How Does Privatization Affect Efficiency, Productivity and Technology Choice?: Evidence from Turkey

Cagla Okten[*]
Bilkent University
Department of Economics
Bilkent, Ankara Turkey

Peren Arin
Louisiana State University
Department of Economics
Baton Rouge, Louisiana

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Abstract

Uncovering the effects of privatization is difficult, because privatization of a particular firm usually is not an accident. This paper tests the effects of privatization on efficiency, firm productivity and technology choice by using a rich panel data set of privatized cement firms from Turkey. Since all public cement firms were privatized and we have pre and post privatization data for all of them, we are able to avoid the problem of endogeneity associated with sample selection. In addition, panel nature of our data allows us to control for both firm and time specific effects. Our results indicate that privatization has a positive and significant effect on labor productivity and output while it has a negative and significant effect on per unit costs and prices. We also find that privatized firm switches to a more capital-intensive technology as capital and capital labor ratio both increase and employment decreases following privatization. These results provide support for an agency model of public ownership presented in Shleifer and Vishny (1994).

1 Introduction

In the last two decades, many countries launched extensive privatization programs. Despite this growing experience, we still lack empirical knowledge of some critical issues. Does privatization affect firm productivity and allocative efficiency? How exactly does technology change as a result of privatization? In this paper, we address these questions as we empirically examine the effects of privatization on firm productivity, allocative efficiency and technology choice with a rich panel data set of Turkish cement plants.

We focus on cement plants in Turkey for several reasons: First, the availability of a unique data set enables us to avoid the endogeneity problem associated with sample selection, which has plagued earlier research. All of the public cement plants—twenty two in total—have been privatized and we have pre and post privatization data for all of these plants. Second, the panel nature of our data set allows us to control for both firm and time specific effects, thereby avoid the problem associated with unobserved heterogeneity which is common in the privatization literature. Third, the cement industry has some elements of a natural (regional) monopoly, and public ownership is considered to be one of the main solutions to the problems of market failure that arise in this type of market structure. Hence, if privatization increases firm productivity without much translating into higher consumer prices in such a market, then we have reason to be hopeful of its success elsewhere. Finally, Turkey is the largest cement producer in Europe and seventh in the world (OAIB, Cimento Sektoru Raporu (1998)).

Privatization efforts in Turkey, fueled by forces of globalization, started in 1986. The official reason for privatization was to relieve the state from the burdens of inefficient state industries and to create revenue for the government. Since then, numerous state companies have been sold to the private sector,

though by most accounts privatization goals are yet to be met (Ertuna, 1998).

The economic theory of privatization is a subset of the vast literature on the economics of ownership and the role for government ownership of productive resources. There are two main branches in this literature: The Social View (Shapiro and Willig (1990)) and the Agency View (Vickers and Yarrow, 1988; Shleifer and Vishny, 1994). In this paper we identify the predictions of existing models of ownership for the productivity and technology choice of the privatized firm and test the validity of these predictions empirically.

There is a growing empirical literature analyzing the relationship between ownership and economic performance (See Megginson and Netter, 2001 for an excellent survey). This literature presents us with studies of partial privatization experiments. Hence these studies are susceptible to sample selection problems since firms they examine were selected for privatization while other firms remained public. Furthermore these studies either compare private and public firms at the same point in time- (Barberis et al., 1996; Cragg and Dyck, 1999; Estrin and Rosevear, 1999) or is gathered from studies of privatization or nationalization of the "before-after" variety which examine the averages of key variables before and after privatization and test for significant changes. (Megginson et al., 1994; Ecker et al., 1997; La-Porta and Lopez-De-Silanes, 1997). Cross-sectional studies cannot satisfactorily control for firm-specific effects, while "before-after" studies cannot satisfactorily control for period effects.

Since we have pre and post privatization data for *all* public cement plants, we are able to avoid the problem of endogeneity associated with sample selection. To our knowledge, ours is the first empirical study of privatization that does not suffer from the sample selection problem. Furthermore, our panel data set allows us to control for both firm-specific and period specific effects when testing for changes in economic performance due to privatization. Ours is also the first single country, single industry study that addresses problems associated with

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unobserved heterogeneity by adopting a fixed effect framework. Because we have data on employment, capital, output, sales, investment, capacity, prices and profits, we are able to look at a more complete picture of privatization, unlike many studies that only analyze the effect of privatization on one variable such as employment.

Our results show that privatization significantly increases labor productivity and reduces per unit costs and prices indicating an improvement in both productive and allocative efficiency. We find evidence that technology becomes more capital intensive as both capital endowment and capital labor ratio increase following privatization.

In the next section we review the empirical literature on the effects of *privatization* on firm efficiency and technology choice as well as the theoretical literature on the effects of *public ownership* on the same variables. Section 3 describes the privatization environment and the cement industry in Turkey. Section 4 describes our data. Section 5 presents the econometric framework. Section 6 presents and discusses the results and section 7 concludes.

2 Literature Review

2.1 Empirical Literature on Privatization

The Effects of Privatization on Firm Performance

The evidence presented by the empirical cross-sectional literature on whether privatized firms are more efficient is mixed. By using a survey of 452 Russian shops, Barberis et al. (1996) show that the existence of new owners and managers increases the chances of restructuring and renovation. Using data from U.K., Cragg and Dyck (1999) find that privatized firms with at least four years in the private sector, like established publicly traded firms, exhibit a significant negative relationship between improved performance and the probability

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of resignation whereas state owned firms show no such relationship. Contrary to these studies, using survey data from Ukraine, Estrin and Rosevear (1999) refute the hypothesis that private ownership per se is associated with improved performance as they find the private ownership dummy to be insignificant in regressions explaining sales, employment or profits.

The "before-after" studies seem to find a more robust positive relationship between privatization and firm performance. Eckel et al. (1997), find that stock prices of US competitors and airfares in markets served by British Airways fell significantly upon privatization. Megginson et al. (1994) find that state owned firms' financial and operating performance increase moderately following privatization. La Porta and Lopes-De-Silanes (1997) find evidence of large increases in profitability of Mexican firms following privatization and attribute most of the increases to gains in productivity, rather than to increases in product prices and transfers from laid-off workers to the privatized firms.

Three notable exceptions to studies with only cross-section or before-after dimension are by Ehrlich et al. (1994), Frydman et al. (1999) and Villalonga (2000). All three studies control for firm fixed effects and Frydman et al. also control for time effects with year dummies. Unfortunately, the results of these studies on privatization and firm performance are mixed. Ehrlich et al. use a sample of 23 comparable international airlines of different ownership categories over the period 1973-83 for which they are able to obtain good and comparable cost, output and ownership data. Their results suggest that private ownership leads to higher rates of productivity growth and declining costs in the long run, and these differences are not affected by the degree of market competition or regulation. Their estimates suggest that the short-run effects of changes from state to private ownership on productivity and costs are ambiguous.

Frydman et al., find that privatization to outsider owners has significant effects on revenue performance, but not on cost reduction using data from the

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Czech Republic, Hungary and Poland, on 218 state owned firms of which 128 were privatized during the 1990-1994 period. We should note that testing the effects of privatization on firm performance is even more difficult in transition economies than in non-transition economies as privatization in these countries occurs at the same time as and is part of, other massive economy-wide changes (Johnson et al., 1994).

Villalonga (2000) examines 24 Spanish firms from different industries and find that privatization does not increase firm efficiency—defined as rate of return on assets. He argues that political factors such as the business cycle during which the firm is privatized and foreign ownership are important determinants of firm efficiency.

The Effects of Privatization on Firm Technology

Empirical studies on the effects of privatization do not directly examine the changes in technology choice as a result of privatization. Rather, they report changes in employment and capital investment, which may suggest a change in technology. In their survey article, Megginson and Netter (2001) report that almost all of the 22 studies from non-transition economies that they review find that capital investment spending increases significantly as firms are privatized. Perhaps surprisingly, they report that these studies are far less unanimous regarding the impact of privatization on employment levels in privatized firms.

La Porta and Lopez-De-Silanes (1999), in their "before and after" type of study of 233 privatized Mexican firms, find that ratio of investment to sales and investment to fixed assets significantly increase after privatization while employment significantly decreases. Furthermore, they present results from a survey of 74 of these firms where their CEOs were asked to rate the importance of twelve factor listed in the survey as explanations for the gains in profitability. In that survey, half of the respondents assign the maximum score to the introduction of new production processes.

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In a longitudinal study not covered in Megginson and Netter (2001), Bhaskar and Khan (1995) find that privatization has a large and significant negative effect on white-collar workers using employment data from Bangladesh, for 62 jute mills of which 31 were privatized in 1982 and controlling for firm fixed effects.

The Effects of Privatization on Allocative Efficiency

Studies that examine the effect of privatization on allocative efficiency are rare. These studies typically find that prices increase after privatization. La Porta and Lopes-De-Silanes (1997) analyze Mexican firms from a variety of industries and find that consumer prices increase after privatization. In their analysis of the water and sewerage industry of England and Wales, Saal and Parker (2001) find that, output prices increase and furthermore, total price performance indices reveal that increases in output prices have outstripped increases in input costs.

It is unrealistic to expect that the effect of privatization on prices will be the same in every industry. Market structure of an industry—market power of firms in the industry—as well as firms' productivity will affect consumer prices. Hence, single industry studies are more appropriate to analyze this question.

2.2   Theoretical Literature on Public Ownership

The economic theory of privatization is a subset of the vast literature on the economics of ownership and the role for government ownership of productive resources. There are two main branches in this literature: The Social View and the Agency View.

According to Social View (Shapiro and Willig, 1990), state owned enterprises are capable of curing market failures by implementing pricing policies that take account of social marginal costs and benefits of production. A privately owned firm is expected to maximize profits whereas a state owned firm is expected

to maximize social welfare, according to this view. For example, in a natural monopoly market structure, efficiency calls for a single firm to exist. But a profit maximizing monopoly will charge too high of a price and produce too low of a quantity. This potential inefficiency can be solved by state ownership.

The Agency View of firm ownership presents a strong critique of this theory. There are two complementary strands of the literature differing on whether the agency conflict is with the manager or with the politician. Vickers and Yarrow (1988) argue that managers of state owned enterprises (SOEs) may lack high-powered incentives or proper monitoring. Shleifer and Vishny (1994) stress that political interference in the firm results in excessive employment, poor choices of product and location, lack of investments and ill-defined incentives for managers.

The Social View, unequivocally predicts that the efficient technology will be chosen by the state owned firms. Models of Agency View on the other hand, while predicting that inefficient technologies will be chosen by politicians/managers, have different predictions for the direction of the distortion in the production process. They either predict that state owned firms will have low investment levels (Shleifer and Vishny, 1994) or will use excess capital as well as excess labor (Vickers and Yarrow, 1988). The over-capitalization argument stems from bureaucratic inefficiency models. The founder of this line of literature, Niskanen (1975), proposed that bureaucrats are inclined to maximize their total budget rather than the utility of their sponsors. In the context of a state-owned enterprise, this translates into over-investment and over-capitalization to justify perks and high salaries.

On allocative efficiency, Social View predicts that prices are likely to rise as a result of privatization. The Agency View on the other hand, predicts that if a reasonable degree of competition ensues then allocative efficiency may actually increase as firms increase their productivity after privatization. In this paper we test the models of the Social View and Agency View by empirically examining

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whether privatization improves allocative efficiency and firm productivity. We further differentiate between the two models of the Agency View by examining how privatization affects firm's investment and capital endowment.

The main limitation of both the Social View and the Agency View models is that they simply posit objective functions for politicians/managers rather than deriving them from explicit models of the political process. Hence predictions of these models change as we change the objective function imposed on the state owned firm. While the Agency View is a relevant critique to the Social View, it assumes a very dismal political or managerial structure in order to make its case. For example, according to one version of the Agency View, the public is disorganized and politicians cater to interest groups, such as labor unions, rather than the median voter and this is the source of inefficiency (Shleifer and Vishny, 1994).

In Okten (2002) we endogenize the politician's technology choice for the public firm by making this choice the outcome of an electoral process which aggregates voters' preferences according to majority rule. We believe that this approach has advantages over making arbitrary assumptions about the politicians' objective function, as it will give us predictions for public sector's technology choices based on voter characteristics.

We propose that a politician who is seeking to maximize his votes can credibly promise to having a high level of employment in the public sector by committing this sector to a labor intensive technology. In a labor abundant country such as Turkey, if voters are to choose between labor-intensive versus capital-intensive technologies, majority of the voters are likely to favor a labor-intensive technology for the public sector even if this technology choice is inefficient.

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3 Institutional Background

3.1 Privatization in Turkey

Historically, Turkey has had a long experience relying heavily on state owned enterprises (SOEs). SOEs were established during the 1930s by the government to jump-start the economy that collapsed with the end of the Ottoman era in 1923. Over the years SOEs grew enormously, leaving the control of a large section of the economy to bureaucrats and politicians. Politicians exploited SOEs to provide jobs to their constituents at the expense of consumers who were faced with higher prices. Consequently, in the 1980s, SOEs began to be perceived negatively due to poor financial performance, overstaffing, dependence on subsidies, protected markets and corruption (Ertuna, 1998).

After a Military Regime (1980-1983), the first party that came to power under the leadership of Prime Minister Turgut Ozal was the Motherland Party (ANAP). Ozal was a strong supporter of Thatcherism that promoted reducing the state's role in the economy. Privatization came into the political agenda first with Ozal's trade and capital account liberalization program in 1984.

Despite this initial enthusiasm, however Turkey realized only a small portion of its privatization potential. Privatization of state owned enterprises has so far been concentrated in a few industries. Between 1986 and 1998 only $4.5 billion worth of assets, representing less than 10% of the outstanding state owned assets could be divested (Ficici, 2001). The privatization reforms have not been fully carried out as intended, due to a lack of legal framework and conflicting laws in the country's constitution with regard to privatization.

3.2 Privatization Process in the Cement Industry

The first cement plant of Turkey was established in 1911 by a private firm. By 1950, four new private plants had been built. Only after 1950 did the

cement industry develop on a large scale by means of a government initiative. A public enterprise, CISAN (Turkish acronym for Turkish Cement Industry Co. later named as CITOSAN), was established in 1953 to build 15 plants in various regions. Before the privatization of the cement plants started in 1989, the public share in the cement industry was nearly 40 percent. (Saygili and Taymaz, 2001). It is believed that each company was able to exercise some monopoly power within its hinterland (Ertuna, 1998), most probably due to the distance between firms and the lack of proper transportation facilities of the public sector.

In 1986, A French company, Sema-Metra Conceil was contracted by the Turkish government and the World Bank to prepare two reports, one on the structural Regulation of the Cement Sector and Privatization and the other on the plan for the Reorganization of CITOSAN. In the latter report, Sema-Metra Conceil suggested that plants in the West be privatized first since they could be as profitable as private plants, and recommended that the eastern plants be restructured prior to privatization. The report also suggested privatization on a plant-by-plant basis, as the sale of the state firm as a single entity, may have led to an unhealthy monopoly (Tallant, 1993). In 1986, there has been a major change in the economic environment of the cement plants. Prior to 1986, the Turkish Cement Producers' Association (TCPA) set prices and market areas for all cement companies, however after 1986 firms were encouraged to operate independently and maximize profits. Sema-Metra's first report might partially have led to this change.

Privatization in the cement industry started in 1989, with the initial sale of five factories to the French firm Cement Francais (SCF). By 1998, the sale of 24 public firms was completed. The recommendations of the Sema-Metra report was taken into consideration, and the western plants were privatized first.[1] It

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[1]Two exceptions were Denizli and Lalapasa. These two public plants were established in

may also be the case that the privatization of the eastern plants were delayed, as the eastern region suffered from unemployment and terrorism throughout 90s, and the public enterprises were used as means for employment. Figure 1 presents the location and the year the cement firms were privatized on a map of Turkey. Table 1 presents all firms that were privatized, with their establishment and privatization dates and the names of their buyers.

Saygili and Taymaz (2001) point out that, holding companies had a tendency to acquire plants in specific regions. For instance, Rumeli Holding bought plants in the Eastern Region and along the black sea coast. Turkish Armed Forces Pension Fund (OYAK) and Sabanci Holding, one of the biggest holding companies in Turkey formed an alliance and purchased companies in Central Anatolia, Southern Anatolia and Marmara regions. Set Cement Holding focused on Central and Western regions, and finally, Lafarge and Yibitas own cement plants in neighboring provinces of Central Anatolia. Saygili and Taymaz argue that, privatization through block sales, instead of public offerings in the stock market gave rise to bigger regional monopolies.

However, according to the report of Central Anatolian Board of Export, the privatization of public cement plants increased competition in the industry and decreased prices. Arin and Okten (2002) find a low capacity utilization ratio to be one of the explanatory factors of higher privatization prices for the 24 cement firms privatized during the period from 1989 to 1998 consistent with the argument that buyers of the privatized firms plan to increase production and decrease prices.

Privatization of the cement plants was carried out under the Privatization Administration of Turkey. Most of the privatizations were realized through block sales - closed-bid auctions - and through a combination of block sales and public offerings in a few cases. Public sector employment was guaranteed to all

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1987 and 1991 respectively, in order to meet the growing demand in the western regions.

workers that lost their jobs because of privatization (Privatization in Turkey, Ozellestirme Idaresi Baskanligi). Hence there was no disposal cost of workers for the buyers of the privatized firms.

Today, Turkish cement industry consists of 39 private plants, some owned by giant industrial holdings and others by small one-plant companies. There are four foreign investors in the industry, namely French firms Ciment Francais, Lafarge Coppee, Ciment Vicat and German Heidelberger Zement/CBR. Cement consumption continues to grow at sound levels and Turkey continues to be a major exporter of cement. According to the report of Central Anatolian Board of Export, in 1998, Turkey was the largest cement producer in Europe and seventh in the world. (OAIB, Cimento Sektoru Raporu).

4 Data

All public cement plants that ever existed were privatized between 1989 and 1998. Since, our sample includes all of these plants and their pre and post privatization data we are able to look at a more complete picture of privatization and avoid the problem of endogeneity associated with sample selection. The privatization of the public cement plants in Turkey is like a natural experiment that allows us to examine the effects of privatization in almost an ideal setting.

Our data spans a period of 1981-1999 for many of the variables of interest, though the time series is shorter for some variables and the panel is not always balanced. Table 1 presents the time table of the privatizations of the cement plants as well as their establishment dates. Our data on output, employment, investment, capacity, and per unit costs are constructed from the official statistics of Privatization Administration of Turkey. Our data on capital and sales are constructed from Istanbul Chamber of Industry 500 largest firms of Turkey

surveys. Table 2 describes the variables used in our analysis.

Ozmucur (1998) analyzes a panel of public and private cement establishments, using the results of Istanbul Chamber of Industry 500 largest firms of Turkey surveys. He estimates a separate equation for each firm to determine the year of structural change for employment and labor productivity for the 1981-1995 period and had at most 14 observations for each equation he estimated. He finds that structural change coincided with time of privatization for public firms and reduction in employment which to a degree happened in all firms was significantly higher in the privatized firms.

Tallant (1993) analyzed the relative efficiency of public sector with respect to the private sector in Turkish cement industry in a cross sectional study. He finds that private plants are more efficient in terms of productivity and capacity utilization. However, he argues that the better showing in physical measures is closely related to geographic location as western plants perform better which indicates that the initial location decision has had more to do with firm performance than public ownership per se. Interestingly, in terms of financial performance measured as profits over sales he finds that private ownership is clearly better and geographic location is not significant. He attributes this result to the monopoly power of the plants in the east which are isolated and hence face little competition.

Saygili and Taymaz (2001) analyze the effects of ownership and privatization on technical efficiency using a panel data set of public and private cement plants for the years 1980-1995. They estimate a stochastic frontier production function and find that neither ownership nor privatization had a significant impact on technical efficiency. They do not control for firm and time fixed effects in their estimations. Furthermore, since their analysis does not extend beyond 1995, six plants remain public in their period of study. Hence their estimates are subject to both unobserved heterogeneity and sample selection problems.

5 Econometric Considerations

We evaluate the impact of privatization on firm performance by adopting the following framework:

$$y_{it} = \gamma P_{it} + \beta x_{it} + \mu_i + \delta_t D_t + \varepsilon_{it} \tag{1}$$

where i denotes firm i and t denotes year t, y_{it} is the outcome variable of interest, P_{it} is the treatment variable equal to 1 if year t is a post privatization period for firm i, X_{it}, is a vector of additional regressors including the price deregulation variable, μ_i is the firm fixed effect, D_t is dummy which is equal to 1 in year t and 0 otherwise. Coefficient γ will capture the effect of privatization on our outcome variable. This will be our standard baseline regression.

Granger and Newbold (1974) pointed out that regressions involving levels of data may lead to misleading conclusions. Regression of one random walk on another is virtually certain to produce a significant relationship even if the two are in fact, independent. In our case, regression of an outcome variable that has a random walk component on our privatization variable which is equal to 1 for later years and 0 for earlier years may lead to a spurious relationship between outcomes and privatization. Hence to consider the dynamic panel nature of our data, in the robustness checks section, we estimate,

$$y_{it} = \theta y_{i,t-1} + \gamma P_{it} + \beta x_{it} + \mu_i + \delta_t D_t + \varepsilon_{it} \tag{2}$$

Several econometric issues are raised by the inclusion of a lagged dependent variable in panel models with fixed effects. As formally illustrated in Nickell (1981), dynamic panel data models with fixed effects are subject to Hurwitz biases of order (1/T) where T is the number of time periods available in the data. Hence to correct for this bias, we use an estimation technique presented in Arellano and Bond (1991) where an optimal instrument set is used.

6   Results and Discussion

Table 3 presents the comparison of the three year averages of the variables of interest before and after privatization. Results indicate that productivity, capital utilization, output are significantly higher whereas employment, per-unit costs and prices are significantly lower in the post privatization period. Fall in prices during this period may be due to an increase in competition among the cement firms and/or decrease in marginal costs of production.

Tables 4 and 5 present our results based on the econometric specification in equation 1. All regressions control for firm specific and period specific effects by adopting a firm fixed effect specification and employing year dummies as regressors. Table 4 presents the effects of privatization on productive and allocative efficiency. Dependent variables, labor productivity and average costs are measures of firm productivity output (regressions 1 through 3) and the dependent variables, price and output are measures of allocative efficiency (regressions 4 through 6). Privatization effect is measured by a dummy variable, which is equal to 1 for the post-privatization period of each firm and 0 otherwise. We observe that privatization has a positive and significant effect on labor productivity (regression 1) and a negative and significant effect on average costs (regression 3).

Privatization effect on labor productivity remains positive and significant when we control for the price deregulation effect by including a dummy variable which is equal to 1 post 1986 and 0 otherwise (regression 2).[2] In the labor productivity regression, price deregulation is positive and significant.

Privatization has a positive and significant effect on output (regression 4)

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[2]Since price deregulation precedes the start of privatization, we re-estimated the effects of privatization including three period dummies; first dummy set equal to one if the year is is pre price deregulation, a second dummy set equal to one if it is post price deregulation but pre-privatization and a third dummy set equal to one if it is a post privatization period for the firm. The results of these estimations are consistent with the findings presented here and are available upon request.

but this effect is not robust to the inclusion of the price deregulation variable (regression 5). Price deregulation variable has a positive and significant effect on output. This indicates that when firms were encouraged to set their own prices and compete with one another, they expanded their output. It also indicates that objective function of the state owned cement plants was clearly different prior to 1986. Regression 6 shows that privatization has a negative and significant effect on cement prices. Since our panel is short for average cost and the price variables we are not able to include price deregulation dummy in these regressions.

These results indicate that productive efficiency improves due to privatization as labor productivity increases while average costs fall. Price deregulation effect appears more important for the improvement in allocative efficiency.

Table 5 presents panel regressions measuring the effects of privatization on firms' technology choice. Our dependent variables in these regressions are labor (employment), capital and capital labor ratio. Our explanatory variables are same as in Table 4. We find that privatization has a negative and significant effect on labor (regressions 1 and 2) and a positive and significant effect on capital and capital labor ratio (regressions 3 through 6). Price deregulation effect is negative and significant for employment while it is positive and significant for capital and capital labor ratio (regressions 2, 4 and 6 respectively). These results suggest that the privatized firm reduces number of employees and increases its capital. Reduction in number of employees as firms are privatized may indicate the presence of excess and wasteful employment practices of the public cement firms. However, the increase in capital utilization as labor decreases might also signal a switch to a more capital intensive technology.

Our yearly dummies may not accurately capture the effects of the business cycle on firm efficiency. It would be interesting to see 1) How our firm productivity measures move with the business cycle and 2) whether privatization effect

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is sensitive to controlling for the changes in the aggregate economy.

Hence we present results controlling for an industry production index constructed by Data Resources Incorporated (DRI) which measures the production level in total manufacturing industries (Table 6). We scale this variable by population of Turkey to get the per capita production level. In these regressions our dependent variables are labor productivity, sales over labor and per unit costs. We control for firm fixed effects as well as capacity of the firm to control for the firm size which changes over years and which may affect firm productivity measures. We also include a time trend variable which is equal to 1 in 1981.

Privatization effect remains positive and significant in the labor productivity and negative and significant in the per-unit costs regression, consistent with our earlier results. It is also positive and significant for ratio of sales (revenues) over labor regression. In labor productivity and sales over labor regressions we control for the price deregulation effect as well as the privatization effect. Price deregulation effect is not significant in these regressions. As we would expect the ratio of sales over labor co-moves with the business cycle: the industry production index has a positive and significant effect on this ratio. Capacity has a positive and significant effect on labor productivity but is insignificant for sales and average cost regressions.

In Table 7, we estimate a Cobb-Douglas production function. The dependent variable is the natural logarithm of sales over labor. Our regressors are natural logarithm of capital labor ratio, privatization effect, price deregulation effect and the time dummies. We estimate a firm fixed effect regression (regression 1). We exclude firms for which lack at least one post privatization observation that we can use in our estimation. We find that privatization effect has a positive and significant effect indicating a positive technological shift in production. Since input choice may be endogenous to the production decision, in regression 2, we estimate a two stage least squares within (fixed effects) estimator where

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we instrument capital labor ratio by other regressors and its lagged values. Privatization effect remains positive and significant in this regression.

In Table 8, we resent results based on a dynamic panel data model where the dependent variable of interest is regressed on its lagged value in addition to our standard regressors. In regression 1 and 2 our dependent variable is (log) sales over labor. Regression 2 includes (log) capital-labor ratio as a regressor in addition to the regressors included in regression 1. In regression 3, our dependent variable is (log) labor productivity (output/labor). In all regressions, privatization has a positive and significant effect on the outcome variable.

Further Robustness Checks

We now discuss robustness checks to our estimations. These results, though not presented here are available upon request.

One criticism of the privatization of the cement industry has been that better performing plants which were located in the west were privatized first while poor performing plants in the east were privatized later (Saygili and Taymaz, 2001). Saygili and Taymaz (2001) also point out that, holding companies had a tendency to acquire plants in specific regions and this caused the creation of regional monopolies in the cement industry after privatization. Plants in the eastern regions may have also been privatized last due to the relative political instability of the region throughout 80s and early 90s.

In order to address the concern of unobserved heterogeneity at the regional level, we estimate random effects specifications of previous analysis where firm effects are random. This specification allows us to use firm specific variables such as regional dummies as explanatory variables. We construct regional dummies for the Marmara region, Aegean and Mediterranean region, Black Sea region, Central Anatolia region and Southeastern/Eastern region. The dummy that we leave out in this regression is the dummy for the Southeast and East region and hence coefficients on region dummies are relative to those plants located in the southeast and east of Turkey. In all regressions we control for the privatization effect and price deregulation effect and time dummies in addition to region dummies.

In general, the sign and significance of the coefficients of the privatization effect and the price deregulation effect are the same as we found in the firm fixed effect regressions. As we would expect, the coefficients on Marmara, Mediterranean/Aegean and Central Anatolia dummies are positive in output and labor productivity regressions. This indicates that firms in the western regions increase output and labor productivity more than those firms in the east and

southeast regions of Turkey.

Another criticism could be that as the timing of the privatization of firms occurs over a number of years, in a given period, some firms remain public while others are privatized and the privatization effect might partially account for the differences between privatized firms and those that remain public in that period. We already control for firm and time specific effects in our fixed effect regression to address this concern. In order to further check the robustness of our results, we estimate fixed effect regressions restricting the sample to those firms privatized in 1989 and in 1992 in the appendix section. We control for the price deregulation effect when data permits. Once again results remain essentially the same as before.

When we estimate fixed effect panel regressions for plants that were privatized in 1993 and 1996, we again find similar results for the effects of privatization on variables of interest with the exception of the effect of privatization on output for plants privatized in 1993. Output of these plants falls in the period following privatization. This is probably due to the financial crisis of 1994. As a result of Turkey's currency crisis in 1994, output fell 6 percent, inflation rose to three-digit levels, the Central Bank lost half of its reserves, and the exchange rate (against the US dollar) depreciated by more than half in the first three months of the year (Celasun (1998)).

7 Conclusion

In this paper, we find support for the Agency View of public ownership presented in Shleifer and Vishny (1994). Using a longitudinal data set of 22 cement plants from Turkey, we find that, privatized firms switch to a more capital intensive technology as they increase capital and investment and decrease employment. Contribution of capital to the value of output increases while the contribution of labor to the value of output decreases as firms are privatized. The new technology choice is more productive as labor productivity increases while average costs fall.

Price deregulation preceding the privatization program and privatization, together improve allocative efficiency. Output increases and prices fall after firms are encouraged to set their own prices and compete with one another in 1986 and privatization process starts in the subsequent period. These results contradict with the claim that privatization resulted in an uncompetitive cement industry where regional monopolies were created (Saygili and Taymaz, 2001).

Since we have pre and post privatization data for all cement plants that were once public, we are able to avoid the endogeneity problem associated with sample selection, which has plagued earlier research. Our results withstand various robustness checks addressing other possible problems associated with sample selection and unobserved heterogeneity.

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Table 1
The privatized cement factories in Turkey

Company	Established in	Privatized in	Buyer
Afyon	1955	1989	Ciment Francais
Ankara	1926	1989	Ciment Francais
Balikesir	1958	1989	Ciment Francais
Pinarhisar	1958	1989	Ciment Francais
Soke	1955	1989	Ciment Francais
Corum	1959	1992	Yibitas
Denizli	1987	1992	Modern
Gaziantep	1957	1992	Rumeli
Nigde	1957	1992	OYAK-SABANCI
Sivas	1943	1992	Yibitas
Trabzon	1966	1992	Rumeli
Askale	1968	1993	Ercimsan
Bartin	1962	1993	Rumeli
Ladik	1983	1993	Rumeli
Sanliurfa	1986	1993	Rumeli
Adiyaman	1983	1995	Teksko
Elazig	1954	1996	OYAK-GAMA
Lalapasa	1991	1996	Rumeli
Kars	1969	1996	Cimentas
Van	1966	1996	Rumeli
Ergani	1984	1997	Rumeli
Kurtalan	1976	1998	Canlar Otomotiv

Table 2
Description of Variables

Variable	Description
Capacity	The Minimum Efficient Scale of the firm, measured in tons scaled by 1000.
Capital	Assets measured in Turkish Liras, deflated by the Wholesale Price Index of Central Bank of Turkey, 1987=100 and scaled by 1,000,000.
Capital/Labor Ratio	Capital divided by number of workers
Labor	The number of workers employed by the firm
Labor productivity	Per capita cement production, measured in tons
Investment	The Investment Expenditures of the firm, measured in Turkish Liras, deflated by the Wholesale Price Index and scaled by 1,000,000
Output	Output sold by the Firm, measured in tons scaled by 1000.
Log Sales	Natural logarithm of sales measured in Turkish Liras, deflated by the Price Index and scaled by 1,000,000.
Profit	The net profit of the firm (net of operating costs and investment), measured in Turkish Liras, and deflated by the Wholesale Price Index and scaled by 1,000,000.
Prices	The sale price per ton, deflated by Wholesale Price index and scaled by 1,000,000
Per Unit Cost	Calculated by subtracting profits and investment expenditures from revenues and dividing this operating cost by the output sold (in TL scaled by 1,000,000).

Table 3
Comparison of Means Three Years Before and After Privatization†

VARIABLE	NUMBER OF OBS.	BEFORE PRIVATIZATION MEAN	AFTER PRIVATIZATION MEAN	T-VALUE
Output	22	366.021	419.982	2.54***
Employment	22	311.841	194.538	-11.47***
Labor Productivity	22	1.902	2.239	8.09***
Price	21	0.036	0.033	-2.44***
Per Unit Cost	21	0.035	0.030	-3.14***
Capital	14	10227	17252	2.63***
Capital Labor Ratio	14	31.613	89.851	3.81***

***Significant at 1%

†Data from the three years before and after the year of privatization are included in the before privatization and after privatization data sets respectively. If data was missing for one or two of these years for a given firm in the pre (post) privatization period, we also excluded the symmetric year in the post (pre) privatization period to ensure that the comparison is symmetric.

Table 4
Privatization Effects on Productive and Allocative Efficiency

Dependent Variable	Labor Productivity		Average Costs	Output		Price
	1	2	3	4	5	6
Privatization Effect	0.789 ***	0.270 ***	-0.007 ***	41.713 ***	-14.480 ***	-0.003 ***
	(0.108)	(0.111)	(0.002)	(18.789)	(21.224)	(0.001)
Price Deregulation		2.429 ***			262.931 ***	
		(0.279)			(53.349)	
Year Dummies†	Yes	Yes	Yes	Yes	Yes	Yes
F Statistic	38.400	52.470	6.250	6.570	8.310	37.520
Overall R2	0.532	0.477	0.228	0.099	0.050	0.617
Test Statistics for the Equality of Firm Effects	F=11.15	F=17.68	F=2.40	F=22.03	F=25.43	F=5.08
(p value)	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00
Number of Observations	266	266	194	266	266	194

Standard errors are in parenthesis.
***Significant at 1%
**Significant at 5%
*Significant at 10%
†Dummy variables are used for each year in 1985-1998 for output and labor productivity regressions.
For average costs and price variables, dummies are used for each year in the period of 1988-1999.

Table 5
Privatization Effects on Technology

Dependent Variable	Labor		Capital		Capital Labor Ratio	
	1	2	3	4	5	6
Privatization Effect	-96.491 ***	-82.966 ***	5657.855 ***	5657.855 ***	43.062 ***	43.062 ***
	(8.24)	(8.53)	(2505.83)	(2505.83)	(12.91)	(12.91)
Price Deregulation		-123.878 ***		20667.630 ***		147.005 ***
		(27.36)		(5999.73)		(35.10)
Year Dummies†	Yes	Yes	Yes	Yes	Yes	Yes
F Statistic	63.97	65.49	6.9	6.9	9.83	9.83
Overall R2	0.698	0.719	0.282	0.282	0.391	0.391
Test Statistics for the Equality of Firm Effects	F=8.35	F= 8.32	F=9.30	F=9.30	F=6.42	F=6.42
(p value)	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00	p=0.00
Number of Observations	350	350	244	244	244	244

Standard errors are in parenthesis.
***Significant at 1%
**Significant at 5%
*Significant at 10%
†Dummy variables are used for each year in the period of 1982-1999 in the employment regression.
For capital-labor ratio and capital regressions, year dummies are used for each year in 1983-1999.

Table 6
Privatization Effects controlling for the Business Cycle:
Firm Fixed Effects

	Productivity Output/Labor	Productivity Sales/Labor	Average Costs
Privatization Effect	0.323***	20.163***	-0.004*
	(0.11)	(5.42)	(0.00)
Price Deregulation Effect	-0.136	3.695	0
	(0.18)	(7.08)	0.00
Time trend	0.148***	0.657	-0.001
	(0.04)	(1.88)	(0.00)
Firm Capacity	0.001***	0.019	0
	(0.00)	(0.01)	(0.00)
Industry Production Index	0.438	75.785*	0.009
	(0.79)	(43.68)	(0.02)
R-squared	0.76	0.63	0.19
Test Statistics for the	F=7.70	F=2.67	F=1.61
Equality of Firm Effects	p=0.00	p=0.00	p=0.052
Observations	261	168	194
Number of firm	22	20	22

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7
Cobb-Douglas Production Function

Method	Firm Fixed Effects Sales/Labor (log)	Firm Fixed Effects & IV† Sales/Labor (log)
Capital/Labor (log)	0.156***	0.176**
	(0.04)	(0.07)
Privatization Effect	0.257***	0.244***
	(0.07)	(0.07)
Price Deregulation Effect	0.547***	0.642***
	(0.13)	(0.16)
Time Dummies	Yes	Yes
R-squared	0.82	0.7987
Observations	192	164
Number of firm	15	15

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
†Capital labor ratio is instrumented by other regressors and its lagged value.

Table 8
Arellano-Bond Dynamic Panel Estimator

	Sales/Labor (log)	Sales/Labor (log) Cobb-Douglas	Labor Productivity (log)
Dependent Variable-Lagged	0.412***	0.279***	0.581***
	(0.08)	(0.07)	(0.07)
Capital/Labor Ratio (log)		0.296***	
		(0.04)	
Privatization Effoect	0.179***	0.185***	0.108***
	(0.07)	(0.06)	(0.04)
Price Deregulation Effect	0.578	0.861	
	(1.46)	(1.24)	
Year Dummies	Yes	Yes	Yes
Wald chi2	133.9	200.82	178.710
Number of Observations	190	140	222
Number of firms	21	15	22
Sargan Test			
Overidentifying Restrictions	p=1.00	p=0.99	p=0.774
Sargan Test			
H0: no autocorrelation	p=0.00	p=0.00	p=0.00
in residual of order 1			
H0: no autocorrelation	p=32.15	p=0.63	p=0.67
in residual of order 2			

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
†Dummy variables are used for each year in the 1985-1998 period.