Leviathan resists: the endogenous relationship between privatization and firm performance

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Abstract Using a panel dataset of privatized cement firms in Turkey, this paper models and finds support for the simultaneous relationship between privatization and firm performance. It is found that favorable short-run performance, weak market potential, higher employment, lower socio-economic development, concentrated voter preferences, and weaker representation of right-wing parties in the firms' locality delay the timing of privatization. The paper also finds that privatization increases output in the medium-term by reducing the labor stock and promoting the adoption of more advanced technology, such that production shifts from constant to decreasing returns to scale.

Keywords Privatization · Firm performance · Simultaneous equations

JEL Classification O38 · L32 · L33

1 Introduction

Technocrats, economists, and international organizations often promote privatization for greater production efficiency, higher employment rates and more vigorous growth. For politicians and bureaucrats, however, state assets are tools for political expediency and the strengthening of their own positions. For trade unions, privatization implies job losses. For example, Belgian privatization attempts were frequently foiled by trade unions in the 1980s

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under the weak Martens government. Also, the failed attempts in the early 1990s at privatizing Turkish Airlines and Turkish Petroleum, as well as power plants, oil refineries, and tourism assets in Greece, are ascribed to the powerful statist structures' dragging their feet (Pagoulatos 2001). Despite resistance to privatization, some success has also been observed under Thatcher in the United Kingdom in the 1980s, Menem in Argentina, and Collor and Cordoso in Brazil in the 1990s.

Privatization has attracted strong attention in the public choice and corporate governance literature due to the perceived link between the ownership structure of firms and firm performance, with the latter being an underlying factor driving industry performance and economy-wide growth. In a pioneering contribution, Boardman and Vining (1989) find that there are significant differences in the performance indicators of public and private enterprises. The celebrated study of Shleifer and Vishny (1994)—the *Agency View*—suggests that political interference in public firms results in excessive employment, low levels of investment, and the adoption of inefficient technologies. This view, therefore, suggests a feedback from privatization to firm performance.

In this paper, we hypothesize a feedback from firm performance to privatization and, therefore, simultaneous determination. Anti-privatization interest groups often raise the question: Why should relatively well-performing public firms be sold? Indeed, each public firm with strong market potential and/or growth performance is regarded as providing a justification for such resistance. Conversely, pro-privatization politicians and buyers are often encouraged in privatization by solid firm performance. Thus, while the potential for better firm performance may drive some politicians to sell, opposing forces may come into play should they face a constituency expecting populist actions, or powerful interest groups, or a statist structure surrounding the bureaucratic layers, which aim at protecting state assets. In addition, public enterprises may employ *surplus* labour. Thus, for politicians, it may not be *politically sound* to relinquish their control over such enterprises.

It is important to characterize these interest groups. Public Choice Theory (PCT) predicts that political agents are utility maximizers, subject to constraints. The principle objective of politicians is to maximize their time in office, while bureaucrats, who are inherently political agents, aim to maximize their budgets to build stronger bureaus (Niskanen 1975). PCT also predicts the existence of political coalitions among different utility maximizers (Belke et al. 2007), such as politicians, bureaucrats, trade union representatives, and sectoral and provincial lobbyists. Thus, robust firm performance is likely to be used by these groups as a means of resistance to privatization. Meanwhile, Partisan Theory (Hibbs 1977) postulates a different but somewhat related division among agents in economic decision-making, i.e., that of left-wing and right-wing ideologies. The core clientele of leftist parties are likely to be among the losers in privatization, which leads them to use strong firm performance as ammunition in the *fight*. Right-wing parties, on the other hand, are typically associated with enhanced commitment to market platforms (Bortolotti et al. 2003), or they at least are inclined to resort to *popular capitalism* when problems such as excessive public debt arise, by disposing of inefficient state assets.[1] Therefore, solid firm performance will be used as a leverage point by right-wingers. Moreover, bureaucrats are not immune to possessing leftist or rightist ideologies, and they can position their bureaus accordingly.

The proceeds of a sale is an additional factor to consider in the debate around privatization. Pro-privatization agents will desire the expeditious sale of high performance firms to capitalize on their strong market potential. Delaying privatization would likely result in

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[1]Bortolotti et al. (2003) and Belke et al. (2007) discuss the public choice and partisan theories thoroughly.

lower revenues due to asset amortisation, and the political uncertainty that may result from a protracted debate on privatisation. Opponents of privatization may benefit from a delay, because expected lower proceeds are likely to decrease the chances of privatization.[2]

In the juncture of these objectives and constraints, this paper explores the simultaneous relationship between privatization and firm performance, using a longitudinal dataset from the Turkish cement industry.[3] Specifically, it models explicitly the endogeneity between privatization and firm performance in a structural equations framework. Endogeneity problems are seldom addressed in a structural setup in exploring institutional reforms,[4] and reduced form equations do not allow for disentangling the impact of variables. In modeling privatization decision-making, we investigate the effects of firm performance, employment, and the spatial and political nexus of the firms in question, as shown by provincial and regional political variables. We also analyze the impact of party composition of the government on privatization to test the Partisan Theory. For firm performance, we employ productivity growth and the level of output as our measures, which enable exploration of the simultaneity in both the short- and long-run.

Several factors commend Turkey and the Turkish cement sector for analysis. First, Turkey has long been trying to align its institutions with those of the European Union, with a prospect of membership. As such, it constitutes a rich playground for investigating the interactions of players with different objectives regarding institutional reforms. Second, being one of the leading cement producers in Europe, Turkey started its privatization drive with the cement industry in the 1980s. All public firms in Turkey were privatized between 1989 and 1998, and this experience, by itself, constitutes almost the only successful privatization attempt finalised in this country up to 2005. Third, annual pre- and post-privatization data for this industry are available for the 1984 to 1999 period. The post-privatization steps taken by the private firms in an industry with excessive employment and an overwhelmingly restrictive political environment are especially important for investigation. Fourth, by including all privatized firms in the sample, we avoid any sample selection bias. Fifth, these firms are geographically dispersed across the country, and voter preferences differ significantly across the different regions. This will enable the identification of the political attitude in the regions in which each firm is located and how this attitude affects national policy-making. Last, using a single country for analysis controls for institutional effects, such as differing legal systems and property rights legislation.

In a nutshell, we find that privatization and firm performance are simultaneously determined in the political economy domain. Controlling for endogenous relationships, privatization is delayed if the number of workers employed in the firms is high, if different regions' political (nationalistic, ethnic, etc.) and economic resistance is resilient, and if the firms exhibit favorable short-run performance. Also, voter fractionalization at the provincial level increases the likelihood of privatization of firms in that particular province. In addition, a stronger presence of centre-right (centre-left) parties in the government increases

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[2]For instance, Turkish Telecom greatly renewed its infrastructure in the early 1990s and was then valued at US$30 billion ($\approx$10% of Turkey's GDP). The statist structure continuously resisted its privatization by appealing to the Supreme Court and having the relevant bills annulled, exploiting legal lacunae. The army also resisted due to the *strategic importance* of the communication lines that the company operates. Finally, 55% of the company's shares were sold for US$6.65 billion in 2005.

[3]The simultaneity between privatization and firm performance has actually been hinted by Boardman and Vining (1989) in the context of the re-nationalization possibility of poorly performing private enterprises.

[4]There are notable exceptions. Alesina et al. (1996) examine the relation between growth and political stability in the same simultaneity structure as we use here. Keshk et al. (2004) analyze the simultaneous relation between trade and conflict.

(decreases) the likelihood of privatization, but this effect is more likely to work when the government is represented strongly in the province where the firm is located, rather than at the national level. The private sector firms, on the other hand, exhibit a very interesting feature. After taking into account most political and economic factors and endogenous relationships, they decrease the labor stock, increase the technological capacity of the firm and, thereby, increase the output by changing the returns-to-scale of production. We also find that, in privatized firms, an increase in labour employed has less negative effects than under public regimes.

The paper is organized as follows: Sect. 2 briefly reviews the relevant literature; Sect. 3 provides the institutional background; Sect. 4 discusses the data used; and Sect. 5 describes the econometric methodology. Section 6 discusses the empirical results. Finally, Sect. 7 concludes the paper.

2 Related literature

The impact of privatization on productive efficiency has received considerable attention from the literature, with mixed conclusions.[5] Only a few studies analyze the privatization-growth relationship, albeit at the macro level. Using a two-sector general equilibrium model, Gylfason (1998) argues that the static output gains from privatization may be large. On the empirical side, Plane (1997) argues that privatization is likely to have boosted growth in thirty-five developing countries in the 1988 to 1992 period. Cook and Uchida (2003) study sixty-three developing countries and argue that effective competition and regulation facilitates privatization increases rates of growth.[6]

On the determinants of privatization, again a relatively sparse body of literature, Clarke and Cull (2002) find that, in the case of Argentine public banks, overstaffed and large banks, poorly performing banks, and a high level of provincial unemployment and public employment, decrease the likelihood of privatization. Dinc and Gupta (2007) investigate the role of political competition and patronage in privatization in India. Their results suggest that the government is reluctant to privatize firms located in regions where the ruling party faces effective political competition from parties in opposition. In addition, no state enterprise located in the home state of the politician in charge of that enterprise is ever privatized. Brandt et al. (2005) find that, in the case of township and village enterprises in China, higher human capital and deteriorating bank liquidity boost privatization. Belke et al. (2007) analyse the determinants of privatization proceeds in OECD countries. They find that right-wing governments and countries in need of tax revenue, with relaxing fiscal stances, are associated with higher privatization revenue. Finally, in a cross-country study, Bortolotti et al. (2003)

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[5]See, inter alia, Earle and Telegdy (2002), Wallsten (2001), Villalonga (2000), Frydman et al. (1999), Ehrlich et al. (1994), and Vining and Boardman (1992). Megginson and Netter (2001) and Megginsson (2005) provide an excellent survey of the privatization literature. See, also, Haggard and Webb (1994), Shirley and Walsh (2000), and Seshinski and Lopez-Calva (2003) for reviews. See Shleifer and Vishny (1997) and Drazen (2000) for theoretical approaches.

[6]Boubakri et al. (2005) find that large shareholders have more incentives to monitor management after privatization to ensure that their resources are not diverted. By contrast, Gupta (2005) finds that partial privatization has a positive impact on profitability, productivity, and investment. Cragg and Dyck (2003) find that privatization affects firm performance through changing management incentives.

find that high per capita income, developed financial markets, high levels of sovereign debt, and a right-wing government result in higher rates of privatization.[7]

Part of our data set has previously been used by Okten and Arin (2006) to study privatization and firm efficiency. Focusing on reduced form single-equation relationships, Okten and Arin show that the change of ownership from the public to the private sector is sufficient to gain productive efficiency, while privatization's effect on allocative efficiency depends on the competitive environment.[8] The current study takes an entirely different approach and explicitly models the privatization decision-making via national and provincial politics variables and, therefore, the simultaneity in a structural framework. It also estimates pre- and post-privatization production functions with endogenously determined privatization decisions.

3 Institutional background

Turkey is a unitarian parliamentary democracy. Accordingly, all privatization decisions are made at the national government level. Resistance to privatization has, however, been undertaken by parliamentary and non-parliamentary organizations, including trade unions, provincial lobby groups, and other elements within the statist structure (such as the army). In the parliament, the stance of the political parties has varied. Parties forming the government, whether right-wing or left-wing, have generally *tended* to support privatization due to international pressures; however, left-wingers, especially, have drifted away from their earlier positions when they have switched to being part of the opposition.

The privatization move was initiated in Turkey in mid-1980s by the centre-right wing government of Turgut Özal. Mass privatization waves driven by neo-liberal governments around the world, as well as persistent budget deficits that were mainly caused by inefficient state-owned enterprises, and the resulting high rates of inflation, motivated the process. The choice of the cement industry in the early wave of privatization in Turkey was due to a significant increase in cement demand in the early 1980s in association with a construction boom in the country. As the cement industry is a highly physical- and capital-intensive industry (Das 1992), the capacity increase required to meet the higher demand was considered too costly for public firms. Thus, the Privatization Administration of Turkey (PAT) was given the green light for sales.[9] The sales proceeds were pooled in a fund, later used to finance infrastructure investments by the public sector.

4 Data

We use an extensive panel dataset covering twenty-two firms. The panel spans the period of 1984 to 1999 and is unbalanced due to random data unavailability. The data for output, employment, capacity, and investment are obtained from the official statistics of the PAT, while

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[7]See Madrid (2003), also, for the determinants of cross-country privatization performance. There is also literature on the political determinants of institutional change (see Kroszner et al. 1999). Lopez-de-Silanes et al. (1997) studied the mode of privatization for various US counties.

[8]Using data from six different industries, Arin and Okten (2003) analyze the determinants of privatization prices in Turkey. They find that revenue and market characteristics are the significant determinants.

[9]The Government initially had an ownership stake in 30 firms. In seven of these, its participation was minor (0.001% in one case). An eighth firm was liquidated after its sale. In the remainder, government ownership was 98–100%.

the data for capital and sales are obtained from the Istanbul Chamber of Industry statistics for the 500 largest firms in Turkey. These institutions are regarded as reliable data sources. The data for Turkish Parliament membership, used to construct the provincial politics variables and the party composition of the government, are obtained from the parliament's website (www.tbmm.gov.tr).[10]

Productivity is defined as the average quantity of cement produced by each worker in tonnes. Productivity growth is the logarithmic change of output per worker. Investment is defined as the expenditure on purchases of capital goods. Investment rate is the ratio of investment to sales, the latter being a proxy for value of output.[11] Real capital stock is inflation-adjusted assets. Labor growth is the logarithmic change in the number of workers. Capacity utilization is output divided by total capacity (in tonnes). Voter fractionalization is a Herfindahl-type index, whereby voter shares are the parliamentary seat shares of different parties for each province.[12] A higher value for this index indicates lower voter concentration. Government's relative strength is the difference between the seat shares of government parties and the largest opposition grouping for a province.

Important differences in the statistics of different regimes are quickly evident (Table 1). For instance, post- privatization median productivity growth is significantly higher than it is under the public regime. This also holds true for the investment rate, output level, real capital stock, and capacity utilization. Labor growth is negative in both regimes, but higher in magnitude after privatization. Labor stock is lower after privatization.

5 Empirical analysis

We consider two systems of equations, whereby privatization and productivity growth, and privatization and output level, are determined simultaneously.

5.1 Privatization and productivity growth: short-term relationship

The standard presumption in the growth literature is that growth regressions with annual data provide short-run relationships, while variables in levels capture long-run associations. Thus, annual growth regressions are expected to display the 'yearly' evolution of productivity towards a long-run steady state. The following system of equations is used to test the short-term joint relationship between privatization and productivity growth:

$$PRIV_{it} = \beta_0 + \beta_1 GROWTH_{it} + \beta_2 \ln(L_{it}) + \beta_3 CU_{it} + \beta_4 RIGHT_t + \delta' \mathbf{P} + \varphi' \mathbf{R} + u_{it}$$

$$GROWTH_{it} = \alpha_0 + \alpha_1 inv_{it} + \alpha_2 n_{it} + \alpha_3 PRIV_{it} + \alpha_4 PRIV_{it} \times inv_{it} + \alpha_5 PRIV_{it} \times n_{it}$$
$$+ \alpha_6 \ln(y_{i,initial}) + \varepsilon_{it} \tag{System I}$$

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[10]Energy consumption data are not available because energy consumption has not been considered as a measure of productive efficiency, the focus of collecting statistics, and, therefore, was never included in the official statistics of the Undersecretariat of the Privatization Administration of Turkey.

[11]This approximation is dictated by data unavailability for the value of output. The estimate is viable, however, because exports and inventories are insignificant in most firms.

[12]Administrative units in Turkey are provinces (in total 81). Representation of each province in the 450-member parliament (550 after 1995) is based on their population share. Turkish territories are also divided into seven geographical regions, which have no administrative functions, but are characterized by different economic, political, social, and demographic features. Each region consists of 8 to 16 provinces.

Table 1 Summary statistics

	Pre-privatization period				Post-privatization period			
	P. Growth	Capacity (tonnes)	Investment	Labor Growth	P. Growth	Capacity (tonnes)	Investment	Labor Growth
Mean	0.099	481,342	0.086	−0.045	0.099 (0.99)	606,555 (0.00)	0.240 (0.00)	−0.068 (0.25)
Median	**0.085**	**450,000**	**0.028**	**−0.023**	**0.113 (0.24)**	**480,000 (0.00)**	**0.077 (0.00)**	**−0.063 (0.00)**
Maximum	0.640	990,000	1.360	0.742	0.860	1,584,000	2.366	1.214
Minimum	−0.439	210,000	0.000	−0.466	−0.583	210,000	0.002	−0.415
Std. Dev.	0.195	192,158	0.172	0.123	0.213	260,674	0.379	0.171
Obs.	101	123	96	101	135	135	70	135

	Pre-privatization period				Post-privatization period			
	Output (tonnes)	Real Capital Stock (TL)	Labor Stock	Cap. Util.	Output (tonnes)	Real Capital Stock (TL)	Labor Stock	Cap. Util.
Mean	347,929	10,500,000,000	310	0.759	469,374 (0.00)	23,100,000,000 (0.00)	180 (0.00)	0.831 (0.01)
Median	**330,733**	**8,010,000,000**	**310**	**0.761**	**433,925 (0.00)**	**12,300,000,000 (0.00)**	**171 (0.00)**	**0.851 (0.03)**
Maximum	740,000	32,200,000,000	420	1.091	968,500	79,500,000,000	377	1.793
Minimum	123,343	2,790,000,000	124	0.154	138,478	4,920,000,000	81	0.281
Std. Dev.	124,600	7,240,000,000	68	0.176	178,673	20,600,000,000	51	0.259
Obs.	123	89	123	123	135	68	135	135

p-values of t-tests and chi-squared tests of the equality of means and medians, respectively, across different regimes. TL: Turkish Lira

where i is an index of the firms, t is an index for time, *PRIV* is the privatization dummy that takes the value 1 if year t is a post-privatization period, *GROWTH* is productivity growth, L is the number of workers, *CU* is capacity utilization, *RIGHT* is the seat share of centre-right parties in the government (a nation-wide variable), *inv* is the rate of investment, n is the growth in the number of workers, and $y_{initial}$ is the initial output per capita. **P** and **R** are the vector of political variables to be explained below.

A priori, we do not have any expectation for the sign of the *GROWTH* variable in the privatization equation. Higher productivity growth may drive pro-privatization politicians to sell these firms, but opposite forces may resist to their attempts. The variable L is expected to capture the concerns of political agents in privatization. As workers and other affected parties are sources of votes, politicians' hesitation and trade unions' opposition would delay privatization. Therefore, we expect a negative sign for this variable.[13] Capacity utilization

[13]Given that labor availability is already included in the regression, the impact of output growth (or, as will be mentioned, output level) on the likelihood of privatization can be attributed to the market power of the firm.

can capture the cement demand that firms face and, thus, how attractive they are to buyers. Its sign is likely to be positive. The variable *RIGHT* tests the partisan theory to the extent that these factions are represented in the government.[14] We expect a positive sign for this variable. Through its presence in the model, *GROWTH* is then expected to capture the effects suggested by the public choice theory (utility maximizers that would oppose privatization) and partisan elements orthogonal to the government (right-, or left-wing bureaucrats, businessmen, etc.).

We use two sets of political variables: Province-level variables (vector **P**); and regional dummies (vector **R**). The province-level variables are; (i) a voter fractionalization index to test whether, and how, the concentration of voter preferences in a province affects privatization, and (ii) the government's relative strength in the province to test whether government representation in a province helps, or deters, privatization (Dinc and Gupta 2007). If the government is concerned about losing votes in a certain province, then it would hesitate to privatize in that province. The government may, however, use its political power such that privatization takes place at the expense of the locals bearing the cost. Thus, the sign of both provincial variables is an empirical question. Meanwhile, regional dummies are used to capture social, economic, and political clout against privatization. The western and north-western regions of Turkey are socio-economically more developed, while the eastern and south-eastern regions are characterized by high unemployment and a relatively sub-standard industrial base. Due to such commonalities across the provinces of each region, regional dummies can also capture most macroeconomic factors (such as GDP growth and unemployment) in the provinces. In addition, regions are heterogenous in nationalist, ethnic, and religious feelings (eastern regions being more conservative than western regions), which provides variation across firms for the related unmeasurable factors.[15]

The productivity growth equation follows the standard neoclassical growth model. In this context, we expect a positive coefficient for *inv* and a negative coefficient for *n*. On the other hand, *PRIV* and its interaction with *inv* and *n* help capture the parametric and slope shifts in productivity growth due to privatization. The related signs are empirical questions. A negative coefficient for $y_{initial}$ would imply that, holding inputs constant, firms converge to their steady states in the long-run.

5.2 Privatization and output level: medium-term relationship

The following system of equations is used to investigate the endogenous relationship between privatization and the level of output in the medium-run:

$$PRIV_{it} = \gamma_0 + \gamma_1 \ln(Y_{it}) + \gamma_2 \ln(L_{it}) + \gamma_3 CU_{it} + \gamma_4 RIGHT_t + \theta'\mathbf{P} + \vartheta'\mathbf{R} + e_{it}$$

$$\ln(Y_{it}) = \phi_0 + \phi_1 \ln(K)_{it} + \phi_2 \ln(L) + \phi_3 PRIV_{it} + \phi_4 PRIV_{it} \times \ln(K)_{it} + \phi_5 PRIV_{it}$$

$$\times \ln(L)_{it} + \phi_6 TREND_{it} + \phi_6 PRIV_{it} \times TREND_{it} + \upsilon_{it} \qquad \text{(System II)}$$

where Y is output, K is capital stock, and $TREND$ is a time trend to capture technology.

The description of the privatization equation follows from Sect. 5.1. In the output equation, the coefficients of K and L provide the shares of capital and labor in production. These variables also interact with $PRIV$ to explore the pre- and post-privatization production functions and their returns-to-scale properties. $TREND$ is employed and interacted with $PRIV$ to find about the technology use of different regimes. Lastly, caution needs to be taken in interpreting the levels results as medium-run results, because the dataset includes a time frame of around 10 to 15 years for each firm.

Note that output growth and level equations are based on a Cobb-Douglas production function, which is adopted after an extensive analysis of a translog production function. As is well-known, a Cobb-Douglas production function is more restrictive than a translog function and cannot capture all the desired curvature properties. Our analysis with the translog function failed to retrieve any significant information on cement production, forcing us to impose more restrictions on the function. This outcome simply suggests that a restricted function is more appropriate to explain the production process in the cement sector, rather than a general one. The most likely reason is the lack of variability in investment for much of the output level.[16,17]

5.3 Estimation

In a simultaneous equations system, identification of the system precedes the estimation. In our specifications, the identification conditions are met, as the number of excluded exogenous variables is at least equal to the number of included endogenous variables in each equation of the relevant system.[18] It is worth noting that we also exclude regional dummies from the productivity growth and output level equations, as the underlying technology is expected to be the same between inputs and outputs in every region. Indeed, these variables are estimated to be individually, and jointly, insignificant when they are included in the regression. In addition, we exclude the time dummies from the privatization equations. Business and election cycles that may be relevant to privatization would be captured by the political variables. Indeed, the time dummies are also estimated to be insignificant individually and jointly.

The estimation of our simultaneous equations systems is challenging, because in both systems one of the dependent variables is continuous and the other is discrete. Heckman (1978) proposes a two-stage method: In the first step, the reduced forms of the structural equations are estimated with OLS and probit, respectively, and in the second step the fitted values of the endogenous variables from the first-step are mechanically plugged into the structural equations. These equations are then again estimated with OLS and probit, respectively. This technique, however, requires a covariance matrix correction in a third step, because the estimated standard errors are based on the fitted values of the endogenous variables. In our case, one of the endogenous variables, i.e., $PRIV$, enters the productivity

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[16]In the cement sector investments tend to be once-and-lumpy (see Das 1992 for a description of the technology and capital utilization in the cement industry). Otherwise, investment figures revolve around relatively small values, made generally for maintenance. Thus, the contemporaneous relation between investment and productivity growth is not strong.

[17]We also tried a linearised CES production function, following Kmenta (1967). The CES terms did not possess any significance in the estimation, reducing the production function to Cobb-Douglas.

[18]In fact, with more than one distinct variable in some equations, the other equation of the system remains overidentified, but the extra restrictions pass the usual Sargan overidentification tests.

and output equations non-linearly. This makes the covariance matrix correction computationally very difficult. Thus, we use a more straightforward method to estimate the output growth and level equations—The Generalized Method of Moments (GMM). In addition to treating the hypothesized endogeneity of the privatization variable, GMM is also robust to heteroskedasticity and autocorrelation of unknown form. We use two sets of instruments in the GMM estimations. The first set includes the levels, interactions, and quadratic terms of the exogenous variables of the relevant system, while the second set includes the lagged value of the endogenous variable and the exogenous variables of the equation. The two sets of instruments is mainly used to check for robustness.

The privatization equation is estimated using the two-stage conditional maximum likelihood (2SCML) method of Rivers and Vuong (1988). 2SCML is a convenient method in that it provides an exogeneity test for productivity growth and output level *en route* to determining whether or not the simultaneity is supported by the data. 2SCML involves a probit estimation of the following type (in this instance, for productivity growth):

$$PRIV_{it} = \beta_0 + \beta_1 GROWTH_{it} + \beta_2 \ln(L_{it}) + \beta_3 CU_{it} + \beta_4 RIGHT_t + \delta' \mathbf{P} + \varphi' \mathbf{R}$$
$$+ \beta_5 RES\_GROWTH_{it} + u_{it}$$

where *RES_GROWTH* is the residuals from an auxiliary OLS regression of *GROWTH* on all exogenous variables of the system.[19] If β_5 is significantly different than zero, then *GROWTH* is endogenous to *PRIV*. The endogeneity of $\ln(L)$ and capacity utilization is addressed in a similar vein.

It is important to clarify the interpretation of the sign of the coefficients in the *PRIV* equations. A maximum likelihood (ML) probit estimation of these models would indicate how a vector of right-hand side variables affects the likelihood of firms remaining public versus them being privatized. That is, given that *PRIV* is a latent variable, the right hand side variables moderate the probability of privatization occurring—once a threshold is passed in the spectrum of probabilities, privatization occurs. The possibility of falling below the threshold and reversing the privatization action during the sample period was, however, also substantial in Turkey due to continued anti-privatization pressures on the government, i.e., the possibility of re-nationalization, or due to the potential failure of the private sector to operate the firms successfully and, as a result, to return them to the state. Boardman and Vining (1989: 23) supports this view as follows: "...*if a large company performs poorly, it may be nationalized to prevent the company from going out of business, to maintain employment, or for some other reason*". A probit model captures these probabilities. In our probit estimations, we obtain high pseudo *R*-squared values, showing that our models provide a sound explanation of the likelihood of firms' remaining public versus their becoming privatized over the course of the sample period.

An alternative method for the estimation of the *PRIV* equation can be a hazard model. We do not opt for this method on theoretical and technical grounds. First, our focus is on the

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[19]Following Keleijan (1971), the levels, interactions, and quadratics of the exogenous variables are used as instruments. This is also in line with the Heckman (1978) method. When a system is solved for its reduced form, each equation has only the exogenous variables of the system on the right-hand side, which Heckman suggested for use as instruments in the second step. In our case, as the privatization variable enters the output equations non-linearly, the reduced form equations yield highly complicated non-linear terms. These complicated reduced forms can be approximated with a Taylor series expansion, which facilitates the use of the level, interaction, and the quadratic terms of the exogenous variables as instruments. A general-to-specific modeling approach has been utilized to eliminate the insignificant variables in the auxiliary regressions, whereby Wald tests allowed the elimination of the insignificant variables.

likelihood of privatization occurring/not occurring over a spectrum of probabilities. A hazard model does not treat *PRIV* as a latent variable, but a probit model does, with the consequent implications better fitting the Turkish political context. Second, the main thrust of this paper is the contemporaneous endogeneity between privatization and firm performance. To the best of our knowledge, a system of equations, one of which is a discrete hazard model, has not yet been estimated.[20] Consequently, we opt to model the privatization equation by using a ML probit model.

As a further estimation issue, the productivity growth and output level equations may exhibit firm-level heterogeneity due to location, management, and infrastructure differences. Whether this necessitates a fixed effects estimator is tested, as per Baltagi (2005: 13). The test fails to reject the absence of fixed effects for the productivity growth equation ($p \approx 0.15$), and rejects it for the output levels equation ($p \approx 0.01$), which indicates individual heterogeneity. Thus, we adopt firm-specific dummies for the latter by also controlling for whether these effects differ across regimes. A random effects model is allowed by Hausman tests, but regime differences in individual heterogeneity cannot be controlled in this model. Given space constraints, those results are not presented here.

Finally, the productivity growth equation includes yearly dummies. Turkey experienced structural adjustments over the sample period. Potential anomalies in the production processes, as well as changes in cement demand within the country (due, for instance, to populist investments during election periods), can be captured via these variables.

6 Estimation results

6.1 System I: the short-term relationship

Table 2 presents the system estimation of privatization and productivity growth. Very importantly, the hypothesis for the simultaneous determination of privatization and firm performance is statistically supported: The residuals of growth are significant in all of the privatization models (Models 1 to 4). Productivity growth itself has a negative and significant coefficient in the regression, hence, the leviathan resists! This implies that the group of agents who use high growth performance, which is a short run indicator, as a resistance point to privatization are successful in reducing the likelihood of privatization. This concurs with Clarke and Cull's (2002) finding that poorly performing public banks are more likely to be privatized in Argentina. In sum, our results do support the hypothesized view that productivity growth affects privatization.

In addition, the number of workers employed, $\ln(L)$, significantly delays the timing of the privatization (Models 1 to 4) and provides another resistance point for privatization.[21] This result is also in accord with Clarke and Cull (2002), who find that overstaffed banks

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[20]In fact, reverse causation in contemporaneous sense is typically bypassed in duration models. We have encountered no estimator with known properties in prominent econometrics textbooks to address this problem. It seems that the Rivers-Vuong setup can be adapted for the duration models under certain assumptions, but the properties of this new estimator are currently unknown. We would like to thank Jeffrey Wooldridge for this point.

[21]Note, as presented in Table 2, that some marginal effects do not lie within the 0–1 interval. While this may appear counter-intuitive, it is certainly possible, as, through finding the marginal effects, the relation between the explanatory variables and the dependent variable is evaluated at the mean of the explanatory variables (except for dummies). In this portion of the data, the slope of the relation may be very steep.

Table 2 System estimation of privatization and productivity growth

	Dependent Var: privatization				Dep. Var: Prod. Growth	
	(1)	(2)	(3)	(4)	(5)	(6)
Prod. Growth	−2.845***	−0.378***	−0.151***	−2.156**		
	(−3.96)	(−3.29)	(−2.76)	(−2.40)		
ln(L)	−4.761***	−0.661***	−0.310**	−3.335***		
	(−4.16)	(−3.00)	(−2.33)	(−2.66)		
Cap. Util.	−0.151	−0.069	−0.048	−0.075		
	(−0.33)	(−0.086)	(−1.14)	(−0.21)		
RIGHT	1.168**	0.089*	−0.002			
	(2.23)	(1.84)	(−0.06)			
Marmara	0.236**	0.036***	0.031***	0.155*		
	(2.33)	(2.56)	(2.20)	(1.65)		
Aegean	−0.657**	−0.997***	−0.983*	−0.870**		
	(−2.34)	(−2.35)	(−1.84)	(−2.20)		
Black Sea	−0.765***	−1.000***	−1.000**	−0.981**		
	(−2.57)	(−2.29)	(−2.01)	(−2.39)		
Eastern Anatolia	−0.918***	−1.000***	−1.00**	−0.992***		
	(−3.21)	(−2.69)	(−2.34)	(−2.64)		
S. Eastern Anatolia	−0.895***	−1.000***	−1.000**	−0.991***		
	(−3.29)	(−2.77)	(−2.32)	(−2.66)		
Voter Fract.		0.161**	0.086*	0.964**		
		(1.85)	(1.71)	(2.03)		
Govtrel		0.040***	−0.049	0.026		
		(2.00)	(−1.40)	(0.22)		
Right ∗ Govtrel			0.077*			
			(1.80)			
Res_GROWTH[a]	1.964**	0.279**	0.105*	1.457***		
	(2.48)	(2.15)	(1.65)	(2.48)		
Res_ln(L)[a]	1.570***	0.236**	0.072	0.230		
	(2.70)	(2.40)	(1.32)	(0.78)		
Res_Cap. Util.[a]	0.599	0.177*	0.117	0.860		
	(0.87)	(1.79)	(1.57)	(1.23)		
Constant					0.062	−0.214
					(0.291)	(0.190)
Labor growth					−1.510***	−1.236***
					(0.368)	(0.141)
Investment					0.041	−0.037
					(0.102)	(0.096)
Ln($y_{initial}$)					−0.010	0.030
					(0.042)	(0.029)
PRIV					0.042	0.084**
					(0.060)	(0.037)

Table 2 (*Continued*)

	Dependent Var: privatization				Dep. Var: Prod. Growth	
	(1)	(2)	(3)	(4)	(5)	(6)
Labor Gr $*$ PRIV					0.869[**]	0.592[***]
					(0.392)	(0.173)
Inv. $*$ PRIV					−0.028	0.088
					(0.111)	(0.103)
Time Dummies					Yes	Yes
Estimation Method	2SCML	2SCML	2SCML	2SCML	GMM	GMM
Instruments	System exogenous vars[b]	System exogenous vars[b]	System exogenous vars[b]	System exogenous vars[b]	Lagged endog. + exogenous vars. of the equation	System exogenous vars
Observations	147	147	147	147	147	147
LR test	61.09[***]	74.76[***]	75.55[***]	68.59[***]		
McFadden R^2	0.79	0.87	0.88	0.83		
F-statistic (Time)					78.09[***]	120.21[***]
Sargan Test					Exactly Identified	24.26 (0.28)

Robust z-statistics in parentheses for probit estimations. Robust standard errors for GMM estimations. [*]significant at 10%; [**]at 5%; [***]at 1%. Marginal Effects for probit estimations. Constant term is irrelevant for marginal effects

[a]Residuals from an auxiliary OLS regression where the relevant variable has been regressed on the exogenous variables of the relevant system

[b]Instruments include the levels, quadratics, and the interactions of exogenous variables of the relevant system. F-test for whether all time dummies are jointly significant. LR test for whether the residuals variables for endogeneity are jointly significant

are less likely to be privatized in Argentina. There is also evidence for the endogeneity of this variable. Capacity utilization is estimated to be insignificant, however.

It is also found that, controlling for endogenous relationships, higher representation of centre-right (-left) parties in the government increases (decreases) the likelihood of privatizations occurring earlier in the country (Models 1 and 2). Also, government's relative strength (*govtrel*) in a province increases the likelihood of privatization in that province (Model 2). At this stage, it is important to identify the precise impact of the government's ideology on privatization in each province, as the sample period witnessed coalition governments in Turkey, involving both centre-right and -left parties. Consequently, interacting *RIGHT* with *govtrel* finds that right (left)-wing governments are more (less) likely to privatize if they are strong at the provincial level (Model 3). Note, however, that when this effect is controlled, *RIGHT* loses its significance, implying that government parties take action only when they are strong in the relevant province. On the other hand, *RIGHT* may have overlapping effects with *GROWTH*. Removing *RIGHT* (and its interaction with *govtrel*) from the regression (Model 4) does not change the significance of *GROWTH*, but does reduce its marginal effect. This may imply that *GROWTH* still hosts significant negative effects for privatization, but it may also be hosting the positive impact of *RIGHT*, which partly countervails the overall negative effect. Finally, voter fractionalization is positive and significant, meaning that privatization becomes more likely if voter preferences in a province are less concentrated (Models 2 to 4).

Regional dummies are estimated to have significant coefficients with intuitive signs (Models 1 to 4). The benchmark region is Central Anatolia. We find that, controlling for other political factors, the support for privatization in the industrialized Marmara (i.e., Istanbul) region was stronger than in Central Anatolia. The Aegean (Western), Black Sea (North), and South-eastern Anatolia regions provided less support for privatization. Thus, when the firm performance is measured by a short-run indicator, such as productivity growth, we find that the central and north-western regions provide the highest support for privatization, while the support in the other regions is significantly negative. It should be noted that Eastern Anatolia, especially, is a stronghold of statist policies and nationalist feelings.

For the productivity growth equation, the investment rate is estimated to be insignificant before, and after, privatization (Models 5 and 6). As noted above, this can be explained by the once and lumpy nature of investment in this industry. Also insignificant is $y_{initial}$ (Models 5 and 6). The coefficient of labor growth is, however, highly significant and negative, a result that holds regardless of which instruments are used (Models 5 and 6). Thus, while holding the investment rate constant, decreasing the labor force increases productivity growth. The intercept privatization $PRIV$ is significant when system exogenous variables are used as instruments (Model 6). The interaction term of labor force growth and $PRIV$, however, is estimated to be strongly significant and positive (Models 5 and 6). This implies that the negative impact of labor force growth on productivity growth is less severe under the privatized regime than before privatization.[22]

Although the estimation output is suppressed in Table 2, the yearly dummies of 1986 and 1995 are estimated to be positive and significant, with those of 1991 and 1993 being positive and weakly significant, relative to that of 1985. Notably, 1986 was a price deregulation year and 1991, 1993, and 1995 were election years. Output might have increased to meet the cement demand for increased populist pre-election investments.

6.2 System II: the medium-term relationship

The system estimation results of the privatization and output level equations are provided in Table 3. In nearly all of the models, the residuals of $\ln(Y)$ are significant (Models 1 to 4). This is a support for the endogeneity of the output level to privatization. The impact of $\ln(Y)$ on the likelihood of privatization is positive and always significant (Models 1 to 4). This positive sign may imply that, as a medium-run performance indicator, the output level may capture the market potential effect, fostering privatization. This effect is likely to bring about higher sales proceeds, as discussed in the introduction. This positive sign is also in line with Dinc and Gupta (2007), who find, in the case of India, that profitable enterprises are relatively more likely to be privatized. On the other hand, $\ln(L)$ is estimated, with a strongly significant negative sign (Models 1 to 4), to contribute to the resistance to privatization. This variable is also robustly endogenous, thus, controlling for its endogeneity is a prudent practice. Capacity utilization possesses a positive sign, but its significance depends on the specification.

As outlined in Sect. 6.1, the stronger presence of centre-right (left) parties in the government increases (decreases) the likelihood of privatizations taking place earlier (Models 1 and 2). Nevertheless, this effect is more likely to work when the government is relatively

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[22]These results are not likely to summarize the differences between early and late privatizers, because the $PRIV$ variable that distinguishes private and public ownership is endogenously determined and controls, in output equations, the factors that affect the timing of privatization.

Table 3 System estimation of privatization and output level

	Dependent Var: privatization				Dep. Var: output level			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(Y)	2.974***	1.572***	2.033***	1.549*				
	(3.03)	(3.29)	(3.55)	(1.70)				
ln(L)	−3.942***	−8.084***	−9.548***	−5.859***	0.883***	1.095***	1.264***	0.828***
	(−4.84)	(−3.55)	(−3.96)	(−3.35)	(0.260)	(0.168)	(0.213)	(0.253)
Cap. Util.	4.514**	1.338	1.047	2.243				
	(2.20)	(0.84)	(0.47)	(0.80)				
RIGHT	1.564**	2.704**	0.783					
	(2.09)	(2.36)	(0.71)					
Marmara	−0.376	0.507	0.645	0.419				
	(−0.96)	(0.82)	(1.15)	(0.48)				
Aegean	−0.711***	−0.630***	−0.720***	−0.511**				
	(−2.98)	(−3.70)	(−3.10)	(−2.03)				
Black Sea	−0.645***	−0.807***	−0.929***	−0.655***				
	(−3.74)	(−3.95)	(−3.74)	(−3.80)				
East. Anatolia	−0.367*	−0.536***	−0.689***	−0.448***				
	(−1.62)	(−3.99)	(−3.83)	(−4.04)				
S-East. Anatol.	−0.597***	−0.662***	−0.791***	−0.604***				
	(−2.81)	(−3.19)	(−3.39)	(−2.74)				
Voter Frac.		4.306***	5.282***	2.260**				
		(3.19)	(3.53)	(2.25)				
Govtrel.		0.213	−3.627***	0.012				
		(0.62)	(−3.14)	(0.03)				
RIGHT ∗ Govtrel			4.541***					
			(3.20)					
Res_ln(Y)[a]	−2.784***	−0.915*	−1.116*	−0.868				
	(−2.70)	(−1.67)	(−1.73)	(−0.87)				
Res_ln(L)[a]	2.153**	5.857***	6.657***	3.559**				
	(2.05)	(2.86)	(2.89)	(2.16)				
Res_Cap. Util.[a]	−5.313***	−1.721*	−1.543	−3.795**				
	(−2.66)	(−1.74)	(−1.31)	(−2.34)				
Ln(K)					0.342***	0.177***	0.220***	0.195***
					(0.066)	(0.055)	(0.040)	(0.036)
PRIV					5.551***	2.919*	7.350***	3.595*
					(1.893)	(1.531)	(1.826)	(2.137)
Ln(K) ∗ *PRIV*					−0.099	0.067	−0.095	−0.018
					(0.077)	(0.069)	(−1.421)	(0.083)
Ln(L) ∗ *PRIV*					−0.601**	−0.693***	−0.855***	−0.671**
					(0.295)	(0.225)	(0.274)	(0.292)
TREND					−0.017	0.015	0.019	−0.006
					(0.014)	(0.009)	(0.016)	(0.011)
TREND ∗ *PRIV*					0.054***	−0.003	0.014	0.029**
					(0.016)	(0.015)	(0.021)	(0.014)

Table 3 (*Continued*)

	Dependent Var: privatization				Dep. Var: output level			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant					−0.066	2.201[*]	0.291	3.498[**]
					(1.684)	(1.173)	(1.277)	(1.712)
Estimation Method	2SCML	2SCML	2SCML	2SCML	GMM	GMM	GMMDV	GMMDV
Instruments	System exogenous vars[b]	System exogenous vars[b]	System exogenous vars[b]	System exogenous vars[b]	Lagged endog. + exog. vars of the equation	System exogenous vars	System exogenous vars[c]	System exogenous vars[c]
Fixed effects					No	No	Yes	Yes
Fix. Eff * *PRIV*					No	No	No	Yes
Observations	157	157	157	157	142	157	157	157
LR-test	66.08[***]	70.47[***]	74.48[***]	73,93[***]				
McFadden R^2	0.82	0.86	0.88	0.87				
F-stat. (Fixed)					n.a.	n.a.	14.66[***]	51.93[***]
Sargan Test					Exactly	19.25	12.90	26.21
					Identified	(0.13)	(0.23)	(0.16)

Robust z-statistics in parentheses for probit estimations. Robust standard errors for GMM estimations. [*]significant at 10%; [**]at 5%; [***]at 1%. Marginal Effects for probit estimations. DV: dummy variable
[a], [b]See Table 2 for explanation
[c]The instrument list includes the interactions of fixed effects and exogenous variables of the relevant system. F-test for whether fixed effects are jointly significant. LR test for whether the residuals variables for endogeneity are jointly significant

strong in the province (Model 3). Also, *govtrel* is generally insignificant, but its sign becomes negative and significant when it interacts with *RIGHT*. Given the coefficient magnitudes, this implies that the stand-alone effect of *govtrel* becomes positive when the share of right-wing parties in the government is above 0.80. Removing *RIGHT* and its interaction with *govtrel* (Model 4) leads to $\ln(Y)$ only becoming significant at the 10% level. This is consistent with our expectation that the market potential of firms will decrease if $\ln(Y)$ captures the wrestling between utility maximizers, centre-right wing parties in the government, and other partisan elements in the political arena. Finally, voter fractionalization is positive and robustly significant across the models.

In terms of regional dummies, the Marmara region becomes significantly no different than Central Anatolia, while all other western, eastern, and northern regions provide significantly less support for privatization. Thus, controlling for the endogeneity of decisions, as well as using a medium-run performance indicator, the support for privatization in the industrialised Marmara region is not as high as expected.

Table 3 reports the results of the estimation of output level equation (Models 5 to 8). An important finding is that after privatization, there is a substantial reduction in the number of employees, as shown by the significant and negative interaction term of *PRIV* and $\ln(L)$. In the following discussion, we focus on Models 7 and 8, as they incorporate the fixed effects into the estimation. In Model 7 firm-specific effects are accounted for via firm dummies. Model 8 adopts the interaction of these dummies with *PRIV* (as well as the dummies themselves), because privatization may change the firm-specific characteristics of production. The results suggest that private administrations have significantly changed the firm-specific

Fig. 1 Turkish cement industry before and after privatization
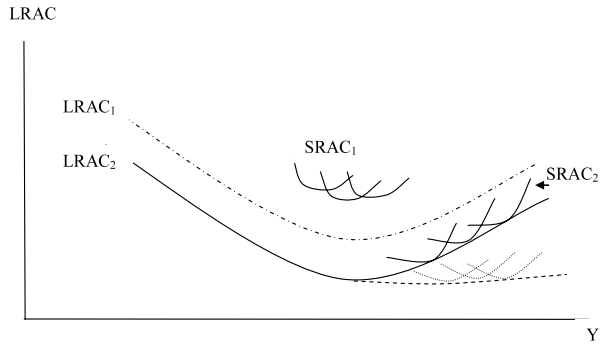
nature of output, as shown by the *F*-test results, which affirms the joint significance of firm dummies and their interaction with *PRIV*. Thus, Model 8 constitutes the gold standard for numerical implications.

Taking the endogeneity of *PRIV* and the fixed effects into account, it is found that the pre-privatization labor *share* in output is around 83%, with the capital *share* being around 20%. Post-privatization labor use drops substantially, to about 16%, whereas the capital use is stable, at around 20%. In addition, technology use grows significantly after privatization, by about 3% per annum. Note from Table 2 that the median output level in the after-privatization period is significantly higher. Thus, the results imply that the rise in output is achieved through both efficiency gains from hiring less labor, and a more effective use of the existing capital stock.

The picture becomes clearer once the returns-to-scale properties of production before, and after, privatization are scrutinised. In the pre-privatization period, production exhibits constant returns-to-scale (CRS) with respect to two inputs (capital and labor), as shown by the capital and labor stock coefficients summing to 1 (Table 3, Model 8).[23] After privatization, however, a decreasing returns-to-scale feature (DRS) is observed with respect to these inputs, as the coefficients of capital and labor sum to less than 1. This implies that an increase in the stock of technology, as is established in our estimations, replaces labor in the production process. In fact, Okten and Arin (2006) argue that increased automatization was the major factor behind higher productivity in the industry after privatization.

All of these results are summarized in Fig. 1. Before privatization, the firms operate close to the minimum point of the long-run average cost curve (LRAC$_1$), which is consistent with CRS. With potential inefficiencies in production, short-run average cost curves (SRAC$_1$) are expected to lie above the LRAC$_1$. After privatization, increasing technology shifts the whole LRAC downwards. In addition, the finding of DRS and the increase in production implies that the SRAC lies to the right of the minimum LRAC. The new short-run average cost curve (SRAC$_2$) of now more efficient firms is at a tangent to LRAC$_2$.

Strictly speaking, though, this feature of returns-to-scale may only be a medium-run phenomenon. Given that a sufficiently long time period has not elapsed for privatization in the sample period, and that private sector is likely to continue driving up the technology level, the DRS portion of the post-privatization LRAC may lie lower in the future. This is shown by the dashed section of LRAC$_2$, where the dotted SRACs are at a tangent to the minimum efficient scale. In other words, the true long-run situation may be where the

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[23]The sum of the coefficients of capital and labor being equal to 1 cannot be rejected (*p*-value 0.85).

SRACs' of the firms will lie at the minimum point of the LRAC, indicating that firms achieve this cost efficiency with a new composition of inputs.

7 Conclusions

Using a panel dataset on the Turkish cement industry, we test the simultaneous determination of privatization and firm performance in a political economy context, a hypothesized phenomenon that has been observed in many countries. We find support for the hypothesis using two different measures of firm performance, i.e., productivity growth and output level, through an extensive econometric treatment. Our results reiterate the importance of political factors in privatization, and derive several general lessons from the case of an emerging market economy, displaying both micro and macro features.

The analysis is undertaken using the framework provided by the public choice and partisan theories. We find that better firm performance in the short-run, a higher number of workers, and voter concentration all delay the timing of privatization. In addition, the likelihood of privatization increases with stronger representation of right-wing parties in the government. These parties are, however, able to push for privatization if they are also strong in the provinces where the firms in question are located. Moreover, the wrestling between interest groups may lower the market potential of firms and may bring about lower sales proceeds. There are also regional differences in the support for privatization, mostly arising due to the differences between their socio-economic and political backgrounds.

There is also a clear difference between the public and private sectors in operating an industry. In particular, the private sector has; altered the scale property of production from constant returns-to-scale to decreasing returns-to-scale, reduced the labor stock, and adopted higher levels of technology. The private sector has also altered the contribution of fixed factors to production. These results support the *Agency View* of Shleifer and Vishny (1994), and provide further insights for partisan and public choice theories.

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