,]$), i.e. $p_L > 0$, and the same applies to any other value $p_R > 0$, since it may be observed that the line AFEC lies above the diagonal OHK. Furthermore, there is a range of values for $p_R$ where it would not be feasible for L to make an offer to attract voters in group 1, namely if $p_R$ lies at the right of point C: $[\,\bar{p} - \sigma^{1/2},\ \ \bar{p}\,]$.

[14] In order to facilitate the location of points in figure 2.1, the notation employed throughout the text is X: $[p_R, p_L]$, where $p_R$ and $p_L$ are the corresponding co-ordinates of point X. Notation on electoral outcomes is L:{i,j,k}, R:{i,j,k}, indicating the groups where each party wins; L:{½ i}, R:{½ i} indicates a situation with a tie in group i.

The interpretation of condition (2.16) represented by AFEC is that, in order to attract these voters, party L must rise its proposed price to be above the offer from R and to eliminate the ideological advantage of its rival. The higher is the attachment of group 1 individuals to party R (higher $\sigma$), the more difficult is for party L to win in that group (points A and C would be closer to J as $\sigma$ rises).

The set of conditions (2.17) related to individuals in group 2 generate lines OHK and IHL in figure 2.1, again determining regions in the space $(p_R, p_L)$ where party R or L wins for this group. As these voters are not ideologically oriented, parameter $\sigma$ does not play any part in the shape or location of these lines, which depend only on $\delta$, the parameter indicating how close are group 2 voters to groups 1 or 3. Coordinates of points are: H: $[\ \delta\,\bar{p}\ ,\ \delta\,\bar{p}\ ]$; I: $[0\ ,\ 2\delta\bar{p}]$; L: $[\ 2\,\delta\,\bar{p},\ 0]$. It must be observed that figure 2.1 presents a particular case in which it is assumed that $\delta < 0.5$, otherwise points I and L would be out of bounds (in the case $\delta > 0.5$ the line IHL would not cross the axes within the range $[0, \bar{p}]$). However, as it is discussed below, shapes in figure 2.1 allow to obtain general results since changes in lines' shapes do not fundamentally alter the determined regions.

Conditions (2.18) determine the division of regions corresponding to voters in group 3, which is defined by curve BGED. Points above the curve are combinations $(p_R, p_L)$ where party R wins in that group, while the complementary region gives votes to L. The interpretation is analogous to that for group 1, but reversing the roles of parties. In this case, it may be observed that party R wins in group 3 only if it is able to offer a price sufficiently below that of party L to overcome the ideological disadvantage. Here, there is also the possibility that L could make an offer so that it could be impossible for party R to attract group 3 voters, namely if $p_L$ is below the level determined by point B. As it happens for group 1, the higher is the degree of ideological attachment the more difficult is for party R to win in group 3. Co-ordinates of relevant points are B: $[\ 0,\ \sigma^{1/2}]$ and D: $[\ (\bar{p}^2 - \sigma)^{1/2},\ \bar{p}\ ]$, and the larger is $\sigma$, the closer that points B and D are to point J.

The combination of four curves (AFEC, OHK, IHL and BGED) determines what is the electoral outcome for all possible pair of price proposals from parties. Figure 2.1 indicates the

party that wins in each of the groups in all the areas that curves determine, and it may be used to obtain optimal strategies and outcomes.

Before going to the analysis of equilibria, the generality of this graphical analysis is discussed. As mentioned above, figure 2.1 is drawn using the assumption $\delta < 0.5$, which only affects to the position of line IHL but not to its slope, which is always equal to -1. Lines IHL and OHK always cross at point H, determined by the preferred price of individuals in group 2 (equal to $\delta \bar{p}$). Another assumption used to draw the figure is to consider that the ideological attachment of voters is such that $\sigma < \bar{p}^2$. This condition guarantees that the analysis has some interest, since in the limit case $\sigma = \bar{p}^2$, points A, B, C and D coincide with J, meaning that ideological advantages are such that party R always wins in group 1 and L in group 3, without any possible room for strategic behaviour.

Although the exact location of curves AFEC and BGED depends on parameter $\sigma$, the generality of obtained results is based on the fact that their relative positions are unaltered by changes in $\sigma$, as the following proposition shows:

*Proposition 2.2: For any possible degree of ideological attachment of voters to parties R and L in the relevant range $\sigma \in [0,\bar{p}^2]$, there always exists a single crossing-point (E) between curves AFEC and BGED in figure 2.1, such that AFE lies below BGE and EC lies above ED.*

*Proof:* Since curves AFEC and BGED are defined by functions $p_L(p_R) = \bar{p} - [(\bar{p} - p_R)^2 - \sigma]^{1/2}$ and $p_L(p_R) = (p_R^2 + \sigma)^{1/2}$, respectively, they are both continuously increasing and convex curves in $p_R$. Therefore, to guarantee the existence of a single-crossing point it suffices to prove that for any $\sigma$ in the relevant range, point B is above A and point C lies left of D.

Vertical co-ordinates of points A and B are $p_L^A = \bar{p} - (\bar{p}^2 - \sigma)^{1/2}$ and $p_L^B = \sigma^{1/2}$, respectively, which are both dependent on the ideological parameter $\sigma$. The sign of $p_L^A - p_L^B$ may be easily determined noting that $p_L^A(\sigma)$ and $p_L^B(\sigma)$ are both increasing functions in $\sigma$, with $p_L^A(\sigma)$ being convex and $p_L^B(\sigma)$ concave. Since $p_L^A(0) = p_L^B(0) = 0$ and $p_L^A(\bar{p}^2) = p_L^B(\bar{p}^2) = \bar{p}$, it

follows that for any value $\sigma \in (0, \bar{p}^2)$, necessarily $p_L^A < p_L^B$. Therefore, for all relevant values of $\sigma$ it is proved that point A lies below point B.

The same type of argument can be used to study the relative positions of points C and D. In that case, the horizontal coordinates of points are $p_R^C = \bar{p} - \sigma^{1/2}$ and $p_R^D = (\bar{p}^2 - \sigma)^{1/2}$, which are both decreasing in $\sigma$, with $p_R^C$ being convex and $p_R^D$ concave. Again, the fact that $p_R^C(0) = p_R^D(0) = \bar{p}$ and $p_R^C(\bar{p}^2) = p_R^D(\bar{p}^2) = 0$ leads to the conclusion that $p_R^C < p_R^D$, $\forall \sigma \in (0, \bar{p}^2)$. □

As a result of proposition 2.2, we positively know that even if larger values of $\sigma$ imply a shift of curves AFEC and BFED towards point J, the basic division in areas that they generate and the electoral outcomes derived for each of them are unaltered, with the following exception. An additional interesting feature of these curves is that their single crossing point E is always located on the diagonal $p_L = \bar{p} - p_R$, E: $[\bar{p}/2 - \sigma/(2\bar{p}), \bar{p}/2 + \sigma/(2\bar{p})]$. Therefore, the size of area GEF depends on the value of $\delta$ and the corresponding position of line IHL. For the case $\delta < 0.5$ (represented in the figure), GEF lies left of point E and electoral outcome in that area is *L:{1,3}; R:{2}* as indicated. In case $\delta = 0.5$, points G, E and F coincide, so area GEF does not exist. If $\delta > 0.5$, the area would be located to the right of point E, and the electoral outcome is then *L:{2} ; R:{1,3}*. However, results about equilibria discussed below are not altered by this possible case or other changes in size or position of those areas in figure 2.1.

*Optimal strategies*

Using information about voters' preferences, and anticipating the rival's reaction, each party chooses the optimal price to offer in its electoral program. Nash equilibria in prices $(p_R^*, p_L^*)$ clearly depend on the relative size of each of the groups $(n_1, n_2, n_3)$, so in order to study the more interesting situations, three possible cases are considered according to societies for which one of the groups is large enough to constitute a majority. Other possible society configurations without a dominant group are likely to converge to the solution of the second case (non-ideologically oriented voters constituting a majority), therefore no detailed analysis of further cases is required.

The procedure to search for equilibria is fairly simple and it is basically a graphical analysis, based on those regions showed in figure 2.1 Since the objective of each party is to win the election and to obtain the larger difference in votes as possible, the best strategy to pursue is always to try to win in the group that constitutes a majority and to try to attract the other two groups as much as possible. Using this rule, in each of the three cases studied the first step is to determine if any of the parties is able to use a strategy to eliminate completely the possibility of its rival 'stealing' the majority group. If a set of strategies exists for a party to achieve this objective, the best option is to select within that set the strategy that makes it a winner in the majority group and renders more votes in the minority groups.

Case 1: $n_1 > n_2 + n_3$

In this case, group 1 is the dominant group in society, therefore the main objective of parties is to try to attract voters in this group to obtain a safe majority, and then to attract voters in the other groups as much as possible to fulfil the objective of maximising the difference of votes. Since in this case the median voter belongs to group 1 by assumption, her preferred price is equal to $\bar{p}$.

Using figure 2.1, it may be observed that party R has a range of possible prices to offer so that victory in group 1 is guaranteed. If party R chooses a price $p_R$ bigger than the one determined by point C: $[\ \bar{p} - \sigma^{1/2}, \bar{p}\ ]$, it leaves no room for party L to find a price to beat R in group 1 (observe that any vertical line traced to the right of point C renders party R as obtaining votes in group 1, for any offer $p_L$ from party L). The best strategy that party L can follow is then to choose a price to win in groups 2 and 3, if possible. Using figure 2.1, it is easy to find a range of feasible prices to achieve this objective, namely by setting $p_L \in (2\,\delta\,\bar{p} - p_R, p_R)$. Any pair of prices $(p_R, p_L)$ satisfying both these conditions constitutes a Nash equilibrium.

It is possible to select one single equilibrium if a particular condition is satisfied. Graphically, if point H lies to the right of point C, there is a single best strategy for party R, and that is to set $p_R$ at the level determined by point H. By doing this, party R wins in group 1 for sure and forces party L to act as a follower and to set the same price, otherwise L would also lose in

group 2. The condition for which this case is relevant is a limit value on $\delta$ which may be found by using coordinates of points C:[ $\bar{p}$- $\sigma^{1/2}$ , $\bar{p}$ ] and H: [ $\delta\,\bar{p}$ , $\delta\,\bar{p}$ ]. The general conclusions about Nash equilibria when group 1 constitutes a majority are summarised in the following proposition:

*Proposition 2.3: In case that groups' sizes are such that* $n_1 > n_2 + n_3$, *Nash equilibria in prices are:*

*(a) If* $\delta < 1 - (\sigma^{1/2}/\bar{p})$, *any pair* $(p_R, p_L)$, *with* $p_R \geq \bar{p} - \sigma^{1/2}$, $2\,\delta\,\bar{p} - p_R < p_L < p_R$ *is a NE and yields the electoral outcome L: {2, 3}, R:{1}.*

*(b) If* $\delta \geq 1 - (\sigma^{1/2}/\bar{p})$, *there exists a single NE,* $p_R = p_L = \delta\,\bar{p}$, *with electoral outcome L: { ½ 2, 3}, R:{1, ½ 2}.*

*In both cases, party R wins elections.*

An interesting result that is derived from this proposition is to observe that the median voter rule is generally not followed, since in case *(b)* of the proposition the observed price will be lower than $\bar{p}$, and although in case *(a)* it would be feasible that $p = \bar{p}$ may constitute an equilibrium, there are other many options where $p < \bar{p}$. The interpretation is the following: case *(a)* corresponds to a situation where preferences of group 2 are relatively close to group 3, i.e. a low price is preferred. Therefore although party R keeps its price proposal relatively high to win in group 1, it may use its ideological advantage over these voters to offer a price lower than the one preferred by this group and make it closer to preferences of 2 and 3. In case *(b)*, preferences of group 2 are close enough to those of group 1 so that the best option for R is to offer exactly the price preferred by the former. In this way, victory in 1 is ensured, and L is forced to make the same offer or it risks losing also group 2.

Case 2: $n_2 > n_1 + n_3$

This second case is easier to analyse than the former, since in this case the objective of both parties is to attract voters in group 2. Since these voters are ideologically neutral, there is no advantage to exploit from any of the parties. The best individual strategy is to offer the price

preferred by this group p = δ p̄, and the rival is then forced to follow or it loses elections, since winning in the other two groups renders worse electoral outcomes. Therefore, in this case the median voter rule is followed and parties converge to offer the same price.

*Proposition 2.4: In case that groups' sizes are such that $n_2 > n_1 + n_3$, there is a single Nash equilibrium in prices: $p_R = p_L = \delta \bar{p}$. The electoral outcome is then L: { ½ 2, 3}, R:{1, ½ 2}. Party L wins elections if $n_1 < n_3$, party R if $n_1 > n_3$ and there is a tie if $n_1 = n_3$.*

Case 3: $n_3 > n_1 + n_2$

This third case is symmetric to case 1, inverting the roles of parties, and changing conditions accordingly. In this situation, the strategic group that provides the necessary votes to win the election is group 3, which forms a society's majority. Party L may use the gap that ideology provides to it and make an offer which cannot be matched by party R. In particular, if $p_L$ is set below point B, party R has to limit itself to attract groups 1 and 2 by choosing an optimal price (observe that any horizontal line traced below point B renders party L as winner in group 3, for any possible proposal $p_R$ from party R). Again, in those cases for which preferences of group 2 are close enough to low price preferences of group 3, party L can do even better and compete with R for group 2, apart from winning in 3. Proposition 2.5 summarises the outcomes for this case:

*Proposition 2.5: In case that groups' sizes are such that $n_3 > n_1 + n_2$, Nash equilibria in prices are:*

*(a) If $\delta > \sigma^{½} / \bar{p}$, any pair $(p_R, p_L)$, with $p_L \leq \sigma^{½}$, $p_L < p_R < 2\delta\bar{p} - p_L$ is a NE and yields the electoral outcome L: {3}, R:{1, 2}.*

*(b) If $\delta \leq \sigma^{½} / \bar{p}$, there exists a single NE, $p_R = p_L = \delta \bar{p}$, with electoral outcome L: { ½ 2, 3}, R:{1, ½ 2}*

*In both cases, party L wins elections.*

As in case 1, the outcome here is generally to set a price different from the one preferred by the median voter (p=0). The intuition is the same as presented above: ideology is the main reason driving this result, since party L in this case may rise its proposed price from the level preferred by the median voter without risk of being undercut by its rival. In case (b), preferences of groups 2 and 3 are close enough to transform the ideologically neutral individual in a *de facto* median voter who attracts parties to offer its preferred price, even if the individual who is the real median voter belongs to group 3 in this case.

## 4. Decision on privatisation of public firm

Once equilibria in price proposals from parties in each of the three cases considered in the former section have been determined, I turn now to the analysis of privatisation. In the second game proposed, the party in office acts as government and it may propose a change of ownership if that is considered convenient. Although in principle a government is not strictly the public firm's owner (all members of society are), it exerts control over it, and it is rarely observed that privatisation decisions are subject to referendum or any other form of public consultation.

In order to make the analysis tractable, I select particular solutions for those cases above where there exists a diversity of possible Nash equilibria (considering that the price preferred by ideologically neutral voters would generally have some attraction, even if other solutions would yield the same results). In particular, in all this section, the following price proposals from parties are used:

Case (1.a): $p_L^* = \delta \bar{p}$ $\quad p_R^* = \bar{p} - \sigma^{1/2}$

Cases (1.b), (2), (3.b): $\quad p_L^* = p_R^* = \delta \bar{p}$

Case (3.a): $p_L^* = \sigma^{1/2}$ $\quad p_R^* = \delta \bar{p}$

As it was mentioned above, these price proposals from parties may also be interpreted as proposals on firm size (lower price implies higher demand, and correspondingly a higher

number of workers). Following the general result presented in proposition 2.3, the equilibrium selected in case (1.a) when group 1 is dominant and groups 2 and 3 are relatively close, corresponds to a situation where party R wins elections offering a high price (a small firm), while party L proposes a larger firm. In case (3.a), according to proposition 2.5, the situation is reversed: party L wins with a proposal for a large firm and the offer from party R is to have a much more reduced size (higher price). In intermediate cases, both parties have the same proposal on size, and the winner party depends on the society's structure.

Again for the sake of tractability, I limit the analysis of the potential privatisation of the firm producing good x to a very simple framework. It is assumed that parties stick to their positions about price offers (size of firm) given by those equilibria above and then they decide on what is their position regarding privatisation of the firm. The party in office is the one that eventually has the responsibility of deciding what to do with the public firm, but the party in opposition plays also an important role when positioning itself on that matter. The question of privatisation is not raised for the electorate to vote on that issue, but parties take decisions on the likely effects to cause on their voting perspectives in a future next election.

### 4.1 Political costs and benefits of privatisation

Privatisation is generally seen as the extreme discipline device for inefficient public firms. Imposing tougher budget constraints, changing objectives or improving managers' incentives could be thought of as other mechanisms by which it could be possible to reduce public firms' productive inefficiency. However, as it was argued in chapter 1, there seem to exist some fundamental reasons linked to public ownership, which make all these alternative devices weaker in achieving efficiency gains compared to privatisation. In this model, it is assumed that there are no other mechanisms available to try to reduce total productive inefficiency generated by excess of employment ($L^e$), wage premia (s) or other technical inefficiencies (e). Moreover, it is assumed that whether a public company to be privatised, these parameters could be reduced to zero.

Public firm's productive inefficiency has a negative impact on utility for all groups of individuals. Analytically, if we use again the approximation proposed in equation (2.13) from which price equilibria were derived, $V_i(p,f) = - p^2 + 2 (p_i^*) p + \omega_i f$; i=1,2,3; it may be possible to see how inefficiencies affect utility. As it was shown above, parameter f (see equation 2.15) is decreasing on $L^e$, e, s and also on exogenous fiscal needs of government (F), therefore higher values for these terms reduce f and imply lower utility levels. From a social point of view, and given that any other alternative mechanism is excluded, these inefficiencies should be eliminated by privatising those firms with $L^e > 0$, $s > 0$ or $e > 0$.

If we define $f^{pub}$ and $f^{priv}$ as the corresponding values for parameter f for the cases of a public and a private firm, respectively, it is possible to evaluate the impact on utility that privatisation introduces for each group. Although the exact analytical expression for the value $f^{priv} - f^{pub}$ is rather complex, it is possible to derive a simple approximation by recalling that wage premium s will be typically small ($s \ll 1$). In that case, it may be obtained that:

$$\Delta f = f^{priv} - f^{pub} \cong \frac{\bar{w} L^e + \bar{\eta} e}{\bar{w}} \qquad (2.19)$$

Therefore, the higher the overstaffing in the public firm and the higher the technical inefficiency, the larger will be the gap between firms in terms of utilities for individuals.

However, it is clear that in the process of privatisation of a public firm there are some losers: those who are obtaining some extra rents due to existence of inefficiency. In this model, the only individuals for whom it is possible to evaluate explicitly how much they lose are public firm workers. In practice, there would exist other agents who lose in the process, namely managers, suppliers or retailers, who could be considered among those who can extract rents from publicly-owned firms. However, in terms of number of votes[15], the group of workers is

[15] In more general contexts, the importance of the other groups can be highly significant. If it is considered for example that political parties may receive contributions from lobbies, as in Grossman and Helpman (1996) or Besley and Coate (1996), it is likely that parties would pay more attention to interests of agents other than workers.

the one that is likely to be more relevant for parties, since they may constitute a significant fraction of votes traded when proposing privatisation.

When defining their positions on privatisation, parties have to consider the effect caused on their future electoral perspectives. A party in office has the possibility of privatising a firm, but it must consider that this policy would (possibly) reduce the support and number of future votes from individuals who lose some income in the process as the wage premium s is reduced to zero, and also from those who lose their jobs in the firm, as excess of employment $L^e$ is eliminated. Meanwhile, even if it is not in government, the rival party must also study its position regarding privatisation, since that may affect its results at future elections. Additionally each party must also weigh if its proposal on ownership provides it with some utility from its ideological position (effect of parameter $\Gamma$ representing parties' utility different from votes).

### 4.2 Equilibria in privatisation proposals

In order to analyse how parties evaluate their position on privatisation, individuals within each group of income *i* are classified into two categories: those who work for the public firm (*workers*, W) and those who work in the private sector (*non-workers*, NW). The actual number of workers within each group may be determined by the assumption that public firm workers are randomly hired between groups, therefore the fraction within each group is equal to the fraction for the overall society. Thus, there exist $(L+L^e)\ n_i$ workers and $(1-L-L^e)\ n_i$ non-workers in each group i=1,2,3.

Each of the possible situations considered in the previous section (cases 1.a, 1.b, 2, 3.a and 3.b), should be studied separately since, as shown, the winner party and equilibrium in price offers are a function of groups' relative sizes. For the sake of brevity, only the analysis of the most interesting cases (1.a) and (3.a) is presented, since procedures to obtain equilibria would be similar for the rest of cases.

*(A) Case 1.a:* $n_1 > n_2 + n_3$; $\delta < 1 - (\sigma^{1/2}/\bar{p})$

$p_L^* = \delta \bar{p}$; $p_R^* = \bar{p} - \sigma^{1/2}$

*Party R is in office.*

In this case, group 1 constitutes a majority of society and groups 2 and 3 are relatively close in their preferences for a low price for good x. Party R wins elections with a proposal on a relatively high price, while party L proposes to enlarge the public firm by offering a lower price. In this context, let's start by studying what is the likelihood of observing parties positioned with respect to privatisation as *{L:pub, R: priv}* (L proposing to keep the firm as public, R proposing privatisation).

Individuals in group 1 who do not work for the public firm will clearly support party R at the light of its proposals. Party R offers them a price closer to their preferences than the price proposed by L, and moreover, efficiency gains achieved by privatisation will benefit them in terms of lower taxes and higher utility (the net gain in utility for each individual in this group is $\omega_1 \Delta f$, see equations (2.13) and (2.19)).

Matters are different for those individuals in group 1 who work in the public firm. When deciding their support for party R or L, they must evaluate gains from the better price offered by R for their preferences, and the rents they lose if the firm is privatised. In addition, we have to remember the assumption that these individuals have some ideological preference for party R given by $\sigma$, so they will only support party L if the utility gain offered by the latter is substantially high. Taking all this into account, we may conclude that this group of workers would vote for party L iff:

$$V_1^L(p_L^*, f^{pub}) > V_1^R(p_R^*, f^{priv}) + \sigma$$

Using equilibrium prices $p_L^*$ and $p_R^*$ for this case and considering that these individuals' income is $w_1$ (1+s) when the firm is public, it is possible to find a condition for public firm workers from group 1 to change their 'natural' vote and offer support to party L:

$$s > \frac{\omega_1 \Delta f + (\delta - 1)^2 \bar{p}^2}{\omega_1 f^{pub}} \qquad (2.20)$$

where $\omega_1 = \alpha_1 w_1$ ; $f^{pub}$ is defined by equation (2.15) and $\Delta f$ by equation (2.19). The interpretation of this condition is rather simple: workers in group 1 may vote for party L if wage premium earned as public workers is sufficiently large to compensate the utility loss implied by the overall inefficiency of the public firm ($\Delta f$ ) and the distance between their preferred price ($\bar{p}$) and the price offered by L ($\delta \bar{p}$). It is remarkable to observe that since $\partial \Delta f / \partial e > 0$ ; $\partial \Delta f / \partial L^e > 0$ ; $\partial f^{pub} / \partial e < 0$ and $\partial f^{pub} / \partial L^e < 0$, the higher the values of technical inefficiency e and excess of labour $L^e$, the more difficult is that condition (2.20) is satisfied. The same effect is caused by a rise in the exogenous fiscal needs of the government (F), since $\partial f^{pub} / \partial F < 0$.

Individuals in group 2 are in principle in favour of party L, given the price offered by this party, which is closer to their preferences than R's price in this case. However, they could change their minds and support party R when observing the positions of parties with respect to privatisation. In particular, for the case of non-workers it is possible to derive a condition that ensures that $V_2^R > V_2^L$ :

$$\Delta f > \frac{\left[(1 - \delta) \bar{p} - \sigma^{1/2}\right]^2}{\omega_2} \qquad (2.21)$$

In this case, individuals evaluate if efficiency gains introduced by privatisation are large enough to compensate the distance of the actual price with respect to their preferences. The higher the inefficiencies e and $L^e$, the easier that this condition is satisfied and non-workers from group 2 change their votes to R. For the case of workers, a similar condition can be obtained, although for that sub-group it is more difficult for party R to attract support, since efficiency gains must be large enough to overcome the price gap plus the income loss imposed to these individuals by reducing the wage premium s to zero.

It is interesting to notice that, even if individuals in group 2 are ideologically neutral, parameter $\sigma$ appears in the condition referred to that group, with higher values of $\sigma$ implying that condition 2.21 is more easily satisfied. The reason is that as ideology becomes more important, party R will reduce its proposed price since it can win more easily in its 'home' group and can be simultaneously closer to the preferences of group 2. Therefore, although they are not directly motivated by ideological grounds, individuals in group 2 may be affected in their decisions by the degree of ideological attachment of the other two groups.

Finally, the case of group 3 is essentially similar to group 2, though in this case the public firm's inefficiency must be larger than in the case of group 2 for these individuals to change their vote to R. People in group 3 are inclined to vote for L by ideology an also by the better price offered by that party, but even then they may change if $\Delta f$ is large enough to yield a utility level $V_3^R$ such that $V_3^R (p_R^*, f^{priv}) > V_3^L (p_L^*, f^{pub}) + \sigma$. The corresponding condition for the case of non-workers is then:

$$\Delta f > \frac{(\bar{p} - \sigma^{1/2})^2 - (\delta\bar{p})^2 + \sigma}{\omega_3} \qquad (2.22)$$

Condition (2.22) indicates the relevant variables on which individuals in group 3 take their decision. In order for them to vote for party R, utility gains from privatisation must compensate the difference between the (squared) prices offered by parties R and L respectively. The reason for these terms to be present in the condition is that these individuals have an ideal price p=0, so both offered prices are higher than the preferred price for this group, though the price of L is closer. In addition, the ideology parameter $\sigma$ appears since by definition the offer from R must overcome that disadvantage.

As in the case of group 2, another stricter condition that is not shown here could be obtained for the case of workers in group 3, in which the inefficiency gap could compensate for the price difference, the ideology advantage, plus the income loss when wages are reduced to average levels.

In order to summarise all these results, table 2.1 presents the parties' perspectives of support from different groups of individuals, when parties take positions on privatisation as *{L: pub, R: priv}* and keep proposals on prices as those obtained as Nash equilibrium in the first game for this case (1.a). Since that scenario is not going to be dealt with, in the table it is assumed that party R is not able to attract public firm workers from groups 2 and 3 with its offer for privatisation.

**Table 2.1: Distribution of votes, case (1.a), proposals *{L: pub, R: priv}***

| | *Group 1* | *Group 2* | *Group 3* |
|---|---|---|---|
| *Workers (W)* | **L** if s is large enough (cond. **(2.20)** ) | **L** | **L** |
| *Non-workers (NW)* | **R** | **R** if $\Delta f$ is large enough ( cond. **(2.21)**) | **R** if $\Delta f$ is large enough (cond. **(2.22)** ) |

In this case, considering that the number of public firm workers ($L+L^e$) is relatively small in terms of total population, the core of the society is formed by group 1-NW, from whom R wins support for sure. Meanwhile, groups 2-NW and 3-NW may also be relevant to determine a substantial difference in terms of support.

From table 2.1, we can observe that whether conditions (2.21) and (2.22) to be satisfied (a case that may be observed when inefficiencies are large), R wins substantial support from non-workers in all groups, therefore *{L: pub, R:priv}* would likely be an equilibrium. The relevant questions are then: (1) is it possible to observe a situation where R does not propose to privatise the firm?, and (2) can we observe in this case a left-wing party L in opposition approving privatisation plans?

In order to try to answer the first question, we must find some conditions under which *{L: pub, R: pub}* is a stable equilibrium. Consider that conditions (2.21) and (2.22) are not satisfied but (2.20) is, which corresponds to a situation where a privatisation proposal is not attractive for groups 2-NW and 3-NW (and therefore even less for 2-W and 3-W) and it makes party R lose

votes from 1-W (workers in its 'home' group 1). Under these conditions, the number of ballots and utilities for each party are:

*{L: pub, R: priv}* ⇒ Ballots: $B_L = (L+L^e)\, n_1 + n_2 + n_3$ ; $B_R = (1-L-L^e)\, n_1$

Utilities: $U_L = n_2 + n_3 - (1 - 2\,(L+L^e))\, n_1 - \Gamma$

$U_R = (1 - 2\,(L+L^e))\, n_1 - n_2 - n_3 + \Gamma$

If the status quo is maintained and the party in government does not privatise the firm:

*{L: pub, R: pub}* ⇒ Ballots: $B_L = n_2 + n_3$ ; $B_R = n_1$

Utilities: $U_L = n_2 + n_3 - n_1 + \Gamma$

$U_R = n_1 - n_2 - n_3 - \Gamma$

In order to observe party R not privatising, it must be the case that the utility it obtains in the first case is smaller than in the second. The condition for that case is that:

$$\mathbf{(L+L^e)\, n_1 > \Gamma} \qquad \textbf{(2.23)}$$

The interpretation of this condition is immediate: even if party R has an ideological preference for private ownership, measured by parameter Γ, it might be the case that privatisation does not attract those voters not supporting the party (groups 2 and 3) and it might even reduce the number of votes in the 'home' group 1. In that case, if the number of votes lost in group 1-W is more important than the gain from ideology (Γ), party R may keep the firm in the public sector.

However, this situation of a pro-private ownership party not following its ideas may be easily altered when public firm's productive inefficiency rises due to technical inefficiency (e) or to overstaffing ($L^e$). Assume for example that conditions (2.20) and (2.21) are satisfied, but not (2.22). In that case, the condition above should be transformed into:

$$\mathbf{(L+L^e)\, n_1 - (1-L-L^e)\, n_2 > \Gamma} \qquad \textbf{(2.23')}$$

It may be observed that (2.23') is a stricter condition than (2.23) and it will require a significant size for the public firm, since the number of group 1 workers (1-W) should be bigger than the size of group 2-NW. Therefore, as inefficiency rises (due to larger values for e or $L^e$), it is easier to depart from the possible equilibrium *{L: pub, R: pub}* and to observe privatisation. Another interesting result is that even if (2.23) is satisfied, a rise in the exogenous fiscal needs of the government (F) would make condition (2.20) more difficult to be verified, and privatisation more likely.

The second relevant question proposed above is to wonder when party L in opposition is going to favour the government's privatisation policy. In this static framework, party L would have no chance to be in government. Therefore, as it cannot influence the decision on ownership, its ideology parameter $\Gamma$ does not play any influence in its position, since it is not going to be able to implement its ideological optimal policy of no-privatisation. As soon as the public firm's inefficiency is large enough to satisfy condition (2.21), party L would lose votes in group 2-NW by keeping its proposals on public ownership, so it would likely change to support privatisation.

So, as a brief summary for case (1.a), the scenario depicted would be one of a country with a relatively right-wing politically oriented society, and a dominant conservative party. The more likely equilibrium in this case will be to observe party R's government privatising the firm. The party in opposition (L) could be either against this policy or supporting it (the latter case only if the public firm's inefficiency is high), but the size of its potential utility from ideology ($\Gamma$) does not affect its position regarding privatisation.

However, it is also possible to find conditions under which an alternative equilibrium in which a relatively inefficient public firm would be kept in public sector could be sustained. This situation would be one of moderate technical inefficiency and overstaffing, relatively high wages for public workers, and not a strong ideological utility for party R. It is likely that these conditions were satisfied in most developed economies before the 1980's, explaining thus the apparent contradiction of right-wing political parties accepting inefficient public firms and not proposing privatisation. Even though some ideological motivation might exist, under these

conditions conservative parties would typically not privatise firms on the basis of electoral perspectives.

The model shows that a rise in the productive inefficiency of public firms can make this equilibrium to be altered. But this rise must be due to technical inefficiency (e) or input-mix inefficiency (excess of labour, $L^e$), since if the problem of public firms is one of workers' high wages (achieved for example by strong public sector unions), the likelihood of privatisation would be smaller instead of bigger.

Another factor which can make the equilibrium *{L: pub, R: pub}* to be altered are government's fiscal needs (F). If public sector deficit rises, that may alter the support from the group of individuals that is basically sustaining the equilibrium, namely 1-W in this case. It can be observed that a rise in F reduces the value of parameter f (see equation 2.15) but it does not affect $\Delta f$, according to 2.19. Therefore, changes in F would modify condition 2.20 but would not alter 2.21 nor 2.22, so the influence of rising public sector deficits on the question of privatisation is relatively weak. The only way by which F alters the equilibrium is by a possible change in the decision of public sector workers belonging to group 1 (the 'home' group of party R), who may favour privatisation when F is relatively high even if they lose the wage premia earned at public jobs.

This last result allows to understand the low correlation found between privatisation and fiscal needs in OECD countries presented above in the thesis' introduction. Even if a tighter public budget constraint may have an influence on the decision to implement privatisation, its effect strongly depends on electoral conditions. The worldwide trend towards privatisation is more likely to have been caused by a general rise in the productive inefficiency of public firms compared to private counterparts, rather than by fiscal needs. However, it must be remarked again that a public firm with inefficient high costs is not a sufficient condition to alter the equilibrium *{L: pub, R: pub}*, since a situation with high costs generated by substantial wage premia for public workers might have the opposite effect, making privatisation less likely.

Meanwhile, ideology plays a role in determining what is the final equilibrium to be observed, though its influence must also be understood within an electoral context. The more ideologically oriented (larger value for parameter Γ) that party R is in this case, the more likely that we observe privatisation of the firm producing good x. However, if firm's inefficiency is not too extreme and the firm has a considerable size, even an ideologically motivated conservative party could sustain an equilibrium *{L: pub, R: pub}*. Contrasting these results with real privatisations, it is not surprising to observe that the first countries to implement the policy had right-wing governments with strong ideology, and the first sales corresponded to relatively small firms.

***(B) Case 3.a:*** $n_3 > n_1 + n_2$; $\delta > \sigma^{1/2}/\bar{p}$

$p_L^* = \sigma^{1/2}$; $p_R^* = \delta\bar{p}$

*Party L is in office.*

In this case, a symmetrical situation to that in case (1.a) is considered: now group 3 constitutes a majority, hence party L wins elections on the question of price proposals (a situation that would correspond to a country with a relatively left-wing oriented society, and a strong Labour party). Meanwhile, party R receives the support from groups 1 and 2 (recall that in case 3.a, preferences of group 2 are close to those of group 1, so price offered by party L does not attract these voters). Then, if the status quo is kept, parties' utilities are:

*{L: pub, R: pub}* ⇒ Ballots: $B_L = n_3$ ; $B_R = n_1 + n_2$

Utilities: $U_L = n_3 - n_1 - n_2 + \Gamma$

$U_R = n_1 + n_2 - n_3 - \Gamma$

If party R, in this case in opposition, proposes to privatise the public firm, it may attract some support from party L's 'home' group voters, but it would lose support from public firm workers who initially vote for R. Table 2.2 indicates the position of each voters' group:

**Table 2.2: Distribution of votes, case (3.a), proposals *{L: pub, R: priv}***

| | *Group 1* | *Group 2* | *Group 3* |
|---|---|---|---|
| *Workers (W)* | **L** if s is large enough (cond. **(2.24)** ) | **L** if s is large enough (cond. **(2.25)** ) | **L** |
| *Non-workers (NW)* | **R** | **R** | **R** if Δf is large enough (cond. **(2.26)** ) |

The corresponding conditions are:

$$s > \frac{\omega_1 \Delta f + (\bar{p} - \sigma^{1/2})^2 - (\bar{p} - \delta\bar{p})^2 + \sigma}{\omega_1 f^{pub}} \qquad \textbf{(2.24)}$$

$$s > \frac{\omega_2 \Delta f + (\delta\bar{p} - \sigma^{1/2})^2}{\omega_2 f^{pub}} \qquad \textbf{(2.25)}$$

$$\Delta f > \frac{(\delta\ \bar{p})^2}{\omega_3} \qquad \textbf{(2.26)}$$

The interpretation of this set of conditions is similar to that in case (1.a). Condition (2.24) indicates that, in order for voters from 1-W to vote for L, the wage premium must be large enough to compensate for the public firm's inefficiency (Δf), the worse price offered by L compared to R, and the ideological attachment of these voters to party R. Condition (2.25) is the equivalent for group 2-W, where ideology does not play a direct role, although it indirectly enters the condition through the parties' offered prices. Finally, the core of the society in this case (group 3-NW) could shift to party R if public firm's inefficiency is large enough to compensate for the lower utility that the price offered by that party ($p=\delta\ \bar{p}$) yields compared to their preferred price ($p=0$).

The key for party R to decide on its position regarding privatisation is going to be the size of public firm's inefficiency, since in this case it is determinant to try to win in group 3-NW. If inefficiency is not large enough for condition (2.26) to be satisfied, party R will support to keep the firm as public as long as condition (2.25) holds, since no ideological gains are to be obtained, and votes from groups 2-W and 1-W might be lost.

Regarding the decision of party L, consider a possible scenario where R is proposing privatisation and conditions (2.24), (2.25) and (2.26) are satisfied. In that case, party L may decide to privatise the firm if the following condition on ideology holds:

$$\Gamma < (1-L-L^e)\, n_3 - (L+L^e)\,(n_1 + n_2) \qquad (2.27)$$

In words, if utility derived from ideology (support from bases or sponsors) is lower than the net number of votes gained by privatising, we may observe the situation *{L: priv, R: priv}* arising as an equilibrium and a left-wing party L in government implementing privatisation. Observe that a large value for the ideology parameter $\Gamma$ could constitute an electoral suicide in this case, since it could make party L not to follow party R and stick to its principles, which would make it lose support from its core voters in group 3-NW.

Thus, again by using a highly simplified framework, it is possible to find an easy interpretation for the apparent contradiction to the hypothesis of ideological motivation for privatisation. Left-wing parties may be forced to privatise by electoral considerations, even if this policy makes them lose some utility or support when breaking their traditional ideological compromises. Again in a situation of high public firm productive inefficiency or tighter public sector budget constraint, and rival party R proposing a change of ownership for the public firm, party L may end up paying more attention to votes than to ideology and pursuing that policy, even if it goes against its ideological beliefs. As in the previous case, the rise in public firm's inefficiency must be generated by increases in problems of technical inefficiency (e) or overstaffing ($L^e$), since if higher costs are due to high wages that would have the opposite effect. Also, a rise in public sector deficit is shown to have an influence favouring privatisation, although its effect is a relatively minor one, since it affects only the decisions of

relatively small groups in this case (1-W and 2-W) by modifying conditions 2.24 and 2.25, respectively.

## 5. Social optimality of equilibria

This section presents some comments about optimality of those equilibria obtained, with respect to firm ownership and firm size (price charged for good x). Regarding ownership, the criterion to analyse social optimality is rather simple, given the assumptions about the public firm. In this model, due to the impossibility of using alternative mechanisms to improve outcomes, the best option in the presence of technical inefficiency ($e > 0$) would be to privatise the firm. Regarding the other type of productive inefficiencies (wage premium $s > 0$, and excess of labour $L^e > 0$), these may be seen as only inducing income redistribution between individuals. However, in this context this redistribution is not justified since it could be extremely regressive, therefore socially undesirable. Thus, it can be concluded that the best option in the presence of any type of productive inefficiency would be a transfer of ownership which could improve the public firm's performance.

However, it has been obtained that it is possible to find situations in which to keep the firm as public is an equilibrium in political terms. For this to be the case, it suffices that productive inefficiency is not sufficiently high to allow significant utility gains for individuals through tax reductions, and wage premia are large enough so that a proposal to privatise the firm reduces the number of votes from public firm workers. Under these conditions, even a pro-private ownership party as R in government could end up not privatising the firm. This situation is an example of how a socially suboptimal ownership structure can constitute an equilibrium in political terms, and there are no forces leading to a change, contrary to the 'Chicago school' view of political markets (Wittman, 1989). This case might characterise the situation in many developed countries during the post-war decades up to the 1980's.

In this model, it is more interesting to analyse what is the outcome of the political game in terms of firm size, compared to a social optimum. This can be done by comparing what is the

actual price resulting from the Nash equilibrium in each case with the socially optimal price $p^*$ obtained in equation (2.10) when using a utilitarian social welfare function. As it was discussed in section 2, this optimal price $p^*$ may be expressed as a weighted average of preferred prices in each group $p_i^*$ with weights $\lambda_i$ given by expression (2.11).

Although the exact expression for weights is rather complex, it is possible again to obtain some intuition by using an approximation. If we consider the case of a society for which differences in income and preferences for each group are not too big, parameters $\alpha_i$ and $w_i$ could be approximated by their average values $\bar{\alpha}$ and $\bar{w}$, respectively. In that case, weights $\lambda_i$ would be:

$$\lambda_i = \frac{\dfrac{n_i\,\bar{\alpha}}{\bar{\alpha}^2\,\bar{w}^2}}{\sum_{i=1}^{3}\left(\dfrac{n_i\,\bar{\alpha}}{\bar{\alpha}^2\,\bar{w}^2}\right)} \cong n_i \qquad (2.28)$$

Using these simplified weights, and the assumed preferred prices in each group ($p_1^* = \bar{p}$, $p_2^* = \delta\bar{p}$, and $p_3^* = 0$), the social price would then be $p^* = (n_1 + \delta\, n_2)\,\bar{p}$.

In case (1.a), party R wins elections with a price $p = \bar{p} - \sigma^{1/2}$, therefore the difference between actual and optimal price can be estimated as $p - p^* = (1 - n_1 - \delta\, n_2)\,\bar{p} - \sigma^{1/2}$. The more important is the ideological attachment of voters to parties, and the larger the size of groups 1 and 2, the more likely that the price imposed by R results to be too small in social terms (a too big firm would be set). The reason is that as ideology becomes more important, party R may depart from the preferred price by its home group 1 and lower its proposal to try to attract voters from the other groups. In this case, the more attached that individuals are to a party, the less likely that it actually makes the best offer for them (since votes are somehow captive).

Case (3.a) corresponds to a situation where party L wins elections by offering a price $p = \sigma^{1/2}$, which in this case is lower than the one preferred by voters in group 2 ($p = \delta\,\bar{p}$), since the alternative $\delta\,\bar{p} \leq \sigma^{1/2}$ constitutes case (3.b), not studied here. Therefore, the gap between actual and social price is $p - p^* = \sigma^{1/2} - (n_1 + \delta\, n_2)\,\bar{p}$, therefore as ideology becomes more important,

it is more likely that the price is too high (firm too small) in social terms. Again the attachment of voters plays against those individuals who form L's 'home' group, since the party may set a higher price by exploiting its ideological advantage. Meanwhile, as groups 1 and 2 become larger, the reversed result is obtained, and price could be too low in social terms in that situation.

## 6. Conclusions

The model presented in this chapter has been developed with the objective of providing some insights into the role that ideology has played in the worldwide trend to privatisation of public firms. An often used argument is that ideology has been an important factor leading governments to implement privatisation programmes. However, this hypothesis should be able to explain several apparent contradictions. First, it is not justified why conservative governments did not start this process sooner, even if public firms' productive inefficiency existed before the 1980's. Second, if ideology is relevant, it is not clear why left-wing governments have jumped the bandwagon of public firms' sales. And third, an ideological view of privatisation faces serious limitations to explain why privatisation is a policy practised simultaneously in many countries, regardless of very different political circumstances.

Ideology is defined as an exogenous bias towards a particular policy. It is considered that there exist only two political parties, which are assumed to have opposite views on the question of public ownership of firms. These parties are mainly interested in obtaining votes at elections, but they might also derive some utility from defending a particular position regarding ownership. This utility can be measured by a parameter that can be interpreted as monetary contributions or other form of support from interest groups that parties might receive.

A second form of ideology is that from voters, as an exogenous attachment to political parties. It is assumed that society is divided into three separate groups of individuals, with one ideologically neutral group and the other two supporting one political party each. Even though they are somehow ideologically biassed, voters do compare the actual proposals from parties.

The structure of the model tries to reflect the process by which governments and political parties have taken decisions over public firms during the last decades. It is considered that parties initially compete at an election where they make offers to voters on the price to charge for a publicly produced good (which is equivalent to determine the size of the public firm producing the good). This political game is aimed to represent how parties established their positions with respect to size of public firms, before the process of privatisation started. On a second independent political game, it is considered that the winner party acts as government and it evaluates the convenience of transferring the public firm to the private sector. This decision is taken on predictions of potential gains and losses in a future next election, although the question of privatisation is not directly voted by individuals. Again, this particular structure tries to reflect how actual decisions on privatisation have been taken, since generally transfers of ownership have not been consulted to voters. The party in opposition in this second game does not have responsibility over the public firm, but it may affect the outcome by positioning itself in favour or against the government's decision.

The model identifies the main factors determining the political equilibria regarding the size of public firms and their possible privatisation. With respect to the first game between parties in which the size of the public firm is determined, a multiplicity of equilibria may arise, basically depending on the structure of society (income and preferences' distribution) and the ideological attachment of voters to parties. Three possible cases are considered, assuming that the group of voters supporting right-wing party R, the group supporting the left-wing party L or the group of ideologically neutral voters constitute a majority. Equilibria in price proposals presented at electoral platforms are generally different from the median voter result. The dominant party in each case wins elections on the basis of a price offer that is close but not equal to the price preferred by the group of voters supporting the party. The ideological bias from voters plays against them, since the party relies on that advantage to make an offer which tries to attract voters from other groups. It is also generally observed that the equilibrium price (size of the firm) does not generally coincide with the social optimum.

Regarding privatisation, again multiple equilibria may exist, which basically depend on ideology from parties, fiscal needs of government and, importantly, from the degree of

productive inefficiency of public firms. Three different sources of productive inefficiency are analysed separately: an excessive use of labour ($L^e$), which can be regarded as an input-mix type of inefficiency; existence of wage premia (s) for public workers; and general technical inefficiency (e) from inputs other than labour. Conditions have been derived for two particular cases to try to illustrate what is the real role that ideology plays and to explain the apparent contradictions faced by the hypothesis of ideology as an important determinant to privatisation.

The first case considers a predominantly right-wing society, where conservative party R's voters constitute a majority, and this party wins elections with a proposal for a relatively small firm. Acting as government, party R is likely to privatise the firm, since this policy offers utility gains to voters and, in addition, the party receives some political gains derived from its own ideology (e.g. more support from sponsors). However, under some conditions, it is easy to sustain an equilibrium where party R would not honour its ideology and would keep the firm as public. These conditions are namely a low degree of technical inefficiency, little overstaffing in the public firm, and relatively high wages for public firm's workers. Therefore, public firm's productive inefficiency is not a sufficient condition for it to be privatised, since if the problem of costs higher than optimal is mainly due to high wages, that would help to keep the firm as public instead of promoting privatisation.

This particular example illustrates how it is possible to observe situations with inefficient public firms constituting a political equilibrium, and no proposals to privatisation, even though the dominant party has a pro-private ownership ideology. This case could approximately match the situation in most developed economies before the 1980's. Nevertheless, some changes in the basic conditions can easily alter this equilibrium and lead to privatisation. A rise in the productive inefficiency of the public firm –but not caused by high wages from workers– is one basic reason that can make some voters to support a party that proposes a transfer of ownership. Another factor is a tighter public sector budget constraint, although the model shows how the link between government's fiscal needs and privatisation is relatively weak, since it affects the equilibrium only through the effect on some groups of public sector workers (namely, those who have higher income levels). This result allows to understand the low correlation between privatisation and fiscal needs in OECD countries obtained above (see page

5). Even though a tighter public budget constraint may have had an influence on privatisation, its effect strongly depends on electoral conditions.

The second case considered corresponds to an almost symmetrical situation, with a left-wing politically oriented society and party L's voters constituting a majority. Party L wins elections on a proposal for a relatively large firm, and it likely keeps it as public thereafter. However, again if the degree of public firm's productive inefficiency rises due to other reasons than wages, or the government's fiscal needs grow, a proposal for privatisation from its rival R could force party L in government to end up privatising the firm to avoid the risk of being displaced from office. The ideological utility earned by party L if it honours its political beliefs may be dangerous here: it might be the case that a non-privatisation policy could mean a defeat in future elections. This feature from the model may explain why in practice some left-based governments (e.g. British Labour Party or Spanish Socialist Party) have cut-off their historical links with trade unions *before* accepting or implementing privatisation policies.

In terms of explaining the general trend towards privatisation that is observed across the world, the proposed framework offers some interesting intuitions. Even though the model exhibits a multiplicity of equilibria, some general conclusions can be extracted from the cases analysed. The worldwide trend to sell public firms is more likely to have been caused by a general rise in their productive inefficiency, rather than by increasing public sector deficits. Even though governments' fiscal needs play a part in the determination of equilibria, it has been shown how these needs only affect indirectly through relatively small groups of individuals (public sector workers with higher income levels).

Another interesting conclusion is that not all factors generating productive inefficiency (higher than optimal costs) equally lead public firms to be privatised. If costs are high due to large wage premia earned by public sector workers, the effect is reversed and public firms are less likely to be privatised. But when costs are high due to technical inefficiency or overstaffing, then it is more likely that a privatisation policy earns sufficient support from voters. If the degree of productive inefficiency is sufficiently high, the policy might be even supported by

some groups of public sector workers, who earn more through tax reductions than they lose through elimination of wage premia earned at the public firm.

Summing up, the more likely explanation to justify why all countries have started almost simultaneously to sell public firms must be sought more in the own inefficiency problems of the firms rather than on external reasons. Severe problems of overstaffing – whose political origins are discussed in the next chapter – added to technical inefficiency generated by slower adoption of innovations and problems of incentives pointed out in the 'managerial' approach to privatisation, have caused over the years a situation of extremely inefficient public firms compared to private counterparts. If we superimpose to these problems a situation of growing public sector deficits, it is possible to interpret why political equilibria have rapidly changed and privatisation proposals have become an attractive electoral option, regardless of country-specific political circumstances. Once that some country was able to show the possibility of transferring large firms to the private sector without major disruptions (in practice, the UK is likely to have played this pioneering role), the rest of countries changed from one equilibrium to another almost immediately.

In all the process towards privatisation, political ideology has indeed played a part, but a relatively minor one compared to electoral strategies from political parties. Thus, it is more likely that a right-wing party decides to implement a privatisation programme, but it is equally easy to obtain conditions under which a left-wing party follows the same policy. At the light of the model proposed here, the hypothesis of privatisation being generated by a global ideological revision of principles about State intervention seems to be relatively weak. Even though the model presented in this chapter is extremely simple and relies on many ad hoc assumptions, it may be used as an example of how, even though political parties do not need to alter substantially their beliefs on the question of ownership of public firms, it is easy to change from a situation of no privatisation proposals to another in which all parties back the policy.

# CHAPTER 3: EFFECTS OF PUBLIC OWNERSHIP OVER FIRMS' SIZE AND OVERSTAFFING PROBLEMS

## 1. Introduction

One of the public firms' problems often reported (Vernon and Aharoni, 1981) is an excessive number of employees. As it was described when defining the concepts of inefficiency, this situation corresponds to an 'input-mix' type of inefficiency, where given market prices of inputs, a firm does not minimise costs by using the optimal amounts of inputs required to produce a given level of output. In the case of public firms, one cause of productive inefficiency is then that too many employees are hired compared to what would be the optimal number determined in each case by the efficient frontier. This effect has been described by casual observation of public firms, but it is also usually detected on empirical studies aimed to measure the relative inefficiency of public firms (e.g. Bhaskar and Khan, 1995; and chapter 4 of this dissertation, where a case of study is presented for the Spanish urban bus industry).

What is the reason for the existence of overstaffing in public firms? Advocates of public ownership argue that these firms are obliged to pursue social objectives. The existence of overstaffing is then only apparent, since public firms are usually required to produce large levels of output, or different types of goods/services than private firms –what is referred to as 'public service obligations'– requiring then more employees (Borcherding et al, 1982). Another argument is that job provision is in itself a social objective, and public firms are sometimes instructed to employ more people than necessary in order to reduce unemployment. Meanwhile, public firms' critics point out that this type of 'input-mix' inefficiency is not satisfactorily justified by these social arguments, and when public firms are overstaffed, this is merely due to political interferences.

Differences in size between a public and a private firm may be easily explained by assuming that they pursue different objective functions, though however, the existence of inefficient overstaffing would still remain unsatisfactorily justified. From a theoretical point of view, the relevant question is again to try to interpret differences between public and regulated private firms in terms of firm size and employment in the context of the 'irrelevance proposition'. If a government uses a public firm to pursue social objectives such as producing non-profitable outputs (as transport connections to isolated communities) or to reduce unemployment, it could in principle try to achieve the same objectives by offering subsidies to regulated private firms. On the other hand, if a politician wishes to provide jobs to obtain votes from workers, she could achieve the same outcome by instructing a regulated firm to provide those jobs. In both cases, either a benevolent or a self-interested government, could use a public or a private firm, but a general preference for the former is usually detected (López-de-Silanes et al, 1995).

The managerial approach to privatisation cannot offer clear answers to explain the phenomenon of overstaffing, apart from interpreting that lower levels of effort from managers may result in little cost-saving activities and more workers required to produce with sub-optimal technologies. However, empirical evidence about rapid processes of labour adjustment immediately after privatisation (Haskel and Szymanski, 1993), reveals that most of the extra workers of public firms are not strictly needed and may be easily laid off. The political approach to privatisation offers here a more attractive explanation: it is likely that politicians may be using excess of employment in public firms to pursue personal agendas (Shleifer and Vishny, 1994).

In this chapter, a model is presented to try to explain endogenously the difference in firm size and the problem of overstaffing, by using comparable structures for a public and a private firm. Managers' effects are completely left aside, since even if they exist, their role on this question is assumed to be of second order compared to political effects. In order to seek for fundamental effects of public ownership, no information asymmetries are assumed between government and a regulated private firm, in the case when it is opted to provide services through an external contractor instead of keeping production of those services 'in-house'. However, two possible cases are considered when the government provides services through

an external private firm. It is considered that it is possible to choose between a complete or an incomplete contract to regulate the relationship between government and private firm. The model is similar to Hart et al (1995), although here there are no private investments to be made. Incomplete contracting and a non-benevolent government are the only two features required to derive some interesting results.

An outline of the chapter is as follows: section 2 presents a description of the main features of the model. Section 3 obtains solutions for the three ownership structures considered –a public firm, a private firm with a complete contract and a firm with an incomplete contract– and then compared. Section 4 contains some numerical simulations to calibrate the effects of different variables over results. Section 5 summarises and concludes.

## 2. Description of the model

Consider an economy in which a government wishes to implement an infrastructure project[16]. Services derived from this infrastructure are priced below cost, due to a positive externality or to a traditional status quo (typical examples could be roads or utilities' networks). For simplicity, it is assumed that services are provided completely free by the government and financed only by taxes. There is a single firm involved in the project, working under monopolistic conditions. This firm receives a subsidy from the government to cover its operational costs.

Society is assumed to be divided in three groups of individuals. There are C individuals who make use of the relevant infrastructure, T taxpayers who do not use it but pay taxes to finance it, and L workers who may be hired to implement the project. There is a competitive wage level $w$ at which all these workers have some external option if not hired by the firm. A basic simplifying assumption is that this society of C+T+L individuals is completely separated in

[16] Although the more intuitive interpretation of the framework proposed is the one of an infrastructure project, it can also be applied to any type of good or service which is publicly provided –although not necessarily publicly produced– and subsidised. Services like mass transport or refuse collection may be easily considered using the same model, although throughout the text I only make reference to the 'infrastructure' interpretation.

these three groups, which are mutually exclusive. The justification for this assumption is that those individuals who could be in the groups' intersections constitute relative minorities to those belonging exclusively to one of the groups, who have clearly identifiable objectives. Since the number of workers plays a key role in this model, the size of each group is expressed in relative terms to L. Hence, society is formed of L workers; $T = \lambda_1 L$ taxpayers and $C=\lambda_2 L$ consumers, where $\lambda_1$ and $\lambda_2$ are parameters representing relative sizes. The total number of individuals is then equal to $(1+\lambda_1+\lambda_2) L$.

A second simplifying assumption is that labour is the more relevant input required to build the infrastructure, since the idea is to measure the size of the firm involved in the project in terms of number of employees. It may be considered that the firm operates with a fixed amount of capital, and technology determines the minimum number of workers required for a project of size $q$, according to a linear function $q = z\, l$, where $z$ is a parameter representing productivity, and $l$ is the number of workers hired by the firm. If we consider the alternative interpretation of the model not as an infrastructure project but as the provision of a service, the project's size $q$ should be considered as the level of output to be produced (for example, if we consider the provision of mass transport, $q$ could be interpreted as train or bus frequencies).

Valuation of the project by consumers depends on some stochastic state of nature $\theta$. There exists a finite discrete number of possible states, $\theta \in \Theta$, where $\Theta = \{\theta_1, \theta_2,...,\theta_n\}$. For each particular state $\theta_i$, there exists an ideal size $q_i$ for consumers so that implementing a larger project $q > q_i$ does not provide any additional utility to them, resulting only in overcapacity for the infrastructure in question (an example can be to build a 6-line highway, when only a 2-line is required by motorists). However, producing a smaller project than the ideal size reduces the utility that consumers derive from the infrastructure. Ideal project sizes for each state are summarised in a vector $q(\theta)$, and states of nature are ordered so that components of $q(\theta)$ are increasing ( $q_1 < q_2 < ... < q_n$ ).

A politician (minister or public agency) takes all decisions concerning the project. Infrastructure can be built by a publicly-owned firm or it can be contracted-out to an external private firm, but in both cases the government decides on the project size $q$ to be implemented.

The politician is assumed to be non-benevolent, i.e. its objective is to maximise the number of votes from the electorate at next elections. Even if the politician may not have information on the exact level of utility obtained by individuals from each of the groups in the society, it is assumed that this agent can predict some 'voting patterns' for each of group, using information from past elections.

These voting patterns are modelled as simple functions which depend on the groups' variables of interest. Each voting function is a parameter $V^i(\cdot) \in (0,1)$, where index i={C,T,L} indicates the group. Dependent variables are: number $l$ of employees hired by the firm, for the L workers; *cost* (i.e. total subsidy to be paid) for the T taxpayers, and project size $q$ for the C consumers. Total number of votes in group i is equal to the number of individuals forming the group multiplied by $V^i(\cdot)$. Particular simple functional forms are assumed for each voting function in order to be able to derive analytical solutions, although it is only required that functions are continuous, increasing (or decreasing, respectively) and concave. The functional forms assumed here are the following:

(a) $V^L(l) = \varphi_1 \ln(l)$

(b) $V^T(cost) = k_2 \ln(\chi - cost)$

(c) $V^C(q, \theta) = k_3(\theta) \ln(q)$ ; if $q \leq q_i$

In expressions above, $\chi$, $\varphi_1$, $k_2$ and $k_3(\theta)$ are parameters defined so that the range of the corresponding functions lies within the interval (0,1). Parameter $k_3$ depends on the state of nature $\theta$, since voting function $V^C$ is related to utility levels that consumers derive from a project of size $q$, which varies according to $\theta$. Since ideal project sizes $q_i$ are ordered to be increasing in $\theta$, parameter $k_3(\theta)$ also increases so that if $\theta_m > \theta_j$, then $k_3(\theta_m) > k_3(\theta_j)$. An additional feature of consumers' voting function $V^C$ is that, for each state $\theta_i$, it is only defined for values of $q$ lower than the ideal size $q_i$, since if a larger than ideal project is implemented, consumers do not derive any additional utility (it might also be interpreted that they have reached a saturation point, above which further increases in $q$ rise utility only marginally). For

values $q > q_i$ it can then be considered that the number of votes from consumers remains constant.

Given that all workers are assumed to have job opportunities outside the firm implementing the project, if we want to evaluate what is the socially optimal project size, we should consider what are the social benefits (utility that consumers receive from the new-built infrastructure) and social costs (disutility generated by the associated taxes). In this context, the easiest way to define a social welfare function is in terms of the voting functions defined above, which are assumed to be proxies for utilities received by each of the groups[17]. The socially optimal project size $q^*$ would then be the value that maximises the sum of votes in the groups of consumers and taxpayers. In fact, we must consider a state-contingent vector of optimal sizes $q^*(\theta) = (q_1^*, \ldots q_n^*)$, since the consumers' votes vary according to the state of nature. Using that $q = z\,l$, it is equivalent to speak of a vector of optimal number of workers to be hired to implement the project $l^*(\theta) = (l_1^*, \ldots l_n^*)$, with $l_i^* = q_i^* / z$.

Without loss of generality, it can be assumed that for each state $\theta_i$, the social optimal size $q_i^*$ is equal to the ideal size desired by consumers ($q_i$). This is formally done by the following assumption (for convenience, expressed in terms of number of workers):

*Assumption 1: For each state of nature $\theta_i$, the number of workers associated to the ideal project size desired by consumers ($l_i = q_i / z$) is smaller than the value that would maximise the sum of votes of taxpayers and consumers, whether the consumers not to reach a saturation point in their utility levels. Formally:*

$$l_i \leq \frac{\phi_3(\theta_i)\ \chi}{(\phi_2 + \phi_3(\theta_i))\ w} = l^{uCT}(\theta_i) \qquad \textbf{(3.1)}$$

*where $\varphi_2 = k_2 \lambda_1$ and $\varphi_3(\theta_i) = k_3(\theta_i) \lambda_2$ to alleviate notation.*

---

[17] Votes are assumed here to be valid representations of utilities, and simple aggregation is used since consumers and taxpayers are not differentiated by income or other variables. From a more purist point of view, in order to correctly compute the socially optimal size of the project we should need information on the monetary valuation of the project by each consumer and the shadow cost of taxes levied to finance it.

The idea behind assumption 1 is the following. The number of workers $l^{uCT}(\theta_i)$ is the value that would solve the problem of maximisation of $V^T T + V^C C$, whether $V^C$ not to be restricted to reach a saturation point. Expressed in terms of choosing the number of workers, this problem can be stated as:

$$\begin{aligned} \text{Max}_{\,l}\ & V^T(cost)\,T + V^C(q,\theta)\,C = k_2 \ln(\chi - cost)\,\lambda_1 L + k_3(\theta)\ln(q)\,\lambda_2 L \\ & = \varphi_2 \ln(\chi - w\,l)\,L + \varphi_3(\theta)\ln(z\,l)\,L \end{aligned} \qquad (3.2)$$

Since the voting function of taxpayers $V^T$ is decreasing in $l$, by assuming that for each state of nature $\theta_i$ the ideal number of workers $l_i$ is smaller than the unrestricted maximum $l^{uCT}(\theta_i)$, it is guaranteed that $l_i$ is the value that maximises $V^T T + V^C C$ once saturation is imposed on consumers (since the term $V^C C$ would then become constant). Therefore, the socially optimal project size $q_i^*$ is equal to the project size desired by consumers $q_i$ in all states of nature, or, in terms of number of employees, $l_i^* = l_i$.

However, the government does not always necessarily implement a project of socially optimal size. The basic distortion results here from the objective of vote maximisation assumed for the government. Even if from a social point of view, the number of workers should not be considered when choosing the project size $q$, the politician taking that decision would typically include workers in its objective function alongside consumers and taxpayers, since workers may provide additional votes. As it can be predicted, the government would generally tend to choose a too large project in social terms due to this reason.

The objective of this chapter is not however to compare the actual project size chosen by the government with an optimal social value, but to analyse whether the outcome would be the same when the project is implemented by a publicly-owned firm or by a contracted-out private firm. The idea is thus to compare these outcomes, but considering that *firms operate under the same objective.* This is the reason why it is considered that the government has all the information and takes all decisions, independently of what is the ownership structure.

Under these perfect conditions, it is clear that the 'irrelevance proposition' applies here as in other privatisation models. Regardlessly of what is the project size that the government

decides to implement, it would be exactly the same under public or private ownership, having both type of firms the same number of workers. However, two elements of interest are included in the model to study the potential effect that they may have in introducing differences between public and private firms. These are namely: (i) some voting patterns may change when a particular ownership structure is chosen for the firm implementing the project; and (ii) the government has to take decisions on size $q$ under uncertainty about the final valuation of the project by consumers. The main point of this chapter is that the government in fact *may choose* different outcomes, even if it has the same sets of choice under both ownership structures. If that is the case, we might conclude that ownership has an effect on firms' outcomes, which in this model is restricted to study firms' sizes. The two main elements of this model are briefly discussed in the following two subsections.

### 2.1 Changes in voting patterns

The voting functions of consumers and taxpayers are considered to be independent of the ownership structure. For the case of taxpayers, some preference on destination of the subsidy paid to the firm implementing the project could be considered, if individuals were to exhibit some concern about private firms receiving substantial amounts of money from a government, following the idea of the 'decency constraint' of Shleifer and Vishny (1994). A difference in the level of subsidies payable to public or private firms would be a sufficient condition for the irrelevance proposition not to hold (Schmidt, 1995). However, taxpayers are here only concerned about the total amount of subsidy paid, without taking into account who is its final recipient.

Nevertheless, even though consumers and taxpayers are unaffected by ownership of the firm implementing the project, it is not too unrealistic to consider that the voting function of workers *may* change when ownership does. The voting decision of a worker is probably different when she is directly employed by the government or when she works for a private firm contracted by the government. Reasons for this behaviour must be based in differences between jobs provided by public and private firms.

According to the empirical evidence, it could be argued as in chapter 2 that the wage level $w$ earned by workers in the public firm is above the average wage paid in a comparable job in private sector. If that were the case, workers would have an interest in supporting the government if the project is implemented by a public firm, on the perspective of getting a job in that firm. Their support for the government would be lower if the project is implemented by a private firm, since in that case, the offered jobs would not be more attractive than other alternatives. However, the model in this chapter assumes the same wage level for a public and a private firm implementing the project, in order to avoid a more complex analysis involving wage differentials. But if, as it is generally observed, public jobs offer more security than comparable jobs in the private sector, the value of a public job would be higher even for the same wage, and the former justification would apply .

In any case, it is assumed that there *may exist* some difference in the voting pattern of workers when the project is implemented by a public or a private firm, with more support for the politician in the first case. This is formalised in the following assumption:

*Assumption 2: Under public ownership, the government obtains $V^L(l)$ L votes from the group of workers, while under private ownership the number of votes in that group is $\alpha$ $V^L(l)$ L, with $\alpha \in [0,1]$.*

Observe that this assumption does not imply an automatic vote-buying by the government: a public firm worker is not necessarily going to vote for the government (a rise in $l$ does not provide votes on a one-to-one basis), and workers not actually hired by the firm might offer stronger support to the government when they observe a larger firm size, since they may perceive that the probability of obtaining a job in the public project is bigger. Hence, when $l$ rises the number of votes from the group of L workers also does, but not from and only from those individuals hired by the public firm. Some other exogenous factors, as the degree of workers' unionisation, may have an influence on the shape of function $V^L$ and the value of $\alpha$.

## 2.2 Decision on firm size under uncertainty: initial size and adjustment costs

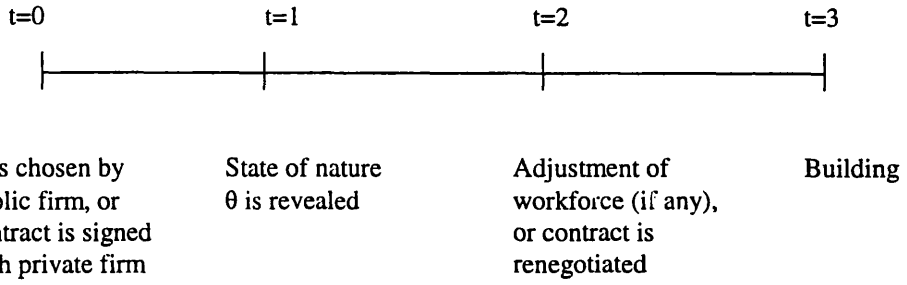
A first basic decision that the government has to make, before knowing which is going to be the ideal project size $q_i$ desired by consumers, is to determine some initial size for the firm implementing the project, which is going to be expressed in terms of number of workers ($l_0$). At this point, firm ownership would be irrelevant: if the government owns the firm, it can directly choose $l_0$, while if it is considering to implement the project through a private firm, it should seek potential candidates that are able to implement a project of size $q_0 = z\, l_0$.

The important point is that, under both ownership schemes, this decision on some initial size cannot be postponed until uncertainty is solved. If a public firm is going to implement the project, workers must be hired and trained well in advance the actual building starts, otherwise it would not be possible to implement the project without a long and costly delay. If a private firm is contracted, the private owner also has to incur in some costs related to the required size $q_0$, so she needs some assurance that the output will be eventually paid by the government.

After the state of nature $\theta$ is realised, it is possible to adjust the size of the project –or equivalently, the associated number of employees– but some costs $\gamma\ (\Delta l)$ derived from the adjustment must be paid. It is considered that these adjustment costs are not symmetric since, in general, it is more expensive to fire than to hire workers. Reducing the size of a firm involves severance payments and early retirements, which are typically more expensive than costs of hiring and training additional new workers.

Adjustment costs $\gamma\ (\Delta l)$ are then assumed to be linear and proportional to the corresponding change in the number of workers. From an initial payroll size $l_0$, if the number of employees is reduced to $l_1 < l_0$, adjustment costs are equal to $\gamma_1\ (l_0 - l_1)$, while if it is enlarged to $l_2 > l_0$ the cost is $\gamma_2\ \ (l_2 - l_0)$, with $\gamma_2 < \gamma_1$. For adjustments to have some meaning in the model, it is necessary to assume that $\gamma_1 < w$ (and consequently $\gamma_2 < w$), where $w$ is the wage per worker, otherwise it would never be in the interest of the government to make any adjustment at all.

The timing of decisions is summarised in the following time-line:




The timing is common to both ownership schemes, but decisions are not exactly the same. Under public ownership, at t=0 the government directly chooses a number of workers to hire, and at t=2 after the uncertainty has been realised, it decides on what adjustment of workforce to make, if any at all. Meanwhile, if the option is to contract the project to an external private firm, at t=0 the decision involves the signature of some contract between firm and government, which can be renegotiated if necessary at t=2.

This contract can be of two types: complete or incomplete. A complete contract would specify at time t=0 all possible project sizes that the private firm is required to implement, contingent on the realised state of nature. A contract of this type must contain all relevant descriptions about θ so that both parties can identify in the future without any doubt which is the actual state of nature. The contract should also include a list of infrastructure's sizes $(q_1,..., q_n)$ to be built in each state and the corresponding payments to receive. The possibility of signing such a contract is not ruled out in this model. Nevertheless, it is assumed that there is a contracting cost K of writing, monitoring and enforcing this contract. The value of K will depend on the particular complexity of the project in question and on the number of possible states of nature.

An alternative to a complete contract of this type is to sign at t=0 an incomplete contract in which only some initial size $q_0$ and a payment are specified. Any possible future renegotiation is modelled as a Nash bargaining between parties, with equal bargaining powers. The choice between a complete or an incomplete type of contract is left to the government. As with the rest of decisions in the model, the government will pick the alternative that yields a higher

number of votes. The objective function for the government under each ownership structure is then the following:

(1) Public ownership:

$$\mathbf{Max}_{l} \quad \mathbf{V}^{L}(l)\,\mathbf{L} + \mathbf{V}^{T}\,[\,w\,l + \gamma\ (\Delta l)\,]\,\mathbf{T} + \mathbf{V}^{C}\,(z\,l, \theta)\,\mathbf{C} \qquad \textbf{(3.3)}$$

(2) Private firm working under a complete contract

$$\mathbf{Max}_{l} \quad \alpha\,\mathbf{V}^{L}(l)\,\mathbf{L} + \mathbf{V}^{T}\,[w\,l + \gamma_{cc}(\Delta l) + \mathbf{K}]\,\mathbf{T} + \mathbf{V}^{C}(z\,l,\theta)\,\mathbf{C} \qquad \textbf{(3.4)}$$

(3) Private firm working under an incomplete contract

$$\mathbf{Max}_{l} \quad \alpha\,\mathbf{V}^{L}\,(l)\,\mathbf{L} + \mathbf{V}^{T}\,[w\,l + \gamma_{ic}(\Delta l)]\,\mathbf{T} + \mathbf{V}^{C}\,(z\,l, \theta)\,\mathbf{C} \qquad \textbf{(3.5)}$$

The variable *cost* that enters the taxpayers' voting function is the amount of subsidy required for the firm to cover its costs in each case. Part of this subsidy is the total operational cost of the firm ($w\ l$), which corresponds to a situation where consumers are not charged for the services and the project is completely financed through taxes. Apart from the operational costs, the corresponding adjustment costs $\gamma\ (\Delta l)$, $\gamma_{cc}\ (\Delta l)$ or $\gamma_{ic}\ (\Delta l)$ must be added to the subsidy if any adjustment on size is made after the uncertainty on $\theta$ is resolved, and also the contracting cost K, if it is decided to sign a complete contract.

## 3. Solution of the model under alternative ownership structures

In this section, the model is solved for the initial project size and the subsequent optimal adjustments to make, under the three alternative ownership schemes: a public firm, a private firm contracted through a complete contract, and a private firm with an incomplete contract.

Before going into the analysis, it is useful to find as a preliminary step what would be the situation if no uncertainty on the state of nature $\theta$ existed. In that case, it is not required to consider any adjustment to the initial size chosen, since the government knows in advance what is the actual valuation of the project by consumers. If the government did choose to

implement a project with smaller size than the socially optimal, it would determine that size by solving this maximisation problem for each $\theta_i$ :

$$\text{Max}_{l}\ \varphi_1 \ln l + \varphi_2 \ln(\chi - w l) + \varphi_3(\theta_i) \ln(z l) \quad ; \qquad l \le l_i \qquad (3.6)$$

which has a solution the following value:

$$l^{CTL}(\theta_i) = \frac{(\phi_1 + \phi_3(\theta_i))\ \chi}{(\phi_1 + \phi_2 + \phi_3(\theta_i))\ w} \qquad (3.7)$$

It can be easily shown that this firm's (project's) size $l^{CTL}(\theta_i)$ is larger than the reference value $l^{uCT}(\theta_i)$ given by expression (3.1) above, for each possible state of nature $\theta_i$. Since by assumption 1 the socially optimal project size is always smaller or equal than this value $l^{uCT}(\theta_i)$, then we have that $l_i \le l^{uCT}(\theta_i) < l^{CTL}(\theta_i)$, $\forall\ \theta_i$. Therefore, under no uncertainty, the government would never choose a firm's size smaller than the size $l_i$ desired by consumers, and the relevant problem to be solved can then be restricted to analyse what is the firm size that maximises the sum of votes in the groups of taxpayers and workers (since for any $l \ge l_i$, the number of votes from consumers is constant). The government's problem can then be rewritten to:

$$\text{Max}_{l}\ \varphi_1 \ln l + \varphi_2 \ln(\chi - w l) \quad ; \qquad l > l_i \qquad (3.8)$$

with solution:

$$l^{TL} = \frac{\phi_1\ \chi}{(\phi_1 + \phi_2)\ w} \qquad (3.9)$$

It can be noticed that this value $l^{TL}$ is independent of the state of nature $\theta$, since the voting functions of taxpayers and workers are not state-contingent. The conclusion of the analysis under no uncertainty would then be the following: for each state $\theta_i$ the government would compare the project size that renders the maximum number of votes in the sum of groups of taxpayers and workers ($l^{TL}$) with the socially optimal size for that state ($l_i$), the latter being

the value that maximises votes in the sum of consumers and taxpayers by assumption 1. For those states of nature with $l^{TL} > l_i$, the government would prefer to implement a project of size $l^{TL}$ since that size provides the same number of votes than $l_i$ in the group of consumers C, while it provides more votes in the sum of groups of taxpayers and workers, T+L. Meanwhile, for those states of nature with $l^{TL} \leq l_i$ the chosen size would be $l_i$ since in those cases this firm size provides more votes in C+T than $l^{TL}$, and also more votes on the group of workers L. Adding all possible states of nature, it can be concluded that the government would always choose a project larger or equal than the socially optimal size $l_i^* = l_i$.

However, this result does not necessarily carry to the case under uncertainty on the optimal valuation by consumers. As the following subsections show, in presence of adjustment costs from an initial chosen size $l_0$, it is possible to find situations where the government may choose project sizes smaller than optimal. The only relevant finding from this preliminary analysis under no uncertainty is that we positively know that the government is never going to choose an initial project size $l_0$ smaller than the reference value $l^{TL}$, since in no state of nature $\theta_i$ it would be a good strategy to pick a project size smaller than the value that maximises votes in the sum of groups of taxpayers and workers.

### 3.1 Public firm implementing the project under uncertainty on optimal size

In conditions of uncertainty, the problem that the government must solve to determine the size of the project has two stages. First, an initial $l_0$ must be chosen without knowing what the final realisation of $\theta$ will be. Second, once $\theta$ is known, the project size $q$ to be finally implemented is decided and the consequent adjustments of payroll size are made.

Using backwards induction, the first step is to analyse which are the optimal adjustments to make for each possible state $\theta_i$, assuming that $l_0$ is given. As it has been shown above, independently of what value of $\theta$ is finally realised, the initial $l_0$ will always be bigger or equal than the value $l^{TL}$, the firm size that maximises the sum of the voting functions of workers and taxpayers. Hiring less workers than $l^{TL}$ would reduce the number of votes in the sum of the

groups of workers and taxpayers, and it would obtain the same or less votes in the group of consumers, therefore all options $l_0 < l^{TL}$ are dominated.

From any value $l_0 \geq l^{TL}$ the government has two options to make adjustments: 1) reduce the project size down to $l_1 < l_0$; or 2) enlarge the project up to a size $l_2 > l_0$. Observe that these options are mutually exclusive: once the state of nature $\theta$ is realized, the problem is reduced to do optimally one adjustment or the other, but at this stage of the analysis all possibilities must be checked out. Rules to make adjustments are the following:

*(a) Project upsizing*: If the optimal project size happens to be $l_i > l_0$, the best option is to increase the initial number of workers to some new value $l_2$ for the public firm to build a larger infrastructure. Since be definition $l_0 \geq l^{TL}$, we must be in a case with $l_i > l^{TL}$, otherwise it would not be necessary to upsize the project. We have seen above that, for these cases, the optimal choice under no uncertainty was to have a project of optimal size $l_i$, but not larger. Therefore, in the presence of adjustment costs the actual value that provides the maximum number of votes must be $l_2 \leq l_i$. The government's problem is then:

$$\textbf{Max}_{l_2}\ \varphi_1 \ln(l_2) + \varphi_2 \ln[\chi - w l_2 - \gamma_2 (l_2 - l_0)] + \varphi_3(\theta_i) \ln(z l_2);\quad l_2 \leq l_i \qquad (3.10)$$

The unrestricted solution to this problem (i.e., without imposing the constraint $l_2 \leq l_i$) is a state-contingent project size, which is also dependent on the initial project size $l_0$, and it is denoted by $\bar{l}(l_0, \theta_i)$:

$$\bar{l}(l_0, \theta_i) = \frac{(\phi_1 + \phi_3(\theta_i))(\chi + \gamma_2 l_0)}{(\phi_1 + \phi_2 + \phi_3(\theta_i))(w + \gamma_2)} \qquad (3.11)$$

Using this reference value $\bar{l}(l_0, \theta_i)$, the best upsizing strategy for the government is then the following. For those cases in which the optimal project size is smaller or equal than $\bar{l}(l_0, \theta_i)$, the best strategy is to set $l_2 = l_i$, since enlarging the project to $l_2 = \bar{l}(l_0, \theta_i)$ yields less votes (even though $\bar{l}(l_0, \theta_i)$ maximises (3.10), the restricted maximum is $l_i$ for those cases). Meanwhile, for states with $l_i > \bar{l}(l_0, \theta_i)$, the best strategy to maximise votes is $l_2 = \bar{l}(l_0, \theta_i)$. It is important to notice that the reference value $\bar{l}$ is increasing in $l_0$ but decreasing in $\theta$. This

implies that, for a fixed $l_0$, if for a particular state $\theta_j$ the option is to adjust not to the optimal size $l_j$ but to a lower level $T(l_0, \theta_j)$, the same option will be taken for the rest of states $\{\theta_{j+1},...,\theta_n\}$, adjusting to their corresponding values $\{T(l_0, \theta_{j+1}), ..., T(l_0, \theta_n)\}$.

*(b) Project downsizing*: When the optimal project size is smaller than the initial chosen size, $l_i < l_0$, the option then is to reduce the initial number of workers, even if that implies to incur in some adjusting costs. Using the results obtained in the case without uncertainty, it is clear that when making downsizing adjustments, the government will never reduce the project size to be under the ideal size desired by consumers, therefore when maximising votes, only the groups of taxpayers and workers need to be considered. The government's problem is then:

$$\mathbf{Max}_{l_1}\ \varphi_1 \ln(l_1) + \varphi_2 \ln[\chi - w l_1 - \gamma_1 (l_0 - l_1)] \qquad (3.12)$$

with solution:

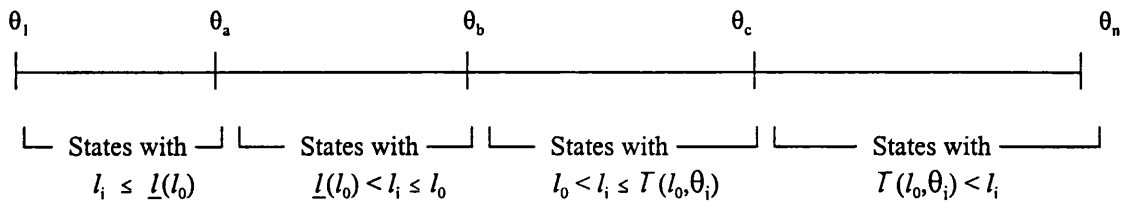
$$l(l_0) = \frac{\phi_1 (\chi - \gamma_1 l_0)}{(\phi_1 + \phi_2)(w - \gamma_1)} \qquad (3.13)$$

Observe that this reference value $\underline{l}(l_0)$ is independent of the state of nature. It does depend on the initial size $l_0$, but for a given $l_0$, it is common to all states. The optimal downsizing choice $l_1$ is then: $l_1 = l_i$, if $l_i \geq \underline{l}(l_0)$; or $l_1 = \underline{l}(l_0)$, if $l_i < \underline{l}(l_0)$.

A peculiar feature of the reference value $\underline{l}$ is that it is decreasing in $l_0$, which implies that the higher is the initial size chosen for the project, the smaller is the reference value to which to adjust in states of low optimal project sizes for consumers. Even if *a priori* this may sound counterintuitive, it can be explained by the concavity of the taxpayers' function: when the initial project size $l_0$ is large, the elasticity of taxpayers' votes to adjustments is bigger than for small values of $l_0$. Therefore, when the initial project size $l_0$ is large, it pays more in terms of number of votes to make a bigger adjustment than when $l_0$ is small.

So, once optimal adjustments to make from any initial project size $l_0$ have been identified, it is easy to determine what is the expected number of votes that each size $l_0$ yields to the

government. For each choice of $l_0$, a partition is introduced in the state space $\Phi$, with a potential maximum of four subgroups of states:




Optimal adjustments for each of the subgroups are:

(a) $\theta_i \in \{\theta_1,...,\theta_a\}$; reduce project size from $l_0$ to $\underline{l}(l_0)$

(b) $\theta_i \in \{\theta_{a+1},...,\theta_b\}$; reduce project size from $l_0$ to $l_i$

(c) $\theta_i \in \{\theta_{b+1},...,\theta_c\}$; enlarge project size from $l_0$ to $l_i$

(d) $\theta_i \in \{\theta_{c+1},...,\theta_n\}$; enlarge project size from $l_0$ to $T(l_0, \theta_i)$

Considering that all the information the government has about the likelihood of each state of nature is a probability vector $p = (p_1, p_2,..., p_n)$, the expected variable number of votes that each initial project size $l_0 \ge l^{TL}$ yields is given by the following function (for some states, the number of votes from consumers is not considered in $V(l_0)$, since it is constant):

$$
\begin{aligned}
V(l_0) = & \left(\sum_{i=1}^{a} p_i\right)\left[\phi_1 \ln \underline{l}(l_0) + \phi_2 \ln\left(\chi - w\,\underline{l}(l_0) - \gamma_1(l_0 - \underline{l}(l_0))\right)\right] \\
& + \sum_{i=a+1}^{b} p_i \left[\phi_1 \ln l_i + \phi_2 \ln\left(\chi - w\,l_i - \gamma_1(l_0 - l_i)\right)\right] \\
& + \sum_{i=b+1}^{c} p_i \left[\phi_1 \ln l_i + \phi_2 \ln\left(\chi - w\,l_i - \gamma_2(l_i - l_0)\right)\right] \\
& + \sum_{i=c+1}^{n} p_i \left[\phi_1 \ln \bar{l}(l_0,\theta_i) + \phi_2 \ln\left(\chi - w\,\bar{l}(l_0,\theta_i) - \gamma_2(\bar{l}(l_0,\theta_i) - l_0)\right) + \phi_3 \ln\left(z\,\bar{l}(l_0,\theta_i)\right)\right]
\end{aligned}
$$

**(3.14)**

Expression (3.14) for the number of votes $V(l_0)$ is written for the more general case in which the reference values $\underline{l}$ and $\overline{l}$ are such that $\Phi$ is partitioned in the four subgroups detailed above. However, the existence of such a partition depends on the reference values for each particular $l_0$. Depending on these values, it is possible that in some cases not all subgroups exist. For example, consider a case for which $l_0 < \underline{l}(l_0)$, i.e. the reference value to downsize the project turns to be a larger value than the actual initial size. In that case, clearly the outcome for all states with $l_i \leq l_0$ is to keep the initial chosen level $l_0$. In terms of the partition, that implies that $\theta_a = \theta_b$, so the second term in expression (3.14) disappears, and the value $\underline{l}$ is replaced by $l_0$ in the first term.

*Proposition 3.1: There exists a single solution $l_0^{pub}$ for the maximisation problem of the government under public ownership of the firm implementing the project.*

*Proof:* See appendix

Therefore, when implementing the planned project with a publicly-owned firm, the optimal strategy for the government to pursue in order to optimise the number of expected votes is to choose initially a project of size $q_0^{pub}$ (which is equivalent to hire an initial number of workers $l_0^{pub} = q_0^{pub}/z$) and, once the state of nature is revealed, to make the required adjustment according to the partition of states that $l_0^{pub}$ has introduced and the corresponding rules described above.

### 3.2 Private firm implementing the project under a complete contract

When the building of the required infrastructure is contracted to an external firm and a complete contract is signed, the problem that the government must solve is very similar to that of a public firm solved in the previous subsection. In order to have a complete contract, all possible contingencies must have been considered and included in the contract at the moment of its signature. The problem again is to choose an initial project size $l_0$ and to compute all possible adjustments to make from that value in each state of nature, and the corresponding payments that the firm will receive.

There are only two basic differences between this case and the problem solved in the previous subsection. One is that the number of votes from workers is reduced by coefficient $\alpha \geq 0$, since by assumption the behaviour of workers in terms of their voting patterns may be affected by ownership. The second difference is that the contracting cost K has to be added to the subsidy that the government must pay to the private firm implementing the project.

As in the public ownership case, two reference levels are obtained from solving the problems of enlarging or reducing the firm size from $l_0$. If the state of nature is one of a large optimal project relative to $q_0 = z\, l_0$, the best policy is to upsize the project. However when adjustment cost $\gamma_2$ is considered, it is obtained that for some states of nature the project is enlarged up to the optimal level $l_i$, while for others the project size is increased to a size below $l_i$.

Meanwhile, if the realised state of nature is one of a relatively small optimal project, the option then is to downsize the initial planned infrastructure. A reduction down to the optimal size $l_i$ provides more votes in the sum of groups of workers and taxpayers, and it does not modify the number of votes in the group of consumers. But again, once the adjustment cost $\gamma_1$ is considered, for some states it yields more votes to reduce the size not to the optimal level $l_i$ but to a larger value, therefore a suboptimal big project can be finally chosen.

Reference values for upsizing and downsizing are $\bar{l}_{cc}$ and $\underline{l}_{cc}$, respectively:

$$\bar{l}_{cc}(l_0,\theta_i) = \frac{(\alpha\phi_1 + \phi_3(\theta_i))(\chi - K + \gamma_2 l_0)}{(\alpha\phi_1 + \phi_2 + \phi_3(\theta_i))(w + \gamma_2)} \qquad (3.15)$$

$$\underline{l}_{cc}(l_0) = \frac{\alpha\,\phi_1\,(\chi - K - \gamma_1 l_0)}{(\alpha\phi_1 + \phi_2)(w - \gamma_1)} \qquad (3.16)$$

The partition of states in four groups and the corresponding optimal adjustment policies follow exactly the same logic as in the previous subsection, although the reference values $\bar{l}$ and $\underline{l}$ must be substituted by $\bar{l}_{cc}$ and $\underline{l}_{cc}$. Since the reference values for adjustments are different, the partition changes with respect to the public ownership case, and therefore the solution may be

different. A description of the four subgroups and the optimal policies for each case is the following:

(a) $\theta_i \in \{\theta_1,...,\theta_{a'}\}$, states with $l_i \leq \underline{l}_{cc}(l_0)$, reduce project size from $l_0$ to $\underline{l}_{cc}(l_0)$.

(b) $\theta_i \in \{\theta_{a'+1},...,\theta_{b'}\}$, states with $\underline{l}_{cc}(l_0) < l_i \leq l_0$, reduce project size from $l_0$ to $l_i$.

(c) $\theta_i \in \{\theta_{b'+1},...,\theta_{c'}\}$, states with $l_0 < l_i \leq \bar{l}_{cc}(l_0,\theta_i)$, enlarge project size from $l_0$ to $l_i$.

(d) $\theta_i \in \{\theta_{c'+1},...,\theta_{n'}\}$, states with $\bar{l}_{cc}(l_0,\theta_i) < l_i$, enlarge project size from $l_0$ to $\bar{l}_{cc}(l_0,\theta_i)$

Using this batch of optimal adjustment policies, the expected number of votes for each value $l_0$ can be immediately computed, using an expression similar to the case of the project being implemented by a public firm:

$$
\begin{aligned}
V_{cc}(l_0) = & \left(\sum_{i=1}^{a'} p_i\right)\left[\alpha\phi_1 \ln \underline{l}_{cc}(l_0) + \phi_2 \ln\left(\chi - K - w\,\underline{l}_{cc}(l_0) - \gamma_1(l_0 - \underline{l}_{cc}(l_0))\right)\right] \\
& + \sum_{i=a'+1}^{b'} p_i\left[\alpha\phi_1 \ln l_i + \phi_2 \ln\left(\chi - K - w\,l_i - \gamma_1(l_0 - l_i)\right)\right] \\
& + \sum_{i=b'+1}^{c'} p_i\left[\alpha\phi_1 \ln l_i + \phi_2 \ln\left(\chi - K - w\,l_i - \gamma_2(l_i - l_0)\right)\right] \\
& + \sum_{i=c'+1}^{n} p_i\left[\alpha\phi_1 \ln \bar{l}_{cc}(l_0,\theta_i) + \phi_2 \ln\left(\chi - K - w\,\bar{l}_{cc}(l_0,\theta_i) - \gamma_2(\bar{l}_{cc}(l_0,\theta_i) - l_0)\right)\right. \\
& \qquad \left. + \phi_3 \ln\left(z\,\bar{l}_{cc}(l_0,\theta_i)\right)\right]
\end{aligned}
\tag{3.17}
$$

By the same arguments used in proposition 3.1, it is easy to show that the problem of maximizing the number of votes given by the function $V_{cc}$ has a single solution $l_0^{cc}$, since the objective function is continuous and concave.

Consider now the type of complete contract that it is signed with the private company. From the solution to the problem of determining the initial project $l_0^{cc}$, the optimal adjustments have already been deduced, so it is possible to compute exactly the amount of adjustment costs for

each possible state of nature. Observe that, given that the government is concerned only with the final size of the implemented project, it is not strictly necessary to include in the contract any clause about an initial project size. The optimal solution $l_0^{cc}$ that the government has calculated can be omitted from the contract. The private firm will then be offered to sign the following contract:

(a) For each state $\theta_i \in \{\theta_1,...,\theta_{a'}\}$, build infrastructure of size z $\underline{l}_{cc}(l_0^{cc})$ and receive a payment $P = w\ \underline{l}_{cc}(l_0^{cc}) + \gamma_1\ (l_0^{cc} - \underline{l}_{cc}(l_0^{cc}))$

(b) For each state $\theta_i \in \{\theta_{a'+1},...,\theta_{b'}\}$, build infrastructure of size z $l_i$ and receive a payment $P = w\ l_i + \gamma_1\ (l_0^{cc} - l_i)$

(c) For each state $\theta_i \in \{\theta_{b'+1},...,\theta_{c'}\}$, build infrastructure of size z $l_i$ and receive a payment $P = w\ l_i + \gamma_2\ (l_i - l_0^{cc})$

(d) For each state $\theta_i \in \{\theta_{c'+1},...,\theta_n\}$, build infrastructure of size z $\overline{l}_{cc}(l_0^{cc},\theta_i)$ and receive a payment $P = w\ \overline{l}(l_0^{cc},\theta_i) + \gamma_2\ [\ \overline{l}(l_0^{cc},\theta_i) - l_0^{cc}\ ]$

It must be remarked that the contract is expressed in terms of the solution $l_0^{cc}$, but in practice it is not required that the private firm should receive information on that particular value, but only a list of project sizes and payments. Considering the contract offered, the private owner of the firm would solve her own maximisation problem, i.e. to choose an initial firm size and the subsequent adjustments to made to be able to produce the required infrastructure in each state. It is clear that the private owner is going to accept the contract, since the government has already solved the same problem.

### 3.3 Private firm implementing the project under a incomplete contract

It is clear that the amount of contracting costs K can be so large that signing such a contract may be unfeasible. The government and the firm, therefore, would be forced in that case to sign an incomplete contract, establishing only some initial project size, and to renegotiate it if necessary after the state of nature is revealed. Even if contracting cost K is not too large, the alternative of an incomplete contract is always feasible, and the government will evaluate it.

The advantage of an incomplete contract is that the contracting cost K is eliminated, so a lower cost is in principle required to produce the good. However, the drawback of this type of contract is that any future adjustment that the government wants to implement in the project must be negotiated with the private firm's owner. As it was mentioned in the description of the model, once that both parties get engaged in the relationship they cannot leave easily without significant costs, therefore any renegotiation of the contract is modelled as a Nash bargaining with equal bargaining powers.

When the government observes the realised state of nature and wants to implement a change on the initial contracted project size, the firm knows that the updated infrastructure size provides more votes than the initial. Then, at the bargaining stage, the private owner will try to extract some rents, knowing that if bargaining fails, the outcome is the status quo, which yields a lower number of votes to the government.

The private firm does not have information on voting functions, but it can make some inference about the potential benefits of an adjustment from the information revealed by the government. This information is the additional cost that it is willing to spend in order to introduce changes. Therefore, observing the amounts of extra costs, the firm bargains by demanding a fraction of these costs as an extra subsidy, otherwise it sticks to the initial contract and builds the infrastructure according to it.

As the assumed bargaining splits gains in a 50:50 proportion, the rent that the firm extracts can be easily computed as half of the planned change. If, from an initial workforce size $l_0$, the government wants to enlarge the firm to a level $l_2 > l_0$, the additional cost of production is $(w+\gamma_2)(l_2 - l_0)$. Therefore the rent that the firm extracts is a half of this amount. Meanwhile, if the objective of the government is to reduce the initial size down to $l_1 < l_0$, its objective is to save an amount of cost $(w-\gamma_1)(l_0 - l_1)$, from which a half is demanded by the private firm.
The government knows in advance that, if an incomplete contract is signed, it will possibly have to face a renegotiation in the future. Therefore, taking into account the extra rents that the firm extracts through the bargaining of adjustments, the problem can be solved exactly as before. However, due to the extra costs generated by contract incompleteness, reference values and the subsequent partition of states differ from the cases of public ownership and private

ownership under a complete contract. Reference values for upsizing and downsizing in this case are denoted by $\bar{l}_{ic}$ and $\underline{l}_{ic}$:

$$\bar{l}_{ic}(l_0,\theta) = \frac{(\alpha\phi_1 + \phi_3(\theta))(2\chi + (w + 3\gamma_2)l_0)}{3(\alpha\phi_1 + \phi_2 + \phi_3(\theta))(w + \gamma_2)} \qquad (3.18)$$

$$\underline{l}_{ic}(l_0) = \frac{\alpha\phi_1(2\chi - (w + \gamma_1)l_0)}{(\alpha\phi_1 + \phi_2)(w - \gamma_1)} \qquad (3.19)$$

The partition of states is represented exactly by the same set of expressions as for the previous cases, substituting the reference values by $\bar{l}_{ic}$ and $\underline{l}_{ic}$. These new values would induce a set of different limiting states: $\{\theta_{a''}, \theta_{b''}, \theta_{c''}\}$. The number of votes in this case is equal to:

$$\begin{aligned} V_{ic}(l_0) = {} & \left(\sum_{i=1}^{a''} p_i\right)\left[\alpha\phi_1 \ln \underline{l}_{ic}(l_0) + \phi_2 \ln\left(\chi - \frac{1}{2}(w-\gamma_1)\underline{l}_{ic}(l_0) - \frac{1}{2}(w+\gamma_1)l_0\right)\right] \\ & + \sum_{i=a''+1}^{b''} p_i\left[\alpha\phi_1 \ln l_i + \phi_2 \ln\left(\chi - \frac{1}{2}(w-\gamma_1)l_i - \frac{1}{2}(w+\gamma_1)l_0\right)\right] \\ & + \sum_{i=b''+1}^{c''} p_i\left[\alpha\phi_1 \ln l_i + \phi_2 \ln\left(\chi - \frac{3}{2}(w+\gamma_2)l_i + \frac{1}{2}(w+3\gamma_2)l_0\right)\right] \\ & + \sum_{i=c''+1}^{n} p_i\left[\alpha\phi_1 \ln \bar{l}_{ic}(l_0,\theta_i) + \phi_2 \ln\left(\chi - \frac{3}{2}(w+\gamma_2)\bar{l}_{ic}(l_0,\theta_i) + \frac{1}{2}(w+3\gamma_2)l_0\right)\right. \\ & \left. + \phi_3 \ln\left(z\bar{l}_{ic}(l_0,\theta_i)\right)\right] \end{aligned} \qquad (3.20)$$

As in the cases of $V(l_0)$ and $V_{cc}(l_0)$, this function $V_{ic}(l_0)$ is continuous and concave, so the existence of a unique solution $l_0^{ic}$ is guaranteed.

### 3.4 Comparison of outcomes under the three ownership schemes

Once solutions for the three schemes have been derived, the next step is to compare outcomes to predict which are the likely effects of ownership over the size of the project finally

implemented. As before, this can be also interpreted as the effect of ownership over the size of the firm building the project (number of workers). As it has been shown, solutions obtained for the three cases are similar: for states of nature associated with small ideal project sizes, it is possible that larger than optimal projects are implemented. On the other hand, for states associated to large ideal projects, the reverse may happen, with smaller than optimal firms being chosen. Suboptimal outcomes of both types may arise under all three ownership structures.

The relevant question then is how frequently these suboptimal projects are likely to be implemented under each ownership structure. Unfortunately, it is not possible to derive analytic expressions for the optimal solutions $l_0^{pub}$, $l_0^{cc}$ and $l_0^{ic}$, which would allow to make a direct comparison. However, it is easy to compare reference values to which adjustments are made in each case. This comparison offers some intuition about how outcomes are likely to be in relative terms, if the initial firm sizes are not very different. Introducing the assumption that values $l_0^{pub}$, $l_0^{cc}$ and $l_0^{ic}$ are equal, the following result can be derived:

*Proposition 3.2: For the same initial size of firm* $l_0^{pub} = l_0^{cc} = l_0^{ic}$, *reference values for adjustments satisfy the following relationships:*

*(a) Public ownership and private ownership with a complete contract:*

$\underline{l} > \underline{l}_{cc}$; $\quad T > T_{cc}$

*(b) Public ownership and private ownership with an incomplete contract:*

$\underline{l} < \underline{l}_{ic}$; $\quad$ *if* $\alpha > [\varphi_2 (\chi - \gamma_1 l_0)] / [(\varphi_1 + 2\varphi_2)(\chi - w l_0) + (w - \gamma_1) \varphi_2 l_0]$;

$T > T_{ic}$

*(c) Private ownership with a complete or an incomplete contract:*

$\underline{l}_{cc} < \underline{l}_{ic}$;

$T_{cc} > T_{ic}$; *if contracting cost K is smaller than* $(\chi - w l_0)/3$;

*Proof:* See appendix

Part (a) of proposition 3.2 shows which are the likely effects of private ownership compared to public ownership, when a private firm is subject to a complete contract. The private firm is likely to be excessively large in less states than the public firm, and divergence between

implemented project size and optimal size is smaller for the former. The size effect is obvious, since the condition establishes that $\underline{l} > \underline{l}_{cc}$, and the reduction in the number of states is clear by realizing that this condition implies partitions of the states such that $\theta_{a'} \leq \theta_a$. The negative side of private ownership is that it is possible that in more states of nature, underprovision of infrastructure occurs. This can be observed by realising that $T > T_{cc}$ implies $\theta_{c'} \leq \theta_c$.

Part (b) of the proposition shows the effects of private ownership when an incomplete contract with the private firm is signed. In some cases, outcomes are worse than under public production. Observe that the contracted private firm can be excessively large in more states if parameter $\alpha$ is sufficiently large. For those cases, partitions of states are such that $\theta_{a''} \geq \theta_a$, and private firms are larger than optimal in states of nature with small ideal project sizes. However, this result can be altered if workers change sufficiently their voting patterns (i.e., $\alpha$ takes small values). Regarding the problem of projects being smaller than optimal, private ownership under incomplete contracting does not improve matters with respect to public ownership, since payroll size is smaller than optimal in more states of nature ($\theta_{c''} \leq \theta_c$).

In part (c), private firms working under a complete and an incomplete contract are compared. A complete contract always improves outcomes in those states associated with small ideal projects: in less states a firm with a complete contract is excessively large ($\theta_{a''} \geq \theta_{a'}$), and the difference in size with respect to the optimal value is smaller. About the problem of smaller than optimal projects, the effect depends on the size of contracting cost K. For small contracting costs, a complete contract is better than an incomplete one, since the number of states in which projects are smaller than optimal is more reduced ($\theta_{c''} \leq \theta_{c'}$). However, the situation is reversed if contracting costs are bigger than the limit established in the proposition.

Information from proposition 3.2 is useful to understand the effects of a change of ownership (privatisation) over the expected size of a firm dedicated to build an infrastructure project or to provide a publicly-funded service. Even if it is not completely conclusive, since the chosen initial sizes $l_0^{pub}$, $l_0^{cc}$ and $l_0^{ic}$ cannot be unambiguously ordered for every range of parameters, it offers some hints about which are the likely outcomes. Given the structure of the problem, it can be predicted that when a government contracts with a firm using a complete contract, the resulting firm size will be smaller than when the firm is publicly owned. The reasons for

this effect are the contracting cost K and the change in the voting pattern of workers. Therefore, privatisation reduces the excessive size of public firms in some states of nature, but on the other hand it may result in firms being smaller than optimal in other states.

Meanwhile, if an incomplete contract is signed, we can expect to observe similar effects, although modified by the fact that the private owner now is able to extract some rents from the government, which translates into higher adjustment costs. If the initial size of a private firm with an incomplete contract is close to the initial size of a public firm, part b of proposition 3.2 would apply, and in some situations privatisation would yield no benefits over public ownership. However, some benefits can be observed if values $l_0^{pub}$ and $l_0^{ic}$ are different or if the voting behaviour of workers changes substantially.

The relevant question now is to study how the initial firm sizes $l_0^{pub}$, $l_0^{cc}$ and $l_0^{ic}$, which are endogenously determined, are likely to be in relative terms, in order to evaluate if predictions of proposition 3.2 reflect typical outcomes of this model. As no analytical expressions can be derived for these initial values, an alternative approach to analyse this question is to simulate the model numerically and study the outcomes.

Next section is devoted to this numerical analysis. An initial vector of parameter values is chosen, which yields a particular solution to the model. Using this solution as a reference benchmark, the next step is to calibrate the effects of different variables by solving the model for wide ranges for each variable.

## 4. Numerical simulations of the model

The numerical exercise contained in this section is aimed to check if outcomes predicted by proposition 3.2 are generally obtained. Since no explicit analytic expressions can be derived, the alternative approach is to simulate the model for a wide array of parameter values and study the outcomes. The benchmark of reference is the solution for a particular case, with parameters: $\lambda_1 = 6$, $\lambda_2 = 3$ (this corresponds to a distribution of society with 60% of taxpayers, 30% of consumers and 10% of workers); $w = 5$, $z = 1/3$, $\gamma_1 = 1.5$, $\gamma_2 = 1$, $\alpha = 0.5$, $K = 200$.

Eight possible states of nature $\theta_i$, are considered, all equally probable. The vector of socially optimal project sizes is $q^* = (5, 10, 15, 20, 25, 30, 35, 40)$. Parameters are adjusted to these values so that voting functions satisfy the required conditions. The values chosen are $\varphi_1 = 6$, $k_2 = 9$, $\chi = 1{,}500$. According to its definition, the value of $k_3$ is state dependent, with $k_3(\theta_i) = \ln(q_i) / 0.8$. Solutions to the problem under each ownership scheme are the following:

(a) Public firm

Initial payroll size: $l_0^{pub} = 73.6$

Adjustment reference values: $\underline{l}(l_0^{pub}) = 79.4$

$\overline{l}(l_0^{pub}) = (187.1, 169.1, 160.6, 155.3, 151.5, 148.7, 146.4, 144.4)$

Final adjustments:

| Optimal size $q_i$ | Optimal firm size $l_i$ | Actual firm size |
|---|---|---|
| 5 | 15 | 73.6 + |
| 10 | 30 | 73.6 + |
| 15 | 45 | 73.6 + |
| 20 | 60 | 73.6 + |
| 25 | 75 | 75 |
| 30 | 90 | 90 |
| 35 | 105 | 105 |
| 40 | 120 | 120 |

The plus signs in the table above identify those states of nature for which the finally implemented project size is excessively large. Observe that the public firm is inefficiently large for states $q_i = \{5,10,15,20\}$, while it has the optimal size for the rest of states. By following this policy, the public firm has an expected size of 85.55 employees, and builds an infrastructure bigger or equal than optimal for each state of nature. The expected number of votes for the government is equal to 7.780 L.

b) Private firm under a complete contract

Initial payroll size: $l_0^{cc} = 60$

Adjustment reference values: $\underline{l}_{cc}(l_0^{cc}) = 38.4$

$\overline{l}_{cc}(l_0^{cc}) = (148.9, 131.3, 123.1, 118.0, 114.4, 111.7, 109.5, 107.7)$

Final adjustments:

| Optimal size $q_i$ | Optimal firm size $l_i$ | Actual firm size |
|---|---|---|
| 5 | 15 | 38.4 + |
| 10 | 30 | 38.4 + |
| 15 | 45 | 45 |
| 20 | 60 | 60 |
| 25 | 75 | 75 |
| 30 | 90 | 90 |
| 35 | 105 | 105 |
| 40 | 120 | 107.7 - |

As above, the plus signs indicate excessively large sizes. Note that, for this case, in state $q_i = 40$, the outcome results in a smaller than optimal project being chosen, due to the fact that from the initial size $l_0^{cc} = 60$, it provides more votes to the government not to adjust up to the optimal level, given the adjustment cost involved. The expected size of the private firm given this outcome is 69.94 employees, and the expected number of votes is 6.803 L.

The complete contract between government and firm will have the following form:

a) States $\theta=\{5,10\}$. Build infrastructure of size q = 12.8 and receive payment P = 224.4

b) State $\theta=15$. Build infrastructure of size q = 15 and receive payment P = 247.5

c) State $\theta=20$. Build infrastructure of size q = 20 and receive payment P = 300

d) State $\theta=25$. Build infrastructure of size q = 25 and receive payment P = 390

e) State $\theta=30$. Build infrastructure of size q = 30 and receive payment P = 480

f) State $\theta=35$. Build infrastructure of size q = 35 and receive payment P = 570

g) State $\theta=40$. Build infrastructure of size q = 35.9 and receive payment P = 586.2

c) Private firm under an incomplete contract

Initial payroll size: $l_0^{ic} = 75$

Adjustment reference values: $\underline{l}_{ic}(l_0^{ic}) = 79.8$

$T_{ic}(l_0^{ic}) = (131.4, 115.8, 108.6, 104.1, 101.0, 98.6, 96.6, 95.1)$

Final adjustments:

| Optimal size $q_i$ | Optimal firm size $l_i$ | Actual firm size |
|---|---|---|
| 5 | 15 | 75 + |
| 10 | 30 | 75 + |
| 15 | 45 | 75 + |
| 20 | 60 | 75 + |
| 25 | 75 | 75 |
| 30 | 90 | 90 |
| 35 | 105 | 96.6 - |
| 40 | 120 | 95.1 - |

In the case of production with an incomplete contract, the outcome is similar to the case of a firm with a complete contract, but suboptimal outcomes are present in more states of nature. First, a larger than optimal project size is chosen in more states, and the excess of size is bigger. Second, underprovision of infrastructure occurs now in two states, and the difference between actual an optimal size is larger than in the complete contract case. The expected size of firm is 82.09 employees, which is bigger than a private firm with a complete contract. The expected number of votes is 6.909 L.

So, comparing the outcomes of the three ownership structures it can be concluded that this case is a clear example of the predictions that the model presented in this chapter offers about consequences of privatisation. A private firm with a complete contract constitutes a general improvement over the excessively large size of public firms. However, the drawback is that in some states it yields worse outcomes, in the sense that smaller than optimal projects are implemented.

Meanwhile, if the contract with the private firm is incomplete, allowing then the private owner to obtain some rents at renegotiations, the outcome is similar to the complete contract case,

but there are suboptimal outcomes in more states. A larger than optimal project is chosen in more states, and underprovision of infrastructure also results more often. Compared to the public production case, the incomplete contract outcome is even less adequate in both aspects. As in this example the initial firm sizes in both cases are almost equal ($l_0^{pub}$=73.6, $l_0^{ic}$=75), this is the result predicted in proposition 3.2: privatisation through an incomplete contract does not necessarily improve the problems of size of a public firm.

The next question to answer is how particular is the solution presented in this example. In order to evaluate this point, the model has been simulated using the proposed benchmark of reference, by modifying different variables, one at a time, for wide possible ranges. Results of these numerical simulations confirm that predictions of the model are quite robust. In almost all cases for which the model has been solved, a similar conclusion as in the benchmark case is obtained: public firms are typically larger than private firms, but private firms underprovide infrastructure with respect to the socially optimal values in more states. A private firm working with an incomplete contract presents a problem of underprovision of infrastructure more serious than a firm with a complete contract.

Some results are presented graphically, using two measures to summarise the effects that can be studied in the model. The first measure is the expected size of firms in terms of number of employees, which has been already used above to provide the expected firm size for each of the three cases considered. The interpretation of this measure can be easily extended to try to explain those inefficiency problems of public firms linked to excessive use of labour. In this model, it can be observed that the government is not mainly interested on the size of the infrastructure that is built, but on the associated number of votes derived from it. For those states of nature in which it is obtained that the finally implemented project is larger than optimal, the firm building the infrastructure cannot be regarded in principle as productively inefficient, since its workers do not necessarily exhibit lower productivities than optimal. The problem of that firm as it stands is that it is requested to produce an excessive amount of output in social terms, which could be reduced without affecting infrastructure users or consumers.

However, since the government obtains the same number of votes, it is possible to consider that in those states of nature with excessively large firms, it might be feasible that at the light of the real valuation of the project by consumers, the government would not require the firm to produce maximum levels of output, as long as the calculated number of workers is hired, and the final project size does not fall below the ideal size for consumers. In other words, in those states for which it is obtained an 'excessive firm size', we may likely observe labour productivity $z'$ being lower than the maximum value $z$ assumed in the model, if the hired workers are to produce a smaller $q$ than the initially required, but they are not laid off. A firm with an excessive size can then be interpreted as being a productively inefficient firm, since too much labour would be used compared to efficient values.

The second measure used in the graphical results presented below is aimed to study the problem of underprovision of infrastructure (smaller firms than optimal). In order for those states with inefficient large sizes not to mask states with smaller than optimal size, only the expected *valued* infrastructure is computed. This definition implies that in those cases when a larger than optimal project is implemented, the value considered for that state to compute the expected infrastructure provision is reduced to the optimal level. The proposed measure allows then to detect underprovision of quality, so that a lower value indicates a worse outcome in terms of suboptimal outcomes in more states and/or bigger gaps. For the example analysed above, the measure of infrastructure provision would be equal to 22.5 for the public firm (no underprovision occurs), 22 for the firm with complete contract case, and 21.1 for the firm with incomplete contract.

Fig. 3.1: Effect of wage on firm size

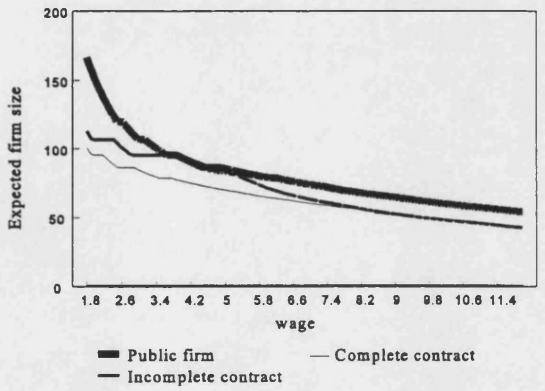
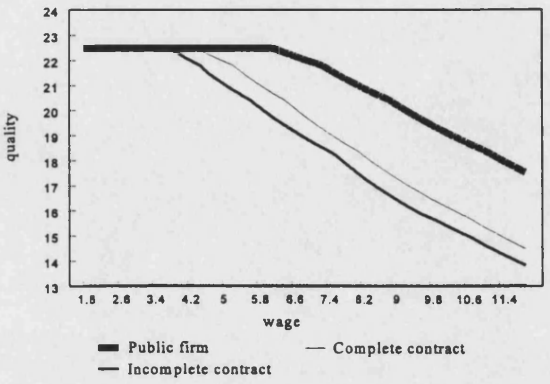



Fig. 3.2: Effect of wage on infrastructure provision



The first two graphs (see figures 3.1 and 3.2) show the two proposed measures to analyse changes in wage level $w$. It can be observed that the expected size of a public firm is always larger than the size of private firms, although for a small interval, a private firm with an incomplete contract would have the same expected size. With respect to infrastructure provision, figure 3.2 shows how private firms have always an equal or lower measure than the public firm, reflecting the problem of underprovision. Observe that, for large values of $w$, even the public firm may implement a project smaller than optimal, since the index shows values lower than the optimal reference value (22.5).

Figures 3.3 and 3.4 show the effects of modifying labour productivity (z). Results are the same as above: a public firm has always a larger expected size than a private firm with an incomplete contract, and the lower expected size corresponds to a private firm with a complete contract. However, even if in terms of expected size the complete contract firm is smaller, it improves the provision of infrastructure with respect to an incomplete contract firm. Observe in figure 3.4 that the problem of underprovision of quality is more serious in the latter.

Fig. 3.3: Effect of productivity on firm size

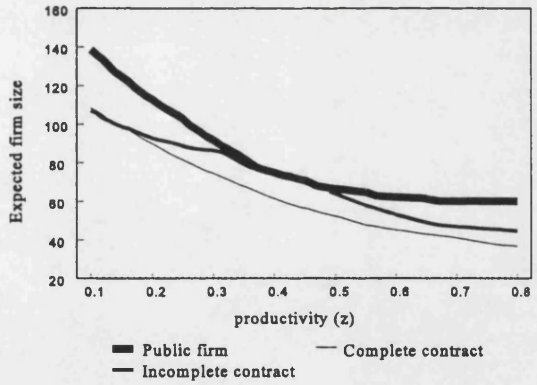
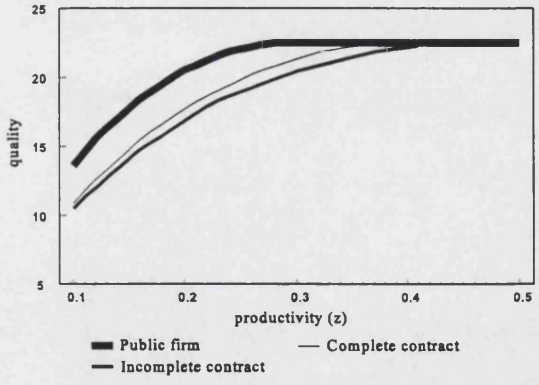



Fig. 3.4: Effect of productivity on infrastructure provision




The next two figures show the effects of adjustment costs $\gamma_1$ and $\gamma_2$. Only the measures concerning expected size are presented, since the provision of infrastructure follows exactly the same pattern as above. Figure 3.5 shows the effect of modifying the downsize adjustment cost $\gamma_1$. It can be observed that the same result is obtained again for all checked values: a

public firm is always larger than a private firm with an incomplete contract, which in turn is larger than a firm with a complete contract.

The upsizing adjustment cost $\gamma_2$ presents an interval for which this result is altered. Figure 3.6 shows how for small values of $\gamma_2$, a private firm with an incomplete contract can have a larger expected size than a public firm. The intuition for this result is clear: if upsizing the firm is not very costly, it is optimal to set initially a relative small size when the firm is public. Meanwhile, even if the adjustment cost is small, a private firm results more expensive due to rent extraction at renegotiation, therefore it is asked to have a larger size than a public firm. When cost $\gamma_2$ is large, the same ordering of firms as above is again restored.

Fig. 3.5: Effect of downsizing cost $\gamma_1$ on firm size

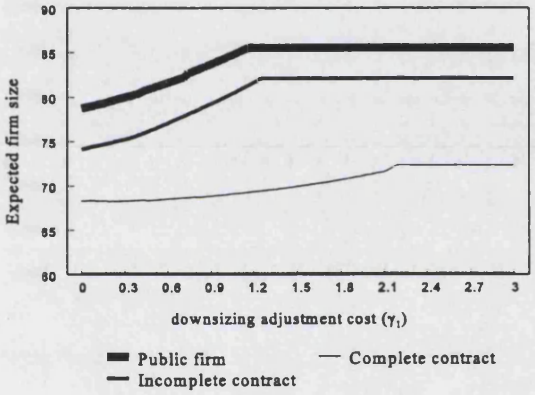
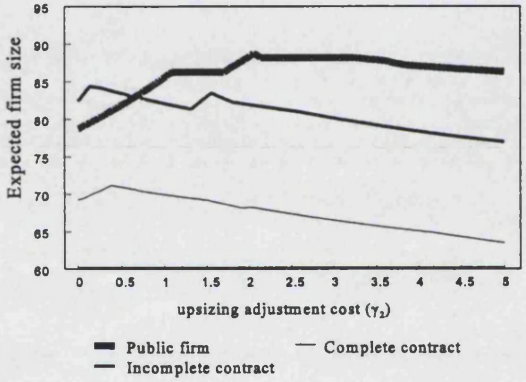



Fig. 3.6: Effect ofupsizing cost $\gamma_2$ on firm size




Finally, figures 3.7 and 3.8 present results about changes in the structure of society. Again, only the size effect is presented here, provision of infrastructure being identical as the cases of wage and productivity. Figure 3.7 shows the solution of the model for a range of percentages of taxpayers in society from 10% to 95%. It must be remarked that, when modifying the percentage of taxpayers, the remaining percentage is divided between the other two groups (workers and consumers) in a 1:3 ratio, since in the benchmark case it was assumed a value of $\lambda_2 = 3$, which is kept constant while modifying $\lambda_1$. The same results are again obtained: apart from a small interval where the expected size of a private firm with an incomplete contract is larger than the public firm, the same ordering is retrieved.

Figure 3.8 is the analogous analysis but modifying the percentage of consumers in the economy, from 5% to 50%. When modifying this percentage, the remaining groups are kept in a proportion 1:6 between workers and taxpayers. The figure shows that when the group of consumers is large (higher than 35%), a privatised firm with an incomplete contract presents a larger expected size than a public firm, although if a complete contract is signed, the expected size is always smaller.

Fig. 3.7: Effect of % taxpayers on firm size

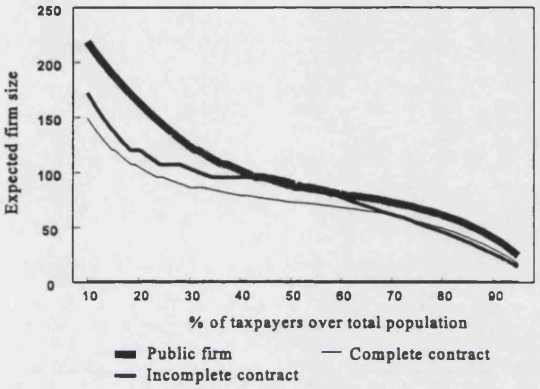
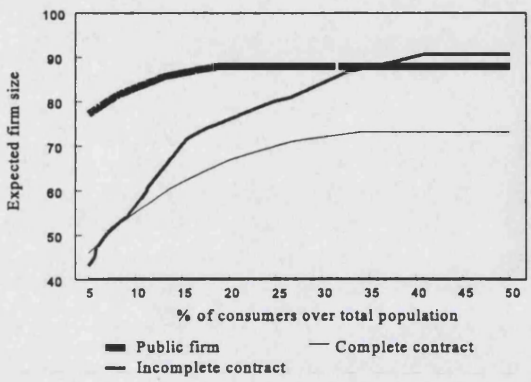



Fig. 3.8: Effect of % consumers on firm size




From all this numerical analysis, it can be concluded that the initial firm sizes that solve the government's problem under each ownership structure ($l_0^{pub}$, $l_0^{cc}$, and $l_0^{ic}$) are such that the ex-post adjustments make the expected size of a public firm to be generally larger than that of contracted-out private firms. Therefore, if we use the interpretation mentioned above of a correspondence between excessive project sizes and overstaffed firms, efficiency gains are obtained with the change of ownership since private firms generally exhibit lower expected sizes.

The drawback of contracting out private firms is that in some states of nature when consumers need large infrastructure projects, private firms tend to underprovide infrastructure compared with the outcomes of public firms. It is important to remark that this effect is generated by the government, not by the behaviour of private owners. When projects are implemented through private firms, the change in workers' voting patterns and the existence of contracting costs result in the government not requiring private firms to provide always the optimal level of

infrastructure. Ownership matters for firms' outcomes, since when the government is required to make adjustments on the initial project size, it is not equivalent to be able to require a publicly-owned firm to introduce changes than to re-negotiate those same changes with the owner of a privately-owned firm building the project or providing the service.

## 5. Conclusions

In this chapter, a voting model is proposed to analyse effects of ownership over firm size and the problem of excess of employment observed in public firms. A government concerned on votes is interested in building an infrastructure project or in the provision of some public service, which in both cases are financed through taxes. There is a single firm involved in the service provision. Three alternative schemes are considered: a state-owned firm, a private contractor with a complete contract, or a private contractor with an incomplete contract.

Under all three ownership schemes, the government chooses the size of the project to be implemented or the level of services to be provided. This choice is made under uncertainty on the final valuation by consumers, which depends on some random state of nature. In order to focus on the number of workers, the only relevant production factor considered is labour. The solution to the government's problem involves the determination of some initial project size $q_0$ (or equivalently, its associated number of workers $l_0$) without information on the final valuation by consumers, and some possible ex-post adjustments to this initial size.

Considering the three possible ownership schemes, it is shown that suboptimal outcomes can arise in all cases. In some states of nature, larger than optimal project sizes are implemented, since the government includes the votes of workers within its objective function. In those cases, since consumers do not derive additional utility from the excess of capacity, it is likely that the government may not eventually require the firm to produce the maximum output, as long as employment is maintained at the desired level, and consumers reach their maximum utility. In those conditions, it would be observed that firms do not obtain maximum productivity levels from employees, or equivalently, firms would be inefficiently overstaffed.

One relevant finding of the model is that, working under the same objective function, public ownership typically results in larger firms than optimal in more states of nature compared to external private contractors. On the other hand, contracted private firms tend to underprovide infrastructure or services in more states of nature. The situation is relatively improved if a complete contract is signed: less underprovision of infrastructure occurs in that case. However, the size of contracting cost determines the type of contract that the government prefers to sign. In numerical simulations, even for moderately small contracting costs, the alternative of an incomplete contract generally yields a higher number of votes. Another result is that the number of votes is usually smaller under contracting that under public ownership. This would imply that a government would never have incentives to privatise if it could freely choose the provision scheme, since that implies losing votes. This result would explain the observed preference of politicians for direct ownership (López-de-Silanes et al, 1995).

The fundamental contribution of this model is to provide an answer to the question of why the irrelevance proposition does not hold. In this case, the only point analysed is the difference between firms' size. Even if the government is able to replicate outcomes under public or private ownership, it chooses differently. Changes in the voting pattern of workers and contracting costs are the only factors that generate ownership effects. The less important the changes in the voting behaviour of individuals after privatisation and the lower the contracting costs, the less effect that privatisation would have on improving public firms' inefficiency.

Finally, some remarks on privatisation of particular industries can be made. Public firms tend to be inefficiently large for political reasons, therefore privatisation yields efficiency gains if voting patterns of workers are altered. However, some underprovision of infrastructure or services can occur when goods are provided by private contractors. This problem is more important if an incomplete contract is signed. Therefore, for industries in which changes in consumers' needs are unfrequent, relatively predictable, and easy to write down in a contract, privatisation would be highly positive. However, if regulation involves large contracting costs and demands vary frequently, privatisation would not unambiguously improve outcomes of publicly-owned firms, since adequate adjustments must then be made through re-negotiations with private firms instead of being directly implemented by the government.

# 6. Appendix

*a) Proof of proposition 3.1:* In order to prove the existence of a unique solution for the choice of an initial number of workers $l_0$, it is required to show that the function $V(l_0)$ is continuous, differentiable and concave.

*Continuity:* Any variation of $l_0$ induces a change in the reference levels $\underline{l}(l_0)$ and $\overline{l}(l_0, \theta_i)$, but it does not necessarily modify the partition of the state space $\Phi$. For small changes of $l_0$ then it is guaranteed that $V(l_0)$ is continuous, since it is the sum of continuous functions. The only case in which discontinuities could arise is when the partition of states is modified. In that case, it is required to show that in fact the function is also continuous.

Consider a change in $l_0$ such that a particular state $\theta_i$ that initially was in the group of states $\{\theta_1,...,\theta_a\}$ now belongs to the subset $\{\theta_{a+1},...,\theta_b\}$. This jump will take place at the moment when $l_i = \underline{l}(l_0)$. Recalling that $\underline{l}(l_0)$ is decreasing in $l_0$, for a value $l_0 - \varepsilon$ the state i will be such that $l_i < \underline{l}(l_0 - \varepsilon)$, so it will belong to subset $\{\theta_1,...,\theta_a\}$. Meanwhile, for $l_0 + \varepsilon$ we will have $l_i > \underline{l}(l_0 + \varepsilon)$, so state i will belong to $\{\theta_{a+1},...,\theta_b\}$ in that case. The number of votes in state i for an initial size $l_0 - \varepsilon$ will then be:

$$\varphi_1 \ln \underline{l}(l_0 - \varepsilon) + \varphi_2 \ln [\chi - w\, \underline{l}(l_0 - \varepsilon) - \gamma_1 (l_0 - \varepsilon - \underline{l}(l_0 - \varepsilon))] + \lambda_2 c^*$$

Meanwhile, for $l_0 + \varepsilon$ the number of votes is:

$$\varphi_1 \ln l_i + \varphi_2 \ln [\chi - w\, l_i - \gamma_1 (l_0 + \varepsilon - l_i)] + \lambda_2 c^*$$

As $\varepsilon \to 0$, $\underline{l}(l_0 \pm \varepsilon) \to l_i$, so both expressions coincide, therefore the function is continuous. A similar argument can be used for changes of states from $\{\theta_{a+1},...,\theta_b\}$ to $\{\theta_{b+1},...,\theta_c\}$, and from $\{\theta_{b+1},...,\theta_c\}$ to $\{\theta_{c+1},...,\theta_n\}$.

*Differentiability:* The derivative of $V(l_0)$ has the following form:

$$\frac{dV(l_0)}{dl_0} = \left(\sum_{i=1}^{a} p_i\right)\left(\frac{\varphi_1}{\underline{l}}\frac{d\underline{l}}{dl_0} - \frac{\varphi_2\left[(w-\gamma_1)\frac{d\underline{l}}{dl_0}+\gamma_1\right]}{\chi - w\underline{l} - \gamma_1(l_0-\underline{l})}\right)$$

$$- \sum_{i=a+1}^{b} p_i \frac{\varphi_2\,\gamma_1}{\chi - wl_i - \gamma_1(l_0-l_i)} + \sum_{i=b+1}^{c} p_i \frac{\varphi_2\,\gamma_2}{\chi - wl_i - \gamma_2(l_i-l_0)}$$

$$+ \sum_{i=c+1}^{n} p_i \left(\frac{\varphi_1}{\bar{l}}\frac{d\bar{l}}{dl_0} - \frac{\varphi_2\left[(w+\gamma_2)\frac{d\bar{l}}{dl_0}-\gamma_2\right]}{\chi - w\bar{l} - \gamma_2(\bar{l}-l_0)} + \frac{\varphi_3}{\bar{l}}\frac{d\bar{l}}{dl_0}\right)$$

Therefore, the function $V(l_0)$ is clearly differentiable but at points $l_0$ where a change in the partition of states is induced. Generally, when a particular state $\theta_i$ belongs to a different subset of states as $l_0$ changes, the effect of the state on the derivative is also different. Observe that the four terms in the expression above correspond to the four potential subsets of the partition and, in general, their values do not coincide. Hence, the derivative of $V(l_0)$ always exists but for those points in which the partition of states is modified.

*Concavity:* The function $dV(l_0)/dl_0$ can be itself differentiated at all points where it exists:

$$\frac{d^2V(l_0)}{dl_0^2} = -\left(\sum_{i=1}^{a} p_i\right)\left(\frac{\varphi_1}{\underline{l}^2}\left(\frac{d\underline{l}}{dl_0}\right)^2 + \frac{\varphi_2\left[(w-\gamma_1)\frac{d\underline{l}}{dl_0}+\gamma_1\right]^2}{[\chi - w\underline{l} - \gamma_1(l_0-\underline{l})]^2}\right)$$

$$- \sum_{i=a+1}^{b} p_i \frac{\varphi_2\,\gamma_1^2}{[\chi - wl_i - \gamma_1(l_0-l_i)]^2} - \sum_{i=b+1}^{c} p_i \frac{\varphi_2\,\gamma_2^2}{[\chi - wl_i - \gamma_2(l_i-l_0)]^2}$$

$$- \sum_{i=c+1}^{n} p_i \left(\frac{\varphi_1}{\bar{l}^2}\left(\frac{d\bar{l}}{dl_0}\right)^2 + \frac{\varphi_2\left[(w+\gamma_2)\frac{d\bar{l}}{dl_0}-\gamma_2\right]^2}{[\chi - w\bar{l} - \gamma_2(\bar{l}-l_0)]^2} + \frac{\varphi_3}{\bar{l}^2}\left(\frac{d\bar{l}}{dl_0}\right)^2\right)$$

Since all terms in expression above are clearly negative, it is proved that $d^2 V(l_0) / d\, l_0^2 < 0$. The function $V(l_0)$ is then continuous, differentiable but in a finite set of points and concave. Therefore, there exists a unique value $l_0^{pub}$ that maximizes $V(l_0)$. □

*b) Proof of proposition 3.2:* The results stated in the proposition can be proved simply by taking differences between the corresponding expressions and evaluating the signs.

*(1) Public firm ($\underline{l}$, $\bar{l}$) and private firm with a complete contract ($\underline{l}_{cc}$, $\bar{l}_{cc}$):*

$$\underline{l} - \underline{l}_{cc} = \frac{\varphi_1 \left((1-\alpha)\varphi_2(\chi-\gamma_1 l_0) + \alpha(\varphi_1+\varphi_2)K\right)}{(\varphi_1+\varphi_2)(\alpha\varphi_1+\varphi_2)(w-\gamma_1)} > 0$$

For any value of $l_0$ the difference between the downsizing adjustment values $\underline{l}$ and $\underline{l}_{cc}$ is always positive. Even if the voting pattern of workers does not change ($\alpha$=1), we will have the result $\underline{l} > \underline{l}_{cc}$ due to the existence of the contracting cost K.

$$\bar{l} - \bar{l}_{cc} = \frac{(1-\alpha)\varphi_1\varphi_2(\chi+\gamma_2 l_0) + (\alpha\varphi_1+\varphi_3)(\varphi_1+\varphi_2+\varphi_3)K}{(\varphi_1+\varphi_2+\varphi_3)(\alpha\varphi_1+\varphi_2+\varphi_3)(w+\gamma_2)} > 0$$

As above, even if individuals do not modify their voting behaviour ($\alpha$ = 1), the expression above is always positive if K > 0.

*(2) Public firm ($\underline{l}$, $\bar{l}$) and private firm with an incomplete contract ($\underline{l}_{ic}$, $\bar{l}_{ic}$):*

$$\underline{l} - \underline{l}_{ic} = \frac{\varphi_1 \left((1-\alpha)(w-\gamma_1)\varphi_2 l_0 - [\alpha\varphi_1+(2\alpha-1)\varphi_2](\chi-w l_0)\right)}{(\varphi_1+\varphi_2)(\alpha\varphi_1+\varphi_2)(w-\gamma_1)}$$

This expression is negative only for cases where

$$\alpha > [\varphi_2(\chi - \gamma_1 l_0)] / [(\varphi_1 + 2\varphi_2)(\chi - w l_0) + (w - \gamma_1)\varphi_2 l_0]$$

In words, if the voting pattern of workers is not highly modified after privatisation, the reference values for adjustments are such that $\underline{l} < \underline{l}_{ic}$, which means that in states of nature with low quality levels, privatised firms are more inefficient than public firms. However, for sufficiently small values of $\alpha$, the result would be reversed.

For the relationship between values $\bar{T}$ and $\bar{T}_{ic}$:

$$\bar{l} - \bar{l}_{ic} = [\left(\alpha\varphi_1^2 + \alpha\varphi_1\varphi_2 + (\alpha+1)\varphi_1\varphi_3 + \varphi_2\varphi_3 + \varphi_3^2\right)(\chi - w l_0)$$
$$+ 3\varphi_2(\chi + \gamma_2 l_0)(1-\alpha)\varphi_1\ ]$$
$$\times\ [3(\varphi_1 + \varphi_2 + \varphi_3)(\alpha\varphi_1 + \varphi_2 + \varphi_3)(w + \gamma_2)]^{-1} > 0$$

*(3) Private firms with a complete ($\underline{l}_{cc}$, $\bar{T}_{cc}$) or an incomplete contract ($\underline{l}_{ic}$, $\bar{T}_{ic}$):*

$$\underline{l}_{cc} - \underline{l}_{ic} = -\frac{\alpha\ \varphi_1\ (\chi - w l_0 + K)}{(\alpha\varphi_1 + \varphi_2)(w - \gamma_1)} < 0$$

$$\bar{l}_{cc} - \bar{l}_{ic} = \frac{(\alpha\varphi_1 + \varphi_3)\ (\chi - 3K - w l_0)}{3(\alpha\varphi_1 + \varphi_2 + \varphi_3)(w + \gamma_2)}$$

This last expression is positive if the contracting cost K is smaller than $(\chi - w\, l_0) / 3$. In that case, $\bar{T}_{cc} > \bar{T}_{ic}$ which means that the problem of underprovision of quality is less important if a complete contract is signed. However, for contracting costs larger than this value the result is reversed.

# CHAPTER 4: PRODUCTIVE INEFFICIENCY OF PUBLIC FIRMS: THE SPANISH URBAN BUS INDUSTRY (*)

## 1. Introduction

Firms providing urban bus transport services in Spain have been traditionally protected against competition. Regardless of ownership –public or private– bus companies operate under franchises in the cities that they serve, with long tenure periods and public financing of deficits. There are no differences in the type of franchise whether the incumbent operator is publicly or privately owned, since these franchises are regulated by a State law which applies equally to all city councils. The choice of public/private provision of services depends on preferences of each city council. Although it is generally accepted that urban public transport is an industry which requires some form of regulation, a framework like this provides little incentives to companies to minimise costs and to produce services efficiently.

Bus transport services are usually provided through regulated monopolies across countries. Although regulatory schemes vary in intensity of control, a number of common characteristics can be found across European countries (apart from UK which constitutes a special case, since it has liberalised almost all markets where bus companies operate). First, public transport companies are protected against competition by legal barriers to entry. Second, service levels, network configuration and fares are usually determined by a public regulatory agency, which might pay subsidies to cover for financial deficits if fares are set at low levels.

There is some empirical evidence of the effects on costs when competition is absent in the bus industry. The literature shows that important cost reductions have been achieved when deregulation is introduced (Heseltine and Silcock, 1990; White, 1990) or when firms must bid

(*) The content of this chapter is a joint work with Ginés de Rus (University of Las Palmas, Spain). A longer version of this study has been published in the *Journal of Transport Economics and Policy* (for full details, see reference list, De Rus and Nombela, 1997).

for licenses to operate temporary monopolies (Beesley, 1991). These cost reductions can be directed to increase social welfare through lower prices and a better quality of service. Dodgson and Topham (1987) have applied a cost-benefit analysis to evaluate the effects of public transport subsidies. In White (1990) a cost-benefit analysis of bus deregulation in the UK is carried out.

The Spanish urban bus transport industry has formerly been analysed in De Rus (1989, 1990) and Matas (1991). These works offer estimations of cost functions, elasticities of demand and some analysis of alternative regulatory schemes. The main results from this literature are that the Spanish regulatory regime of the bus industry, with public or private firms protected against competition by legal barriers to entry, has not prevented inefficiency in the provision of public transport services and the decline or stagnation of demand.

The objective of this chapter is to analyse if there are differences in productive efficiency between Spanish urban bus operators due to the type of ownership, in order to evaluate whether privatisation could enhance social welfare. Additionally, this exercise constitutes an example of the methodology employed to analyse firms' efficiency, by estimating a frontier of reference against which the performance of individual firms is measured.

An outline of the chapter is as follows. Section 2 provides a descriptive analysis of firms' activity and a first comparison between firms. In section 3, a cost function is estimated, with the double objective of obtaining information about the bus industry technology (returns to scale, elasticities of substitution) and evaluating the performance of each firm in terms of relative productive efficiency. Section 4 is dedicated to evaluate the potential increase in social welfare achievable by privatisation of public firms, using a highly simplified cost-benefit analysis. Finally, section 5 concludes with the main findings of the paper.

## 2. Descriptive analysis of the urban bus industry in Spain

The analysis presented here is based on information obtained from a survey on Spanish urban bus companies, conducted via questionnaires sent to firms. Information was revised and

filtered, and inconsistent questionnaires were omitted. The sample used is formed of 33 bus companies, of which 12 are public and 21 private. Information provided by firms refers to costs and service levels from 1992. Each company is the only provider of bus services in the city where it operates. Although in large cities there may exist other companies linking suburbs to city centre, the system of zone-franchising isolates firms from competition in the areas that they serve. Tables 4.1 and 4.2 offer some statistics on firms' activities.

**Table 4.1: Average data on Spanish urban bus industry (1992)**

| | Total sample | Private firms | Public firms |
|---|---|---|---|
| Workers | 211<br>(17.1) | 151<br>(15.9) | 326<br>(18.0) |
| Number of buses | 64<br>(8.7) | 49<br>(8.5) | 92<br>(8.7) |
| Bus-kilometres (thousands) | 3,307<br>(65.2) | 2,603<br>(63.7) | 4,650<br>(65.4) |
| Bus-hours (thousands) | 258<br>(18.2) | 207<br>(14.4) | 355<br>(17.9) |
| Peak-hours intensity coefficient (*) | 1.20<br>(0.23) | 1.24<br>(0.26) | 1.14<br>(0.10) |
| Passengers (thousands) | 16,061<br>(191.9) | 12,558<br>(155.1) | 23,069<br>(151.9) |

Standard deviations in parentheses
(*) Number of buses during peak hours divided by number in inter-peak hours.

Average size of private and public bus companies varies greatly, as table 4.1 illustrates. If the number of buses is used as an indicator of size, averages are 49 buses for a private firm and 92 for a public firm. Similarly, payrolls' size is different, with an average of 151 workers in private firms and 326 in public ones.

One reason for these differences in size is the fact that large cities are generally served by public companies, usually owned by councils. In accordance with size, the level of service provided by public companies is higher than in the case of private ones, either measured by bus-km, bus-hours or number of passengers.

**Table 4.2: Productivity and cost indicators - Spanish urban bus industry (1992)**

| | Total sample | Private firms | Public firms |
|---|---|---|---|
| Number of workers/bus | 2.67 | 2.41 | 3.18 |
| | (0.88) | (0.89) | (0.56) |
| **Productivity indicators** | | | |
| Km/bus | 47.16 | 47.0 | 47.48 |
| (thousands) | (12.43) | (14.28) | (7.75) |
| Km/worker | 18.63 | 20.48 | 15.08 |
| (thousands) | (4.4) | (4.16) | (1.99) |
| Bus-hours/worker | 1.55 | 1.73 | 1.20 |
| (thousands) | (0.49) | (0.50) | (0.18) |
| **Average costs** | | | |
| Total cost/km | 277.71 | 240.74 | 342.40 |
| (pesetas) | (82.30) | (73.23) | (51.55) |
| Total cost/bus | 13.11 | 11.55 | 16.09 |
| (millions pesetas) | (5.12) | (5.29) | (3.02) |
| Total labour cost/worker | 3.01 | 2.83 | 3.35 |
| (millions pesetas) | (0.68) | (0.68) | (0.55) |
| Total labour costs/km | 174.6 | 147.0 | 227.0 |
| (pesetas) | (65.9) | (53.9) | (53.2) |

Standard deviations between parentheses

Table 4.2 contains data on productivity and cost indicators. Before using these data to compare private and public firms, the following points must be considered. First, since public and private firms differ in size, they are not directly comparable unless constant returns to scale are present. Previous empirical studies (De Rus, 1989) on bus industry have shown that size does not matter in the production of bus-km, i.e. constant returns to scale are obtained. As presented below in section 3, the same result is obtained in the present work. Therefore, data on table 4.2 would be comparable regardless of size differences between public/private firms.

A second point to consider is the existence of differences on average speeds and the importance of peak hours, which might have an effect on cost structures and observed outcomes. Both aspects have been checked without finding significant differences between public and private firms. Therefore, indicators in table 4.2 may be used to make a first comparison of firms' efficiency levels.

These indicators reveal the existence of significant disparities between both type of firms. While the average cost of production of one bus-km is 240.74 pesetas for a private firm, this cost rises to 342.40 pesetas in the case of a public firm. This huge difference between average costs (42.2%) is indicative of a high degree of productive inefficiency in public firms.

Meanwhile, productivities are found to be much lower in public firms, both in terms of capital and labour. Table 4.2 shows that public firms seem to be overstaffed, since the average number of workers per bus is 3.18 while it is 2.41 workers in private firms. As the intensity of bus use is similar in both groups (the number of hours run annually per bus is 3,879 for private firms and 3,727 for public firms), productivity of labour in the public sector is much lower. In terms of bus-hours per year, a worker in a private firm produces 1,728 bus-hours, while in the public sector the average is 1,200 hours. Since there are no differences on speed, productivity is also much lower when measured by the number of kilometres produced annually per worker (20,480 against 15,080).

However, wages are not related to productivity differentials in this industry. In fact, workers in public firms are paid higher wages than in private sector. Average wages 2.83 million pesetas for a private worker and 3.35 million for a worker in a public firm (18.3% higher). The difference is especially significant in the case of bus drivers, who constitute the higher percentage of workers. A bus driver on a permanent contract in a public company earns 27.2% more than a driver working in a private firm. There is only a 7.0% difference if the driver is hired through a temporary contract. Fixed-term contracts are more widely used among private firms, with 15.4% of the workforce hired through these contracts, while the percentage is only 5.3% for public firms. It must be remarked, however, that these wages are not corrected by local conditions (situation of labour market, cost of living, average wage levels, etc). Since public firms operate predominantly in large cities, it is possible that some part of the observed wage differentials might be attributed to these non-controlled factors.

To sum up, this descriptive analysis of the urban bus industry in Spain reveals the existence of significant differences between public and private firms. Public firms use more labour and they seem to pay higher wages than private firms. Nevertheless, labour productivity in private

firms is much higher. Intensity in bus use and productivity per bus are similar for both groups. Since there are no other factors affecting firms' performance (average speed, peak hours, returns to scale) and technologies employed are the same, the analysis clearly shows the existence of productive inefficiency in public firms. These observations are in accordance with results obtained in the model of chapter 3: probably due to political reasons, some city councils have highly overstaffed public firms providing local bus services.

## 3. Cost function estimation

In order to evaluate correctly the observed differences between public and private firms, a more rigorous approach than a simple descriptive analysis is required. The methodology used here is the estimation of a cost function, which allows to approximate the concept of an efficient frontier. As discussed in chapter 1 when presenting the concepts of efficiency (see p. 9), efficient frontiers can be equivalently estimated using production or cost functions. In this work, it is opted for a cost function on the basis that output levels are generally determined by local authorities and not by those firms providing the services.

Given that only cross-section data and a small sample are available, the objectives pursued are not ambitious. The aim of the study is simply to analyse differences by estimating a relative cost frontier. In other words, the estimated frontier is not intended to represent the absolute minimum feasible cost to achieve a level of production, but only the average cost that the sample of firms provides. If public firms are found to be significantly above this average frontier, it will be possible to conclude that public firms are inefficient when compared to the average performance in the Spanish bus industry, and to evaluate the inefficiency gap. In order to obtain an absolute cost frontier, we would need to make the assumption that private firms in the sample are efficient. As described in the introduction, private bus companies in Spain operate in a highly protected environment, therefore it is not likely that they strictly minimise costs. It would be required to have information on firms operating in competitive frameworks, as in the British case, to claim that an estimated cost function adequately represents the efficient frontier.

The specification assumed for the cost function is a transcendental logarithmic function (translog) with three factors (labour, fuel and capital). This type of function is commonly used in empirical work because it can be regarded as a second order approximation to any other arbitrary specification (see Christensen, Jorgensen and Lau, 1973, for an analysis of this functional form in the context of production functions). One drawback, however, is the large number of parameters to be estimated.

A parametric approach to the frontier is used, hence the complete disturbance term derived from the estimation is assumed to represent the distance between firms' outcomes and the efficient frontier. Using a more sophisticated stochastic-parametric approach to the efficient frontier, the noise term could be separated in two components: a normally distributed random noise and a second term following a truncated distribution (positive or negative, depending on whether a cost or a production frontier were to be estimated, respectively). Only this second term would represent firm's inefficiency, since the first term would reflect factors non-controlled by the firm (see Lewin and Lovell, 1990). However, due to the small sample available for this work, it is opted for a simple parametric approach to measure firms' efficiency.

The translog cost function estimated here is the following:

$$\ln C(P_L,P_F,P_K,Q,V) = \alpha_0 + \alpha_1 \ln Q + \sum_i \beta_i \ln P_i + \frac{1}{2} \sum_i \sum_j \Gamma_{ij} \ln P_i \ln P_j + \sum_i \rho_i \ln P_i \ln Q + \gamma \ln V + \lambda PUBL + u \qquad (4.1)$$

where C≡costs, $P_L$≡wage, $P_F$≡fuel price, $P_K$≡capital price, Q≡output, V≡average bus speed, PUBL≡dummy variable with value 1 for public firms, u≡random shock, $u \rightarrow N(0,\sigma_u^2)$; i,j≡ L,F,K; $\{\alpha_0, \alpha_1, \beta_i, \Gamma_{ij}, \rho_i, \gamma, \lambda\}$ ≡ parameters. As it is usual, symmetry on cross-products is assumed, hence $\Gamma_{ij} = \Gamma_{ji}$.

Average speed of buses (V) is included in the cost function, modifying the traditional specification for the translog. The underlying hypothesis is that average speed contains

information about the type of routes a firm is running (number of stops, traffic density, etc). This structural factors are assumed to have an effect on firms' costs. A negative sign is expected for parameter $\gamma$, since a higher average speed implies the same amount of output with lower costs, due to the fact that less man- and bus-working hours are needed while the difference in the use of fuel and other inputs may be negligible.

A dummy variable for public ownership is introduced (PUBL). From the descriptive analysis in section 2, public firms seem to be inefficient compared to private firms. Hence, we expect to obtain a statistically significant positive value for $\lambda$. This value would reflect the distance of a public firm with respect to the estimated cost frontier, therefore it could be used as a measure of the degree of relative inefficiency of public firms.

With the proposed specification, 16 parameters must be estimated. Due to the size of the available sample, the number of degrees of freedom is strongly reduced. One property that can be used to improve the efficiency of estimators is to estimate jointly equation (4.1) and the system of factor share equations derived by applying Shephard's lemma:

$$\frac{\partial \ln C(P,Q)}{\partial \ln P_i} = \frac{\partial C(P,Q)}{\partial P_i}\frac{P_i}{C} = \frac{X_i(P,Q)\,P_i}{C} = S_i \qquad (4.2)$$

where $X_i(P,Q)$ is the demand for factor i, depending on the vector of factor prices (P) and on output (Q). In the case of the translog cost function, these factor share equations can be expressed as:

$$S_i = \frac{\partial \ln C}{\partial \ln P_i} = \beta_i + \sum_j \Gamma_{ij} \ln P_j + \rho_i \ln Q \qquad (4.3)$$

As the three factor share equations are linearly linked, since by definition $\sum_i S_i = 1$, one of the equations must be dropped to avoid a singular system.

The data set used for the cost function estimation is slightly smaller than the one used in the descriptive analysis. The reason is that factor prices are defined as exogenously as possible to satisfy the assumptions of a well-defined cost function. Hence, price of labour is measured as wage per worker, price of fuel is cost per litre and price of capital is cost per bus. Unfortunately, we do not have complete information to compute these prices for all the initial 33 firms, so 5 observations are lost.

Other alternatives for the definition of prices were tried (e.g. defining prices as costs of factors per kilometre or bus-hour) with poorer results in terms of goodness-of-fit and economic interpretation. Then, the sample finally used for the econometric estimation comprises 28 bus companies, of which 11 are public, and the rest are private. Definitions of variables are the following:

- C : Total costs, year 1992.
- Q : Output, total number of kilometres, year 1992.
- $P_L$ : Price of labour = Wage per worker (Total labour costs/Number of workers)
- $P_F$ : Price of fuel = Cost per litre (Total fuel costs/Total litres)
- $P_k$ : Price of capital = Cost per bus (Total capital costs/Number of buses)
  Capital costs include depreciation, insurance, maintenance, interest payments and administration.
- V : Average speed (Total km/Bus-hours)
- PUBL : Dummy with value 1 for public firms.
- $S_L$, $S_F$, $S_K$ : Cost factor shares (labour, fuel, capital, respectively) =
  Total factor cost/Total costs.

### 3.1 Results

The cost function was estimated jointly with the share equations of fuel and capital. Standard errors reported in parentheses are computed from heterocedastic-consistent matrix (White) since, given the fact that firms greatly differ in size, any non-measured effect would result on different disturbances' variances.

The estimated translog cost function is the following:

$$\ln C = \underset{(45.0)}{-54.05} + \underset{(1.20)}{2.65} \ln Q + \underset{(6.61)}{4.11} \ln P_L + \underset{(0.22)}{0.98} \ln P_F + \underset{(0.70)}{1.14} \ln P_K + \underset{(0.25)}{0.04} (\ln P_L)^2$$

$$+ \underset{(0.01)}{0.05} (\ln P_F)^2 + \underset{(0.01)}{0.08} (\ln P_K)^2 - \underset{(0.01)}{0.07} \ln P_L \ln P_F - \underset{(0.05)}{0.20} \ln P_L \ln P_K$$

$$- \underset{(0.01)}{0.02} \ln P_F \ln P_K - \underset{(0.08)}{0.09} \ln P_L \ln Q + \underset{(0.002)}{0.005} \ln P_F \ln Q - \underset{(0.01)}{0.02} \ln P_K \ln Q$$

$$- \underset{(0.08)}{0.54} \ln V + \underset{(0.032)}{0.141} PUBL$$

$R^2$: Cost function equation = 0.997
Fuel share equation = 0.720
Capital share equation = 0.653

Some of the estimated coefficients (namely $\beta_L$, $\Gamma_{LL}$ and $\rho_L$) present low t-ratios. A likelihood-ratio test was performed on the joint significance of these coefficients, rejecting the hypothesis $\beta_L = \Gamma_{LL} = \rho_L = 0$. Therefore, the three coefficients were included as valid in the final specification.

From the estimated equation, the following information on bus industry technology can be obtained (standard errors between parentheses):

*a) Constant returns to scale:* the elasticity of cost with respect to output is close to one; therefore, no significant economies of scale are obtained in this sector:

$$\varepsilon_{CQ} = \partial \ln C / \partial \ln Q = \underset{(0.021)}{1.042}$$

*b) Elasticities of factor demands with respect to prices:*

$$\varepsilon_{LPl} = \underset{-0.776}{-0.235} \qquad \varepsilon_{LPf} = \underset{-0.023}{-0.016} \qquad \varepsilon_{LPk} = \underset{-0.074}{-0.054}$$

$$\varepsilon_{FPl} = \underset{-0.145}{-0.103} \qquad \varepsilon_{FPf} = \underset{(0.176)}{0.091} \qquad \varepsilon_{FPk} = \underset{-0.07}{0.095}$$

$$\varepsilon_{KPl} = \underset{-0.18}{-0.131} \qquad \varepsilon_{KPf} = \underset{(0.026)}{0.036} \qquad \varepsilon_{KPk} = \underset{-0.074}{-0.104}$$

Estimated elasticities of demand for labour and capital with respect to their own prices are negative, indicating well-behaved demand functions. According to these values, labour demand would be more elastic with respect to wages than capital with respect to its price. Nevertheless, these elasticities present small values, and the same applies to cross-elasticities. If signs obtained are considered valid, factors in this industry seem to be complementary, except fuel and capital that present positive signs, hence they would be substitutes.

As expected, the coefficient $\gamma$ on average speed is significant and negative. This implies that a higher average speed reduces costs or, in other words, that the type of routes a firm operates affects its cost structure.

### 3.2 Efficiency analysis

The degree of productive efficiency of each firm included in the sample can be studied using the estimated cost function. Considering that this function represents a relative cost efficient frontier of the bus industry, those firms with costs above the frontier would be producing inefficiently with respect to the industry average. On the contrary, firms with lower costs than those represented by the frontier should be considered as relatively more efficient than the average.

When evaluating the performance of a firm, we compare the realised cost with the minimum cost provided by the function, for some given values of price factors (those which that individual firm is paying). In other words, using this method, what it is evaluated is the technical efficiency of firms, i.e. the distance from their input choice to the frontier, not to the optimal point in the frontier. Since in practice it is difficult to determine a unique vector of market prices for inputs, it is not easy to determine what is the optimal point within the efficient frontier, so it is not intended to measure the full productive inefficiency of firms, but only the technical part of that inefficiency.

The main result which is derived from the cost function estimation is that coefficient $\lambda$ is significantly positive. Therefore, this result indicates that public firms are technically inefficient compared to private firms. Using the value of $\lambda$ and its standard error, we can provide a measure of this type of inefficiency. Consider two firms, private and public, producing the same level of output $Q^0$ and paying the same prices $P_L^0$, $P_F^0$, $P_K^0$. The difference between their costs, considering both have $u_i=0$, is given by:

$$\ln C_{pub} = f(Q^0, P_L^0, P_F^0, P_K^0) + 0.141$$
$$C_{pub}/C_{priv} = \exp\{0.141\} = 1.151$$

Therefore, from the estimated value of $\lambda$ it can be derived that on average, public firms have 15.1% higher costs than private firms. If standard errors are taken into account, a 95% confidence interval for the possible values of $\lambda$ is (0.077,0.205), which correspond to cost differences between 8.0% and 22.75%.

Again, it must be emphasised that these cost differences are computed without discounting differences in prices paid to inputs, or changing the ratios at which they are combined. The conclusion is that the estimated 15% is a pure economic loss since it means that the same level of production could be obtained using smaller amounts of inputs. Next section explores the increase in social welfare that could be achieved by eliminating this technical inefficiency detected in public bus companies.

## 4. Economic evaluation of public bus firms' privatisation

In order to evaluate the increase in welfare achievable by privatisation of public firms, a cost-benefit approach is used here. Following Jones et al (1990), privatising a public firm is a desirable policy only if the change of ownership results in increased welfare. Change in welfare is defined as:

$$\Delta W = V_{sp} - V_{sg} + (\lambda_g - \lambda_p)\, Z \qquad \textbf{(4.4)}$$

where $V_{sp}$ is the social value of the firm in the private sector, $V_{sg}$ is the social value in the public sector, $\lambda_g$ and $\lambda_p$ are the shadow multipliers of income for the public and the private sector, respectively, and Z is the actual price paid for the privatised firm by the buyer.

Privatisation would be socially optimal when $\Delta W > 0$, i.e., when the value of the firm in the private sector plus the value of the money transfer to the public sector (if this value is positive, which corresponds to the case when $\lambda_g > \lambda_p$), exceeds the value of the firm in the public sector.

Consider the case in which the public firm sets a price equal to marginal cost (in this case, identical to average cost). After privatisation, average cost goes down, due to efficiency improvements, but price could be set above that new average cost and still consumers would pay a lower price. In other words, we may allow for the possibility of private firms obtaining some profits, and still obtain some net social benefits from the transfer of ownership.

Discounted present values of a firm in the public ($V_{sg}$) and private ($V_{sp}$) sectors are as follows:

$$V_{sg} = \sum_{t=0}^{\infty} \rho^t \left[S_g(t) + \lambda_g \Pi_g(t)\right] \tag{4.5}$$

$$V_{sp} = \sum_{t=0}^{\infty} \rho^t \left[S_p(t) + \lambda_p \Pi_p(t) + (\lambda_g - \lambda_p) X(t)\right] \tag{4.6}$$

where $S_g$ ≡consumer surplus when firm is public, $\Pi_g$ ≡public firm's profits, $S_p$ ≡consumer surplus when firm is private, $\Pi_p$ ≡ firm's profits after privatisation, X ≡taxes on the firm after privatisation, and $\rho$ ≡discount factor.

Substituting expressions (4.5) and (4.6) into (4.4), and assuming that the discounted sum of future profits after taxes when the firm is private is the maximum price that an investor is willing to pay for the firm ($Z_p$), the change in welfare can be expressed as a function of changes in consumer surplus and profits after the transfer of ownership:

$$\Delta W = \sum_{t=0}^{\infty} \rho^t \left[\Delta S(t) + \lambda_g \Delta \Pi(t)\right] - (\lambda_g - \lambda_p)(Z_p - Z) \tag{4.7}$$

Expression (4.7) may be used to calculate the expected welfare increase after some further simplifications. First, a linear demand D(p) = a - b p is assumed, which allows to calculate approximations to the changes in consumer surplus and profits. These changes are considered to be constant over time, therefore $\Delta S(t) = \Delta S$, and $\Delta \Pi(t) = \Delta \Pi$, $\forall t$, where:

$$\Delta S = (p_g - p_p) q_g + \frac{1}{2} (p_g - p_p) (q_p - q_g) \qquad (4.8)$$

$$\Delta \Pi = (p_p - C_p) q_p \qquad (4.9)$$

A second simplification is to consider that the value of income in public and private sectors is equal to one, i.e. $\lambda_g = \lambda_p = 1$. This assumption allows to drop out the last term in expression (4.7), so there is no need to estimate what is the difference between the maximum and the actual price paid for the privatised firm.

In order to determine which are the values of prices $p_g$ and $p_p$, it is considered that the public firm sets its price according to a marginal cost rule, hence $p_g = C_g$. Meanwhile, for the case of the privatised firm, it is assumed that the government does not pay any subsidy to the firm, but it allows the private owner to earn some profits as a return to investment. Price charged by the private firm is then $p_p = k\, C_p$, where $k \geq 1$ is a mark-up over cost determined by the regulator.

Using all these simplifying assumptions, it is finally possible to transform (4.7) into an operative expression which is used to compute the values presented below:

$$\Delta W = \frac{1}{r} \left[ \frac{1}{2} (C_g - k\, C_p)(q_p + q_g) + (k-1) C_p q_p \right] \qquad (4.10)$$

where $r = 1/\rho$ is the social rate of discount.

In order to evaluate from (4.10) the change in welfare obtained through privatisation, the only values required are $C_g$, $C_p$, $q_g$, $q_p$, r and k. Values for $C_g$ and $q_g$ are available, since these are the observed values of the marginal cost and the output level of a public firm, respectively. $C_p$ is the marginal cost of a privatised firm, and from the estimated cost function, we may infer

that the expected cost savings from privatisation are between 8 per cent and 23 per cent, so it is possible to obtain a value for $C_p$ using $C_g$ as a reference. According to values of $C_p$, it would be possible to determine $q_p$ if an estimation for the demand curve D(p) was available. As it is out of the scope of this work to estimate a demand function for urban bus services, we consider a value of -0.3 for the elasticity of demand with respect to price, which was obtained for the Spanish urban bus transport in a previous work (De Rus, 1990).

Regarding the value of the mark-up allowed for the privatised firm to charge (k), attention is restricted to three possible scenarios, considering only values k = {1, 1.05, 1.1}. These values correspond to situations where the mark-up is equal to zero (the privatised firm is obliged to set price equal to marginal cost), 5 per cent, and 10 per cent, respectively. These mark-ups can be interpreted as profits that the private bus company is allowed to make by the regulator.

Changes in welfare have been derived for three possible firm sizes, namely a small, a medium and a large company, in terms of total production. Average values of output considered are 800,000 km per year for a small firm, 3 million km for a medium-sized, and 11 million for a large one. All welfare increases presented in the following table are referred to a single year, hence avoiding the use of an arbitrary social rate of discount:

**Table 4.3: Welfare increases per year from privatisation of bus companies (million pesetas)**

| | **Mark-up allowed for the regulated private firm** | | |
|---|---|---|---|
| | **0%** | **5%** | **10%** |
| Small company | | | |
| 8% | 15.0 | 14.9 | 14.8* |
| 23% | 38.2 | 38.1 | 38.0 |
| Medium company | | | |
| 8% | 76.7 | 76.4 | 75.4* |
| 23% | 195.2 | 194.9 | 194.2 |
| Large company | | | |
| 8% | 288.2 | 287.0 | 283.3* |
| 23% | 733.1 | 732.1 | 729.2 |

* In these cases the price would rise and production would be reduced after privatisation. However, the increase in welfare is positive since profits of the privatised firm compensate the loss in consumer surplus.

Again, it must be emphasised that calculated welfare increases are only obtained from elimination of the technical inefficiency observed in public bus firms. When computing values presented in table 4.3, firms are assumed to keep paying the same prices to inputs, and they keep the same ratios in which inputs are used. As mentioned in the descriptive analysis, wages are on average 18.3% higher in public firms, and firms seem to be overusing labour. Hence if privatisation was accompanied by a reduction in wages, and input-mix inefficiency was eliminated, cost savings could be even higher than the ones computed here, although possibly wages should also be corrected by potential differences generated by regional conditions.

## 5. Conclusions

This chapter has presented a study of the urban bus industry in Spain. A descriptive analysis of public and private firms shows that there are significant differences between both groups. Public firms use a large number of employees compared to private companies, and public workers' productivity is much lower. However, wages in the public sector are 18% higher. These facts indicate the presence of an input-mix type of inefficiency, and also some degree of technical inefficiency, in public firms. The combination of both effects results in average costs being 42% higher in public than in private firms.

A translog cost function has been estimated, to obtain information about technology and also to evaluate the individual performance of firms. Results obtained are similar to those of previous empirical studies of this sector: constant returns to scale, low elasticities of factor demands with respect to prices and a low degree of substitution between factors. Results on firms' efficiency derived from the estimated translog cost function confirm the differences observed in the descriptive analysis. On average, public firms present a degree of productive efficiency lower to that of private firms, when their costs are compared to the frontier represented by the cost function. Cost savings that can be expected by privatising public firms are evaluated between 8% and 23%.

A cost-benefit analysis of privatisation of urban bus public firms has been carried out, using results from the cost frontier analysis and a linear approximation to demand. The effect of privatisation on consumer and producer surpluses has been considered. Wage reductions have not been included, since they are considered simply as transfers from workers to consumers/producers and, therefore, do not represent net welfare increases. Moreover, there is no adjustment of wages for local labour conditions or regional differences.

Results are presented for different scenarios, considering minimum an maximum cost savings achievable and different possibilities for pricing by the privatised firm. Assuming that privatised firms are allowed to charge a mark-up of 5% over marginal cost as return on investment, welfare increases per year are estimated between 14.9 and 38.1 million pesetas for a small firm; 76.4 and 194.9 million pesetas for a medium size company; and between 287 and 732.1 million pesetas for a large company. Therefore, it seems that a policy of privatisation of urban bus firms operating at present in the public sector is highly recommendable, as large social gains could be obtained.

This work constitutes an example of the typical methodology applied to study efficiency differences between public and private firms, based on the estimation of cost or production functions. Even though the analysis is only restricted to measure observed outcomes, results may also be connected to those political issues discussed in chapter 3. Likely due to political reasons, public urban bus companies are overstaffed and employees are well paid. In this case, Spanish city councils receive funds from the State to finance their mass transport services, but they are not strictly controlled on how these funds are spent. On the other hand, inefficiency problems seem to be smaller in privately-owned bus firms, *even though they are regulated and financed* also by local authorities. Local politicians must then be obtaining more benefits from public bus firms than from regulated companies, in the line of chapter 3 predictions. Unfortunately, it is not feasible to try to measure empirically these effects, and neither it is possible to assess if there exist any potential differences on quality levels between services provided by public and private firms.

# CHAPTER 5: POLITICAL EFFECTS OVER EMPLOYMENT AND WAGES: EVIDENCE FROM US LOCAL GOVERNMENTS

## 1. Introduction

Public ownership of a firm producing a good or service implies that no single agent has rights over the firm, but the entire society does. In turn, that means that control over the firm is left to some elected representatives who take decisions over its running. At first sight, this scenario is not very different to the case of a large private company owned by multiple small shareholders, so it would seem that both could be compared on equal terms. However, there are important differences that strike immediately. First, asymmetries of information between owners and representatives are more severe in the case of a public firm, since ownership is more dispersed and individual dividends are generally negligible, so incentives of individuals to acquire information about the firm are poorer. Second, political representatives face reelections in which they are responsible not only for the firm's managing but on a large number of other issues. Third, these representatives have the privilege of imposing taxes on individuals and managing the resources levied, under some control on how public budgets are spent.

A framework like this provides little incentives for elected representatives to promote productive efficiency in public firms. On the contrary, it tends to foster political patronage: jobs and wages can be exchanged for votes, and the lower the control over political agents the more inefficient behaviour can be predicted for public firms. Anecdotal evidence of these political effects over state-owned firms can be found almost in any type of country around the world.

Political effects are, however, more difficult to study empirically and to be properly evaluated. In order to have fairly accurate measures, it would be necessary to have information on financial resources available to a politician when taking decisions, and the constraints that he

must face. On the other hand, unions' objectives coincide with those of politicians up to some limit, since both agents may be interested in raising employment and wages above efficient levels. Therefore, unions' effects are entangled with those of politicians, and any attempt to evaluate one side should consider simultaneously the other.

Therefore, usually in practice is almost impossible to try to analyse political effects over productive efficiency of public firms. Resources available to a firm are not always even clearly determined, since losses can be covered ex-post by government subsidies to bail out companies[18]. However, local governments can provide an optimal framework for this analysis: they usually produce in-house some services for relatively small communities, employing workers generally drawn from the same population to which they serve, and their available resources can be more easily determined. Even though not all these services can always be assimilated to the industrial type of firms which are the main object of study in this thesis, some of them have the typical characteristics of private goods (e.g. utilities or transport).

In this chapter, some data from services provided by US local governments are used to analyse political effects on employment and wages, in the context of a bargaining model. The main point of the test is to exploit the fact that the degree of control over US local politicians varies across states, since regulation is based on state-level laws. It is possible then to examine what is the influence of politicians over productive efficiency of local services, when these agents are more or less controlled. Although results are circumscribed to this particular case of study, they are presented here on the belief that political effects are also likely to be present in other industrial state-owned firms, even if they are harder to be evaluated.

The chapter is structured as follows. Section 2 briefly reviews theories on collective bargaining and comments some evidence on US public sector. Section 3 presents the model and section 4 describes the data used. Section 5 contains the results of empirical estimations. Section 6 summarises the main findings and concludes.

---

[18] This was a common practice among western European countries before the passing of an EC Directive by which these subsidies have been severely restricted, in order to promote fair competition between firms. State-owned air lines, car and ship builders and some other large industrial groups have enjoyed this privileged situation for decades.

## 2. Collective bargaining models

In the context of profit-maximising private firms, there exists two alternative ways of modelling collective bargaining between firms and unions. The first model considers that the object of bargaining are only wages, and that firms adjust the level of employment according to the negotiated wage (right-to-manage model). A variation of this model assumes that unions can set unilaterally the wage and firms choose employment. Both versions lead to the same basic conclusion: the observed wage-employment outcome would lie on the firm's labour demand curve.

An alternative model considers that both unions and firms can do privately better by bargaining simultaneously over wages and employment. This is the efficient bargaining model of McDonald and Solow (1981). Its main prediction contradicts that of the labour demand model: the wage-employment outcome is located on a contract curve which lies to the right of the labour demand curve, therefore for each wage level, a larger number of workers is hired according to this model. Well-known results of the model are that the position of the contract curve is determined by the union's risk aversion and the particular outcome finally observed is a function of the relative bargaining powers of unions and firms.

It is difficult to assess which of the two models is relevant for particular industries and countries. Numerous papers have developed empirical tests to discriminate between both models (MaCurdy and Pencavel, 1986; Bean and Turnbull, 1988; Eberts and Stone, 1986), or to study the interaction between bargaining models and product markets (Dowrick, 1989; Bughin, 1993). There have been also attempts to integrate both models in single frameworks, as in Manning (1987) or Oswald (1993).

In this paper, an efficient bargaining model is used, based on the existent evidence on US local governments. First of all, there is a strong degree of unionization among public sector employees. Freeman (1986) reports that in 1984, 44% of workers in this sector were represented by unions or other organizations, in contrast of 18% in the private sector. Public

sector unions have been shown to have significant effects on workers' compensation (Ehrenberg, 1973; Ehrenberg and Goldstein, 1975; Zax, 1985a; Robinson and Tomes, 1984), but also on the levels of employment (Freeman and Valletta, 1988; Zax and Ichniowski, 1988). Moreover, there is also evidence that political institutions affect labour market outcomes. Zax (1985b) reports that cities in which a large proportion of councillors are directly elected at nonpartisan ballots have more workers and pay higher wages, in contrast to cities managed by professional administrators.

Considering all this evidence together, it seems obvious that in order to estimate correctly the effects of political variables on employment and wages, it is necessary to consider simultaneously the interaction between politicians and unions. One possible approach to the problem is simply to estimate reduced-form equations for employment and wages, using union, political and other relevant variables as regressors. Estimates obtained in this way are useful to show net effects of each variable, but they offer no information at all on some other important features of the bargaining process, as the relative bargaining power of each party or the union's degree of risk aversion.

On the other hand, a complete bargaining model can provide this information, though it is technically more complex to estimate. Both models are considered here, since they can offer complementary information. First, an efficient bargaining model is estimated to check if political variables have a significant effect on outcomes and to obtain estimates for relevant parameters, as the union's risk aversion and bargaining power. In a second stage, simplified reduced-form equations are estimated to obtain elasticities of employment and wages with respect to all variables.

## 3. A bargaining model between local governments and unions

In order to analyse collective bargaining between US local authorities and unions, an efficient bargaining model similar to the one developed by Svejnar (1986) for US industrial firms is considered. Efficient bargaining is assumed given that it has been reported that unions seem

to have an effect both over employment and wages in this sector. Moreover, papers which use tests to discriminate between efficient bargaining and labour demand models need to rely on some assumed type of production function, from which relative marginal products are derived. For services offered by local governments, it is difficult to assess the use of other inputs apart from labour, therefore it is not possible to try to test the relevant type of bargaining model.

The basic efficient bargaining model needs to be modified for the case of the public sector, since when the employer is a government or public agency, its objective is not profit maximization. Consider initially, using a normative approach, that a government is concerned exclusively on welfare maximisation. In that case, the labour demand of the public firm must be determined by the social benefits derived from the good or service provided by the firm, and its corresponding costs. Let F(L) be the total social benefit generated by the public provision of a certain amount of good/service, for whose production it is required to employ L workers, and assume that $F'>0$ and $F''<0$. If L is the only factor of production, total cost of service provision would be equal to $w$ L, where $w$ is the wage per worker. Optimal number of workers to be hired (labour demand curve) depends on the social valuation of the service and on wage level. This socially optimal number of workers would be implicitly defined by:

$$F'(L) = w \qquad (5.1)$$

However, as in chapters 2 and 3, it seems more realistic to consider a non-benevolent government (i.e. not interested on welfare maximization, but on its own objective of maximising the expected number of votes at next election). Thus, this agent would not be directly interested in social benefits derived from the service, but on the potential votes linked to that service. It is clear that votes will increase as more level of service is provided, therefore there must exist a direct relationship between votes and F(L). But it is also likely to expect that the government may receive additional support from hired workers, specially in conditions of high unemployment, or when public sector jobs provide better pay or better conditions that comparable private sector jobs. In order to summarise both sources of votes for the government, let's simply assume that the number of votes linked to the service provision is proportional to the social benefit generated, so that votes are equal to $\lambda F(L)$, $\lambda \geq 0$.

On the other hand, there are evident constraints for the government on the quantity of goods/services (and associated jobs) that can be provided, which are given by available resources. But again, instead of taking into account the social costs generated, the government will typically be concerned on the votes that are lost when taxes to finance the service are required. It is sensible to assume that, even if taxpayers are uninformed, they will react to levels of services perceived and taxes paid. Indeed, recent results obtained by Besley and Case (1995) show that in the US, votes are significantly affected by taxes at state government level. In order to represent the number of votes lost by the government due to taxes, assume that all the information can be summarised in a function g(t), g'>0, g''>0, where t is a tax rate controlled by the local government. Total number of votes associated to the provision of a particular service is then equal to $V = \lambda F(L) - g(t)$.

Local governments' budgets are simple and relatively easy to specify in a model. In the case of US local governments, there are two basic sources of revenue for these authorities: intergovernmental transfers and income from property taxes, which together represent on average around 80% of total revenue. Budgets can then be expressed as $B = t P + R$, where t is property tax rate, P is assessed property value, and R is revenue received from other levels of government (federal and state). Local authorities have some autonomy about how to spend their budgets, although they are subject to established rules and controls. Since these controls are not uniform across the nation, but instead they are set in state-level laws which vary in intensity, this is precisely why turns these local governments to be an interesting case study to try to measure the importance of political effects over employment and wages.

A particular way of modelling the degree of external control on how public budgets are spent on the provision of services is proposed. Assume that for each service, a fraction $\alpha$ of total budget must be spent in order to provide the socially optimal amount F(L). However, if a politician is not strictly controlled on how the budget is spent, he may try to spend a larger fraction on total labour cost $w$ L, either to employ more people than strictly required and/or pay higher wages than in private sector to attract votes. Hence it is considered that the amount spent on labour cost to provide a particular service may be expressed as a fraction $\alpha(c)$ of total resources, where c is a set of political variables reflecting the external control over the local

government. It is assumed that $\alpha'(c) < 0$, which means that stricter controls would reduce the percentage of resources that a politician can use to hire labour.

A government maximising the number of votes then solves the following problem:

$$\begin{aligned} &\text{Max}_{L} \quad V = \lambda F(L) - g(t) \\ &\text{s.t.} \quad w L = \alpha(c)\,(t P + R) \end{aligned} \tag{5.2}$$

with the following implicit labour demand curve as solution:

$$F'(L) = \frac{g'(t)}{\lambda\ \alpha(c)\ P}\ w \tag{5.3}$$

Expression (5.3) exhibits the typical results expected from a politically motivated government. If we compare this labour demand curve with the one associated to a welfare-maximising government given by (5.1), it is easy to appreciate that more workers would normally be hired. This may be observed by realising that the coefficient affecting $w$ in the RHS of (5.3) is typically smaller than 1, since assessed property value P is usually a large value compared to the marginal effect of property tax on votes ($g'(t)$). Hence, since F(L) is assumed to be concave, for each wage level $w$, the number of employees is larger when a non-benevolent government provides the service than when a welfare-maximising government does. In other words, the labour demand curve associated to expression (5.3) lies to the right of the curve given by (5.1). A second interesting feature of (5.3) is that as political controls are stricter, we have smaller values for parameter $\alpha(c)$, therefore the labour demand curve shifts to the left as politicians are more controlled by state-laws regulating local governments activities.

However, as it was described above, it seems that trade unions have a significant presence in the US public sector (Freeman, 1986), therefore it is not likely that a local government can decide on the levels of employment and wages on its own, but it should have to negotiate with a union. In order to derive a bargaining model, a standard objective function is assumed for the union: the workers' organization is concerned both on the wage perceived by its members and the number of workers employed.

The union's objective function is then the following:

$$U = (w - w_a)^{\delta} L \tag{5.4}$$

where $w_a$ is the alternative wage or income expected by workers if not hired by the local government. The parameter $\delta$ represents the union's risk aversion ($\delta < 1$, union is risk averse; $\delta > 1$, risk loving).

Assuming a bargaining power $\gamma \in [0,1]$ for the union, the outcome of the bargaining process is obtained by solving the problem:

$$\begin{aligned} Max_{w,L} \quad & [(w - w_a)^{\delta} L]^{\gamma} [\lambda F(L) - g(t)]^{1-\gamma} \\ s.t. \quad & w L = \alpha(c) (tP + R) \end{aligned} \tag{5.5}$$

The outcome of the bargaining process is going to be located on a contract curve which is defined as in the profit-maximising firm case by points at which both the government and the union benefit privately from the bargaining. A basic difference is that in this case the government is not interested in maximising profits, nor welfare, hence instead of the usual isoprofit lines, in this case we must speak of some 'isovote lines' formed of combinations (L,*w*) yielding the same number of votes to the government. The contract curve is then obtained at points where the slopes of the isovotes and the union's indifference curves derived from (5.4) coincide. The contract curve has the expression:

$$w = \frac{\delta \alpha(c) \lambda P}{(\delta - 1) g'(t)} F'(L) - \frac{w_a}{\delta - 1} \tag{5.6}$$

It can be observed that, as the labour demand curve given by expression (5.3) this contract curve is also affected by the degree of political control. Stricter laws regulating the activity of local governments reduce the value of $\alpha(c)$ and thus, the contract curve is shifted to the left, resulting in lower levels of employment and wages. Another interesting feature is that the slope of this contract curve depends on the union's risk attitude: the curve is downward sloping if the union is risk-averse, vertical if risk-neutral and upward sloping if risk-loving.

As in the case of a profit-maximising firm, the final outcome of the bargaining process is a point located on the contract curve given by (5.6), but it is not possible to determine which is the actual point without further information. Relative bargaining powers of union and government are the determinants of which combination (L,*w*) is finally observed.

From an empirical perspective, an interesting exercise is to try to obtain an estimation of this contract curve, in order to determine what is the relevance of the political effects determined by $\alpha(c)$. However, since the actual forms of relevant functions $\lambda$ F(L) and g(t) are unknown, any particular specification used is condemned to be highly subjective. Two options are then left open for the empirical analysis: (1) propose some particular form for the general functions and estimate a complete bargaining model, or (2) estimate reduced-form equations of the endogenous variables (L and *w*) depending on political and union variables.

Since the main objective of the chapter is to evaluate the importance of the political effects over the efficiency of publicly provided services, it is opted for using both approaches since their results might be complementary and may be regarded as two different types of test on the same question.

### 3.1 Estimation of first-order conditions from complete bargaining model

Using the first approach to the problem, the following functional forms are proposed for the relevant functions forming the government's objective function. The idea behind these functions is to make them as simple as possible, to reduce the number of parameters to be estimated to a minimum. Thus, the first function representing the votes gained by provision of the service is made equal to L (number of workers employed), on a similar argument to that used in chapter 3 about consumers reaching a saturation point. If provision of the service reaches sufficiently high levels, consumers do not increase their votes proportionally any longer (additional services would provide little utility gains to them). Thus, the number of votes from consumers can be considered almost constant, and the only variable votes are

obtained from hired employees. Of course, this argument would not be valid if the number of workers falls below some limit, since then not only the votes from employees are to be considered, but also those from consumers. The existent evidence on generalised overstaffing in public firms is the basis for the functional form chosen here.

With respect to the votes lost according to the level of property tax, again for the sake of simplicity, a very stylised form is used, which satisfies the conditions assumed and only requires one parameter to be estimated. Hence, it is assumed that $g(t) = \beta t^2$. Combining both these assumed functions, the total number of votes for the government is then:

$$V = L - \beta t^2 \tag{5.7}$$

Using this government's objective function and the constraint on the fraction of total budget spent on provision of the services, the resulting map of "isovotes" curves is analogous to the isoprofits' map in the private firm case (McDonald and Solow, 1981). In the wages-employment space, isovotes curves are increasing up to a point and then decrease. The line joining the points where the isovotes curves are flat is the government's labour demand curve, which now is the following:

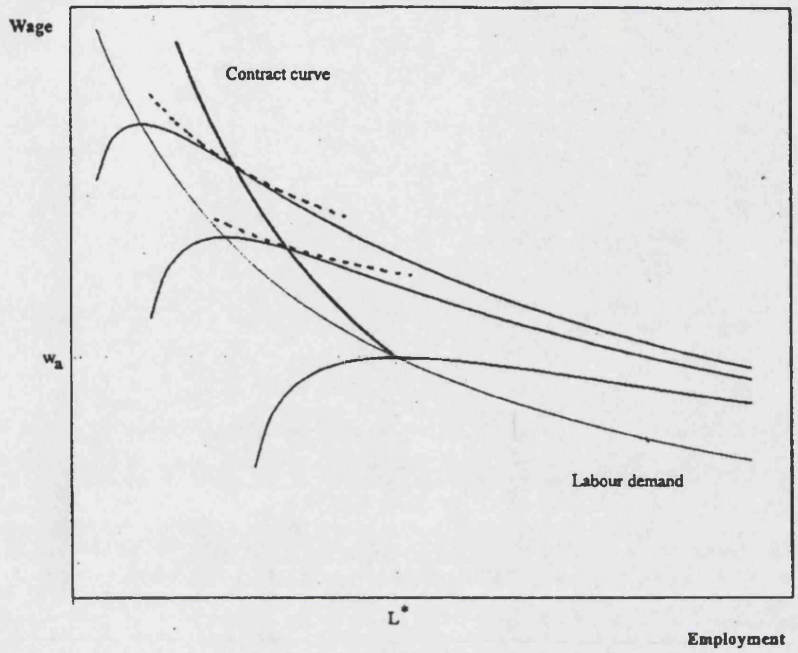
$$L = \frac{\alpha}{w}\left(\frac{\alpha P^2}{2 \beta w} + R\right) \tag{5.8}$$

Meanwhile, using the proposed functional forms, the contract curve is in this case given by expression (5.9). It can be observed that this contract curve generally lies to the right of the labour demand curve (5.8) (consider, for example the case $\delta=1$ of a risk-neutral union).

$$L = \frac{\alpha}{w}\left(\frac{\delta \alpha P^2}{2 \beta \left((\delta-1) w + w_a\right)} + R\right) \tag{5.9}$$

Figure 5.1 depicts the shape of isovotes' lines, labour demand and contract curve for this case.

**Figure 5.1: Isovotes map and labour demand curve**




As it can be observed, the contract curve depicted in figure 5.1 corresponds to a situation where the union is risk averse ($\delta < 1$). Even if then the contract curve is downward sloping, this does not imply that the level of employment would be smaller to the comparable case for a profit-maximising firm (which would exhibit an upward sloping curve). It must be observed that the labour demand curve associated to the isovotes' lines will typically be far to the right of the labour demand curve of a profit maximising firm. Typically, a welfare-maximising government providing a service would employ more workers than a profit-maximiser, and it was shown by comparing expressions (5.1) and (5.3) that the labour demand curve of a politically-oriented government is farther to the right.

As usual when solving bargaining models for the contract curve, it can be observed that expression (5.9) does not contain any information on the relative bargaining powers of union ($\gamma$) and government ($1-\gamma$). Since one of the features in which we are interested is precisely this coefficient, it is more convenient to try to estimate first order conditions of the bargaining

problem (5.5), specified for the assumed functional forms. From these two first-order conditions, the particular form of the contract curve (5.6) for this case can be derived. The two first-order conditions are the following:

$$\frac{1}{L} = \frac{1}{\beta\, t^2} - \frac{2\,(1-\gamma)}{\alpha(c)\;\delta\;\gamma}\;\frac{(w-w_a)}{P\,t} \qquad (5.10)$$

$$w = \frac{\alpha(c)}{2\;\beta\;(1-\gamma)}\;\frac{P}{t} - \frac{\alpha(c)\;\gamma}{2\;(1-\gamma)}\;\frac{P\,t}{L} \qquad (5.11)$$

On the other hand, the tax rate t can be expressed in terms of the endogenous variables *w* and L, using the condition on the fraction of budget spent on labour cost to provide the service:

$$t = \frac{w\,L}{\alpha(c)\;P} - \frac{R}{P} \qquad (5.12)$$

Substituting expression (5.12) on (5.10) and (5.11), two implicit equations in terms of *w* and L can be obtained. Although, in principle, these two expressions could be used for estimation, they result to be too complex to obtain reliable estimates from them[19].

The alternative approach used here is to add a disturbance term to expression (5.12), which would represent all other effects on t not included in α(c), and to consider a three-equation system formed of (5.10), (5.11) -adding also disturbance terms to these two- and (5.12). Assuming independent normally distributed disturbances, the system is estimated using full information maximum likelihood (FIML), since this is the only known method that provides asymptotically efficient estimators for nonlinear models (Chow, 1983).

This bargaining model is estimated separately for six different services, which are described in the following section, provided by a majority of US local governments. Thus, it is possible to obtain different estimates for parameters of interest: unions' risk aversion (δ), bargaining power (γ), effect of tax rate on votes (β) and labour costs' budget share (α(c)).

---

[19] The two implicit expressions are the following:

$$\beta[2+(\delta-2)]w^2L^2-2\alpha\beta[1+(\delta-1)]RwL-2\beta(1-\gamma)w_awL^2-\alpha^2\delta\gamma P^2L+2\alpha\beta(1-\gamma)w_aRL+\alpha^2\beta\delta\gamma R^2=0 \qquad (5.10')$$

$$\beta(2-\gamma)w^2L^2-2\alpha\beta RwL-\alpha^2P^2L+\alpha^2\beta\gamma R^2=0 \qquad (5.11')$$

The effect of political variables (c) over the budget share is specified as $\alpha(c)= \alpha_0 + \sum_i \alpha_i c_i$, where $c_i$ are different types of controls over local governments. Since all $c_i$ variables are defined so that higher values represent tighter controls, it is expected to obtain significant negative estimates for all parameters $\alpha_i$'s (tighter controls would lead to smaller budget shares spent on labour).

### 3.2 Estimation of reduced-form equations

After the estimation of the complete bargaining model, in a second stage a simpler reduced-form is estimated by OLS for each service. There are two reasons to perform this second estimation: 1) it provides elasticities of the net effect of each variable over employment and wages; 2) it allows to include additional variables representing unions' strength and general economic conditions in each area. Given the complexity of the nonlinear model, the only way in which it includes demand aspects is by considering all variables in relative terms to the number of inhabitants served. The simpler OLS estimation permits the introduction of other variables representing economic conditions of each area and the degree of organization of workers.

The specification of the reduced-form model is then the following:

$$L = f\ (c_i,\ u_i,\ D_i,\ M_i) \qquad \textbf{(5.13)}$$

$$\frac{w}{w_a} = g\ (c_i,\ u_i,\ D_i,\ M_i) \qquad \textbf{(5.14)}$$

where $c_i$ are the political control variables used in the bargaining model; $u_i$ is a set of variables representing unions' strength; $D_i$ are variables reflecting demand and general economic conditions in each geographical area; and $M_i$ are variables representing external resources available to local governments and existent debt.

## 4. Data

The data set used for estimation of the model is mainly drawn from the 1987 US Census of Governments. This Census, elaborated every five years[20], provides detailed information on the number of workers and payrolls for different services, assessed property value for local tax purposes, revenues from taxes and intergovernmental transfers, long-term debt issued for education, utilities and other purposes. In addition, it also contains some information on labour-management relations: number of contractual agreements and workers covered, number of bargaining units and workers represented by them, number of memoranda of understanding, and percentage of organized employees for some activities.

The unit of observation chosen is the county area, which is the lowest aggregation level for the published Census data[21]. For each county, information of all local governments in its area (county governments, municipalities, townships and special districts) is aggregated. The use of aggregated data presents the drawback that several local governments are considered as a single decision unit. However, the number of large municipalities in each area is small, which implies that data of each county area represent mainly the behaviour of large cities. Moreover, it has been reported the existence of spillover effects between large cities and smaller neighbours (Ehrenberg and Goldstein, 1975), which may support the use of county areas as single observation units.

The original data set contains 3,132 observations, corresponding to the 50 US states (in addition to the 3,042 counties, some observations correspond to cities which are reported separately from their county areas). From the available services, six activities which are provided in a majority of county areas by local governments have been chosen: administration, highways, police, sanitation, sewerage and utilities.

---

[20] It was not possible to use the 1992 Census of Government for estimation, since at the moment of writing, not all the relevant information was available.

[21] County areas are units commonly used for statistical purposes in US, since they represent homogeneous administrative divisions across the country. County governments are present in all states, expect Connecticutt, Rhode Island and Columbia. In Louisiana and Alaska, there exist divisions comparable to county areas (parish governments and boroughs, respectively).

For each activity, the number of observations used for estimation differs, since only those counties providing the service are considered. Variables are expressed in relative terms to the population served, therefore employment and financial resources represent values per inhabitant. In order to avoid outliers caused by small communities, only counties with more than 2,000 inhabitants are included. Employment figures are full-time employees for each of the six activities. Workers' earnings are average monthly wages obtained from the figures of total payrolls and number of workers. Unfortunately, the Census does not contain information about different categories of workers within each activity.

In addition to the Census of Governments, two complementary sources of information have been used. Political variables are drawn from a compilation of state laws regulating the activity of local government, elaborated by the US Advisory Commission on Intergovernmental Relations (USACIR, 1993). Variables obtained from this source are dummies reflecting the existence of state laws on: imposition on debt limits, limits to debt purposes, property tax limits, imposition of accounting procedures, ex-post independent audits, merit system of personnel hiring, authorization for collective bargaining and restrictions on public workers' strikes. This source of information has been previously used by López-de-Silanes et al (1995), who have found significant political effects in the analysis of privatisation decisions by county governments.

The second source of complementary information is a study on the US private sector: 1987 County Business Patterns. For establishments located at the same county areas defined by the Census, the number of workers and payrolls for different industries are available. Using this information, it is possible to obtain values for the outside option of the bargaining model of the public sector ($w_a$) and a gross indicator of economic activity for each county, in terms of private sector workers per inhabitant.

A complete description of each of the variables used in the model estimation can be found in the appendix. The following table presents average values for the main variables (for employment and wages, averages are taken on counties used for estimation in each activity)

**Table 5.1: Average employment and wages in different US local services**

[L = workers/1,000 inhabitants; w = monthly wage ($) ]

| *Variable* | | *Average* | *Variable* | *Average* |
|---|---|---|---|---|
| Admin. | L | 1.426 | Property value | |
| | w | 1421.6 | ($/inhab.) | 17896.94 |
| Highways | L | 1.619 | Intergov.transfers | |
| | w | 1427.55 | ($/inhab.) | 980.52 |
| Police | L | 1.58 | Property tax rate | 3.72 |
| | w | 1629.72 | Debt/inhab.($) | 751.92 |
| Sanitation | L | 0.391 | Private sector | |
| | w | 1328.58 | workers/inhab. | 231.9 |
| Sewerage | L | 0.334 | Workers covered | |
| | w | 1575.72 | by coll. agr.(%) | 22.93 |
| Utilities | L | 0.836 | | |
| | w | 1631.96 | | |

# 5. Empirical results

## 5.1 Results of the non-linear bargaining model

The three-equation system (5.10)-(5.11)-(5.12) resulting from the bargaining model was estimated by FIML. Initially, a larger set of political variables was used for the specification of the shares $\alpha(c)= \alpha_0+\sum_i \alpha_i c_i$. From these variables, only four (which were the more significant) are used in the estimations reported here. These variables are: limits on issued debt (*deblim*), limits on property tax (*taxlim*), imposition of external audit (*audit*), and merit system of hiring workers (*merit*).

Estimation of a non-linear system of simultaneous equations involves the use of a numerical method to maximize the likelihood function. A Gauss-Newton gradient method is used, which

requires the provision of initial values for all estimated parameters. Standard errors reported are asymptotic, computed from a consistent estimate of the information matrix.

Initial values provided for estimation were selected as follows: $\gamma$=0.5 (equal bargaining powers); $\delta$=1 (risk neutrality); $\alpha_i$=0 (no effect of political variables). For the central value of the percentages spent in labour costs ($\alpha_0$), an average share of labour over total expenditure was used for each activity. Since the parameter $\beta$ (effect of tax rate on votes) was completely unknown, a range of possible values were checked, finally using values in the range 0.5-1.5, which performed better. From this set of central initial values, some variations were introduced for each activity to achieve convergence in the maximization process, except for the parameters $\alpha_i$ which were set equal to zero in every case. Actual initial values and complete results for each activity are reported in the appendix. Estimated values for parameters are reported in Tables 5.2 and 5.3:

**Table 5.2: Estimated values for structural bargaining parameters**

| | $\beta$ | $\gamma$ | $\delta$ | $\alpha_0$ |
|---|---|---|---|---|
| Administration | 1.221<br>(.020) | .119<br>(.189E-2) | .917<br>(.523E-2) | .078<br>(.121E-2) |
| Highways | .900<br>(.011) | .464<br>(.374E-2) | .683<br>(.330E-2) | .068<br>(.115E-2) |
| Police | .558<br>(.010) | .262<br>(.617E-2) | .759<br>(.481E-2) | .054<br>(.114E-2) |
| Sanitation | 1.340<br>(.060) | .040<br>(.169E-2) | .976<br>(.102E-2) | .013<br>(.604E-3) |
| Sewerage | .160<br>(.351E-2) | .207<br>(.376E-2) | .776<br>(.428E-2) | .010<br>(.269E-3) |
| Utilities | 1.306<br>(.067) | .022<br>(.130E-2) | 1.177<br>(.012) | .039<br>(.200E-2) |

Note: Asymptotic standard errors in parentheses

Estimated unions' bargaining power ($\gamma$) varies across activities, although it always presents values smaller than 0.5, which would correspond to the Nash bargaining assumption. Therefore, it seems that the position of local governments is stronger than that of unions when bargaining collectively. Another regularity observed in the results are relative risk aversion

parameters ($\delta$) smaller than 1, except for utilities, which indicates the presence of risk averse unions.

The parameter representing the effect of tax rates on votes ($\beta$) takes different values across activities. This variability, although small, is not completely satisfactory and may be indicating the need to modify the simple quadratic specification used in (5.1). Several alternative specifications were explored, without obtaining better results, probably due to the increasing complexity of the equations to estimate when additional parameters are included.

Different estimates were obtained for the shares' central values ($\alpha_0$), although in this case the results only reflect the fact that labour cost shares differ across activities, according to the required number of workers employed. Thus, activities with lower average number of employees, as sanitation or sewerage, present smaller values for $\alpha_0$.

**Table 5.3: Estimated values for parameters on political variables**

| | *deblim* | *taxlim* | *audit* | *merit* |
|---|---|---|---|---|
| Administration | -.634E-4<br>(.305E-3) | -.017<br>(.285E-3) | -.019<br>(.341E-3) | .564E-2<br>(.124E-3) |
| Highways | .028<br>(.546E-3) | -.029<br>(.653E-3) | -.886E-2<br>(.437E-3) | -.711E-3<br>(.395E-3) |
| Police | .015<br>(.611E-3) | -.012<br>(.581E-3) | -.207E-2<br>(.466E-3) | .019<br>(.508E-3) |
| Sanitation | .334E-2<br>(.171E-3) | -.727E-3<br>(.503E-4) | -.210E-2<br>(.101E-3) | -.768E-3<br>(.571E-4) |
| Sewerage | .388E-2<br>(.130E-3) | .199E-2<br>(.957E-4) | -.216E-3<br>(.842E-4) | -.218E-3<br>(.823E-4) |
| Utilities | -.424E-2<br>(.391E-3) | .188E-2<br>(.266E-3) | -.811E-3<br>(.206E-3) | .667E-2<br>(.387E-3) |

Note: Asymptotic standard errors in parentheses

Three of the political variables present the expected negative effect for most activities (*taxlim*, *audit* and *merit*). Meanwhile, a majority of positive signs were obtained for the dummy

variable representing the existence of limits on debt for local governments (*deblim*), an effect for which no clear interpretation can be given.

According to the variables' definition, the presence of negative signs implies that stricter controls over local governments' expenditure and hiring practices induce a reduction in the labour cost share of total expenditure. The majority of negative signs obtained in the non-linear model estimation supports the hypothesis that less controlled politicians would be devoting more resources to hire employees, in the form of larger number of workers per inhabitant and/or higher wages.

### 5.2 Results of the reduced-form estimations (OLS)

As mentioned in section 3, the second step of the analysis is to estimate a reduced-form model formed of an employment equation (5.10) and a wage premium equation (5.11) for each activity. Equations are linear and include a larger set of exogenous variables than the one used in the non-linear version of the model, to allow variability in the unions' strength and to include demand an other effects.

In order to summarise the obtained results, variables are grouped in four categories, and parameter estimates for all activities in each category are presented together (complete results for each activity and equation are reported in the appendix). The four categories are the following: political effects, union effects, demand and general economic conditions, and financial resources available to local governments. All variables are used in logs, therefore reported estimates can be interpreted as elasticities of employment and wage premium (perceived wage over alternative wage, $w/w_a$) with respect to each variable.

*5.2.1 Political effects*

Variables included in this group are those used for the bargaining model: *deblim*, *taxlim*, *audit* and *merit*. While in the non-linear model the global effect of these variables on the total labour cost share was obtained, here it is possible to analyse separately the effects on employment and wages.

**Table 5.4: Effect of political variables (OLS estimations)**

| *Employment equation (dependent variable, L)* | | | | |
|---|---|---|---|---|
| | *deblim* | *taxlim* | *audit* | *merit* |
| Administration | -0.032 | .223* | 0.022 | -0.029 |
| Highways | -.237* | -.077* | -.149* | 0.047 |
| Police | -.137* | 0.044 | -0.02 | -.084* |
| Sanitation | -.329* | -.116* | -0.078 | 0.04 |
| Sewerage | -.132* | .152* | .104* | 0.054 |
| Utilities | -.347* | 0.044 | .152* | 0.05 |
| *Wage premium equation (dependent variable, $w/w_a$)* | | | | |
| | *deblim* | *taxlim* | *audit* | *merit* |
| Administration | -.056* | -.072* | -0.006 | -.108* |
| Highways | .081* | -0.014 | 0.002 | -.040* |
| Police | 0.011 | 0 | -0.013 | -.042* |
| Sanitation | 0.031 | -0.002 | .030* | -.050* |
| Sewerage | .034* | -.030* | 0.002 | -.049* |
| Utilities | -0.027 | -.037* | 0.002 | -0.022 |

* Coefficient significantly different from zero at 95%

Although in the non-linear model the imposition of debt limits on counties presented in general a positive effect on total labour costs, the same variable (*deblim*) seems to have a negative effect on the number of workers for almost all services. Estimates vary from -0.137 for police to -0.346 for utilities, which correspond to differences of 1.147 and 1.413 workers

per inhabitant, respectively. The effect of debt limits on wages is less significant and it has no clear pattern on signs, which may explain the result obtained in the non-linear model.

Tax limits do not present a clear-cut effect on the number of workers for all activities, while it seems that those counties in which taxes are limited pay lower wages, specially for administration, sewerage and utilities' employees. External audits do not seem to have clearly defined effects on wages or number of workers for most activities, though the overall effect was negative according to the results of the nonlinear estimates. Finally, the imposition of a merit system of hiring workers only reduces the number of workers for police departments, but it has a negative significant impact on wages for all activities, except utilities.

### *5.2.2 Union effects*

Variables included to represent the strength of unions are: percentage of workers covered by collective agreements (*agrcov*); and percentage of organized workers, only for highways, police and sanitation (*hiorg, poorg, saorg*), since these data are not available for the other activities. Two dummies are also included to represent union effects: authorization for collective bargaining (*collbar*) and for public sector workers' strikes (*strikes*).

**Table 5.5: Effect of union variables (OLS estimations)**

| *Employment equation (dependent variable, L)* | | | | |
|---|---|---|---|---|
| | *agrcov* | *collbar* | *strikes* | *i_org* |
| Administration | .055* | -.073* | 0.01 | - |
| Highways | .062* | 0.058 | -0.068 | 0.018 |
| Police | -0.013 | -0.004 | .289* | 0.01 |
| Sanitation | -.188* | -.254* | -.342* | 0.021 |
| Sewerage | 0.008 | -0.069 | 0.002 | - |
| Utilities | -.029* | 0.072 | 0.118 | - |

**Table 5.5 (cont.): Effect of union variables (OLS estimations)**

| *Wage premium equation (dependent variable, $w/w_a$)* | | | | |
|---|---|---|---|---|
| | *agrcov* | *collbar* | *strikes* | *i_org* |
| Administration | 0.005 | 0.02 | .052* | - |
| Highways | .030* | .057* | 0.038 | .017* |
| Police | .021* | -0.002 | 0.024 | .021* |
| Sanitation | .034* | .059* | 0.023 | .017* |
| Sewerage | .037* | .070* | -0.04 | - |
| Utilities | .036* | .065* | -0.02 | - |

* Coefficient significantly different from zero at 95%

The effect of collective agreement coverage on employment has not a determined sign for all activities: it increases the number of workers for administration and highways, but decreases it for sanitation and utilities. However, it shows a clear positive effect on wages: except for administration workers, the elasticity of wage premia to coverage is around 0.03. The same result applies to the percentage of organized workers in those activities for which data is available (highways, police and sanitation): a higher percentage of organized workers does not affect employment, but it rises wages. Therefore, it seems that local government unions have relevant effects on their members' earnings, but they do not rise employment significantly.

Regarding the dummies representing laws on unions, the authorization to collective bargaining again seems to affect wages but not employment, while laws authorizing strikes do not present a relevant effect on neither of them for most activities.

### *5.2.3 Demand and general economic conditions*

Variables included in this group are: assessed property value (*P*); number of private sector workers per inhabitant (*activ*), which is used as a gross indicator of economic activity in each county area; density of population (*dens*); percentage of part-time worked hours over total hours (*_pperc*), and unemployment rate (*unempl*).

**Table 5.6: Demand and general economic conditions (OLS estimations)**

| *Employment equation (dependent variable, L)* | | | | | |
|---|---|---|---|---|---|
| | *P* | *activ* | *dens* | *i_pperc* | *unempl* |
| Administration | .053* | .095* | -.166* | -1.684* | -.283* |
| Highways | -.080* | .126* | -.250* | -1.758* | -.181* |
| Police | .041* | .348* | -.030* | -1.243* | -.199* |
| Sanitation | -0.05 | .317* | -.105* | -1.348* | -.320* |
| Sewerage | 0.017 | .589* | .043* | -.987* | 0.009 |
| Utilities | -.076* | .408* | -0.026 | -1.188* | 0.042 |
| *Wage premium equation (dependent variable, $w/w_a$)* | | | | | |
| | *P* | *activ* | *dens* | *i_pperc* | *unempl* |
| Administration | .026* | -.104* | 0.007 | 0.026 | -.125* |
| Highways | .037* | -.087* | -.028* | -0.059 | -.131* |
| Police | .033* | -.085* | -0.005 | 0.043 | -.136* |
| Sanitation | .017* | -.090* | -.010* | 0.06 | -.108* |
| Sewerage | 0.003 | -.109* | -.014* | 0.072 | -.153* |
| Utilities | -0.004 | -.095* | -.020* | 0.033 | -.148* |

* Coefficient significantly different from zero at 95%

Some interesting results are observed in this group of variables. First of all, the property value, which tries to represent counties' wealth, has a positive significant effect on wages for four activities (administration, highways, police and sanitation). This would imply that richer counties pay higher wage premia to their workers, ceteris paribus all the rest of effects. As politicians in these counties are able to rise revenues easily without affecting tax rates too much, it must be easier for them to accept unions' demands on wages. Meanwhile, the effect of property value on employment has not a determined sign for all activities.

The gross indicator of economic activity (*activ*), presents clear cut effects: positive for employment and negative for wages. While it seems obvious that the positive effect on employment may be explained by a demand factor, it is less intuitive how to interpret the observed effect on wages. Possible explanations could be that counties with more activity have

more competitive labour markets, which make wage premia more difficult to obtain for unions, or it could simply be the case that in those counties, wages outside public sector are generally higher (correlation ($w_a$, *activ*) = 0.495).

Population density presents a negative effect on the number of workers, which can be attributed to economies of scale, except for sewerage, for which it has a positive effect, and for utilities, where is not significantly different from zero. With respect to wages, density has a negative effect for most services. This can be explained in a similar manner as the economic activity effect: counties with higher density of population tend to have higher average wages (correlation ($w_a$, *dens*) = 0.298).

The use of part-time work has a clear negative effect on employment, as it could be expected, since workers considered in all estimations are full-time employees. Nevertheless, it is important to observe the magnitude of the effects: elasticities are in general bigger than 1 in absolute value, which means that productivity of part-time work in local governments' activity must be high. Another interesting result is that there is no impact at all on wages derived of the use of part-time work.

Finally, the unemployment rate has a negative effect both on employment and wages. On the employment side, several factors can be causing it: counties with high unemployment may have lower demands for services, and the reaction of voters to tax rises may be stronger. The effect of wages is clearer: unemployment rates directly affect unions' demands, since the smaller the probability of finding alternative jobs, the lower the wage premia obtained.

### *5.2.4 Financial resources*

Two variables are included in this group: revenues obtained from other sources than property tax (*R*), which basically comprises intergovernmental flows; and long-term debt issued for other purposes than education and utilities (*debt*). For utilities, it was possible to include debt issued specifically for that purpose (*utdebt).*

**Table 5.7: Financial resources (OLS estimations)**

| *Employment equation (dependent variable, L)* | | | |
|---|---|---|---|
| | *R* | *debt* | *utdebt* |
| Administration | .247* | -0.003 | - |
| Highways | .208* | 0.002 | - |
| Police | .362* | .015* | - |
| Sanitation | .382* | 0.016 | - |
| Sewerage | .325* | 0.003 | - |
| Utilities | .273* | 0.009 | .204* |
| *Wage premium equation (dependent variable, $w/w_a$)* | | | |
| | *R* | *debt* | *utdebt* |
| Administration | .091* | -0.005 | - |
| Highways | .067* | 0 | - |
| Police | .076* | -0.003 | - |
| Sanitation | .076* | -0.005 | - |
| Sewerage | .035* | -0.003 | - |
| Utilities | .071* | -.009* | .025* |

* Coefficient significantly different from zero at 95%

One of the more relevant and clear effects of all analysed variables is found for the external resources (*R*): the more revenue per inhabitant that a county receives from other levels of government, the higher the employment and wages for all activities considered. This effect seems to have a direct political interpretation: as external flows are more important, politicians can use more resources without affecting tax rates, therefore their actions are less perceived by voters. As the room for manoeuver is larger, we observe that discretion causes a rise in the cost of labour. It could be argued that external flows could be higher if some grants received depend on the actual number of employees, which could be an alternative explanation for the observed employment effect, but it definitely does not justify the wage premia effect.

Regarding the level of existent debt, it has no significant effect for almost any variable. However, for the case of utilities, the effect of *utdebt* is positive for both employment and

wages, which again supports the idea that the more external resources a county has, politicians use more discretion to pursue personal objectives.

## 6. Conclusions

This paper analyses political and unions' effects on employment and wages for six different services provided by most US local governments: administration, highways, police, sanitation, sewerage and utilities. US county areas are considered as units of observation, since they constitute homogeneous administrative divisions found across all states.

The model proposed is a variation of the efficient-bargaining model (McDonald and Solow, 1981), for the case of a bargaining process between public authorities and unions. Local governments are assumed to pursue objective functions which reflect their political interests, basically a seek of re-election for future periods. Thus, local politicians are assumed to be interested in providing services to the communities, but at the same time, they may choose to offer extra jobs for the service provision and to pay high wages, if this policy produces a higher number of votes for them. The main hypothesis tested in the model is that external controls over local politicians, in the form of state-level laws regulating the activity of local governments, have an effect on the shares of budgets spent on labour costs. If these controls are effective, tighter regulations would imply less room of manoeuver for politicians and, therefore, lower labour shares. A bargaining model is considered appropriate to test this hypothesis, since to these potential political effects, unions' effects must be superimposed.

The model is estimated using two complementary approaches. First, a system of non-linear simultaneous equations, formed of the first order conditions from the bargaining problem and a budget constraint, is estimated. This approach allows to obtain estimates for relevant parameters and to analyse political effects on labour costs' shares, though it heavily relies on the assumed functional forms determining the government's objective functions and its complexity limits the number of variables which can be included.

The second approach is to estimate a reduced-form of the same model, formed of two linear expressions: an employment equation and a wage-premium equation. This alternative estimation allows to include more variables to represent unions' strength and demand conditions, and to analyse separately the effects of variables on employment and wages.

Results of the non-linear model supports the hypothesis of negative effects of political controls over labour costs. Therefore, politicians seem to be using some discretion in the hiring of personnel to pursue personal objectives. Unions have relatively small bargaining powers, lower than the 0.5 value assumed for the Nash bargaining case. For almost all activities, estimates for the parameter of relative risk aversion ($\delta$) are smaller than 1, which indicates the presence of risk averse unions.

The reduced-form estimates confirms the negative effects of political variables obtained by the non-linear model. Moreover, it adds two interesting results: first, the average county wealth has a positive impact on the wage premia obtained by local governments' employees in most activities. And second, the larger the transfers received from other levels of governments, the higher the number of workers and higher wage premia are paid. The reading of both these results is clear: when politicians have more resources in their hands without the need to rise taxes, they use them more freely to increase labour costs. According to the model, a rise in labour costs would be pursued to increase the expected number of votes.

Finally, the reduced-form model also reveals that unions have a significant effect on wages, but less on employment. Unemployment rates affect unions' bargaining position, since it is obtained that higher rates decrease the number of employees and, more importantly, the wage premia obtained for all activities.

# 7. Appendix

*A) Definition of variables*

$L_i$: Number of full-time employees per 1,000 inhabitants, for activity i. *Source: CG* (i=administration, highways, police, sanitation, sewerage, utilities)

$w_i$: Average monthly wage, October 1987, for employees of activity i. *Source: CG*

$w_a$: Average wage level, October 1987, for private sector workers in each county area. *Source: CBP.*

t: Property tax rate, computed as the ratio property tax revenue/assessed property value. *Source: CG.*

P: Assessed property value for tax purposes. *Source: CG.*

R: Net intergovernmental transfers and other revenues apart from property taxes, per capita. *Source: CG.*

Deblim: Dummy variable, value 1 if local governments in county area have limits on issued debt. *Source: USACIR.*

Taxlim: Dummy, value 1 if local goverments have limits on property tax rates. *Source: USACIR.*

Audit: Dummy, value 1 if local governments' accounts must be externally audited. *Source: USACIR.*

Merit: Dummy, value 1if a merit system must be used to hire employees. *Source: USACIR.*

agrcov: Percentage of workers in all local governments' activities covered by collective agreements. *Source: CG.*

collbar: Dummy, value 1 if local governments are authorized to enter collective bargaining with employees.*Source: USACIR.*

strikes: Dummy, value 1 if public sector workers' strikes are permitted. *Source: USACIR.*

i_org: Percentage of organized workers in activity i (only available for highways, police and sanitation). *Source: CG.*

activ: Number of private sector workers per 1,000 inhabitants. *Source: CBP.*

dens: Density of population. *Source: CG.*

i_pperc: Percentage of part-time worked hours over total worked hours. *Source: CG.*

unempl: Unemployment rates for state level and selected metropolitan areas, November 1987. *Source: US Bureau of Labor.*

debt: Long-term debt per capita issued for other purposes than education and utilities. *Source: CG.*

utdebt: Long-term debt per capita linked to utilities' expenditure. *Source: CG.*

*Sources: CG= Census of Governments, 1987; CBP= County Business Patterns; USACIR=US Advisory Commission on Intergovernmental Relations.*

*B) Results of non-linear model estimations (FIML)*

## 1. Administration

Initial values: $\beta$=0.7; $\gamma$=0.35; $\delta$=0.7; $\alpha_0$=.02; $\alpha_1=\alpha_2=\alpha_3=\alpha_4$=0.

FULL INFORMATION MAXIMUM LIKELIHOOD
**********
EQUATIONS: EQ1 EQ2 EQ3
ENDOGENOUS VARIABLES: INVL W T

CONVERGENCE ACHIEVED AFTER 12 ITERATIONS
54 FUNCTION EVALUATIONS.

LOG OF LIKELIHOOD FUNCTION = -34773.8
NUMBER OF OBSERVATIONS = 2749

| Parameter | Estimate | Standard Error | t-statistic |
|---|---|---|---|
| BETA | 1.22193 | .020391 | 59.9251 |
| GAMMA | .119045 | .189853E-02 | 62.7036 |
| DELTA | .917200 | .523770E-02 | 175.115 |
| A0 | .078953 | .121885E-02 | 64.7764 |
| A1 | -.634486E-04 | .305263E-03 | -.207849 |
| A2 | -.017042 | .285769E-03 | -59.6371 |
| A3 | -.019257 | .341526E-03 | -56.3842 |
| A4 | .564340E-02 | .124594E-03 | 45.2943 |

Standard Errors computed from covariance of analytic first derivatives (BHHH)

---

## 2. Highways

Initial values: $\beta$=0.5; $\gamma$=0.5; $\delta$=0.7; $\alpha_0$=.09; $\alpha_1=\alpha_2=\alpha_3=\alpha_4$=0.

FULL INFORMATION MAXIMUM LIKELIHOOD
**********
CONVERGENCE ACHIEVED AFTER 21 ITERATIONS
81 FUNCTION EVALUATIONS.

LOG OF LIKELIHOOD FUNCTION = -33590.2
NUMBER OF OBSERVATIONS = 2539

| Parameter | Estimate | Standard Error | t-statistic |
|---|---|---|---|
| BETA | .900513 | .011186 | 80.5022 |
| GAMMA | .464978 | .374722E-02 | 124.086 |
| DELTA | .683375 | .330689E-02 | 206.652 |
| A0 | .068529 | .115041E-02 | 59.5696 |
| A1 | .028405 | .546278E-03 | 51.9978 |
| A2 | -.029211 | .653607E-03 | -44.6924 |
| A3 | -.886541E-02 | .437518E-03 | -20.2629 |
| A4 | -.711063E-03 | .395981E-03 | -1.79570 |

Standard Errors computed from covariance of analytic first derivatives (BHHH)

---

## 3. Police

Initial values: $\beta$=0.5; $\gamma$=0.5; $\delta$=1; $\alpha_0$=.08; $\alpha_1=\alpha_2=\alpha_3=\alpha_4$=0.

FULL INFORMATION MAXIMUM LIKELIHOOD
**********
EQUATIONS: EQ1 EQ2 EQ3
ENDOGENOUS VARIABLES: INVL W T

CONVERGENCE ACHIEVED AFTER 106 ITERATIONS
588 FUNCTION EVALUATIONS.

LOG OF LIKELIHOOD FUNCTION = -30437.6
NUMBER OF OBSERVATIONS = 2549

| Parameter | Estimate | Standard Error | t-statistic |
|---|---|---|---|
| BETA | .558628 | .010147 | 55.0544 |
| GAMMA | .262738 | .617833E-02 | 42.5257 |
| DELTA | .759913 | .481806E-02 | 157.722 |
| A0 | .054173 | .114994E-02 | 47.1090 |
| A1 | .015313 | .611337E-03 | 25.0482 |
| A2 | -.012368 | .581435E-03 | -21.2719 |
| A3 | -.207780E-02 | .466227E-03 | -4.45663 |
| A4 | .019136 | .508962E-03 | 37.5985 |

Standard Errors computed from covariance of analytic first derivatives (BHHH)

---

## 4. Sanitation

Initial values: $\beta$=1; $\gamma$=0.1; $\delta$=0.9; $\alpha_0$=.01; $\alpha_1=\alpha_2=\alpha_3=\alpha_4$=0.

FULL INFORMATION MAXIMUM LIKELIHOOD
**********

CONVERGENCE ACHIEVED AFTER 3 ITERATIONS
11 FUNCTION EVALUATIONS.

LOG OF LIKELIHOOD FUNCTION = -32868.2
NUMBER OF OBSERVATIONS = 2065

| Parameter | Estimate | Standard Error | t-statistic |
|---|---|---|---|
| BETA | 1.34091 | .060157 | 22.2904 |
| GAMMA | .040624 | .169534E-02 | 23.9621 |
| DELTA | .976796 | .102969E-02 | 948.631 |
| A0 | .013810 | .604997E-03 | 22.8263 |
| A1 | .334625E-02 | .171975E-03 | 19.4577 |
| A2 | -.727322E-03 | .503805E-04 | -14.4366 |
| A3 | -.210198E-02 | .101283E-03 | -20.7536 |
| A4 | -.768629E-03 | .571724E-04 | -13.4441 |

Standard Errors computed from covariance of analytic first derivatives (BHHH)

---

## 5. Sewerage

Initial values: $\beta=2$; $\gamma=0.1$; $\delta=0.9$; $\alpha_0=.09$; $\alpha_1=\alpha_2=\alpha_3=\alpha_4=0$.

FULL INFORMATION MAXIMUM LIKELIHOOD
**********
EQUATIONS: EQ1 EQ2 EQ3
ENDOGENOUS VARIABLES: INVL W T

CONVERGENCE ACHIEVED AFTER 16 ITERATIONS
75 FUNCTION EVALUATIONS.

LOG OF LIKELIHOOD FUNCTION = -32346.4
NUMBER OF OBSERVATIONS = 2222

| Parameter | Estimate | Standard Error | t-statistic |
|---|---|---|---|
| BETA | .160488 | .351716E-02 | 45.6299 |
| GAMMA | .207445 | .376730E-02 | 55.0645 |
| DELTA | .776505 | .428454E-02 | 181.234 |
| A0 | .010246 | .269865E-03 | 37.9663 |
| A1 | .388359E-02 | .130546E-03 | 29.7488 |
| A2 | .199464E-02 | .957389E-04 | 20.8342 |
| A3 | -.216295E-03 | .842551E-04 | -2.56714 |
| A4 | -.218755E-03 | .823653E-04 | -2.65591 |

Standard Errors computed from covariance of analytic first derivatives (BHHH)

---

## 6. Utilities

Initial values: $\beta=1$; $\gamma=0.2$; $\delta=0.9$; $\alpha_0=.01$; $\alpha_1=\alpha_2=\alpha_3=\alpha_4=0$.

FULL INFORMATION MAXIMUM LIKELIHOOD
**********
CONVERGENCE ACHIEVED AFTER 30 ITERATIONS
128 FUNCTION EVALUATIONS.

LOG OF LIKELIHOOD FUNCTION = -35454.1
NUMBER OF OBSERVATIONS = 2401

| Parameter | Estimate | Standard Error | t-statistic |
|---|---|---|---|
| BETA | 1.30627 | .067197 | 19.4395 |
| GAMMA | .022778 | .130867E-02 | 17.4057 |
| DELTA | 1.17756 | .012186 | 96.6297 |
| A0 | .039936 | .200122E-02 | 19.9558 |
| A1 | -.424814E-02 | .391621E-03 | -10.8476 |
| A2 | .188639E-02 | .266818E-03 | 7.06995 |
| A3 | -.811011E-03 | .206828E-03 | -3.92119 |
| A4 | .667124E-02 | .387202E-03 | 17.2294 |

Standard Errors computed from covariance of analytic first derivatives (BHHH)

---

*C) Results of the reduced-form estimations (OLS)*

1.Administration

| | **Employment equation** | | **Wage premium equation** | |
|---|---|---|---|---|
| Variable | Coef. | Std. Err. | Coef. | Std. Err. |
| P | .0532637 | .0124826 | .0263228 | .006251 |
| activ | .0948631 | .0249769 | -.103776 | .0125079 |
| dens | -.1664345 | .0081848 | .0068887 | .0040987 |
| adpperc | -1.684269 | .0623509 | .026251 | .0312239 |
| unempl | -.2829703 | .0409971 | -.1249281 | .0205304 |
| agrcov | .0547762 | .0060698 | .0045822 | .0030396 |
| collbar | -.0730991 | .0243359 | .0197693 | .0121869 |
| strikes | .0099243 | .05003 | .0516801 | .0250538 |
| R | .2466727 | .0293775 | .0907176 | .0147116 |
| debt | -.0031039 | .0071729 | -.0046505 | .003592 |
| deblim | -.0322819 | .0257804 | -.0557003 | .0129102 |
| taxlim | .2233442 | .025706 | -.0717427 | .012873 |
| audit | .0215999 | .0200834 | -.0058312 | .0100573 |
| merit | -.0287899 | .0206031 | -.108175 | .0103175 |
| constant | -1.372428 | .2358793 | .2028285 | .1181227 |
| | Number of obs = 2749 | | Number of obs = 2749 | |
| | F( 14, 2734) = 120.35 | | F( 14, 2734) = 34.52 | |
| | R-squared = 0.3813 | | R-squared = 0.1502 | |
| | Adj R-squared = 0.3781 | | Adj R-squared = 0.1458 | |

2. Highways

| | **Employment equation** | | **Wage premium equation** | |
|---|---|---|---|---|
| Variable | Coef. | Std. Err. | Coef. | Std. Err. |
| P | -.079706 | .019033 | .0371164 | .0057176 |
| activ | .1259962 | .0382075 | -.086563 | .0114778 |
| dens | -.2500996 | .0125443 | -.0280446 | .0037684 |
| hipperc | -1.757673 | .1597831 | -.0589182 | .0479999 |
| unempl | -.1809194 | .0630099 | -.1313978 | .0189286 |
| agrcov | .0622503 | .0103353 | .0298137 | .0031048 |
| collbar | .0575157 | .037486 | .0569273 | .011261 |
| strikes | -.0679976 | .0755543 | .0383248 | .022697 |
| hiorg | .0183321 | .0103052 | .0169562 | .0030958 |
| R | .207627 | .0438113 | .0665604 | .0131612 |
| debt | .0024081 | .0114752 | -.0005759 | .0034472 |
| deblim | -.2372069 | .0394531 | .0811311 | .011852 |
| taxlim | -.0774435 | .038525 | -.0142879 | .0115732 |
| audit | -.1493865 | .0304581 | .0022507 | .0091498 |
| merit | .0473641 | .0306365 | -.0399196 | .0092034 |
| constant | .3450572 | .356987 | .0373821 | .1072413 |
| | Number of obs = 2539 | | Number of obs = 2539 | |
| | F( 15, 2523) = 55.07 | | F( 15, 2523) = 75.15 | |
| | R-squared = 0.2466 | | R-squared = 0.3088 | |
| | Adj R-squared = 0.2422 | | Adj R-squared = 0.3047 | |

3. Police

| | Employment equation | | Wage premium equation | |
|---|---|---|---|---|
| Variable | Coef. | Std. Err. | Coef. | Std. Err. |
| P | .0406158 | .0127545 | .0330729 | .0050333 |
| activ | .3475702 | .0256691 | -.084893 | .0101297 |
| dens | -.0298095 | .0084855 | -.0052897 | .0033486 |
| popperc | -1.242655 | .1283506 | .0429964 | .0506506 |
| unempl | -.1992589 | .0415448 | -.1363901 | .0163947 |
| agrcov | -.0130574 | .0069256 | .0207424 | .002733 |
| collbar | -.0036943 | .0246739 | -.0025578 | .009737 |
| strikes | .2888493 | .0513866 | .0239001 | .0202785 |
| poorg | .010026 | .0065745 | .0213254 | .0025945 |
| R | .3621073 | .0298082 | .0758921 | .0117631 |
| debt | .0151303 | .0074344 | -.0026365 | .0029338 |
| deblim | -.1367986 | .0258881 | .0115304 | .0102161 |
| taxlim | .0447863 | .0256235 | .0001416 | .0101117 |
| audit | -.0202541 | .0201199 | -.0126953 | .0079399 |
| merit | -.0841179 | .0206545 | -.0423642 | .0081508 |
| constant | -3.817281 | .2498146 | .1698658 | .0985835 |
| | Number of obs = 2549 | | Number of obs = 2549 | |
| | F( 15, 2533) = 67.99 | | F( 15, 2533) = 52.89 | |
| | R-squared = 0.2871 | | R-squared = 0.2385 | |
| | Adj R-squared = 0.2828 | | Adj R-squared = 0.2340 | |

---

4. Sanitation

| | Employment equation | | Wage premium equation | |
|---|---|---|---|---|
| Variable | Coef. | Std. Err. | Coef. | Std. Err. |
| P | -.0498664 | .025732 | .0173828 | .0077401 |
| activ | .3172228 | .0533316 | -.0898337 | .0160419 |
| dens | -.1046142 | .0171633 | -.0101926 | .0051626 |
| sapperc | -1.348475 | .119706 | .0600789 | .0360069 |
| unempl | -.3202679 | .0827553 | -.1081679 | .0248924 |
| agrcov | -.1875636 | .0138321 | .0341104 | .0041606 |
| collbar | -.2535061 | .0514658 | .0593543 | .0154806 |
| strikes | -.342328 | .1041831 | .0234391 | .0313378 |
| saorg | .0210974 | .0133726 | .0168669 | .0040224 |
| R | .3819628 | .0611024 | .076465 | .0183793 |
| debt | .0158599 | .0150446 | -.0052436 | .0045253 |
| deblim | -.3293764 | .0525922 | .0306852 | .0158195 |
| taxlim | -.1163854 | .050703 | -.0017698 | .0152512 |
| audit | -.0783763 | .0410904 | .0296629 | .0123598 |
| merit | .0399575 | .0439766 | -.0495347 | .0132279 |
| constant | -3.386785 | .4915145 | -.0062225 | .1478451 |
| | Number of obs = 2065 | | Number of obs = 2065 | |
| | F( 15, 2049) = 50.43 | | F( 15, 2049) = 30.51 | |
| | R-squared = 0.2696 | | R-squared = 0.1826 | |
| | Adj R-squared = 0.2643 | | Adj R-square = 0.1766 | |

5. Sewerage

| | Employment equation | | Wage premium equation | |
|---|---|---|---|---|
| Variable | Coef. | Std. Err. | Coef. | Std. Err. |
| P | .0174718 | .0193642 | .0034849 | .0071468 |
| activ | .5893136 | .0422083 | -.1094935 | .0155779 |
| dens | .043451 | .0127643 | -.0137621 | .004711 |
| sepperc | -.9874429 | .1625095 | .0720183 | .0599777 |
| unempl | .0086445 | .0633387 | -.1530745 | .0233765 |
| agrcov | .007656 | .0092914 | .0367883 | .0034292 |
| collbar | -.0686743 | .0372369 | .0700028 | .0137431 |
| strikes | .0019652 | .0740825 | -.0400032 | .0273418 |
| R | .3247131 | .0457488 | .0354692 | .0168846 |
| debt | .0026981 | .0123353 | -.0034892 | .0045526 |
| deblim | -.131661 | .0413748 | .0341437 | .0152703 |
| taxlim | .1520057 | .0406098 | -.0296444 | .014988 |
| audit | .1044468 | .0312205 | .0016754 | .0115226 |
| merit | .0541894 | .0317344 | -.0486982 | .0117123 |
| constant | -7.206991 | .3752108 | .8062259 | .1384798 |
| | Number of obs = 2222 | | Number of obs = 2222 | |
| | F( 14, 2207) = 50.23 | | F( 14, 2207) = 37.01 | |
| | R-squared = 0.2416 | | R-squared = 0.1901 | |
| | Adj R-squared = 0.2368 | | Adj R-squared = 0.1850 | |

---

6. Utilities

| | Employment equation | | Wage premium equation | |
|---|---|---|---|---|
| Variable | Coef. | Std. Err. | Coef. | Std. Err. |
| P | -.075728 | .0223514 | -.0041309 | .007092 |
| activ | .4080701 | .0477665 | -.095101 | .0151562 |
| dens | -.0257842 | .014856 | -.0197997 | .0047138 |
| utpperc | -1.187709 | .1376093 | .0334456 | .043663 |
| unempl | .0424037 | .0724919 | -.1482472 | .0230015 |
| agrcov | -.0290326 | .0109146 | .0364274 | .0034632 |
| collbar | .0724021 | .044407 | .0645821 | .0140902 |
| strikes | .1176261 | .0884851 | -.0200446 | .0280761 |
| R | .2734475 | .0538959 | .0709362 | .017101 |
| debt | .009502 | .0137444 | -.0093905 | .0043611 |
| utdebt | .2041355 | .0108723 | .0247951 | .0034498 |
| deblim | -.3465065 | .0468893 | -.0274779 | .0148778 |
| taxlim | .0439177 | .0461935 | -.0365846 | .0146571 |
| audit | .1522616 | .0359409 | .0020664 | .011404 |
| merit | .0503171 | .0370855 | -.0226003 | .0117671 |
| constant | -4.641362 | .4285029 | .5916848 | .1359627 |
| | Number of obs = 2401 | | Number of obs = 2401 | |
| | F( 15, 2385) = 54.39 | | F( 15, 2385) = 35.34 | |
| | R-squared = 0.2549 | | R-squared = 0.1819 | |
| | Adj R-squared = 0.2502 | | Adj R-squared = 0.1767 | |

# SUMMARY AND GENERAL CONCLUSIONS

It is probably not too exaggerated to affirm that privatisation of publicly-owned firms has been one of the most popular economic policies practised by governments since the late 1980's. In about a decade, the size of public sectors has been substantially reduced in many western countries, but the policy has not been restricted to developed countries. Privatisation has been specially important in the transition of former communist countries to capitalist economies, although the process has special features for those States, since property rights were only diffusely defined in the pre-privatisation period.

The initial motivation that originated this work was a personal interest in understanding the whole phenomenon of privatisation that we have witnessed in the last fifteen years, specially for developed European countries. Before 1980, it was extremely rare to hear any proposal from academics or politicians favouring a transfer of state-owned enterprises (SOE's) to the private sector, up to the point that even the actual term 'privatisation' did not exist. However, since Britain pioneered the first privatisations in the early 1980's, it has been difficult to open economic newspapers without finding a headline about some particular privatisation. To an economist, the speed at which this process has developed and the wide spread across countries are the most startling features of privatisation.

What are the reasons behind this phenomenon? Governments usually justify their sales of SOE's on the basis of efficiency improvements. It is common wisdom, and it has been also empirically shown (Borcherding et al, 1982; Vining and Boardman, 1992), that public firms are generally less cost-efficient than private firms. Typical efficiency problems of public firms are technical (low productivities from inputs, slow adoption of new technologies, low effort from managers) and also generated by an incorrect use of inputs and prices paid, what has been named in this work as an 'input-mix' type of inefficiency (overstaffing, high wages). On the other hand, there are arguments justifying the higher costs of SOE's, since these firms have

been sometimes used to pursue social objectives. The debate about public/private firm is a very old one, and it will probably still remain unsettled for a long time, since it is usually more based on ideological than on economic arguments. Nevertheless, the present trend towards privatisation poses very interesting queries, from a theoretical point of view, about the inefficiency of public firms and the transfer of ownership. There are three main questions that this thesis tries to answer:

*(a) Why governments have endured inefficient public firms for long periods, and have started only recently to transfer them to the private sector in a worldwide trend?*

*(b) What is the role that political ideology and rising public deficits have played in privatisation decisions?*

*(c) Are there any fundamental reasons linked to public ownership that generate inefficiency problems in public firms?*

If one turns to the available economic theory on public firms and privatisation to try to answer these questions, results are not completely satisfactory. First, traditional economic theory about public sector was developed almost exclusively from a normative point a view. This literature is more concerned on the design of optimal pricing systems than on the actual working of SOE's. As a matter of fact, when privatisation started to be applied, it was a policy implemented almost on faith, since there was no sound economic analysis to justify the welfare gains that it was assumed to generate. Theoretical works on the question of privatisation were simply non-existent before the policy started in the 1980's.

Since that time, many papers have been written on this topic, but it is not yet clear to me that we may claim to have a satisfactory 'privatisation theory'. The problem is that most of the models developed to analyse efficiency differences assume different objective functions for public and private firms. Even if this might sound correct, in fact it is a misleading assumption since it places firms on non-comparable grounds. In order to seek for fundamental reasons that generate differences between public and private firms, one should make comparisons between firms under different ownership structures but with similar objectives.

As a matter of fact, the best theoretical contributions on this field have tried to perform the analysis in that way. Even if each model has its own features, a common striking result is generally found in all of these works: under abstract perfect conditions, ownership would not matter at all. This result is obtained by Sappington and Stiglitz (1987), Shapiro and Willig (1990), Schmidt (1990, 1995), and Shleifer and Vishny (1994). Throughout this thesis I have referred to this result as the 'irrelevance proposition'. The idea is that if ownership does not have an influence on outcomes, a public firm could perform as efficiently as a private firm and therefore privatisation would not be required. And conversely, a private firm could be used to pursue the same social objectives which are assumed for public firms.

The objective of the privatisation literature has been then to identify reasons which may explain why this proposition is observed not to be valid in practice. The most trodden path to the problem has been to examine the role that managers play in the productive and allocative efficiency of public and private firms. Assuming the existence of some level of effort that a manager should exert optimally for a firm to be productively efficient, and some asymmetries of information between firm owner and manager, it is possible to derive differences in the outcomes of public and private firms, which would explain the lower efficiency of SOE's.

The basic result obtained in models based on this 'managerial approach' is a trade-off between productive an allocative efficiency. Thus, public firms would typically be productively inefficient because their managers have poorer incentives to exert optimal levels of effort on cost saving activities. This idea goes back to the seminal work of Leibenstein (1966) on X-efficiency. But, on the other hand, private firms tend to be less allocatively efficient, since the price set by a public firm is generally closer to a social optimum. When it must be decided whether a firm is to be privatised or kept as public, a balance between these two objectives should be considered.

Even if these models offer a good intuition on the benefits and costs of privatisation for society, they are not completely satisfactory. Two criticisms can be made in general to all of them. First, obtained results depend extensively on the assumption of asymmetric information between government and regulated private firm, which allows the latter to extract some

information rents. In that sense, privatisation is a mechanism for the government to be less informed on a firm and thus improve the incentives for managers to work efficiently. The difficulty is then to justify why a government cannot choose to behave as a private owner without selling the firm.

A second criticism to the managerial approach to privatisation would be that the answer it provides to the question about the origin of SOE's inefficiencies is not completely convincing. In particular, this answer is relatively poor to justify one the main problems detected in public firms: excess of employees. Unless low managers' efforts might be interpreted to result in suboptimal technologies which require a higher number of workers —or in too weak positions at collective bargaining with unions, which might lead to overstaffing— it is difficult to understand what is the interest of publicly owned firms in hiring too many employees. Additionally, this managerial approach cannot explain the timing of the process (i.e. why many governments have started to sell firms almost simultaneously), and neither what is the importance that public deficits may have had in the process.

Therefore, it seems that a more comprehensive theory of privatisation is required. The most attractive alternative is a 'political approach', which may allow to study the problem from a positive perspective, since politicians are likely to play a relevant part on this problem. This approach would be in the tradition of the Public Choice school (Buchanan and Tullock, 1962) and the analysis of bureaucracy (Niskanen, 1971). Some papers on privatisation have already started to change the focus from managers to politicians, as Shleifer and Vishny (1994), Laffont (1996), Boycko et al (1996) and Bennedsen (1997). The main change proposed by the political approach to privatisation is to drop off the assumption of social welfare-maximising governments. A more realistic description is to assume self-interested agents, concerned more on personal agendas than on welfare. The relevant question in this case is why a politician may have a preference to seek personal objectives through a public firm instead of a regulated private firm, as it has been observed empirically (López-de Silanes et al, 1995).

This thesis tries to offer some contributions to this line of research. Two voting models are proposed, which may provide some answers to the three basic questions posed above. In both

of them, a non-benevolent government concerned exclusively on votes' maximisation is assumed, and managers' effects are completely ignored. Even if it is recognised the importance of managers in the outcomes obtained by public firms, it is considered that their effects are of second order compared to political effects.

In chapter 2, a model is proposed to explore what is the role of ideologies from political parties in determining equilibria about privatisation decisions. A second feature studied in the model is the effect that public sector deficits may have had in leading governments to sell firms. Based on the existent empirical evidence, the model assumes exogenously that a public firm is productively inefficient, since it is not intended to show how inefficiencies are generated, but the effect they might cause on privatisation. Three distinct types of productive inefficiencies are assumed, in order to analyse separately their effects: excess of employment, higher wages than in private sector, and technical inefficiency from inputs other than labour.

A particular structure is assumed to try to reflect the actual process of decision-making over public firms during the last decades. It considered that there only exist two political parties, with opposite ideologies on the question of public ownership of firms. Ideology is defined as an exogenous bias towards a particular policy, which may bring political parties some monetary or other form of support from sponsors. In a first stage, these parties compete at an election for office, where they offer proposals to voters on the price to charge for a publicly provided good or service, which is equivalent to determine the size of the public firm producing it. On the other hand, voters have some degree of attachment to political parties, even though this ideological preference is not directly related to the question of firms' ownership. Voters' ideologies are exogenous preferences to vote for a party, although voters do compare proposals from parties and cast their ballots to the party offering them the higher utility levels. Equilibria in this electoral game determines which party is in office, and what is the final size of the public firm. Multiple equilibria are found, basically dependent on the structure of society (distribution of income and preferences), and a general deviation from the median voter result is obtained. Departures from the median voter theorem are due to the assumed ideology from voters, and they have also been obtained in other models (Lindbeck and Weibull, 1993; Helpman, 1996).

On a second stage, parties play another political game in which it is decided a possible transfer of the firm to the private sector. This second game is based on parties' positions obtained in the first stage (price proposals), and parties evaluate the potential impact on votes in a future election that privatisation may cause. However, the question is not raised for the electorate to vote on that matter, again to try to reflect how privatisation of firms has been usually decided upon. The party in office (determined by the equilibrium in the first game) is the one that takes the final decision on ownership of the firm, though the proposal from the party in opposition plays an important role. Again, multiple equilibria can be found in this second political game, but the most interesting point is to study conditions that sustain each potential equilibrium. Thus, it is found that the more relevant factors determining privatisation are those related to productive inefficiency of public firms.

However, it is shown that it is not a sufficient condition that a public firm is cost-inefficient for it to be privatised. Only a large degree of overstaffing and technical inefficiencies from inputs other than labour are important causes of privatisation. Meanwhile, high wages for production workers may have the opposite effect: even if they raise costs above efficient levels, they might easily sustain a political equilibrium where neither party proposes to privatise the firm. Other factors affecting equilibria are ideology from parties and public sector deficits, but both these have been shown to play a minor indirect role in modifying parties' strategies on the question of ownership.

Two particular equilibria are studied in detail, since they constitute the more interesting cases offering some answers to the relevant questions on privatisation proposed above. The first case considers a predominantly politically oriented right-wing society, where a conservative party wins elections on a proposal for a small public firm. Once in office, this party is likely to privatise the firm, but under some conditions, it might sustain an equilibrium where an inefficient public firm remains in public sector. These conditions are namely a low degree of technical inefficiency, little overstaffing, and relatively high wages for public workers. If the ideological commitment of the party is not too strong, it might easily not honour its belief on private ownership of firms and keep the firm as public.

This particular example may illustrate the situation in many western economies before the 1980's. However, changes in some conditions (basically, a rise in the public firm's inefficiency, but not from high wages) may alter this equilibrium and lead to privatisation of the firm. Another factor modifying the equilibrium is a tighter public sector budget constrain, although the model shows how the link between fiscal needs and privatisation is relatively weak, since it only affects the equilibrium through an effect on a relatively small group of individuals (public sector workers who are ideologically more close to the right-wing party). This result allows to understand the low correlation found between privatisation and fiscal needs in OECD countries.

The second equilibrium analysed corresponds to an almost symmetrical situation, with a left-wing politically oriented society and a Labour party winning elections on a proposal for a large public firm. Although this party has a preference for public ownership, and it will likely keep the initial status quo unmodified, again rises in the public firm's inefficiency generated by factors other than wages, and increasing public sector deficits may lead the party to privatise the firm, if the rival party launches that proposal to voters. The ideological position of the left-wing party may be extremely dangerous in this situation: a strong belief in public ownership might result in a defeat at an election, even if the party is in principle supported by a majority of individuals. This feature from the model may explain why some traditional left-wing parties (e.g. British Labour Party UK[22], and Spanish Socialist Party) have cut-off their historical links with trade unions *before* accepting or implementing themselves privatisation policies.

Even if this model on ideology is somehow rigid in its assumptions and structure, it offers some interesting intuitions to explain some features of the process of privatisation. First, it is shown that the hypothesis of privatisation being caused by a general ideological revision of the role of the State in the economy is relatively weak. Results show that, even if political parties do not modify at all their positions regarding their beliefs on ownership, it is possible to sustain many political equilibria in which inefficient firms can be kept as public, resulting in a Pareto suboptimal allocations, or alternatively they can be privatised. Second, the model

[22] In the case of the British Labour Party, another interesting step in the process of ideological change was the modification of the old Clause IV of its constitution in 1995, after strong internal debates. This clause was referred to the traditional commitment of the party to public ownership.

allows to understand the main factors causing changes in these equilibria and to interpret the global world trend towards privatisation. Severe problems of overstaffing added to technical inefficiency generated by slower adoption of innovations and lack of effort from managers (as pointed out in the 'managerial' approach to privatisation) have caused over the years a situation of extremely inefficient public firms. If we superimpose to these problems a situation of growing public sector deficits, it is possible to interpret why political equilibria have rapidly changed and privatisation has become an attractive electoral option. Once that a country was able to show the possibility of transferring large firms to the private sector without major disruptions, (the UK has played this role in practice), the rest of countries have changed from one equilibrium to another almost immediately.

Chapter 3 presents another voting model, exploring the effect of public ownership on the size of public firms and the reported problems of overstaffing. In order to compare firms on equal grounds, the model assumes that a non-benevolent government is interested in building an infrastructure project or in the provision of some public service, which in both cases are financed through taxes. Three alternative types of firms are assumed to build the project or provide the service: a publicly-owned firm, a private contractor regulated by a complete contract, or a private contractor working under an incomplete contract.

Under all three ownership schemes, the government chooses the size of the project to be implemented or the level of services to be provided. This choice is made under uncertainty on the final valuation by consumers of the infrastructure/services, which depends on some random state of nature. In order to focus on the number of workers as a key variable, the only relevant production factor considered is labour. The solution to the government's problem involves the determination of some initial project size without information on the final valuation by consumers, and some possible ex-post adjustments to this initial size.

Result indicate that suboptimal outcomes can arise under the three ownership schemes. In some states of nature, larger than optimal project sizes are implemented. In those cases, since consumers do not derive additional utility from the excess of capacity, it is likely that the government may not eventually require the firm to produce the maximum output, as long as

employment is maintained at the desired level, and consumers reach their maximum utility. In those conditions, it would be observed that firms do not obtain maximum productivity levels from employees, or equivalently, firms would be inefficiently overstaffed. The more relevant finding of the model is that public ownership of firms typically results in larger firms than optimal in more states of nature compared to external private contractors, therefore more likely to have an excess of employment. On the other hand, contracted private firms tend to underprovide infrastructure or services in more states of nature. The situation is relatively improved if a complete contract is signed: less underprovision occurs in that case.

Another result is that the total number of votes is usually smaller under contracting that under public ownership. This would imply that a government would never have incentives to give up public ownership if it could freely choose the provision scheme, since privatisation implies losing a number of votes. This result would explain the observed preference of politicians for direct ownership instead of contracting-out, as reported by López-de-Silanes et al (1995).

The fundamental contribution of this model is to provide an answer to the question of why the irrelevance proposition does not hold. In this case, the point that it is analysed is basically the size of firms in terms of number of employees. Here, even if the government is able to replicate the same outcomes under public or private ownership, it chooses differently in its own interest. Changes in the voting pattern of workers and contracting costs with an external private firm are the only factors that generate ownership effects. The less important the changes in the voting behaviour of workers after privatisation and the lower the contracting costs, the smaller effect that privatisation would have on improving public firms' efficiency.

Finally, some remarks on privatisation of particular industries can be made. Public firms tend to be inefficiently large for political reasons, therefore privatisation yields efficiency gains if voting patterns of workers are altered. However, some underprovision of infrastructure or services can occur when goods are provided by private contractors. This problem is more important if an incomplete contract between government and firm is signed. Therefore, for industries in which changes in consumers' needs are unfrequent, relatively predictable, and easy to write down in a contract, privatisation would be highly positive. However, if regulation

involves large contracting costs and demands vary frequently on some non-predictable aspects, privatisation would not unambiguously improve the outcome of publicly-owned firms, since adequate adjustments must then be made through re-negotiations with private firms instead of being directly implemented by governments.

The next two chapters of this thesis present two empirical case studies on the relative inefficiency of publicly-owned firms and the importance of political effects, which are aimed to support those results derived in the theoretical models. Chapter 4 studies the Spanish urban bus industry, where it is detected in a descriptive analysis that public firms are substantially overstaffed and they pay higher wages than private counterparts. A more rigorous analysis is thereafter performed by estimating a cost function. Results unequivocally indicate that there is a high degree of productive inefficiency in public firms. As both public and private operators are regulated according to similar franchise systems, these findings indicate that politicians have a preference for pursuing personal agendas by imposing larger inefficiencies on publicly- owned than on regulated firms. These observations seem to confirm the results of the overstaffing model in chapter 3. Moreover, the large gap observed in wages could justify why, according to results from the ideology model in chapter 2, no proposals have been heard to privatise these highly inefficient public urban bus companies. Another objective of this case study is to show an example of the methodology usually employed to assess public firms' inefficiency (estimation of cost or production functions).

Chapter 5 tries to evaluate the relevance of political effects on the efficiency of provision of services for the case of US local governments. Even if not all the services can be assimilated to the 'industrial' type of goods and services subject to privatisation, which are the object of study in this thesis, the exercise offers a good test of the impact of politicians on employment and wages. US local governments offer a perfect framework for the analysis, since there are different degrees of control over local politicians across states (regulation of local activity is not based on federal, but on state-level laws). Moreover, it is easy to identify which are the financial resources available, since local governments' financial structure is simple.

An efficient bargaining model between a union and a non-benevolent government in the line of McDonald and Solow (1981) is proposed and solved to offer a framework for the analysis. First order conditions and reduced-form equations from this model are estimated using data from 1987. Results indicate that the looser the controls over politicians and the more resources available from other levels of government imply a higher number of employees and better wages. Therefore, from this evidence found for a case of publicly provided services, it may be inferred that political effects are also likely to be present in SOE's. Politicians, more than managers, would be the real origin of the inefficiency problem of public firms.

Finally, some general conclusions from the theoretical and the empirical work presented in this thesis can be extracted. There seems to exist enough evidence to justify that the process of privatisation must be studied from a political economy perspective. Inefficiency problems observed in public firms are likely to be mainly generated by political interferences, according to the importance of observed effects, although the role of managers pointed out by the existent literature on privatisation should not be fully neglected. However, the political approach to privatisation is still in its infancy as a theory block. In general, existent models rely too heavily on *ad hoc* assumptions (a criticism that specially applies to the models presented in this thesis) about incentives of politicians and benefits that they receive. As pointed out by Hart (1995), an interesting point, still unsatisfactorily studied, is to try to derive endogenously what is the objective function for a government to pursue. A more complete understanding of the working of political markets and public firms is needed for economists to finally settle the debate of public vs. private firms, and to try to avoid that the current process of privatisation of public firms might be reversed in the future, starting a new nationalisation/privatisation cycle.

## References


Aghion, P.; O. Blanchard and R. Burgess (1994): "The Behaviour of State Firms in Eastern Europe, Pre-Privatisation", *European Economic Review*, 38, 1327-1349.

Anderson, S.P.; A. de Palma and J.F. Thisse (1997): "Privatization and Efficiency in a Differentiated Industry", *European Economic Review*, 41 (9), 1635-1654.

Atkinson, A.B. and J.E. Stiglitz (1980): *Lectures on Public Economics*, McGraw-Hill, London.

Baron, D.P. and R.B. Myerson (1982): "Regulating a monopolist with unknown costs", *Econometrica*, 50, 911-930.

Barrow, M. and A. Wagstaff (1989): "Efficiency Measurement in the Public Sector: an Appraisal", *Fiscal Studies*, 10, 72-97.

Bean, C.R. and P.J. Turnbull (1988): "Employment in the British Coal Industry: a Test of the Labour Demand Model", *Economic Journal*, 98, 1092-1104.

Beesley, M.E. (1991): "Bus Deregulation: Lessons from the UK", *Transportation Planning and Technology*, 15, 95-106.

Bennedsen, M. (1997): "Political Ownership", Harvard University, mimeo, unpublished Ph.D. dissertation.

Besley, T. and A. Case (1995): "Incumbent Behaviour: Vote-Seeking, Tax-Setting, and Yardstick Competition"; *American Economic Review*, 85 (1), 25-45.

_____ and S. Coate (1996): "Lobbying and Welfare in a Representative Democracy", mimeo.

Bhaskar, V. and M. Khan (1995): "Privatization and Employment: A Study of the Jute Industry in Bangladesh", *American Economic Review*, 85 (1), 267-273.

Bishop, M.; J. Kay and C. Mayer, eds. (1994): *Privatization and economic performance*, Oxford University Press, Oxford.

Boardman, A.E. and A.R. Vining (1989): "Ownership and Performance in Competitive Environments: A Comparison of the Performance of Private, Mixed and State-Owned Enterprises, *Journal of Law and Economics*, 32, 1-33.

Borcherding, T.E.; W.W. Pommerehne and F. Schneider (1982): "Comparing the Efficiency of Private and Public Production: The Evidence from Five Countries", *Zeitschrift für Nationalökonomie/Journal of Economics*, Supplement 2, 127-156.

Bös, D. (1981): *Economic Theory of Public Enterprises*, Springer-Verlag, Berlin.

_____ (1991): *Privatization: A Theoretical Treatment*, Clarendon Press, Oxford.

_____ (1993): "Privatization in Europe: A Comparison of Approaches", *Oxford Review of Economic Policy*, 9 (1), 95-111.

Boycko, M.; A. Shleifer and R.W. Vishny (1993): "Privatizing Russia", *Brooking Papers on Economic Activity*, 2, 139-192.

_____, _____, _____ (1996): "A Theory of Privatization", *Economic Journal*, 106, 309-319.

Buchanan, J.M. and G. Tullock (1962): *The Calculus of Consent*, University of Michigan Press, Ann Arbor, Michigan.

Bughin, J. (1993): "Union-Firm Efficient Bargaining and Test of Oligopolistic Conduct", *Review of Economics and Statistics*, 75, 563-567.

Button, K. and T. Weyman-Jones (1993): "X-inefficiency and Regulatory Regime Shift in the UK", *Journal of Evolutionary Economics*, 3, 269-284.

Caillaud, B.; R. Guesnerie; P. Rey and J. Tirole (1988): "Government Intervention in Production and Incentives Theory: A Review of Recent Contributions", *Rand Journal of Economics*, 19 (1), 1-26.

Christensen, L.R.; D.W. Jorgensen and L.J. Lau (1973): "Transcendental Logarithmic Production Frontiers", *Review of Economics and Statistics*, 55, 28-45.

Chow, G.C. (1983): *Econometrics*, Economics Handbook Series, McGraw-Hill.

Clarke, T. and C. Pitelis, eds. (1993): *The Political Economy of Privatization*, Routledge, London.

_____ (1993): "The Political Economy of the UK Privatization Programme: A Blueprint for Other Countries?", in Clarke, T. and C. Pitelis, eds., *op cit.*

Coughlin, P. (1986): "Elections and Income Redistribution", *Public Choice*, 50, 27-91.

De Alessi, L. (1969): "Some Implications of Property Rights for Government Investment Choices, *American Economic Review*, 59, 16-23.

De Fraja, G. (1991): "Efficiency and Privatisation in Imperfectly Competitive Industries", *Journal of Industrial Economics*, 39 (3), 311-321.

_____ (1993a): "Productive Efficiency in Public and Private Firms", *Journal of Public Economics*, 50, 15-30.

De Fraja, G. (1993b): "Unions and Wages in Public and Private Firms: A Game-Theoretic Analysis", *Oxford Economic Papers*, 45, 457-469.

_____ and Delbono, F. (1989): "Alternative Strategies of a Public Enterprise in Oligopoly", *Oxford Economic Papers*, 41, 302-311.

De Rus, G. (1989): "El transporte público urbano en España: comportamiento de los costes y regulación de la industria", *Investigaciones Económicas*, 13 (2), 207-225.

_____ (1990): "Public Transport Demand Elasticities in Spain", *Journal of Transport Economics and Policy*, 24 (2), 189-201.

_____ and G. Nombela (1997): "Privatisation of Urban Bus Services in Spain", *Journal of Transport Economics and Policy*, 31 (1), 115-129.

Dewatripont, M. and G. Roland (1992): "Economic Reform and Dynamic Political Constraints", *Review of Economic Studies*, 59, 703-730.

Dodgson, J.S. and N. Topham (1987): "Benefit-Cost Rules for Urban Transit Subsidies", *Journal of Transport Economics and Policy*, 21, 57-71.

Downs, A. (1957): *An Economic Theory of Democracy*, Harper&Row, New York.

Dowrick, S. (1989): "Union-Oligopoly Bargaining", *Economic Journal*, 99, 1123-1142.

Eberts, R.W. and J.A. Stone (1986): "On the Contract Curve: a Test of Alternative Models of Collective Bargaining", *Journal of Labor Economics*, 4 (1), 66-81.

Ehrenberg, R.G. (1973): "Municipal Government Structure, Unionization, and the Wages of Fire Fighters", *Industrial and Labor Relations Review*, October, 36-48.

Ehrenberg, R.G. and G.S. Goldstein (1975): "A Model of Public Sector Wage Determination", *Journal of Urban Economics*, 2, 223-245.

Enelow, J. and M. Hinich (1989): "A General Probabilistic Spatial Theory of Election", *Public Choice*, 61, 101-113.

Farrell, M.J. (1957): "The Measurement of Productive Efficiency", *Journal of the Royal Statistical Society*, Series A, 120, 253-282.

Fernandez, R. and D. Rodrik (1991): "Resistance to Reform: Status Quo Bias in the Presence of Individual-Specific Uncertainty", *American Economic Review*, 81 (5), 1146-1155.

Freeman, R.B. (1986): "Unionism Comes to the Public Sector", *Journal of Economic Literature*, 24, 41-86.

Freeman, R.B. and R.G. Valletta (1988): "The Effects of Public Sector Labor Laws on Labor Market Institutions and Outcomes", in R.B. Freeman and C. Ichniowski (eds): *When Public Sector Workers Unionize*, University of Chicago Press.

Glaeser, E.L. and J.A. Scheinkman (1996): "The Transition to Free Markets: Where to Begin Privatization", *Journal of Comparative Economics*, 22, 23-42.

Gravelle, H.S.E. (1982): "Incentives, Efficiency and Control in Public Firms", *Zeitschrift für Nationalökonomie/Journal of Economics*, Supplement 2, 79-104.

_____ (1984): "Bargaining and Efficiency in Public and Private Sector Firms", in Marchand, M.; P. Pestieau and H. Tulkens, eds., *op. cit.*

Grossman, S.J. and O. D. Hart (1986): "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration", *Journal of Political Economy*, 94 (4), 691-719.

Grossman, G.M. and E. Helpman (1996): "Electoral Competition and Special Interest Politics", *Review of Economic Studies*, 63, 265-286.

Grout, P. (1987): "The Wider Share Ownership Programme", *Fiscal Studies*, 8(3), 59-74.

Hansson, I. and C. Stuart (1984): "Voting Competitions with Interested Politicians: Platforms Do Not Converge to the Preferences of the Median Voter", *Public Choice*, 44, 431-442.

Harberger, A.C. (1954): "Monopoly and Resource Allocation", *American Economic Review*, 54 (2), 77-87.

Hart, O. (1995): *Firms, Contracts and Financial Structure*, Oxford University Press, Oxford.

_____ and J.H. Moore (1990): "Property Rights and the Nature of the Firm", *Journal of Political Economy*, 98 (6), 1119-1158.

_____; A. Shleifer; and R.W. Vishny (1995): "The Proper Scope of Government: Theory and an Application to Prisons", Harvard University, mimeo.

Haskel, J. and S. Szymanski (1993): "Privatization, Liberalization, Wages and Employment: Theory and Evidence for the UK", *Economica*, 60, 161-82.

_____ and A. Sanchís (1995): "Privatisation and X-Inefficiency: A Bargaining Approach", *Journal of Industrial Economics*, 53 (3), 301-321.

Heath, J., ed. (1990): *Public Enterprise at the Crossroads: Essays in Honour of V.V. Ramanadham*, Routledge, London.

Heseltine, P.M. and D.T. Silcock (1990): "The Effects of Bus Deregulation on Costs", *Journal of Transport Economics and Policy*, 24, 239-254.

Hinich, M.J.; J.O. Ledyard and P.C. Ordeshook (1972): "Nonvoting and the Existence of Equilibrium under Majority Rule", *Journal of Economic Theory*, 4, 144-153.

Hyman, H. (1989): "Privatisation: The Facts", in C. Veljanovski, ed., *Privatisation and Competition*, London, Institute of Economic Affairs.

IMF (1995): *International Financial Statistics Yearbook*, International Monetary Fund, Washington DC.

Jenkinson, T. and C. Mayer (1988): "The Privatisation Process in France and the UK", *European Economic Review*, 32, 482-490.

Jones, L.P.; P. Tandon and I. Vogelsang (1990): *Selling Public Enterprises: A Cost-Benefit Methodology*, MIT Press, Cambridge, Massachusetts.

Kay, J. and D. Thompson (1986): "Privatisation: A Policy in Search of a Rationale", *Economic Journal*, 96, 18-32.

Laffont, J.J. (1996): "Industrial Policy and Politics", *International Journal of Industrial Organization*, 14, 1-27.

_____ and J. Tirole (1991): "Privatization and Incentives", *Journal of Law, Economics and Organization*, 7, 84-105.

Leibenstein, H. (1966): "Allocative Efficiency vs. 'X-efficiency' ", *American Economic Review*, 56, 392-415.

Lewin, A.Y. and C.A.K. Lovell, eds. (1990): "Frontier Analysis: Parametric and Nonparametric Approaches", *Journal of Econometrics*, 46 1-245.

Lindbeck, A. and J.W. Weibull (1987): "Balanced-Budget Redistribution as the Outcome of Political Competition", *Public Choice*, 52, 273-297.

_____ , _____ (1993): "A Model of Political Equilibrium in a Representative Democracy", *Journal of Public Economics*, 51, 195-209.

López-de-Silanes, F. (1995): "Determinants of Privatization Prices", Harvard University, mimeo.

_____ ; A. Shleifer and R.W. Vishny (1995): "Privatization in the United States", NBER Working Paper no. 5113.

MaCurdy, T.E. and J.H. Pencavel (1986): "Testing between Competing Models of Wage and Employment Determination in Unionized Markets", *Journal of Political Economy*, 94 (3), S3-S39.

Manning, A. (1987): "An Integration of Trade Union Models in a Sequential Bargaining Framework", *Economic Journal*, 97, 121-139.

Marchand, M.; P. Pestieau and H. Tulkens, eds. (1984): *The Performance of Public Enterprises: Concepts and Measurement*, Elsevier Science Publishers, Amsterdam.

Matas, A. (1991): "La demanda de transporte urbano: elasticidades y tiempo", *Investigaciones Económicas*, 25, 249-268.

McDonald, I.M. and R.M. Solow (1981): "Wage Bargaining and Employment", *American Economic Review*, 71 (5), 896-908.

Millward, R. and J. Singleton, eds. (1995): *The Political Economy of Nationalisation in Britain, 1920-1950*, Cambridge University Press, Cambridge.

Myerson, R.B. and R.J. Weber (1993): "A Theory of Voting Equilibria", *American Political Science Review*, 87, 102-114.

Niskanen, W.A. (1971): *Bureaucracy and Representative Government*, Aldline, Chicago.

Oswald, A. (1993): "Efficient Contracts Are on the Labour Demand Curve", *Labour Economics*, 1, 85-113.

Ott, A.F. and K. Hartley, eds. (1991): *Privatization and Economic Efficiency: A Comparative Analysis of Developed and Developing Countries*, Elgar, London.

Perotti, E.C. (1995): "Credible Privatization", *American Economic Review*, 85 (4), 847-859.

Pint, E.M. (1991): "Nationalization vs. Regulation of Monopolies: The Effects of Ownership on Efficiency", *Journal of Public Economics*, 44, 131-164.

*Privatisation Yearbooks*: 1994, 1995 and 1996; London Privatisation International Ltd., London.

Ramanadham, V.V., ed. (1993): *Constraints and the impacts of privatization*, Routledge, London.

_____, ed. (1994): *Privatization and After: Monitoring and Regulation*, Routledge, London.

Rees, R. (1976): *Public Enterprise Economics*, Weidenfeld and Nicolson, London.

Robinson, C. and N. Tomes (1984): "Union Wage Differentials in the Public and Private Sectors: A Simultaneous Equations Specification", *Journal of Labor Economics*, 2 (1), 106-127.

Roland, G. (1994): "On the Speed and Sequencing of Privatization and Restructuring", Centre for Economic Policy Research, CEPR Discussion Paper n. 942.

Roland, G. and T. Verdier (1994): "Privatization in Eastern Europe: Irreversibility and Critical Mass Effects", *Journal of Public Economics*, 54, 161-183.

Sappington, D.E.M. and J.E. Stiglitz (1987): "Privatization, Information and Incentives", *Journal of Policy Analysis and Management*, 6, 567-582.

Schmidt, K.M. (1990): The Costs and Benefits of Privatization", University of Bonn, Discussion Paper no. A-287.

_____ (1995): "Incomplete Contracts and Privatization", University of Bonn, Discussion Paper no. A-480.

_____ and M. Schnitzer (1993): "Privatization and Management Incentives in the Transition Period in Eastern Europe", *Journal of Comparative Economics*, 17, 264-287.

Shapiro, C. and R. D. Willig (1990): "Economic Rationales for the Scope of Privatization", in Suleiman and Waterbury, eds., *op. cit.*

Shleifer, A. and R.W. Vishny (1994): "Politicians and Firms", *Quarterly Journal of Economics*, 109 (4), 995-1025.

Suleiman, E.N. and J. Waterbury, eds. (1990): *The political economy of public sector reform and privatization*, Westview Press, Boulder, Colorado.

Svejnar, J. (1986): "Bargaining Power, Fear of Disagreement, and Wage Settlements: Theory and Evidence from US Industry", *Econometrica*, 54 (5), 1055-1078.

Turvey, R., ed. (1968): *Public Enterprise: Selected Readings*, Penguin, Harmondsworth.

United States Advisory Commission on Intergovernmental Relations (1993): *State Laws Governing Local Government Structure and Administration*, Washington, DC.

United States Dept. Of Commerce, Bureau of the Census (1990): *County Business Patterns, 1987 on CD-ROM*, Washington DC.

United States Dept. Of Commerce, Bureau of the Census (1991): *Census of Governments, 1987, Employment Statistics*, ICPSR 6069, Washington DC.

Vernon, R. and Y. Aharoni, eds. (1981): *State-Owned Enterprises in the Western Economies*, Croom Helm, London.

Vickers, J. and G. Yarrow (1988): *Privatization: An Economic Analysis*, MIT Press, Cambridge, Massachusetts.

Vining, A.R. and A.E. Boardman (1992): "Ownership versus Competition: Efficiency in Public Enterprise", *Public Choice*, 73, 205-239.

White, J.B. (1946): *Nationalisation: Chaos or Cure?*, Falcon Press Ltd, London.

White, P.R. (1990): "Bus Deregulation: A Welfare Balance Sheet", *Journal of Transport Economics and Policy*, 24, 311-332.

Williamson, O. (1985): *The Economic Institutions of Capitalism*, Free Press, New York.

Wintrobe, R. (1987): "The Market for Corporate Control and the Market for Political Control", *Journal of Law, Economics and Organization*, 3, 435-448.

Wittman, D. (1977): "Candidates with Policy Preferences: A Dynamic Model", *Journal of Economic Theory*, 14, 180-189.

_____ (1989): "Why Democracies Produce Efficient Results", *Journal of Political Economy*, 97, 1395-1426.

Zax, J.S. (1985a): "Labor Relations, Wages and Nonwages Compensation in Municipal Employment", NBER Working Paper no. 1582.

_____ (1985b): "Economic Effects of Municipal Government Institutions", NBER Working Paper no. 1657.

_____ and C. Ichniowski (1988): "The Effects of Public Sector Unionism on Pay, Employment, Department Budgets and Municipal Expenditures", in R.B. Freeman and C. Ichniowski, eds.: *When Public Sector Workers Unionize*, University of Chicago Press.