

## **Privatization Benefits in Eastern Europe**

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### **Abstract.**

We document changes in the performance of over 6,000 privatized and state-owned manufacturing enterprises in seven Eastern European countries over the initial transition period. We find that privatization is associated with significant increases in sales revenues and labor productivity, and, to a lesser extent, with fewer job losses. The positive effect of privatization is stronger in economic magnitude and statistical significance as the time elapsed since privatization increases. Enterprises privatized for less than two years have labor productivity growth similar to that of state-owned enterprises. In contrast, enterprises privatized for three or more years significantly outperform state-owned enterprises. The results are robust to the use of alternative econometric specifications (fixed-effects, cluster-effects, and random effects), and survive in six of the seven individual country samples (the exceptions being Hungary for sales growth and Romania for labor productivity growth).

Keywords: Privatization, Eastern Europe.

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## 1. Introduction

Many countries have launched large-scale privatization programs in the last two decades, including both developing countries and developed countries.<sup>1</sup> The most ambitious privatization programs, however, have been the ones undertaken in the transition economies of Eastern Europe. In these economies, all enterprises were state-owned in 1990, but by 1996 several governments had privatized the majority of them. For example, 80% of Czech manufacturing enterprises were transferred to private hands in the period 1992-95. Despite the scale of these privatization programs, empirical evidence on the effects of privatization on enterprise performance in Eastern Europe has only recently become available.

In this paper, we estimate the effect of privatization on enterprise performance, using a sample of over 6,000 former and state-owned firms from seven Eastern European countries (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia) during the initial transition period of 1992 to 1995. We use sales growth, the rate of job destruction, and labor productivity growth as alternative measures of firm performance. We follow the performance of privatized firms relative to state-owned firms in the same sector and country. We also construct cohorts of firms by their year of privatization, to test the importance of the length of privatization on the magnitude of performance changes.

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<sup>1</sup> Megginson et al. (1994) and Boubakri and Cosset (1998) review studies on privatization effects in developing countries and La Porta and Lopez-de-Silanes (1999) analyze the Mexican privatization program. Bailey (1986) and Kay and Thompson (1986) analyze the privatization experience in the United States and the United Kingdom, respectively. Megginson and Netter (2000) review the literature on privatization in both developing and developed countries.

Our data differ significantly from the data used in the previous cross-country studies on the effect of privatization in Eastern Europe, Frydman et al. (1999) and Konings (1997). Data collection, including sample design, was carried specifically for each of these studies. This raised the quality and the extensiveness of information collected. For example, the researchers could ask detailed questions on the type and concentration of ownership in each firm. On the other hand, the survey methodology caused sample sizes to be small. It also limited the number of years for which data could be collected. Frydman et al. (1999) examine the performance of 218 privatized and state-owned firms from the Czech Republic, Hungary, and Poland in the period 1990 to 1993. Konings (1997) is based on a survey of 346 firms in Hungary, Romania, and Slovenia. Firms were visited by interviewers once, in the period September 1996 to April 1997, and disclosed financial information only for 1996. The cross-sectional nature of these data do not permit an investigation of the effects of ownership change over time.

In contrast, our data are collected from the statistical office in each sample country and cover all manufacturing firms that were registered as state-owned enterprises in 1991 and had more than 25 employees. Firms report full balance sheet and income statements for the end of fiscal years 1992 through 1995. This results in a sample of 6,354 firms, with over 700 firms in each country. The large-size sample allows us to use econometric techniques that are too demanding on survey-based data sets, e.g., cluster analysis. Also important, the panel nature of our data allow us to track the evolution of ownership over the 1991-1995 period, which is not possible in survey data that take a snapshot of ownership at a given point in time. Finally, the use of comparable data for enterprises in all seven Eastern European countries permits us to see whether the effects of privatization are similar across countries.

Comparing the relative performance of privatized and state-owned enterprises, we find that privatization is associated with significant increases in sales growth and labor productivity, and, to a lesser extent, with fewer job losses. These effects strengthen in economic magnitude and statistical significance as the time elapsed since privatization increases. For example, the performance of firms that have been privatized for less than two years do not differ significantly from that of state-owned firms. In contrast, firms that have been privatized for three or more years always display better performance than state-owned firms. The findings are robust to the use of fixed-effects, cluster, and random-effects specifications. They hold in six of the seven country samples. The only exceptions are that privatized and state-owned firms display similar sales growth in Hungary, and that in Romania the labor productivity growth of privatized is statistically indistinguishable from that of state-owned enterprises.

These results complement the existing literature on privatization in transition economies that has primarily focused on examining the effects of different owners. Frydman et al. (1999) examine outsiders, insiders, and the state in one set of analyses, and foreign owners, domestic financial firms, domestic non-financial firms, domestic individuals, the state, workers, and managers in another set of analyses. Anderson et al. (2000) use a survey of over 500 privatized firms in Mongolia to contrast the effect of residual state versus outsider versus insider ownership. Frydman et al. show that foreigners and domestic financial firms produce large positive effects, while outsider owners outperform insiders. Anderson et al. find that outsiders and insiders perform less effectively than the state in partially privatized enterprises, while there is no statistically significant difference between insiders and outsiders. Djankov and Murrell (2000) summarize the results of 21 other empirical studies on the effects of various types of owners on increasing productivity in transition economies.

The paper is organized as follows. Section 2 documents the data set, and its drawbacks, and provides descriptive statistics on all variables of interest. Section 3 reports the results from the empirical tests. Section 4 concludes.

## **2. Data Description**

We have firm-level data (balance sheet and income statements) for 1992-95 obtained from the National Statistical Offices in Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovak Republic, and Slovenia. The data cover all manufacturing firms that were registered as state-owned enterprises in 1991 and had more than 25 employees. The data, although not complete manufacturing census, are representative of the manufacturing sector in each country.

We exclude all firms that have missing observations and form balanced panels, i.e. all firms appear throughout the 1992 to 1995 period. In three countries (Romania, Slovak Republic, Slovenia) we have almost full coverage in terms of employment, while the data for the other four countries contain about half of the manufacturing sector. The latter is due to two reasons. First, small firms are not included in the data. In countries where small business was allowed to operate prior to 1991 – Bulgaria, Hungary and Poland - a relatively larger number of firms are missing. Second, countries that have introduced changes in enterprise registration codes also show smaller coverage. This is the case for the Polish and (to a lesser extent) Bulgarian data.<sup>2</sup> The majority of excluded Hungarian firms (483 observations) have missing values between the

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<sup>2</sup> During the 1993-95 period, over 1,700 Polish manufacturing firms were sold through liquidation-privatizations. The process meant that a new company emerged, which was not easily traceable to the old state firm. This helps explain why only 1,066 Polish enterprises in our initial data set of 2,453 report consistently in the 1992 to 1995 period.

beginning and end of the sample period, which suggests that they were not liquidated and the bias introduced through non-survivorship is small. There is no new entry of state-owned enterprises in the sample period (entry through split-ups and spin-offs is captured in the data). The information concerning exit of enterprises is not utilized here since we cannot distinguish between apparent exit, due to non-reporting and true exit, due to liquidation, mergers and acquisitions.

Table 1 lists for each country the number of firms in the data set, aggregate employment in 1992, and the share of the sample of firms in total manufacturing employment (Panel A), and the sectoral distribution of employment (Panel B), as well as the mean and median number of employees (Panel C). The data cover altogether 6,354 firms with over 6.5 million employees. Polish and Romanian firms are the largest among the seven countries - they have a mean number of employees of 911 and 1,521 respectively, with the largest firms having 21,457 and 37,824 employees respectively. This is hardly surprising since the two countries have also the largest total population among the sample countries. The sectoral distribution of employment in the data set varies across countries, with Bulgaria, the Czech Republic, and Poland displaying a high concentration in the non-electrical machinery sector, Hungary in textiles, Romania and the Slovak Republic in fabricated metals, and Slovenia in electrical machinery.

Although international accounting standards were introduced in all seven countries (as of January 1992 in (then) Czechoslovakia, in 1993 in Hungary, Poland, and Slovenia, and in January 1995 in Bulgaria and Romania), many firms reported according to the old standards. For those firms, we have used the conversion tables to international accounting standards for each country as produced by PriceWaterhouseCoopers. Sales and inventory changes are reported in all cases. This allows us to adjust the revenue numbers to account for sold, rather

than produced, output during the period when firms still used old accounting conventions. Firm-specific output prices are not available. Instead, we use output price indices at the industry level, as reported by the respective statistical offices. All nominal values are deflated using these price indices. This limits the comparisons between firms within the same sector and country, but would not appear to introduce a significant bias in comparisons across sectors or countries.

The data on factor inputs include detailed information on firm expenditures and employment. Expenditures on electricity are available separately from other material inputs' expenditures. Industry-level input and electricity price indices reported by the statistical offices are used to deflate nominal values. In particular, we use industry-matched PPI indices to adjust all product prices and the aggregate CPI index to adjust the values of all remaining nominal quantities. We use purchased inputs rather than used inputs in constructing our material input variable. Under this definition, output produced using materials drawn from inventory results in increased productivity.<sup>3</sup>

**[Table 1 here]**

Each firm reports its ownership status starting in 1991. In particular, the data show what ownership share of the firms went (was) private in a given year. To avoid differences in the definition of private firms, we call a firm privatized when more than a third of its shares is privately owned. This choice was made based on the corporate laws of the countries. In all seven countries, major strategic and investment decisions at the firms' Board of Directors could only be taken with two-thirds majority. Thus if more than one-third of shares were privately owned, private owners could collectively block decisions at the Board. Based on this criterion,

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<sup>3</sup> We also try the used materials' expenditures as a basis for the material input variable. The results are robust to either specification.

the sample contains 1,286 firms privatized before 1993, 1,383 firms privatized in 1993, 512 firms privatized in 1994, and 3,173 firms which remained in state ownership at the end of the period (Table 1, Panel D). The Czech and Slovak Republics have the largest share of privatized enterprises at the end of the period – 79.4% and 78.9% respectively. Bulgaria and Romania, on the other hand, privatized only 6.8% and 7.3% of their manufacturing sector during the sample period.

We also use a 66% privatization cut-off as a robustness check. According to this definition, 1,028 firms were privatized before 1993, 838 firms were privatized in 1993, 427 firms were privatized in 1994, and 4,061 firms remained state-owned at the end of the period. Since the use of this alternative definition does not change the qualitative results of the regression analysis in Section 3, we only report the findings with the 33% privatization definition, but discuss the robustness to the alternative privatization definition in the text.

The ownership data have four drawbacks. First, the short time-period allows us to capture the effect of privatization for a maximum of four years following privatization. We might therefore underestimate the benefits of privatization, especially since we rely on quantitative indicators of changes in performance.<sup>4</sup> Second, privatization can have positive spillover effects within a country. Privatization can create, for example, a market for managers and thus encourage managers of state-owned enterprises to perform better, e.g., Barberis et al. (1996) document this phenomenon in the Russian context. It also spurs institutional development, for example, the establishment of credit bureaus and commercial courts, thereby enhancing overall enterprise performance. Our specification may therefore underestimate the privatization effect at the firm level, attributing part of it to the improving overall economic

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<sup>4</sup> The magnitude of such a bias is estimated in Djankov and Murrell (2000), p.36.

environment. Third, there may be an endogeneity problem in the selection of enterprises for privatization. Previous literature, e.g., Frydman et al. (1999), attempts to control for this problem by using instrumental variables techniques. The findings, surveyed in Djankov and Murrell (2000), suggest that for Eastern European countries the enterprise restructuring efforts were on average invariant to the adjustment for endogeneity. This is because the bias was for privatizing better enterprises in Bulgaria, the Czech Republic, Hungary, and Romania, and worse performing firms in Poland, Slovakia, and Slovenia.

Finally, the data do not allow us to distinguish among different types of investors during the privatization process. This limits our ability to interpret the results from the regression analysis and to properly account for the effects of ownership types. Previous literature, including Frydman et al. (1999) and Djankov and Murrell (2000), show that there is a large difference in post-privatization performance across ownership types, with the best owners (strategic foreign investors) being associated with eight times higher productivity growth than the worst owners (diffuse individual owners).

The literature on enterprise performance measurement relies heavily on Tornquist approximations of Divisia indices or on production function estimates. Since we use data for transition economies, there are many reasons to suspect that Divisia indices may be inappropriate to measure productivity changes. The production function approach is particularly useful when the underlying assumptions of the former (constant returns to scale, perfect competition, and profit maximization) are too demanding. On the other hand, production function estimates involve the use of book values of fixed assets, which may be inaccurate and are likely to introduce significant noise in the estimation. Managers of still state-owned firms, for example, may have an interest in reducing the reported value of capital in order to lower the price at which

they would purchase the firm, thus inflating productivity growth. Since the data come from statistical offices, however, they are robust to accounting fraud prior to 1992. In line with the recent empirical literature on enterprise performance in transition economies, we therefore use sales growth, the rate of job destruction, and labor productivity growth as our alternative indicators of enterprise performance.

**[Table 2 here]**

Table 2 reports the median sales growth of the sample firms, divided into 2-digits SIC industries, with the mapping from the NACE to the SIC industrial classification provided by the Statistical Office of the European Union (Eurostat). These numbers are reached by taking the average growth of real sales for 1992-1993, 1993-1994, and 1994-1995 for each firm. Within a country, we then calculate the median sales growth across all sample firms. In other words, the number for the food sector in Bulgaria tells us that the sales revenue of the median Bulgarian food-producer declined by 8.38% on average during 1992-1995. Several observations merit attention. First, virtually all sectors in Bulgaria, Romania, and the Slovak Republic recorded negative sales growth during the sample period. This decline was especially pronounced in the heavy industries (SIC codes 33 to 38) in Bulgaria and the light industries (SIC codes 20-24) in Romania. In contrast, only one industry (rubber) recorded an output decline in Slovenia, while the majority of industries in Hungary and Poland had positive growth. This pattern may be in part due to the timing of overall reform efforts, as Bulgaria and Romania started their reform programs in earnest only in 1993.

We also report Z-statistics testing the equality of the distributions of sales growth in privatized and state-owned firms. Privatization is dummied by a variable equal to one if a firm was privatized by the end of 1995, zero otherwise. In six of the seven sample countries,

privatized firms showed higher sales growth or smaller declines in sales revenues than state-owned firms. The exception is Hungary, where privatized firms grew faster than state-owned firms, by 1.32 percent and by  $-0.66$  percent respectively, but where the growth rates were not statistically significant, with a Z-statistic of 1.40. The largest difference between privatized and state firms is documented in Slovakia, where sales revenues of privatized firms declined by 4.27% each year during 1992 through 1995, while sales revenues of state-owned firms declined by 10.80% each year. The difference in sales growth between privatized and state-owned firms is highly significant for the sample as a whole, with a Z-statistic of 17.30.

**[Table 3 here]**

Table 3 reports the median labor shedding for each of the seven countries. Remarkably, with the exception of the lumber, petroleum, and transport equipment sectors in Slovenia, employment fell in all sectors in all seven countries. The largest job decline took place in Bulgaria (SIC codes 21, 22, 25, 31, 35-38) and Romania (SIC codes 20-22, 24, 27, 30-31, 35-36, 38). Privatization is associated with a lower rate of labor shedding for the sample as a whole, with privatized firms reducing their labor force by 6.11% on average each year, and state-firms reducing employment by 7.42%. The Z-test of the difference in the distribution of labor shedding in privatized and state-owned firms is significant at the 1% level, with a value of 9.10. Country samples display a mixed picture, however. Privatization is associated with less labor shedding in Romania, Slovakia, and Slovenia, and with more labor shedding in the Czech Republic. There is no evidence of a difference in the rates of labor shedding between privatized and state-owned firms in Bulgaria, Hungary, and Poland.

The empirical literature on transition is divided on the question of whether labor shedding should be viewed as evidence of more enterprise restructuring. Some scholars, e.g.,

Frydman et al. (2000) argue that restructuring firms will expand faster (or shrink less), and as a result that labor shedding is a proxy for less enterprise restructuring. Other papers point out that excess labor was a characteristic feature of socialist enterprises and that labor shedding should be viewed as evidence that the new managers or owners are laying off under-utilized workers. While we tend to give more credit to the Frydman et al. argument, we report the labor change statistics mostly to give the reader a feel for the data and not as a variable that necessarily captures the essence of restructuring.

**[Table 4 here]**

Table 4 documents the median labor productivity growth by industry. Only in 9 out of 95 sectors-country observations in the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia were the median productivity growths negative. In contrast, only one-third of the manufacturing sectors in Bulgaria and Romania recorded productivity improvements. These descriptive statistics suggest that the transition process in the two Balkan countries lagged behind those of the Central European countries. The difference in labor productivity growth between privatized and state-owned enterprises is statistically significant in Bulgaria, the Czech Republic, Hungary, Poland, Slovakia, and Slovenia, with Z-test values of 4.70, 1.71, 2.08, 1.74, 6.64, and 5.56, respectively. The difference is also highly statistically significant for the sample as a whole, with a Z-statistic of 13.63. Only in Romania is labor productivity growth similar in privatized and state-owned firms.

The descriptive statistics so far point to the importance of privatization in improving enterprise performance in the early years of transition in Eastern Europe. The evidence on sales growth and labor productivity growth strongly supports the view that privatization brings about the necessary impetus for improvement in firms' behavior. As stated earlier, theory does not

yield unambiguous hypotheses for the effect that privatization (or any reform associated with restructuring) should have on labor shedding. The fact that privatization seems to be associated with less labor shedding does, however, alleviate fears of policy makers that mass lay-offs will take place as a result of the ownership change. We find evidence to suggest that this fear is unfounded.

### **3. Regression Analysis**

We use three alternative specifications to estimate the effect of privatization on enterprise performance: fixed effects, cluster effects, and random effects. We use the fixed-effects specification as our benchmark specification, since it does not require any assumptions on the correlation between country effects and other (firm- or sector-level) explanatory variables, while it still controls for omitted country and industry effects. The fixed-effects specification reduces the power of the regression analyses, however, as it increases the number of right-hand side variables. The cluster-effects specification controls for industry effects in that it allows the error terms in the regressions to be correlated within industry groups. The error terms within countries are assumed to be uncorrelated, however, which may introduce a bias. Finally, the random-effects estimation allows the industry effects to have a variance, instead of being fixed across countries and years. However, this specification assumes no correlation between the right-hand side variables and the random industry effect. Since each specification has weaknesses, we use all three specifications in the regression analysis. If the findings are consistent across specifications, we are reasonably assured of the robustness of our results.

**[Table 5 here]**

Table 5 reports the estimation results. The data are organized as a cross-section panel, where the dependent variable is the median annual sales, employment, and labor productivity

growth as described in Tables 2-4, while the explanatory variables are dummies for the time passed since privatization. The time component is captured by different sets of dummies on privatization, i.e., a dummy for firms privatized in or before 1992, a dummy for firms privatized in 1993, a dummy for firms privatized in 1994, and a dummy for firms that remained in state ownership at the end of 1995 or were privatized in that year. The latter category includes firms privatized in 1995, since we consider the time too short for the effect of privatization to show up. If the effect of privatization were to arise in such a short time, it would bias our results against documenting any differences between state and private ownership. State ownership is associated with lower sales and labor productivity growth<sup>5</sup> and more labor shedding in nearly all specifications. These results are statistically significant in all cases, but specification (v). There is a monotonically increasing relationship between the time passed since privatization and improvements in enterprise performance. In particular, enterprises privatized for three or more years grew 6.5% faster each year than still state-owned enterprises, as seen in column (i) by comparing the coefficients on the first and last ownership dummy. This is due to the fact that this cohort of privatized enterprises laid off 2.2% less workers (column iv) and had a 4.3% higher labor productivity growth on average (column vii). In contrast, enterprises privatized in 1994 had a decline in sales revenues and labor productivity over the sample period, and performed only marginally better than state-owned enterprises. In particular, there is no statistically significant

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<sup>5</sup> In Claessens and Djankov (1998) we control for the initial level of labor productivity and find that the results are not qualitatively changed. This is because privatization was associated with enterprises with higher initial labor productivity in Bulgaria, the Czech Republic, Hungary, and Romania, and lower initial labor productivity in Poland, Slovakia, and Slovenia. These biases cancelled each other in the regression analysis on the whole sample.

difference in labor productivity growth of enterprises privatized in 1994, and enterprises privatized in 1995 or enterprises that remained in state ownership by the end of the sample period.

We also use F-tests –  $F(1, 6325)$  - to compare the relative performance of enterprises in different privatization cohorts. The tests are based on the regression coefficients reported in the fixed-effects specifications. Enterprises privatized in or before 1992, enterprises privatized in 1993, and enterprises privatized in 1994 all have higher sales growth than state-owned enterprises, with F-statistics of 72.09, 18.94, and 4.17, respectively. The former two are significant at the 1% level while the latter is significant at the 5% level. All privatized cohorts are also shown to have a lower rate of job destruction, with F-statistics of 11.76, 3.26, and 3.62, respectively. The latter two statistics are significant only at the 10% level. Finally, enterprises privatized in 1992 or before and enterprises privatized in 1993 are shown to have higher labor productivity growth relative to state-owned enterprises, with F-statistics of 42.57 and 10.66, respectively. In contrast, enterprises privatized in 1994 have labor productivity growth similar to that of state-owned enterprises, with F-statistic of 0.50.

Since we use industry-matched PPI indices to deflate nominal product prices, a fraction of what we call sales growth and labor productivity growth may represent price increases by privatized firms. That may happen, for example, if privatized firms make use of their previously unexploited monopoly power, particularly if the state abolished some price controls around the time of privatization. The available data do not allow us to purge this effect, i.e., it is likely that higher markups may in part explain the positive coefficient on privatization. Of course, price increases may reflect the improved quality of output in privatized firms and thus reflect productivity gains. Also, state enterprises' prices may not have reflected the true marginal cost of

production. Using product-level price and quantity data for Mexican companies, La Porta and Lopez-de-Silanes (1999) find that of the 24-percentage-point increase in operating profits attributed to privatization, 5% is due to higher product prices, 31% is due to transfers from laid-off workers, and 64% (almost two-thirds) is due to productivity gains. If we take a conservative approach and assume that only two-thirds of the growth in real sales and labor productivity is a true gain, the estimates are reduced to 4.4% higher sales growth for enterprises privatized for three years or more, and 2.8% higher labor productivity growth.

The results in the industry cluster regressions (specifications ii, v, and vii) are qualitatively identical to the fixed-effects results. Enterprises privatized in or before 1992 display a 6.7% increase in annual sales revenues relative to state owned enterprises, as can be seen by comparing the coefficients on the respective ownership dummies. This cohort of privatized enterprises also shows 2.3% smaller reduction in employment and a 4.4% higher growth in labor productivity in each year during 1992 to 1995. This suggests that the effects of privatization are robust to the use of different econometric specifications. We also use the random-effects specification (iii, vi, and ix). Those results are fully consistent with the findings of the other two specifications.

**[Table 6 here]**

We next run the regressions with labor productivity growth as the dependent variable for each individual country (Table 6). The positive effect of privatization is documented in the data for all countries, but is not monotone in Bulgaria, Hungary, and Poland. In Bulgaria, firms privatized in 1994 already show a 9.5% higher growth than state-owned firms. Firms that have been privatized for a longer period also have superior performance relative to state-owned firms, but their productivity growth is not higher than that of the cohort of firms privatized in 1994. In

contrast, the performance of firms in the Czech Republic, Romania, and Slovenia increases monotonically with the time elapsed since privatization. Finally, the performance of firms in Slovakia improves with privatization, except for firms privatized during and before 1992.

Finally, we use a 66% ownership cutoff in the construction of the privatization dummies. The only appreciable difference from the results in Table 5 is that the privatization coefficients become positive and significant even for firms privatized in 1993. The magnitude of the effect also increases. Firms that have been privatized for three or more years now display sales growth, job creation rate, and labor productivity growth that are higher than those of still state-owned firms by 12.2%, 6.1%, and 6.3% respectively. This represents more than a 100% increase in the effectiveness of privatization over the findings using the 33% ownership cutoff. We consider our findings using the 33% ownership cutoff, however, to be more representative of the overall effect of privatization in Eastern Europe, since very few firms were majority privately owned in Bulgaria, Poland, and Romania in 1992. Using the 66% ownership cutoff makes our results therefore dependent on fewer enterprise performance in the Czech Republic, Slovakia, Slovenia, and (to a lesser extent) Hungary.

#### **4. Conclusions**

This paper investigates the benefits of privatization in Eastern Europe. We find that privatization is associated with statistically significant improvement in enterprise performance, especially for companies that have been privatized for three or more years. Firms privatized for less than two years do not behave very differently than still state-owned firms, i.e., the effect of privatization has not yet been fully manifested.

Further research can shed more light on the effect of various types of privatization on enterprise efficiency. Some empirical evidence suggests that the method of privatization and the type of private owners affect enterprise restructuring in transition economies (Frydman et al., 1999; Djankov and Murrell, 2000). Our study suggests that there are also large differences across privatization cohorts, and that these differences may in part explain why the empirical literature on privatization in Eastern Europe generally finds strong positive effects, while the literature on privatization in the former Soviet Union finds (as of yet) little or no effect.

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**Table 1: Descriptive Statistics on the Sample of Firms**

|   | Bulgaria | Czech Rep | Hungary | Poland    | Romania   | Slovak Rep | Slovenia |
|---|----------|-----------|---------|-----------|-----------|------------|----------|
| A. Data Coverage  |          |           |         |           |           |            |          |
| Number of firms   | 828      | 706       | 1,044   | 1,066     | 1,064     | 883        | 763      |
| Number of Employees<br>1992                               | 618,772  | 645,241   | 428,645 | 1,338,629 | 2,678,436 | 578,737    | 272,249  |
| % of total*   | 69       | 52        | 41      | 45        | 93        | 93         | 92       |
| B. Average Share of Sector Employment in Total Employment |          |           |         |           |           |            |          |
| Food  | 12.0     | 5.4       | 11.6    | 9.1       | 8.4       | 13.7       | 10.6     |
| Tobacco   | 0.8      | 1.0       | 2.6     | 1.1       | 1.6       | 0.8        | 1.9      |
| Textiles  | 9.0      | 5.5       | 13.0    | 8.5       | 6.9       | 4.2        | 12.9     |
| Apparel   | 6.4      | 3.0       | 3.7     | 1.9       | 1.3       | 3.6        | 5.9      |
| Lumber  | 7.1      | 3.6       | 3.5     | 2.3       | 8.8       | 4.3        | 3.0      |
| Furniture   | 2.6      | 1.2       | 2.8     | 2.0       | 5.5       | 1.8        | 3.2      |
| Paper   | 2.9      | 1.5       | 1.6     | 1.4       | 1.5       | 1.9        | 1.7      |
| Printing  | 0.6      | 3.3       | 0.9     | 0.4       | 5.1       | 2.9        | 1.1      |
| Chemicals   | 9.7      | 2.3       | 8.2     | 7.9       | 9.2       | 7.6        | 8.0      |
| Petroleum refining  | 3.8      | 2.6       | 4.4     | 3.2       | 6.7       | 1.0        | 1.0      |
| Rubber  | 3.3      | 1.7       | 4.3     | 4.5       | 1.6       | 2.8        | 2.2      |
| Leather   | 3.5      | 2.5       | 2.5     | 2.6       | 3.3       | 3.0        | 3.5      |
| Stone, clay, glass  | 3.2      | 10.3      | 5.4     | 7.6       | 3.7       | 4.6        | 1.6      |
| Primary metals  | 6.2      | 7.0       | 9.1     | 0.6       | 2.0       | 4.9        | 13.5     |
| Fabricated metals   | 2.9      | 9.8       | 3.9     | 4.6       | 10.4      | 14.6       | 4.0      |
| Nonelectrical machinery                                   | 13.1     | 16.2      | 5.6     | 15.2      | 9.2       | 10.0       | 4.1      |
| Electrical machinery                                      | 4.3      | 6.5       | 10.9    | 3.3       | 3.6       | 5.3        | 14.1     |
| Transport equipment                                       | 0.8      | 12.9      | 3.7     | 11.6      | 9.0       | 8.8        | 2.4      |
| Instruments   | 7.8      | 4.3       | 2.3     | 2.2       | 2.2       | 4.2        | 5.3      |
| C. Size of Firms (Number of Employees)                    |          |           |         |           |           |            |          |
| Mean  | 747      | 913       | 425     | 911       | 1521      | 656        | 357      |
| Median  | 396      | 419       | 241     | 820       | 1327      | 335        | 213      |
| D. Share of Privatized Firms (33% ownership cut-off)      |          |           |         |           |           |            |          |
| % of firms 1992   | 2.9      | 33.2      | 12.2    | 4.2       | 1.1       | 29.8       | 20.9     |
| % of firms 1993   | 4.5      | 47.2      | 25.8    | 7.1       | 3.9       | 34.9       | 29.2     |
| % of firms 1994   | 5.8      | 76.3      | 28.9    | 44.3      | 6.8       | 47.3       | 31.1     |
| % of firms 1995   | 6.8      | 79.4      | 32.5    | 46.4      | 7.3       | 78.9       | 35.1     |

\* Share of 1992 manufacturing employment as reported in the Statistical Yearbooks of the respective country.

**Table 2: Annual Sales Growth, 1992-1995**  
(medians)

The table reports the median sales growth of the sample firms, divided into 2-digits SIC industries, with the mapping from the NACE to the SIC industrial classification provided by the Statistical Office of the European Union (Eurostat). These numbers are reached by taking the average growth of real sales for 1992-1993, 1993-1994, and 1994-1995 for each firm. Within a country, we then calculate the median sales growth across all sample firms. In other words, the number for the food sector in Bulgaria tells us that the sales revenue of the median Bulgarian food-producer declined by 8.38% on average during 1992-1995.

| SIC Code | Name                      | Bulgaria          | Czech Rep.        | Hungary | Poland            | Romania           | Slovakia          | Slovenia          | Sample             |
|----------|---------------------------|-------------------|-------------------|---------|-------------------|-------------------|-------------------|-------------------|--------------------|
| 20       | Food                      | -8.38             | 13.51             | -0.82   | -3.89             | -22.28            | -3.12             | 6.47              | -2.69              |
| 21       | Tobacco                   | -12.01            | 5.13              | 0.11    | 1.14              | -27.49            | -8.30             | 4.15              | -5.73              |
| 22       | Textiles                  | -19.24            | -5.49             | -4.04   | 2.47              | -26.90            | -12.54            | 1.16              | -7.58              |
| 23       | Apparel                   | -9.49             | 2.27              | 4.15    | 2.88              | -20.22            | -5.34             | 9.22              | -2.32              |
| 24       | Lumber and Wood Products  | -3.58             | 4.13              | -3.08   | 5.89              | -16.40            | -5.51             | 13.47             | -3.77              |
| 25       | Furniture                 | -8.19             | -3.83             | 0.82    | -4.60             | 4.75              | -3.57             | 6.82              | -3.15              |
| 26       | Paper                     | 1.11              | 6.32              | -4.24   | 7.09              | -13.55            | -6.98             | 5.80              | -4.63              |
| 27       | Printing                  | -4.04             | -0.04             | -0.53   | 3.17              | -10.54            | -5.96             | 3.77              | -3.76              |
| 28       | Chemicals                 | -1.89             | -3.50             | 0.15    | 1.14              | -10.28            | -6.93             | 9.46              | -0.95              |
| 29       | Petroleum                 | -9.11             | -4.66             | 5.40    | -13.10            | -12.77            | -6.21             | 12.89             | 0.23               |
| 30       | Rubber                    | -6.72             | -4.35             | -0.85   | 1.14              | -12.61            | -2.01             | -3.04             | -3.91              |
| 31       | Leather                   | -45.53            | 20.39             | 1.42    | 7.40              | -17.76            | -11.34            | 3.64              | -5.06              |
| 32       | Stone                     | -0.79             | 2.08              | 4.02    | 1.14              | -6.88             | -7.05             | 6.80              | 0.19               |
| 33       | Metallurgy                | -16.76            | -2.54             | -0.01   | -0.10             | -7.59             | -3.54             | 3.81              | -1.29              |
| 34       | Fabricated Metal products | -13.86            | 6.02              | -2.37   | -1.12             | -9.74             | -4.87             | 3.67              | -4.53              |
| 35       | Industrial Machinery      | -12.91            | -1.88             | 1.24    | 1.14              | -19.01            | -6.79             | 7.61              | -5.79              |
| 36       | Electric Machinery        | -15.02            | -2.54             | -2.95   | 2.06              | -11.76            | -5.38             | 0.66              | -3.80              |
| 37       | Transport Equipment       | -10.92            | 2.45              | 13.16   | -0.59             | -8.58             | -3.85             | 18.36             | -0.07              |
| 38       | Instruments               | -14.16            | 3.35              | 3.67    | 7.27              | -10.02            | -6.86             | 10.83             | -4.69              |
|          | Manufacturing             | -11.13            | 1.41              | 0.80    | 1.08              | -13.67            | -6.11             | 6.61              | -3.64              |
|          | Privatized Firms          | -0.46             | 2.08              | 1.32    | 1.14              | -12.36            | -4.27             | 11.11             | 0.11               |
|          | State-Owned Firms         | -11.86            | 0.11              | -0.66   | -1.43             | -15.48            | -10.80            | 4.04              | -0.63              |
|          | Z-Test                    | 4.27 <sup>a</sup> | 1.68 <sup>c</sup> | 1.40    | 2.52 <sup>b</sup> | 2.04 <sup>b</sup> | 7.55 <sup>a</sup> | 7.12 <sup>a</sup> | 17.30 <sup>a</sup> |

**Table 3: Annual Employment Growth, 1992-1995**  
(medians, number of employees)

The table reports the median annual employment growth of the sample firms, divided into 2-digits SIC industries, with the mapping from the NACE to the SIC industrial classification provided by the Statistical Office of the European Union (Eurostat). These numbers are reached by taking the average growth of employment for 1992-1993, 1993-1994, and 1994-1995 for each firm. Within a country, we then calculate the median employment growth across all sample firms. In other words, the number for the tobacco sector in Romania tells us that employment of the median Romanian tobacco-producer declined by 15.57% on average during 1992-1995.

| SIC Code | Name                      | Bulgaria | Czech Rep.         | Hungary | Poland | Romania           | Slovakia          | Slovenia          | Sample            |
|----------|---------------------------|----------|--------------------|---------|--------|-------------------|-------------------|-------------------|-------------------|
| 20       | Food                      | -6.96    | -3.52              | -6.56   | -6.95  | -12.09            | -8.20             | -2.74             | -6.54             |
| 21       | Tobacco                   | -10.13   | -6.73              | -3.49   | -6.39  | -15.57            | -12.63            | -4.11             | -8.02             |
| 22       | Textiles                  | -12.83   | -5.32              | -4.58   | -6.99  | -19.74            | -13.04            | -5.70             | -8.43             |
| 23       | Apparel                   | -9.27    | -7.68              | -3.67   | -1.35  | -5.30             | -8.86             | -4.11             | -6.13             |
| 24       | Lumber and Wood Products  | -8.76    | -3.64              | -6.86   | -7.02  | -12.89            | -7.03             | 2.67              | -7.12             |
| 25       | Furniture                 | -10.15   | -12.31             | -1.92   | -0.81  | -4.88             | -6.23             | -1.57             | -5.15             |
| 26       | Paper                     | -5.03    | -6.82              | -6.97   | -7.02  | -9.50             | -10.24            | -5.98             | -7.94             |
| 27       | Printing                  | -8.40    | -3.00              | -3.93   | -4.80  | -10.87            | -6.43             | -2.49             | -6.16             |
| 28       | Chemicals                 | -6.13    | -4.59              | -2.46   | -5.03  | -6.27             | -8.65             | -1.26             | -5.90             |
| 29       | Petroleum                 | -5.76    | -0.57              | -2.15   | -7.03  | -5.09             | -12.43            | 7.21              | -5.09             |
| 30       | Rubber                    | -2.73    | -3.51              | -3.09   | -5.99  | -12.15            | -9.79             | -1.79             | -6.96             |
| 31       | Leather                   | -20.49   | -5.38              | -4.22   | -7.04  | -10.50            | -12.79            | -4.32             | -7.31             |
| 32       | Stone                     | -3.73    | -4.51              | -1.25   | -5.03  | -6.17             | -12.93            | -0.89             | -5.03             |
| 33       | Metallurgy                | -11.51   | -4.81              | -3.50   | -6.16  | -5.88             | -7.14             | -3.83             | -4.98             |
| 34       | Fabricated Metal products | -6.38    | -5.93              | -5.21   | -7.03  | -9.22             | -8.77             | -4.17             | -7.03             |
| 35       | Industrial Machinery      | -11.03   | -5.56              | -4.05   | -7.01  | -14.02            | -6.55             | -2.84             | -7.59             |
| 36       | Electric Machinery        | -10.47   | -5.44              | -4.86   | -5.03  | -16.02            | -8.77             | -4.66             | -6.08             |
| 37       | Transport Equipment       | -10.96   | -4.11              | -1.23   | -5.57  | -8.05             | -7.40             | 2.82              | -5.03             |
| 38       | Instruments               | -15.18   | -4.17              | -0.92   | 1.88   | -13.68            | -6.04             | -0.31             | -7.50             |
|          | Manufacturing             | -9.26    | -5.14              | -3.73   | -5.28  | -10.42            | -9.15             | -2.00             | -6.53             |
|          | Privatized Firms          | -6.87    | -4.88              | -3.88   | -5.51  | -8.15             | -8.46             | -2.35             | -6.11             |
|          | State-Owned Firms         | -10.05   | -3.64              | -3.93   | -7.02  | -11.37            | -9.24             | -3.21             | -7.42             |
|          | Z-Test                    | 1.35     | -2.08 <sup>b</sup> | -0.28   | 0.94   | 2.18 <sup>b</sup> | 2.78 <sup>a</sup> | 2.07 <sup>b</sup> | 9.10 <sup>a</sup> |

**Table 4: Annual Labor Productivity Growth, 1992-1995**  
(medians)

The table reports the median labor productivity growth of the sample firms, divided into 2-digits SIC industries, with the mapping from the NACE to the SIC industrial classification provided by the Statistical Office of the European Union (Eurostat). These numbers are reached by taking the average growth of real sales for 1992-1993, 1993-1994, and 1994-1995 for each firm. Using the same technique, we calculate the average employment growth over the period. Within a country, we then calculate the median labor productivity growth across all sample firms. In other words, the number for the instruments sector in Slovenia tells us that labor productivity of the median Slovenian instruments-producer increased by 12.10% on average during 1992-1995.

| SIC Code | Name                      | Bulgaria          | Czech Rep.        | Hungary           | Poland            | Romania      | Slovakia          | Slovenia          | Sample             |
|----------|---------------------------|-------------------|-------------------|-------------------|-------------------|--------------|-------------------|-------------------|--------------------|
| 20       | Food                      | -0.04             | 16.25             | 4.53              | -0.52             | -8.26        | 6.60              | 9.41              | 3.82               |
| 21       | Tobacco                   | -1.21             | 12.96             | 5.23              | 6.17              | -11.11       | 1.94              | 10.30             | 3.06               |
| 22       | Textiles                  | -6.61             | -0.66             | 0.65              | 6.88              | -6.78        | -0.47             | 6.89              | -0.23              |
| 23       | Apparel                   | -0.70             | 12.92             | 7.53              | 3.93              | -12.58       | 2.18              | 12.45             | 4.87               |
| 24       | Lumber and Wood Products  | 4.86              | 6.14              | -0.68             | 7.41              | -3.32        | 2.09              | 7.57              | 2.21               |
| 25       | Furniture                 | 1.95              | 5.39              | 1.67              | -6.37             | 3.91         | 0.43              | 8.04              | 2.01               |
| 26       | Paper                     | 7.95              | 14.66             | 2.16              | 13.06             | -5.39        | 2.47              | 8.15              | 3.52               |
| 27       | Printing                  | 4.39              | 2.95              | 5.65              | 5.43              | 2.10         | 0.37              | 5.39              | 2.07               |
| 28       | Chemicals                 | 4.42              | 0.94              | 3.27              | 6.17              | -4.00        | 2.96              | 9.22              | 4.21               |
| 29       | Petroleum                 | -1.20             | -0.64             | 8.08              | -7.56             | -5.32        | 0.47              | 10.20             | 2.48               |
| 30       | Rubber                    | -7.71             | -0.67             | 3.95              | 5.68              | -5.21        | 8.23              | 4.01              | 3.28               |
| 31       | Leather                   | -24.79            | 25.78             | 5.91              | 14.44             | -4.22        | 1.35              | 9.65              | 3.43               |
| 32       | Stone                     | 3.63              | 8.12              | 2.53              | 6.17              | 1.88         | 3.09              | 6.35              | 5.04               |
| 33       | Metallurgy                | -3.81             | 3.02              | 2.51              | 5.34              | -2.03        | 2.82              | 6.40              | 3.23               |
| 34       | Fabricated Metal products | -2.81             | 12.49             | 2.95              | 6.17              | -2.03        | 1.93              | 8.94              | 2.54               |
| 35       | Industrial Machinery      | -0.76             | 4.18              | 6.05              | 6.17              | -2.31        | -2.46             | 12.76             | 1.74               |
| 36       | Electric Machinery        | -7.49             | 0.22              | 1.08              | 6.62              | -2.88        | 1.08              | 6.98              | 2.14               |
| 37       | Transport Equipment       | 2.64              | 7.71              | 9.59              | 2.86              | 2.43         | 1.01              | 14.46             | 5.37               |
| 38       | Instruments               | -3.96             | 9.12              | 7.37              | 3.80              | 3.62         | -0.54             | 12.10             | 3.92               |
|          | <b>Manufacturing</b>      | <b>-1.65</b>      | <b>7.04</b>       | <b>4.23</b>       | <b>4.82</b>       | <b>-3.26</b> | <b>1.92</b>       | <b>8.91</b>       | <b>3.09</b>        |
|          | Privatized Firms          | 9.02              | 7.08              | 5.97              | 6.17              | -2.35        | 2.73              | 12.26             | 6.24               |
|          | State-Owned Firms         | -1.38             | 3.66              | 3.09              | 2.66              | -3.56        | -2.46             | 7.85              | 1.12               |
|          | Z-Test                    | 4.70 <sup>a</sup> | 1.71 <sup>c</sup> | 2.08 <sup>b</sup> | 1.74 <sup>c</sup> | 0.96         | 6.64 <sup>a</sup> | 5.56 <sup>a</sup> | 13.63 <sup>a</sup> |

**Table 5: The Effects of Privatization, Full Sample**

The table reports the results of fixed (specifications i, iv, and vii), cluster (specifications ii, v, viii), and random effects (specifications iii, vi, ix) regressions. The dependent variables are the average annual growth rates, in sales revenues, employment, and labor productivity during the period 1992 through 1995. State-owned in 1995 is a dummy equal to one if the enterprise was state-owned at the beginning of 1995, zero otherwise. This category includes enterprises that were privatized during the year 1995. Privatized in 1994 is a dummy equal to one if the enterprise was privatized in that year, zero otherwise. We define likewise the dummy variables for privatized in 1993, and privatized in 1992 or before. Industry dummies for the 2-digit SIC sectors are included (as defined in Tables 2-4), as are country dummies. <sup>a</sup>, <sup>b</sup>, <sup>c</sup> signify statistical significance at the 1%, 5%, and 10% level, respectively.

| Variable                     | Sales                         |                               |                               | Employment                    |                  |                               | Labor Productivity            |                               |                              |
|------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|
|                              | (i)                           | (ii)                          | (iii)                         | (iv)                          | (v)              | (vi)                          | (vii)                         | (viii)                        | (ix)                         |
| State-Owned in 1995          | -0.037 <sup>a</sup><br>(3.74) | -0.041 <sup>a</sup><br>(3.43) | -0.037 <sup>a</sup><br>(3.12) | -0.019 <sup>b</sup><br>(2.21) | -0.021<br>(1.56) | -0.026 <sup>a</sup><br>(2.65) | -0.017 <sup>b</sup><br>(2.05) | -0.020 <sup>b</sup><br>(2.27) | -0.015<br>(1.28)             |
| Privatized in 1994           | -0.019 <sup>c</sup><br>(1.73) | -0.022 <sup>c</sup><br>(1.83) | -0.019<br>(1.47)              | -0.007<br>(0.76)              | -0.008<br>(0.66) | -0.008<br>(1.24)              | -0.011<br>(1.24)              | -0.013<br>(1.12)              | -0.016<br>(1.31)             |
| Privatized in 1993           | 0.007<br>(0.49)               | 0.008<br>(0.54)               | 0.001<br>(0.42)               | -0.004<br>(0.34)              | -0.004<br>(0.26) | -0.001<br>(0.86)              | 0.011<br>(0.94)               | 0.011<br>(1.24)               | 0.011<br>(0.86)              |
| Privatized in or before 1992 | 0.028 <sup>a</sup><br>(2.85)  | 0.026 <sup>b</sup><br>(2.32)  | 0.028 <sup>b</sup><br>(2.29)  | 0.003<br>(0.28)               | 0.002<br>(0.14)  | 0.003<br>(0.34)               | 0.026 <sup>a</sup><br>(3.00)  | 0.024 <sup>c</sup><br>(1.81)  | 0.026 <sup>a</sup><br>(2.61) |
| Industry Dummies Included    | Yes                           | Yes                           | Yes                           | Yes                           | Yes              | Yes                           | Yes                           | Yes                           | Yes                          |
| Country Dummies Included     | Yes                           | Yes                           | Yes                           | Yes                           | Yes              | Yes                           | Yes                           | Yes                           | Yes                          |
| Number of Observations       | 6,354                         | 6,354                         | 6,354                         | 6,354                         | 6,354            | 6,354                         | 6,354                         | 6,354                         | 6,354                        |
| R <sup>2</sup>               | 0.25                          | 0.19                          | 0.19                          | 0.28                          | 0.10             | 0.10                          | 0.11                          | 0.08                          | 0.08                         |

**Table 6: The Effects of Privatization, by Country**

The table reports the results of fixed effects regressions. The dependent variable is the average annual growth rate in labor productivity during the period 1992 through 1995. State-owned in 1995 is a dummy equal to one if the enterprise was state-owned at the beginning of 1995, zero otherwise. This category includes enterprises that were privatized during the year 1995. Privatized in 1994 is a dummy equal to one if the enterprise was privatized in that year, zero otherwise. We define likewise the dummy variables for privatized in 1993, and privatized in 1992 or before. Industry dummies for the 2-digit SIC sectors are included (as defined in Tables 2-4). <sup>a, b, c</sup> signify statistical significance at the 1%, 5%, and 10% level, respectively.

|                              | Bulgaria                     | Czech Rep.                   | Hungary                      | Poland                       | Romania                      | Slovakia                      | Slovenia                     |
|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|-------------------------------|------------------------------|
| State-Owned in 1995          | -0.008<br>(0.37)             | 0.067 <sup>b</sup><br>(2.17) | 0.070 <sup>a</sup><br>(3.20) | 0.101 <sup>a</sup><br>(3.39) | 0.029<br>(1.62)              | -0.063 <sup>a</sup><br>(6.62) | 0.049 <sup>b</sup><br>(2.09) |
| Privatized in 1994           | 0.095 <sup>a</sup><br>(2.65) | 0.105 <sup>a</sup><br>(3.35) | 0.071<br>(1.35)              | 0.094 <sup>a</sup><br>(3.08) | 0.026<br>(0.92)              | -0.013<br>(1.29)              | 0.060 <sup>c</sup><br>(1.87) |
| Privatized in 1993           | 0.061 <sup>c</sup><br>(1.79) | 0.140 <sup>c</sup><br>(1.76) | 0.084 <sup>a</sup><br>(3.51) | 0.092 <sup>a</sup><br>(2.53) | 0.027<br>(0.97)              | 0.038 <sup>c</sup><br>(1.69)  | 0.064 <sup>a</sup><br>(2.67) |
| Privatized in or before 1992 | 0.093 <sup>c</sup><br>(1.91) | 0.149 <sup>a</sup><br>(4.55) | 0.064 <sup>b</sup><br>(2.55) | 0.153 <sup>a</sup><br>(5.15) | 0.129 <sup>a</sup><br>(2.74) | 0.001<br>(0.14)               | 0.108 <sup>a</sup><br>(4.06) |
| Industry Dummies Included    | Yes                          | Yes                          | Yes                          | Yes                          | Yes                          | Yes                           | Yes                          |
| Number of Observations       | 828                          | 706                          | 1,044                        | 1,066                        | 1,064                        | 883                           | 763                          |
| R <sup>2</sup>               | 0.16                         | 0.26                         | 0.08                         | 0.11                         | 0.12                         | 0.16                          | 0.27                         |