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State Control, Ownership Transformation, and Firm Restructuring: The Case of Hungary

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ABSTRACT

This study examines the effects of ownership transformation from state to private sector on firm performance in the post-privatization period using annual census-type data of Hungarian enterprises for the early 2000's. The empirical methodology designed to overcome the data limitations arising from an insufficient observation period have effectively captured restructuring efforts by new owners and company managers and provided strong empirical evidence of the close relationship between ownership transformation and firm performance.

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Introduction

The privatization of public enterprises is becoming increasingly common throughout the world due to globalization of market principles. This move was first made by some Western nations, such as the U.K. which adopted the denationalization program during the Thatcher administration, and then spread to other industrialized states and developing countries. At the end of the twentieth century, when state socialism came to an end, privatization became an overriding trend in the international political and economic arena. People's perception about the boundary between public and private enterprise has considerably changed over the last 20 years. The denationalization process is steadily growing even in such sectors as post services and social securities services, which were once believed by everyone to be the traditional state-run businesses.

The philosophical background behind the widespread privatization of public enterprises currently observed in many countries lies in a high degree of trust in the overwhelming advantage of private ownership over public ownership in terms of efficiency. Many citizens now expect that the transfer of public firms to private owners could alleviate the financial burden of the state and also significantly improve the management efficiency of privatized firms themselves, contributing a lot to the betterment of society. Accordingly, it becomes one of important subjects in contemporary economics to ascertain whether such an expectation is feasible. In response to this demand, many studies pioneered by Megginson, Nash, and van Randenborgh (1994) and Boubakri and Cosset (1998) were conducted, and they repeatedly verified the positive change in firm performance before and after privatization through case analysis of industrialized and developing countries. Also, it is almost certain that the effect was observed in the enterprise privatization in former socialist states, including Russia (Djankov and Murrell (2002), Iwasaki (2007a)).

On the other hand, however, most of the previous studies fall short in identifying whether these effects are due to the privatization process itself or to other factors (Omran (2004)). Furthermore, many studies focusing on the effect of new ownership structure on firm performance following privatization fail to identify a statistically significant relationship between the two elements. This is particularly truth for studies covering transition economies (Dewenter and Malatesta (2001), Harper (2002), Megginson (2005), Aussenegg and Jelic (2007)). Therefore, despite the strong belief of economists in the superiority of private sector to state regarding ownership structure, no empirical study on privatization has yet presented a definitive conclusion as to this point.

Using annual census-type data of Hungarian enterprises for the early 2000's, we analyze the impacts of ownership transformation from state to private sector on firm performance in the post-privatization period. Unlike Russia and Czech Republic, Hungary

avoided giving away public assets to private interests as much as possible and instead thoroughly pursued direct sale of public assets to strategic investors, including foreigners. This privatization strategy was in principle applied to all industries across the country. As a result, almost all of 1,859 former socialist enterprises designated in 1990 as to-be-privatized firms had become completely privately-owned or liquidated by the end of the 1990s.[1] This policy approach and the accumulated experience during the large-scale privatization period were substantially passed on to the privatization process in the early 2000s, leading to the steady privatization of dozens of government-owned companies left in the portfolio of the Hungarian Privatization and State Holding Company (ÁPV Rt.) and other public firms, mainly through open bidding. Due to this adamant policy stand of the Hungarian government, the share of state-owned enterprises (SOEs) in the total number of employees and total added-value for 2002 (2005) shrank to 15.0 (12.0)% and 17.6 (15.6)％, respectively, suggesting that the state sector is now playing only a supplementary role in the Hungarian national economy (KSH (2003, 2006)).

Unlike the early transitional period which saw an economic crisis triggered by the collapse of the COMECON system and went through large-scale institutional changes toward market economy, the early 2000s is a suitable period to investigate into the relationship between privatization and firm performance in Hungary since the social and economic circumstances and the legal system in this country were quite stable during that time. Furthermore, as explained later, the data we employ cover almost all business firms, including SOEs, therefore ensuring the representativeness of the Hungarian corporate sector. The data, however, limit us to trace firm performance in these companies only beyond two years after privatization. An insufficient observation period poses a significant obstacle to empirical analysis of the effects of privatization policies.

To deal with this problem, we present a new empirical approach which makes it more certain to identify the impacts of ownership transformation even if short-term data are used. The essence of the proposed methodology is to reject the null-hypothesis that the effects of ownership transformation is zero by regressing a variety of performance indices into the scale and the type of ownership transformation and then synthesizing the estimates (effect size) using meta-analysis techniques, in order to fully capture restructuring efforts by new owners and managers of privatized enterprises. Although meta-analysis is a statistical method basically designed to combine estimates across independent research studies, it is

[1] There are many studies concerning the enterprise privatization in Hungary during its early transition period: For the institutional framework and history of the privatization policies in Hungary, see Mihályi (1998), Macher (2000), Szanyi (2000), Major (2003), and Voszka (2003), and for the evaluation of the privatization policies, see Bartlett (2000), Mihályi (2001), Hanley, King and János (2001), and Báger and Kovácz (2004).

also quite effective in summarizing various tests conducted within a single study (Hunter and Schmidt (2004)). The approach in this paper focuses on the latter function of meta-analysis. Because everything is self-contained for conducting meta-analysis, we can prevent the so-called "publication bias" and other problems from occurring due to the lack of commonality of model structures and variables. Moreover, the researcher's arbitrariness can be effectively eliminated by setting no limitation on firm performance to be analyzed.

Our empirical analysis confirmed that ownership transformation from state to private sector has statistically and economically significant impacts on post-privatization firm performance in Hungary. We also found that there are clear differences in performance improvement effects among privatization implemented with no lower limit on the scale of ownership transformation, privatization with strategic control rights, and full privatization. Moreover, we found that ownership transformation to foreign investors has greater positive impacts on firm performance than that to domestic investors. These results were obtained with due consideration to selection bias of privatization decision by the Hungarian government and acquisitions by foreign investors, and by controlling other potential determinants on firm performance in the post-privatization period. The advantage of using regression coefficients in meta-analysis over using odds rates or single correlation coefficients is that multivariate regression makes it easier to take such analytical measures when estimating the effect size of ownership transformation.

The remainder of this paper is organized as follows. Section I presents testable hypotheses. Section II describes the data employed for this study. Section III reviews our empirical methodology. Section IV presents our empirical results. Section V concludes.

I. Ownership Transformation and Firm Performance: Testable Hypotheses

Theoretically, privatization gain originates in the context of relative inefficiency of the state sector compared with the private sector. From the political viewpoint, public enterprises should pursue strategies to achieve the public or political objectives of politicians and bureaucrats who control them. However, such management goals often conflict with the profit maximization, distorting the incentive structure and the constraints regarding company managers (Shleifer and Vishny (1994)). As seen in the fact that government subsidies are more likely to be criticized by tax payers and opposition parties when they are paid to specific private firms than when they are provided to public entities, privatization raises transaction costs for the use of political influences over firms' decision-making, therefore inhibiting interventions from politicians and bureaucrats and promoting firm restructuring (Sappington and Stiglitz (1987)).

From the viewpoint of corporate finance and firm organization, the governance structure in SOEs is particularly problematic. For instance, the property rights

untransferability in public firms inhibits the capitalization of future consequences into current transfer prices, resulting in damaging incentives for managerial supervision by residual claimants (De Allesi (1980)). In addition, although the cash flow of SOEs ultimately belongs to taxpayers, the share of each of them is quite trivial, preventing citizens from organizing themselves to overcome the free rider problem and, hence, from exercising their influence over the control-holding managers (Bennedsen (2000)). Moreover, compared with private firms, public companies are effectively protected from the threat of takeover and bankruptcy. As long as the government announces that no financial crisis is at hand, management discipline and budget constraints in SOEs are inevitably loosen (Haskel and Szymanski (1992), OECD (2005)). Further, the fact that SOEs are far remote from both capital market and managerial market poses a serious impediment to the development of managerial discipline and to the securing of effective monitoring from outside. Transfer of ownership to private sector greatly alleviates these governance problems and therefore functions as a political measure for creating more effective control (Goldstein (1997)).

Nevertheless, some argue that private companies do not always outperform public ones (Boardman, Eckel, and Vining (1986), Kole and Mulherin (1997), Kwoca (2005), Ang and Ding (2006)). Also it is likely that some state regulations and administrative measures may make it possible for SOEs to achieve better performance than private firms operating in the same product market, and the fact of being fully-government dependent may give more confidence to markets and customers than that of private firms, *ceteris paribus*. Normally, privatization is involved with partial or complete removal of favorable conditions to state firms. There is no guarantee that privatized firms can achieve the same performance as they previously did under the state protections, even after being faced with the worsening of managerial environments in the above sense. As LaPorta and Lopez-de-Silanes (1999) suggest, the financial and operating performance of privatized enterprises tends to converge to that of private firms. This rule is assumed to be applicable also when SOEs have an advantage over private firms. Accordingly, we present a neutral hypothesis with respect to the effects of ownership transformation on firm performance:

> Hypothesis H_1: Ownership transformation from state to private owners changes the financial and operating performance of privatized firms in the direction to reduce the gap between state and private sector.

Meanwhile, the effect of ownership transformation on post-privatization performance is not a monotonic increasing function for the degree of privatization, even if there is a room to seek privatization gains. Boycko, Shleifer, and Vishny (1996) argue that privatization works when strategic control rights transfers from state (or politicians) to managers. To achieve this goal, private investors must acquire at least a majority of

ownership.[2] In fact, many earlier studies report that privatized firms exhibit stronger performance improvements after their majority control was sold by the government (Eckel, Eckel, and Singal (1997), D'Souza and Megginson, (1999), Boubakri, Cosset, and Gueghami (2005), Omran (2007), Chen et al. (2008)). Renunciation of strategic control by the state sends a good signal to company managers and private investors that it has no more intention of intensive political intervention and future re-nationalization, increasing motivation of managers and private owners for firm restructuring.

Nevertheless, retention of strategic control rights by private entities does not provide a full solution although it makes significantly easier for private investors to resist government interventions that are likely to damage corporate value or to have a negative impact on the profit maximization. As Broadman and Vining (1989) argue, partial privatization is still not sufficient to eliminate conflicts of interest between government and private sector. The empirical evidences that private firms outperform not only SOEs, but also mixed enterprise are considered to support this statement (Vining and Broadman (1992), Majumdar (1996), Konings (1997)). Based on the above discussions, we derive the following hypothesis with respect to the marginal effects of ownership transformation on the financial and operating performance of privatized firms:

> Hypothesis H_2: The marginal effects of transfer of strategic control rights on the post-privatization firm performance are larger than those of ownership transformation without lower limit, and the marginal effects of full privatization surpass those of partial privatization.

The effects of ownership transformation are greatly affected also by types of new ownership. In this regard, foreign participation can be a strong driving force for restructuring of newly privatized firms. Foreign investors have a great deal of potential to provide enterprises acquired from the state with sophisticated expertise, including management know-how and production technologies accumulated in developed countries, as well as with greater access to new markets and to new capital resources. In addition, they have a strong tendency to demand accountability in accordance with the international standard from company managers in an effort to assess their performance based on strict criteria (Dyck (2001), D'Souza, Megginson, and Nash (2005b)). With these advantages, foreign owners are highly likely to bring remarkable positive contributions into the former socialist economies, which are characterized by poor management and production techniques, a closed domestic market, underdeveloped financial system, and weak

[2] As in other OECD countries, the Corporate Law in Hungary stipulates that simple majority voting is the standard decision-making procedure, except for matters requiring extraordinary resolution (2006. évi IV. törvény – a gazdaságj társaságokról 20 § (6)).

corporate governance system. Actually, many researchers find a positive causality between foreign participation in management and firm performance in transition economies (Frydman et al. (1999), Kocenda and Svejnar (2002), Weill (2003), Yudaeva et al. (2003), Hanousek, Kočenda, and Svejnar (2007)). There are also many studies reporting similar empirical results with respect to Hungary (Szekeres (2001), Novák (2002), Hamar (2004), Hasan and Marton (2003), Perotti and Vesnaver (2004), Makó (2005), Brown, Earle, and Telegdy (2006), Colombo and Stanca (2006), Iwasaki (2007b)).

In contrast to foreign investors, domestic investors in the post-communist states are more sensitive to political influence from regional government and local magnates and also more prone to be motivated by interests other than profit maximization, such as attainment of social prestige or relationship with local citizens. Further, it is repeatedly pointed out from both theoretical and empirical perspectives that insiders, who often buy out privatized enterprises in transitional countries, are quite problematic as key players in corporate restructuring aimed at improvement of profitability and productivity (Aoki and Kim (1995), Blanchard and Aghion (1996), Li (1998), Filatotchev, Wright, and Bleaney (1999), Megginson and Netter (2001)). We, therefore, test the following hypothesis with respect to the relationship between types of investors and firm performance:

> Hypotheses H_3: Ownership transformation to foreign investors has larger positive impacts on improvement in the financial and operating performance of privatized firms than that to domestic investors.

In the next section onwards, we verify the three hypotheses discussed above combining a large-scale panel data of Hungarian firms and a new empirical methodology.

II. Data

The data underlying our empirical analysis are annual census-type data of Hungarian firms, which were compiled from financial statements associated with tax reporting submitted to the National Tax Authority in Hungary from legal entities using double-sided bookkeeping. The observation period is four years from 2002 through to 2005. The data cover all industries and contain basic information of each entry including NACE 4-digit industrial classification, annual average number of employees, total asset, sales and other financial indices. In addition, the locations of firms are identical to the extent that they are divided into the capital region including Budapest and Pest County, the western region made up of nine counties, and the eastern region comprising of nine counties.[3]

Information about ownership structure includes the total amount of capital (subscribed

[3] For details, see notes in **Table I**. Due to the state regulation on disclosure of the official census data, more specific location information is not available.

equity) at the end of the calendar year and its share of the state, domestic and foreign private investors. The data, therefore, allow us to know the timing and scale of ownership transformation from state to private sector. In this paper, we define that privatization has been carried out in the year *t* if there was a relative decrease in the proportion of state ownership between the previous and current years.

All nominal values are deflated with the base year being 2002. As Sgard (2001) and Claessens and Djankov (2002) mention, the firm-specific price indices are not available in Hungary. Hence, following the steps taken by these two studies, we use the consumer price index, industrial producer price index and investment price index reported by the Hungarian Central Statistical Office as alternative deflators.

Although the data are basically reliable, they have a number of missing values and further include unrealistic or inconsistent input values. To deal with this problem, we carefully cleaned the data to remove inconsistencies and to eliminate samples containing missing values and, hence, posing an impediment to our empirical analysis.

The data form an unbalanced panel having additional new entry and exit of enterprises during the observation period. Since we have no information concerning these firms, any of these samples were not utilized in empirical analysis. In this regard, nothing was found to indicate that samples containing missing and abnormal values and newly entered and exited samples were extremely biased toward certain categories of firms in terms of industrial sector, firm size, location, and financial performance, as compared with other samples.

With regard to sample group for 2002, **Table I** shows the total number of enterprises, basic statistics of number of employees and equity capital, and composition by region and industrial sector for both private firms and SOEs. This table also reports a frequency distribution of the proportion of state ownership in the latter. One-man companies are totally excluded because ownership structure is not a crucial issue for corporate management in these firms. As a result of the extensive data cleaning and the exclusion of one-man companies, 99,315 firms are left out in our dataset. It is about half the number of samples on the original data. According to the official statistics, 98,367 private firms and 948 SOEs covered here accounts for 84.2% of all private firms and 81.6% of all public enterprises in Hungary, respectively, in terms of the total number of employees in 2002.

In **Table I** we can also confirm, first, that the average size of SOEs is larger than that of private firms in terms of both the number of employees and the amount of equity capital; second, that the degree of geographical concentration of SOEs in the capital region is slightly moderate compared with private firms; and third, that the share of agriculture, forestry, hunting and fishing sector in the industrial composition of SOEs is as much as 20% higher than that of private firms, whereas the share of wholesale and retail trade companies in the total number of SOEs is 18% lower than of private firms. Furthermore,

Table I reveals that more than half of SOEs are 100% government-owned and firms with less than 50% state ownership account for only 27% of all SOEs. We take into account these facts in the empirical analysis.

III. Empirical Methodology

As pointed out by Kocenda and Svejnar (2003), as well as small and unrepresentative samples of firms, short observation period could pose a serious impediment to empirically examining the effects of privatization policies in developing and transition economies. With the development of state statistical systems and private company information services, the former two problems are steadily becoming less troublesome because of increasing availability of large-scale sample sets. Although the problem of short observation period is also finding solutions, the real difficulty behind this issue is attributable to firms to be observed, rather than to observers. That is, the shorter life-cycles of firms and the frequent changes in their company profiles in developing and transitional countries compared with those in developed countries are the major obstacles to tracing the effects of enterprise privatization from a mid and long-term perspective. The other related issue is the scarcity and distortion of information concerning management and performance of SOEs, especially in former socialist states. This defect considerably limits the application of empirical method advocated by Megginson, Nash, and van Randenborgh (1994) into transition economies for detection of the privatization gains through comparing firm performance before and after privatization. Unfortunately, there seems to be no instant solution to this situation.

Researchers often attempt to find the privatization gains by looking at changes in profitability and productivity in a narrow sense. This attitude makes a lot of sense because those changes are directly related to improvements in corporate value and shareholders' wealth. However, if profitability or productivity is increased as a result of multifaceted improvements in business strategies, firm organization and production systems, the use of short-term observation data may lead to the failure to detect the end products of those managerial efforts. With this in mind, there should be an empirical study covering a broad range of performance indices including short-term ones that are more operational for new owners and managers of ex-state companies, focusing on the byproduct of the process of firm restructuring at their hands. By covering performance indices as many as practicable, the statistical power of hypothesis tests is also expected to be enhanced due to increased information about the effects of ownership transformation on firm performance. This is the reason why we perform panel data regressions taking a variety of performance indices as dependent variables, and then synthesize these estimates using meta-analysis techniques to examine the testable hypotheses presented in Section I.

Our empirical analysis broadly consists of five stages. At the first stage, as a prerequisite for verifying hypothesis H_1, we conduct comparative analysis using descriptive statistics of full SOEs and private firms in order to identify in which aspects of firm performance state ownership is inferior or superior to private ownership. This procedure aims to identify the potential source of privatization gains. The comparison is carried out between 499 full government-funded companies listed on **Table I** and approximately 90,000 private firms whose distribution of firm sizes, locations and industrial compositions are mostly identical to those of the above full SOEs. We exclude mixed enterprises, in which ownership structure and firm performance are highly likely determined endogenously, from all stages of our empirical analysis since the main research interest in this paper lies in how the exogenous privatization decision made by the government affects firm performance in the post-privatization period.

Comparison is made with respect to a total of 23 financial and operating indices from 5 areas routinely utilized by company executives and investment analysts all over the world including Hungary. They consist of: (i) 7 indices of profitability (ordinary income to total assets (ROI)/value-added to sales/operating income to sales/ordinary income to sales/return on equity (ROE)/return on total assets (ROA)/ordinary income on equity); (ii) 7 indices of productivity (value-added per employee/operating income per employee/ordinary income per employee/sales per employee/sales to employment/sales to total costs/fixed investment efficiency); (iii) 2 indices of financial ability (total assets turnover/fixed assets turnover); (iv) 2 indices of financial soundness (fixed ratio/capital adequacy ratio (CAR)); and (v) 5 indices of firm growth (sales growth/value-added growth/operating income growth/ordinary income growth/total assets growth).[4] The number of employees and the average employee salary are not investigated since it is theoretically unclear how a change in these two variables implies for corporate restructuring of privatized firms in contemporary Hungary after the dozen years since the collapse of the communist regime.

The second stage traces when and how much ownership of which companies was transferred to private sector among the above 499 SOEs during 3 years from 2003 to 2005. At this stage, in order to identify the presence and extent of selection bias regarding the privatization decision of the government and foreign participation in management of privatized firms, we carry out univariate comparison between privatized firms and remaining SOEs, and between firms acquired by domestic investors and those by foreign investors in terms of pre-privatization company size and firm performance. We also perform multivariate regression taking the probability of privatization and that of foreign

[4] The following indices are defined as follows: fixed investment efficiency = value-added / total fixed assets; total (fixed) assets turnover = sales / total assets (fixed assets); and fixed ratio = total fixed assets / equity capital.

acquisition as dependent variables.

At the third stage, we conduct panel estimation of the impact of ownership transformation on post-privatization firm performance. The above mentioned 23 performance indices are regressed into the scale and the type of ownership transformation controlling the other potential determinants. We estimate the following regression equation:

$$y_{it} = \mu + \alpha' x_i + \gamma Z_i + \delta_i + \varepsilon_{it}, \quad Z_i = (z_{i1}, \ldots, z_{iK}), \tag{1}$$

where y_{it} represents the firm i's performance for year t, x_i is an ownership variable, Z_i is a $K \times 1$ vector of control variables, μ is a constant term, α and γ are parameters of interest to be estimated, δ_i is individual effects, and ε_{it} is an error term.[5] The regression model taking an ownership variable with no lower limit to the scale of ownership transformation is named Model I. We use the estimation results of this model to examine hypothesis H_1. We also estimate Model II, in which limitations are placed on the scope of ownership variables to be investigated into the impact of transfer of strategic control rights (i.e., 50% or more ownership), and Model III, which is exclusively applied to the cases of full privatization. The estimation results of the latter two regression models are used for verifying hypothesis H_2. To test hypothesis H_3 regarding the relationship between types of new ownership and firm performance, we estimate Model IV and Model V, which regress post-privatization firm performance into ownership transformation ratio to domestic investors and foreign investors, respectively, and compare estimates of these two models.

According to Claessens and Djankov (2002), which document changes in the performance of over 6,000 firms in seven Eastern European countries in early 1990s, it takes several years for the privatization benefits on firm level to become noticeable. The panel data employed in this paper can deal with time lags of up to two years. Thereupon, with regard to Model I, we estimate a regression equation that takes ownership transformation ratio in the current year (x_{it}) as the ownership variable and name it Model Ia. We also perform estimation of Model Ib and Model Ic, which regress firm performance into one-year lag ownership variable (x_{it-1}) and two-year lag ownership variable (x_{it-1}), respectively. We group these three regression equations into Model I family. The same estimation procedure is adopted for Models II to V. Consequently, our panel estimation is based on a total of 15 types of regression equations classified into one of 5 model families.

In order to fully identify the effects of ownership transformation, our regression model controls the following potential determinants of firm performance: the sales share of each firm to represent its position in the product market; the median of dependent variable for

[5] We hypothesize that no change had been made to ownership structure for two years before privatization.

the sector each firm belongs to, calculated from about 10,000 effective samples, to capture the sector's market fluctuation; the sales-based Herfindahl index to proxy for the degree of market concentration of the sector each firm belongs to; industry fixed effects; time effects; and region-specific fixed effects. The firm's market position, the market fluctuation and the market concentration level of the sector it belongs to, and industry fixed effects are all based on the NACE two-digit level. In addition, to avoid simultaneous bias with the dependent variable, a predetermined variable for the previous term is used for the firm's market position and the degree of market concentration of the sector it belongs to.

We estimate the regression models using three panel estimators: fixed effects, random effects, and pooled OLS with cluster effects on the NACE two-digit level.

The fourth stage synthesizes regression coefficients of ownership variables using estimation results of the models selected basing on the Hausman test to test the random effects assumption, and the Breusch-Pagan test to test the null-hypothesis that the variance of the individual effects is zero. We set the critical value for both of these specification tests at the 10 % level of significance.

The following method is applied for synthesizing regression coefficients. Suppose there are N independent studies. Here, the "effect size" estimate of the n-th study is labeled as T_n, and the corresponding population and standard deviation as θ_n and s_n, respectively (n=1, …, N). We assume that estimate T_n is normally distributed ($T_n \sim N(\theta_n, \ s_n^2)$). We also assume that $\theta_1 = \theta_2 = \ldots = \theta_N = \theta$ implying that each study in meta-analysis is estimating the common underlying population effect, and the estimates differ only by random sampling errors. An asymptotically-efficient estimator of unknown true population parameter θ is a weighted mean by the inverse variance of each estimate:

$$\overline{T} = \sum_{n=1}^{N} w_n T_n \Big/ \sum_{n=1}^{N} w_n \ , \tag{2}$$

where $w_n = 1/v_n$ and $v_n = s_n^2$. The variance of $\overline{T}$ is given by:

$$\mathrm{var}\left(\overline{T}\right) = 1 \Big/ \sum_{n=1}^{N} w_n \ . \tag{3}$$

This is the meta fixed-effects model. In order to utilize this method, we need to confirm that the estimates are homogeneous. A homogeneity test uses the statistic:

$$H_T = \sum_{n=1}^{N} w_n \left(T_n - \overline{T}\right)^2 \ , \tag{4}$$

which has a Chi-square distribution with N-1 degrees of freedom. The null-hypothesis is rejected if H_T exceeds the critical value. In this case, we assume that heterogeneity exists among the studies and adapt a random-effects model which incorporates the sampling variation due to an underlying population of effect sizes as well as the study-level sampling error. If the deviation between estimates is expressed as δ_θ^2, the unconditional variance of

the n-th estimate is given by $v_n^u = \left(v_n + \delta_\theta^2\right)$. In the meta random-effects model, the population θ is estimated by replacing the weight w_n with the weight $w_n^u = 1/v_n^u$ in Eq. (2).[6] For the between-studies variance component we use the method-of-moment estimator computed by the next equation using the value of the homogeneity test statistic H_T obtained from Eq. (4):

$$\hat{\delta}_\theta^2 = \frac{H_T - (N-1)}{\sum_{n=1}^{N} w_n^u - (\sum_{n=1}^{N} w_n^{u\,2} \Big/ \sum_{n=1}^{N} w_n^u)}. \tag{5}$$

In other words, the fourth stage verifies the testable hypotheses basing on the value of synthesized regression coefficients and its statistical significance adopting either the meta fixed-effects model or the meta random-effects model according to the results of the homogeneity test. At this stage, we also make use of the p-value combination method and the vote-counting method, both of which are more conventional meta-analysis techniques, to supplement the results from the synthesis of regression coefficients.[7]

At the last fifth stage, we conduct a meta-regression analysis.[8] This quantitative method has a great advantage in strictly interpreting the differences in the results of panel estimation, and, thus, it can be an effective means for supplementing the results of meta-analysis at the fourth stage. We estimate the following meta-regression model:

$$T_n = \beta_0 + \sum_{m=1}^{M} \beta_m W_{nm} + e_n, \quad n = 1,\ldots,N, \tag{6}$$

where, β_0 represents the effects of ownership transformation under the default conditions (W_{nm}=0), W_{nm} is a meta-independent variable having the characteristics of the panel regression model and observations that are considered to create differences in estimation results, β_{m} denotes a meta-regression coefficient to be estimated, and e_{n} is an error term.

To reexamine our testable hypotheses, we use dummy variables that identify whether the dependent variable y_{it} in the panel regression model is a superior or inferior performance index to private firms in comparison with full SOEs, as well as dummy variables that capture the differences in the scale and the type of ownership transformation. In addition, we check sensitivity of the overall estimation results of the panel regressions by

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[6] This means that the meta fixed-effect model is a special case based on the assumption that $\delta_\theta^2 = 0$.

[7] For more details on the meta-analysis methods, see Hedges and Olkin (1985), Hedges (1992), and Keef and Roberts (2004).

[8] As it is called "the regression analysis of regression analyses" (Stanley and Jarrell, 1989), this method is now increasingly applied in economics to summarize the empirical literature. Among the recent studies using this technique include Nelson (2006), Connor and Bolotova (2006), Brander, Van Beukering, and Cesar (2007), and Doucouliagos and Paldam (2008). In the literature on transition economies, Fidrmuc and Korhonen (2006) practice this method.

incorporating into the meta-regression model such independent variables that capture the time-lags of ownership variables, the industrial sector, the qualitative difference in performance indices, the difference in panel estimators and a dummy variable, which is equal to one if an effect size is obtained from the regression model selected according to the model specification tests, as well as the number of observations used in the panel estimation.

To estimate meta-regression models, most precedent studies employ one or a combination of a weighted least square (WLS) estimator with number of observations or standard errors as analytical weights, a meta random-effects estimator using the restricted maximum likelihood (RML) method or the non-iterative moment method, or a meta mixed-effects estimator using the RML method. In order to check the robustness of the estimation results, we adopt all of these five estimators. We also perform regressions both by using all panel estimates as the dependent variables and by using exclusively the estimates of models selected by the specification tests.

IV. Results

Tables I through **VIII** present the main results of our empirical analyses. In this section we summarize and interpret these results as well as entering into the details of the methodological procedure that were not explained in the previous section.

A. Performance Comparison between Private and Full State-Owned Enterprises

Table II shows univariate comparisons between private and full SOEs using 23 performance indices. According to the results covering whole corporate sector (panel A), Hungary's SOEs are generally inferior to its private firms. In fact, 18 of these 23 indices demonstrated the superiority of private firms over SOEs in the 10% or less significance level either by a *t*-test or a Wilcoxon rank-sum test. These indices are hereinafter referred to as the "SOE-inferior indices". This is one of the political reasons why the Hungarian government has been and is still now pushing forward the privatization of public firms.

Nevertheless, when looking into the four individual sectors (panel B-E), performance gaps between full SOEs and private firms vary significantly from industry to industry. For example, in service sector, 13 of the 23 performance indices apply to the SOE-inferior indices, whereas in agriculture, forestry and, hunting fishing sector, only 7 indices apply to those. Also, there is no particular common trend observed among the four sectors regarding the structure of the comparison results. On the other hand, turning to the performance indices showing the statistically significant superiority of SOEs over private firms (hereinafter "SOE-superior indices"), the capital adequacy ratio for SOEs is much higher than that for private firms in all sectors. Further, in agriculture, forestry, hunting and fishing

sector, SOEs outperform private firms in six performance indices, and in manufacturing sector, SOEs performs better then private firms in terms of ordinary income to equity ratio. And more than anything, there are 42 test results demonstrating no statistical significant performance gaps between the two corporate sectors (hereinafter "difference-insignificant indices"), accounting for 46 % of all results. As discussed in Section I, if privatization gain can be attributable to the comparative inefficiency of public firms, the effects of enterprise privatization are considered to have become noticeable in more limited situations than expected in Hungary of the early 2000s.

B. Privatization Process of State-Owned Enterprises and Selection Bias

Table III shows that of 499 companies that were fully government-owned as of the end of 2002, 313 or 62.7% partially or entirely transferred their property rights to private sector over the three years up to 2005. This table also shows that most of these firms were privatized in 2003.[9] It is probably due to the policies adopted by the Hungarian government facing the need to restructure public finance and to further promote deregulation in the domestic market toward EU accession in 2004.[10] This provides a favorable condition for measuring the time-lag effects of ownership transformation for two consecutive terms.

The statistics on the scale of ownership transformation indicates that a vast majority of these 313 SOEs, including 24 or 7.7% acquired by foreign investors, are fully privatized. Looking at the regional and industrial compositions of privatized firms, we confirm that the sales of public enterprises were conducted in all industries on a nationwide scale. This reveals that the Hungarian government had been consistent in actively pursuing ownership transformation to strategic investors beyond industrial and regional boundaries.

Nevertheless, because the government's privatization decision is a highly political matter and because the sale of SOEs is also influenced by the bidding private investors, a statistically significant bias may occur between privatized firms and remaining SOEs. Hence, in measuring the effects of ownership transformation on firm performance in the post-privatization period, it is indispensable to know the presence and extent of the selection bias. In the case of this research, we also should consider possible differences in behavioral patters between domestic and foreign investors.

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[9] All of the four enterprises, which had experienced privatizations twice until 2005, transferred more than 50% of their property rights to private investors at the first privatization, whereas they sold only a few to a dozen or so percent at the second privatization.

[10] In May 2002, Pétel Medgyessy has formed coalition government of the Hungarian Socialist Party (MSZP) and the Alliance of Free Democrats (SZDSZ) as a result of the forth post-communist parliamentary elections. Aiming at early fulfillment of Hungary's EU accession and entry into EURO zone, the Medgyessy administration took political measures to promote market-oriented structural reform and tight fiscal policies.

To check these aspects, we compare between privatized firms and remaining SOEs and between privatized firms acquired by domestic investors and those by foreign investors for 2003 in terms of company size and firm performance in the previous year. According to the results presented in **Table IV**, the company size of privatized firms is much smaller than that of remaining SOEs, while the firm performance of the former is better than that of the latter especially in terms of productivity and financial ability indices (panel A). Similarly, firms acquired by foreign investors are larger in size than firms acquired by domestic investors, while by and large the latter outperform the former (panel B).

In order to test whether the above relationships can appear when controlling other factors simultaneously, we perform probit regressions taking discrete variable which assigns a value of 1 to privatized firms or firms acquired by foreign investors in 2003 as the dependent variable. As independent variables we employ the natural logarithm of total assets for 2002 to proxy for company size before privatization and a dummy variable, which takes one for the firms whose operating income was negative for 2002 as well as the six performance indices which differed at the 10% or less significance level between compared groups in **Table IV**. We also use dummy variables to capture the fixed effects of the firm locations in the western and eastern regions and a dummy variable with a value of one if the firms operating in traditional public sectors[11] as control variables.[12] We estimate a regression model of the probability of being acquired by foreign investors using the two-step probit maximum likelihood estimator with the probability of privatization being the dependent variable at the first stage. **Table V** presents the results of our regressions. The signs of the independent variables estimated with statistical significance at the 10% or less level correspond to the results of the univariate comparison shown in **Table IV**. These findings strongly suggest the presence of selection bias in the Hungarian government's privatization decision and also certain differences between domestic and foreign investors in term of their behavior when purchasing state firms.[13]

C. Panel Estimation of the Effects of Ownership Transformation

In performing the panel estimation of the effects of ownership transformation, we take

[11] These sectors refer to mining of uranium and thorium ores (NACE12); electricity, gas, steam and hot water supply (40); collection, purification and distribution of water (41); transport via railways (60.1); post and courier activities (64.1); central banking (65.11); public administration and defense, compulsory social security (75); education (80), health and social work (85), and sewage and refuse disposal, sanitation and similar activities (90).

[12] The largest correlation coefficient between these independent variables in all combinations including the 6 performance indices is 0.41, well below the threshold of 0.70 for possible multicollinearity.

[13] Almost the same results were obtained by conducting the analyses reported in **Table IV** and **V** excluding all firms privatized in 2004 and onwards from the remaining SOEs as of 2003.

four measures to deal with the selection bias of the privatization decision and the acquisition by foreign investors. First, in our panel regressions, we use not the level of firm performance, but the rate of its annual change as the dependent variable for the 18 indices of profitability, productivity, financial ability and soundness. Secondly, we control the level of the dependent variable in the previous year since the past performance level may strongly affect the range of the growth rate of the relevant performance index as a result of management efforts for the current term. Thirdly, to control firm size, we use the natural logarithm of total assets as an independent variable. And fourthly, we exclude every sample falling outside from the mean ± 2 standard deviations of all samples with respect to the level of performance index for 2002 to be analyzed.[14]

We performed regressions using the panel data on 411 firms from agriculture, forestry, hunting and fishing, manufacturing, construction and service sectors, which made up for 82% of the 499 SOEs listed in **Table III**. We carried out a total of 4,140 estimation trials (i.e., 15 types of regression equations defined in Section III × 23 types of performance indices × 3 types of panel estimators × 4 industrial sectors). We failed 585 or 14.3% of these estimations mainly due to small sample size of the firms acquired by foreign investors or lack of data. As a result, we obtained a total of 3,555 estimates of ownership variables. The meta-analyses in the following two subsections use these estimates. With respect to the composition by panel estimator of the 1,185 models selected by the Hausman and Breusch-Pagan specification tests, 964 or 81.4% are pooled OLS estimators, 154 or 13.0% are random effects estimators and the remaining 67 or 5.7% are fixed effects estimators. It suggests that our panel regression model is considered to be well formulated in the sense that there is little need for distinguishing individual firm effects as fixed effects or random effects.

D. Synthesis of Regression Coefficients

Synthesis of regression coefficients is performed using the estimation results of the selected models according to the type of model family and the type of investor as well as by the each of three categories of performance index: the SOE-inferior indices, the SOE-superior indices, and the difference-insignificant indices. **Table VI** details the results. In addition to the synthesized values of regression coefficients based on the meta fixed-effects models and the meta random-effects models and the values of homogeneity tests, this table also presents the asymptotic *z*-values to test the null-hypothesis that the synthesized effect size is zero, the combined *p*-value obtained using the inverse Chi-square

[14] The actual number of outliers excluded by this criterion is less 0.5% of total samples in all cases, suggesting significant homogeneity of Hungarian SOEs in firm performance.

method and the inverse normal method[15], and the results of the vote-counting method.

If hypothesis H_1 is true, we expect that the synthesized effect size of Model I family based on the SOE-inferior indices is significantly positive due to the sources of privatization gains, whereas those based on the SOE-superior indices is negative. We also predict that it is more difficult to detect the positive effects of ownership transformation through the meta-analyses based on the difference-insignificant indices than through those based on the SOE-inferior indices. If hypothesis H_2 is empirically supported, the synthesized effect size of Model II family whose scope of application is limited to the cases of transfer of strategic control rights should exceed those of Model I family, which covers ownership transformation effects without lower limit, and further, the synthesized effect size of Model III family, which tracks only the effects of full privatization, should be superior to those of the former two models. And if hypothesis H_3 is correct, the synthesized effect size of ownership transformation to foreign investors (Model V family) will surpass those of ownership transformation to domestic investors (Model IV family).

The results shown in **Table VI** strongly support the above predictions. Except only for the case of ownership transformation to domestic investors using the difference-insignificant indices, we refer to the synthesized effect sizes based on the meta random-effects model to verify the hypotheses because the null-hypothesis is rejected by the homogeneity test at the 5% or less significance level. The synthesized effect size for Model I family basing on the SOE-inferior indices is positively estimated at the 1% level, whereas that basing on the SOE-superior indices is negative at the 1% level and that basing on the difference-insignificant indices is statistically insignificant. The similar results are repeated when comparing the synthesized effect sizes of other models. By comparing the results for Models I, II and III family, we confirm that the synthesized effect sizes of ownership transformation without lower limit are always smaller than those of transfer of strategic control rights, and those of full privatization are always larger than those of partial privatization. Furthermore, the comparison of the synthesized effect sizes of Model IV family and Model V family indicate that the effects of ownership transformation to foreign investors are greatly superior to those to domestic investors except for those based on the SOE-superior indices. Although we do not go into the details here due to space limitations, the results from the *p*-value combination procedure and the vote-counting method also by and large support the conclusions derived from the meta-analysis of regression

[15] If $p_1, p_2, \ldots, p_N$ are *p*-values of *N* estimates, the inverse Chi-square method uses the statistic: $-2\sum_{n=1}^{N}\log(p_n)$, which has a Chi-square distribution with $2N$ degree of freedom, and the inverse normal method uses the statistic: $1/\sqrt{N}\cdot\sum_{n=1}^{N}\Phi^{-1}(p_n)$, which has the normal distribution. $\Phi(\cdot)$ represents the standard normal distribution function (Hedges (1992)).

coefficients.[16]

E. Meta-Regression Analysis

Table VII provides the definitions and descriptive statistics of the variables used in the meta-regression analysis. The estimation results are presented in **Table VIII**. Models [1] through [5] show the estimation results from the meta-regression models covering all panel estimates and Models [6] through [10] show the estimation results using only the estimates of the selected models.

We interpret the results that hypothesis H_1 is strongly supported by the fact that with the difference-insignificant indices as the default category, in 7 of the 10 models, the dummy variables denoting that a SOE-inferior index is used as a dependent variables for panel estimation have positive signs at the 10% or less significance level, while the dummy variables designating the use of a SOE-superior index are significantly negative. Similarly, the results that the dummy variables identifying the panel estimates on the effects of ownership transformation to foreign investors are positively estimated in 9 models are considered to provide supporting evidence for hypothesis H_3. On the other hand, although all of the dummy variables relating to the effects of transfer of strategic control rights and those of full privatization have positive signs excluding one case in Model [1], they are not statistically robust enough to be used as supporting evidence for hypothesis H_2.

The estimation results of other meta-independent variables suggest the following four points with respect to the sensitivity of the panel estimation: First, the effects of ownership transformation tend to wane over time. Second, no statistically robust differences are observed between the industrial sectors and between the qualitative categories of the performance indices. Third, although no apparent bias is seen in the overall estimation results arising from the differences among panel estimators, the random effects estimators in the selected models tend to be more biased downward than OLS and the fixed-effects estimators. And fourthly, the estimates of the selected models have no significant bias in comparison to those of the unselected models. We think that the second point is an interesting finding from the viewpoint of policy implication.

V. Conclusions

In this paper we empirically examined the effects of ownership transformation from state to private sector on post-privatization firm performance focusing on the Hungarian enterprises in the early 2000's. We utilized the annual census-type data compiled by the Hungarian National Tax Authority for our empirical analyses. Although this dataset presents an ample sample size in cross-section, they allow us to trace the performance changes only

[16] See Coggin and Hunter (1993) for how to interpret the results from the vote-counting method.

for up to two years after privatization. The lack of sufficient observation period forms a serious obstacle to detect the privatization effects. We made an attempt to overcome this data constraint by combining the panel estimation regressing various performance indices into the scale and type of ownership transformation with the meta-analysis of the regression coefficients. This empirical methodology made it possible to wholly capture restructuring efforts of new owners and managers, leading to the successful detection of the statistically significant effects of ownership transformation. That is, the synthesis of regression coefficients of the ownership variables provided supporting evidences for all three testable hypotheses presented in Section I, and the results of the meta-regression analysis verified hypotheses H_1 and H_3.

The most important lesson from this research is that to identify the potential sources of privatization gains is a necessary step to detect the effects of ownership transformation. It was revealed that in Hungary in the beginning of the new century, the performance gaps between public and private enterprises were more limited than we had expected. This fact in itself is considered to be the positive side of the systemic transformation to a market economy in this country. Yet, if it is impossible to know in advance in what aspects SOEs are inferior to private firms in performance, we might have overlooked the effects of ownership transformation that actually existed. In fact, according to **Table VI**, the null-hypothesis that the synthesized effect size of Model I family is zero cannot be rejected (z=0.01) when covering all performance indices. We expect that the feasibility of detecting the privatization effects will improve significantly if the potential source of privatization gains can be identified beforehand.

The other interesting finding in this paper is the fact that foreign investors outperform domestic investors in a short period of time with regard to medium and small-sized SOEs soled in the early 2000's, reminding us of the large-scale privatization period when foreign direct investment made a critical contribution to the restructuring of Hungarian large corporations (Makó and Illéssy (2007)). Moreover, according to the empirical results reported in the previous section, unlike in the 1990's, foreign investors bought and successfully restructured the public enterprises that had not been in good financial condition before privatization. This constitutes counterevidence to the view that the effects of foreign participation in management of privatized firms are overestimated due to selection bias that drives foreign investors to select good companies for investment. If an appropriate policy framework is in place, there may be still plenty of room left for Hungary, the largest foreign capital recipient among the former socialist countries, to be able to receive further benefits from foreign direct investment.

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Table I
Comparison between Private and State Corporate Sectors, 2002

This table compares 98,367 private firms and 948 state-owned enteprises (SOEs) using annual census-type data for 2002, which were compiled from financial statements associated with tax reporting submitted to the Hungarian National Tax Authority in Hungary from legal entities using double-sided bookkeeping. The western region consists of the following nine counties: Győr-Moson-Sopron; Komá rom-Esztergom; Vas; Veszprém; Fejér; Zala; Somogy; Tolna; and Baranya county. The eastern region also consists of nine counties: Nógrád; Bács-Kiskun; Csongrád; Békés; Jász-Nagykun-Szolnok; Hajdú-Bihar; Szabolcs-Szatmár-Bereg; Borsod-Abaúj-Zemplén; and Heves county. The composition by industrial sector is based on the Classification of Economic Activities in the European Community (NACE). Other industries include: public administration and defence, compulsory social security; education; health and social work; other community, social and personal service activities; and activities of households.

	A. Private firms	B. SOEs
Number of firms	98,367	948
Annual average number of employees (persons)		
Total	1,497,832	255,960
Mean	15	270***
Median	4	19†††
Equity capital		
Total (billion HUF)	4,360	1,592
Mean (thousand HUF)	44,325	1,679,550***
Median (thousand HUF)	3,000	60,864†††
Composition by region (actual number/proportion) [a]		
Capital region (Budapest and Pest County)	44,422 /0.45	392 /0.41
Western region	25,883 /0.26	254 /0.27
Eastern region	28,062 /0.29	302 /0.32
Composition by industrial sector (actual number/proportion) [b]		
Agriculture, forestry, hunting and fishing	4,095 /0.04	226 /0.24
Mining and quarrying	192 /0.00	3 /0.00
Manufacturing	17,490 /0.18	116 /0.12
Electricity, gas and water supply	305 /0.00	30 /0.03
Construction	10,605 /0.11	80 /0.08
Wholesale and retail trade	30,255 /0.31	122 /0.13
Hotels and restaurants	4,780 /0.05	18 /0.02
Transport, storage and communication	4,681 /0.05	56 /0.06
Financial intermediation	1,004 /0.01	30 /0.03
Real estate and renting	15,855 /0.16	175 /0.18
Other industries	9,105 /0.09	92 /0.10
Share of state ownership (actual number/proportion)		
1-25%	-	147 /0.16
26-50%	-	101 /0.11
51-75%	-	83 /0.09
76-99%	-	118 /0.12
100%	-	499 /0.53

[a] Test for equality: χ^2=6.7446, p=0.034.

[b] Test for equality: χ^2=1246.8518, p=0.000.

*** denotes that differences between privave firms and SOEs is significant at the 1% level by t-test.

††† denotes that the difference between private firms and SOEs is significant at the 1% level by the Wilcoxon rank-sum test.

Table II
Comparison of Firm Performance between Private Firms and Full State-Owned Enterprises, 2002

This table presents the results of univariate comparison of firm performance between approximately 90,000 private firms and 499 full state-owned enterprises (SOEs) using annual census-type data of Hungarian firms available for 2002 and 2003 in terms of 23 financial and operating performance indices. These 23 indices consist of five groups: profitability; productivety; financial ability; financial soundness; and firm growth. The following indices are defined as follows: fixed investment efficiency = value-added / total fixed assets; total (fixed) assets turnover = sales / total assets (fixed assets); and fixed ratio = total fixed assets / equity capital. All nominal values are deflated with the base year being 2002 using the consumer price index, industrial producer price index and investment price index reported by the Hungarian Central Statistical Office as deflators when we compute the firm growth indices. Service sector includes: wholesale and retail trade; hotels and restaurants; transport, storage and communication; and real estate and renting. The SOE-inferior (SOE-superior) indices denote the financial and operating performance indices in which the mean or median for full SOEs regarding the relevant indices are inferior (superior) to those for private firms with statistical significance at the 10% or less level. The difference-insignificant indices refer to the indices which do not satisfy these conditions.

		A. Whole corporate sector		B. Agriculture, forestry, hunting and fishing		C. Manufacturing		D. Construction		E. Services	
		Private firms	Full SOEs	Private firms	Full SOEs	Private firms	Full SOEs	Private firms	Full SOEs	Private firms	Full SOEs
Profitability											
Ordinary income to total assets (ROI)	Mean	-0.311	-0.334	-0.170	-0.467	-0.230	0.020	-0.502	-0.104	-0.305	-0.491
	Median	△ 0.016	0.002 †††	△ 0.029	0.008 †	0.029	0.043	0.025	0.010	△ 0.010	-0.005 †††
Value-added to sales	Mean	△ 0.018	-0.239 ***	-0.135	0.229	0.116	0.154	△ 0.112	-0.308 **	0.003	-0.155
	Median	0.198	0.222	▼ 0.152	0.318 †††	0.255	0.305	△ 0.190	0.140 ††	0.168	0.183
Operating income to sales	Mean	-0.344	-0.679	-0.339	0.024	△ -0.287	-1.662 **	-0.253	-0.157	-0.372	-0.793
	Median	0.016	0.015	0.032	0.017	0.020	0.029	0.014	0.017	0.014	0.009
Ordinary income to sales	Mean	△ -0.419	-1.213 ***	-0.390	0.035	△ -0.303	-1.159 *	-0.271	-0.210	△ -0.446	-1.136 ***
	Median	△ 0.017	0.007 †††	△ 0.045	0.015 ††	0.023	0.029	0.016	0.011	△ 0.014	0.002 †††
Return on equity capital (ROE)	Mean	6.123	1.938	5.338	1.449	5.033	13.228	2.917	-1.029	4.249	2.522
	Median	△ 0.089	0.034 ††	0.108	0.036	0.122	0.104	0.099	0.025	0.051	0.024
Return on total assets (ROA)	Mean	-0.390	-0.262	-0.222	-0.457	-0.339	0.011	-0.683	-0.085	-0.392	-0.394
	Median	△ 0.019	0.009 ††	0.020	0.016	0.024	0.037	0.019	0.009	0.012	0.007
Ordinary income on equity capital	Mean	2.167	1.065	2.487	1.384	▼ 2.062	12.062 ***	0.808	-1.410	1.842	1.273
	Median	△ 0.054	0.003 †††	△ 0.124	0.027 †	0.120	0.127	△ 0.100	0.015 ††	△ 0.032	-0.010 †††
Productivity											
Value-added per employee [a]	Mean	△ 2287	1233 ***	1375	1660	2232	2541	△ 1784	867 **	△ 2389	1215 ***
	Median	1327	1426	▼ 1107	1670 ††	1451	2147	△ 1215	1046 ††	1318	1354
Operating income per employee [a]	Mean	△ 590	-392 ***	525	-84	467	1099	340	580	△ 643	-1209 ***
	Median	86	86	196	90	85	241	62	137	69	52
Ordinary income per employee [a]	Mean	△ 540	-483 ***	658	-213	490	1010	393	94	△ 610	-763 ***
	Median	△ 105	29 †††	△ 328	66 †††	128	75	101	91	△ 90	1 †††
Sales per employee [a]	Mean	△ 14681	12636 *	△ 13852	7643 *	11502	12540	12420	12616	16673	14386
	Median	△ 6088	5597 †	△ 7123	5792 †	5721	6822	△ 5969	4344 †	6727	5903
Sales to employment	Mean	42.421	25.271	49.282	14.788	27.692	7.394	37.611	11.280	46.587	35.686
	Median	△ 6.780	3.325 †††	△ 7.370	3.176 †††	△ 5.345	3.410 †††	△ 6.878	2.614 †††	△ 7.746	4.278 †††
Sales to total costs	Mean	△ 1.133	1.003 ***	1.066	1.007	△ 1.088	0.997 *	△ 1.079	0.838 ***	△ 1.130	1.049 ***
	Median	△ 1.051	1.018 †††	1.014	0.998	1.063	1.054	△ 1.046	0.935 †††	△ 1.045	1.026 †††
Fixed investment efficiency	Mean	△ 2.576	1.446 **	0.649	0.065	2.698	3.471	△ 3.269	0.819 **	△ 2.748	1.423 *
	Median	△ 0.932	0.592 †††	▼ 0.309	0.536 ††	1.191	1.347	△ 1.444	0.119 †††	△ 0.893	0.775 †

(continued)

(**Table II** continued)

		A. Whole corporate sector			B. Agriculture, forestry, hunting and fishing			C. Manufacturing			D. Construction			E. Services		
		Private firms	Full SOEs		Private firms	Full SOEs		Private firms	Full SOEs		Private firms	Full SOEs		Private firms	Full SOEs	
Financial ability																
Total assets turnover	Mean		3.622	3.236		2.348	2.868		2.851	2.236		5.756	5.312		3.609	3.425
	Median	△	1.545	1.127 †††		0.871	0.891		1.593	1.393	△	2.044	0.788 †††	△	1.558	1.235 †
Fixed assets turnover	Mean	△	15.362	8.237 ***		5.115	2.485		10.848	11.329	△	17.487	3.043 ***		19.405	12.223
	Median	△	4.610	1.946 †††		2.159	1.880		4.456	4.648	△	7.397	0.615 †††	△	5.529	2.008 †††
Financial soundness																
Fixed ratio	Mean	△	19.426	7.997 **		18.796	2.742		15.334	1.846		15.528	1.198		21.692	17.203
	Median	△	2.485	1.328 †††	△	2.781	1.802 ††	△	2.502	0.879 †††	△	2.485	1.185 †††		2.509	1.730
Capital adequacy ratio (CAR)	Mean	▼	0.184	0.281 ***	▼	0.189	0.318 ***	▼	0.184	0.282 ***	▼	0.177	0.419 ***	▼	0.190	0.245 ***
	Median	▼	0.092	0.231 †††	▼	0.103	0.283 †††	▼	0.100	0.242 †††	▼	0.088	0.448 †††	▼	0.097	0.178 †††
Firm growth [b]																
Sales growth	Mean		2.040	0.902		1.079	0.011		1.397	-0.030		2.157	-0.233		2.174	2.321
	Median	△	0.051	0.002 †††		-0.022	0.025		0.021	-0.005	△	0.058	-0.239 †††		0.051	0.024
Value-added growth	Mean	△	1.488	-1.244 ***		0.910	-0.011		1.174	-1.074	△	2.053	-4.155 ***	△	1.500	-0.980 *
	Median	△	0.063	-0.034 †††		-0.035	-0.001	△	0.032	-0.034 †	△	0.038	-0.432 †††		0.063	0.052
Operating income growth	Mean		0.190	-0.815		-0.154	0.240	△	0.223	-9.835 *		0.248	-0.636		0.052	-4.972
	Median		0.023	0.044	▼	-0.192	0.085 †		0.010	-0.285		-0.033	-0.282		0.030	0.046
Ordinary income growth	Mean		0.121	-0.420		-0.078	0.456		0.276	-4.568		0.232	-0.548		-0.037	0.520
	Median		0.038	-0.055	▼	-0.166	-0.041 †	△	0.025	-0.451 ††		-0.046	-0.103		0.054	0.195
Total assets growth	Mean		1.292	0.116		1.021	0.034		0.844	0.085		1.722	0.051		1.290	0.104
	Median		0.021	0.007		0.008	0.028		0.026	0.004		0.040	0.071	△	0.009	-0.015 †
Classification of performance indices (actual number/proportion)																
SOE-inferior indices (△)			18 /0.78			7 /0.30			8 /0.35			12 /0.52			13 /0.57	
SOE-superior indices (▼)			1 /0.04			6 /0.26			2 /0.09			1 /0.04			1 /0.04	
Difference-insignificant indices			4 /0.17			10 /0.43			13 /0.57			10 /0.43			9 /0.39	

[a] The unit is thousand HUF.

[b] Real growth rate for 2002-03

***, **, * Significant at the 1, 5, and 10% levels, respectively, by *t* -test.

†††, ††, † Significant at the 1, 5, and 10% levels, respectively, by the Wilcoxon rank-sum test.

△ denotes that private firms are superior to full SOEs with statistical significance at the 10% or less level. ▼ denotes that private firms are inferior to full SOEs with statistical significance at the 10% or less level.

Table III

Privatization Process of State-Owned Enterprises, 2002-2005

This tabel traces the privatization process of state-owned enterprises (SOEs) in the period of 2002-2005 using annual census-type data of Hungarian firms. The western region consists of the following nine counties: Győr-Moson-Sopron; Komárom-Esztergom; Vas; Veszprém; Fejér; Zala; Somogy; Tolna; and Baranya county. The eastern region also consists of nine counties: Nógrád; Bács-Kiskun; Csongrád; Békés; Jász-Nagykun-Szolnok; Hajdú-Bihar; Szabolcs-Szatmár-Bereg; Borsod-Abaúj-Zemplén; and Heves county. The composition by industrial sector is based on the Classification of Economic Activities in the European Community (NACE). Other industries include: public administration and defence, compulsory social security; education; health and social work; other community, social and personal service activities; and activities of households.

		2002	2003	2004	2005
Number of full SOEs		499	223	203	186
Number of privatized firms		0	276	23	18
Number of firms acquired by domestic investors		0	262	21	17
Number of firms acquired by foreign investors		0	20	3	1
Number of firms which experienced privatization two times		0	0	3	1
Accumulated number of privatized firms		0	276	296	313
Scale of ownership transformation					
All privatized firms	Mean	-	0.99	0.84	0.82
	Median	-	1.00	1.00	1.00
Firms acquired by domestic investors	Mean	-	0.98	0.81	0.81
	Median	-	1.00	1.00	1.00
Firms acquired by foreign investors	Mean	-	0.80	0.83	1.00
	Median	-	1.00	1.00	1.00
Frequency distribution of the scale of ownership transformation (actual number/proportion)					
1-10%		-	0 /0.00	2 /0.09	2 /0.11
11-25%		-	2 /0.01	0 /0.00	1 /0.06
26-50%		-	1 /0.00	1 /0.04	0 /0.00
51-75%		-	1 /0.00	2 /0.09	2 /0.11
76-99%		-	0 /0.00	4 /0.17	1 /0.06
100%		-	272 /0.99	14 /0.61	12 /0.67
Composition of privatized firms by region (actual number/proportion) [a]					
Capital region (Budapest and Pest County)		287 /0.58	160 /0.58	11 /0.48	10 /0.56
Western region		95 /0.19	55 /0.20	9 /0.39	1 /0.06
Eastern region		117 /0.23	61 /0.22	3 /0.13	7 /0.39
Composition of privatized firms by industrial sector (actual number/proportion) [a]					
Agriculture, forestry, hunting and fishing		43 /0.09	12 /0.04	1 /0.04	2 /0.11
Mining and quarrying		3 /0.01	0 /0.00	0 /0.00	1 /0.06
Manufacturing		63 /0.13	32 /0.12	4 /0.17	4 /0.22
Electricity, gas and water supply		5 /0.01	1 /0.00	0 /0.00	1 /0.06
Construction		72 /0.14	29 /0.11	3 /0.13	2 /0.11
Wholesale and retail trade		86 /0.17	79 /0.29	4 /0.17	0 /0.00
Hotels and restaurants		16 /0.03	16 /0.06	0 /0.00	0 /0.00
Transport, storage and communication		19 /0.04	11 /0.04	0 /0.00	1 /0.06
Financial intermediation		11 /0.02	3 /0.01	1 /0.04	0 /0.00
Real estate and renting		112 /0.22	63 /0.23	7 /0.30	7 /0.39
Other industries		69 /0.14	30 /0.11	3 /0.13	0 /0.00

[a] The data for 2002 is the breakdown of state enteprises.

Table IV
Comparison between Privatized Firms and Remaining State-Owned Enterprises and between Firms Acquired by Domestic Investors and Firms Acquired by Foreign Investors

This tables presents the results of univariate comparison between firms privatized in 2003 and remaining state-owned enterprises (SOEs) and between firms acquired by domestic investors and firms acquired by foreign investors as a result of the enterprise privatization conducted in 2003 in terms of pre-privatization company size and firm performance in 2002 to identify the presence and extent of selection bias regarding the privatization decision of the Hungarian government and acquisition of privatized firms by foreign investors in comparison with those by domestic investors. We use annual census-type data of Hungarian firms for 2002 and 2003. The sample are the same in Table III.

		A. Comparison between privatized firms and remaining SOEs			B. Comparison between firms acquired by domestic investors and firms acquired by foreign investors		
		Privatized firms		SOEs	Firms acquired by domestic investors		Firms acquired by foreign investors
Company size							
Total number of employees (persons)	Mean	▼	16.558	677.833 **	▼	14.863	46.909 *
	Median	▼	3	61 †††		3	5
Total sales [a]	Mean	▼	143304	3420213 ***		138589	226004
	Median	▼	18917	355055 †††		18652	36188
Total assets [a]	Mean	▼	167591	11000000 ***	▼	129251	658348 ***
	Median	▼	10093	569656 †††	▼	9322	27826 †††
Profitability							
Ordinary income to total assets (ROI)	Mean	▼	-0.319	-0.019 **		-0.338	-0.084
	Median		0.002	0.004		0.010	-0.050
Value-added to sales	Mean	△	0.050	-5.356 *		0.029	0.416
	Median		0.173	0.274	▼	0.165	0.356 †
Operating income to sales	Mean		-0.450	-20.561		-0.467	-0.155
	Median		0.017	0.016		0.017	0.018
Ordinary income to sales	Mean		-0.472	-20.682		-0.484	-0.260
	Median		0.009	0.008		0.010	-0.006
Return on equity capital (ROE)	Mean		7.148	0.410		7.677	0.625
	Median		0.096	0.027	△	0.120	-0.087 †
Return on total assets (ROA)	Mean	▼	-0.145	-0.003 *		-0.152	-0.055
	Median		0.017	0.009	△	0.024	-0.019 ††
Ordinary income on equity capital	Mean		3.801	0.219		5.029	-11.300
	Median		0.014	0.011	△	0.029	-0.213 †
Productivity							
Value-added per employee [a]	Mean		3197	285		3166	3774
	Median		1417	1629		1417	986
Operating income per employee [a]	Mean		-902	-5952		-987	636
	Median		109	92		116	39
Ordinary income per employee [a]	Mean	△	846	-5244 *		1027	-2390
	Median		43	31	△	50	-504 †
Sales per employee [a]	Mean	△	17152	10376 **		17063	18841
	Median	△	6963	5571 ††		6999	4031
Sales to employment	Mean	△	48.086	10.622 *		50.422	7.025
	Median	△	6.706	2.204 †††	△	6.864	2.550 ††
Sales to total costs	Mean	△	1.149	0.872 ***	▼	1.110	1.823 ***
	Median	△	1.032	0.961 †††		1.035	1.017
Fixed investment efficiency	Mean		1.435	-1.282		1.505	0.295
	Median	△	0.825	0.372 ††		0.947	0.024
Financial ability							
Total assets turnover	Mean	△	4.494	1.023 **		4.679	1.251
	Median	△	1.778	0.773 †††	△	1.847	0.318 †††
Fixed assets turnover	Mean	△	10.200	4.361 ***		10.773	0.849
	Median	△	4.894	1.539 †††	△	5.714	0.127 ††
Financial soundness							
Fixed ratio	Mean	△	11.550	2.815 **		12.074	6.412
	Median	△	1.951	1.266 †††		1.800	6.909
Capital adequacy ratio (CAR)	Mean	▼	0.273	0.368 ***		0.269	0.330
	Median	▼	0.167	0.309 †††		0.163	0.292

[a] The unit is thousand HUF.

***, **, * Significant at the 1, 5, and 10% levels, respectively, by *t*-test.

†††, ††, † Significant at the 1, 5, and 10% levels, respectively, by the Wilcoxon rank-sum test.

△ denotes that privatized firms (firms acquired by domestic investors) are superior to SOEs (firms acquired by foreign investors) with statistical significance at the 10% or less level. ▼ denotes that privatized firms (firms acquired by domestic investors) are inferior to SOEs (firms acquired by foreign investors) with statistical significance at the 10% or less level.

Table V

Regression Analysis of Privatization Decision and Acquisition of Privatized Firms by Foreign Investors

This table presents the results of regression analyses on the presence and extent of selection bias regarding the privatization decision made by the Hungarian government and acquisition of privatized firms by foreign investors in comparison with those by domestic investors. The models [1] to [3] take the probability of privatization as a dependent variable and are estimated using probit maximum likelihood (ML) estimator. The models [4] to [6] take the probability of privatization and the probability of being acquired by foreign investors as dependent variables of the first and second stage of regression, respectively. We estimated the models [4] to [6] using the two-step probit ML estimator. As independent variables we employ the natural logarithm of total assets for 2002 to proxy for company size before privatization and a dummy variable, which takes one for the firms whose operating income was negative for 2002 as well as the six performance indices which differed at the 10% or less significance level between compared groups in Table IV. We also use dummy variables to control the fixed effects of the firm locations in the western and eastern regions and a dummy variable with a value of one if the firms operating in traditional public sectors. The *t*-values are reported in parentheses beneath regression coefficients. The Wald test tests the null-hypothesis that all coefficients are jointly zero. All SOE samples used for estimation of regression models are the same in Table III and IV.

Dependent variable	A. Probability of privatization			B. Probability of being acquired by foreign investors		
Estimator	Probit ML			Two-step probit ML		
Model	[1]	[2]	[3]	[4]	[5]	[6]
Pre-privatization company size						
Total assets (natural logarithm)	-0.409 ***	-0.470 ***	-0.476 ***	0.334 **	0.420 ***	3.817 *
	(-9.55)	(-10.54)	(-5.88)	(2.00)	(5.22)	(1.78)
Pre-privatization firm performance						
Firms with negative operating income		-0.344 *			0.796 ***	
		(-1.87)			(2.87)	
Value-added to sales			0.082			3.787 **
			(0.73)			(2.10)
Return on total assets (ROA)			-1.409			-8.301 **
			(-1.21)			(-2.21)
Ordinary income per employee			0.0001 *			-0.0002
			(1.77)			(-1.00)
Sales to total costs			0.594 *			-7.655 ***
			(1.85)			(-2.84)
Total assets turnover			0.274 *			-3.208 **
			(1.95)			(-2.07)
Fixed ratio			0.056 **			-0.340
			(2.19)			(-1.37)
Location						
Western region	-0.032	-0.118	-0.202	0.312	0.320	0.004
	(-0.18)	(-0.63)	(-0.62)	(0.95)	(1.22)	(0.08)
Eastern region	0.051	-0.034	0.209	-0.194	-0.220	-1.765
	(0.30)	(-0.19)	(0.78)	(-0.72)	(-0.83)	(-1.42)
Industrial sectors						
Traditional public sectors	-1.036 ***	-1.009 ***	-0.838 *	0.449	0.601	-0.177 **
	(-5.05)	(-5.12)	(-1.85)	(0.51)	(1.18)	(-2.27)
Const.	4.866 ***	5.738 ***	4.348 ***	0.000	-5.503 ***	0.682 *
	(9.66)	(10.93)	(4.68)	(0.00)	(-8.44)	(1.88)
N	499	477	196	499	477	196
N (The second stage)	-	-	-	223	210	124
Pseudo R^2	0.41	0.44	0.40	-	-	-
Log likelihood	-203.60	-183.92	-65.09	-269.30	-244.58	-7.26
Wald-test	126.93 ***	124.08 ***	57.94 ***	17.09 ***	48.85 ***	24.70 ***

***, **, * Significant at the 1, 5, and 10% levels, respectively.

Table VI
Meta-Analysis of the Effects of Ownership Transformation on Firm Performance

This table presents the results of synthesis of regression coefficients (effect sizes) of ownership variables estimated by the panel data regression analysis conducted as the third stage of our empirical analysis. The table also provides the results of supplemental analyses using the *p* -value combination method and the vote-counting method - more traditional meta-analysis techniques. See Section III for details of the meta-analysis methods. Here we employ the estimates of regression models selected according to the Hausman test and the Breusch-Pagan test. The critical value for both of these specification tests is set at the 10 % level. We verify the testable hypothesis presented in Section I basing on the value of synthesized regression coefficients and its statistical significance adopting either the meta fixed-effects model or the meta random-effects model according to the results of the homogeneity test. The SOE-inferior (SOE-superior) indices denote the financial and operating performance indices in which the mean or median for full SOEs regarding the relevant indices in Table II are inferior (superior) to those for private firms with statistical significance at the 10% or less level. The difference-insignificant indices refer to the indices which do not satisfy these conditions.

	Synthesis of regression coefficients			*p* -value combination method		Vote-counting method			*N*
	Meta fixed-effects (asymptotic *z* -value) [a]	Meta random-effects (asymptotic *z* -value) [a]	Homogeneity test	Inverse Chi-square method	Inverse normal method	Proportion of positive to negative estimates (*z* -value) [b]	Number of positively significant estimates (one-sided *z* -value) [c]	Number of negatively significant estimates (one-sided *z* -value) [c]	
A. All performance indices									
Ownership transformation without lower limit (Model I family)	-0.000	0.000	1459.143 ***	710.656 ***	5.801 ***	172/107 ***	33/276	24/276	276
	(-0.23)	(0.01)				(4.09)	(1.08)	(-0.72)	
Transfer of strategic control rights (Model II family)	-0.001	0.002	1490.377 ***	710.000 ***	5.803 ***	171/105 ***	33/276	23/276	276
	(-0.58)	(0.02)				(3.97)	(1.08)	(-0.92)	
Full privatization (Model III family)	-0.004 *	0.052 ***	1682.125 ***	746.838 ***	5.854 ***	177/99 ***	36/276 **	16/276	276
	(-1.68)	(2.92)				(4.70)	(1.69)	(-2.33)	
Ownership transformation to domestic investors (Model IV family)	-0.000	-0.004	305.088 ***	509.124 ***	4.757 ***	113/67 ***	21/180	9/180	180
	(-0.74)	(-0.66)				(3.43)	(0.75)	(-2.24)	
Ownership transformation to foreign investors (Model V family)	-0.041 *	0.274 ***	699.528 ***	444.988 ***	4.694 ***	107/70 ***	28/177 ***	11/177	177
	(-1.89)	(3.75)				(2.78)	(2.58)	(-1.68)	
B. SOE-inferior indices									
Ownership transformation without lower limit (Model I family)	0.005 **	0.069 ***	551.471 ***	312.164 ***	3.861 ***	77/43 ***	16/120	6/120	120
	(2.08)	(4.41)				(3.10)	(1.22)	(-1.83)	
Transfer of strategic control rights (Model II family)	0.009 ***	0.078 ***	530.535 ***	313.094 ***	3.867 ***	77/43 ***	16/120	5/120	120
	(3.72)	(4.34)				(3.10)	(1.22)	(-2.13)	
Full privatization (Model III family)	0.013 ***	0.117 ***	499.806 ***	311.135 ***	3.897 ***	80/40 ***	13/120	3/120	120
	(4.08)	(4.99)				(3.65)	(0.30)	(-2.74)	
Ownership transformation to domestic investors (Model IV family)	-0.034	0.042 **	112.714 ***	217.186 ***	3.118 ***	49/29 **	8/78	3/78	78
	(-0.75)	(2.41)				(2.26)	(0.08)	(-1.81)	
Ownership transformation to foreign investors (Model V family)	-0.021	0.466 ***	313.841 ***	220.249 ***	3.096 ***	49/27 **	14/76 ***	6/76	76
	(-0.60)	(3.93)				(2.52)	(2.45)	(-0.61)	

(continued)

(**Table VI** continued)

	Synthesis of regression coefficients			*p* -value combination method		Vote-counting method			*N*
	Meta fixed-effects (asymptotic *z* -value) [a]	Meta random-effects (asymptotic *z* -value) [a]	Homogeneity test	Inverse Chi-square method	Inverse normal method	Proportion of positive to negative estimates (*z* -value) [b]	Number of positively significant estimates (one-sided *z* -value) [c]	Number of negatively significant estimates (one-sided *z* -value) [c]	
C. SOE-superior indices									
Ownership transformation without lower limit (Model I family)	-0.036 ***	-0.105 ***	282.294 ***	57.344	1.744 *	13/17	3/30	9/30 ***	30
	(-5.67)	(-3.03)				(-0.73)	(0.00)	(3.65)	
Transfer of strategic control rights (Model II family)	-0.045 ***	-0.089 ***	312.985 ***	57.463	1.745 *	13/17	3/30	9/30 ***	30
	(-7.32)	(-2.57)				(-0.73)	(0.00)	(3.65)	
Full privatization (Model III family)	-0.069 ***	-0.041	539.425 ***	68.870	1.772 *	13/17	5/30	9/30 ***	30
	(-12.20)	(-1.06)				(-0.73)	(1.22)	(3.65)	
Ownership transformation to domestic investors (Model IV family)	-0.001	-0.032 ***	79.697 ***	28.087	1.094	5/7	1/12	6/12 ***	12
	(-0.46)	(-2.82)				(-0.58)	(-0.19)	(4.62)	
Ownership transformation to foreign investors (Model V family)	-0.041	-0.044	18.374 *	19.662	1.125	5/7	1/12	2/12	12
	(-1.21)	(-0.82)				(-0.58)	(-0.19)	(0.77)	
D. Difference-insignificant indices									
Ownership transformation without lower limit (Model I family)	-0.018	-0.044	586.949 ***	341.148 ***	3.967 ***	82/44 ***	14/126	9/126	126
	(-1.42)	(-0.82)				(3.39)	(0.42)	(-1.07)	
Transfer of strategic control rights (Model II family)	-0.009	-0.038	579.511 ***	339.442 ***	3.962 ***	81/45 ***	14/126	9/126	126
	(-0.56)	(-0.61)				(3.21)	(0.42)	(-1.07)	
Full privatization (Model III family)	0.018 *	0.073	476.781 ***	366.833 ***	3.996 ***	84/42 ***	18/126 **	4/126	126
	(1.88)	(1.35)				(3.74)	(1.60)	(-2.55)	
Ownership transformation to domestic investors (Model IV family)	0.046 ***	0.054 ***	104.287	263.851 ***	3.426 ***	59/31 ***	12/90	0/90	90
	(2.86)	(3.68)				(2.95)	(1.05)	(-3.16)	
Ownership transformation to foreign investors (Model V family)	-0.087 *	0.395 **	366.141 ***	205.077 **	3.346 ***	53/36 *	13/89 *	3/89	89
	(-1.71)	(2.36)				(1.80)	(1.45)	(-2.08)	

[a] Null hypothesis: The synthesized effect size is zero.

[b] Null-hypothesis: The proportion of positive to negative estimates is 50/50.

[c] Null-hypothesis: The proportion of estimates with statistical significance at the 10% or less level is less than 10% .

***, **, * Significant at the 1, 5, and 10% levels, respectively.

Table VII
Definitions and Descriptive Statistics of the Variables Used in the Meta-Regression Analysis

This table details the definitions and descriptive statistics of the variables used in the meta-regression analysis, the estimation results from which are reported in Table VIII. The SOE-inferior (SOE-superior) indices denote the financial and operating performance indices in which the mean or median for full SOEs regarding the relevant indices in Table II are inferior (superior) to those for private firms with statistical significance at the 10% or less level. The elements of each of four index groups correspondence with those in Table II. CV and BD denotes a continuous variable and a binary dummy variable, respectively. S.D. denotes standard deviation.

Variable name	Definition	Mean	S. D.	Median
Effects of ownership transformation (dependent variable)	CV: Regression coefficients of ownership variables (effect sizes)	0.451	7.738	0.165
SOE-inferior indices	BD: 1 = if a SOE-inferior index is used as a dependent variable	0.434	0.496	0
SOE-superior indices	BD: 1 = if a SOE-superior index is used as a dependent variable	0.096	0.295	0
Transfer of strategic control rights	BD: 1 = An estimate of the effects of 50% or more ownership transformation	0.233	0.423	0
Full privatization	BD: 1 = An estimate of the effects of full privatization	0.233	0.423	0
Ownership transformation to domestic investors	BD: 1 = An estimate of the effects of ownership transformation to domestic investors	0.152	0.359	0
Ownership transformation to foreign investors	BD: 1 = An estimate of the effects of ownership transformation to foreign investors	0.149	0.357	0
One-year lag	BD: 1 = An estimate of the one-year lag effects of ownership transformation	0.334	0.472	0
Two-year lag	BD: 1 = An estimate of the two-year lag effects of ownership transformation	0.332	0.471	0
Manufacturing	BD: 1 = if samples are manufacturing enterprises	0.291	0.454	0
Construction	BD: 1 = if samples are construction enterprises	0.246	0.430	0
Services	BD: 1 = if samples are service enterprises	0.289	0.453	0
Productivity index group	BD: 1 = if a productivity index is used as a dependent variable	0.283	0.450	0
Financial ability index group	BD: 1 = if a financial ability index is used as a dependent variable	0.085	0.279	0
Financial soundness index group	BD: 1 = if a financial soundness index is used as a dependent variable	0.085	0.279	0
Firm growth index group	BD: 1 = if a firm growth index is used as a dependent variable	0.228	0.420	0
Fixed effects estimator	BD: 1 = if a fixed effects estimator is used	0.333	0.471	0
Random effects estimator	BD: 1 = if a random effects estimator is used	0.333	0.471	0
Selected models	BD: 1 = An estimate obtained from regression models selected by the model specification tests	0.333	0.471	0
Number of observations	CV: A natural logarithm of the number of observations used in a panel estimation	5.351	0.646	5.142

Table VIII
Meta-Regression Analysis

This table presents the estimation results of meta-regression models that take the effects of ownership transformation on post-privatization firm performance estimated by panel regression analyses conducted as the third stage of the empirical analysis as a dependent variables. The dependent variable is regressed into the meta-independent variables having the characteristics of the regression model and observations that are considered to create differences in panel estimation results. To estimate the meta-regression models, we use five estimator for robustness check: (1) weighted least square (WLS) estimator with number of observations as analytical weights: (2) WLS estimator with standard errors as analytical weights; (3) meta random-effects estimator using the restricted maximum likelihood method (RML); (4) meta random-effects estimator using the non-iterative moment method (MM); (5) meta mixed-effects estimator using RML method. Models [1] through [5] are the estimation results from the meta-regression models covering all panel estimates and Models [6] through [10] are the estimation results using only the estimates of the selected models according to the model specification tests. The definitions and descriptive statistics of the variables used in the estimations are listed in Table VII. The *t*-test and the Wald test test the null-hypothesis that all coefficients are jointly zero.

Dependent variable	Effects of ownership transformation (all models)					Effects of ownership transformation (selected models)				
Estimator	WLS [*N*]	WLS [s.e.]	Random effects RML	Random effects MM	Mixed effects RML	WLS [*N*]	WLS [s.e.]	Random effects RML	Random effects MM	Mixed effects RML
Independent variable (default category)/model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Effects of ownership transformation in default conditions (intercept)	2.524 ***	18.191	0.135 ***	0.229 ***	0.925	2.249 **	8.589	0.114	0.107	3.177
	(3.46)	(1.41)	(4.29)	(2.74)	(0.21)	(2.44)	(0.31)	(1.17)	(0.65)	(0.48)
Performance differences (difference-insignificant indices)										
SOE-inferior indices	0.144	0.055	0.011 ***	0.048 ***	1.470 ***	0.707 *	2.424 ***	0.035 ***	0.067 ***	0.671
	(0.55)	(0.11)	(3.05)	(4.64)	(4.71)	(1.67)	(3.21)	(3.27)	(3.02)	(1.33)
SOE-superior indices	-0.422	-5.188 **	-0.135 ***	-0.145 ***	1.087	-0.782 *	-2.250 *	-0.319 ***	-0.189 ***	0.948
	(-0.64)	(-2.49)	(-8.68)	(-9.01)	(1.62)	(-1.73)	(-1.81)	(-8.62)	(-6.15)	(0.91)
Scale of ownership transformation (without lower limit)										
Transfer of strategic control rights	-0.009	0.209 *	0.0008 ***	0.0047	0.015	0.005	0.030	0.001	0.001	0.007
	(-0.02)	(1.75)	(3.92)	(0.47)	(0.04)	(0.01)	(0.03)	(0.33)	(0.03)	(0.01)
Full privatization	0.051	0.426	0.006 **	0.021 **	0.137	0.093	0.789	0.006	0.044 **	0.185
	(0.14)	(0.61)	(2.55)	(2.12)	(0.37)	(0.16)	(0.78)	(1.58)	(2.12)	(0.31)
Types of ownership transformation (no classification)										
Ownership transformation to domestic investors	-0.209	-0.471	-0.015 ***	0.018	-0.039	-0.425	-2.824 **	0.000	0.013	-0.173
	(-0.54)	(-0.61)	(-7.52)	(1.45)	(-0.09)	(-0.68)	(-2.46)	(-0.11)	(0.52)	(-0.25)
Ownership transformation to foreign investors	1.700 ***	2.154 ***	0.063 ***	0.054 ***	1.381 ***	2.623 ***	7.987 ***	0.008	0.005 **	2.393 ***
	(4.36)	(2.64)	(3.79)	(2.61)	(3.26)	(4.20)	(6.03)	(0.38)	(2.17)	(3.49)
Time-lag effects (no lag)										
One-year lag	-1.860 ***	-3.291 ***	-0.007 ***	-0.074 ***	-0.811 ***	-1.658 ***	-1.763	-0.007 **	-0.121 ***	-0.711
	(-6.33)	(-5.05)	(-3.26)	(-8.08)	(-2.66)	(-3.53)	(-1.49)	(-2.04)	(-6.50)	(-1.44)
Two-year lag	-3.168 ***	-14.768 ***	-0.004 *	-0.019 **	-2.871 ***	-2.487 ***	-12.779 ***	-0.007 **	-0.023	-2.541 ***
	(-6.78)	(-8.11)	(-1.83)	(-1.98)	(-9.41)	(-5.28)	(-4.62)	(-2.29)	(-1.22)	(-5.14)
Industrial sector (agriculture, forestry, hunting and fishing)										
Manufacturing	0.449	5.172 ***	-0.033 ***	-0.019	0.662	0.347	4.945 *	0.070 ***	0.104 ***	0.145
	(0.81)	(3.27)	(-4.84)	(-1.63)	(1.41)	(0.38)	(1.89)	(7.17)	(4.08)	(0.18)
Construction	-1.191 **	0.054	-0.058 ***	-0.087 ***	-1.177 **	-0.446	-5.465	0.040 ***	0.029	-0.620
	(-2.15)	(0.03)	(-7.73)	(-6.10)	(-2.10)	(-0.50)	(-1.60)	(3.19)	(1.02)	(-0.70)
Services	-0.217	9.269 **	-0.065 ***	-0.006	-0.433	0.256	-7.739	0.089 ***	0.123 **	-1.004
	(-0.44)	(2.03)	(-6.36)	(-0.22)	(-0.30)	(0.32)	(-0.78)	(2.76)	(2.22)	(-0.45)

(continued)

(**Table VIII** continued)

Independent variable (default category)/model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Performance index group (profitability index group)										
Productivity index group	-0.228	-3.164 ***	0.028 ***	0.009	-0.707	-0.272	1.279	-0.030 ***	0.034	-0.315
	(-0.71)	(-4.02)	(4.85)	(0.52)	(-0.61)	(-0.53)	(0.93)	(-3.46)	(1.12)	(-0.26)
Financial ability index group	-0.728	-3.023	0.010	-0.102 ***	-0.960	-0.970	0.481	-0.104 ***	-0.083 **	-0.597
	(-1.43)	(-1.03)	(1.61)	(-5.03)	(-0.55)	(-1.19)	(0.11)	(-6.67)	(-2.32)	(-0.33)
Financial soundness index group	-0.479	-5.098	0.103 ***	0.064 ***	-1.190	-0.681	-2.918	0.139 ***	0.081 **	-1.050
	(-0.71)	(-0.98)	(12.95)	(3.09)	(-0.68)	(-0.60)	(-0.33)	(9.97)	(2.17)	(-0.54)
Firm growth index group	-0.383	-2.151 ***	0.048 ***	0.017	-0.461	-0.683	-2.315 ***	-0.029 **	0.018	-0.666
	(-1.22)	(-3.43)	(7.91)	(0.94)	(-0.37)	(-1.35)	(-2.62)	(-2.49)	(0.56)	(-0.52)
Estimators (pooled OLS estimator)										
Fixed effects estimator	-0.336	0.390	0.056 ***	0.026 ***	0.028	0.197	-2.282	0.108 ***	0.140 ***	0.479
	(-0.66)	(0.29)	(7.61)	(2.61)	(0.07)	(0.15)	(-0.62)	(6.98)	(6.01)	(0.45)
Random effects estimator	0.055	0.962	0.038 ***	0.001	-0.002	-0.778	-10.019 ***	-0.146 ***	-0.096 **	-0.227
	(0.11)	(0.76)	(6.44)	(0.11)	(0.00)	(-0.94)	(-6.81)	(-5.19)	(-2.37)	(-0.32)
Selected models (non-selected models)	0.083	-1.064	0.039	-0.005	0.013	-	-	-	-	-
	(0.17)	(-0.85)	(0.78)	(-0.53)	(0.03)					
Number of observations	-	-2.295	-0.018 ***	-0.032 **	0.088	-	-3.040	-0.020	-0.031	0.875
		(-0.87)	(-2.60)	(-1.88)	(0.10)		(-0.52)	(-1.02)	(-0.95)	(0.64)
N	3555	3555	3555	3555	3555	1185	1185	1185	1185	1185
Adjusted R^2	0.042	0.214	-	-	-	0.042	0.237	-	-	-
F-test	9.57 ***	51.79 ***	-	-	-	4.01 ***	20.13 ***	-	-	-
Wald-test	-	-	1137.52 ***	557.51 ***	157.20 ***	-	-	1113.14 ***	260.24 ***	52.01 ***

***, **, * Significant at the 1, 5, and 10% levels, respectively.