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# Divide and Privatize: Firm Break-up and Performance

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# Divide and Privatize: Firm Break-up and Performance

## Abstract

We analyze the long-term effects of firm break-up and ownership change on corporate performance. Our analysis is based on a unique data set for a large number of Czech firms spanning the period 1996–2005. We employ a propensity score matching procedure to deal with endogeneity problems. Our results, which are generally in line with the positive effects of firm break-up found in the developed-market literature, show that the initial effects of firm break-up are positive but after a certain point they quickly diminish over time. Factors like changes in ownership structure and management are to be found behind later improvements in the performance of firms.

JEL-Code: D230, G320, G340, L200, M210, P470.

Keywords: break-up of firms, corporate performance, ownership changes, privatization, emerging markets, endogeneity, propensity score matching procedure.

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## 1. Introduction

The literature on corporate divestitures in developed countries has provided considerable evidence of their positive effects but Moschieri and Mair (2008) in their survey argue that our understanding of divestiture is still limited. Since the majority of the existing research targets developed economies, the effects of divestitures in emerging markets are largely under-researched (e.g., Domadenik et al., 2003; Makhija, 2004; Omran, 2004; Bartel and Harrison, 2005; Shin, 2008; Hanousek et al., 2009). We contribute to the literature by analyzing the break-up of firms in the Czech Republic in the early 1990's and this phenomenon's short- and medium-term effects on firm performance. In this analysis we consider a break-up as a means of initial firm restructuring. We also account for the potential endogeneity of the break-up and privatization with respect to firm performance. Our results show that firm break-up has short- and medium-term positive effects that vanish thereafter.

The motivation behind our analysis stems from the fact that in the early 1990's the break-up of firms was the initial type of the restructuring of the large state-owned companies in Central and Eastern European (CEE) economies. The break-up of firms became one of the most important forms of restructuring because it reduced the size of firms, increased the number of firms, and brought in new management (Domadenik et al., 2003). Break-up became the main form of early restructuring in the Czech Republic (Zemplerová and Charap, 1994).

Since the break-up of firms served as a first step in the restructuring pursued by the government, it can be hypothesized that in the short-run the break-up of firms improves corporate performance as the new firms strive to establish themselves on the market and to improve corporate governance.<sup>1</sup> When considering the medium- and long-run effects of firm break-up the overall picture is rather uncertain. On the one hand, firm break-up and certain types of corporate ownership can enhance performance by eliminating diseconomies of scale and by serving as a disciplining device for management. On the other hand, firm break-up can have a negative effect because of substandard corporate governance, weak government coordination and regulation, unclear property rights, and the underdeveloped legal and institutional framework that exists in emerging market economies (Hanousek et al., 2009).

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<sup>1</sup> See Roland (1994), who also discusses restructuring and privatization policies along with their pace and sequencing.

Further, there are different reasons for restructuring between market and transformation economies. The need for the restructuring of firms in market economies focuses on the trade-off between transaction costs via markets and the internal inefficiencies within organizations. However, in the context of transformation economies, the focus is on the bargaining between the key decision-makers (such as managers, politicians, workers, and new private owners) after restructuring/privatization. Grosfeld and Roland (1996) argue that in the early phase of transition, there was high expectation that price liberalization, increased product market competition, and tight fiscal and monetary policies would create an appropriate environment to which managers of state-owned enterprises (SOE) would be forced to adjust. It was also expected that the selection of healthy enterprises and the elimination of unprofitable ones would start immediately. However, these expectations were not met due to the large-scale asset-stripping behavior of SOE managers and skilful protectionism against the pressures to change (Grosfeld and Roland 1996). Overall, the need to restructure generally inefficient state enterprises and the required privatization processes in the CEE region fostered a debate over the sequence: whether restructuring should be done prior to or after privatization. A number of studies consider these two processes counterbalancing, and thus treats them as “friends or enemies” (Aghion et al., 1994; Kotrba, 1996; Pohl et al., 1997; Roland, 2000).

A special feature of restructuring in transformation economies is defensive vs. strategic types of restructuring, introduced by Grosfeld and Roland (1996) and Aghion et al. (1997) and tested for by Domadenik et al. (2008). Defensive restructuring includes measures that seek to reduce costs and scale down enterprise activity with the primary goal of the immediate survival of the enterprise. In contrast, strategic restructuring is based on a thoughtful business strategy developed in response to a need for a significant redeployment of assets (introduction of new product lines, new processes, new technologies, or new investments).<sup>2</sup> These types of restructuring came to play in broken-up firms only after their break-up and subsequent privatization, though. In any event, D’Souza et al. (2007) show that restructuring and changes in corporate governance are important determinants of post-privatization performance.

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<sup>2</sup> Empirical evidence on enterprise restructuring in Poland, Hungary, and the Czech Republic suggests that significant restructuring measures were mainly defensive in nature and the extent of strategic restructuring was much more limited (Grosfeld and Roland, 1996). Domadenik et al. (2008) show that firms in Slovenia actively adjusted employment, and the adjustment was of both a defensive (short-term) and strategic (long-term) nature. Significant investment only took place in firms that were privatized, with foreign ownership or through retained earnings.

The overall expectation is that any active restructuring of an enterprise, including company break-up, would tend to improve operating efficiency, increase cash flow, and ultimately, enhance firm profitability;<sup>3</sup> however, it is not clear how long the effect of firm break-up would last, or if break-up would be the appropriate starting point for more active corporate governance. These general observations are valid with respect to the break-up of firms in the Czech Republic as well as in other CEE emerging markets because before the 1990's the socialist planners preferred large firms whose size in these countries was excessive when compared to firm size in market economies (Hanousek et al., 2009).

Although firm break-up is an important phenomenon in emerging market economies, surprisingly little research has been produced in the context of the CEE countries. Two recent contributions address the issue by employing data on Czech firms and show positive effects of break-ups in general. However, both have some limitations. Lizal et al. (2001) show that small- and medium-sized divestitures have positive effects on the productive efficiency and profitability of both the parent companies and divested units in the year when the division occurs. However, the authors do not know the identities of the firms and have to use indirect methods to identify divestitures and then link the divested units to the parent firms. Moreover, the authors can follow the firms only during the year of the breakup (1991) and the following year (1992). Hanousek et al. (2009) provide evidence of generally positive effects in divested Czech firms with detailed results varying across the new owners. However, their study covers only the two-year period (1995–1996) following the privatization of divested firms.

Since we have richer data with an exact identification of all firms and a longer time span, we are able to overcome the earlier shortcomings and credibly estimate the effects of the break-up of firms in the Czech Republic. We analyze the effect of firm break-up and subsequent changes in ownership structure due to privatization, a feature that is frequently missing in the literature. However, ownership changes were shown by Cusatis et al. (1993) and Bartel and Harrison (2005) to be important. We also investigate the short- and medium-term effects of firm break-up, as these have been documented to be important (Cho and Cohen, 1997), but have not been thoroughly researched yet (Moschieri and Mair, 2008).

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<sup>3</sup> In the literature we can find also other important benefits such as synergies, innovative capabilities, improved resource allocation, and competitiveness (Bethel and Liebeskind, 1993; Bergh, 1998). Further, according to agency theory, firm restructuring is seen as a mechanism to reduce agency costs (Fama and Jensen, 1983; Hoskisson and Turk, 1990).

Specifically, in this paper we contribute to the literature in two ways. First, we analyze how the break-up of firms in an emerging market affects firms' medium-term economic performance. To do so, we study the performance of new units (emerging from the break-up), as well as the performance of the original master firms. Second, we study this question while accounting for endogeneity issues by employing propensity score matching. In our approach we consider firm break-up as the "treatment" variable and by estimating the medium-term effects of the break-up we study the average treatment effect on the treated subject (ATT). In this respect we conduct two matching procedures: 1) we follow the mainstream research on firm divestitures and match new firms resulting from a break-up and those not from a break-up, and 2) we reconstruct the master firm performance indicators and match master firms with those not experiencing break-up. The combination of both approaches enables us to capture the total effect of the break-up. The employed dual approach, i.e., a combination of the break-up effects observed on new units and master firms, is an ideal application of  $p$ -score matching. Moreover, an identification strategy using  $p$ -score matching during the pre-privatization and pre-firm break-up periods should be better equipped to address endogeneity issues along with the attrition problem than a classical IV estimation (Dehejia and Wahba, 2002).

An additional key value-added of the present paper is that we cover several years after the break-up of firms, a long enough period to uncover the medium-term effects of firm break-up. In the paper we show that even more than five years after firm break-up, the effects of firm break-up were still positive. However, the effects in subsequent years turned out to be negative and later insignificant as the number of observations was reduced substantially by the end of our sample in 2005.

The paper is structured as follows. In Section 2 we outline the institutional setting underlying our analysis and formulate the hypotheses to be tested. In Section 3 we present our data, variables, and the method for identifying firm break-up. Section 4 describes our estimating framework. We present our empirical results in Section 5 and conclude in Section 6.

## **2. The Institutional Setting and Hypotheses**

In this section we outline the main features of the institutional setting underlying the surge of firm break-up in our data set. The break-up of firms took place during the period 1991–1992, prior to the launch of the mass privatization scheme, also known as

voucher privatization.<sup>4</sup> Hence, in the early 1990's the government managed a wave of swift break-up of firms in which parent firms were broken into smaller units. This process resulted in no original parent firm and the state remained in control of the smaller units. Rapid privatization of these new units was performed and ownership was transferred to new private owners.

The decisions on corporate break-up were taken by the relevant government ministries in conjunction with the government privatization authority. Hence, the break-up of firms as well as privatization did not occur at random as the decision for each firm was based on the winning privatization project that outlined the proposed framework for the break-up of the firm.<sup>5</sup> Consequently, the endogeneity of the break-up as well as post-privatization ownership have to be taken into account despite the fact that the decisions to privatize and even the specific design of the programs were dictated by politics and not performance criteria (Boycko et al., 1994).

Following this surge of the break-up of firms, the new units, which were transformed into joint-stock companies, were privatized during 1992–1993 in the voucher scheme. The voucher scheme was part of the large-scale privatization process and two waves of voucher privatization took place in 1992–93 and 1993–94. Privatization was to eradicate in the quickest possible way public ownership as this was associated with a communist ideology.<sup>6</sup> Shares from the first and second wave were distributed in 1993 and early 1995, respectively, creating the early post-privatization ownership structure. There was also significant post-privatization share trading (often off the official stock market) among large shareholders during 1995–1996 (for details see Hanousek and Němeček, 2001).

Let us note that the break-up of firms happened well before any new owners started to control privatized companies and therefore there was no monetary effect

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<sup>4</sup> A detailed description of the privatization mechanism is to a large extent irrelevant with respect to our analysis. For more details on the privatization process see, e.g., Kočenda (1999), Hanousek and Kočenda (2008), and Estrin et al. (2009), among others.

<sup>5</sup> The privatization of each state-owned firm was decided on the basis of an officially accepted privatization project. According to the law, all state-owned enterprises were selected either for the first or the second privatization wave or they were temporarily exempted. Each selected firm had to submit an official privatization proposal that was usually crafted by the firm's management under the tutelage (and responsibility) of its sectoral ministry. Any domestic or foreign corporate body or individual was allowed to present a competing project that was to be considered on an equal footing with the official one. See Hanousek et al. (2009) for details that are beyond the scope relevant for this paper.

<sup>6</sup> Shleifer and Treisman (2005) show that privatization was very successful from a political point of view almost from the outset. However, Hanousek and Kočenda (2008) and Kočenda and Hanousek (2009) show that state control over privatized firms was considerable and persisted well beyond the completion of privatization.

associated with the divestiture. In other words, the break-ups did not affect the accounting figures of the involved companies and we can therefore use the original composition of the master firm to reconstruct their financial indicators even after the break-up of the firm. This means we can analyze the break-up from both the divested- and master-firm point of view to capture the total effect of the break-up.

The structural and institutional features observed in emerging market economies in general, and the Czech Republic in particular, lead us to test two competing hypotheses with respect to firm break-up and privatization:

1. Break-up and privatization have a positive effect on the performance of the resulting units by eliminating inefficiencies such as the diseconomies of scale of large SOEs, weak managerial incentives and information asymmetries that existed prior to economic liberalization and the reduction of state control.

2. Divestitures and privatization have a negative effect on the performance of the resulting units because of weak corporate governance, waning government coordination and regulation, unclear property rights, and the underdeveloped legal and institutional framework in emerging market economies.

Further, the short- and medium-term effects of firm break-up were shown to be important (Cho and Cohen, 1997) but they have not been thoroughly researched yet (Moschieri and Mair, 2008). Therefore, in terms of the time effect of the break-up we test this hypothesis:

3. Break-up does not have a permanent effect on the performance of new units.

As mentioned above, we assess the total effects of the break-up of firms and test all hypotheses on financial indicators for new firms resulting from break-up as well as for reconstructed indicators of the original master firms.

### **3. Data, Identification of Break-up, and Definitions of Variables**

We deviate from the standard sequencing and introduce our data prior to describing our model: this set-up enables a better flow of exposition. The data originate from the wave of corporate break-ups orchestrated by the Czech government in the early 1990's. The data were compiled by Aspekt, a commercial database, and from the archives of the Ministry of Privatization and the National Property Fund of the Czech Republic; the pre-break-up descriptive statistics are presented in Table 1 later in this section. The data allow us to identify unambiguously the parent enterprises and all new units related to the

surge of the break-up of firms that occurred in 1991–1992. Altogether 44 large enterprises were broken up into 130 new firms, the result of the numerous break-ups.<sup>7</sup> Along with these 130 newly created firms, we also have data on 780 firms that did not experience any firm break-up and they constitute our control group. The firms in both groups were subsequently privatized in the first wave of the voucher scheme. This means that all the firms were privatized at the same time using the same privatization method and thus, the treatment effect of privatization affected all firms—with or without break-up—in a uniform manner.<sup>8</sup>

The institutional setting described in Section 2 has strong implications for data quality. Boycko et al. (1994) showed that the decision to pursue mass privatization and even the specific designs of the programs were largely dictated by politics. This is consistent with the imperative of politicians losing control in privatized firms voiced by Roland (1994) and Boycko et al. (1996). Hence, the early wave of firm break-up followed by the subsequent privatization of new units were primarily tools to prevent the revival of communist economic ideas rather than a profit-making enterprise for the state. Later privatizations of the residual state property in the 2000's were directed more toward maximizing gains. Finally, based on the subsequent identified ownership structure available from our data, we assign each firm with an ownership corresponding to the following categories of owner: the state, an industrial firm, an individual owner, or a financial company.

For each firm in our data set, we have detailed information derived from all the proposed privatization projects that were submitted to the government before privatization. This includes the relevant information about the break-up of the firm, the links between the parent (master) company and new units, the privatization scheme, and information on assets, liabilities, profit, sales, and number of employees in 1990. Table 1 displays pre-firm break-up economic indicators in 1990 for the new units, parent firms, and firms in the control group. A key observation is that new units were more capital-intensive and less labor-intensive than non-broken firms. A striking difference can also be observed in the number of privatization projects submitted for new units, which

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<sup>7</sup> These new firms received new tax identification numbers and had the same rights to use the brand and/or trade name of the former parent enterprise. Originally there were 131 new firms but we use only 130 of them since for one divested firm no relevant data covering the period under research are available.

<sup>8</sup> In this scheme altogether 988 firms were privatized. This means that there are only 77 firms (8% of the total) for which the data are dubious due to legal problems associated with privatization and we do not include them in our sample. Due to the high percentage of firms not experiencing break-up and the complete set of new firms in the data set, there is virtually no truncation involved in our case.

greatly exceeds that for non-broken firms. This difference points to greater interest in new units and bigger expectations for them on the part of potential investors. For many enterprises there were several privatization projects submitted and their number was directly and primarily related to the number of divisions within each firm or the number of units into which a firm could be naturally divided. Each privatization project reflected the structure of the firm, managers' motives, degree of investor interest, and expected future performance of the firm. However, prior to firm break-up and privatization, the non-broken firms exhibit better performance measured by scaled profit and sales than new units.<sup>9</sup>

Finally, in Figure 1 we illustrate the average performance developments in firms with and without break-up after the break-up of firms and privatization. We present four indicators of corporate performance recorded with a yearly frequency: the operating profit per total assets to show unit performance irrespective of size, the operating profit per equity to allow for changes in capital structure, the profit over staff costs to provide a perspective on differences in cost effectiveness among firms, and finally a value-added as a complementary standard productivity measure. Using all firms for which data are available in a given year, we compute and plot the mean values for firms with and without break-up during the post-break-up and post-privatization period (1996–2005). In terms of profit indicators, we observe a stable upward trend that is most pronounced for profit per total assets and staff costs and less pronounced in the case of profit per equity. In both upward trends new units also record higher performance than non-broken firms, especially in terms of the labor productivity measure. All the profit measures exhibit some degree of seasonality with a sharp drop in 1999 that echoes the poor economic performance and the country's negative aggregate growth in 1998. Other ups and downs are likely to reflect less-than-complete reporting by firms rather than economic reasons. Primarily, in later years we observe a sizeable drop in the number of observations for both new units and non-broken firms. The reasons why some firms are not recorded in our panel data set in later years are: a) they were acquired, b) they underwent a bankruptcy procedure, or c) those firms were no longer required to regularly publish their annual income statements by law and thus failed to do so. Unfortunately, we were not able to fully distinguish the reasons for each firm. Finally, the value-added indicator

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<sup>9</sup> Let us note that domestic accounting standards in the early years of transition reflected more the production side of business activities rather than corporate profits. However, since we compare firms within the same industrial sector the possible discrepancies are minimized.

shows consistently better performance of new units over non-broken firms, albeit with a considerable drop during the period 2001–2005.

To conclude, generally positive performance findings at first glance show a better position for new firms resulting from break-up during the whole period under research. This observation should be viewed with a caution as developments of the performance indicators are presented for all firms for which data were available in a given year. Hence, these are raw data that have no way to present a true picture in which the endogeneity of firm break-up and ownership change with respect to performance could be properly processed and accounted for. This task will be performed in the next step. First we introduce our methodology (Section 4) and then empirical findings (Section 5).

## **4. The Estimating Framework**

### *4.1 General Outline*

From the methodology perspective the break-up of a firm represents a treatment that is present in a group of divested firms but absent in a control group of firms that did not experience a break-up.<sup>10</sup> Since firms' break-up and subsequent changes in ownership structure can be correlated with firms' unobserved characteristics, the explanatory variables related to firm break-up and ownership have to be treated as endogenous. The endogeneity issue related to the Czech surge of break-ups has been dealt with by Hanousek et al. (2009), who modeled corporate performance as a function of the presence or absence of a firm break-up and type of ownership structure. Since the explanatory variables related to firm break-up and ownership structure were found to be endogenous, they used instrumental variables in their estimation.<sup>11</sup> In particular, they used a logit equation to model the break-up of a company and subsequent changes in its ownership structure, with the explanatory variables being predetermined and exogenous with respect to the break-up of the firm and privatization. This regression-based

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<sup>10</sup> In a similar fashion Jurajda and Stancik (2009) consider the foreign takeover of Czech firms as a treatment and analyze its effect on firm performance.

<sup>11</sup> Hanousek et al. (2009) used the following IVs: the number of privatization projects submitted to the government in 1991, the extent of how much the size of each firm deviates in 1990 from the standard size of a firm in a specific industry in the OECD economies, the ownership structure proposed in 1991 in the winning privatization project (expressed in the percentage intended for a particular ownership type), the profitability of the parent firm prior to privatization and break-up (in 1990), and the total number of shares per parent firm in 1990 (e.g., total assets). The effects of variables such as the firm's distance from the mean OECD size, profitability, and total number of shares can be nonlinear and a Taylor series expansion of the second and third orders were used to formulate a specification that took into account potential nonlinearities.

approach is suitable provided adequate instruments are available and the time span is adequate.

In our analysis we take a different approach, though. In order to capture the total effect of the break-up of a firm we need to analyze the effects of the break-up on both the new units resulting from the break-up as well as on the original master firms. Obviously, the employed method should account for the possible endogenous character of the break-up along with sample selection due to potential data attrition. As time goes on some firms might fail to report data or even completely disappear. Then, it is natural that as less data becomes available, the estimation and identification of the desired effects becomes less accurate and meaningful.

For the reasons articulated above we use in our analysis propensity score matching and DID estimation instead of the classical IV approach. This allows us to correctly study the medium-term effects of firm break-up on corporate performance while accounting for endogeneity issues. To do so, we study the performance of new units as well as the performance of the original master firms. We consider firm break-up as the “treatment” variable and we study the average treatment effect on the treated subject (ATT). In this respect we conduct two matching procedures. First, we follow the mainstream of the research on firm divestures and match new firms resulting from a break-up with those not experiencing break-up. Second, we reconstruct master firm performance indicators and match master firms with those not experiencing break-up. The combination of both approaches enables us to capture the total effect of the break-up. This dual approach, i.e., a combination of the break-up effects observed on new units and master firms, is an ideal application of  $p$ -score matching.

Further, an identification strategy using  $p$ -score matching during the pre-privatization and pre-firm break-up period can also better address endogeneity issues together with the data attrition problem when compared with the IV technique (Dehejia and Wahba, 2002). This is because we are interested in the effect of firm break-up; other influences are of secondary interest but we still control for them. In the case of  $p$ -score matching the proper evaluation of the impact of a break-up on the performance of a firm involves speculation about how this firm would have performed if it was not divested (see Roy, 1951 and Rubin, 1974 for earlier references). The matching approach in the context of our research is based on the idea of comparing the performance of treated versus non-treated firms (e.g., new units versus non-broken firms) based on observable characteristics common to both. The comparison is used to interpret the difference in

their post-treatment performance as an effect of firm break-up (and of subsequent ownership).

Formally, we use the standard approach to evaluate the treatment effects of the break-up of a firm. As it has become standard, we employ a binary treatment indicator  $DIV_i$  that equals one if firm  $i$  is a new unit resulting from break-up (divested) and zero otherwise. The potential firm performance is then defined as  $Y_i(DIV_i)$  for each firm  $i$  in the sample, where  $i = 1, \dots, N$  and  $N$  denotes the total number of observations.

The parameter that has been widely used in the evaluation literature is the so-called *average treatment effect on the treated* (ATT), which is defined as:

$$ATT = E[treatment \mid DIV = 1] = E[Y_1 \mid DIV = 1] - E[Y_1 \mid DIV = 0] \quad (1)$$

From the perspective of the general type of divestiture the ATT measures the difference in the potential performance of a divested firm in the two states of being and not being divested. Because we do not observe the mean for divested firms, we have to define an appropriate alternative for it as  $E[Y_i \mid DIV = 0]$  in order to estimate the ATT. A widely used strategy is to assume that for a given subset of observable variables  $X$  that are not affected by firm break-up, the potential firm outcome is independent of treatment indicator  $D_i$ . In a seminal paper Rosenbaum and Rubin (1985) suggest to use so-called balancing scores to overcome the dimensionality problem in  $X$ . The independence of a potential outcome given a set of variables  $X$  is then transferred to conditional independence on a balancing score  $b(X)$ .

The propensity score  $P(DIV = 1 \mid X) = P(X)$ , i.e., the probability for a firm to be divested given its observed covariates  $X$ , is the suitable balancing score. The propensity score ( $p$ -score) is then formally defined as

$$E\{Y_{0,t+k} - Y_{0,t} \mid DIV_t = 1, P(X_{t-1})\} = E\{Y_{0,t+k} - Y_{0,t} \mid DIV_t = 0, P(X_{t-1})\}. \quad (2)$$

Using the propensity score, the  $p$ -score estimator for ATT can be written as

$$ATT_{t+k}^{PSM} = E_{P(X) \mid DIV=1} \{E[Y_{1,t+k} \mid DIV_t = 1, P(X_{t-1})] - E[Y_{0,t+k} \mid DIV_t = 0, P(X_{t-1})]\},$$

or in simplified notation,

$$ATT^{PSM} = E_{P(X)|DIV=1}\{E[Y_1|DIV = 1, P(X)] - E[Y_0|DIV = 0, P(X)]\}. \quad (3)$$

The time index  $t$  indicates the sequencing and proper variables used: break-up (divestiture) happened at time  $t$ , conditioning for  $p$ -score matching is done on pre-firm break-up characteristics ( $X_{t-1}$ ), and the evaluation of  $ATT$  occurs several periods after the break-up of the firm. Basically, the  $ATT^{PSM}$  estimator is nothing but the mean difference in firm performance over the common support, appropriately weighted by the propensity score distribution of matched firms. Under such assumptions the matching method results in an unbiased estimate of the treatment impact such as firm break-up; for more discussion of the treatment effect see Dehejia and Wahba (2002) or Smith and Todd (2005), among others.

Despite the fact that the literature on matching estimators considers several kinds of estimators, the  $ATT^{PSM}$  defined in (3) that uses a difference-in-differences (DID) matching technique is considered a superior estimator.<sup>12</sup> The DID matching estimator allows for temporally invariant differences in outcomes between treated and control (non-treated) units that can arise (Smith and Todd, 2005). The property that the DID matching estimator eliminates time-invariant differences in performance between divested and non-divested firms is counterbalanced by the fact that the DID matching estimator is more data-demanding and requires the use of longitudinal data before and after treatment and a suitable set of conditioning variables for pair matching.

Since we employ panel data we greatly benefit from the DID matching estimator's quality. Further, we use a set of conditioning variables—i.e., pre-firm break-up characteristics such as the size of the firm, industrial sector, and pre-break-up (and pre-privatization) performance indicators, along with proxies for the future ownership structure—that satisfy the required conditions. Therefore, in the present paper we employ propensity score matching that fully accounts for the outlined endogeneity and is well suited for our purpose due to the longitudinal character of our data.

#### 4.2 Our Estimation Approach

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<sup>12</sup> The literature on matching estimators considers several kinds of matching algorithms, which leads to different estimators with particular properties like a) nearest-neighbor matching, b) caliper matching, c) kernel matching, or d) local-linear matching.

As mentioned in the previous sections, we estimate the causal average effect of treatment on the treated subject (ATT), i.e., the effect of break-up on new units. Specifically, we test these effects 1) on the new units that emerged from a break-up (130 firms) with respect to those that did not experience break-up (780 firms) and 2) on original master firms (44 firms) that were broken-up with respect to those that were not (780 firms). The first set of ATT effects is a mainstream result while the second set serves as a complementary result.

In the above outline  $Y_j$  is a measure of the corporate performance of new units resulting from break-up ( $j=1$ ,  $DIV_t = 1$ ) or firms that were not broken ( $j=0$ ,  $DIV_t = 0$ ). The period when we compare firm performance is 1996–2006; the initial period  $t_0$  refers to 1996, after the post-privatization changes in ownership structures were settled. Our estimator of interest  $ATT$  introduced in (3) therefore reflects the difference in performance between the current ( $t_0+k$ ) and initial period ( $t_0$ ). Similar to other matching studies, we match firms within the same industrial sector.

First, it is possible to estimate the causal effect of firm break-up on firm performance by assuming that firm break-up is as good as random conditional on the observed characteristics among the firms that have a similar predicted probability of being subject to break-up (divested)  $P(X_{t-1}) \equiv P(DIV_t = 1|X_{t-1})$ , where  $t$  denotes the time of the break-up of the firm. Then, the causal effect is defined as the difference between the average performance over  $k$  years of firms (denoted as  $E\{Y_{1,t+k} - Y_{1,t}|DIV_t = 1\}$ ) that became new units after the break-up (were divested) and the hypothetical performance of the same firms had they not been divested (denoted as  $E\{Y_{0,t+k} - Y_{0,t}|DIV_t = 1\}$ ). The probability of being divested (the propensity score) is assumed to depend on a set of pre-firm break-up (as well as pre-privatization) observable characteristics. The fact that we are able to use for matching pre-firm break-up firm-specific variables, whose values were set by central planners independently of what firms would subsequently do in a market setting, makes them quality-conditioning variables. The variables used in estimating  $p$ -scores represent measures of the size, industrial sector, and scaled performance of firms. Specifically, we consider the probability of firm break-up as the function

$$P(\text{divested}) = f(\text{size}, \text{industry}, \text{performance}, \text{owners}, DE), \quad (4)$$

where we consider various functional forms of size (log of capital, capital, and capital squared), industrial sectors, and pre-firm break-up indicators represented by sales per total assets ( $s\_tns$ ) and profit per total assets ( $p\_tns$ ). To capture the future ownership structure we consider the proxies derived from privatization projects: the percentage of shares held by investment privatization funds ( $ipf$ ) and municipalities ( $munic$ ). With these two variables we control for the initial ownership structure intended for privatized firms. In addition we also employ a relative excess employment variable ( $DE_i$ ) to control for differences in firm size. In the logit specification we also use some of these variables squared. In Table 2 we list all the observables introduced above. The financial and economic characteristics are easy to understand and we provide the necessary intuition for the rest of the variables below.

The relative excess employment ( $DE_i$ ) variable and its construction corresponds to the fact that central planners tended to establish and maintain very large firms, both because it was easier to control a few large (rather than many small) firms and because of the prevailing political philosophy to build large firms under a command regime. Thus, relative excess employment ( $DE_i$ ) is a matching criterion that measures the number of employees in a firm in 1990 minus the number of employees in a (weighted) average firm belonging to the same industrial sector in the OECD economies in the same period (see Kumar et al., 1999).<sup>13</sup>

Finally, the proportions of assets held by investment privatization funds and municipalities are proxies for corporate governance. Investment privatization funds held substantial stakes in privatized firms, pursued profitable opportunities, and were also found to engage in defensive restructuring by reducing employment (Hanousek et al., 2007). Hence, they are taken as a proxy for the extent of corporate governance. Municipalities received various ownership stakes as free property transfers and became stakeholders in numerous companies, mainly in utilities and transportation, but being a

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<sup>13</sup>We take the mean OECD firm size as a benchmark because the transition countries declared their commitment to move towards a standard market economy and many, including the Czech Republic, succeeded in joining the OECD in 1995, soon after the start of the transition. One of the determining factors for a divestiture is therefore likely to be the size of the firms that emerged from the centrally planned system, relative to the size of firms in established market (OECD) economies. Since the socialist planners preferred large firms, the relative employment variable ( $DE_i$ ) captures effectively the excessive size of enterprises under central planning relative to the firm size in market economies and serves as a matching variable.

The  $DE_i$  variable can also be understood as an instrument for divestiture. We run our matching procedure without this variable but the results (available upon request) were not materially different as we primarily control for the size of the company and industrial sector, which indirectly corresponds to the definition of  $DE_i$ .

part of the state ownership structure they did not pursue an overly active role in the companies (Kočenda and Hanousek, 2009). They are then taken as a proxy for weak corporate governance.

For all observables listed in Table 2 we provide marginal effects along with the  $p$ -value of the marginal effect for each variable. To capture the possible heavier tail distribution we primarily employed a logit model, however, we also checked that a probit model yields very similar results. Since the purpose of estimating equation (4) is classification rather than the estimation of underlying structural coefficients, the optimal choice of the underlying functional form is not an issue (Smith, 1997).

The estimated  $p$ -scores are later used to control for influential factors in the score matching procedure. We can derive several key observations from the table. The size of the firm measured by the log of capital is a key factor behind firm break-up. The marginal effect shows that the bigger the firm the greater the probability of the break-up occurrence.<sup>14</sup> A similar observation can be made for marginal effects associated with other variables. However, in most cases the effect is economically marginal. Finally, based on relatively high values of  $R^2$  and stable results across different specifications we conclude that the employed variables adequately characterize firms for the propensity score matching procedure.

## 5. Empirical Results

### 5.1 Effect of break-up on new units

We present our results in Tables 3 and 4. For estimation we used STATA 10 and specifically we employ the standard procedure *psmatch2* implemented by Leuven and Sianesi (2003), with kernel matching using a Gaussian kernel. Standard errors were obtained by using bootstrapping methods. An additional STATA procedure *pstest* was used for covariate imbalance testing.

First we show performance results measured in terms of operating profit scaled by total assets and operating profit scaled by firm equity (Table 3). Scaling by total assets helps to put the performance indicator into the perspective of the firm's profitability irrespective of its size. The second measure complements the information on performance by accounting for changes in capital structure, as equity can often change over time. Further, we use profit over staff costs as a measure of labor

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<sup>14</sup> We also include the results of the  $p$ -score estimation where we exclude different measures of firm size.

productivity and finally a value-added as a complementary standard productivity measure (Table 4).

In Tables 3 and 4, separately for each year we present the average treatment effect on treated firms (ATT) along with the statistical significance of the effect. Treated firms are the new firms resulting from the break-up of the master firm and the average treatment effects on treated firms show time-dependent positive or negative differences in the performance of new firms with respect to the performance of non-treated firms (without break-up). For example, in 1996 new firms recorded a profit over total assets that was 0.039 times larger than the profits of non-broken firms. In the same year the profit over equity of new firms was 0.628 times larger when compared with non-broken companies (Table 3). In 1996 profit over staff costs were 1.587 times larger and the value-added was 6.035 times larger in new firms when compared to non-broken firms (Table 4). In 1997 the effects related to profit over total assets and profit over equity were even larger than in 1996, while the profit over staff costs and value-added were smaller but still positive and statistically significant. The situation changes afterwards.

The observed effects presented in Tables 3 and 4 are quite uneven: after growing gradually, there is a sharp drop into negative territory. In more detail, at the beginning of the researched period new firms resulting from the break-up of the master firms exhibit better performance than non-broken firms. This positive difference gradually increases for a limited period of time and quickly reaches its peak around 1997–1998. During the subsequent stage the positive differences become negative when statistically significant values are available. For the rest of the observed period values become mostly negative, albeit without being statistically significant. Therefore, judgment has to be made carefully as the numbers of observed data for both new and non-broken firms were dropping considerably in the later years of our sample. As our paper is the first attempt to analyze the medium- and long-term effects of the break-up of firms we acknowledge the fact that due to the drop in the treated sample size after 1999 we cannot possibly capture the long-term effect in full. However, we report the results for all years for which we have data along with changes in the treated sample for the sake of completeness. We observe that the effect of firm break-up rapidly dissipates. Since break-up was the initial form of restructuring, the intuition behind this result is that the performance-enhancing potential of the break-up was exhausted quickly. Hence, later improvements in the performance of firms had to be due to other factors. Based on the

relevant literature we conjecture that the most likely factors were changes in ownership structure and management (see Roland, 2000; Estrin et al., 2009).

The values of the observed effects in Tables 3 and 4 are based on the large total number of matched observations between treated and non-treated firms, e.g. the total number of firms that were exposed to matching (shown in the column labeled N). Further, we show the number of new units used for matching that were successfully matched with adequate firms not experiencing break-up based on a set of matching indicators (column N treated matched). Finally, we show the number of non-broken (control) firms used for matching (column N controls matched). The ratios between the total number of firms used for matching (N) and the number of matched firms emerging from break-up (N treated matched) vary over time. In the majority of the years these ratios exceed 10%. In many years they are well below 50%, though. Thus, the range of these ratios suggests that the common support problem could be a relevant concern in these data. For this reason, we perform a thorough check of the results presented in Tables 3 and 4 to assess how well the propensity score did to balance observables across the matched new units (treated) and non-broken (control) firms. We perform a series of balancing tests, e.g., the two-sample *t*-tests suggested by Rosenbaum and Rubin (1985). The results of the balancing tests are presented in Table 5. The key finding of our balancing tests is shown in the last column, which records the *p*-values of the test for the treated and control groups. Bold *p*-values for matched variables clearly indicate that we cannot reject the null hypothesis of the equality of treated and control groups for all compared variables. Hence, there is no systematic difference in the distribution of covariates after matching. Moreover, the results of our estimations presented above are based on variables that were proven to be exogenous.<sup>15</sup> Our results (Tables 3 and 4) are then based on a correctly specified procedure as well as an appropriate selection of variables.

### *5.2 Effect of break-up on master firms*

The decision to break up firms was taken and carried out when all the firms under research, including the firms in our control group that were not broken, were state-owned companies. The decision to breakup those firms had no monetary effect on any firm involved. Therefore, we can use (accounting) performance indicators of new units

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<sup>15</sup>The results of these tests are not presented, but they are available upon request.

from the post-break-up period to construct artificial key performance indicators of the master firm as if the firm was not broken up into several new units. This approach allows us to analyze the combined effect of the break-up on all the firms coming from the original master firm and thus the estimated ATT effect captures the total effect of the break-up of the firm. The results are then compared to those obtained in Section 5.1. To obtain the results of the ATT effects we use exactly the same step-by-step approach as described earlier with a single exception: to match firms we use single-digit industry codes as some of the new units have slightly different double-digit industry codes than the master firm.

We show our results in Table 6, where we present the average treatment effect on treated firms (ATT) along with the statistical significance of the effect. Treated firms are now the original master firms. The average treatment effects on treated firms show time-dependent positive or negative differences in the performance of the original master firms with respect to the performance of non-treated firms (without break-up). The performance of master firms was artificially constructed based on the performance indicators of the new firms resulting from the break-up of the original master firm.

Due to the fact that the number of master firms suitable for matching drops to an insufficiently low level after 1999, we present our results for the period 1996–1999. Despite this limitation our results are consistent with those presented in Tables 3–4. In 1996–1997 master firms showed increasing positive profits that were to different extents larger than the profits of non-broken firms; coefficients related to value-added are statistically insignificant and prevent interpretation. The pattern broke down in 1998 and profits over assets and equity became negative, albeit statistically insignificant. Profit over staff costs became statistically insignificant as well but coefficient values remained positive. These results indicate two key interpretations. First, initial restructuring in the form of a break-up worked as, on average, new firms prospered better than non-broken firms; artificially composed master firms showed better performance as well. Second, restructuring brought pressure to lower costs through wages: when we inspect the ATT results of new firms' performance in the form of master firm performance we see that master firm profits over staff costs was consistently positive and superior with respect to non-broken firms. Hence, in new firms the pressure on staff costs was greater, possibly due the initiated restructuring.

Finally, in Figures 2–3 we present a summary of our findings in graphical form. In both figures we show the development of all four performance indicators over the

period 1996–1999 for both new firms as well as the artificially constructed master firms. This presentation also shows the variability of coefficients and their statistical significance. Smaller bars mean smaller variability. Bars above or below the zero threshold mean statistical significance while bars crossing the zero threshold indicate statistical insignificance. Both new and master firms consistently show initial improvements over non-broken firms that disappear after 1998. Thus, the total effect of a break-up is shown to be consistent with effects found in separate new firms.

## **6. Conclusions**

We analyzed the effects of corporate divestitures and ownership changes on firm performance in an emerging European market. We employed a unique data set for a large number of Czech firms over the period 1996–2006. In our analysis we accounted for ensuing changes in ownership structure due to privatization and the endogeneity of performance with respect to firm break-up and privatization. Regression-based techniques often suffer from a lack of so-called “common support” when the characteristics of new units coming from break-up differ from firms that were not broken up. Therefore, we employed a propensity score matching procedure that fully accounted for endogeneity and was well suited for our purpose due to the panel character of our data.

Our results show that five years after the wave of firm break-up took place, the effects of firm break-up are positive. However, later on, after the post-firm break-up and post-privatization events settled down, the primarily positive effect of firm break-up dissipated very fast and in two to three years (from the beginning of our sample) it became negative or statistically indistinguishable (Tables 3 and 4). These results are in contrast to the development of post-firm break-up and post-privatization positive performance obtained from raw data (Figure 1). The reason behind this difference centers on the use of a proper procedure that accounts for the endogeneity of firm break-up and ownership change with respect to performance. In order to verify our results we performed proper balancing tests to show that our results are based on a sound procedure employing an adequate set of variables. In addition, we artificially constructed performance indicators for the original master firms and showed the same performance pattern as in the new units.

In general, our results are in line with the positive effects of firm break-up found in the literature covering developed markets. However, we show that within five to

seven years after divestiture and even sooner after the subsequent privatization these effects disappear. Since break-up was the initial form of restructuring we believe that the performance-enhancing potential of firm break-up was exhausted quickly. Consequently, factors like changes in ownership structure and management are to be found behind later improvements in the performance of firms.

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Table 1

Descriptive Statistics for Selected Pre-firm Break-up and Pre-privatization Firm Characteristics.

Variable	Sub-sample	Number of Observations	Mean	Std. Deviation	Minimum	Maximum
Capital in millions of CZK	Divested	130	640	4330	15.8	49,200
	Not divested	780	301	748	2.2	9,390
	All firms	910	350	1770	2.2	49,200
Number of employees	Divested	130	822	1907	23	17880
	Not divested	780	1156	3049	3	49701
	All firms	910	1108	2915	3	49701
Profit per share	Divested	129	0.89	4.28	-16.94	30.95
	Not divested	778	1.05	6.29	-15.59	90.38
	All firms	907	1.02	6.04	-16.94	90.38
Sales per share	Divested	130	11.73	32.97	0.01	266.17
	Not divested	779	12.10	41.52	0.00	461.36
	All firms	909	12.05	40.39	0.00	461.36
Total number of projects	Divested	130	13.48	18.68	1.00	77.00
	Not divested	780	2.96	4.38	1.00	41.00
	All firms	910	4.46	8.92	1.00	77.00

Source: Privatization databases, authors' computations.

Table 2

## P-score Estimation (divested firms)

variable	dy/dx	z	P>z	dy/dx	z	P>z	dy/dx	z	P>z	Mean (X)
lnc	-5.26E-02	-2.50 <sup>b</sup>	0.01				-5.45E-02	-2.79 <sup>a</sup>	0.01	11.75
tns	4.59E-08	1.03	0.30	4.32E-08	0.93	0.35				3.47E+05
tns2	-2.72E-15	-0.69	0.49	-5.80E-15	-1.43	0.15				4.10E+12
s_tns	5.51E-04	0.99	0.32	9.08E-04	1.64	0.10 <sup>c</sup>	5.62E-04	1.10	0.31	11.37
p_tns	-3.08E-03	-0.73	0.47	-3.45E-03	-0.79	0.43	-3.11E-03	-0.73	0.47	1.10
ipf	-3.38E-08	-0.16	0.88	-3.05E-07	-1.58	0.11	1.19E-07	1.14	0.26	1.37E+05
excess_e	-2.20E-05	-1.25	0.21	-2.80E-05	-1.55	0.12	-2.23E-05	-1.27	0.21	388.15
municip	-1.54E-03	-0.13	0.90	-2.50E-03	-0.21	0.83	-2.32E-03	-0.20	0.84	1.00
(ipf)^2	4.13E-14	0.59	0.56	1.18E-13	1.65	0.10 <sup>c</sup>	5.61E-16	0.03	0.98	2.80E+11
(municip)^2	9.98E-04	1.30	0.19	1.04E-03	1.28	0.20	1.02E-03	1.35	0.18	11.51
(excess_e)^2	4.11E-10	0.67	0.51	5.66E-10	0.91	0.36	4.22E-10	0.69	0.49	1.20E+07
	R2=0.127			R2=0.117			R2=0.126			
Number of observations:	670			670			670			

## Notes:

The table contains the marginal effects for each variable (i.e., derivatives  $dy/dx$ ). The variable *\_pscore* denotes p-score matching, *lnc* stands for ln(capital), *tns* and  $(tns)^2$  denote the total number of shares and the total number of shares squared, respectively; *s\_tns* and *p\_tns* stand for sales and profit per share, respectively. The variable *ipf* denotes the percentage of shares held by investment privatization funds; the variable *excess\_e* corresponds to the mean excess of the number of employees with respect to similar firms in OECD countries. The variable *Municip* denotes the percentage of shares originally transferred to and held by municipalities. Finally, variables  $(ipf)^2$  and  $(municip)^2$  capture the results for the quadratic versions of *ipf* and *municip*, respectively.

Table 3

ATT Results for Operational Profit over Total Assets and Equity  
(new units resulting from break-up)

Operational Profit over Total Assets					
Year	ATT	t-stat	N	N treated matched	N controls matched
1996	0.039 <sup>b</sup>	1.80	694	87	607
1997	0.074 <sup>c</sup>	2.09	671	79	592
1998	-0.038 <sup>c</sup>	-3.40	636	78	558
1999	-0.021 <sup>b</sup>	-1.65	579	71	508
2000	-0.021	-0.15	197	9	188
2001	-0.013	-0.07	188	9	179
2002	-0.027	-0.22	187	9	178
2003	0.003	0.29	179	9	170
2004	-0.021	-0.06	167	8	159
2005	-0.033	-0.63	146	6	140

Operational Profit over Equity					
year	ATT	t-stat	N	N treated matched	N controls matched
1996	0.628 <sup>b</sup>	1.72	693	87	606
1997	0.699 <sup>c</sup>	2.91	670	79	591
1998	0.066	0.47	634	78	556
1999	-0.060 <sup>c</sup>	-2.16	579	71	508
2000	-0.122 <sup>b</sup>	-1.81	197	9	188
2001	-0.202	-1.50	188	9	179
2002	0.018	0.21	187	9	178
2003	0.016	0.21	179	9	170
2004	-0.022	-0.21	167	8	159
2005	-0.072	-0.67	146	6	140

Note: ATT denotes the average treatment effect on treated. It is the effect of the break-up (treatment) on the particular performance variable in new units resulting from the break-up. t-stat is the corresponding t-statistics, N denotes the total number of observations, and N treated matched and N controls matched denote the number of matched divested firms and the number of matched non-divested firms, respectively. The statistical significance of the coefficients is denoted as follows: a (1%), b (5%), and c (10%).

Table 4

ATT Results for Operational Profit over Staff Costs and Value Added  
(new units resulting from break-up)

Operational Profit over Staff Costs					
year	ATT	t-stat	N	N treated matched	N controls matched
1996	1.587 <sup>c</sup>	2.07	496	81	415
1997	1.378	1.54	474	76	398
1998	-0.550	-0.45	442	72	370
1999	-0.717 <sup>c</sup>	-1.98	383	68	315
2000	-9.705 <sup>c</sup>	-8.41	84	7	77
2001	-0.266	-1.15	68	2	66
2002	-2.952	-0.05	77	4	73
2003	0.016	0.09	72	7	65
2004	-5.760	0.70	62	5	57
2005	-5.240	-0.76	46	2	44

Value Added					
year	ATT	t-stat	N	N treated matched	N controls matched
1996	6,035	0.42	501	81	420
1997	3,210	0.20	482	79	403
1998	-2,584	-0.12	448	73	375
1999	-2,452	-0.09	384	68	316
2000	-82,848	-0.56	84	7	77
2001	-67,574	-0.74	82	4	78
2002	-45,740	-0.36	80	5	75
2003	-4,693	-0.04	76	7	69
2004	-10,936	-0.07	71	8	63
2005	-15,874	-0.11	48	2	46

Note: ATT denotes the average treatment effect on treated. It is the effect of the break-up (treatment) on the particular performance variable in new units resulting from the break-up. t-stat is the corresponding t-statistics, N denotes the total number of observations, and N treated matched and N controls matched denote the number of matched divested firms and number of matched non-divested firms, respectively. The statistical significance of the coefficients is denoted as follows: a (1%), b (5%), and c (10%).

Table 5

## Balancing Test Results (new units resulting from break-up)

Variable	Sub-Sample	Mean Treated	Mean Control	%Bias %Bias	removed	t-test	p-value P>t
_pscore	Unmatched	0.20	0.12	51.1		35.36	0.000
	Matched	0.14	0.13	3.9	92.4	0.35	<b>0.730</b>
Lnc	Unmatched	11.59	11.71	-9.3		-4.16	0.000
	Matched	11.54	11.65	-8.9	4.2	-0.58	<b>0.562</b>
Tns	Unmatched	6.40E+05	3.00E+05	11		8.34	0.000
	Matched	2.80E+05	2.80E+05	0	99.9	0.00	<b>0.997</b>
(tns)^2	Unmatched	1.90E+13	6.50E+11	12.3		9.98	0.000
	Matched	5.00E+11	5.90E+11	-0.1	99.5	-0.14	<b>0.890</b>
s_tns	Unmatched	11.73	12.11	-1		-0.40	0.689
	Matched	11.48	10.15	3.6	-258.9	0.23	<b>0.819</b>
p_tns	Unmatched	0.89	1.05	-2.9		-1.10	0.269
	Matched	0.87	0.75	2.2	22.6	0.20	<b>0.843</b>
Ipf	Unmatched	2.10E+05	1.30E+05	11.3		8.08	0.000
	Matched	1.30E+05	1.30E+05	0.6	94.4	0.09	<b>0.926</b>
excess_e	Unmatched	-302.94	630.86	-25.6		-11.70	0.000
	Matched	285.00	31.50	6.9	72.9	0.54	<b>0.592</b>
Municip	Unmatched	2.40	0.59	42		28.07	0.000
	Matched	1.00	0.81	4.5	89.3	0.41	<b>0.680</b>
(ipf)^2	Unmatched	1.20E+12	8.80E+10	12.8		10.33	0.000
	Matched	1.50E+11	1.00E+11	0.5	96	0.37	<b>0.711</b>
(excess_e)^2	Unmatched	1.50E+07	1.20E+07	3.40		1.37	0.170
	Matched	5.50E+07	1.60E+06	3.60	-14.6	0.88	<b>0.382</b>
(municip)^2	Unmatched	39.45	3.95	37.1		28.35	0.000
	Matched	9.95	8.16	1.9	95	0.24	<b>0.807</b>

Notes: The variable *\_pscore* denotes p-score matching, *lnc* stands for ln(capital), *tns* and *(tns)^2* denote the total number of shares and the total number of shares squared, respectively; *s\_tns* and *p\_tns* stand for sales and profit per share. The variable *ipf* denotes the percentage of shares hold by investment privatization funds; the variable *excess\_e* corresponds to the mean excess of the number of employees with respect to similar firms in OECD countries. The percentage of shares originally transferred to and held by municipalities is captured by the variable *Municip*. Finally, the variables *(ipf)^2* and *(municip)^2* capture the results for the quadratic versions of *ipf* and *municip*, respectively. The last column shows the comparisons of treated and control groups; bold-type p-values clearly indicate that we cannot reject the null hypothesis of the equality of treated and control groups for all compared variables.

Table 6

## ATT Results for Master firms

Operational Profit over Total Assets					
Year	ATT	t-stat	N	N treated matched	N controls matched
1996	0.025 <sup>b</sup>	1.71	646	20	626
1997	0.054 <sup>a</sup>	2.29	624	15	609
1998	-0.046	-0.63	598	15	583
1999	-0.011	-0.41	543	14	529

Operational Profit over Equity					
year	ATT	t-stat	N	N treated matched	N controls matched
1996	1.088 <sup>a</sup>	2.38	645	20	625
1997	0.510	0.40	623	15	608
1998	-1.043	-1.14	596	15	581
1999	-0.830	-0.79	543	14	529

Operational Profit over Staff Costs					
year	ATT	t-stat	N	N treated matched	N controls matched
1996	1.32 <sup>a</sup>	2.57	637	18	619
1997	2.05 <sup>b</sup>	1.94	616	15	601
1998	3.50	0.78	588	15	573
1999	0.70	1.11	532	11	521

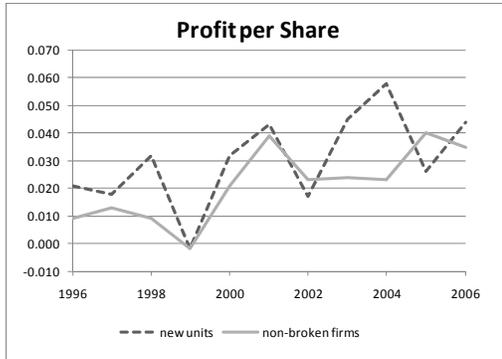
Value-added					
year	ATT	t-stat	N	N treated matched	N controls matched
1996	139927	1.22	646	20	626
1997	137042	1.31	623	15	608
1998	-63990	-1.25	597	15	582
1999	53168	0.41	541	14	527

Note: ATT denotes the average treatment effect on treated. It is the effect of the break-up (treatment) on the particular performance variable in master firms. The performance variable of the master firm was constructed based on the performance variables of the new units resulting from the break-up of the specific master firm. t-stat is the corresponding t-statistics, N denotes the total number of observations, and N treated matched and N controls matched denote the number of matched master firms (divested) and number of matched non-divested firms, respectively. The statistical significance of the coefficients is denoted as follows: a (1%), b (5%), and c (10%).

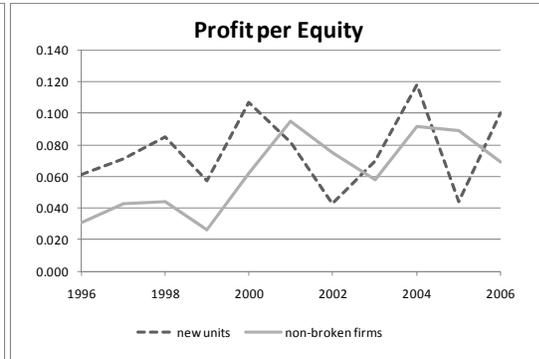
Figure 1

Post-firm Break-up and Post-privatization Performance

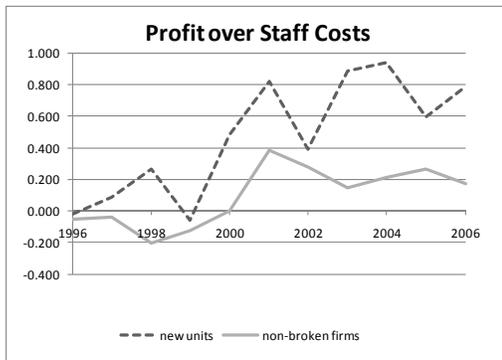
A) Profit over Assets



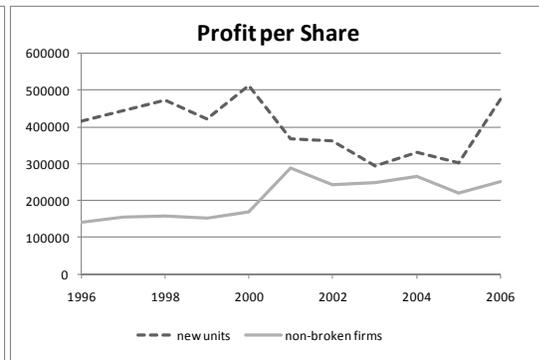
B) Profit over Equity



C) Profit over Staff Costs



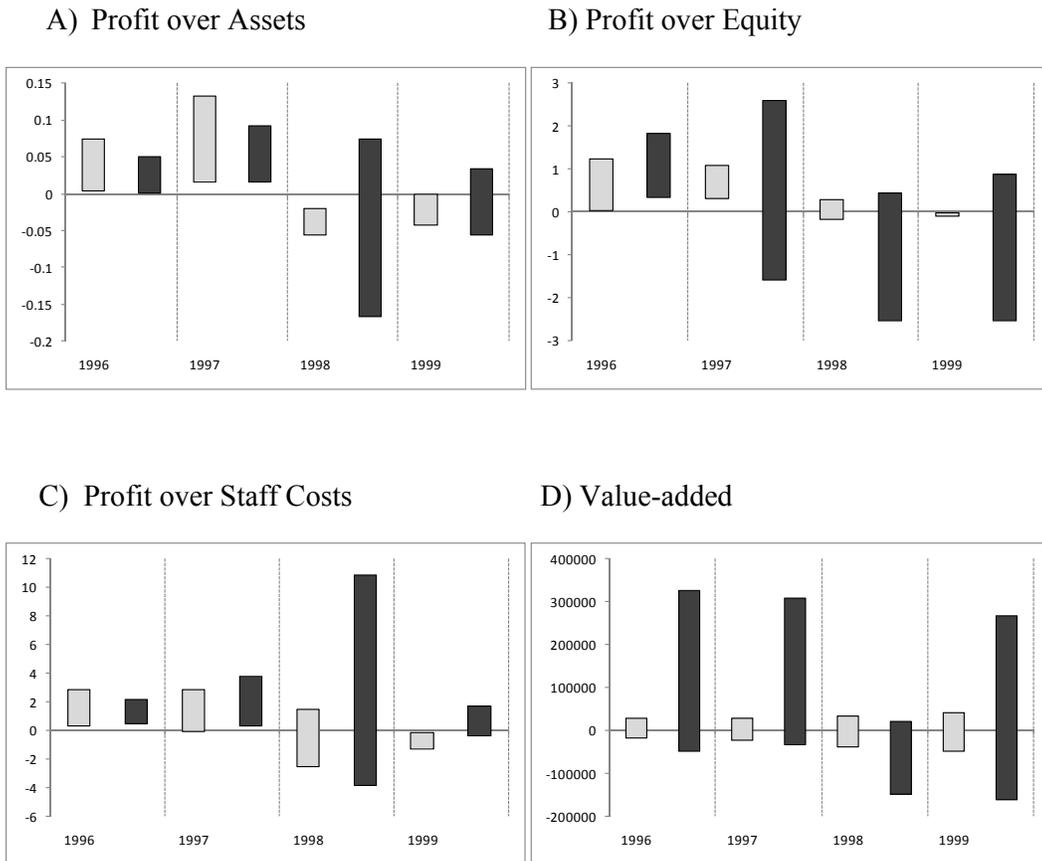
D) Value Added



Note: Above we illustrate the average performance developments in new units emerging after break-up as well as non-broken firms after firm break-up and privatization were put into effect. Mean performance indicators are presented for all firms for which data were available in a given year.

Figure 2

Average Treatment on Treated (ATT) for Selected Performance Indicators:  
 Graphical Summary for New Units as well as Artificially Reconstructed Master Firms



Note: Vertical bars represent 10% double side confidence intervals for ATT, i.e., measuring the effect of firm break-up with respect to the chosen performance indicator. Shadow bars represent ATT for new units resulting from break-up and black colored bars correspond to the original master firms.