Privatization and efficiency: differentiating ownership effects from political, organizational, and dynamic effects

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Received 12 October 1998; received in revised form 25 February 1999; accepted 11 March 1999

Abstract
This paper argues that the private-public ownership factor should be differentiated from other factors that also influence the effect of privatization on efficiency. This is empirically confirmed in a longitudinal study of 24 Spanish firms, for which several political and organizational factors are found to influence the estimated effects of privatization on efficiency. The analysis of the timing of the effects reveals a strong significance for post-privatization years 5–6 (negative), and 7–8 (positive). This suggests that the negative effect of these factors is transitional, being eventually offset by the positive effects of the change to private ownership. ©2000 Elsevier Science B.V. All rights reserved.

JEL classification: L33

Keywords: Privatization; Efficiency; Organizational; Change; Panel data

1. Introduction

One of the most significant economic phenomena of recent years has been the privatization of state-owned enterprises all over the world. According to Megginson and Netter (1997), the amount raised by all governments during the last two decades, considering only public offers, is over $400 billion, a figure that would be considerably surpassed if direct sales were also taken into account.1 While there are several possible reasons why privatization may be undertaken (Yarrow, 1986), the main driver of this trend has been the search for an increase in the efficiency of the firms involved (Meggison et al., 1994).

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1 According to the World Bank, over 2000 firms were privatized during the period 1980–1993 (almost half between 1991 and 1993), less than 5 percent of which involved public share offerings.
Whether privatization actually leads to that improvement in efficiency has been the subject of what appears to be a considerable amount of research, both theoretical and empirical. Most of this research, however, has actually been concerned with whether private ownership leads to a higher efficiency than state ownership, which is only part of the former question. As a consequence, empirical results do not always support the theoretical predictions. Several factors, independent of the private-public distinction, also intervene in the relationship between privatization on efficiency. Moreover, some of them do so in a dynamic way, thus affecting the timing of privatization effects. Therefore, they need to be controlled for, not only in empirical research, but also in a complete theory of privatization.

This paper addresses such need in two ways. First, by discussing the different factors that affect the privatization-efficiency relationship, which are grouped into political, organizational, and dynamic factors. The latter reflect the transition and evolution inherent to any privatization process which are ignored, however, in studies about public-private ownership. Second, by empirically testing for the presence of all these factors in a longitudinal study using a sample of 24 Spanish firms which were privatized between 1985 and 1993. While the superior efficiency of private (versus state-owned) firms in Spain has been confirmed in a number of cross-sectional studies, this is the first time the effects of privatization processes are analysed in this country. It is also the first time the privatization-efficiency relationship is examined in a representative sample of firms from a Western country other than the UK.² and one of the few statistical analyses of privatization effects that have been done, as the empirical literature review will show. More importantly, this study is the first to pay attention to the political, organizational, and transitional effects of privatization on efficiency.

Section 2 reviews what has been said in theoretical and empirical research about the effect of privatization on efficiency. Section 3 discusses what is missing from this literature, namely the political, organizational, and dynamic implications of privatization that may affect firm efficiency, and states the hypotheses. Section 4 describes the methods and results of the empirical study, and Section 5 discusses its findings, limitations and implications.

2 Barberis et al. (1996) have tested it for Russia, and Dyck (1997) for Eastern Germany. This paper will not consider those studies or any other about privatization in Eastern countries, given the peculiarities these economies entail.

3 Note that this definition of privatization, which is the most widespread, does not include the possible changes in the competitive or regulatory environment that may accompany it.

2. Background

Privatization can be defined in a strict sense as the sale of a state-owned firm to the private sector.³ Many theoretical and empirical articles have examined the differences between state-owned and private firms and what these differences imply for firm efficiency.

2.1. Theoretical approaches

Three distinct streams of thought have dealt with the public-private firm comparison: (1) Agency/Property Rights Theory; (2) Public Choice; and (3) organization theories. The
Table 1
Theoretical studies of public versus private ownership and/or privatization

<table>
<thead>
<tr>
<th>Agency/property rights theories</th>
<th>Public choice</th>
<th>Organization theories</th>
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<tr>
<td><strong>Property rights theory</strong></td>
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<tr>
<td>Alchian (1965)</td>
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<td>De Alessi (1980, 1987)</td>
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<td>Boycko and Vishny (1996)</td>
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<tr>
<td><strong>Positive agency literature</strong></td>
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<td>Aharoni (1981)</td>
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<td>Kay and Thompson (1986)</td>
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<td>Sappington and Stiglitz (1987)</td>
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<td>Vickers and Yarrow (1988, 1991)</td>
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<td>Caves (1990)</td>
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<td>Estrin and Perotin (1991)</td>
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<td>Fernández (1995)</td>
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<tr>
<td>Martin and Parker (1997)</td>
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<tr>
<td><strong>Principal-agent models</strong></td>
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<td>Shapiro and Willig (1990)</td>
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<td>Bös (1991)</td>
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<td>Bös and Peters (1991)</td>
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<td>Laffont and Tirole (1993)</td>
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<td>Garcia Cestona and Salas (1995)</td>
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<td>Schmidt (1996)</td>
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<tr>
<td>Ricart et al. (1991)</td>
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<tr>
<td>Bishop and Thompson (1992)</td>
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<td>Parker (1993, 1995)</td>
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</table>

Specific theoretical studies within each of these streams are listed chronologically in Table 1. The table also incorporates Jensen’s (1983) generic distinction between ‘the two agency literatures’ (positive agency theory versus principal-agent models), both of which have been represented in the public-private context. Essentially, each stream provides a different explanation for a common outcome: private firms are more efficient than state-owned.

The *Agency Theory* explanation is based on the different agency problems and availability of solutions to them that are associated with each form of ownership. Managers (the agent) in both types of firms are assumed to seek the maximization of their own utility rather than that of the organization or its owners (the principal). In private firms, this divergence is reduced through the existence of: (1) a market for ownership rights which enables the owners to sell if they are not satisfied with managerial performance — this is the focus of *Property Rights Theory*; (2) the threat of takeover; (3) the threat of bankruptcy; and (4) a managerial labor market. In the case of state-owned firms, not only are all of these mechanisms absent, but also, the owner-manager relationship is broken down into two other agency relationships: owner (the public)-politician, and politician-manager.

The *Public Choice* school’s central argument is that politicians pursue their own utility rather than the public interest. Accordingly, they impose on state-owned firms goals that can lead them to gain votes but can conflict with efficiency. For the general public, who are the ultimate owners of the firm, the costs of monitoring this public sector behavior (e.g.

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4 The fourth mechanism, the managerial labor market, may not be exactly absent. More typically, there are two separate managerial labor markets, one for private firms managers, another for state-owned. But since the latter is frequently governed by political decisions rather than by the price of managerial ability, it may be useless as a threat to managerial discretion. Cragg and Dyck (1997a, b, 1998) provide empirical evidence about this fact.
information gathering, lobbying) are likely to offset the benefits (e.g. less taxes, or more efficient public spending). This is not the case, however, for interest groups such as trade unions, which makes state-owned enterprises an easy target for rent-seeking activity.

Organizational theories about this topic draw heavily from the other two approaches, but focus on the organizational characteristics of private firms that are different in state-owned firms, such as incentives and control mechanisms (Ricart et al., 1991); culture (Bishop and Thompson, 1992); objectives, organization structure, communications/reporting systems, nature and location of the business, management, and labor (Parker, 1993, 1995; Martin and Parker, 1997).

2.2. Empirical approaches

The empirical literature can be classified into two groups: cross sectional studies of public-private ownership effects, and longitudinal studies of privatization effects.

2.2.1. Cross-sectional studies of public-private ownership effects

Nearly all of the empirical research comparing the efficiency of state-owned and private firms has been in the form of cross-sectional comparisons of both types of firms in industries in which they coexist.\(^5\) The most rigorous method that has been used for this consists on calculating the relative inefficiency of firms of both types with respect to an estimated profit, cost, or production frontier. Pestieau and Tulkens (1993) have argued for the superiority of this approach to efficiency measurement. They have also reviewed most of its applications in the private versus public context. Table 2(a) includes all the studies they cite, as well as others.

Cross-sectional studies of ownership using more traditional methods (regression) are listed in Table 2(b). Cross-industry comparisons of public and private sectors are also included in this table, within the ‘various’ industry category. Since most of these studies have already been included in one or more empirical reviews, and these reviews are frequently cited in the theoretical literature, the table indicates, for each of the studies, the review(s) in which they appear.

As Table 2(a) and (b) shows, although a simple count of results would give a considerable edge to private ownership (adding up in both tables there are 104 in favor, 14 against and 35 neutral), the cumulative evidence is not wholly conclusive. Two factors play a significant role in explaining the diversity of results within these tables: the market structure of each of the industries (and countries) to which the firms studied belong, and the way their efficiency is measured. With respect to market structure, as Vickers and Yarrow note, “statistical tests have rarely been sophisticated enough to take account of the interacting (non-separable) effects of ownership, competition and regulation on incentive structures, and hence on the performance of firms” (1988, p. 39). As for efficiency measurement, one thing to be noted first is that many different concepts of efficiency are relevant in this context: productive and allocative, static and dynamic... (see Martin and Parker, 1997: pp. 47–53; Walker and Vasconcellos, 1997: pp. 27–29). Second, three different measures —

\(^5\) All of the articles included in Table 2a and b, except Boussofiane et al. (1997) and Ehrlich et al. (1994), which are longitudinal.
<table>
<thead>
<tr>
<th>Industry</th>
<th>State-owned more efficient</th>
<th>No significant differences</th>
<th>Private more efficient</th>
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<tr>
<td>(a) Based on efficiency frontiers</td>
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<tr>
<td>Railways</td>
<td>Distexhe (1993), Belgium</td>
<td>Filipini and Maggi (1991), Switzerland</td>
<td>Wilson and Jaddow (1982), US*</td>
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<td>Insurance</td>
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<td>Al-Obaidan and Scully (1991), International*</td>
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<td>Education</td>
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<td>Bousofiane et al. (1997), UK*</td>
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<td>Petroleum</td>
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<td>Argimón et al. (1997), Spain*</td>
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<td>Sugar</td>
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<tr>
<td>Various</td>
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<tr>
<td>(b) Other</td>
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<tr>
<td>Industry</td>
<td>State-owned more efficient</td>
<td>No significant differences</td>
<td>Private more efficient</td>
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<tr>
<td>Railways</td>
<td>Caves and Christensen (1980), Canada; {BPS,M,BB,B,Y,BV,PM}; Caves et al. (1982), US and Canada {BV}; Freeman et al. (1985), Canada {VB}</td>
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<td>Construction</td>
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<td>Schneider and Schuppener (1971), Germany {BPS}; Rechnungshof Rheinland-Pfalz (1972), Germany {BPS}; Muth (1973), US {BPS}</td>
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<tr>
<td>Financial</td>
<td>Lewin (1982), Europe {BV}</td>
<td></td>
<td>Davies (1981), Australia {BPS,BV,PM}; Davies and Brucato (1987) {VB}</td>
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<tr>
<td>Industry</td>
<td>State-owned more efficient</td>
<td>No significant differences</td>
<td>Private more efficient</td>
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<td>Timber</td>
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\* Classified as neutral by De Alessi.
\*\* Classified as neutral by Boyd.
\*\*\* Classified as neutral or as favorable to state ownership, depending on the measurement employed.
\*\*\*\* Classified as favorable to private ownership by De Alessi and Yarrow; as favorable to state ownership by Millward and Parker.
\*\*\*\*\* Classified as favorable to private ownership by De Alessi.
\*\*\*\*\*\* Classified as favorable to private ownership by Borcherdings et al.
\*\*\*\*\*\*\* Classified as favorable to private ownership by Borcherdings et al.
\*\*\*\*\*\*\*\* Classified as favorable to private ownership by Borcherdings et al.
\*\*\*\*\*\*\*\*\* Classified as favorable to private ownership by Borcherdings et al.
profitability, productivity, and costs can be and have been used in these studies, and the appropriateness of using one or another is highly dependent on market structure (Cuervo and Peres, 1981; Borins and Boothman, 1985: pp. 100–104; Cuervo, 1995c: pp. 37–38). Still, after accounting for these two factors, the evidence about which form of ownership is associated with a higher level of efficiency remains mixed.

In fact, the authors of the various review articles mentioned offer very different conclusions, depending on the studies selected. For instance, Borcherding et al. report that “the findings in most studies are consistent with the notion that public firms have higher unit cost structures” (1982, p. 134). In contrast, Millward finds “no broad support for private enterprise superiority” (1982, p. 83). Fifteen years later, during which many more empirical studies of public-private ownership have been published, Martin and Parker still conclude from their survey that “on balance it seems that neither private nor public sector production is inherently or necessarily more efficient” (their emphasis; 1997, p. 93).

2.2.2. Longitudinal studies of privatization effects

The availability and variety of studies in this category sharply contrast with the previous one. Many summaries of different countries’ privatization programs have been written, but almost always of a qualitative nature. In fact, so far there has only been one country for which quantitative studies of privatization are available: the UK (see Martin and Parker, pp. 85–86, for a review). Of these, only five studies have dealt with a sample size large enough to allow some kind of statistical analysis: Haskel and Szymanski (1992b), Bousofiane et al. (1997), and Cragg and Dyck (1997a, b, 1998) the last three based on the same data base. Two cross-country studies are also of a statistical nature: Megginson et al. (1994) and Nash et al. (1997). Other than this, the only empirical evidence regarding privatization comes from case studies such as those included in Galal et al. (1994), Vickers and Yarrow (1988), Ramamurti (1996), Martin and Parker, or Walker and Vasconcellos (1997).

As in the cross-sectional studies of public-private ownership, the evidence from longitudinal studies about whether privatization leads to an efficiency increase is not totally conclusive.

3. Political, organizational and dynamic implications of privatization

The previous literature review shows that the positive effects of privatization on efficiency predicted by the different theories are not always supported by the existing empirical evidence. Why is there such a mismatch between theory and evidence?

The answer proposed here is that the existing privatization literature has only looked at part of the problem, which is whether private ownership leads to a higher efficiency than

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6 While a proper meta-analysis is beyond the scope of this paper, Table 2 can give some hints on: (1) how influential each study has been, (2) the pro/con proportion of the set of studies chosen by each of the reviewers, (3) indirectly, the methodological rigor required for the papers reviewed and (4) the subjectivity with which the original results are sometimes interpreted. Hirsch’s (Hirsch, 1965) study provides a good illustration for this point: it has been classified as favorable to private ownership by Yarrow (1986) and by De Alessi (1975), as favorable to state ownership by Millward and Parker (1983), and as neutral by Borcherding et al. (1982) and by Boardman and Vining (1980) and in this paper, in view of the discrepancies.
state ownership. Privatization implies a change in a firm’s ownership, from state to private. Hence, the superiority of private to public ownership in terms of firm efficiency is a necessary condition for the existence of a positive relationship between privatization and efficiency. However, the condition is not sufficient, for two reasons. First, public versus private ownership is primarily a static question, which can be typically addressed by comparing both types of firm in a given period of time, as the above classification of empirical research has highlighted.  

7 However, privatization is by definition a change, and needs to be addressed dynamically by looking at a given firm’s evolution and transition between its private and public stages within a given firm.  

8 Second, privatization has other implications, political and organizational, that are likely to affect the firm’s efficiency, either positively or negatively, and therefore, reinforce or counteract the effect of the change in ownership per se.

All these other implications of privatization, however, have been overlooked by previous researchers, even within the organizational stream. In fact, among all the theoretical privatization studies listed in Table 1, there are only two exceptions to this oversight: Boycko and Vishny (1996), for whom the effect of privatization on efficiency hinges on the firm’s restructuring which for them means strictly reducing employment, and Martin and Parker, who argue: “...in so far as ownership and competition are important, they impact on performance through an internal adjustment process” (their emphasis, p. 170).  

9 Moreover, my classification of the empirical research, by separating out ownership (cross-sectional) studies from privatization (longitudinal) studies, shows that the evidence regarding the relationship between privatization and efficiency is actually much more scarce than what has been implied by (1) previous empirical reviews of this relationship (e.g. Yarrow, 1986); and (2) previous theoretical works about privatization claiming support for their theories (e.g. Bös, 1991).

The basic prediction of all existing privatization theories is the following:

**Hypothesis 1. Privatization increases firm efficiency.**

How, exactly, is this prediction affected by the political, organizational, and dynamic factors mentioned?

### 3.1. Political and organizational implications of privatization

**Political implications of privatization** are all the government decisions triggered by the decision to privatise a given firm.  

10 These may affect the firm’s efficiency either positively or negatively. A positive effect will take place if, for instance, the government chooses to
privatize a firm from an industry that will rapidly grow, in order to make privatization look good. On the other hand, negative effects are typically a consequence of giving priority to privatization goals other than efficiency, when the choice between those goals and that of efficiency involves a trade-off. Such would be the case, for instance, of privatizing a monopoly before introducing competition or an appropriate regulation, as opposed to afterwards, in order to increase the revenue from privatization (Vickers and Yarrow, 1988); or of hastening to privatize the firm in a period of recession in the industry or in all of the economy, as opposed to waiting for a better time, because the government wants to increase its revenues in that period for political reasons. There is also the possibility of unintended negative effects, such as a government’s mistake or failure in choosing the optimal buyer or privatization method.

Organizational implications of privatization are all the decisions taken by the new owners or managers of the privatized firm that cannot be predicted by the government at the time of choosing who to sell the firm to. Again, these can affect the firm’s efficiency either positively or negatively. As an example of a positive effect, consider a firm which, under state ownership, is being managed through a large conglomerate, and is privatized through its direct sale to a more specialized company. If the buyer is able to exploit some synergies with its former business, and part of the savings are passed on to its acquired (the privatized) firm, the gains in efficiency for this one would have been obviously brought about by its privatization, but would have nothing to do with the private/public distinction. Negative effects may also take place if, like government representatives before privatization, managers of a newly-privatized firm give a higher priority to other conflicting objectives. For instance, consider a firm which is privatized by direct sale to another firm, and is maintained as a separate business unit of the acquirer. The corporate strategy of a firm may be such that not all business units are treated equally (Brush and Bromiley, 1997); thus, it may be the case that it is not in the acquiring firm’s interest as a whole to maximize the performance of the individual unit constituted by the privatized firm. Also, as with political decisions, there is the possibility of unintended negative effects from the new management’s decisions: managers may find themselves unable to turn around a low-performing firm, encounter resistance to change at some level of the organization, or face any other unintended situation.

These two groups of implications, then, lead to the following hypothesis:

**Hypothesis 2.** The observed effect of privatization on efficiency is influenced by political and organizational factors.

Which of these implications actually take place, and hence whether their overall effect on efficiency is positive or negative, is ultimately an empirical question that depends on the specific case(s) examined.

### 3.2. Dynamic implications of privatization

The ownership effect per se raises some dynamic issues which are likely to influence the timing of the effect of privatization on efficiency. For instance, Pelikan (1989, 1993) has argued that the main advantage of private (and tradeable) ownership of firms over state ownership is that, under the former, the search for competent owners never stops, while
under the latter all such searched is blocked, regardless of how good or poor an owner the government proves to be. One implication of such argument for privatization is that a privatized firm may not show an efficiency improvement immediately after privatization, but it may exhibit an increasing trend in the evolution of its post-privatization efficiency.

In addition, some of the political and organizational factors with negative effects discussed have an important dynamic component associated to them, in the sense that those negative effects are likely to diminish over time. Such would be the case of the political decision to privatize the firm in a period of industrial or economic recession, when the industry or economy starts to recover; or of the organizational inertia encountered by the newly-privatized firm’s management, as the initial resistance to change begins to be overcome. All these are reflections of the transition inherent to any privatization process, as a result of which, political and organizational factors not only may influence the observed effect of privatization on efficiency, but also the timing of this effect. Thus, I hypothesize:

**Hypothesis 3.** The observed effect of privatization on efficiency is contingent upon the time period considered.


The three hypotheses are tested in a sample of 24 Spanish firms which were privatized between 1985 and 1993. The superior efficiency of private (versus state-owned) firms in Spain has been confirmed in a number of cross-sectional studies (see Maroto, 1991, for a review; Azofra et al., 1991; Argimón et al., 1997). However, this is the first time the effects of privatization processes are analysed in this country. Before Spain’s official privatization program was started in 1996, 73 firms were fully privatized (all except two through direct sales) by the former government, and four others had their privatization process started through public share offerings (Villalonga, 1996). Therefore, time has gone by for enough firms to allow an analysis of privatization effects, for which the Spanish case may be as good as any other country’s. Besides, given the scarcity of empirical privatization (longitudinal) analyses and of samples studied (British firms, and Megginson et al.’s sample), this study may add some variety to the literature; I do not attempt to extend any specific conclusion drawn from its results beyond the Spanish case, though, since the institutional environment and the privatization process during the socialist government were highly idiosyncratic (Villalonga, 1996; Cuervo, 1997). Details of the Spanish state-owned sector’s structure and reorganizations during that period can be found in Sanchis (1996). For the purpose of this

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11 Sanchís (1996) claims to be doing so on a dataset that ends in 1990. However, of the 17 firms in his sample for which he examines the effects of ‘privatization’, 11 were not really privatized (3 were transferred to another state-owned firm, 8 — counting Repsol as 5 had just minority stakes sold through IPO, and remained under the state’s control and majoritarian ownership), and 5 (plus the 5 included in Repsol) were privatized in 1989 (including 3 that he says were privatized in 1988), so he just has 1 year of post-privatization data for them. Thus, only his results for one company (Seat) may be trustworthy estimates of the effect of privatization on efficiency, and so it cannot be properly considered as a privatization study.

12 See, for a dynamic source of information on Spain’s privatization program, Expansion newspaper's website at: http://www.recoletos.es/privatizaciones.
paper, it is sufficient to note that all the firms in the sample were operating in competitive environments at the time of their privatization, so no de- or re-regulation interferes with the estimation of strict privatization effects.

Following the order of the three hypotheses, I first determine whether privatization has actually increased the efficiency of each of the firms in the sample (Hypothesis 1). I then examine some of the political and organizational factors that may have played a role in arriving at those results (Hypothesis 2). Although I am constrained by the data in the choice of the specific factors to be examined, I have been able to include the following: As political factors, (1) the stage of the business cycle at which the company was privatized (which captures the government’s decision of when exactly to privatize the firm); and (2) the foreignness of the buyer, which is typically an issue of political concern. As organizational factors, (1) the company’s starting performance level as a private firm, which is assumed to be reflecting the difficulty of running or turning around a low-performing privatized firm; (2) the size of the organization at the time of its privatization, which is assumed to be proportional to any possible resistance to change encountered; and (3) the firm’s capital intensity (also at the time it was privatized), since if a firm in a capital-intensive business has its capital investment increased as a result of being privatized, its efficiency will probably increase in the longer run, but might not appear so in the early post-privatization years. This issue particularly merits investigation in the Spanish case between 1985 and 1996, since several firms were privatized in that period for lack of appropriate size or technology (De la Dehesa, 1992). Note that all three organizational factors, as well as the first political factor mentioned, are also transitional in nature. However, following Hypothesis 3, the actual dynamic effect of these factors is tested separately.

4.1. Method

4.1.1. Population

The population of interest is comprised of the 77 Spanish firms privatized between 1985 and 1995, as listed in Villalonga (1996). Unlike more recent Spanish privatizations, these were undertaken by the socialist government without any explicit privatization program or goal statement and can, therefore, be considered as a separate population.

4.1.2. Sample

My sample of 24 firms results from excluding companies from the population in the following order: (1) Those that were privatized after 1993, for which a maximum of only 2 years of post-privatization data would be available; (2) partial privatizations, i.e. those that remained under state control; (3) those for which data could not be obtained for a minimum of 3 years of public and 3 years of private ownership, on the following variables: profits before taxes, assets, financial expenses (interests), sales, and number of employees. Data on the state ownership period for each firm have been obtained from the annual reports kept at the (former) Instituto Nacional de Industria (INI)’s library. In most cases, however, individual companies’ reports were not available, and data come from the annual reports of the holding groups to which the firms belonged when they were sold (INI, Teneo, or Patrimonio). Post-privatization data were directly requested from companies through fax
and/or phone and/or in person. If and when the request was denied, company reports were requested from the Registro Mercantil of the province in which the firm was incorporated. The requirement to file in company reports is fairly recent, though (1989) and, as it appears, often disregarded. The most recent year of data in the sample is 1996. In addition, data on the average profitability of Spanish firms until 1995 is available from the annual reports of the Central de Balances del Banco de España (Spain’s central bank).

This information has allowed me to construct a panel data set on profitability, sales, employees, a dummy for whether the buyer was a foreign company or not, and average profitability of Spanish firms, for 24 firms and a number of years between 7 and 14 (between 3 and 5 pre-privatization, the privatization year, and between 3 and 8 post-privatization). The average number of years per firm is 9.9.

The list of firms in the sample, together with the available data for each of them in the year of their privatization, is shown in Table 3. The table also contains information on the year each firm was privatized, the industry, the buyer, and whether such buyer is foreign or not.

4.1.3. Dependent variable(s)

As will be explained in more detail within the models section, a different econometric model is used to test each of the three hypotheses. The dependent variable in Model 1 is efficiency (EFFI), measured by Return on Assets (ROA) — calculated as earnings before interest and taxes divided by total net assets. It is the measure more commonly used in cross-industry privatization studies, and is considered a correct indicator of efficiency in competitive environments (Borins and Boothman, 1985; Cuervo, 1995), as it is the case for all the firms in the sample in the time period considered.

In Model 2, the dependent variable is efficiency increase (EFFINC), measured by the estimated coefficient of the time*post-privatization period interaction term from Model 1.

In Model 3, it is efficiency growth (EFFGROwth), measured as \( \left( \frac{\text{ROA}_t - \text{ROA}_{t-1}}{\text{ROA}_{t-1}} \right) \). 

4.1.4. Independent variables

In Model 1 there are two main independent variables: post-privatization period (PRIV), which is a dummy variable (=1 if within period, 0 otherwise), and TIME (a discrete variable ranging from 1 (year –5 before privatization) to 14 (year 8 after privatization). In Model 3 there are two groups of variables: (a) Political, which include: (1) initial stage of cycle (CYCLE0) — average ROA of Spanish firms in the year the firm was privatized — , as published in the annual reports of the Central de Balances del Banco de España; and (2) a dummy for whether the buyer was foreign (=1) or not (=0) — FBUYER; and (b) Organizational: (1) initial level of performance (PERF0) — firm’s ROA; (2) initial firm size (SIZE0), measured as real sales (in 1990-pesetas); and (3) initial capital intensity (CAPINT0) — firm’s assets per employee. All three variables are measured in the year the

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13 Nominal sales have been deflated using year-wide averages of industry-specific industrial price indices (IPRI) for each firm, except for Jobac, which is a supermarket chain, and for which we have used the food and drinks consumer price index (IPC) instead. The source for these indices is Spain’s Instituto Nacional de Estadística (INE). We have maintained the base period from the original source, January 1990.
Table 3
Summary data at privatization dates

<table>
<thead>
<tr>
<th>Priv. date</th>
<th>Company</th>
<th>Industry</th>
<th>Buyer</th>
<th>ROA (%)</th>
<th>EBITd</th>
<th>Salesd</th>
<th>Real salesd</th>
<th>#Empl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>Ingenasa</td>
<td>Biotechnology</td>
<td>ERT</td>
<td>−26.2</td>
<td>−64</td>
<td>38</td>
<td>39</td>
<td>n/a</td>
</tr>
<tr>
<td>1985</td>
<td>SKF Española</td>
<td>Bearings</td>
<td>Aktiebogalet SKF*</td>
<td>8.5</td>
<td>302</td>
<td>8513</td>
<td>11187</td>
<td>991</td>
</tr>
<tr>
<td>1986/1990</td>
<td>Seat</td>
<td>Automotive</td>
<td>Volkswagen AG*</td>
<td>−6.3</td>
<td>−27434</td>
<td>231954</td>
<td>275807</td>
<td>22197</td>
</tr>
<tr>
<td>1987</td>
<td>Evatsa</td>
<td>Aluminum</td>
<td>Cebal*</td>
<td>3.9</td>
<td>15</td>
<td>642</td>
<td>650</td>
<td>77</td>
</tr>
<tr>
<td>1987</td>
<td>LitoJan</td>
<td>Aluminum</td>
<td>Baumgartner Iberica*</td>
<td>−5.6</td>
<td>−37</td>
<td>554</td>
<td>592</td>
<td>48</td>
</tr>
<tr>
<td>1987</td>
<td>Alumalsa</td>
<td>Aluminum</td>
<td>Montupet*</td>
<td>13.7</td>
<td>98</td>
<td>1518</td>
<td>1622</td>
<td>n/a</td>
</tr>
<tr>
<td>1989</td>
<td>Astican</td>
<td>Shipbuilding</td>
<td>Italmar</td>
<td>14</td>
<td>−490</td>
<td>3457</td>
<td>3510</td>
<td>329</td>
</tr>
<tr>
<td>1989/1992</td>
<td>MTM</td>
<td>Equipment</td>
<td>GEC Alsthom*</td>
<td>−4.3</td>
<td>−1727</td>
<td>2315</td>
<td>2458</td>
<td>1315</td>
</tr>
<tr>
<td>1989/1992</td>
<td>Ateinsa</td>
<td>Equipment</td>
<td>GEC Alsthom*</td>
<td>4.5</td>
<td>−636</td>
<td>4255</td>
<td>4517</td>
<td>482</td>
</tr>
<tr>
<td>1989/1991</td>
<td>Enferesa</td>
<td>Fertilizers</td>
<td>Ercros</td>
<td>3.2</td>
<td>382</td>
<td>25587</td>
<td>27630</td>
<td>1657</td>
</tr>
<tr>
<td>1989</td>
<td>Oesa</td>
<td>Food</td>
<td>Ferruzi*</td>
<td>−1.6</td>
<td>−598</td>
<td>19096</td>
<td>19115</td>
<td>125</td>
</tr>
<tr>
<td>1989</td>
<td>Pesa</td>
<td>Electronic</td>
<td>Amper</td>
<td>8.8</td>
<td>401</td>
<td>7141</td>
<td>7042</td>
<td>351</td>
</tr>
<tr>
<td>1990</td>
<td>Hytas</td>
<td>Textile</td>
<td>Textil Guadiana</td>
<td>−14.7</td>
<td>−3633</td>
<td>3768</td>
<td>3731</td>
<td>1047</td>
</tr>
<tr>
<td>1990</td>
<td>Salinas Torrevieja</td>
<td>Salt</td>
<td>U. Salinera (Solvay*)</td>
<td>−17.2</td>
<td>−1049</td>
<td>1608</td>
<td>1597</td>
<td>354</td>
</tr>
<tr>
<td>1991/1993</td>
<td>Enasa</td>
<td>Automotive</td>
<td>Ivec (Fiat*)</td>
<td>−19.1</td>
<td>−19738</td>
<td>54876</td>
<td>52867</td>
<td>5123</td>
</tr>
<tr>
<td>1991</td>
<td>GEA</td>
<td>Indust. Crafts</td>
<td>Pickman (Estudesa)</td>
<td>−32.4</td>
<td>−3171</td>
<td>3606</td>
<td>3511</td>
<td>1291</td>
</tr>
<tr>
<td>1991</td>
<td>TSD</td>
<td>Electronic</td>
<td>Telepubicaciones</td>
<td>−22.7</td>
<td>−364</td>
<td>1021</td>
<td>1069</td>
<td>41</td>
</tr>
<tr>
<td>1991</td>
<td>Cosia</td>
<td>Frozen food</td>
<td>Rusticas</td>
<td>4.1</td>
<td>−14</td>
<td>592</td>
<td>580</td>
<td>60</td>
</tr>
<tr>
<td>1991</td>
<td>Jobac</td>
<td>Distribution</td>
<td>Consum (Eroski)</td>
<td>−1.8</td>
<td>−504</td>
<td>20731</td>
<td>21219</td>
<td>1419</td>
</tr>
<tr>
<td>1992</td>
<td>Icuatro</td>
<td>Medical Equip</td>
<td>Grupo Alegre</td>
<td>10.4</td>
<td>136</td>
<td>2419</td>
<td>2439</td>
<td>23</td>
</tr>
<tr>
<td>1993</td>
<td>FSC</td>
<td>Equipment</td>
<td>Navacel/TTT/L.Telleria</td>
<td>−37.2</td>
<td>−1486</td>
<td>566</td>
<td>525</td>
<td>259</td>
</tr>
<tr>
<td>1993/1994</td>
<td>Paleon</td>
<td>Aluminum</td>
<td>Alcan Deutscheland*</td>
<td>−6.8</td>
<td>−66</td>
<td>867</td>
<td>942</td>
<td>44</td>
</tr>
</tbody>
</table>

* Sources: Firms’ annual reports, Villalonga (1996).

b The date in bold shows when the state became a minority owner. These are the dates that have been considered as the effective privatization dates (year 0) for this study.

b Foreign buyers have been marked with an asterisk. There are no “partially foreign” companies among these.

d Millions of pesetas.

Millions of January 1990-pesetas. Nominal sales are deflated using year-wide averages of industry-specific industrial price indices (or the food and drinks consumer price index, in the case of Jobac), as supplied by Spain’s Instituto Nacional de Estadística (INE). The base period from the original source is maintained.
firm was privatized. In Model 2, all the independent variables are bi-yearly time dummies (YEARt1t2).

4.1.5. Control variables

Control variables in Model 1 refer to external factors not implied by privatization that may affect firm efficiency, and therefore, should be discounted in order to estimate the net effect of privatization. These are: firm size (SIZE) and business cycle (CYCLE) — measured as indicated above. In Model 3, the only factors considered as external are industry dummies for all industries which are represented by more than one firm in the sample: aluminum (ALUM), automobile (AUTO), ELECTRONIC, FOOD, and equipment (EQUIP).

4.2. Models

Hypothesis 1 is tested using similar methods to those that have been used in previous statistical analyses of this hypothesis (or of the superiority of private ownership) on longitudinal datasets like mine. Similarly to Megginson et al., the differences between the means and medians of the efficiency measure in the pre- and post-privatization periods are compared through t-statistics, and z-statistics are used to test if the proportion of firms that changed in the expected direction is significantly different from 0.5. 14 As in Ehrlich et al. (1994), the time trends of efficiency in both periods are also compared, by estimating the following fixed-effects model: 15

\[
\text{Model 1: } \text{EFFI}_{it} = \alpha_i + \beta_{it}^{\text{PRIV}} + \beta_{it}^{\text{TIME}} + \beta_{it}^{\text{PRIV-TIME}} + \gamma_1^{\text{SIZE}} + \gamma_2^{\text{CYCLE}} + \epsilon_{it},
\]

where \( E(\epsilon_i \epsilon_j) = \sigma_{ij} \).

The effect of privatization in this model can be seen from the coefficients of PRIV and TIME^{PRIV}: PRIV captures differences in performance levels before and after privatization, while TIME^{PRIV} captures changes in performance trends. That is, a positive coefficient in TIME^{PRIV} would indicate that performance increases more over time after privatization than before (or decreases less, if the time coefficient is negative). 16 Chow specification tests shown at the bottom of Table 5 lead to reject the hypothesis of common intercept and slope coefficients across pool members for the PRIV, TIME and TIME^{PRIV} terms. Thus, those coefficients are estimated individually for each firm (\( \alpha_i, \beta_{it}, \gamma_{it} \)), and

14 A 0.5 proportion corresponds to the null hypothesis of privatization having no effect on efficiency. A proportion significantly above (below) 0.5 would provide statistical evidence of privatization having a positive (negative) effect on efficiency.

15 Ehrlich et al. use a similar model to test the effect of public versus private ownership (though not of privatization) on a panel of 23 international airlines over a 10-year period.

16 I am treating the effects as fixed, as opposed to random, for two reasons: (1) Given the idiosyncratic nature of the Spanish privatization process during the period considered in this study, and how the sample has been selected, my inferences are conditional on the individual characteristics, not unconditional on the population characteristics (Hsiao, 1986, 41, 136; Baltagi, 1995, 10, 13), and (2) I have no reason to assume that the regressors are uncorrelated with individual-specific coefficients, which is a key assumption in random effects models (Matýás and Sevestre, 1996). These arguments respond to the two alternative views within the panel data econometrics literature as to what justifies the choice of fixed versus random effects models.
but those of the control variables, size and cycle, \((y_4\text{ and } y_5)\) in common.\(^{17}\) The error structure specification, based on the evidence and diagnostic tests reported in Table A.1 of the Appendix, allows for groupwise heteroskedasticity and cross-sectional correlation, but not for autocorrelation.\(^{18}\) Given this error structure, the appropriate method of estimation is Feasible Generalized Least Squares (FGLS), as in a Seemingly Unrelated Regressions (SUR) model (Zellner, 1962). That is, the covariance matrix across pool members is estimated in a preliminary OLS regression and then applied in GLS estimation in a second stage.

Hypothesis 2 is tested as a second step after the estimation of Model 1. The estimated firm-specific parameters of TIME*PRIV from Table 5 (those of \(\beta_{3i}\) in Model 1) are used as measures of efficiency increase (in trend), which becomes the dependent variable in the following cross-sectional model:

\[
\text{Model 2 : } \text{EFFINC}_i = \alpha + \beta_1^* \text{CYCLE}_{i0} + \beta_2^* \text{FBUYER}_i + \beta_3^* \text{PERF}_{i0} + \beta_4^* \text{SIZE}_{i0} \\
+ \beta_5^* \text{CAPINT}_{i0} + \beta_6^* \text{ALUM}_i + \beta_7^* \text{AUTO}_i \\
+ \beta_8^* \text{ELECTRONIC}_i + \beta_9^* \text{FOOD}_i + \beta_{10}^* \text{EQUIP}_i + \varepsilon_i, \tag{2}
\]

where \(E(\varepsilon_i \varepsilon_j') = \sigma_i^2\) and the regressors represent all the political and organizational factors and controls, as described before. Hypothesis 2 may be tested from this model by a Wald test of the joint significance of the coefficients of CYCLE, FBUYER, PERF, SIZE, and CAPINT. The correlation matrix of the data used for this regression is reported in Table A.2 of the Appendix. A weighted least squares (WLS) estimator is now used to correct for heteroskedasticity, which in this case arises from the dependent variable’s being estimated with varying precision. Following Saxonhouse (1976), each observation is weighted on all variables by the inverse of the estimated standard error of the dependent variable.

Hypothesis 3 is tested by regressing efficiency growth on time dummies. The diagnostic tests (also shown in Table A.1) and assumptions support the same error structure as in Model 1, so the same estimation procedure is followed. I have chosen to specify and report results from the regression in bi-yearly dummies to keep the specification parsimonious (results were similar, though, when yearly dummies were used). Thus, the model can be written as:

\(\vdots\)

\(^{17}\) Since the number of cross-sectional units (firms) in the data set is very small, I do not need to difference away the intercepts through a ‘deviation from individual means’ transformation, as it is common practice in the estimation of fixed effects models in large \(N\) panels.

\(^{18}\) I find evidence of groupwise heteroskedasticity in the residual variances for each firm, which differ by as much as 400 times. I cannot, however, reject the null hypothesis of no autocorrelation within firms, based on any of the two different tests used. This suggests that any possible autocorrelation in the dependent variable (firm ROA) has been captured by the control variables, most likely by the economy-wide ROA (business cycle). I have not tested for cross-sectional correlation, but I want to allow for it since I have two powerful reasons to assume there is: (1) Several firms share a common industry affiliation with others, and I have not been able to control for it explicitly within the regression (the inclusion of industry dummies yielded a near-singular matrix); and (2) time observations for each firm have been aligned with respect to the privatization date so that year 0 corresponds to a different date in each case. Thus, any unobservable factor due to privatization is likely to affect the individual firms in a related way.
Table 4
Tests for changes in efficiency after privatization

<table>
<thead>
<tr>
<th>Efficiency measure</th>
<th>Sample statistic</th>
<th>Pre-priv. mean (%)</th>
<th>Post-priv. mean (%)</th>
<th>Mean of differences</th>
<th>t-stat for differences</th>
<th>Proportion of firms that changed as predicted</th>
<th>z-stat for prop &gt;0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA Means</td>
<td>-4.9</td>
<td>-2.4</td>
<td>2.5</td>
<td>0.96</td>
<td>0.46</td>
<td>-0.28</td>
<td></td>
</tr>
<tr>
<td>Medians</td>
<td>-3.4</td>
<td>-1.4</td>
<td>2.1</td>
<td>0.98</td>
<td>0.54</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>ROA Medians</td>
<td>-670</td>
<td>50</td>
<td>719</td>
<td>1.16</td>
<td>0.54</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>Growth Medians</td>
<td>-630</td>
<td>-57</td>
<td>574</td>
<td>0.96</td>
<td>0.58</td>
<td>0.57</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) N=24.

Model 3: \( \text{EFFGROWTH}_{it} = \alpha + \beta_{1i} \text{YEAR}_{43it} + \beta_{2i} \text{YEAR}_{21it} + \beta_{3i} \text{YEAR}_{12it} \\
+ \beta_{4i} \text{YEAR}_{34it} + \beta_{5i} \text{YEAR}_{56it} + \beta_{6i} \text{YEAR}_{78it} + \varepsilon_{it}, \)

where \( E(\varepsilon_{i,t}, \varepsilon_{j,t}) = \sigma_{ij} \) and the coefficients on the bi-yearly time dummies measure the increase in efficiency growth that takes place in each pair of years with respect to the privatization year, which is the base period captured by the intercept.

4.3. Results

The values of the \( t \) and \( z \)-statistics used to test Hypothesis 1 are reported in Table 4. As the table shows, none of the statistics are significant at the conventional levels. This hypothesis is also tested through the estimation of Model 1, the results of which are reported in Table 5. There it can be seen that the coefficient of the post-privatization period dummy (PRIV) is significant in nine (out of 24) cases, of which five are positive and four negative. The coefficient of \( \text{TIME}^\text{PRIV} \) is significant in 13 cases, which are also split into six positive and seven negative.

Results of the estimation of Model 2 appear in Table 6. As the table shows, the two variables representing political factors are significant and positive, and so are, among the three organizational factors, firm size and capital intensity (the latter only at the 10 percent level). However, the initial performance level has no significant effect on efficiency increase. The Wald test of the joint significance of the coefficients of these five variables (the political and organizational factors altogether), through which Hypothesis 2 may be more directly tested, yields a chi-square statistic of 246.28, with a probability value of 0.001. Four of the five industry dummies included (all except equipment) also turn out to have a significant positive effect.

The results of regressing efficiency growth on time dummies through which Hypothesis 3 is tested are shown in Table 7. A positive and significant effect obtains for years 1–2, 3–4, and 7–8 after privatization, and for years 4–3 before privatization. Note that only the last two are large enough to offset the negative value of the constant term coefficient. In particular, the 7–8 post-privatization effect, net of the base year’s (2260.5) is nearly five times larger than the next largest coefficient in absolute value (−486.1 , for years 3–4 after privatization, which is the only significant negative estimate).
Table 5
Model 1: Fixed-effects regression of efficiency on time, post-privatization period, and time*post-privatization period.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Constant</th>
<th>Time</th>
<th>Post-PRIV period</th>
<th>Time*Post-PRIV period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingenasa</td>
<td>−0.321*** (0.100)</td>
<td>−0.104** (0.046)</td>
<td>−0.264 (0.163)</td>
<td>0.225*** (0.056)</td>
</tr>
<tr>
<td>SKF Española</td>
<td>0.001 (0.032)</td>
<td>0.013 (0.012)</td>
<td>0.096** (0.045)</td>
<td>−0.068*** (0.013)</td>
</tr>
<tr>
<td>Seat</td>
<td>−0.188*** (0.036)</td>
<td>−0.017 (0.012)</td>
<td>0.042 (0.048)</td>
<td>0.006 (0.014)</td>
</tr>
<tr>
<td>Evatsa</td>
<td>0.142** (0.055)</td>
<td>0.153*** (0.024)</td>
<td>−0.295*** (0.076)</td>
<td>−0.127*** (0.025)</td>
</tr>
<tr>
<td>Litohan</td>
<td>−0.087* (0.047)</td>
<td>0.025 (0.019)</td>
<td>−0.003 (0.066)</td>
<td>−0.018 (0.021)</td>
</tr>
<tr>
<td>Alumalsa</td>
<td>0.023 (0.034)</td>
<td>0.050*** (0.018)</td>
<td>−0.055 (0.046)</td>
<td>−0.053*** (0.019)</td>
</tr>
<tr>
<td>Telesincro</td>
<td>−0.037** (0.017)</td>
<td>0.003 (0.006)</td>
<td>−0.066*** (0.023)</td>
<td>0.017** (0.008)</td>
</tr>
<tr>
<td>Astican</td>
<td>−0.239*** (0.021)</td>
<td>−0.066*** (0.007)</td>
<td>0.125*** (0.029)</td>
<td>0.072*** (0.008)</td>
</tr>
<tr>
<td>MTM</td>
<td>−0.229*** (0.054)</td>
<td>0.095*** (0.020)</td>
<td>0.086 (0.094)</td>
<td>−0.097*** (0.030)</td>
</tr>
<tr>
<td>Areina</td>
<td>−0.172*** (0.049)</td>
<td>0.009 (0.018)</td>
<td>0.117 (0.079)</td>
<td>−0.021 (0.023)</td>
</tr>
<tr>
<td>Enfersa</td>
<td>−0.165*** (0.044)</td>
<td>−0.040* (0.022)</td>
<td>0.069 (0.109)</td>
<td>0.056* (0.031)</td>
</tr>
<tr>
<td>Oesa</td>
<td>−0.112*** (0.026)</td>
<td>−0.015* (0.009)</td>
<td>0.001 (0.039)</td>
<td>0.017 (0.011)</td>
</tr>
<tr>
<td>Pesa</td>
<td>−0.037 (0.083)</td>
<td>−0.027 (0.028)</td>
<td>0.375*** (0.135)</td>
<td>−0.139*** (0.039)</td>
</tr>
<tr>
<td>Hytasa</td>
<td>−0.194*** (0.046)</td>
<td>−0.035** (0.017)</td>
<td>0.108 (0.084)</td>
<td>−0.004 (0.023)</td>
</tr>
<tr>
<td>Salinas Torrevieja</td>
<td>−0.428*** (0.090)</td>
<td>−0.064** (0.030)</td>
<td>0.252 (0.150)</td>
<td>0.084* (0.046)</td>
</tr>
<tr>
<td>Enasa</td>
<td>−0.326*** (0.015)</td>
<td>−0.058*** (0.005)</td>
<td>−0.154*** (0.021)</td>
<td>0.168*** (0.007)</td>
</tr>
<tr>
<td>GEA</td>
<td>−0.379*** (0.028)</td>
<td>−0.011 (0.010)</td>
<td>0.106* (0.056)</td>
<td>0.080*** (0.016)</td>
</tr>
<tr>
<td>TSFD</td>
<td>−0.465*** (0.140)</td>
<td>−0.100 (0.064)</td>
<td>0.043 (0.229)</td>
<td>0.139* (0.081)</td>
</tr>
<tr>
<td>Coisa</td>
<td>−0.073*** (0.015)</td>
<td>0.051*** (0.007)</td>
<td>−0.216*** (0.022)</td>
<td>0.018* (0.009)</td>
</tr>
<tr>
<td>Jobac</td>
<td>−0.125*** (0.020)</td>
<td>−0.015 (0.010)</td>
<td>0.029 (0.031)</td>
<td>0.026* (0.013)</td>
</tr>
<tr>
<td>Icinaro</td>
<td>0.005 (0.035)</td>
<td>0.036 (0.012)</td>
<td>0.346*** (0.061)</td>
<td>−0.186*** (0.020)</td>
</tr>
<tr>
<td>Repsol (Grupo)</td>
<td>−0.291*** (0.059)</td>
<td>−0.015** (0.007)</td>
<td>−0.001 (0.015)</td>
<td>−0.004 (0.008)</td>
</tr>
<tr>
<td>FSC</td>
<td>−0.538*** (0.118)</td>
<td>−0.019 (0.043)</td>
<td>0.724*** (0.234)</td>
<td>−0.292*** (0.107)</td>
</tr>
<tr>
<td>Palco</td>
<td>−0.101*** (0.013)</td>
<td>−0.047 (0.008)</td>
<td>0.034 (0.025)</td>
<td>0.051*** (0.013)</td>
</tr>
</tbody>
</table>

Unweighted statistics:
\[ R^2 = 0.73 \]
\[ \text{Adjusted } R^2 = 0.51 \]

a Total number of panel observations: \( N \times T_i = 238 \). \( N = 24; T = T_i \), i.e., the panel is unbalanced. Values of \( T_i \) for each firm appear in Table 8. Average \( T = 9.9 \).

b Real sales, measured in millions of January 1990-pesetas. Nominal sales are deflated using year-wide averages of industry-specific industrial price indices (or the food and drinks consumer price index, in the case of Jobac); Sources: Firms’ and state holding companies’ (Instituto Nacional de Industria (INI), Teneo, or Patrimonio) annual reports, for nominal sales figures; Instituto Nacional de Estadística (INE), Spain, for inflation indices.

c Average ROA of Spanish firms for each year. Source: Central de Balances del Banco de España, Spain.

d F-statistics from Chow tests of different coefficients across firms: 184.86 for intercept; 99.24 for \( T \); 43.98 for Post-PRIV period; 108.85 for Time*Post-PRIV period. All test statistics are significant at the 1% level.

e The unweighted are reported because the GLS transformation inflates the \( R^2 \) from the regression (Greene, 1997). These unweighted statistics come from regressing the untransformed dependent variable on the predicted values using untransformed regressors and the coefficients from the weighted (GLS) regression. Standard errors are in parentheses.

f Statistically significant at the 10% level.

** Statistically significant at the 5% level.

*** Statistically significant at the 1% level.
Table 6
Model 2: Regression of efficiency increase on political and organizational factors

<table>
<thead>
<tr>
<th>Dependent variable: efficiency increase</th>
<th>Estimation method: weighted least squares (WLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>(-0.324^{***}) (0.037)</td>
</tr>
<tr>
<td>Political factors</td>
<td></td>
</tr>
<tr>
<td>Business cycle at privatization date</td>
<td>(2.210^{***}) (0.379)</td>
</tr>
<tr>
<td>Foreign buyer</td>
<td>(0.093^{**}) (0.029)</td>
</tr>
<tr>
<td>Organizational factors</td>
<td></td>
</tr>
<tr>
<td>Initial performance level</td>
<td>0.086 (0.170)</td>
</tr>
<tr>
<td>Size</td>
<td>(1.14E-7^{**}) (4.1E-8)</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>(0.002^{*}) (0.001)</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
</tr>
<tr>
<td>Aluminum industry</td>
<td>(0.251^{**}) (0.078)</td>
</tr>
<tr>
<td>Automotive industry</td>
<td>(0.160^{*}) (0.072)</td>
</tr>
<tr>
<td>Electronic industry</td>
<td>(0.151^{***}) (0.024)</td>
</tr>
<tr>
<td>Food industry</td>
<td>(0.124^{**}) (0.037)</td>
</tr>
<tr>
<td>Equipment industry</td>
<td>(-0.045) (0.035)</td>
</tr>
<tr>
<td>Unweighted statistics</td>
<td></td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.95</td>
</tr>
<tr>
<td>Adjusted (R^2)</td>
<td>0.80</td>
</tr>
</tbody>
</table>

\(a\) N=22.  
\(b\) Measured by the estimated coefficient of the Time*Post-privatization period interaction term from Table 3.  
\(c\) Wald test of joint significance of political and organizational factors: \(\chi^2\)-statistic=246.28, p-value=0.001.  
\(d\) Average ROA of Spanish firms in the year the firm was privatized. Source: Central de Balances del Banco de España, Spain.  
\(e\) Dummy variable (=1 if true, 0 otherwise). Source: Villalonga (1996).  
\(f\) Firm’s ROA at privatization date. Source: Firms’ annual reports.  
\(g\) Real sales, measured in millions of January 1990-pesetas. Nominal sales are deflated using year-wide averages of industry-specific industrial price indices (or the food and drinks consumer price index, in the case of Jobac). Source: Instituto Nacional de Estadística, Spain.  
\(h\) Firm’s assets per employee at privatization date. Source: Firms’ annual reports.  
\(i\) The unweighted statistics are reported because the GLS transformation inflates the \(R^2\) from the regression (Greene, 1997). These unweighted statistics come from regressing the untransformed dependent variable on the predicted values using untransformed regressors and the coefficients from the weighted regression. Standard errors are in parentheses.  
\(*\) Statistically significant at the 10% level.  
\(**\) Statistically significant at the 5% level.  
\(***\) Statistically significant at the 1% level.

5. Discussion and implications

Hypothesis 1 (that privatization increases efficiency) has been tested in two different ways. First, based on the test results reported in Table 4, the null hypotheses that the mean and median levels of efficiency for each firm are the same before and after privatization cannot be rejected. Neither can the null hypothesis that the proportion of firms for which these levels increased after privatization is equal to 0.5. And the conclusions are the same concerning mean and median efficiency growth. Second, the results from estimating Model 1 show that, in this sample, the effect of privatization has led to significant increases in
Table 7
Model 3: Regression of efficiency growth on bi-yearly dummies

<table>
<thead>
<tr>
<th>Dependent variable: Efficiency (ROA) growth</th>
<th>Estimation method: FGLS (SUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 0 (Privatization year)</td>
<td>−141.753*** (30.013)</td>
</tr>
<tr>
<td>Years −4 to −3 (pre-privatization)</td>
<td>159.345*** (39.463)</td>
</tr>
<tr>
<td>Years −2 to −1 (pre-privatization)</td>
<td>−13.288 (37.666)</td>
</tr>
<tr>
<td>Years 1 to 2 (post-privatization)</td>
<td>89.889** (36.758)</td>
</tr>
<tr>
<td>Years 3 to 4 (post-privatization)</td>
<td>87.297** (37.029)</td>
</tr>
<tr>
<td>Years 5 to 6 (post-privatization)</td>
<td>−344.345*** (51.030)</td>
</tr>
<tr>
<td>Years 7 to 8 (post-privatization)</td>
<td>2402.241*** (276.720)</td>
</tr>
<tr>
<td>Unweighted statistics b</td>
<td></td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.92</td>
</tr>
<tr>
<td>Adjusted ( R^2 )</td>
<td>0.91</td>
</tr>
</tbody>
</table>

*a Total number of panel observations: \( \sum (T_i - 1) = 214 \), due to loss of the first observation for each firm to calculate growth series (\( N = 24; T = T_i - 1 \), Values of \( T_i \) for each firm are reported in Table 8. Average \( T = 9.9 \)).

*b The unweighted statistics are reported because the GLS transformation inflates the \( R^2 \) from the regression (Greene, 1997). These unweighted statistics come from regressing the untransformed dependent variable on the predicted values using untransformed regressors and the coefficients from the weighted (GLS) regression. Standard errors are in parentheses: *Statistically significant at the 10% level; ** Statistically significant at the 5% level; ***Statistically significant at the 1% level.

efficiency in about as many cases as it has led to significant decreases. Consequently, Hypothesis 1 is rejected. This finding, together with the evidence reported in previous studies that, in the same country and period, private ownership was significantly associated with higher levels of performance, lends support to my claim that privatization involves more than pure ownership effects. Neither does the positive effect of ownership on efficiency observed in other studies lead to a positive effect of privatization on efficiency, nor does the inconclusive effect of privatization on efficiency observed in this study imply that ownership has no effect on efficiency, as would be concluded from estimating the effect of private versus public ownership in this sample in the ‘traditional’ way ignoring the effect of all factors other than ownership. Thus, the discrepancy can only be resolved by examining what other factors may have intervened in the observed relationship between privatization and efficiency.

The analysis of Model 2 reveals that several political and organizational factors unrelated to ownership have significantly intervened. The result of the Wald test for the joint significance of all these factors provides statistical support for Hypothesis 2. Among the political factors, the significant positive effect found for the state of the business cycle at which the company was privatized suggests that the government may have sold some of the firms at a period of economic recession, which, as it had been predicted, would be a potential negative factor contributing to the net effect of a firm’s privatization on efficiency. The foreign buyer dummy’s positive sign and significance provide evidence of another political factor affecting the observed privatization-efficiency relationship: the trade-off governments face between the efficiency objective and responding to popular and political concerns about ‘selling the country away’. Among the organizational factors, the firm’s initial performance level turns out to be insignificant, so the difficulty of running or turning
around a low-performing privatized firm does not seem to have played a role in arriving at the observed effects of privatization in efficiency. Firm size, however, does have a positive and significant effect. If, as it has been assumed, size is proxying for the resistance to change encountered within the organization, the positive sign found appears to contradict my expectation (that larger firms would be less prone to confirm the positive effects of privatization on efficiency). On the other hand, as a dynamic and transitional factor, it is consistent with the overall timing of effects observed from Model 3 (discussed below). Finally, the positive sign on capital intensity reveals that efficiency increases are associated with the more capital-intensive firms within the sample and, insofar as it is another transitional factor, its effect is also consistent with the observed timing of the total privatization effect.

The estimation of Model 3 yields the strongest evidence of efficiency increase for years 7 and 8 after privatization, as well as fairly strong evidence of decrease for the 2 previous years (5 and 6). This confirms Hypothesis 3 (that the observed effect of privatization on efficiency is contingent upon the time period considered), thus making clear that conclusions about the privatization-efficiency hypothesis drawn from looking at short post-privatization periods (e.g. Sanchís, 1996) may be misleading. It also suggests that one or more of the negative transitional factors described might have actually been operating during the first 6 years after privatization, but their impact has finally been offset by the effects of private ownership and possibly other positive implications of privatization. The positive significance of years 4–3 before privatization is worth noting. None of the theories mentioned offer any prediction about the efficiency of privatized firms before they are privatized, but there is typically a popular concern, supported by empirical evidence from some British companies, that governments pick out for privatization firms that have already begun to experience an efficiency increase. On the other hand, such an explanation easily fits within the framework presented here, as another possible political factor. Nevertheless, the fact that the positive significance is observed 4–3 years before privatization, but not immediately before (e.g. in years 2–1), seems at odds even with that explanation. In this sense, all that can be said is that both my specific finding and the more general issue of the timing of efficiency effects before privatization deserve further investigation.

Two limitations of this empirical study that qualify the results just discussed have already been mentioned: the idiosyncrasies of the Spanish institutional environment and privatization process during the socialist government, which limit the generalizability of my specific findings; and the data constraints faced in the choice of the factors to be examined. To these, three more may be added, which are also a product of the data availability problem. First, sample size; while adequate for the population it is representing, and reasonable compared to those in former privatization studies, it is admittedly small from a statistical point of view. This may have been the reason, for example, for the inconclusiveness of the tests in Table 4. Second, the accuracy with which the variables included have been measured. Particularly, although I have noted that profitability is a valid measure of efficiency in competitive environments, it would be highly desirable to complement it with costs or productivity indicators, which unfortunately I do not have. Also, I must admit that size is a rather indirect measure of organizational inertia, and so its observed effect on efficiency increase may lend itself to alternative interpretations. For instance, it may
well be the case that large firms have been able to downsize themselves to a greater extent than small firms, and that the higher efficiency increase observed for them is just a consequence of that restructuring. Third, given the evidence I have provided that the effect of privatization on efficiency is contingent upon the time period considered, this is a limitation of any empirical privatization study to which mine is no exception. For instance, it is possible that some of the results would have been different if the panel had been balanced.

These limitations are hardly solvable within the context of the population of this study, since they are mostly data-driven and I believe I have exhausted all possible means of data collection for most of the sample. However, they may be solved by investigating a different population of privatized firms for which more internal data are available. Given the large number of firms that have been privatized all over the world in recent years, this extension is likely to become increasingly feasible. Moreover, I believe this is highly desirable, since (1) there are still very few statistical studies of privatization effects, and (2) my findings definitely encourage further research.

This study has important implications for the privatization literature, since it has identified a major mismatch between privatization theories and evidence, and contributed to explain it. It has proven the relevance of some implications of privatization that had, however, been ignored by previous privatization theorists and empiricists, namely, political, organizational, and dynamic implications that go beyond the private-public distinction. I think this should be of interest not only to academics, but also to the multiple stakeholders involved in privatization programs: governments undertaking these programs, companies or investors participating on the demand side, and even the general public, to the extent that we are all the ultimate owners of the state-’owned’ enterprises of our countries of citizenship.

Acknowledgements

I would like to thank Alvaro Cuervo, Harold Demsetz, Javier Gómez Biscarri, Bill McKelvey, and Pavel Pelikan for their comments and suggestions on earlier versions of this paper. All remaining errors are of course my own. Financial support for my doctoral studies from the Fulbright Commission, Fundación Caja de Madrid, Fundación Ramón Areces, and the Anderson School Doctoral Program Office is also gratefully acknowledged.

Appendix

The following tables report the results of the diagnostic tests carried out for Models 1 and 3 (Table A.1), and the correlation matrix of the variables included in Model 2 (Table A.2).
### Table A.1
Heteroskedasticity and autocorrelation tests for Models 1 and 3: residual variances, Durbin–Watson, and F-statistic from Breusch–Godfrey test equations

<table>
<thead>
<tr>
<th>Firm</th>
<th>$T_i$</th>
<th>Model 1</th>
<th>Durbin–Watson$^a$</th>
<th>Breusch–Godfrey $^b$</th>
<th>Residual variances$^c$</th>
<th>Durbin–Watson$^c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingenasa</td>
<td>8</td>
<td>0.0136</td>
<td>2.85$^{au}$</td>
<td>0.85</td>
<td>6.43E+06</td>
<td>1.10$^{au}$</td>
</tr>
<tr>
<td>SKF Española</td>
<td>12</td>
<td>0.0019</td>
<td>1.97</td>
<td>0.67</td>
<td>3.05E+06</td>
<td>0.60$^{d}$</td>
</tr>
<tr>
<td>Seat</td>
<td>13</td>
<td>0.0028</td>
<td>2.75$^t$</td>
<td>2.57</td>
<td>1.58E+08</td>
<td>2.11$^t$</td>
</tr>
<tr>
<td>Evatsa</td>
<td>11</td>
<td>0.0245</td>
<td>3.42$^t$</td>
<td>3.77</td>
<td>2.98E+06</td>
<td>0.67$^t$</td>
</tr>
<tr>
<td>Litofan</td>
<td>14</td>
<td>0.0154</td>
<td>2.58$^t$</td>
<td>2.24</td>
<td>1.57E+06</td>
<td>1.17$^t$</td>
</tr>
<tr>
<td>Alumalsa</td>
<td>13</td>
<td>0.0043</td>
<td>2.75$^t$</td>
<td>1.95</td>
<td>2.01E+06</td>
<td>2.13$^t$</td>
</tr>
<tr>
<td>Telesincro</td>
<td>11</td>
<td>0.0014</td>
<td>2.63$^t$</td>
<td>5.22$^*$</td>
<td>2.05E+05</td>
<td>1.72$^t$</td>
</tr>
<tr>
<td>Astican</td>
<td>11</td>
<td>0.0024</td>
<td>2.75$^t$</td>
<td>4.52$^*$</td>
<td>2.62E+06</td>
<td>1.35$^t$</td>
</tr>
<tr>
<td>MTM</td>
<td>11</td>
<td>0.0132</td>
<td>3.11$^t$</td>
<td>3.06</td>
<td>8.76E+04</td>
<td>1.94$^t$</td>
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<tr>
<td>Atenisa</td>
<td>11</td>
<td>0.0046</td>
<td>3.21$^t$</td>
<td>3.79</td>
<td>6.21E+05</td>
<td>2.17$^t$</td>
</tr>
<tr>
<td>Oesna</td>
<td>10</td>
<td>0.0176</td>
<td>3.21$^t$</td>
<td>7.38$^*$</td>
<td>3.21E+06</td>
<td>2.10$^{au}$</td>
</tr>
<tr>
<td>Pesa</td>
<td>11</td>
<td>0.0035</td>
<td>3.02$^t$</td>
<td>3.66</td>
<td>7.28E+05</td>
<td>0.46$^t$</td>
</tr>
<tr>
<td>Hytasa</td>
<td>11</td>
<td>0.0037</td>
<td>3.41$^t$</td>
<td>16.32</td>
<td>5.67E+05</td>
<td>2.06$^t$</td>
</tr>
<tr>
<td>Salinas Torrevieja</td>
<td>10</td>
<td>0.0282</td>
<td>3.22$^{au}$</td>
<td>9.44</td>
<td>6.79E+05</td>
<td>2.45$^{au}$</td>
</tr>
<tr>
<td>Enasa</td>
<td>9</td>
<td>0.0021</td>
<td>2.07$^t$</td>
<td>0.53</td>
<td>2.02E+05</td>
<td>1.46$^{au}$</td>
</tr>
<tr>
<td>GEA</td>
<td>10</td>
<td>0.0062</td>
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<td>1.42</td>
<td>4.40E+04</td>
<td>1.96$^{au}$</td>
</tr>
<tr>
<td>TSD</td>
<td>7</td>
<td>0.0458</td>
<td>3.00$^{au}$</td>
<td>5.82</td>
<td>7.00E+05</td>
<td>1.98$^{au}$</td>
</tr>
<tr>
<td>Coisa</td>
<td>7</td>
<td>0.0007</td>
<td>3.57$^{au}$</td>
<td>43.70$^*$</td>
<td>2.35E+05</td>
<td>1.71$^{au}$</td>
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<td>6</td>
<td>0.0002</td>
<td>3.13$^{au}$</td>
<td>n/a</td>
<td>1.30E+06</td>
<td>1.95$^{au}$</td>
</tr>
<tr>
<td>Icatro</td>
<td>8</td>
<td>0.0024</td>
<td>3.46$^{au}$</td>
<td>4.32</td>
<td>1.19E+05</td>
<td>1.77$^{au}$</td>
</tr>
<tr>
<td>Repsol (Grupo)</td>
<td>8</td>
<td>0.0001</td>
<td>2.57$^{au}$</td>
<td>0.12</td>
<td>3.79E+04</td>
<td>2.64$^{au}$</td>
</tr>
<tr>
<td>FSC</td>
<td>8</td>
<td>0.0501</td>
<td>2.72$^t$</td>
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<td>4.80E+05</td>
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<td>Palco</td>
<td>6</td>
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<td>3.64$^{au}$</td>
<td>n/a</td>
<td>8.72E+04</td>
<td>2.18$^{au}$</td>
</tr>
<tr>
<td>Pooled</td>
<td>9.9</td>
<td>0.3160</td>
<td>2.98$^t$</td>
<td>3.18E+08</td>
<td>2.26$^{au}$</td>
<td></td>
</tr>
</tbody>
</table>

$^a$ The residual variances and Durbin–Watson statistics come from the individual firm regressions:

$$\text{EFFI}_t = \alpha + \beta_1 \text{PRIV}_t + \beta_2 \text{TIME}_t + \beta_3 \text{TIME^PRIV}_t + \beta_4 \text{SIZE}_t + \beta_5 \text{CYCLE}_t + \varepsilon_t,$$

$I=Test$ is inconclusive; na=dL and dU critical values are not available in tables for this sample size.

$^b$ The Breusch–Godfrey F-statistic is testing the null hypothesis that the coefficient of the lagged residuals $e_{t-1}$ is zero in the individual firm regressions:

$$e_t = \alpha + \beta_1 \text{PRIV}_t + \beta_2 \text{TIME}_t + \beta_3 \text{TIME^PRIV}_t + \beta_4 \text{CYCLE}_t + \beta_5 e_{t-1} + u_t,$$

where $e_t$ are the estimated residuals of $e_{it}$ for each firm $i$ from Model 1 (Table 5).

$^c$ The residual variances and Durbin–Watson statistics come from the individual firm regressions:

$$\text{EFFGROWTH}_t = \alpha + \beta_1 \text{YEAR43}_t + \beta_2 \text{YEAR21}_t + \beta_3 \text{YEAR12}_t + \beta_4 \text{YEAR34}_t + \beta_5 \text{YEAR56}_t + \beta_6 \text{YEAR78}_t + \varepsilon_t,$$

$I=Test$ is inconclusive; na=dL and dU critical values are not available in tables for this sample size.

$^* Statistically significant at the 10% level.
Table A.2
Correlation matrix of variables in Model 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Efficiency increase (dependent) (^b)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Business cycle (^c)</td>
<td></td>
<td>0.40</td>
<td>1.00</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3. Foreign buyer (^d)</td>
<td></td>
<td>0.49</td>
<td>0.52</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Initial performance level (^e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5. Size</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6. Capital intensity (^f)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Aluminum industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>8. Automobile industry</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Electronic industry</td>
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<td>10. Food industry</td>
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<td>11. Equipment industry</td>
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\(^a\) N=24.

\(^b\) Firm’s assets per employee at privatization date. Source: Firms’ annual reports.

\(^c\) Average ROA of Spanish firms in the year the firm was privatized. Source: Central de Balances del Banco de España, Spain.

\(^d\) Dummy variable (=1 if true, 0 otherwise). Source: Villalonga (1996).

\(^e\) Firm’s ROA at privatization date. Source: Firms’ annual reports.

\(^f\) Real sales, measured in millions of January 1990-pesetas. Nominal sales are deflated using year-wide averages of industry-specific industrial price indices (or the food and drinks consumer price index, in the case of Jobac); Source: Instituto Nacional de Estadística (INE), Spain.

\(^g\) Firm’s assets per employee at privatization date. Source: Firms’ annual reports.

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