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### **Ownership and Productive Efficiency: Evidence from Estonia\***

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**RRH:** OWNERSHIP and EFFICIENCY in ESTONIA

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**Abstract:** Privatization in Estonia has produced varied ownership configurations. This enables hypotheses on the productivity effects of different ownership forms to be tested. Findings are based on fixed effects production function models and are estimated using a large, random sample of firms. Depending on the particular specification (and relative to state ownership) we find that: (i) private ownership is 13-22% more efficient; (ii) all types of private ownership are more productive, though managerial ownership has the biggest effects (21-32%) and ownership by domestic outsiders has the smallest impact (0-15%). The joint hypothesis that privatization coefficients are equal is rejected. Findings are robust with respect to choice of technology and the use of instrumental variable estimates. These results provide only partial support for the standard theory of privatization and stronger support for theorists who argue that some forms of insider ownership may constitute preferable forms of corporate governance in some circumstances.

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## **1. Introduction**

In this paper empirical evidence is provided for a single economy not only on whether state ownership is more efficient than private ownership but also on the comparative efficiency of several forms of private ownership. More reliable empirical evidence on these matters for transition economies (and, more generally, in developing economies) is needed for two reasons. First, there is clear gap between mainstream theory and empirics. Most theorists (e.g. Boycko et al. 1996) accept two key propositions, namely: (i) economic efficiency demands that the vast bulk of firms in the socialized sectors should be privatized; (ii) the preferred ownership structure for privately owned firms is outside (rather than inside) ownership and the most efficient form of insider ownership is manager (rather than employee) ownership (Aghion and Blanchard, 1998). Also, based mainly on their empirical work, some researchers reach conclusions that provide broad support for some of these propositions (e.g. Frydman et al., (1999) for transition economies and De Mello, (1997) for developing economies.) However, not only is theory in fact ambiguous on some of these matters (see on) but findings derived from broader surveys of the available empirical evidence do not provide strong support for these hypotheses (for reviews see Estrin and Wright, 1999; Carlin and Landesman, 1997; Aghion and Carlin, 1997).<sup>1</sup>

The other reason why these matters loom large, especially in transition economies, is that an important feature of the privatization process has been the emergence of widespread insider ownership (Nuti, 1997; Uvalic and Vaughan-Whitehead, 1998). However, since privatization in transition economies has often been driven by political considerations, the ownership structures that initially emerged after privatization often were not viewed by most economists with particular concern. While

such ownership structures might be judged to be “inefficient,” these ownership configurations were believed to be only temporary, disequilibrium arrangements. As secondary markets emerged, asset reallocation would quickly take place so that efficient structures of ownership would soon emerge (with assets transferred to the hands of owners who would allocate to better uses). However, it appears that often insider ownership has proved to be a much more *resilient* phenomenon than was anticipated (Estrin and Wright, 1999). Consequently, it has been argued that a crucial need for many transition countries are new policies to change the environment which permits insider ownership to continue (Aghion and Blanchard, 1998).

In this paper, because we are able to draw on a rich new panel for a large and random sample of 660 Estonian firms, we provide evidence that is more robust than much of the available evidence on the effects of ownership on productive efficiency. Furthermore, since the Estonian privatization process has led to the emergence of diverse patterns of enterprise ownership, then it is especially instructive to investigate the effects of ownership for this case. Indeed privatization in Estonia has resulted not only in the sale of a number of firms to foreigners but also in the creation of insider-owned enterprises including a significant proportion of employee-owned firms (Jones and Mygind, 1999). This large panel is used to estimate diverse specifications including OLS fixed effects production function models and, to correct for potential problems of endogeneity, instrumental variable estimates. Evidence of a positive and sizeable privatization effect is consistently found. However, only partial support for other propositions associated with the standard theory of privatization concerning the preferred forms of corporate governance in private firms is found. Stronger support is found for alternative hypotheses that insider ownership may be preferred in some circumstances.

## II Conceptual Framework

The theoretical case for privatization rests on several arguments (e.g. Boycko et al., 1996). Besides the alleged need for depoliticization, it is argued that state firms require restructuring and that, in turn, this requires new owners who will seek profits, revenue growth and improved productivity. Unlike their predecessors, new non-state owners are expected to nurture financial discipline in several ways including introducing more efficient methods for monitoring firm performance and bringing with them improved technologies and knowhow as well as funds for investment in new technology. Privatized firms would be more likely to shed excess labor as they might be less vulnerable than government-controlled firms to the political and social consequences of such actions. While not everyone accepts these views (e.g. Pinto et al., 1993), in this section we accept the need for privatization and a large private sector and instead discuss the arguments for the preferred form of private ownership.

To consider these issues, the dominant approach in the corporate governance literature classifies firms by ownership (see, e.g. Schleifer and Vishny, 1997). For reasons including greater ease in raising new capital and a better ability to pay for necessary expenditures, it is argued that restructuring requires ownership by outsiders (Aghion and Blanchard, 1998). However, it is recognized that new private owners may fail to ensure proper control of management. For example, mass privatization schemes could lead to diffuse private ownership by small outside shareholders that often lack the means and incentives to restructure and monitor firms (Pohl et al., 1997). Therefore concentrated private ownership by outsiders is often argued to be the preferred form of privatization.

When insiders dominate, it is argued that the most efficient form of insider ownership is managerial (rather than worker) ownership (e.g Boycko et al., 1996). The conclusion that firms owned

by their workers will have inferior economic performance is based in part on the argument that the perceived interests of enterprise workers are likely to conflict in important respects with the long-run interests of their enterprise leading to underinvestment in capital equipment. Also, worker-owners are expected to expend little effort and to resist layoffs leading to low productivity. Consequently, the conventional wisdom is that significant employee ownership will have detrimental effects on enterprise performance and undermine the ability of newly-privatized firms to undertake meaningful restructuring (Frydman et al., 1993). However, there are several theoretical and empirical reasons why these conclusions may not always be most appropriate for transition economies.<sup>2</sup>

To begin with, on closer examination, formal economic theory is found to yield no clear cut predictions concerning the preferred form of ownership in transition economies. Thus critics question whether stock markets actually perform their intended functions effectively, especially in the context of formerly centrally planned economies with very underdeveloped capital market institutions. Aoki and Kim (1995) note that much of the traditional analysis assumes an idealized view of advanced market economies and that the argument for the promotion of outside ownership and efficient securities markets ignores crucial matters such as inherited factors and assumes competitive product and labor markets. In the context of transition economies, Earle and Estrin (1996) also argue that the effects of employee ownership may be dependent on a host of factors such as market conditions. In particular cases, some forms of employee ownership may be a feasible solution to the choice of ownership structure.

More generally, some types of insider-owned structures, can be justified on several grounds (Ben-Ner, 1993; Weitzman, 1993; Stiglitz, 1999). Advocates of insider owned and controlled firms

argue that such firms are more likely to be characterized by a focused, tightly-knit, flesh and blood ownership group with a strong stake in enterprise performance--as compared with the alternative of external ownership of joint stock companies. In such firms, the security and stability of the enterprise and its work force will weigh more heavily in decision-making. Arguably insider ownership and insider control is more conducive to enterprise stability and long term employment relationships and thus may contribute to better economic performance in a number of ways. Also, greater enterprise stability may encourage more salvaging of still useful capital stock, and it may help to avoid a cascade of business failures due to the shutdown of one key enterprise in a productive structure still characterized by an inflexible network of input sources and output outlets.

The closer alignment of the goals of different economic agents within insider-owned firms (what Stiglitz, 1999 calls “privatization to stakeholders”) may better motivate workers to join in restructuring efforts and to better use their accumulated experience and firm-specific knowledge. Ownership by non-managerial employees (as well as managers) may thus be expected to lead to enhanced productivity and, at some point, enterprise success will be reflected in a higher stock price. In such cases, the interest of the firm is more aligned with the interest of its employees. For several reasons, these interest alignment effects can be expected to be more significant in firms in which the precise institutional arrangements enable broad participation by employees (and are not restricted to executives) and in which employee ownership constitutes a significant part of the average employees' wealth.<sup>3</sup>

### **III Privatization and Ownership Structures in Estonia**

Since our econometric work hinges on differences in ownership structures, it is important to consider key aspects of the legal institutional changes that have occurred in Estonia in the 1990s. Compared to the Russian case (and also those of Poland, Hungary and the Czech Republic), unsurprisingly not only have the Baltic Republics such as Estonia in general received much less attention, but also much less is known about them.<sup>4</sup> What is known is sometimes quite surprising. In Estonia, discussions of privatization (e.g. E.B.R.D., 1998) often proceed as though all privatization has occurred in a particular way (through a state agency soliciting tenders for state firms.) But in fact the privatization process has been much more complex and the resulting range of forms of enterprise potentially is quite diverse.

In particular, in Estonia, as in many other transition economies, and primarily reflecting political considerations, initially the privatization process conveyed special advantages to insiders. This happened first during the Gorbachev era in the late 1980s with the nurturing of a handful of collectively owned firms or "people's enterprises."<sup>5</sup> Subsequently, as in the Soviet Union, there were opportunities for employees to lease state firms (or parts thereof), a process which was accelerated by the introduction of an Estonian law on leasing in 1990 (Terk, 1996.) Also, during 1991-1992 seven large firms were privatized to insiders (so-called "experimental privatization". Finally, some advantages were initially given to employees concerning the privatization of small firms --e.g. a December 1990 law gave insiders the right of first refusal in buying assets of small companies.

However, these advantages to employees were short lived (Mygind, 1995). Various developments, including the establishment of the Estonian Privatization Enterprise in 1992 and the Law on Privatization (1993) meant that the objectives of privatization legislation changed away from limited support for employee ownership. Thereafter a political climate which altered dramatically after



independence led to the bulk of the privatization of big firms through use of a Treuhand-like privatization agency soliciting tenders for state firms. Equally, a core investor model has been encouraged and foreign ownership has been aggressively and fairly successfully sought (O.E.C.D., 2000).

These practices mean that after 1993 very few firms were privatized to employees. However, reflecting earlier privatization policy, it is likely that very different patterns of ownership might be expected to have emerged within Estonia. But the situation is complicated because both theory and case studies (e.g. Mygind and Pederson, 1996) suggest that these new forms of ownership vary in stability. In particular, employee ownership is believed to have been much less stable than other forms of ownership (e.g. Aghion and Blanchard, 1998.) At the same time, the data available at enterprise level with which to gauge systematically what has actually happened, especially before 1993, are quite limited. However, and importantly, case studies of firms that were privatized early do not provide any strong evidence of any selection bias insofar as employees were systematically able to buy firms that were better performing than the average firm (Mygind and Pederson, 1996.)

To provide more reliable information on some of these processes in this study we make use of a unique data set. With the cooperation of the central statistical authority in Estonia, annual economic and financial data were extracted from company records for a random sample of 666 firms for 1993-1997 to construct a rich panel. To complement these standard economic data (including profits, sales, assets and employment), special ownership surveys were undertaken. In these three ownership surveys<sup>6</sup>, detailed data on the distribution of ownership for insiders, available separately for managers and employees, and outsiders, split into foreigners and domestic outsiders, as well as the state, were

collected for this large panel. By selecting a large sample, we expect to have representation of all the main forms of ownership, as well as firms which had been privatized at different times and firms from a broad range of industries.<sup>7</sup>

These data enable not only estimation of diverse specifications, but also construction of measures of key variables. Concerning ownership, most previous studies of transition economies which investigate the impact of different forms of privatization upon economic performance, have used measures of which group is the largest or the *dominant* shareholder (see Earle and Wright, 1999 for a review.) Often researchers have proceeded this way since classifications based on majority ownership would have led to the vast bulk of firms in particular transition economies being designated as “no-majority”. By contrast, in Estonia, ownership is distributed so that in most cases we are able to classify firms based on the analytically preferable method of *majority* ownership. While dispersed shareholdings within a category may lead to limited cohesiveness by the largest ownership group, this problem is likely to be more acute in classifications based on dominant ownership which may account for as little as 25% of the total voting stock.

The descriptive statistics for the whole sample are reported in Table 1 while in Tables 2 and 3 similar data are reported by type of ownership; variable definitions are given in the Appendix.<sup>8</sup> All financial data are denominated in thousands of real 1993 Estonian kroons (\$1=approximately 12-14 kroons). Using a 50% benchmark for majority ownership, it is evident that the transition in Estonia has resulted in a simple majority in almost all firms. Indeed in 1993, only 1.4% (9 of 660) of sample firms did not have a simple majority (Table 2) while 42.3% of sample firms (279/660) were majority state-owned. At the same time, from Table 3 we see that there was enormous heterogeneity in the ownership

arrangements of private firms. Foreigners controlled 14.7% of sample firms (97/660), domestic outsiders had majority ownership in 17.7% of firms while insiders had a majority stake in 24% of the firms, with managers controlling 11.4% and employees the balance.

Moreover, comparison of the data for 1993 and 1997 in Tables 2 and 3 show a great degree of change in ownership configurations. For firms with a majority owner, the proportion of firms in which the state had a majority stake declined to 22.5% (110/489) as privatization continued. While the fraction of enterprises with a foreign majority rose a little, firms with majority ownership by domestic outsiders and managers increased their shares to 27.8% and 20.4% (106/520) respectively. As predicted by some (e.g. Aghion and Blanchard, 1998) employee owned firms are somewhat less stable than other forms of private ownership and the percentage of firms with an employee majority declined somewhat to 10.0%. There were still few firms with no majority (4.0% of the sample).

Turning to the key economic variables, compared to firms in other former communist countries, it is clear that mean employment in Estonian firms has always been quite low (Table 1.)<sup>9</sup> Moreover, transition is seen to have had a negative impact on real sales and employment (Table 1).<sup>10</sup> Moreover, the analysis indicates significant differences between ownership groups in key economic variables. In particular, state-owned firms have significantly higher real sales, real fixed assets, real fuel and energy consumption, and employment than private firms (Table 2). For example, in 1997, firms with state majority had average real fixed assets of 25,735,000 kroons and employment of 301 whereas the corresponding numbers for private firms are 7,084,000 and 100. Clearly, firms that remained state-owned retain some features of the larger firms of the communist era.

Within the private sector, insider-owned firms have smaller real sales and real fixed assets than

outsider-owned firms (Table 3). By contrast, insider owners employ similar numbers of workers as do firms in which outsiders own a majority of the equity, with the exception of 1997. By focusing solely on employee ownership, we see that there are mixed results for all relevant variables. In particular, employee-owned firms do not seem to be undercapitalized relative to manager-controlled firms but are definitely smaller in terms of real fixed assets than firms with an outsider majority.

#### **IV Estimating Framework and Results**

In designing our empirical strategy, for former communist countries we note that, broadly speaking, hypothesis-testing studies on the determinants of enterprise performance in general and the effect of ownership structures on enterprise behavior in particular, have tended to use two main approaches.<sup>11</sup> Most frequently, diverse indicators of economic performance, both quantitative and qualitative, are explained by using models in which the key variable is either a privatization dummy or a set of dummy variables for different ownership structures (e.g. Earle and Estrin, 1996). Often the available data permit only cross sectional regressions to be estimated by using simple OLS though, to deal with potential problems of endogeneity, sometimes instrumental variable methods are used. Reviews of studies which adopt this empirical strategy do not reveal any consistent findings on the effects of ownership.

Frydman et al, (1999), adopt another approach that is broadly comparable insofar as they too attempt to model a single indicator of performance, such as the change in the labor force or labor productivity. However, by measuring all key variables in privatization (rather than in calendar) time, including a control for inherited pre-privatization differences in performance, and measuring average

performance over a period of time (rather than for a single year), their work makes significant innovations. In some regressions the coefficient on a privatization dummy measures the performance effect specific to privatized firms whereas in other specifications a set of dummies for the largest owner (different forms of privatization) are included instead of the privatization dummy variable. Importantly, in their empirical work, which pools data for 1990-1993 for a sample of 185 firms in Poland, Hungary and the Czech Republic, strong evidence is found of privatization effects, and that the most efficient forms of privatization are outsider-owned and that firms owned by employees are the least efficient. However, the adoption of a similar approach for other countries has not yielded comparably firm conclusions.<sup>12</sup>

These empirical strategies have been developed partly in response to the unusual difficulties that confronted the first applied researchers in transition countries—for example, large measurement errors in key variables such as capital. However, not only is the theoretical rationale for some of the performance indicators that are used less than convincing, but another potential criticism of these innovative strategies is that the empirical approach itself may not be well-grounded within an established conceptual framework. In the case of Estonia, our task is easier since a high degree of macro stability was quickly achieved during transition (O.E.C.D. 2000.) Moreover, our data are quite recent and, compared to studies of many transition economies, have two important advantages. First, there is greater transparency and a fairly well-developed legal infrastructure which produce relatively good accounting standards and, in turn, pretty good quality data for this transition economy that is on a fast track for EC accession. Second, unlike most empirical work for firms in transition economies, ours is a large and random sample of firms. For reasons such as these it seems appropriate to use labor

productivity as the performance indicator<sup>13</sup> and to employ standard approaches that are customary in the literature for western firms.<sup>14</sup> In addition, conventional empirical methods such as the estimation of augmented production functions using panel data have a number of well-known econometric advantages over the usual approaches used to date in empirical analysis for transition economies.<sup>15</sup> Consequently, in estimating the impact of various ownership structures on productive efficiency, we therefore estimate equations of the general form:

$$Q = F(K, L, H, Z) \quad (1)$$

where  $Q$  denotes a measure of output,  $K$  and  $L$  are a measure of total capital stock and total employment;  $H$  is a vector of variables representing the effects of ownership structures on productivity; and  $Z$  is a vector of control variables such as managerial and labor quality. To see how the ownership variables enter equation (1) consider the Cobb Douglas case when the effects of ownership structures are disembodied. In logarithmic form this becomes:

$$\ln Q_{it} = \hat{\alpha}_E \ln K_{it} + \hat{\alpha}_L \ln L_{it} + \hat{\alpha}_H H_{it} + \hat{\alpha}_Z Z_{it} + \hat{\alpha}_i + \hat{\alpha}_t + \mu_{it} \quad (2)$$

where  $\hat{\alpha}_i$  = firm specific fixed effects,  $\hat{\alpha}_t$  = year effects and the disturbance term is  $\mu_{it}$ .

In part, because the data are quite rich we estimate diverse specifications. Thus, often we are able to use different proxies for key variables. For example, and unlike many other studies of transition economies, our measures of enterprise production including the conceptually preferable value added, as well as sales. For capital, not only do we use a measure of fixed assets, but also, following the literature for transition economies (e.g. Pohl *et al.*, 1997) we also employ a measure of energy use as a surrogate for capital use.

In our basic regressions ownership is simply represented by a dummy variable for whether or

not the firms is majority state owned. In subsequent regressions this single dummy variable is replaced by a vector of four majority ownership (with the base case being majority state owned). We include year dummy variables ( $\hat{\delta}_t$ ) to capture technological change and other shocks that are common to all firms. Firm-specific fixed effects ( $\hat{\alpha}_i$ ) capture the time-invariant heterogeneity of our firms. In particular, firm-specific effects will attempt to control for differences among firms in managerial abilities, worker quality and other human resource management practices.

Other important aims of our analysis are to identify the most appropriate form of the production function and to examine whether findings are sensitive to potential problems of endogeneity. When a single functional form of technology is imposed, the effects attributed to the ownership variables may in fact be due to misspecification of technology. We therefore estimate diverse specifications and, after estimating forms including the generalized Cobb-Douglas and translog production functions, the production function that is best supported by the data is selected on the basis of appropriate test statistics. Also, to correct for possible endogeneity of labor and the capital stock, we report instrumental variable estimates.

In Table 4 we report our basic fixed effects estimates. Translog specifications are reported as F tests indicate that they are preferred at the 1% level. In addition, to see if the translog estimates are well-behaved we calculate the elasticity of output with respect to capital and labor. Always we find positive elasticities (and elasticities that are similar to those based on Cobb-Douglas specifications). Also, firm fixed effects are always found to be significant at the 1% level.

The main finding that emerges from Table 4 is that, after controlling for firm-specific effects, strong evidence is found that ownership helps to account for differences in productivity. Moreover,

whereas previous cross-sectional estimates of the impact of privatization have sometimes indicated effects that are implausibly high, the magnitudes of ownership effects that emerge from this panel are at reasonable levels.<sup>16</sup> In particular, the coefficient on *Majpriv* in Specification 1 is positive and significant, indicating that firms with a private majority outperform state firms by 15.2%.

Turning to the second specification in Table 4, an important finding is that the null hypothesis that the joint effect of the majority ownership variables is zero is rejected at the 1% level. Also, and perhaps more important, an F test of the joint hypothesis that all privatization coefficients are equal is rejected at the 5% level. In terms of the impact of different ownership configurations, we see that firms in which there is a majority foreign owner (*Majfor*) have a 21.2% edge over state firms. As such this finding corroborates results from other studies (e.g. Frydman et al., 1999). However, the results also indicate that, in Estonia, there are other forms of private ownership that outperform the base case of state ownership. Most interestingly, both forms of insider ownership are also found to be statistically significantly (at the 1% level) more productive than are state firms. Moreover, the effects are quite large, though not unrealistically so. Indeed, firms in which managers have majority ownership outperform state firms by 31.2%; as such managerial ownership is the most productive form of private ownership, outperforming even foreign owned firms. Firms in which non-managerial owners are the main owners also do very well. Employee owned firms are found to be 24% more productive than state owned firms; also, they perform 3% better than do firms in which foreigners are the majority owners.

To examine for the robustness of our findings, we estimated several alternative specifications. In some alternative regressions, the exercises reported in Table 4 are replicated but alternative proxies for



key variables are used. In the main the key findings remain unaltered when these alternative specifications are estimated. Thus in unreported regressions, real energy and fuel consumption was used as an alternative surrogate for capital.<sup>17</sup> Again we find that the translog specification is preferred to Cobb-Douglas at the 1% level and that privatization is a more efficient form of business organization than state ownership. Also, majority ownership by foreigners, managers and employees are each found to be more productive than state ownership (at the 5% level or better).<sup>18</sup>

Similarly, when the models reported in Tables 4 were replicated except that value added was used as an alternative measure of productivity, in the main these estimates using value added do not produce a dramatic effect on the findings reported in Table 4. Thus, in these unreported regressions,<sup>19</sup> again we find that there is a privatization effect that is statistically significant (the size of the effect is about 22%). When the privatization dummy is replaced by dummies for types of majority ownership (model 2) the ranking of best performing forms of ownership does not change and all three individual forms of ownership continue to be statistically significant.

We also examined whether the reported results change when we use instrumental variable (IV) estimates to correct for the possible endogeneity of labor and the capital stock.<sup>20</sup> Our main instruments are first lags of the endogenous variables, and these IV estimates are reported in Table 5.<sup>21</sup> Interestingly the preferred form of technology in the IV estimates is Cobb Douglas, rather than translog (as in specifications reported in Table 4). However, by using first lags of the endogenous variables as instruments, note that the number of observations used for the estimates reported in Table 5 falls by 497. This use of a smaller data set may account for the differences in the preferred form of technology.

The signs of all key ownership coefficients are unaffected by the use of IV estimates--all remain positive. Also, in terms of the effects on business performance of different forms of private ownership, majority ownership by managers continues to have the greatest effects and ownership by domestic outsiders still has the smallest effects. However, there is a tendency for the ownership coefficients to be larger in these estimates. For example, the results for specification 1\* suggest that private firms have a 21% edge over state owned firms (this compares with a 15% effect in specification 1 reported in Table 4). Also the impact of foreign ownership on enterprise productivity increases to about 32% (compared to 21% in the comparable specification reported in Table 4.) As such, the rank order of preferred private ownership forms is changed in the IV estimates with foreign ownership surpassing employee ownership. In addition, in these IV estimates, we see that *all* forms of private ownership (including firms in which domestic outsiders constitute a majority, as well as firms in which there is no majority) are found to be more productive than firms in which the state continues to have majority ownership.

## **V. Conclusions**

In Estonia, privatization has led to the emergence of firms with widely differing ownership configurations (Jones and Mygind, 1999). Significant numbers of firms with majority ownership by outsiders (in turn, divided into majority ownership by either foreigners or locals), coexist with many firms in which different groups of insiders are majority owners. In addition some firms continue to be state-owned. The existence of firms with heterogeneous ownership structures operating within a reasonably stable macro context means that Estonia is a particularly apt case for the empirical analysis

of the effects of these differing corporate governance structures upon firm performance. Our empirical work is based on new enterprise-level data that are especially rich in details of ownership structures and which we have collected during annual surveys over a five year period. By using this large panel and a fixed effects production function framework, as well as instrumental variable estimates to deal with potential problems of endogeneity, we provide some of the most rigorous findings for any transition economy on the effects of ownership on business performance to date.

Depending on the particular specification, estimates indicate that: (i) private ownership is 15-22% more efficient than state ownership; (ii) the null hypothesis that the joint effect of the majority ownership variables on productivity is zero is rejected at the 1% level; (iii) in terms of the rank ordering of the productivity effects of the various forms of ownership, managerial ownership always has the biggest effects and ownership by domestic outsiders always has the smallest impact; (iv) majority ownership by foreigners, domestic outsiders, managers and employees are respectively 21-32%, 0-15%, 31-34% and 24-25% more productive than state ownership. (v) the joint hypothesis that privatization coefficients are equal is rejected at the 5% level. In the main these findings do *not* depend upon whether : (i) one uses Cobb-Douglas or translog specification; (ii) output is measured by sales or value added; (iii) capital is measured by fixed assets or energy use; (iv) to correct for potential endogeneity, the use of IV estimates (though the ownership coefficients are usually at the higher end of the ranges reported above in the IV estimates.)

Thus our findings for Estonia strongly confirm the hypothesis that privatization will be accompanied by gains in economic efficiency. This finding that privatized firms outperform state firms is consistent with findings from studies that focus on industrialized countries (e.g. D' Souza and

Meggison, 1999). It also corroborates findings for the Visegrad countries which are usually based on earlier data and use alternative empirical strategies, notably Frydman et al. (1999). Moreover, the size of the privatization effect is comparable to that found in these other studies of transition economies (e.g. Pohl, 1997). The finding of this strong evidence of a privatization effect for a country other than those in Central and Eastern Europe is important since many studies for Russia and CIS countries (e.g. Estrin and Rosevear, 1999) do not find evidence that private ownership improves economic performance. These sharply differing cross-national findings point to the importance of factors other than privatization per se in accounting for successful business performance. An important task of future research is to uncover these other determinants of business performance.

So far as the impact of specific forms of ownership are concerned our findings are quite different than those emerging from other influential studies. For example, unlike Frydman et al. (1999), we find that insider ownership not only can be more productive than state ownership, but also that types of insider ownership can rank amongst the most effective forms of private ownership. Similarly our finding that foreign ownership does not always have the biggest impact on productivity is apparently at variance with most evidence for developing countries (for a recent survey see de Mello, 1997).<sup>22</sup> In accounting for these varying findings (especially when compared with other studies of firms in transition economies), as well as differences in empirical method and geographical coverage, we again note that our findings are based on recent data for a large panel of firms with dissimilar ownership structures within a single economy that is fairly homogeneous.

This finding, on the effectiveness of majority employee ownership, extends similar conclusions obtained from studies of mainly minority employee ownership elsewhere (e.g. Kruse and Blasi, 1997).

This conclusion is consistent with the hypothesis that employee ownership is expected to produce more interest alignment and more involvement of employees and, in turn, better organizational performance (compared to majority ownership by outsiders as well as state ownership). In turn, this finding supports those who predict the beneficial effects of insider ownership in some firms in some transition and developing economies. As such our findings may help to provide a better basis for informed public policy in transition and developing economies. By providing support for theorists who argue that insider ownership may be preferred in some circumstances in transition economies, our findings do *not* suggest that, to promote effective restructuring, what is always needed are policies to undo insider ownership. On the contrary, in some circumstances what may be needed are policies which promote and sustain insider ownership.<sup>23</sup> More generally, our findings point, as many have argued (e.g. Murrell, 1991) to the dangers both of theory and policy that seek to promote universal prescriptions for transition and developing economies.

## Appendix: The Data and the Variables

### The Data

The data used in the study resulted from merging two data sets for the same firms which were collected during three waves of data collection in 1995, 1996 and 1997. The sample selection process is described in the text.

The Estonian Economic Survey collected information on basic economic information--for example, employment, sales, assets, costs, debts and taxes-- for the period 1993-1997. The data were collected in cooperation with the national statistical authorities.

The Estonian ownership surveys collected detailed data on ownership from enterprise representatives or heads during interviews in 1995, 1996 and 1997.

### The Variables

RSale = real sales

Rvalad = real value added

Rfa = real fixed assets

Emp = employment (average number of workers during the year)

LnRfasqr = square of natural logarithm of real fixed assets

LnEmp = square of natural logarithm of employment

LnRfaEmp = (natural logarithm of real fixed assets\*natural logarithm of employment)

Majsta = Dummy variable = 1 if state has majority ownership in the firm, 0 otherwise

Majpri = Dummy variable = 1 if private owners have majority ownership in the firm, 0 otherwise

Majfor = Dummy variable = 1 if foreign owners have majority ownership in the firm, 0 otherwise

Majdom = Dummy variable = 1 if domestic owners have majority ownership in the firm, 0 otherwise

Majemp = Dummy variable = 1 if employees have majority ownership in the firm, 0 otherwise

Majman = Dummy variable = 1 if managers have majority ownership in the firm, 0 otherwise

Nomaj = Dummy variable = 1 if no ownership group has majority ownership in the firm, 0 otherwise

### Note:

Sales and Value added figures are deflated by the Consumer Price Index deflator, using 1993 as the base year. By using the Producer Price Index deflator, similar adjustments are made to measures of the capital stock,

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Notes

Table 1 Descriptive Statistics: Means (Standard Deviations) for the Entire Sample

Year	1993	1997	1993-97
Variable			
Rsale (Real sales)	18880 (65762)	17431 (59614)	17265 (56951)
Rfa (Real fixed assets)	8811 (46170)	9794 (47719)	8621 (43956)
Emp (# of workers)	152 (514)	130 (420)	135 (441)
Renergy (Real energy costs)	N.A.	1505 (12062)	1261 (7432)

Note.

1. Real energy costs are unavailable for 1993-1994. Hence the entries for 1993-1997 refer to the period 1995-1997.

**Table 2 Descriptive Statistics: Means (Standard Deviations) by Ownership**

Majority Owner	Year			
	Variable	1993	1997	1993-97
State (Majsta)	Rsale	31162 (97111)	41188 (132538)	28659 (83210)
	Rfa	15752 (67793)	25735 (107625)	15004 (61845)
	Emp	234 (764)	301 (998)	228 (724)
	Renergy	N/A.	6794 (30119)	3020 (16862)
	%	42.3	21.3	21.3-42.3
Foreign (Majfor)	Rsale	13158 (29820)	26414 (45724)	20899 (41114)
	Rfa	4372 (15590)	18628 (47065)	13273 (36141)
	Emp	41 (77)	92 (135)	70 (115.2)
	Renergy	N/A.	1754 (6130)	1288 (5167)
	%	14.7	16.7	14.4-16.7
Domestic (Majdom)	Rsale	10991 (17354)	13861 (32918)	12499 (25791)
	Rfa	4769 (8843)	6136 (13190)	25791 (12806)
	Emp	128 (191)	134 (154)	124 (179)
	Renergy	N/A.	746 (1167)	626 (1084)
	%	17.7	28.1	17.7-28.1

<b>Manager</b> (Majman)	Rsale	5442 (13190)	6876 (18896)	6301 (15370)
	Rfa	651 (1762)	2459 (7601)	1630 (4999)
	Emp	71 (190)	80 (182)	79 (173)
	Reenergy	N/A.	368 (745)	298 (694)
	%	11.4	20.5	11.4-20.5
<b>Employee</b> (Majemp)	Rsale	7227 (12879)	7454 (20811)	7058 (16217)
	Rfa	1726 (4341)	2336 (7063)	1822 (5006)
	Emp	111 (147)	83 (217)	103 (182)
	Reenergy	N/A	536 (1665)	443 (1086)
	%	12.6	10.1	10.1-12.6
<b>No majority</b> (Nomaj)	Rsale	14555 (29821)	7535 (9103)	8025 (16418)
	Rfa	3821 (6818)	1424 (1985)	1707 (3688)
	Emp	157 (243)	59 (68)	65 (135)
	Reenergy	N/A	275 (376)	116 (247)
	%	1.4	3.3.	1.4-3.9
<b>Private</b>	Rsale	9708 (20362)	13433 (31785)	11786 (27111)
	Rfa	3134 (9333)	7084 (24115)	5358 (19188)
	Emp	92 (164)	100 (167)	96 (165.8)

	Reenergy	N/A	798 (2945)	625 (2481)
	%	57.7	78.7	57.7-78.7

**Table 3 Fixed-Effects Estimates for 1993-1997**

Dependent Variable: LnRsale		
Variables	Specification 1	Specification 2
<b>LnRfa</b>	-.0073 (.0626)	-.0054 (.0625)
<b>LnRfasqr</b>	.0018 (.0052)	.0017 (.0052)
<b>LnEmp</b>	.7764* (.1184)	.7633* (.1185)
<b>LnEmpsqr</b>	-.0344*** (.0189)	-.034*** (.0188)
<b>LnRfaEmp</b>	.036** (.0152)	.0361** (.0152)
<b>Majpriv</b>	.1519** (.0641)	
<b>Majfor</b>		.2123** (.1005)
<b>Majdom</b>		.064 (.0717)
<b>Majman</b>		.3123* (.0826)
<b>Majemp</b>		.2441* (.0899)
<b>Nomaj</b>		.0612 (.1119)
<b>Time</b>	Yes*	Yes*
<b>Firm</b>	Yes*	Yes*
<b>N</b>	2485	2485

**Notes:** 1. Rfa (real fixed assets) is used as a proxy for capital.

2. Standard errors are in parentheses.
3. \* denotes significance at the 1% level; \*\* at the 5% level; \*\*\* at the 10% level.
4. In both specifications, the omitted variable is Majsta (majority state ownership).
5. The translog specification is preferred at the 5% level.
6. The inclusion of all ownership dummies in Specification 2 is significant at the 1% level [ $F(5, 1830)=4.26$ ].

**Table 4 Fixed-Effects Estimates for 1995-1997**

<b>Dependent Variable: LnRsale</b>		
<b>Variables</b>	<b>Specification 3</b>	<b>Specification 4</b>
<b>LnRenergy</b>	.4042* (.091)	.4075* (.0914)
<b>LnRenergysqr</b>	.0364* (.0093)	.0359* (.0094)
<b>LnEmp</b>	.362*** (.2151)	.3596*** (.2165)
<b>LnEmpsqr</b>	.0947* (.0323)	.0943* (.0325)
<b>LnRenergyEmp</b>	-.1121* (.0262)	-.1119* (.0262)
<b>Majpriv</b>	.1302*** (.0722)	
<b>Majfor</b>		.1944*** (.1194)
<b>Majdom</b>		.1037 (.0779)
<b>Majman</b>		.1544*** (.095)
<b>Majemp</b>		.1399*** (.0803)
<b>Nomaj</b>		.1701 (.1389)
<b>Year</b>	Yes*	Yes*
<b>Firm</b>	Yes*	Yes*
<b>N</b>	1326	1326

- Notes:**
1. Renergy (real fixed assets) is used as a proxy for capital.
  2. Standard errors are in parentheses.
  3. \*-significant at the 1% level; \*\*-at the 5% level; \*\*\*-at the 10% level.
  4. In both specifications, the omitted variable is Majsta (majority state ownership).
  5. The F-test showed that the translog specification is preferred to Cobb--Douglas at the 1% level [ F(3, 811)=6.79].
  6. The inclusion of all ownership dummies in Specification 2 is significant at the 5% level.



**Table 5 Instrumental Variable Estimates**

Dependent Variable: LnRsale		
Variables	Specification 1*	Specification 2*
<b>LnRfa</b>	.1348** (.0687)	.1380** (.0092)
<b>LnEmp</b>	.8848* (.1822)	.8697* (.1906)*
<b>Majpriv</b>	.2248* (.0714)	
<b>Majfor</b>		.3189* (.1095)
<b>Majdom</b>		.1519*** (.0812)
<b>Majman</b>		.3378* (.0919)
<b>Majemp</b>		.2519* (.1013)
<b>Nomaj</b>		.216 * (.1251)
<b>Time</b>	Yes*	Yes*
<b>Firm</b>	Yes*	Yes*
<b>N</b>	1988	1988
<b>R<sup>2</sup>adj</b>	.9235	.9239

- Notes:**
1. Rfa (real fixed assets) is used as a proxy for capital.
  2. Standard errors are in parentheses.
  3. \* denotes significance at the 1% level; \*\* at the 5% level; \*\*\* at the 10% level
  4. In both specifications, the omitted variable is Majsta (majority state ownership).
  5. The Cobb-Douglas specification is preferred at the 5% level to the translog specification.
  6. The variables LnRfa and LnEmp are instrumented by using, in addition to the predetermined variables used in the model, the first lags of real fixed assets and employment.
  7. The adjusted R<sup>2</sup> for the OLS fixed effects estimates for specifications 1 and 2, but using the smaller data set that was used in the estimates reported in this table, are .9346 and .9398 respectively.

## Notes

1. Recently, however, there have been valuable empirical contributions for particular countries including Frydman et al. (1999), Earle and Estrin (1998), Pohl et al. (1997), Estrin and Rosevear (1999) and Buck et al. (1999). As noted by many researchers (e.g. Aghion and Carlin, (1997), the failure to uncover general conclusions to some degree may reflect important weaknesses of many studies, particularly difficulties in obtaining data for large and representative samples of firms. In addition, most studies have tended to focus only on selected cases (particularly Russia and the Visegrad countries) and, in part because of data restrictions, researchers have employed differing empirical approaches, some of which have well-known weaknesses (e.g. the use of cross sectional analysis).
2. For the ambiguous nature of the findings based on the available empirical evidence for transition economies, again see the references previously noted. In addition, studies of western firms with varying levels of employee ownership conclude that employee ownership typically has beneficial effects on enterprise performance. (For reviews see Blasi and Kruse, 1997 and Bonin et al., 1993).
3. In addition powerful complementarities may be expected to exist when employee participation accompanies employee control. Goal alignment effects of employee participation (e.g. small group activities) are more subtle (but not necessarily weaker) than effects through ownership. Small group activities may provide valuable opportunities for both management and labor to learn about each other in a cooperative atmosphere and thus develop stronger trust. With stronger trust, sharing vital business information with labor will help convince labor that it is in their interest to improve productivity and firm performance. Various forms of employee participation may play an important role of providing employees a voice in the firm and thus reduce the costs of exit from the firm, saving specific human capital.
4. For broader discussions of Estonia see World Bank (1993) and Jones and Mygind (1998).
5. In these firms ownership was to be shared equally by all employees (Mygind, 1995).
6. The first survey was in 1995 which was the year the sample was drawn. In that year retrospective ownership data for 1993 and 1994 as well as for 1995 were collected. The sample size fell in 1996 and 1997 mainly due to refusals--we estimate that fewer than 20 firms from the original sample ceased to exist. Also, the economic data, which are available for all survivors from the statistical authorities (rather than just those firms which responded to the ownership surveys) do not indicate any systematic differences in the characteristics of the samples based on the presence of the ownership data of the larger sample based on the economic data.
6. Thus we include firms that were never privatized and also some privatized firms in which the state remained the majority owner during the period of study.
8. Mainly because of missing values, the actual number of observations that can be used for estimation each year averages about 550. In the econometric work reported in Tables 4 and 5 we use data for

497 firms for which complete data are available for all years; the corresponding number for the estimates reported in Table 5 is 442 firms. Descriptive statistics for these balanced panels show no discernible differences from the statistics reported in Tables 1-3 (which use all available information.)

9. The relatively small average size of Estonian firms is confirmed by other sources (e.g. Mygind and Pedersen, 1996.) Note, however, that standard deviations for sample firms were high especially during early years and also particularly in state firms.

10. Many of these differences are statistically significant (using paired t tests).

11. Reviews include Carlin and Landesman (1997) and Jones (1999).

12. For the case of Russia see Jones (1998).

13. Note also that, increasingly, authorities suggest that this is the indicator that is least subject to bias (see Bevan, Estrin and Schaffer, 1998).

14. There is a huge literature that has examined diverse matters concerning the effects of ownership for firms in western countries. Studies which focus on employee ownership include Jones and Kato, 1995 and reviews include Blasi and Kruse (1998) and Bonin *et al.*, (1993). Similar approaches were also standard in efficiency studies of the former Republic of Yugoslavia (e.g. Praznikar *et al.*, 1992), the former communist countries (e.g. Jones, 1993) as well as the new countries that have emerged from the former Republic of Yugoslavia (e.g. Smith *et al.*, 1998 for Slovenia).

15. By using a panel we can control for time-invariant, firm fixed effects. In particular, there may be some firm characteristics such as superior organization, location or better quality of labor force whose effect is only partially explained by industry and region dummies in cross-sectional analysis.

16. For example, by using a different data set for Estonian firms for an earlier period, Jones and Mygind (2000) find productivity effects that in some years for some types of ownership approach 80%. Moreover, in regressions that use this data set to estimate cross sectional estimates, we find much more stability in the impact of privatization on business performance. These unreported regressions are available from the authors upon request.

17. Since energy data are not available for all years, these models were estimated for a shorter time period, namely 1995-1997.

18. In most cases the size of the ownership effects is essentially unaltered by the use of a different measure of capital. However, the size of the effects of majority ownership by managers and employees, while still strongly positive, are not nearly as great in the results reported in Table 4.

19. We choose to report findings using sales because many firms had either tiny or negative value added. In the logarithm models that are estimated this then leads to a censoring of observations-- for

example, estimation of specification 1 reduces the sample size to 1825. These and other regression results are available from the authors upon request.

20. Ownership is also potentially endogenous (though our institutional discussion suggests that at least for employee owned firms their selection may usually have been arbitrary). In any event, unfortunately the existing data do not contain any suitable instruments.

21. Hausman tests indicate that these results are preferred to the OLS fixed effects when Cobb Douglas technology is assumed.

22. However, it also appears that the development literature has not been able to examine for the productivity effects of as many types of private ownership as we do in this study

23. For suggestions see, for example, Stiglitz (1999) and Fitzroy *et al.*, (1998).