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# Privatization Methods and Productivity Effects in Romanian Industrial Enterprises

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*Privatization Methods and Productivity Effects*  
*in Romanian Industrial Enterprises*

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## **ABSTRACT**

Comprehensive panel data on privatization transactions and labor productivity in Romanian industrial corporations are used to describe the post-privatization ownership structure, and to estimate the effect of Romania's diverse privatization policies on firm performance. The econometric results show consistently positive, highly significant effects of private ownership on labor productivity growth, the point estimates implying an increased 1.0 to 1.7 percentage growth for a 10 percent rise in private shareholding. The strongest estimated impacts are associated with sales to outside blockholders; insider transfers and mass privatization are estimated to have significantly smaller—although still positive—effects on firm performance.

## 1. INTRODUCTION

The impact of privatization on enterprise performance has been a key analytic and policy issue in the transformation of formerly socialist economies, and a sizable body of empirical literature is accumulating on the topic.<sup>1</sup> In this paper, we extend the privatization-performance research agenda to Romania, a large country in Eastern Europe that has been the subject of relatively little systematic analysis. Previous studies of Romanian privatization have focused on describing the policies themselves, and they have not provided information concerning either the resulting ownership structure or the effects on firm performance.<sup>2</sup> Previous research on firm behavior in Romania has generally relied on small samples of firms and emphasized issues other than privatization.<sup>3</sup>

Our study is motivated not only by the usefulness of adding another country to the list of those for which an analysis of post-privatization ownership and enterprise performance has been conducted, but also by the broader lessons that Romania's experience may offer on the effects of alternative privatization policies and ownership structures on firm behavior. The privatization process in Romania has been quite heterogeneous, involving all the major methods employed in transition economies: employee buyouts, mass privatization, and sales to outside investors. The

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<sup>1</sup> Djankov and Murrell (2000) and Megginson and Netter (2001) provide surveys of research on enterprise restructuring in transition economies and on privatization and firm performance, respectively.

<sup>2</sup> Earle and Sapatoru (1993) describe the initial framework for Romanian privatization policies; Earle and Sapatoru (1994) analyze the role of the Private Ownership Funds; Munteanu (1997) discusses the legal framework for Management and Employee Buyouts; Earle and Telegdy (1998) study the Mass Privatization Program; Negrescu (2000) provides a policy overview and some case studies; and Telegdy et al. (forthcoming) provide information on privatization through the Bucharest Stock Exchange.

<sup>3</sup> The sole exception is a study of the impact of privatization on total factor productivity growth in seven countries, including Romania, by Claessens, Djankov, and Pohl (1997). The usefulness of the Romanian results in this study is constrained by the data, however: the time series ends in 1995, by which time very little privatization had taken place, and the only available ownership measure is a dummy variable for privatization, with no information on different methods of privatization or on types of private owners and their shareholdings. Other firm-level studies of Romania include Konings (1997) on the impact of competition, Konings and Repkin (1998) on the relationship of technical efficiency and profitability, Carlin, Estrin, and Schaffer (2000) on European Union accession, and Djankov (1999a) on the isolation program for loss-making firms.

employee buyout and mass privatization methods resulted in dispersed inside and outside ownership, respectively, while sales nearly always involved large blocks of shares. At the same time, the process has been incomplete, leaving many companies fully or partially in state hands despite repeated governmental proclamations of intentions to “accelerate” the process. Thus, the post-privatization ownership structure contains significant components of insiders, outsiders, and the state, and examples of both concentrated and dispersed ownership among firms with private outside shareholders.

Our database, which we have constructed from several sources, is unusual in enabling us to measure virtually all privatization transactions and different types of acquiring owners in the corporatized enterprises from 1992 to 1998 in Romania. To estimate the impact of owner-types on firm performance, we have linked the ownership information with panel data containing basic information on industrial firms for each year from 1992 to 1999. Unlike previous studies of the impact of privatization in most countries, we are thus able to provide estimates based on a large sample, including nearly the entire surviving population of industrial joint-stock companies eligible for privatization in Romania, which amounts to about 90 percent of such companies in 1999, and containing longitudinal data spanning the pre- and post-privatization periods.

Our empirical strategy follows the broader literature on firm performance in the choice of the dependent variable and controlling covariates, and we employ a variety of alternative econometric techniques to control for potential selection bias and measurement error. Subject to the constraints of the data, which—despite their richness concerning the post-privatization ownership structure—are rather limited in financial and operating information, we investigate possible problems of endogeneity in the determination of the ownership variables. We also consider alternative specifications of the functional form through which ownership affects firm

performance; in particular, we estimate both linear equations based on proportionate shareholdings and threshold models of majority privatization and of the largest owner type, a specification commonly adopted in the literature. In the latter specification, we use time-invariant group effects to control for pre-privatization differences in performance and to permit an assessment of the magnitude of such differences.

Section 2 describes the construction of the data, the Romanian privatization process, and the post-privatization ownership structure. Section 3 presents econometric specifications, Section 4 reports estimation results, and Section 5 concludes with a summary of our findings.

## **2. DATA, PRIVATIZATION POLICIES, AND OWNERSHIP OUTCOMES**

### **2.1 Database Construction**

Our analysis of the post-privatization ownership structure is based on unpublished data from multiple sources that we have linked together.<sup>4</sup> The information on the ownership of the initially state-owned joint-stock companies is compiled from seven databases: the State Ownership Fund (SOF) Transactions Database, the SOF Portfolio Database, and one database for each of the five Private Ownership Funds (POFs).<sup>5</sup> From these sources, we construct a nearly complete evolution of the post-privatization ownership structure through the end of 1998 for all initially state-owned enterprises in the SOF portfolio. Thus, the sample includes all the surviving joint-stock (“commercial”) companies, but it excludes spin-offs of shops and other assets from the parent companies as well as the *regii autonome*, which are discussed later in this section. We construct our final sample for the ownership structure by selecting all industrial firms, resulting

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<sup>4</sup> The appendix of Earle and Telegdy (2002) contains a detailed description of the construction of the database.

<sup>5</sup> The establishment and functions of these organizations are discussed in detail in the second part of this section.

in 2,354 cases representing about 95 percent of the total number of surviving industrial firms from the SOF portfolio.<sup>6</sup>

To study firm performance, we draw information on employment and sales for each year from 1992 to 1999 from the corresponding Romanian Enterprise Registries.<sup>7</sup> The Registries have nearly complete information on all registered firms with at least five employees, but in each year from 1993 to 1999, between 8 and 11 percent of the firms have missing values; the percentage missing is 18 percent in 1992. Table 1 presents the number of observations in the final sample, by year. In summary, the data enable us to measure the post-privatization ownership structure of almost all industrial joint-stock companies from the surviving population of the SOF, and to estimate the relationship between privatization methods and performance for about 90 percent of these companies.

## **2.2 Corporatization and Residual State Ownership**

Similar to most other transition economies, the process of large and medium-sized enterprise reform in Romania began with corporatization of the SOEs, in order to make possible their transfer to multiple owners. In Romania, the legal conversion took place relatively quickly and was completed by 1991, when the SOEs were divided into two groups: *regii autonome* (remaining SOES) and *societati comerciale* (commercial companies). The so-called “strategic” companies were included in the former group, and although relatively small in number (about 400 companies), they tended to be large in size, accounting for about 47 percent of total SOE

<sup>6</sup> Incomplete information in the files resulted in the loss of about five percent of all observations.

<sup>7</sup> Sales are deflated by producer price indices, usually at the 4-digit industry level. See the appendix of Earle and Telegdy (2002) for more detail.

assets (Romanian Development Agency, 1997).<sup>8</sup> The second group of firms, nearly all of which were reorganized as open joint-stock companies, is the focus of attention in this paper.

The shares in these corporatized entities were placed in a newly established State Ownership Fund (SOF) and one of five Private Ownership Funds (POFs), in a ratio of 70:30 percent. The SOF's organization and governance resembled those of Ministries of Privatization and State Property Funds in other transition economies. The POFs, however, were more unusual. Despite their name, they remained state-governed, their boards of directors appointed by the government and approved by the Parliament, and their nominal owners, who were the approximately 18 million Romanian citizens, without any effective means of control. Thus, we treat the POFs as a separate category, neither private nor state, in the empirical analysis.<sup>9</sup>

As presented in Table 2, our database contains 2,354 industrial firms in SOF ownership in 1992, when the privatization process began. Most of these (1,822 firms or 77 percent of the total) still had some state ownership at the end of 1998. Indeed, the SOF holding, conditional on being present in these firms, was 46.9 percent at the mean and 50.9 at the median. The unconditional mean, the evolution of which we have calculated in Table 3, fell from 70 percent at the end of 1991 to 36.3 percent at the end of 1998. As a percentage of firms by largest owner-type, the SOF share fell from 100 to 47.6 percent, as reported in Table 4. Concerning POF ownership, 941 firms were partially POF-owned at the end of 1998, with a conditional mean of 20.1 percent. The POF has almost always been a minority owner, and only 32 of these firms were majority POF-owned. Starting from the 30 percent handed over to them in 1991, the POF

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<sup>8</sup> The average number of employees in the 357 *regii* included in the Romanian Enterprise Registry was 2,988 in 1992.

<sup>9</sup> Earle and Sapatoru (1993, 1994) describe the legal basis and incentives of the SOF and POFs during their first few years of operation. From 1996 to 1997, the POFs were converted into investment funds, known in Romanian as SIFs, but their governance remained nontransparent, each having several million small shareholders and explicit rules preventing ownership concentration. We refer to them as POFs for simplicity. See Negrescu (2000) for more discussion of the POF/SIFs.

share declined to 8.0 by the end of 1998 (Table 3); they were never the largest owner in any but a very small number of firms (Table 4).<sup>10</sup>

The Romanian Privatization Law of 1991 and associated regulations charged the SOF with the privatization of all the shares in its portfolio within seven years. But the law provided little guidance on how this goal was to be accomplished, specifying only a very general list of possible methods. In practice, three fairly specific techniques have dominated Romanian privatization: management-employee buyout (MEBO), the mass privatization program (MPP), and block sales of shares to outside investors. Sales were intended to be the primary method of privatization from the beginning, although the MEBO method had already received some encouragement in the Privatization Law's provision for preferential terms for managers and employees. These included the right of first refusal and installment payments at very low interest rates, and these preferences were expanded and extended in later legislation.<sup>11</sup> The MPP was adopted later, in 1995, as an announced attempt to "accelerate" the rate of property transfer.

### **2.3 The Management-Employee Buyout (MEBO) Method**

Transfer of shares to employees, through giveaways or sales at low prices, has been a common privatization method in transition economies due to the relative ease of administrative and political implementation. The method is controversial, however, and frequently alleged to be ill-suited to the restructuring demands of the transition.<sup>12</sup> On the one hand, insider

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<sup>10</sup> The tables also present the shares owned by a group labelled as "others," which are not identifiable on the basis of the SOF sources. Of the 18 firms in which others were the majority owners, we were able to obtain further ownership data on the 7 firms listed on the Stock Exchange or RASDAQ, the over-the-counter market. In these firms, outside blockholders had majority stakes in 4 and the employees' organizations had majority ownership in 3.

<sup>11</sup> MEBOs began in earnest in 1993, although a law formalizing the practices was adopted only in 1994; see Munteanu (1997) for a detailed discussion. After 1996, sales to employees were no longer formally referred to as MEBOs, but the institutional arrangements remained the same.

<sup>12</sup> Frydman and Rapaczynski (1994), and Lipton and Sachs (1990) argue against privatization to employees, while Ellerman (1993), Stiglitz (1999) and Weitzman (1993) argue in favor of this policy. Estrin, Jones, and Svejnar (1987) analyze the performance effects of producer cooperatives in Western economies, and Earle and Estrin (1996) discuss the advantages and disadvantages of worker and manager ownership in transition economies.

privatization may improve work incentives, company loyalty, and support for restructuring. If ownership is widely dispersed among employees, it may also facilitate takeovers by outsiders.<sup>13</sup> On the other hand, employees may lack the necessary skills, capital, access to markets, and technologies necessary to turn their firms around. Corporate governance by employees may function particularly poorly when the firm requires difficult restructuring choices that have disparate distributional impacts within the firm.<sup>14</sup>

While standard arguments such as these might have some relevance for every form of employee ownership in the transition economies, the Romanian MEBOs also have some significant institutional peculiarities. These stem largely from the legal requirement that the employees establish an employees' association to hold the shares and exercise most ownership rights during the repayment period of 3 to 5 years, in order to obtain the payment preferences.<sup>15</sup> During the repayment period, the unpaid shares may not be resold; this constraint limits the possibility for concentration or takeovers that might improve governance. Moreover, the Romanian privatization contracts often included restrictions on changes in the firm's employment level and main product that also applied during the repayment period. The complicated governance and limitations on restructuring that resulted from these arrangements may have further attenuated any potentially positive effects of privatization on these firms' performance.

In addition to these institutional peculiarities, insider privatization in Romania is also somewhat unusual in the magnitude of the insider share in the affected firms. Table 2 shows that

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<sup>13</sup> For a review of evidence on the productivity effects of worker ownership in the West, see Bonin, Jones, and Putterman (1993).

<sup>14</sup> Hansmann (1990) contains a similar argument with respect to the patterns of worker ownership in Western economies.

<sup>15</sup> Anecdotal evidence suggests that voting within the employee association is sometimes according to one-member one-vote rather than by shareholding. This suggests that MEBO firms are hybrid organizations, part public corporation and part producer cooperative.

a total of 858 industrial firms—over a third of all industrial firms in the SOF portfolio—had undergone MEBO transactions by the end of 1998, with the mean employee stake reaching 64.9 percent and the median 70.6 percent. Unlike most share transfers to employees in Hungary and Poland, and to an even greater degree than in Russia, the Romanian MEBOs tended to yield overwhelming employee ownership. Usually the entire SOF stake of 70 percent was transferred to employees, although there were also some cases of minority participation, sometimes combined with other privatization methods.<sup>16</sup>

Table 3 displays the evolution of ownership from 1992 to 1998. MEBOs were most common in the years 1994 and 1995, although employees continued to buy out their companies through 1998 (the last year in our ownership data). Second only to the SOF, MEBO participants were the largest owner-type in 24.5 percent of the firms at the end of 1998, as shown in Table 4. Measured either as the average percentage of shares privatized or the largest private owner-type, MEBO has been the single most important privatization method in Romania. Therefore, Romanian MEBOs provide an interesting opportunity to test the effect of dominant employee ownership in a large number of privatized firms.

#### **2.4 The Mass Privatization Program (MPP)**

The second major method used in Romania was mass (or “voucher”) privatization. As elsewhere in Eastern Europe, the rationale for this method was that the speed of privatization could be increased by overcoming the problems of insufficient demand due to low domestic savings and reluctance of foreign investors (Earle, Frydman, and Rapaczynski, 1993; Boycko, Shleifer, and Vishny, 1994). These programs were intended to jump-start domestic equity markets with a rapid release of shares, but they run the risk of highly dispersed ownership

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<sup>16</sup> See Earle and Estrin (1996) for a comparative discussion. The fraction obtained by insiders in Romanian MEBOs was frequently 100 percent, as the POFs often sold their shares simultaneously with the SOF.

structures. This problem was normally addressed through the creation of intermediaries, either by the state as part of the program (e.g., in Poland), or by private parties competing for individuals' vouchers (e.g., in Czechoslovakia). Although there has been little empirical evidence on the effects of these programs, a number of authors have been highly critical of them (Stiglitz, 1999; Black, Kraakman, and Tarrasova, 2000; Kornai, 2000; and Roland, 2001).

The Romanian mass privatization program (MPP), carried out in 1995-96, provides an opportunity to analyze a rather extreme form of voucher privatization; one that ensured maximal dispersion of ownership by prohibiting the trading of vouchers and the formation of intermediaries. The potential benefits of the program may also have been reduced by the large stake kept by the state: in most companies included in the program, only 60 percent of the shares were offered. In those deemed strategic, which tended to be relatively large firms, the figure was only 49 percent. Even these percentages were reached in very few companies, due to the peculiar asymmetry in the treatment of excess demand and excess supply in the allocation procedure. Oversubscription resulted in *pro rata* allocation, while undersubscription resulted in untransferred shares.<sup>17</sup> As Table 2 shows, a total of 1,727 industrial firms were included in the program, with a mean of 24.5 percent and a median of 18.4 percent privatized; only about one-sixth of the firms in the program were majority privatized.

The consequence of the MPP was inevitably an ownership structure heavily dominated by the state, which usually retained a majority stake, with a highly dispersed group of private owners. The possibility for a positive impact of this program on firm performance would rest on some indirect mechanism: either through secondary sales leading to increased private ownership

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<sup>17</sup> Earle and Telegdy (1998) analyze details of the MPP procedures. The relevant law, No. 55/1995, refers to the acceleration of the privatization process in both its title and text. The full law can be found in Romanian Development Agency (1996).

concentration, through share trading increasing information about firm performance and therefore improving managerial incentives,<sup>18</sup> or through some complementarity with other owners, particularly blockholders that purchased shares through a direct sale. In such cases, the MPP may still have had a positive effect, despite its design.

Shares allocated in the MPP were taken from the portfolios of both the SOF and the five POFs, but the POFs could regain some shares if citizen-participants in the MPP exercised their option to place their vouchers with them. On average, the POFs were net losers from this procedure by the program's design. As shown in Table 3, their mean share dropped from 23.8 percent at the end of 1995 to 9.2 percent a year later. Both before and after the MPP, the POFs also sold shares from their portfolios, resulting in a reduction of their stake to only 8.1 percent by the end of 1998. Frequently, such sales were organized in conjunction with SOF privatization sales.

## **2.5 Privatization through Sales to Outsiders**

The third major privatization method employed in Romania involved case-by-case sales of large blocks of shares to outside investors. The most important method was closed-bid tender, in which not only the price offer but also the business plan, investment and employment promises, and other considerations were taken into account by the SOF in selecting the buyer. These considerations are frequently reflected in provisions of the privatization contract that restrict post-privatization behavior, as in the MEBO privatizations (Negrescu, 2000). Although Romanian policymakers may have considered themselves constrained politically to ensure continued employment and operation of the firms, such restrictions could have reduced

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<sup>18</sup> After the MPP, most of the companies were listed on either the Bucharest Stock Exchange or RASDAQ, the over-the-counter market in Romania.

restructuring in the companies privatized through block sales, and thus decreased the potential benefits of privatization.<sup>19</sup>

Moreover, the sales method has intrinsic problems that tend to make it slow and uncertain. Multi-criteria tenders naturally involve a lack of transparency in the process, because there are no announced or pre-determined weights for the various aspects of the bid and potential participants are left guessing about the trade-offs among them. The bids are not publicly revealed after the tender, making it difficult to monitor the SOF's decisions. Because of the lack of an objective criterion and the nontransparency of the process, the selection decision can be easily manipulated, creating the appearance—if not always the reality—of corruption. Indeed, even a perfectly clean process organized by honest, well-intentioned bureaucrats is subject to corruption charges, because there is little defense against allegations of favoritism. Opposition parties are quick to exploit the possibility, and government bureaucrats, fearing charges of corruption and with few incentives to privatize aggressively, tend to act very cautiously. Of course, the problems are magnified to the extent that some of the bureaucrats are less than honest and act as rent-seekers both by taking bribes in the privatization process and by colluding with the enterprise managers to strip assets before privatization. Political battles may also erupt over the fulfillment of the contractual restrictions, resulting in cancellation of privatization contracts and renationalization of firms.<sup>20</sup> The cumulative effect is to further reduce demand and make sales more difficult as potential investors become more reluctant to participate in an uncertain environment.

<sup>19</sup> Unfortunately, our database does not permit us to measure these restrictions for each company separately.

<sup>20</sup> Our database shows that annulments of transactions are much more common for sales than for MEBOs, and that they are non-existent for MPP transfers.

These difficulties are reflected in the slow pace of privatization through sales in Romania, which has been similar to the experience of most other transition economies.<sup>21</sup> Nonetheless, the data contain a sufficient number of observations on sales to permit an evaluation of their impact on firm performance. As shown in Table 2, 473 firms underwent large-block sales by the end of 1998. Most of these blocks were quite large, with an average of 53.8 percent and a median of 50.9. Out of these firms, 246 had majority outside ownership. In 12.6 percent of the firms, blockholders were the largest—although not necessarily majority—type of owner (Table 4).<sup>22</sup>

## **2.6 Summary of Post-Privatization Ownership and Corporate Governance**

This analysis of ownership results shows that the state's share in the corporatized industrial companies had fallen to 36.3 percent on average by the end of 1998. Most of the companies with private ownership became majority private. The most prevalent types of owners were employees, with 23.6 percent on average, and participants of the Mass Privatization Program, with 18.2 percent on average. Concentrated outsiders were present in 473 companies, or 20 percent of the sample, and the average stake in this group of firms was a majority. In more than three-quarters of all firms, the SOF retained some ownership stake; within this group, the average state share was quite high, at 46.9 percent. The heterogeneity of the Romanian privatization methods thus produced an interesting testing ground for examining the impact of alternative ownership structures on firm performance.

Our discussion has also presented reasons why privatization in Romania may have had little or no effect, or at least fewer benefits than if it had been optimally designed. Each of the

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<sup>21</sup> Eastern Germany, Hungary, and Estonia, each of which had clear advantages in selling to outsiders, are partial exceptions to the generally slow rate of privatization through sales in transition economies. The pace was criticized even in these three countries, however.

<sup>22</sup> The buyers were both domestic and foreign. Domestic investors bought shares in 378 companies and foreigners in 98, with an average holding of 52.7 and 56.6 percent, respectively. Earle and Telegdy (2001) contains more discussion of domestic and foreign ownership.

privatization methods created possible corporate governance problems (e.g., insider control, dispersion of shareholdings, and contractual restrictions) that might have blocked or reduced the new owners' incentives to restructure and raise productivity. An additional factor that could have weakened the impact of any form of privatization is the general business environment. If property rights are not respected and enforcement of contracts and corporate governance rules is poor, the new owners may expect little return from their investments and restructuring efforts.<sup>23</sup> The business environment in Romania has been frequently criticized; for instance, in its regular grading of "institutional performance" in the transition economies, the EBRD (2000, p. 21) awarded Romania a score only slightly ahead of Russia and well behind Hungary, Poland, and the Czech Republic. None of these economies were considered to have reached "a standard that would not look out of place in an industrialized market economy" (p. 16). Privatization under such conditions, even sales of large blocks to outsiders, may not yield substantial benefits. The question can only be decided through empirical analysis.

### 3. ESTIMATION FRAMEWORK

Our empirical strategy follows the broader literature in estimating reduced form equations for firm performance as a function of ownership, while taking into account potential problems of heterogeneity, both observed and unobserved, and simultaneity bias. Using a model for panel data in which  $i$  indexes firms and  $t$  indexes years, we estimate equations of the following form:

$$P_{it} = \mathbf{b}_0 + \mathbf{b}_1 OWN_{it} + \mathbf{b}_2 X_{it} + u_{it}, \quad (1)$$

<sup>23</sup> See Anderson, Lee, and Murrell (1999) for this argument with respect to Mongolia. Black, Kraakman, and Tarrasova (2000) claim that privatization in a poor institutional environment actually increased asset-stripping and worsened firm performance in Russia.

where  $P_{it}$  is a measure of firm performance,  $OWN_{it}$  captures the ownership structure, sometimes as a vector of variables,  $X_{it}$  is a vector of covariates, and  $u_{it}$  is a residual.

Our measure of firm performance in this paper is the annual growth of labor productivity; the ratio of real sales to average employment.<sup>24</sup> While it might seem desirable to use other performance indicators, such as profitability, Tobin's Q, or total factor productivity, the available data do not permit us to measure these variables. Without a measure of the capital stock or other inputs, we cannot estimate total factor productivity, nor do we have profits, return to assets, or stock market value. These indicators suffer from severe measurement problems in the transition context, however due to the arbitrary valuation of the capital stock acquired during the socialist period, the ubiquitous hiding of profits, and underdevelopment of stock markets. Moreover, labor productivity growth has the advantage of reflecting changes in the capital stock due to investment, which may itself demonstrate superior performance in the poorly functioning capital market environment of Eastern Europe. Specifying the dependent variable as a growth rate serves to difference away any fixed firm-specific characteristics, such as superior technology or larger initial capital stock, that affect the level of labor productivity. We also control for industry, size, and the lagged level of labor productivity to account for other differences across firms, such as in capital-labor ratios. In some specifications we also include firm fixed-effects or group-effects for ownership types.

Table 5 presents summary statistics for the levels of average employment, real value of sales in thousands of 1992 lei, and labor productivity. According to these data, average

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<sup>24</sup> The level or growth of labor productivity is commonly used in studies of firm performance; see, e.g., Anderson, Lee, and Murrell (2000), Boubakri and Cosset (1998), Carlin et al. (2001), Claessens and Djankov (1999a,b), Djankov (1999b,c), D'Souza and Megginson (1999), Earle (1998), Earle and Estrin (1997), Frydman et al. (1999), Megginson, Nash, and van Randenborgh (1994), Pohl et al. (1997), and Weiss and Nikitin (1998). Total factor productivity equations that include book values of the capital stock are estimated by Anderson, Lee, and Murrell (2000), Claessens, Djankov, and Pohl (1997), Piesse and Thirtle (2000), and Smith, Cin, and Vodopivec (1997).

employment in industrial enterprises dropped every year by 8 to 17 percent, except for 1996, when the fall was around 4 percent. Over the whole period, the cumulative drop was 55.7 percent on average. The real value of sales and labor productivity displayed much more volatile patterns, rising in some years and falling in others.

Next we turn to the specification of the ownership structure,  $OWN_{it}$ . Our analysis of the Romanian privatization programs in the previous section suggests several alternative ways of specifying the ownership variables. A first approach is based on the proportion of shares in private ownership.<sup>25</sup> In this linear specification, an estimate of  $b_1$  refers to the average impact of an increase in private shareholding on firm performance. An alternative specification involves a threshold or critical level of private ownership, below and above which an increase in private shareholding has zero marginal impact. A natural candidate for the threshold is majority private ownership. In these definitions, we do not treat the shareholdings of the POFs as private, but rather combine them with SOF ownership, for the reasons discussed in the previous section.<sup>26</sup>

In other specifications of the ownership structure, we distinguish different types of new private owners: employees, mass privatization participants, and investors who purchase blocks of shares. We treat POF ownership as a separate group, while another category represents unidentifiable owners in the database who have very small shareholdings on average. We specify these ownership types by their percentage shareholdings in some specifications, and with respect to a shareholding threshold, here defined as the largest type of owner, in others.<sup>27</sup>

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<sup>25</sup> All the firms in the SOF portfolio, and therefore in our database, are share companies.

<sup>26</sup> The ownership variables take into account any privatization transactions that occurred during the preceding year; thus,  $OWN_{it}$  refers to the ownership structure on January 1 of year  $t$ . This date falls at the exact midpoint of the period of growth measured by the dependent variable, labor productivity growth, since the latter is calculated using total sales and average employment for year  $t$  relative to year  $t-1$ .

<sup>27</sup> This specification is similar to that estimated by Frydman et al. (1999), and it differs from the dominant ownership approach of Earle and Estrin (1997) and others, which requires that the dominant shareholding exceed some minimum stake, e.g., 40 percent.

Turning to the control variables,  $X_{it}$ , we are interested in accounting for heterogeneity in performance,  $P_{it}$ , that may also be correlated with our variables of interest,  $OWN_{it}$ . The first problem involves mismeasurement in labor productivity due to firms differing systematically with respect to their production functions, levels of investment, and capital-labor ratios. This suggests that industry effects and firm size should be included, and we specify 14 industrial categories and measure size by employment, lagged to avoid endogeneity problems. Firms may also differ in their set-up costs, quality of equipment, and technology. These characteristics are likely to be correlated with industry and size, and we also include the lagged level of labor productivity in  $X_{it}$  and, in some specifications, firm-specific fixed effects.<sup>28</sup>

A second problem involves initial conditions and the magnitude of the demand shock faced by the firm, as the state cut its orders drastically and customer and supply chains broke down (Blanchard and Kremer, 1997). Firms with better initial conditions may have been cushioned from the impact of competition, while those facing greater shocks may have had proportionately greater difficulty adjusting and maintaining productivity due to the costs of laying off workers and unbundling equipment. These shocks may be correlated with industry and region, and they are likely to vary across years. We include year, industry, and region effects, under the assumption that these may be correlated with unobserved shocks to a firm's productivity. It is frequently argued that larger firms face more difficult adjustments, thus lagged employment is useful here as well. The region effects may also reflect market conditions in the firm's environment. For declining firms, particularly, maintaining productivity may be easier

<sup>28</sup> The lagged level of productivity is frequently included in productivity and productivity growth equations, e.g., Anderson, Lee, and Murrell (2000); Earle (1998); Frydman et al. (1999). Another argument for including it is the possibility that it is more difficult, other things being equal, to increase productivity if it is already high.

when the industry and region is growing because this facilitates the release of workers and capital to other firms. Finally, the region effects may account for differences in relative input prices that could lead to different allocation of factors of production within firms.<sup>29</sup>

With these specifications of the dependent variable, of the post-privatization ownership structure, and of the set of controls, the basic estimating equation focusing on private shareholdings is the following:

$$\begin{aligned} \text{Log}(S_{it}/E_{it}) - \text{Log}(S_{it-1}/E_{it-1}) = & \mathbf{b}_0 + \mathbf{b}_1 \text{PrivateShare}_{it} + \mathbf{b}_2 \text{Log}(S_{it-1}/E_{it-1}) + \mathbf{b}_3 \text{Log}E_{it-1} \\ & + \sum_t \mathbf{b}_t \text{YEAR}_t + \sum_j \mathbf{b}_j \text{IND}_{ij} + \sum_k \mathbf{b}_k \text{REG}_{ik} + u_{it}, \end{aligned} \quad (2)$$

where  $S_{it}$  is sales of firm  $i$  in year  $t$ ,  $E_{it}$  is the corresponding employment,  $\text{YEAR}_t$  represent year effects ( $t = 1993, \dots, 1999$ ),  $\text{IND}_{ij}$  are industry effects ( $j = 1, \dots, 14$ ),  $\text{REG}_{ik}$  are region effects ( $k = 1, \dots, 6$ ),  $\mathbf{b}$  is a vector of parameters to be estimated, and  $u_{it}$  reflects unmeasured factors.

When ownership shares are disaggregated by type, the estimating equation becomes:

$$\begin{aligned} \text{Log}(S_{it}/E_{it}) - \text{Log}(S_{it-1}/E_{it-1}) = & \mathbf{b}_0 \\ & + \mathbf{b}_{11} \text{OutsideShare}_{it} + \mathbf{b}_{12} \text{InsideShare}_{it} + \mathbf{b}_{13} \text{MassShare}_{it} + \mathbf{b}_{14} \text{OtherShare}_{it} + \mathbf{b}_{15} \text{POFShare}_{it} \\ & + \mathbf{b}_2 \text{Log}(S_{it-1}/E_{it-1}) + \mathbf{b}_3 \text{Log}E_{it-1} + \sum_t \mathbf{b}_t \text{YEAR}_t + \sum_j \mathbf{b}_j \text{IND}_{ij} + \sum_k \mathbf{b}_k \text{REG}_{ik} + u_{it}, \end{aligned} \quad (3)$$

where the sum of the share variables plus the omitted state shareholding equals one.

Even with such controls, it is possible that there is still some unmeasured heterogeneity correlated both with ownership and performance. To take this into account, we also estimate equations 2 and 3 including firm fixed-effects. In these models, the estimates of  $\mathbf{b}_1$  and  $\mathbf{b}_{11}$  to  $\mathbf{b}_{15}$  reflect the effects of the within-firm variation of ownership by permitting each firm to have a

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<sup>29</sup> To assess the necessity of including these firm characteristics in the performance equation, we regress the share ownership variables on groups of industry, region, size-category, and year dummies. Each group of dummies was jointly significant in every equation, nearly always at the 1 percent significance level, suggesting the importance of including them as controls. Concerning industrial affiliation, the data show higher rates of privatization in the food, printing and publishing, furniture, footwear, textile, and other sectors of light industry. Lower rates of privatization are found in heavy industrial sectors such as mining, wood, chemicals, metallurgy, and machine building.

separate intercept. Thus, any systematic variation across firms in the rate of its labor productivity growth will not contaminate the parameter estimates. The firm fixed-effects also help to control for possible endogeneity of ownership, which may be due to a tendency for firms with higher productivity growth to be privatized. As long as the unobserved component of productivity growth associated with the privatization propensity is fixed over time, the inclusion of firm effects controls for selection bias.

We also estimate analogous equations with dummies representing majority privatized (*PrivateDummy*, defined as = 1 if *PrivateShare* > .5) or largest non-state owner (*OutsideDummy*, *InsideDummy*, *MassDummy*, *OtherDummy*, and *POFDummy*). In these models, we include group effects in the equations. For example, the variable *PrivateEver* indicates whether the firm ever became majority private during the entire sample period. Thus, the estimating equation is:

$$\begin{aligned} \text{Log}(S_{it}/E_{it}) - \text{Log}(S_{it-1}/E_{it-1}) = & \mathbf{g} + \mathbf{g}_0 \text{PrivateEver}_i + \mathbf{g}_0 \text{PrivateDummy}_{it} \\ & + \mathbf{g}_2 \text{Log}(S_{it-1}/E_{it-1}) + \mathbf{g}_3 \text{Log}E_{it-1} + \sum_t \mathbf{g} \text{YEAR}_t + \sum_j \mathbf{g} \text{IND}_{ij} + \sum_k \mathbf{g} \text{REG}_{ik} + v_{it}, \end{aligned} \quad (4)$$

where  $\mathbf{g}$  is a vector of parameters to be estimated, and  $v_{it}$  represent the residuals associated with this specification of ownership. Note that *PrivateDummy<sub>it</sub>* is nested in *PrivateEver<sub>i</sub>*, so that the estimated coefficient on *PrivateDummy<sub>it</sub>* reflects the impact of becoming majority privately owned relative to pre-privatization performance.

The analogous equation for the disaggregated case with largest owner dummies is:

$$\begin{aligned} \text{Log}(S_{it}/E_{it}) - \text{Log}(S_{it-1}/E_{it-1}) = & \mathbf{g} + \mathbf{g}_1 \text{OutsideEver}_i + \mathbf{g}_2 \text{InsideEver}_i \\ & + \mathbf{g}_3 \text{MassEver}_i + \mathbf{g}_4 \text{OtherEver}_i + \mathbf{g}_5 \text{POFEver}_i + \mathbf{g}_1 \text{OutsideDummy}_{it} + \mathbf{g}_2 \text{InsideDummy}_{it} \\ & + \mathbf{g}_3 \text{MassDummy}_{it} + \mathbf{g}_4 \text{OtherDummy}_{it} + \mathbf{g}_5 \text{POFDummy}_{it} \\ & + \mathbf{g}_2 \text{Log}(S_{it-1}/E_{it-1}) + \mathbf{g}_3 \text{Log}E_{it-1} + \sum_t \mathbf{g} \text{YEAR}_t + \sum_j \mathbf{g} \text{IND}_{ij} + \sum_k \mathbf{g} \text{REG}_{ik} + v_{it}, \end{aligned} \quad (5)$$

where the group effects (*OutsideEver<sub>i</sub>*, etc.) are constant over time, analogously to *PrivateEver<sub>i</sub>*. This method imposes a stronger restriction than the firm fixed-effects specification, but it also has the advantage of permitting some inferences to be drawn concerning the pre-privatization performance of firms that are privatized subsequently. For example, in equation (4),  $g_0$  represents the difference between the productivity growth of firms that have not yet been privatized but will be in the future, and the productivity growth of firms that are never privatized within our sample period. If better performing firms tend to be privatized,  $g_0$  should be positive. On the other hand,  $g_0$  represents the post-privatization change in labor productivity growth relative to the pre-privatization growth rate of firms that are eventually observed to be privatized. If privatization is pure selection,  $g_0$  should be zero. In equation (5), the parameters ( $g_1, \dots, g_5$ ) represent the labor productivity performance of the firm prior to its acquisition by the given owner-type, relative to firms remaining in state ownership. The group effects may be interpreted as estimates of the selection bias into each ownership category, while the coefficients on the largest owner dummies ( $g_1, \dots, g_5$ ) reflect the change in performance associated with ownership change.

Our efforts to control for selection bias notwithstanding, the possibility remains that some dynamic selection mechanism exists, whereby firms with greater possibilities for raising productivity growth have greater or smaller probabilities of being privatized and of being acquired by different types of private owners. Such a selection mechanism could result in biased estimates if there is some characteristic of firms, for example their quality, that is observable to buyers or to the SOF but not to the researcher. This characteristic cannot relate to either the level or growth of labor productivity, because such an effect would be eliminated by the firm fixed-effects in a growth equation. Rather, the characteristic must accelerate productivity, and it must

be independent of all of our control variables, if it is to create selection bias. Such a selection mechanism may seem implausible, but it would be desirable to check for it if data were available to instrument changes in the ownership structure. Instruments would need to be correlated with ownership change but not with labor productivity growth, which is difficult to satisfy. Unfortunately, our analysis uses all the variables in our database and we have no appropriate instruments for such an investigation. All studies of privatization and firm performance, including studies that treat selection bias through fixed effects, face this problem. The possibility of such a dynamic selection mechanism should be considered in interpreting results.<sup>30</sup>

A final issue concerns measurement error. Although we have carefully constructed and cleaned our data, some significant outliers remain. We cannot be sure whether these represent true differences across firms or simply noise associated with most large firm-level databases. Moreover, the fixed-effects procedure that we employ in some specifications is especially sensitive to measurement error, because within-firm estimates may exacerbate the noise-to-signal ratio. For these reasons and to establish the robustness of our results, we estimate all equations using both ordinary least squares (OLS) and least absolute deviations (LAD) or median regressions. This latter procedure puts equal weight on all observations regardless of how far they lie from the regression line; hence, large outliers do not influence the estimates as much as in OLS.

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<sup>30</sup> Smith, Cin, and Vodopivec (1997) use contemporaneous financial indicators, namely exports, sales, profits, wage bonus, and debts, to instrument employee and foreign ownership in total factor productivity regressions. Anderson, Lee, and Murrell (2000) exploit details of the privatization process to instrument ownership in Mongolia, and Earle (1998) instruments ownership with privatization method and other variables in Russia. None of these studies use group- or fixed-effects.

#### 4. EMPIRICAL RESULTS

We first examine the association between ownership and productivity growth, starting with simple descriptive statistics and tests of differences of means across ownership categories. Table 6 pools the data across years, treating each firm-year as an independent observation, and reports the mean productivity growth by dominant owner. State and Private refer to majority ownership, while the disaggregated private groups (i.e., Outside, Inside, and Mass) are classified according to their largest private owner type. Firm-year observations in which the state was majority owner tend to have a productivity decline of  $-0.024$  at the mean. Privatized firms tend to have a productivity increase of  $0.012$  on average. This difference is statistically significant at the 1 percent level. Concerning disaggregated private categories, both inside- and mass-owned firms experience average productivity declines of  $-0.007$  and  $-0.014$ , respectively, but the differences from state-owned firms are not statistically significant. Firm-year observations in which the dominant owner was an outside blockholder, however exhibit increased labor productivity by an annual average of about 13 percent, and the difference with state ownership is highly significant.

These descriptive statistics take no account of possible omitted variables and selection biases in estimating the performance-ownership relationship. Before turning to the regression estimates in which other factors are included as controls, we look for evidence of selection bias. For example, this may arise if more efficient firms are privatized more easily and have a higher probability of obtaining active owners (e.g., concentrated external investors). A first test of possible selection bias is reported in Table 7, where we report the pre-privatization productivity growth rates for firms that are subsequently privatized and compare these with the growth rate for firms never privatized within our observation period. The first column of the table contains

the average annual productivity growth for firms that never became majority private, while the other columns refer to firm-year observations previous to becoming majority private, or previous to becoming dominated by a particular type of owner, using the same categories and definitions as in Table 6. The mean growth rates lie in a narrow range, from  $-0.032$  to  $0.008$ , and the t-test of the difference in the means relative to the category of “never majority private” is never significant. The small differences in the means for firms that subsequently became outside investor-owned are particularly striking compared with the differences in their post-privatization performance reported in Table 6. This basic test reveals no evidence of selection bias in the privatization process.

In the regression results, we control for third factors that may influence both firm performance and ownership. Table 8 examines the effect of the private share on productivity growth, based on equation (2) estimated using OLS, LAD, and fixed-effects. Private shareholding is estimated to have a positive and statistically significant effect on productivity growth in every equation. The point estimate varies between  $0.102$  and  $0.167$ , depending on the estimation method employed.<sup>31</sup>

These results refer to the average effect of privatizing an additional one percent of the firm’s shares, without distinguishing the type of new private owner. Table 9 contains estimates of equation (3), which disaggregates private ownership shareholdings into several subcategories. Each type of private shareholding is estimated to have positive effects that are statistically significant at the 1 percent level. The inside and mass privatization coefficients range from

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<sup>31</sup> We focus on results concerning our variables of interest, because the others are only control variables and not the focus of this paper. However, we should emphasize that the results are robust to changes in the specification. To check whether the results are sensitive to measurement error that creates spurious correlation between the dependent variable and either lagged productivity or lagged employment, we experimented with including two-period rather than one-period lags and dropping one or both variables from the regression. None of these alternative specifications produced qualitatively different results for the ownership effects from those reported.

0.108 to 0.190 across specifications, but the difference between the estimated effects of these two types is not large or statistically significant. Moreover, their relative ranking varies across specifications: in the OLS and fixed-effects models the coefficient of *MassShare* is larger, while in the LAD regression *InsideShare* has a larger coefficient. However, outside blockholder shares have by far the largest coefficients in every equation, ranging from 0.274 to 0.392. The differences between the estimated effects of *OutsideShare* and the other types of private ownership are large in every equation, and they are always statistically significant at the 1 percent level.

Tables 10 and 11 report the results of the models in which ownership is specified as a categorical variable and in which we also include group effects. The estimates of equation (4) in Table 10, which contain a dummy variable for majority private ownership (*PrivateDummy*) and the group effect (*PrivateEver*), demonstrate a positive, statistically significant effect of majority privatization. The point estimates imply 8.4 percent higher productivity growth for the OLS and 6.6 percent higher in the LAD regression for majority privatized firms relative to their pre-privatization performance. The estimated coefficient of *PrivateEver* is also positive and significant in both specifications, indicating a higher pre-privatization growth rate of firms subsequently majority privatized relative to those never majority privatized. The estimated coefficients are only one-third to one-half the size of those on *PrivateDummy*, however suggesting that selection effects have a much smaller impact than privatization.<sup>32</sup>

Estimates of equation (5), including dummies and group effects for disaggregated largest owner-types, are reported in Table 11. In both the OLS and LAD models, the group effects for insider privatization suggest that firms with higher pre-privatization productivity growth rates are

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<sup>32</sup> We also estimated equation (6) replacing the group effect with firm fixed-effects, resulting in an estimate coefficient (standard error) of 0.121 (0.012) on *PrivateDummy*.

more likely to be privatized by the MEBO method: *InsideEver* has positive, significant estimated coefficients in both regression models. Only the OLS model provides evidence of higher pre-privatization productivity growth in *OutsideEver*, however. Notwithstanding the presence of these group effects, the results are fully consistent with those for share ownership. Outside blockholders are estimated to have the largest impact on productivity growth relative to their pre-privatization performance, while the effects of insider and mass participants are smaller but still positive.<sup>33</sup> Among the identified owner-types, *OutsideDummy* has the largest coefficients, and *InsideDummy* and *MassDummy* coefficients are smaller, while all are highly statistically significant.<sup>34</sup> All forms of privatization appear to dominate continued state ownership. As we have indicated, these results are highly robust to changes in the model specification.

## 5. CONCLUSION

The debates over the effects of privatization on firm performance, which privatization method works best, and which type of owner is most likely to carry out restructuring have been lengthy and impassioned. Yet there are remarkably few studies analyzing the privatization-performance relationship using panel data from a large sample of firms containing information for periods both before and after privatization. Given that privatization policies are typically so prominent and controversial, we know remarkably little about their outcomes in the transition economies. Among these economies, Romania offers an interesting testing ground for two reasons. First, we have been able to construct a data set containing high quality and nearly

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<sup>33</sup> We also re-estimated equations (4) and (5) with a sample excluding firms privatized in 1998, so that only firms with at least two years of post-privatization observations were included. This exercise produced very similar results to those reported in Tables 10 and 11.

<sup>34</sup> Estimating equation (5) with firm fixed-effects resulted in a somewhat higher outside and inside dummy coefficient, 0.191 and 0.101 respectively, and only trivial differences for the mass and POF dummy coefficients relative to Table 11. *OtherDummy* has the largest estimated impact in the OLS estimates, although not in LAD estimates, possibly because of the outside investor ownership discussed in Section 2.

complete information on the privatization process for corporatized industrial enterprises. Second, variants of all of the major types of privatization policies are represented, resulting in an ownership structure with significant stakes held by employees, dispersed and concentrated outsiders, and the state.

Our analysis of the effects of Romania's privatization policies on industrial enterprises had three elements: the ownership structure resulting from privatization, the corporate governance characteristics of privatized firms, and the association of ownership structure with enterprise productivity performance. The description of the ownership structure represents the first comprehensive picture of the impact of privatization in the Romanian industrial sector. We find that the state retained a dominant role in many Romanian firms through the end of 1998; in more than three-quarters, the SOF kept a positive ownership stake, and the average stake was 46.9 percent within this group. Only a slight majority (53.8 percent) of the firms originally slated for privatization in 1992 had become majority private by 1998. The most prevalent types of new private owners were insiders/employees, holding 23.6 percent on average, and participants of the Mass Privatization Program, with 18.2 percent on average. Concentrated outsiders were present in only 473—or 20 percent—of the companies, but the average ownership stake in this group of firms was a majority.

The discussion of the privatization methods and their ownership outcomes indicated possible corporate governance problems that might have reduced the potential benefits of privatization in Romania. The analysis led us to hypothesize that sales to outside blockholders were most likely to have raised firm efficiency, but even these investors may be handicapped in restructuring efforts by contractual restrictions and other impediments posed by Romanian policies and business environment. We also hypothesized that firms bought by their employees

may exhibit lower productivity performance due to the pursuit of non-value-maximizing objectives, difficulties in raising capital, and the continued role of the state through the institutional design of the MEBO privatization process. Finally, the highly dispersed ownership structure resulting from the mass privatization suggests that MPP participants may be unlikely to contribute much to corporate governance, although secondary transactions might have created some concentration. The weakness of these latter two programs raises the question of whether or not they led to any improvements in firm performance, relative to continued ownership by the state. Given that most Romanian privatization was either MEBO or MPP, a corollary question is whether privatization in Romania has made any difference on average.

Our empirical findings provide strong evidence that, despite the corporate governance problems resulting from peculiarities in its design, privatization has had a positive and substantial effect on the growth of labor productivity in Romania. The statistical significance of these effects remains highly robust across alternative equation specifications and estimation methods. Our work strongly supports the proposition that outside blockholders are the most effective owners of privatized companies. More surprisingly, the estimated regression coefficients on disaggregated outsider owners (MPP participants) and on insiders (MEBO participants) are also positive and statistically significant. Thus, the data provide evidence that even insiders and dispersed outside owners have a positive impact relative to continued state ownership, although these point estimates are distinctly and statistically significantly smaller than those of the outside blockholders.<sup>35</sup>

<sup>35</sup> Our ownership measures pertain only to the results from privatization transactions, and we do not observe subsequent secondary sales of shares. Perhaps the employees and other individuals acquiring small quantities of shares through these programs sold them quickly so that some concentrated owners emerged subsequently.

This evidence implies that privatization has been surprisingly successful in Romania—for the firms that have been privatized. For the others, the results suggest that waiting has been deleterious. Given the large remaining state shareholdings, our analysis would recommend a further stage of what the Romanian government has been wont to call “acceleration.”

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**Table 1: Number of Firms with Complete Ownership, Employment and Sales Data**

Year	1992	1993	1994	1995	1996	1997	1998	1999
Number of firms	1,931	2,074	2,115	2,134	2,179	2,183	2,202	2,168
Percent of firms	82.0	88.1	89.8	90.7	92.6	92.7	93.5	92.1

Total number of firms: 2,354.

**Table 2: Post-Privatization Ownership Structure, End-1998  
(percentage ownership conditional on a non-zero share in the firm)**

Privatization method (owner-type)	Mean ownership (percent)	Median ownership (percent)	Number of firms with owner-type	Number of firms with majority ownership- type
Sales (outside)	53.8	50.9	473	246
MEBO (inside)	64.9	70.6	858	519
Mass	24.5	18.4	1,747	296
Other	10.4	1.2	693	18
POF	20.1	18.6	941	32
State	46.9	50.9	1,822	935

Total number of firms: 2,354.

Notes: “Sales (outside)” refers to outside investors who obtained their holdings through block sales, “MEBO (inside)” refers to employees who obtained shares through management-employee buyouts, “Mass” refers to individuals who obtained shares within the Mass Privatization Program, “Other” refers to owners not classifiable with available information, “POF” refers to Private Ownership Funds, and “State” refers to State Ownership Fund (SOF).

**Table 3: Evolution of the Ownership Structure  
(average percentage at year-end)**

Privatization Method / Owner-Type	1992	1993	1994	1995	1996	1997	1998
Sales (outside)	0.2	0.2	0.6	0.9	2.6	4.9	10.8
MEBO (inside)	0.2	3.0	9.6	17.5	21.3	22.1	23.6
Mass	0.0	0.0	0.0	0.0	18.2	18.2	18.2
Other	0.0	0.4	0.8	1.2	1.3	2.1	3.1
Total private	0.4	3.6	11.0	19.6	43.4	47.3	55.7
POF	29.8	28.7	26.4	23.9	9.1	8.7	8.0
State	69.7	67.7	62.6	56.5	47.5	44.0	36.3
N.B. Percentage of firms majority private <sup>a</sup>	0.4	3.3	10.3	18.4	38.7	43.8	53.8

Number of firms: 2,354.

Notes: “Sales (outside)” refers to outside investors who obtained their holdings through block sales, “MEBO (inside)” refers to employees who obtained shares through management-employee buyouts, “Mass” refers to individuals who obtained shares within the Mass Privatization Program, “Other” refers to owners not classifiable with available information, “POF” refers to Private Ownership Funds, and “State” refers to State Ownership Fund (SOF). The calculation of total private excludes POF as well as state.

<sup>a</sup> Percentage of firms with more than 50 percent of shares privately owned.

**Table 4: Distribution of Firms by Largest Owner-Type  
(percent of firms at year-end)**

Privatization Method	1992	1993	1994	1995	1996	1997	1998
Sales (outside)	0.3	0.3	0.6	1.1	2.4	5.0	12.6
MEBO (inside)	0.2	3.0	9.7	17.4	21.5	22.3	24.5
Mass	0.0	0.0	0.0	0.0	13.5	14.0	14.2
Other	0.0	0.0	0.0	0.0	0.2	0.5	1.0
POF	0.0	0.0	0.0	0.0	0.1	0.2	0.2
State	99.6	96.7	89.7	81.6	62.3	58.0	47.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Number of firms: 2,354.

Notes: “Sales (outside)” refers to outside investors who obtained their holdings through block sales, “MEBO (inside)” refers to employees who obtained shares through management-employee buyouts, “Mass” refers to individuals who obtained shares within the Mass Privatization Program, “Other” refers to owners not classifiable with available information, “POF” refers to Private Ownership Funds, and “State” refers to State Ownership Fund (SOF).

**Table 5: Summary Statistics for Employment, Real Sales and Labor Productivity**

		1992	1993	1994	1995	1996	1997	1998	1999
Employment	Mean	1,154.3	1,045.5	898.9	836.1	788.9	733.8	622.2	514.4
	Std. Dev.	1,778.0	1,707.1	1,587.2	1,558.8	1,908.7	1,451.6	1,266.8	1,083.8
Real sales	Mean	2,072.1	2,328.0	1,864.1	1,962.2	1,908.7	1,750.6	1,477.2	1,256.8
	Std. Dev.	5,188.2	7,931.6	7,980.2	9,096.5	8,481.6	9,132.1	8,413.3	6,310.0
Labor productivity	Mean	2.07	2.01	1.69	1.87	1.89	1.73	1.71	1.86
	Std. Dev.	2.87	2.75	2.38	2.47	2.39	2.32	2.69	2.49
Productivity growth	Mean	NA	0.43	-0.90	0.28	0.39	-0.03	0.06	0.24
	Std. Dev.	NA	4.22	0.62	2.30	12.75	0.48	0.99	1.16
Number of firms		1,931	1,924	2,048	2,050	2,108	2,129	2,134	2,139

Notes: Real value of sales is measured in thousands of 1992 lei. Productivity growth is expressed as proportion. NA = not available.

**Table 6: Productivity Growth by Largest Owner-Type**

	State	Private	Outside	Inside	Mass
Mean (t-stat)	-0.024	0.012 (4.03)**	0.133 (5.43)**	-0.007 (1.75)	-0.014 (0.64)
N	10,857	3,670	466	13,028	11,752

Notes: N refers to the number of firm-year observations. Productivity growth is measured as the log of the ratio of labor productivity for year  $t$  to that for year  $t-1$ . “State” and “Private” refer to majority ownership, while the disaggregated private ownership categories refer to largest shareholding; “outside” is all blockholder shares, “inside” refers to all shares obtained by employees through MEBO privatization, and “mass” consists of all shares distributed through the MPP. Ownership is measured at end of year  $t-1$ . The absolute value of the  $t$ -statistic in parentheses tests the difference of means for each type of private owner relative to majority state ownership. \*\* indicates significance at the 1 percent level.

**Table 7: Pre-Privatization Productivity Growth by Future Owner-Type**

	Never majority private	Private after year t	Outside after year t	Inside after year t	Mass after year t
Mean (t-stat)	-0.032	-0.012 (1.75)	-0.007 (1.53)	0.000 (1.91)	-0.033 (0.06)
N	4526	3207	1132	966	929

Notes: Firm-year observations are included only if the state is the largest owner in the given year. Productivity growth is measured as the log of the ratio of labor productivity for year  $t$  to that for year  $t-1$ . The absolute value of the  $t$ -statistic in parentheses tests the difference of means for each future largest owner-type relative to “never majority private.”

**Table 8: The Estimated Impact of Private Shareholding**

	Estimation Method					
	<u>OLS</u>		<u>LAD</u>		<u>Fixed-effects</u>	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
PrivateShare	0.149**	0.015	0.102**	0.008	0.167**	0.016
1994	-0.282**	0.015	-0.285**	0.010	-0.242**	0.013
1995	-0.009	0.015	-0.018	0.010	-0.054**	0.013
1996	-0.078**	0.014	-0.094**	0.010	-0.079**	0.014
1997	-0.243**	0.015	-0.218**	0.010	-0.231**	0.016
1998	-0.224**	0.017	-0.212**	0.011	-0.259**	0.016
1999	-0.113**	0.019	-0.083**	0.011	-0.169**	0.018
Log( $S_{t-1}/E_{t-1}$ )	-0.175**	0.010	-0.102**	0.003	-0.594**	0.008
Log( $E_{t-1}$ )	0.048**	0.004	0.028**	0.002	0.114**	0.011
$R^2$	0.147		0.078		0.346	

Number of observations: 14,532.

Notes: The dependent variable is labor productivity growth. “PrivateShare” is the proportion of shares privately owned by the beginning of the year. OLS and LAD regressions include controls for region (6 categories) and industry (14 categories). SE refers to estimated standard error. OLS standard errors are adjusted for clustering on firms.  $R^2$  refers to  $R^2$  for OLS, pseudo- $R^2$  for LAD, and  $R^2$ -within for fixed-effects. \*\* indicates significance at the 1 percent level.

**Table 9: The Estimated Impact of Private Shareholding Types**

	Estimation method					
	<u>OLS</u>		<u>LAD</u>		<u>Fixed-effects</u>	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
OutsideShare	0.344**	0.050	0.274**	0.024	0.392**	0.036
InsideShare	0.161**	0.018	0.114**	0.012	0.178**	0.021
MassShare	0.172**	0.035	0.108**	0.023	0.190**	0.036
OtherShare	0.264**	0.074	0.179**	0.054	0.299**	0.106
POFShare	0.166**	0.042	0.113**	0.031	0.264**	0.047
$R^2$	0.150		0.079		0.350	

Number of observations: 14,532.

Notes: The dependent variable is labor productivity growth. Shareholding variables are expressed as proportions. All regressions include year effects, lagged level of labor productivity, and lagged employment size as controls. OLS and LAD regressions also include controls for region (6 categories) and industry (14 categories). SE refers to estimated standard error. OLS standard errors are adjusted for clustering on firms.  $R^2$  refers to  $R^2$  for OLS, pseudo- $R^2$  for LAD, and  $R^2$ -within for fixed-effects. \*\* indicates significance at the 1 percent level.

**Table 10: The Estimated Impact of Majority Privatization, Controlling for the PrivateEver Group Effect**

	Estimation method			
	<u>OLS</u>		<u>LAD</u>	
	Coeff.	SE	Coeff.	SE
PrivateEver	0.042**	0.010	0.022**	0.007
PrivateDummy	0.084**	0.012	0.066**	0.090
$R^2$	0.146		0.077	

Number of observations: 14,532.

Notes: The dependent variable is labor productivity growth. “PrivateEver” is a dummy variable equal to one if the firm became majority privatized in any year during the sample period (1992 to 1999), and “PrivateDummy” is equal to one if the firm became majority privatized before the current year of the firm-year observation. All regressions include lagged level of labor productivity, lagged employment, year effects (1994 to 1999), region effects (6 categories) and industry effects (14 categories) as controls. SE refers to estimated standard error. OLS standard errors are adjusted for clustering on firms.  $R^2$  refers to  $R^2$  for OLS, pseudo- $R^2$  for LAD, and  $R^2$ -within for fixed-effects. \*\* indicates significance at the 1 percent level.

**Table 11: The Estimated Impact of Largest Private Owner-Type, Controlling for Ownership Group Effects**

	Estimation method			
	<u>OLS</u>		<u>LAD</u>	
	Coeff.	SE	Coeff.	SE
<u>Ownership Group Effects</u>				
OutsideEver	0.046**	0.014	0.013	0.011
InsideEver	0.062**	0.014	0.035**	0.011
MassEver	0.000	0.014	0.002	0.012
OtherEver	0.033	0.052	0.074*	0.035
POFEver	0.011	0.059	0.056	0.065
<u>Current Ownership Effects</u>				
OutsideDummy	0.165**	0.032	0.150**	0.020
InsideDummy	0.055**	0.016	0.044**	0.013
MassDummy	0.083**	0.019	0.056**	0.017
OtherDummy	0.266**	0.104	0.104	0.069
POFDummy	0.262	0.146	0.056	0.091
$R^2$	0.148		0.078	

Number of observations: 14,532.

Notes: The dependent variable is labor productivity growth. Group effects are dummies equal to one if the indicated private owner-type is ever the largest during the sample period. All regressions include lagged level of labor productivity, lagged employment, year effects (1994 to 1999), region effects (6 categories), and industry effects (14 categories) as controls. SE refers to estimated standard error. OLS standard errors are adjusted for clustering on firms.  $R^2$  refers to  $R^2$  for OLS, pseudo- $R^2$  for LAD, and  $R^2$ -within for fixed-effects. \*\* indicates significance at the 1 percent level.