WIFO
ÖSTERREICHISCHES INSTITUT
FÜR WIRTSCHAFTSFORSCHUNG

WORKING PAPERS

Corporate Ownership and Performance

Going Public versus Going Private in Europe

Franz R. Hahn, Peter Egger

358/2010

Corporate Ownership and Performance

Going Public versus Going Private in Europe

Franz R. Hahn, Peter Egger

WIFO Working Papers, No. 358
February 2010

E-mail addresses: Franz.Hahn@wifo.ac.at, egger@ifo.de
2010/042/W/0

Corporate Ownership and Performance

Going Public versus Going Private in Europe

Franz R. Hahn
Austrian Institute of
Economic Research
P.O. Box 91
1103 Vienna
E-mail: Franz.Hahn@wifo.ac.at

Peter Egger
ETH Zürich and CEPR
KOF Konjunkturforschungsstelle
WEH E6, Weinbergstrasse 35
8092 Zürich
E-mail: egger@kof.ethz.ch

Abstract

This paper conducts an in-depth analysis of the impact of acquisitions, initial public offerings and management buyouts on productivity and profitability of a large sample of Europe-based manufacturing companies covering the period from 1996 to 2005. At the centre of our analysis is the perception that the performance evaluation of governance-related activities in the business sector such as ownership changes is similar in spirit to the assessment of treatment effects in the evaluation literature. We use propensity score matching techniques in order to resolve the missing data and the selection problem and find evidence corroborating the view that efficiency gains are strongest for those ownership changes that establish corporate governance structures with low principal-agent costs.

JEL classification: F36, C23, C52, G21, G24, G34

Keywords: sample selection, matching techniques, corporate governance, growth

1. Introduction

A large and influential literature stresses the relevance of corporate governance to fostering economic growth. The latter is said to be key to understanding growth at the firm level. The argument is that effectively monitoring firms and inducing managers to maximize firm value improve efficiency and innovation which elevates performance.

A powerful means to make managers maximize firm value is the threat of reorganization involving changes in ownership. Mergers and acquisitions (ACQ), initial public offerings (IPO), and management buyouts (MBO) involve changes of ownership. In a merger, shareholders of the merging firms give up their shares in the individual companies and receive in exchange shares of the merged company. In an acquisition (or takeover), the acquiring firm purchases the stock of the targeted company from its existing shareholders for cash or with its own stock. In an initial public offering, a formerly private firm becomes public by sale of stock to new investors. Further powerful instruments of disciplining firms are hostile takeovers and leveraged buyouts. Firms whose management is blamed for wasting money and leaving profit opportunities unused are among those likely to fall prey to "corporate raiders" who motivate their doing with creating value by restructuring companies and refocusing management.

Advanced financial markets facilitate such changes of ownership. As mentioned, the aim of such ownership changes is to improve efficiency and elevate the growth potential of the firms involved. Well-functioning public equity markets have been widely used in the common-law countries, such as the United States and the United Kingdom, to enforce discipline and exercise control in order to stimulate corporate growth. In the civil-law systems of continental Europe and Japan, public equity markets played a minor role as a vehicle of corporate control until recently. In these countries, stakeholders such as banks functioned as monitors of the non-financial business sector. With the rapidly changing business environment and growing importance of privately funded innovation, research and development activities since the early 1990s, the financial markets have gained in importance as corporate governance mechanism worldwide, in general, and in continental Europe, in particular. Mergers and acquisitions, initial public offerings and management buyouts have become frequently deployed governance devices in almost all European countries aimed to boost firm growth and reduce management slack.

However, there is a divide of opinion regarding the effectiveness of governance-related interventions that are closely related to ownership changes. Among practitioners the usefulness of disciplinary measures activated by an imminent or actual change of ownership is widely undisputed, among academics scepticism prevails. The latter is mostly due to the lack of empirical evidence which corroborates the proposed effectiveness of ownership changes as an appropriate corporate governance device. With the availability of both large-scale data sets at the firm-level and appropriate microeconometric techniques the

likelihood rises that empirical analysis is capable of making a substantial contribution to clarify the role of ownership changes within the ongoing corporate governance debate.

In this study, we address this topic by conducting a difference-in-difference analysis at the firm-level aimed at investigating whether and to what extent the corporate governance-performance nexus is likely to be strengthened by a change of ownership structure while considering the possibility that firms self-select into ownership changes. To be specific, we intend to analyze the impact of acquisitions, initial public offerings and management buyouts on corporate performance, as measured by corporate productivity and profitability, across the manufacturing sector of various European countries, most of which member states of the European Union. Each of these interventions is to be modelled as a treatment with effects on the firm's outcomes (i.e., productivity and profitability) which can be measured by a treatment effect estimator capable of detecting the difference in outcomes for a firm being treated (i.e., gone through ACQ, IPO, and MBO) and not being treated (i.e., not gone through ACQ, IPO, or MBO). Since most firms do not face an ownership change during the sample period, the treatment effect of a specific ownership change we are mostly interested in is the average treatment effect on the treated, which is the average gain due to the treatment for those firms that actually received a specific treatment (ACQ, IPO, or MBO).

The paper is structured as follows. In section 2 we give a brief overview of the empirical relevance of acquisitions, initial public offerings and management buyouts across the globe. In section 3 we present the rationale for the hypotheses to be statistically tested. Section 4 introduces the data used and the methods applied. In section 5 we present the findings of the empirical analysis. Section 6 concludes.

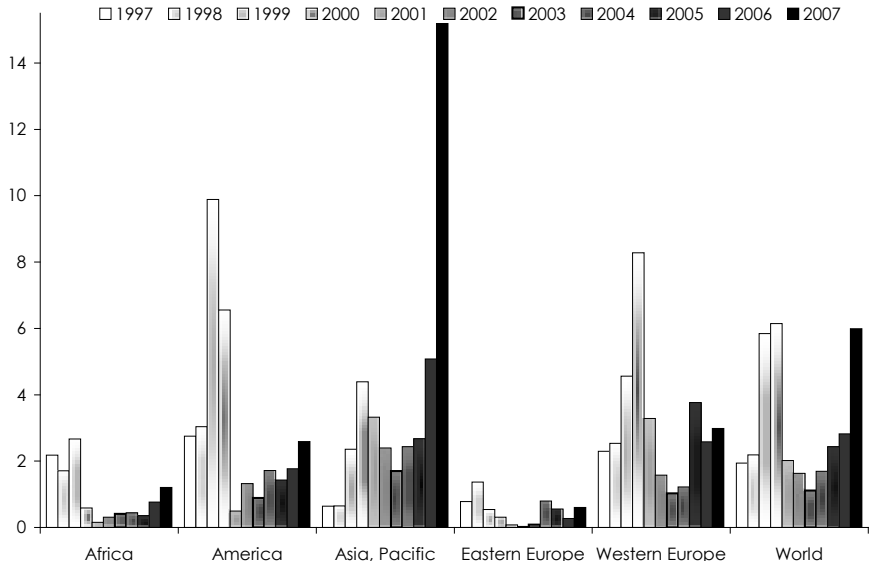
2. Going Public and Going Private: Some Stylized Facts

As pointed out in *Tirole* (2006), the benefits for the firm from going public are said to be manifold. First, new sources of finance can be tapped to spur growth. In addition, it enables firms to be less reliant on a single financier (bank, venture capitalist). That is to say, the firm is less vulnerable against a holdup by a key investor. In addition, going public facilitates exit (assets are more liquid). Compensation schemes can be designed more effectively depending on market-based performance evaluation. Further, going public may work as a governance device to put pressure on the management to perform well otherwise a takeover may become imminent (*Zingales*, 1995, points out that free riding by small shareholders may help extract more surplus from prospective acquirers). However, by going public incentives on the parts of investors may be diminished to monitor effectively management due to a more dispersed ownership structure.

Lastly, as argued in *Tirole* (2006), listing on a stock exchange may help enhance name recognition which may improve approaching new investors, raising new funds and advancing relationship with other stakeholders such as creditors and trading partners. This

may have particularly strong contributed to the high attractiveness to private firms worldwide of going public (see Figure 1).

Figure 1: Going Public – Initial Public Offering Activities around the Globe
Transaction values as percent of GDP



Source: World Federation of Exchanges, UN.

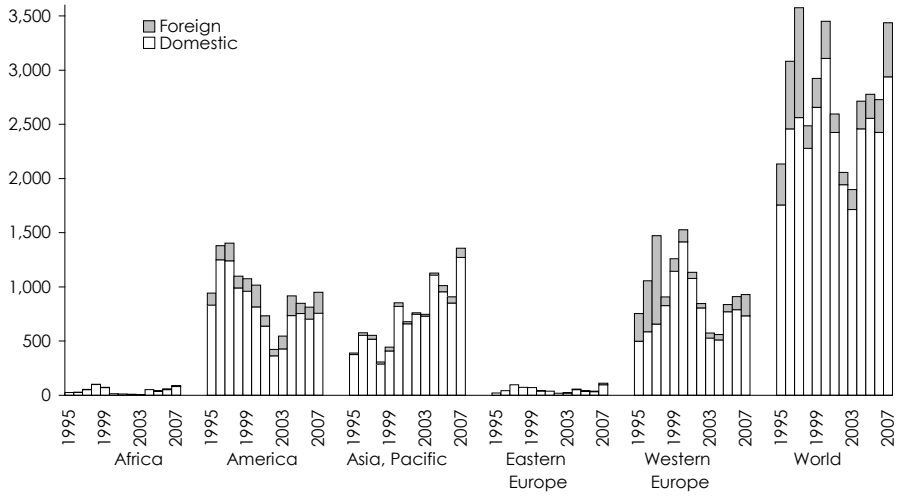
Acquisitions, that is, hostile and friendly ACQs of firms and MBOs are the reverse of going public. Both actions result in taking a firm private by purchasing its shares and allocating them to the private owner (to a raider or another firm in case of takeover, to management in case of management buyout). For lack of own funds, ACQ and MBO are usually highly leveraged.

Tirole (2006) describes the characteristics of an MBO as follows: managers of a firm, usually under the threat of a takeover, join with leverage buyout (LBO) specialists who bring equity of their own or help find investors to cofinance the LBO. The coalition acquires the outstanding shares and divides equity in roughly the following fashion: management receives up to 30 percent, the LBO specialists (who sit on the board) and the external investors pick up the remainder. The ownership pattern of an MBO resembles to a large degree the financing of start-ups by venture capitalists. There are notable differences in that start-ups generate lower income, and therefore are not much leveraged while LBOs often concern firms with steady cash flows and are usually highly leveraged.

Concerning LBOs, the MBO firm usually accumulates a substantial amount of debt. High leverage puts pressure on both management and its LBO partner to strive for high level efficiency (for example, by cutting costs and elevating productivity). Further virtues accompanied with LBOs are said to be stronger monetary incentives for the firm's managers relative to those of a publicly traded corporation. The latter is said to induce superior management performance. In addition, LBO-acquired firms are more likely to be exposed to

particularly active monitoring by credit-providing banks and the LBO specialist who has both incentives and means to intervene in management matters. This also may spur growth, productivity and profitability of a firm which is managed by its skilful owners.

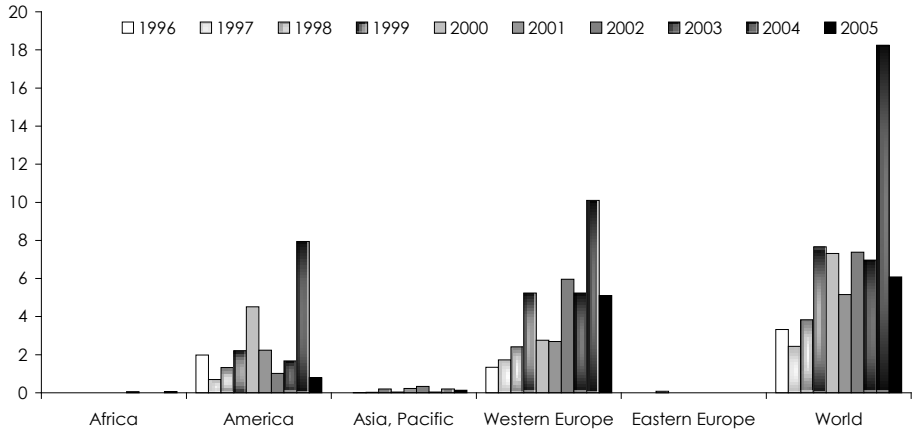
Figure 2: Number of Newly Listed Companies



Source: World Federation of Exchanges.

As to mergers and acquisitions (M&A), we conceptually distinguish between mergers and acquisitions because the latter operation is driven by different motives and, hence, may lead to different results. Accordingly, we refer to a bid as a merger when the active firm fully integrates (the assets and the operations of) the target firm whereas acquisition operations (or takeovers) are characterized by purchasing a controlling stake in the target firm with the aim to keep the target firm going as a separate entity (the same distinction between merger and acquisition has been made by *Focarelli – Panetta – Salleo*, 2002). In this study, we confine the empirical analysis to acquisitions (takeovers) since we are primarily interested in investigating the impact of ownership changes on corporate performance. In takeovers, the active firm acquires ownership and, thus, control rights of the target firm which are exerted by the management of the active firm (on behalf of the owners of the latter firm). In this case, managers of the acquiring firm control managers of the acquired firm.

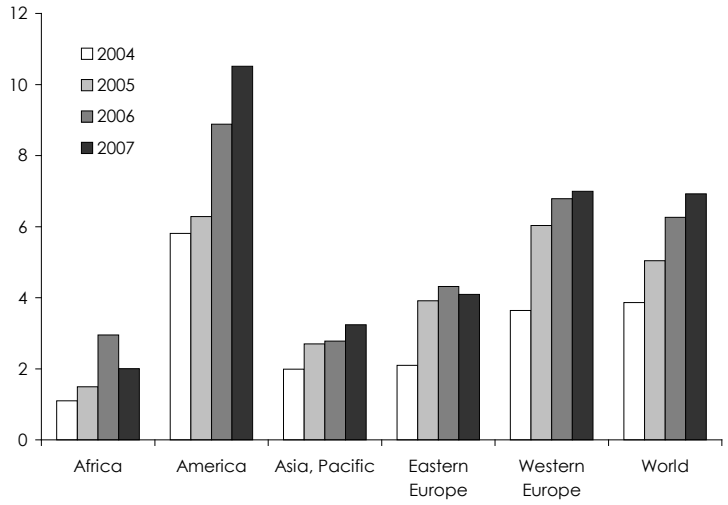
Figure 3: Management Buyout Activities around the Globe
Transaction values in bn USD



Source: CapitalIQ.

In the theoretical literature, however, mergers and acquisitions are seldomly taken as separate occurrences but rather as the same ball game. From a theoretical perspective, M&As, particularly horizontal ones, are considered to be a double-edged sword. There are welfare losses and welfare gains associated with M&As. The downside is that M&As, by reducing the number of active players and by changing the asymmetries between competitors, have a tendency to reduce competition and increase prices. This may be good for the firms but is certainly bad for consumers. The gains for the firms are often smaller than the welfare losses of the consumers. The upside is that mergers have a tendency to reduce costs that may translate into welfare gains for the consumers via price reduction and/or for the firms via higher profits. This trade-off between competition costs and productivity gains arising from mergers was first addressed by *Williamson* (1968). Since then, merger analysis has been primarily concerned with balancing these conflicting effects particularly with respect to their welfare implications as measured by aggregate surplus and/or consumer surplus.

Figure 4: Merger and Acquisition Activities around the Globe
Transaction values as percent of GDP



Source: Thomson Financial, UN.

3. The Corporate Governance-Performance Linkage

For example, the usual conjecture in applied M&A analysis is that the occurrence of a merger or acquisition is basically due to three reasons: (a) the aim for increasing profits, (b) the aim for increasing shareholder wealth, and (c) managerial reasons such as the desire of managers suffering from hubris to build empires (maximizing the size of the firm).

Defining market power as the ability to control (raise) prices, *Gugler et al.* (2003), for example, argue that "if a firm faces a downward sloping demand schedule, and it takes advantage of its increase in market power by raising prices, both its output and sales will fall, if it is maximizing profits, as it will then be operating in the elastic portion of its demand schedule". The authors justify the latter assumption that firms face negative sloped demand schedules by adding that firms being exposed to governance-related interventions such as mergers do not tend to operate in atomistically competitive industries since many of them are very likely to sell differentiated products and exert some limited market power[1]).

Based on this rationale, *Gugler et al.* (2003) derive the following possible consequences of mergers (Table 1).

[1]) Given our data sample, this assumption is very likely to hold since we cover exclusively manufacturing companies that headquarter overwhelmingly in EU member states and produce, in general, differentiated products which allow for some market power. Hence, the assumption that the firms under study are in the position to behave as monopolistic competitor and exert some kind of control over prices appears to be quite reasonable.

Table 1: Possible Efficiency Consequences of Mergers

	$\Delta\Pi>0$	$\Delta\Pi<0$
$\Delta S>0$	Efficiency increase	Market power reduction
$\Delta S<0$	Market power increase	Efficiency decline

Source: *Gugler et al.* (2003). Π ... profitability, S ... sales. Δ refers to the differencing operator between two periods.

The hypotheses being tested in this study are guided by considerations similar to those developed in *Gugler et al.* (2003). Due to the lack of a generally accepted model that provides clear-cut predictions concerning the impacts of corporate governance-related interventions such as mergers, acquisitions, initial public offerings and management buyouts on the status of the enterprises exposed to these activities we proceed along the following lines: since the aim of our empirical analysis is focused on performance effects we advance the industrial organization-based rationale presented in *Gugler et al.* (2003) by theoretical considerations proposed by Schumpeterian-oriented economic growth theory (see, for example, *Aghion – Howitt*, 1998). For this purpose, we choose "productivity" (sales per employee) as our prime investigative target.

The key proposition of endogenous growth theory is that private innovation is due to rent-seeking and as such elevates productivity and spurs overall economic growth. Imperfect competition (i. e., monopolistic competition) allows firms to engage in deliberate research activities with the aim to create new knowledge which is, if marketable, rewarded by monopoly rents. This implication suggests that governance-related actions such as ACQ, IPO and MBO are likely to affect economic growth permanently if they have a positive impact on both productivity and profitability.

If ACQ, IPO or MBO may have the consequence that a firm's productivity rises but its profits decline then we conclude that growth is only temporarily affected by the respective activities.

Finally, both economic theory and economic intuition suggest that the combined occurrence of declining productivity and rising profits be very likely caused by exerting market power with the aim of collecting rents without creating positive growth effects. This possible outcome may be privately optimal, but is socially inefficient and, evenly important, growth-retarding.

The last combination, declining profits and declining productivity, cannot be the aim of a profit-maximizing manager and we know of no theoretically meaningful rationale that would motivate such an outcome. Consequently, we do not consider this combination in the empirical analysis to come.

Based on this reasoning we propose the following possible performance consequences of acquisitions, initial public offerings, and management buyouts (Table 2).

Table 2: Possible Growth Consequences of Governance-related Interventions

	$\Delta\Pi>0$	$\Delta\Pi<0$
$\Delta P>0$	Supporting permanent growth	Supporting temporary growth
$\Delta P<0$	Retarding growth	Causing contraction

Π ... profitability (EBIT over total assets), P ... productivity (sales per employee). Δ refers to the differencing operator between two periods.

4. Testing the Corporate Governance-Performance Linkage for Europe-based Manufacturing Companies

4.1 Data

For the empirical analysis, we use the firm-level database systems AMADEUS and ZEPHYR, respectively. Both data systems are supplied by the Belgium-based Bureau van Dijk, one of the leading commercial business data vendors. These data systems cover about 1.5 million Europe-based non-financial enterprises and provide detailed information on both, firm-level data such as balance sheet and income statement data (AMADEUS) and a broad spectrum of corporate governance-related activities such as ownership changes due to mergers, acquisitions, management buyouts and initial public offerings (ZEPHYR).

The annual balance sheet and the income statement data provided by AMADEUS range over 1996 to 2005. Within this time span we have been able to draw a balanced sample of 4,151 manufacturing companies which regularly report operational business data on a yearly basis and meet our prime requirements, that is, being either an entity that had, between 1999 and 2002, been exposed only once to one of the following interventions (treatments) "target of an acquisition", "target of a management buyout", and "target of an initial public offering ", or a firm that had not gone through an ownership change.

Table 3: Number of Treated Companies by Intervention, Sector and Country

	Consumer goods	Basic products	Technical products	Total
Acquisitions (ACQ)				
Belgium	–	1	–	1
Bulgaria	1	3	1	5
Croatia	2	3	–	5
Czech Republic	–	2	3	5
Finland	1	–	1	2
France	3	2	3	8
Germany	–	–	2	2
Greece	–	1	–	1
Hungary	1	–	–	1
Italy	–	2	3	5
Netherlands	–	–	1	1
Norway	2	2	–	4
Poland	11	3	5	19
Romania	1	8	12	21
Slovak Republic	–	–	1	1
Slovenia	2	5	–	7
Sweden	2	–	1	3
United Kingdom	2	1	–	3
Total	28	33	33	94
Initial public offering (IPO)				
Austria	–	–	3	3
Belgium	1	1	1	3
Finland	–	1	3	4
France	2	5	10	17
Germany	–	2	6	8
Greece	3	6	3	12
Hungary	1	1	–	2
Italy	2	–	6	8
Latvia	–	–	1	1
Norway	1	–	–	1
Poland	–	1	1	2
Spain	–	2	–	2
Sweden	–	2	2	4
Total	10	21	36	67
Management buyout (MBO)				
Belgium	2	1	–	3
Bulgaria	–	1	–	1
Czech Republic	–	–	1	1
France	–	3	5	8
Germany	1	1	–	2
Italy	1	–	–	1
Netherlands	–	1	1	2
Norway	–	1	–	1
Poland	1	–	–	1
Portugal	–	–	1	1
Romania	–	–	1	1
Spain	1	1	–	2
Sweden	–	1	–	1
United Kingdom	2	28	11	41
Total	8	38	20	66

Source: AMADEUS, ZEPHYR. Consumer goods ... food, beverages, tobacco; basic products ... pulp, paper and paper products; publishing and printing; chemicals, chemical products and man-made fibres; rubber and plastic products; basic metals and fabricated metal products; technical products ... machinery and equipment; electrical and optical equipment; transport equipment.

The sample covers manufacturing companies of 22 European countries, most of which are member states of the European Union (EU). The set of companies that has been "treated" only once (that is, companies that having gone through one of the ownership changes under study) within the defined intervention or treatment period (1999 to 2002) encompasses 227 units where ACQs run to 94, IPOs to 67, and MBOs to 66, respectively. Consequently, 3,924 companies were not exposed to either of such actions over the entire period of investigation (1996 to 2005). A detailed summary of the essential characteristics of the data sample used is given in Table 3 and Table 4. Figure 5 below will illustrate the distinction of three periods during 1996-2005. In general, we refer to 1996-1998 as the pre-treatment period, to 1999-2002 as the treatment period, and to 2003-2005 as the post-treatment period. Importantly, in order to mitigate "noise in the data" all variables used in the analysis are averaged over the years within a respective period, and the firm sample is balanced (i.e., each firm reports data in every one of the years between 1996 and 2005).

Table 4: Number of Untreated Companies by Sector and Country

	Consumer goods	Basic products	Technical products	Total
Belgium	129	280	83	492
Czech Republic	54	51	33	138
Finland	12	28	15	55
France	143	533	210	886
Germany	–	7	3	10
Italy	160	468	269	897
Netherlands	5	7	5	17
Norway	14	44	22	80
Poland	16	13	5	34
Portugal	2	2	3	7
Romania	36	15	35	86
Slovak Republic	3	3	–	6
Spain	143	427	138	708
United Kingdom	86	310	112	508
Total	803	2,188	933	3,924

Source: AMADEUS, ZEPHYR. Consumer goods ... food, beverages, tobacco; basic products ... pulp, paper and paper products; publishing and printing; chemicals, chemical products and man-made fibres; rubber and plastic products; basic metals and fabricated metal products; technical products ... machinery and equipment; electrical and optical equipment; transport equipment.

In addition, a broad set of market-related and environment-related data has been used in order to get a sufficiently thorough picture of the firms' external conditions. Hence, the presented data cover three different areas aimed at reflecting information (i) on the firms' operations as contained in the balance sheets and on the firms' cost-income structure as contained in the income statement, (ii) on the external markets environment the firms are related to and (iii) on the firms' domestic and international competitiveness position.

4.2 Evaluation Methodology – The Difference-in-Difference Matching Approach

This study addresses two analytical problems of intervention analysis, the selectivity problem and the missing data problem. At the centre of our approach is the view that the performance evaluation of corporate ownership-related activities is similar in spirit to the assessment of treatment effects in the evaluation literature. Consequently, we argue that, for example, going public (or going private) share with, say, social policy programs not only the aim, namely improving performance of the treated but also the fact that each participant (individual or firm) has only one observable outcome, either an outcome with treatment or without treatment. Thus, corporate intervention analysis and program evaluation analysis face the same fundamental problem to assess how a company or an individual receiving treatment would have performed without treatment. The latter outcome is, of course, unobservable and hence called counterfactual outcome. Thus, the problem faced in both the program evaluation analysis and corporate intervention analysis is one of missing data. Further, since activities such as acquisitions, initial public offerings, and management buyouts are exclusively non-experimental, performance analysis also has to cope with self-selection into treatment. Typically, companies (that is, their management) determine by themselves whether, for example, they go public (that is, receive a treatment) and their decision may be related to the benefits of such action. Both selectivity and missing data, that is omitted variables, are usually considered to have the potential of severely biasing the findings of intervention analysis particularly when aimed at evaluating performance effects.

4.2.1 Coping with Self-selectivity

In the respective applied literature, potential evaluation failings due to selectivity and missing data problems have not been addressed so far in the most rigorous way possible. The paper by *Egger – Hahn* (2010) is among the first which applies matching techniques to analyzing corporate governance-related activities (in concreto, bank mergers).

The econometric technique applied in this study may be sketched out as follows. First, there are three periods as outlined in Figure 5: $t-1$ corresponds to (averages during) 1996-1998, t corresponds to (averages during) 1999-2002, and $t+1$ corresponds to (averages during) 2003-2005.

Figure 5: Timing of Events and Variable Construction

Pre-treatment phase:	Treatment phase:	Post-treatment phase:
averages of X_{t-1} between years 1996 and 1998.	$w^m{}_t=1$ if treatment m in any year between 1999 and 2002 and no treatment before; $w^m{}_t=0$ if no treatment in 2002 or any year before that.	change in outcome (y_{t+1}) between average of phase $t+1$ and phase $t-1$.

Let us use superscript m to refer to the three possible treatments ACQ/IPO/MBO which are defined in terms of change in ownership from period $t-1$ to period t and superscript 0 to refer to the control group (alternatively, we could dub the latter as the group of firms with treatment of no change in ownership).[2]) See *Lechner* (2001) for an estimation theory about evaluation with multiple endogenous treatments and *Becker – Egger* (2010) for an application. Since treatment is in changes, so is outcome. Hence, in our application, we focus on y_t^m (y_t^0) and, alternatively, y_{t+1}^m (y_{t+1}^0) denoting vectors of changes (for the sake of simple notation, we suppress the differencing operator) in some outcome level variable for treatment group m (control group 0) from period $t-1$ to period t and, alternatively, (or $t+1$). Furthermore, let w_t^m denote a vector of a binary treatment indicator, where an entry of one denotes an ownership change from 0 to m (that is ACQ, IPO, or MBO) of firms from period $t-1$ to t (treatment m) but not before, and an entry of zero indicates that a firm did not go through an ownership change in that time span. What we are primarily interested in is the difference in outcomes with and without ACQ/IPO/MBO for company i. More formally, with treatment m in year t, we are interested in

(1) $\Delta y_{it}^m = y_{it}^m - y_{it}^0$.

Since y_t^m and y_t^0 are based on annual differences in performance from $t-1$ to t already, Δy_{it}^m represents a difference in differences (DID). As mentioned above, we only can observe either y_{it}^m or y_{it}^0, but not both for the same company i as given by

(2) $y_{it}^m = (1-w_{it}^m)y_{it}^0 + w_{it}^m y_{it}^m = y_{it}^0 + w_{it}^m (y_{it}^m - y_{it}^0)$.

Thus, we are not capable of estimating (1) directly. Though individual treatment effects Δ_{it} cannot be estimated directly, indirect inference on the basis of population averages can be drawn provided the so-called stable unit-treatment value assumption $(SUTVA)$ applies. The $SUTVA$ states that the treatment of each company i be independent of treatment participation of other firms $j \neq i$ in period t. This implies that there are no (or only negligible) feedback effects such as peer effects or general equilibrium effects that may bias the estimands, the population average treatment effects.

As to population averages, there are several treatment effect concepts used in the evaluation literature, the most prominent of which are the "average treatment effect (of treatment m) on the treated" (ATT^m)

(3) $ATT_t^m \equiv E(y_{it}^m - y_{it}^0 \mid X_{it-1}, w_{it}^m = 1) = E(y_{it}^m \mid X_{it-1}, w_{it}^m = 1) - E(y_{it}^0 \mid X_{it-1}, w_{it}^m = 1)$

and the "average treatment effect (of treatment m)" (ATE^m)

---

[2]) As said before, the treatment group consists of firms which changed ownership only once during period t. None of the treated or untreated firms in our sample was treated in period $t-1$.

(4) $$ATE_t^m \equiv E(y_{it}^m - y_{it}^0 \mid X_{it-1}) = E(y_{it}^m \mid X_{it-1}) - E(y_{it}^0 \mid X_{it-1}),$$

where X_{it-1} denotes a vector of pre-treatment firm-specific characteristics or covariates measured in phase $t-1$.[3])

As to ATT^m, the second term on the right hand side of equation (3) is unobservable as it represents the counterfactual. Thus, in order to compute ATT^m we need to state an identifying assumption that allows for assessing $E(y_{it}^0 \mid X_{it-1}, w_{it}^m = 1)$.[4]) A reasonable presumption is that $E(y_{it}^0 \mid X_{it-1}, w_{it}^m = 1)$ equals $E(y_{it}^0 \mid X_{it-1}, w_{it}^m = 0)$. If this condition holds, untreated companies can serve as an adequate control group. While this requirement is most likely met by randomized experiments it is certainly not met by non-experimental data such as ACQ/IPO/MBO data since self-selection into treatment is usually at work by interventions like ACQ/IPO/MBO operations. Typically, companies (that is, their management) determine by themselves whether to go public/go private (that is, receive a treatment) or not and their decision may be related to the benefits of the ACQ/IPO/MBO.

There are several solutions to the selection problem, one of which is the matching approach[5]). Overcoming the self-selection bias through matching techniques calls for some further identifying assumptions. In the evaluation literature based on the matching approach, a common (and reasonable) identification strategy is one that is guided by the so-called "conditional independence" assumption (CIA) and the "common support or overlap" condition (CSC), respectively. The former holds that the assignment to treatment be unconfounded, the latter states that the probability of assignment be bounded away from zero and one. In other words, the CIA allows for the construction of the missing counterfactual means since, conditional on X_{it-1}, the potential outcomes and the assignment to treatment are taken to be independent. The CSC makes sure that the construction is well-defined since, according to this assumption, there always exists, conditional on (the same) X_{it-1}, a positive probability of belonging to both groups, the population treated with m and the control (that is, untreated) population. In the evaluation literature, these assumptions together are referred to as "strong ignorability" (*Rosenbaum* –

---

[3]) With multiple endogenous treatments, there are not only multiple average treatment effects of the treated comparisons but also multiple average treatment effects. There are even two alternative concepts of average treatment effects where one of them conditions on the composition of the treatment and control groups (as we do in ATE_t^m) and the other one does not (see Lechner, 2001, for details).

[4]) Estimating ATE^m requires additional identifying assumptions since both counterfactual outcomes $E(y_{it}^m \mid X_{it-1}, w_{it}^m = 0)$ and $E(y_{it}^0 \mid X_{it-1}, w_{it}^m = 1)$ have to be constructed.

[5]) As to the causal-treatment analysis, there basically are three strands of research ongoing: (i) matching techniques (see *Rosenbaum – Rubin*, 1983, 1984; *Abadie*, 2005; *Imbens*, 2004), (ii) estimating the selection equation and the average treatment effect equation jointly by maximum likelihood (see *Heckman*, 1978), and (iii) adopting an instrumental variable approach (see *Wooldridge*, 2002). An introduction to these methods is given, among others, in *Cobb-Clark – Crossley* (2003). *Lechner* (2001) introduces propensity score matching with multiple endogenous treatments.

Rubin, 1983). As stressed in *Caliendo – Kopeinig* (2005), these assumptions are very strong indeed since they propose "that selection is solely based on observable characteristics and that all variables that influence treatment assignment and potential outcomes simultaneously are observed by the researcher"[6]).

Clearly, above all it depends on the data quality at hand if the imposition of such strong assumptions is justified. Emphasizing the importance of good data, we consider the available dataset rich enough to justify the view that all three basic assumptions elemental to the matching approach be rightly so imposed in our case. Since we primarily deal with activities which happen to occur in different countries and industries we are confident that there are no feedback effects of the sort which may violate $SUTVA$. Further, we certainly do expect given the size and structure of our company sample, that the group of untreated companies allows for the construction of viable counterfactuals for the estimation of both, ATT^m and ATE^m.

As a result, the data situation at hand is most likely to support fully either matching assumption, CIA and CSC, so that the differences in performance outcomes between the group of companies with treatment m in period t and the adequate control group can be rightly attributed to the respective intervention activity.

In contrast to an analysis of levels, difference-in-difference (DID) analysis is able to avoid contamination of the estimates due to complicated time composition effects. Hence, sample-composition effects can be minimized by conditioning on responses of outcome to treatment within clearly specified time windows. Accordingly, the DID estimators of ATT^m and ATE^m in equations (3) and (4) allow for the analysis of immediate versus sluggish adjustment or for the comparison of the before-after performance outcome, respectively.

In accordance with the respective literature, we view the DID estimator combined with the cross-section matching estimator to be more robust than the matching approach applied single-handedly since it allows both, selection on observables and selection on time-invariant unobservables (*Blundell – Costa-Dias,* 2002*; Caliendo – Hujer*, 2005, p. 12).

5. Empirical Findings – The Effect of Acquisitions, Management Buyouts and Initial Public Offerings on Company Performance

5.1 Implementing the Matching Procedure

As indicated above, we are interested in the possible impact of ownership changes such as an acquisition (ACQ), an in initial public offering (IPO) or a management buyout (MBO) on productivity and profitability of manufacturing companies in Europe.

---

[6]) According to *Heckman – Ichimura – Todd* (1998) for the estimation of both, the ATT and ATE it often suffices to assume mean-independence only.

For measuring the impact of ownership changes on the performance of manufacturing companies, we apply the matching approach based on the propensity score procedure introduced by *Rosenbaum – Rubin* (1983) but for multiple treatments as in *Lechner* (2001).

Since this approach deals with selectivity, the topic of whether corporate ownership changes are a binary or multiple choice problem is elemental. Ultimately, the latter determines whether similarity of units with treatment m and untreated units indexed by 0 is determined on the basis of propensity scores estimated from independent binary choice models or on the basis of mode-specific propensities estimated from a multinomial choice model. An ownership change may be modelled by a binary choice model when a company has only one option such as, for example, the option of going public (IPO) or not going public. That is to say, the company has an IPO-option but has no ACQ-option and no MBO-option, respectively.

If a company may simultaneously choose between IPO, ACQ and MBO, one would rather determine the choice probabilities underlying propensity score matching by a multinomial choice model (e.g., a multinomial logit model; see *Lechner*, 2001).

Since we have no prior knowledge of whether the companies under study had an option for just one ownership change, for more than one or for all types of ownership changes during the treatment period, we opt for conducting the analysis under either (extreme) assumption: the one-option mode and the all-option mode[7]).

We start out by assuming that the one-option mode applies. That is to say, the firms under study are assumed to have had just one option among m of changing their ownership structure in the treatment period t. The likelihood of the occurrence of such an event in period t is estimated on the basis of observed characteristics represented by the covariate vector X_{it-1}. In so doing, we search for functions $b^m(X_{it-1})$ called balancing scores with the conditional distribution of X_{it-1} given $b^m(X_{it-1})$ being independent of assignment into treatment m of firm i in year t on average. The probability of receiving treatment in year t given observed characteristics X_{it-1} is called propensity score $P^m(X_{it-1})$. This approach facilitates matching when firms (or individuals) under study are compared on the basis of characteristics that are continuously measured such as balance sheet and income statement data, respectively. Given the one-option framework, the propensity score $P^m(X_{it-1})$ for each company can be estimated by the following binary choice model

$$(5) \qquad P\left(w_{it}^m = 1\right) \approx P\left(\alpha_0^m + \sum_{k=1}^{K} \alpha_k^m X_{k,it-1} + \varepsilon_{it}^m > 0\right)$$

7) It is worth noting that conventional wisdom suggests that companies rarely have multiple options for an ownership change at a given time.

where α_0^m is a constant in the choice model for treatment m, K denotes the number of explanatory variables $X_{k,it-1}$ in the selection equation, and ε_{it}^m is an identically and independently distributed error term. In our applications, ε_{it}^m is assumed to be distributed either normally (probit model) or logistically (logit model). The left-hand-side variable w_{it}^m is set to one in the very period t company i exercised its single option for an ownership change (that is, ACQ, IPO, or MBO) and to zero in the previous period $t-1$.

As mentioned above, the binary choice model is used to select those firm-specific observables into treatment which allow for consistent estimation of treatment effects on the basis of propensity score matching. The observables in question primarily cover firm-specific characteristics that are continuously measured such as production and balance sheet data. The relevant condition for the propensity score to be a valid measure of similarity between the treatment group and the control group is being checked by testing the balancing hypothesis. This establishes that both the average propensity scores of the treated and the controls and the averages of the continuously measured characteristics for the treated and the controls are the same within specific ranges of the propensity score.

In the multiple option frame, we account for the fact that a company (that is, its owners and/or management) may have had the choice among all types of ownership changes simultaneously: an acquisition (sale of stock to another company), an initial public offering (sale of stock to the public) and a management buyout (sale of stock to the company's management). We may even pool these choices into a binary indicator variable referring to any intervention (ACQ, MBO, or IPO) at time t versus no intervention. Since we allow for choosing among different options, we have to factor in that the likelihoods of ACQ, IPO, and MBO add up to one. Hence, we expand the binary choice model (5) into a multinomial choice model. While $P\left(w_{it}^0 = 1\right) + P\left(w_{it}^m = 1\right) = 1$ in the two-option choice models for ownership change, $P\left(w_{it}^0 = 1\right) + \sum_m P\left(w_{it}^m = 1\right) = 1$ in the multinomial choice models. Otherwise, choice probabilities may be represented by (5) also with many options of unit i at time t.

Matching of outcome based on the propensity scores gained by the binary or multinomial choice models obtaining probabilities according to (5) is then carried out by a propensity score matching (PSM) estimator. For example, the respective estimator has the following general form for ATT^m irrespective of whether a binary or a multinomial choice problem is at stake:

$$(6) \qquad \Delta_{ATT^m,t}^{PSM} = E_{P(X_{it-1}|w_{it}^m=1)}[E(y_{it}^m \mid w_{it}^m = 1, P(X_{it-1}), Z_{it-1}) - E(y_{it}^0 \mid w_{it}^m = 0, P(X_{it-1}), Z_{it-1})],$$

where Z_{it-1} denotes a vector of country-specific and industry-specific characteristics transformed into categorical variables. Given our sample of manufacturing companies drawn from various European countries (mostly EU member states) and various industries, the latter allows for exact matching with respect to Z_{it-1}. by applying the matching technique introduced by *Abadie – Imbens* (2002). In addition, one may correct the estimated standard errors of ATT^m and ATE^m for a small sample bias, following *Abadie – Imbens* (2002).

The matching is conducted based on the r-nearest-neighbour principle. For each firm undergoing ACQ/IPO/MBO in period t, r twin firms have to be found that are similar to the former but have not been treated. Following the suggestion of *Abadie – Imbens* (2002), we choose $r = 4$ matches in order to make sure that we get as much information out of the dataset as possible.

5.2 Empirical Findings

The outcome variables used to measure the impact of the ownership changes on performance and the observable covariates at the firm-level, the industry-level, and the country-level X_i and Z_i, respectively, used to identify similar companies are presented in Table 5.

The timing of events and variable construction is outlined in Figure 5.

Table 6 and Table 7 summarize the findings for those model specifications that proved to be superior in terms of both explanation power (pseudo-R^2) and compliance with the balancing hypothesis. Beyond that, these specifications are also supported by respective likelihood ratio tests. In both tables, the coefficient estimates reported are from the logit model (the corresponding probit estimates are available from the authors upon request).

Tables 8 to 11 show that the models presented do not violate the balancing property condition indicating that the treatment and the control group are sufficiently similar besides the treatment activity under study (that is, having gone through an ownership change).

The specifications for both the binary and the multinomial model have been gained by exploring regressions with three blocks of determinants in the most generous form. The first block consists of variables which reflect the linear relationship of firm-specific determinants such as company size, productivity, profitability and capital endowment with the occurrence of ownership changes. The second and third block is designed to capture nonlinear effects of these firm-specific indicators in the form of squared terms and interaction terms, respectively.

Table 5: List of Matching Variables

Treatment Variables	
ACQ	Acquisition (sold to another company), binary
IPO	Initial public offering (sold to the public), binary
MBO	Management buyout (sold to the management), binary
IV	Sum of ACQ, IPO and MBO, binary in multiple-option mode
Outcome variables in treatment(1999 to 2002) or post-treatment period (2003 to 2005)	
rent	Earnings before interest and taxes (EBIT) over total assets
prod	Sales per employee (at 2000 prices)
Firm-specific observable covariates X_i *in pre-treatment period (1996 to 1998)*	
capital	Equity over total assets
wages	Labour compensation per employee (at 2000 prices)
sales	Sales (at 2000 prices)
emp	Employees
size	Sales over gross production of respective industry
wageq	Labour compensation over sales
grow	Rate of change of total assets (at 2000 prices)
prodg	Rate of change of sales per employee (at 2000 prices)
profitq	Earnings before interest and taxes (EBIT) over sales
Industry-specific characteristics Z_i in pre-treatment period (1996 to 1998)	
size_i	Gross production of industry as percent of gross production of total manufacturing
grr_i	Rate of change of gross production of industry by country relative to rate of change of gross production of industry of the Euro area, first quintile = 1 etc.
crr_i	Rate of change of competitiveness indicator of industry by country relative to average rate of change of competitiveness indicator of industry of 22 countries (see *Magerl – Hahn*, 2009), first quintile = 1 etc.
Country-specific characteristics Z_i *in pre-treatment period (1996 to 1998)*	
inc_c	GDP per capita (at purchasing power parities), first quintile = 1 etc.
fin_c	Stock market capitalization as percent of GDP, first quintile = 1 etc.
cred_c	bank loans to non-banks as percent of GDP, first quintile = 1 etc.
Other characteristics encompassed by Z_i	
ind	Pulp, paper and paper products; publishing and printing; chemicals, chemical products and man-made fibres; rubber and plastic products; basic metals and fabricated metal products, Machinery and equipment; electrical and optical equipment; transport equipment; categorical
count	Austria, etc. (see Table 3), categorical

Table 6: Logit Selection Equation, conditioned on the One-option Mode

	ACQ			IPO			MBO		
	β	std		β	std		β	std	
capital $_{t-1}$	4.165	2.541		1.608	2.022		-0.436	0.924	
(capital $_{t-1}$) ^{2}	-1.358	2.414		-2.755	2.378		0.184	1.08	
emp $_{t-1}$	1.249	0.388	***	-2.248	1.264	*	-0.035	0.998	
(emp $_{t-1}$) ^{2}	-0.154	0.065	**	-0.003	0.507		0.683	0.314	**
prod $_{t-1}$	-0.008	0.004	**	0.001	0.002		0.001	0.005	
(prod $_{t-1}$) ^{2}	-0.138	9.38		-0.114	0.716		-0.633	3.1	
profitq $_{t-1}$	3.351	3.93		-1.385	3.263		-5.585	4.382	
(profitq $_{t-1}$) ^{2}	10.797	8.577		22.157	5.928	***	23.214	8.329	***
rent $_{t-1}$	-11.095	4.209	***	0.939	4.223		3.722	4.952	
(rent $_{t-1}$) ^{2}	8.305	8.162		1.076	7.21		-12.82	11.544	
sales $_{t-1}$	0.001	0.002		0.012	0.006	*	0.039	0.017	**
(sales $_{t-1}$) ^{2}	0.001	0.001		-0.01	0.007		-0.251	0.134	*
size $_{t-1}$	-0.006	0.066		0.057	0.134		-0.431	0.283	
(size $_{t-1}$) ^{2}	0.001	0.001		-0.001	0.001		0.029	0.012	**
wageq $_{t-1}$	-16.147	3.332	***	-2.427	4.243		4.826	6.939	
(wageq $_{t-1}$) ^{2}	20.134	4.43	***	7.061	4.413		-7.19	8.73	
wages $_{t-1}$				-0.001	0.031		-0.053	0.037	
(wages $_{t-1}$) ^{2}				-0.041	0.303		0.593	0.245	**
(cap*size) $_{t-1}$	0.067	0.072		0.162	0.13		-0.227	0.215	
(emp*size) $_{t-1}$	0.015	0.012		-0.058	0.074		-0.296	0.108	***
(prod*size) $_{t-1}$	0.151	0.173		-0.285	0.293		-0.666	1.127	
(profit*size) $_{t-1}$	-0.24	0.371		-0.093	0.425		-1.102	1.826	
(rent*size) $_{t-1}$	-0.11	0.239		-0.468	0.406		0.676	1.303	
(sales*size) $_{t-1}$	-0.149	0.041	***	0.465	0.251		-0.587	1.6	
(wageq*size) $_{t-1}$	0.11	0.167		1.662	0.488	***	1.54	0.617	
(wages*size) $_{t-1}$				-0.006	0.003	**			
Constant	-2.301	0.926	**	-4.925	0.921	***	-4.139	1.186	***
Observations	4,018			3,990			3,989		
Log-likelihood	-268.418			-279.843			-314.712		
Pseudo R2	0.398			0.168			0.064		

std ... standard deviation; *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent. $_{t-1}$ ... pre-treatment period (1996 to 1998).

Table 7: Logit Selection Equation, conditioned on the Multiple-option Mode

	Any intervention (ACQ or IPO or MBO)			Multinomial								
				ACQ			IPO			MBO		
	β	std		β	std		β	std		β	std	
capital $_{t-1}$	0.795	0.391	**	2.565	0.703	***	0.324	0.653		-0.383	0.636	
emp $_{t-1}$	0.180	0.166		0.286	0.188		-0.544	0.547		0.716	0.662	
prod $_{t-1}$	0.778	0.612		-1.843	2.395		1.986	0.674	***	-0.596	1.810	
profitq $_{t-1}$	-1.157	1.441		2.459	3.673		-3.588	1.648	**	1.002	3.516	
rent $_{t-1}$	-0.472	1.472		-8.370	3.508	**	4.747	1.892	**	-1.678	2.877	
sales $_{t-1}$	0.001	0.001		0.002	0.001		0.001	0.002		-0.003	0.007	
size $_{t-1}$	0.118	0.044	***	0.124	0.046	***	0.143	0.081	*	0.181	0.163	
wageq $_{t-1}$	2.556	0.810	***	0.189	1.666		4.248	1.198	***	0.111	1.783	
wages $_{t-1}$	-0.011	0.007		-0.045	0.017	***	-0.003	0.011		0.027	0.014	*
(cap*size) $_{t-1}$	0.081	0.048	*	0.035	0.048		-0.008	0.062		-0.048	0.197	
(emp*size) $_{t-1}$	-0.003	0.001	***	-0.003	0.001	***	-0.035	0.020	*	-0.054	0.057	
(prod*size) $_{t-1}$	-0.180	0.168		-0.075	0.125		-0.365	0.272		-0.417	1.048	
(profit*size) $_{t-1}$	0.084	0.131		0.037	0.189		0.292	0.191		-0.047	0.407	
(rent*size) $_{t-1}$	-0.250	0.150	*	-0.078	0.185		-0.574	0.289	**	-0.010	0.483	
(sales*size) $_{t-1}$	-0.021	0.012	*	-0.027	0.012	**	0.081	0.086		-0.106	1.110	
(wageq*size) $_{t-1}$	0.021	0.163		-0.019	0.176		0.271	0.327		0.188	0.470	
(wages*size) $_{t-1}$	-0.057	0.949		-0.565	0.984		1.240	1.545		-4.970	6.074	
Constant	-3.873	0.331	***	-3.812	0.631	***	-5.945	0.532	***	-4.638	0.567	***
Observations	4,150						4,150					
Log-likelihood	-752.273						-915.800					
Pseudo R2	0.143						0.184					

std ... standard deviation; *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent. $_{t-1}$ ... pre-treatment period (1996 to 1998).

In the multiple-option mode, the second block did not meet the balancing property requirement and, thus, was excluded from the regression analyses altogether. Interestingly, in both modes the regressions indicate that profitability- and size-related determinants are those firm-specific indicators that affect the likelihood of an ownership change most. However, as to profitability the impact is not uniform across the various types of ownership changes. It affects the likelihood of being taken over negatively, whereas the occurrences of initial public offerings and management buyouts become more likely when sales profitability is high. Size indicators also matter in almost all cases but, again, in a rather mixed form.

Under either option-mode, the choice models applied work sufficiently well as to explaining the occurrences of acquisitions and initial public offerings, respectively, but have less explanation power in estimating the likelihood of management buyouts.

Table 8: Balancing Property for Acquisitions (ACQ), Binary Model

Explanatory variables	Sample	Treated	Control	t	p>|t|
$capital_{t-1}$	Unmatched	0.518	0.382	6.120	0.000
	Matched	0.521	0.498	0.710	0.477
$(capital_{t-1})^2$	Unmatched	0.312	0.191	6.320	0.000
	Matched	0.314	0.294	0.590	0.553
emp_{t-1}	Unmatched	2.321	0.227	22.320	0.000
	Matched	1.901	1.582	0.630	0.529
$(emp_{t-1})^2$	Unmatched	26.000	0.380	11.290	0.000
	Matched	21.000	6.900	0.910	0.366
$prod_{t-1}$	Unmatched	97.532	194.430	-5.160	0.000
	Matched	100.740	116.360	-0.840	0.403
$(prod_{t-1})^2$	Unmatched	0.019	0.071	-1.580	0.114
	Matched	0.020	0.033	-0.670	0.505
$profitq_{t-1}$	Unmatched	0.067	0.068	-0.070	0.946
	Matched	0.059	0.055	0.270	0.786
$(profitq_{t-1})^2$	Unmatched	0.019	0.009	4.860	0.000
	Matched	0.010	0.012	-0.650	0.519
$rent_{t-1}$	Unmatched	0.069	0.095	-2.840	0.005
	Matched	0.067	0.068	-0.080	0.940
$(rent_{t-1})^2$	Unmatched	0.013	0.016	-1.180	0.237
	Matched	0.013	0.013	0.000	0.999
$sales_{t-1}$	Unmatched	170.000	39.207	7.820	0.000
	Matched	140.000	170.000	-0.390	0.694
$(sales_{t-1})^2$	Unmatched	210.000	22.000	4.270	0.000
	Matched	160.000	240.000	-0.560	0.577
$size_{t-1}$	Unmatched	27.745	1.443	22.150	0.000
	Matched	14.826	9.271	1.560	0.122
$(size_{t-1})^2$	Unmatched	5,575.100	19.497	11.800	0.000
	Matched	1,126.100	256.810	1.150	0.253
$wageq_{t-1}$	Unmatched	0.221	0.219	0.190	0.846
	Matched	0.223	0.253	-1.170	0.245
$(wageq_{t-1})^2$	Unmatched	0.070	0.060	1.500	0.135
	Matched	0.072	0.096	-1.320	0.187
$(cap*size)_{t-1}$	Unmatched	13.108	0.555	22.600	0.000
	Matched	7.034	4.472	1.750	0.082
$(emp*size)_{t-1}$	Unmatched	300.000	2.001	12.850	0.000
	Matched	140.000	33.664	0.990	0.325
$(prod*size)_{t-1}$	Unmatched	2.513	0.358	9.140	0.000
	Matched	1.304	1.029	0.600	0.551
$(profit*size)_{t-1}$	Unmatched	1.796	0.104	20.380	0.000
	Matched	0.843	0.618	0.860	0.390
$(rent*size)_{t-1}$	Unmatched	1.917	0.148	17.230	0.000
	Matched	0.951	0.728	0.690	0.490
$(sales*size)_{t-1}$	Unmatched	22.000	0.500	9.220	0.000
	Matched	7.000	3.500	0.840	0.401
$(wageq*size)_{t-1}$	Unmatched	4.383	0.270	25.460	0.000
	Matched	2.712	2.177	0.800	0.425

$_{t-1}$ … pre-treatment period (1996 to 1998).

Table 9: Balancing Property for Initial Public Offerings (IPO), Binary Model

Explanatory variables	Sample	Treated	Control	t	p>|t|
$capital_{t-1}$	Unmatched	0.401	0.382	0.720	0.470
	Matched	0.381	0.381	-0.010	0.996
$(capital_{t-1})^2$	Unmatched	0.205	0.191	0.610	0.541
	Matched	0.185	0.190	-0.160	0.871
emp_{t-1}	Unmatched	0.386	0.227	2.230	0.026
	Matched	0.229	0.237	-0.100	0.922
$(emp_{t-1})^2$	Unmatched	0.870	0.380	1.000	0.320
	Matched	0.160	0.370	-0.410	0.685
$prod_{t-1}$	Unmatched	214.020	194.430	0.860	0.389
	Matched	235.110	199.690	0.730	0.467
$(prod_{t-1})^2$	Unmatched	0.110	0.071	1.070	0.283
	Matched	0.130	0.086	0.550	0.584
$profitq_{t-1}$	Unmatched	-0.203	0.068	-7.710	0.000
	Matched	0.087	0.065	1.250	0.213
$(profitq_{t-1})^2$	Unmatched	4.616	0.009	7.770	0.000
	Matched	0.016	0.011	1.020	0.308
$rent_{t-1}$	Unmatched	0.096	0.095	0.150	0.884
	Matched	0.115	0.095	0.990	0.325
$(rent_{t-1})^2$	Unmatched	0.024	0.016	2.080	0.038
	Matched	0.026	0.018	0.970	0.333
$sales_{t-1}$	Unmatched	66.562	39.207	1.530	0.126
	Matched	40.014	40.622	-0.030	0.978
$(sales_{t-1})^2$	Unmatched	43.000	22.000	0.410	0.678
	Matched	6.500	21.000	-0.290	0.773
$size_{t-1}$	Unmatched	7.608	1.443	9.060	0.000
	Matched	1.983	1.748	0.280	0.781
$(size_{t-1})^2$	Unmatched	852.550	19.497	8.510	0.000
	Matched	15.206	29.346	-0.340	0.732
$wageq_{t-1}$	Unmatched	0.433	0.219	8.340	0.000
	Matched	0.223	0.231	-0.320	0.749
$(wageq_{t-1})^2$	Unmatched	2.037	0.060	7.900	0.000
	Matched	0.067	0.073	-0.310	0.754
$wages_{t-1}$	Unmatched	34.238	31.002	2.110	0.035
	Matched	32.532	31.018	0.610	0.542
$(wages_{t-1})^2$	Unmatched	1.616	1.109	4.320	0.000
	Matched	1.226	1.115	0.600	0.547
$(cap*size)_{t-1}$	Unmatched	2.126	0.555	6.360	0.000
	Matched	0.722	0.689	0.090	0.926
$(emp*size)_{t-1}$	Unmatched	18.881	2.001	5.360	0.000
	Matched	1.097	2.314	-0.400	0.694
$(prod*size)_{t-1}$	Unmatched	1.019	0.358	2.800	0.005
	Matched	0.432	0.419	0.040	0.967
$(profit*size)_{t-1}$	Unmatched	0.068	0.104	-0.620	0.538
	Matched	0.213	0.126	1.050	0.298
$(rent*size)_{t-1}$	Unmatched	0.065	0.148	-0.980	0.329
	Matched	0.255	0.183	0.570	0.573
$(sales*size)_{t-1}$	Unmatched	2.100	0.500	1.490	0.136
	Matched	0.170	0.560	-0.330	0.739
$(wageq*size)_{t-1}$	Unmatched	1.932	0.270	10.880	0.000
	Matched	0.427	0.343	0.490	0.622
$(wages*size)_{t-1}$	Unmatched	199.790	47.260	6.620	0.000
	Matched	59.475	56.474	0.090	0.925

$_{t-1}$ … pre-treatment period (1996 to 1998).

Table 10: Balancing Property for Management Buyouts (MBO), Binary Model

Explanatory variables	Sample	Treated	Control	t	p>|t|
$capital_{t-1}$	Unmatched	0.366	0.382	-0.590	0.558
	Matched	0.355	0.357	-0.050	0.958
$(capital_{t-1})^2$	Unmatched	0.193	0.191	0.100	0.924
	Matched	0.181	0.194	-0.400	0.693
emp_{t-1}	Unmatched	0.263	0.227	0.500	0.618
	Matched	0.270	0.244	0.250	0.802
$(emp_{t-1})^2$	Unmatched	0.400	0.380	0.040	0.970
	Matched	0.410	0.440	-0.060	0.956
$prod_{t-1}$	Unmatched	166.130	194.430	-1.260	0.208
	Matched	166.920	188.910	-0.790	0.434
$(prod_{t-1})^2$	Unmatched	0.046	0.071	-0.640	0.525
	Matched	0.046	0.067	-0.510	0.608
$profitq_{t-1}$	Unmatched	0.061	0.068	-0.780	0.437
	Matched	0.053	0.058	-0.340	0.737
$(profitq_{t-1})^2$	Unmatched	0.012	0.009	1.550	0.122
	Matched	0.007	0.012	-1.270	0.206
$rent_{t-1}$	Unmatched	0.082	0.095	-1.180	0.239
	Matched	0.082	0.085	-0.140	0.888
$(rent_{t-1})^2$	Unmatched	0.015	0.016	-0.510	0.614
	Matched	0.015	0.018	-0.580	0.565
$sales_{t-1}$	Unmatched	23.566	39.207	-0.880	0.378
	Matched	24.272	36.307	-0.700	0.487
$(sales_{t-1})^2$	Unmatched	1.300	22.000	-0.420	0.673
	Matched	1.300	19.000	-0.380	0.704
$size_{t-1}$	Unmatched	1.412	1.443	-0.060	0.953
	Matched	1.455	1.665	-0.280	0.779
$(size_{t-1})^2$	Unmatched	16.070	19.497	-0.120	0.907
	Matched	16.572	23.258	-0.220	0.827
$wageq_{t-1}$	Unmatched	0.250	0.219	2.210	0.027
	Matched	0.237	0.222	0.750	0.453
$(wageq_{t-1})^2$	Unmatched	0.079	0.060	2.330	0.020
	Matched	0.068	0.062	0.530	0.598
$wages_{t-1}$	Unmatched	32.040	31.002	0.680	0.497
	Matched	30.163	30.749	-0.260	0.797
$(wages_{t-1})^2$	Unmatched	1.419	1.109	2.650	0.008
	Matched	1.074	1.107	-0.200	0.846
$(cap*size)_{t-1}$	Unmatched	0.560	0.555	0.020	0.981
	Matched	0.577	0.555	0.060	0.952
$(emp*size)_{t-1}$	Unmatched	1.552	2.001	-0.160	0.871
	Matched	1.601	2.249	-0.220	0.823
$(prod*size)_{t-1}$	Unmatched	0.153	0.358	-0.890	0.373
	Matched	0.157	0.336	-0.790	0.428
$(profit*size)_{t-1}$	Unmatched	0.089	0.104	-0.320	0.745
	Matched	0.092	0.111	-0.330	0.741
$(rent*size)_{t-1}$	Unmatched	0.114	0.148	-0.430	0.664
	Matched	0.117	0.147	-0.350	0.724
$(sales*size)_{t-1}$	Unmatched	0.065	0.500	-0.400	0.687
	Matched	0.067	0.440	-0.370	0.714
$(wageq*size)_{t-1}$	Unmatched	0.367	0.270	1.020	0.307
	Matched	0.378	0.342	0.200	0.840

$_{t-1}$ … pre-treatment period (1996 to 1998).

Table 11: Balancing Property for Ownership Change (IV), Multinomial Model

Explanatory variables	Sample	Treated	Control	t	p>|t|
capital$_{t-1}$	Unmatched	0.439	0.382	3.930	0.000
	Matched	0.439	0.418	1.020	0.309
emp$_{t-1}$	Unmatched	1.155	0.227	14.690	0.000
	Matched	0.978	1.012	-0.150	0.881
prod$_{t-1}$	Unmatched	151.580	194.430	-3.450	0.001
	Matched	154.740	158.670	-0.230	0.817
profitq$_{t-1}$	Unmatched	-0.014	0.068	-4.260	0.000
	Matched	0.063	0.068	-0.410	0.685
rent$_{t-1}$	Unmatched	0.081	0.095	-2.320	0.020
	Matched	0.081	0.088	-0.740	0.462
sales$_{t-1}$	Unmatched	95.736	39.207	5.280	0.000
	Matched	83.753	86.088	-0.090	0.925
size$_{t-1}$	Unmatched	14.145	1.443	15.410	0.000
	Matched	7.799	6.525	0.780	0.436
wageq$_{t-1}$	Unmatched	0.292	0.219	5.170	0.000
	Matched	0.246	0.237	0.630	0.530
wages$_{t-1}$	Unmatched	26.115	31.002	-5.590	0.000
	Matched	26.784	26.199	0.330	0.740
(cap*size)$_{t-1}$	Unmatched	6.218	0.555	15.080	0.000
	Matched	3.669	2.929	1.050	0.293
(emp*size)$_{t-1}$	Unmatched	130.000	2.001	8.500	0.000
	Matched	59.863	22.812	0.870	0.387
(prod*size)$_{t-1}$	Unmatched	1.387	0.358	6.640	0.000
	Matched	0.851	0.685	0.730	0.467
(profit*size)$_{t-1}$	Unmatched	0.790	0.104	11.750	0.000
	Matched	0.567	0.494	0.390	0.694
(rent*size)$_{t-1}$	Unmatched	0.846	0.148	9.960	0.000
	Matched	0.525	0.560	-0.220	0.824
(sales*size)$_{t-1}$	Unmatched	9.900	0.500	6.110	0.000
	Matched	3.400	1.900	0.860	0.391
(wageq*size)$_{t-1}$	Unmatched	2.492	0.270	17.600	0.000
	Matched	1.600	1.568	0.090	0.927
(wages*size)$_{t-1}$	Unmatched	192.170	47.260	9.560	0.000
	Matched	142.000	114.300	0.650	0.519

$_{t-1}$ … pre-treatment period (1996 to 1998).

Consistent estimation of treatment effects by selection on observables using matching techniques requires the construction of a suitable control group based on some measures of similarity. A necessary condition for a valid compound measure of similarity is that the treatment group and the control group are similar in each and every respect, besides the intervention activity. Otherwise, we cannot be sure whether the difference between the treated and untreated firms in the change of the outcome variable which we are ultimately interested in is in fact due to the difference in some other determinants rather than entering a treatment in the form of going public and going private.

As indicated above, we estimate average treatment effects of the treated (ATT^m, conditional on having gone public or gone private) and average treatment effects (ATE^m, unconditional on the actual going public/going private activity) on two different measures of

firm performance: productivity (defined as sales per employee) and profitability (defined as EBIT over total assets). Table 12 and Table 13 summarize our estimates for both ATT^m and ATE^m for the treatment period (1999 to 2002) and the post-treatment period, (2003 to 2005), respectively.

Table 12: Treatment Effects, conditioned on the Single-Option Mode

Panel A: DID-Treatment Effect for the Treated (ATT^m): Productivity

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATT	8.519	30.086 **	17.075
Standard deviation	6.252	13.131	10.647
95 percent confidence interval	[-3.736; 20.773]	[4.350; 55.821]	[-3.793; 37.943]
Post-treatment period			
ATT	25.950 **	26.404	56.785 *
Standard deviation	10.026	23.145	26.329
95 percent confidence interval	[6.300; 45.600]	[-18.960;71.768]	[5.181; 108.389]

Panel B: Treatment Effect for the Treated (ATT^m): Profitability

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATT	-0.043 ***	-0.009	-0.014
Standard deviation	0.013	0.016	0.014
95 percent confidence interval	[-0.068; -0.017]	[-0.041; -0.023]	[-0.042; 0.014]
Post-treatment period			
ATT	0.012	-0.070 ***	0.017
Standard deviation	0.017	0.020	0.018
95 percent confidence interval	[-0.021; 0.045]	[-0.110; -0.030]	[-0.018; 0.053]

Panel C: DID-Average Treatment Effect (ATE^m): Productivity

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATE	10.955	0.541	6.441
Standard deviation	23.395	14.346	10.325
95 percent confidence interval	[-34.898; 56.808]	[-27.577; 28.660]	[-13.796; 26.679]
Post-treatment period			
ATE	19.332	29.091 *	36.560 **
Standard deviation	35.905	25.584	12.972
95 percent confidence interval	[-51.041; 89.705]	[-21.052; 79.234]	[11.136; 61.984]

Panel D: DID-Average Treatment Effect (ATE^m): Profitability

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATT	0.025 **	-0.061	0.014
Standard deviation	0.011	0.024	0.025
95 percent confidence interval	[0.004; 0.046]	[-0.107; -0.014]	[-0.035; 0.064]
Post-treatment period			
ATT	0.050 ***	-0.049 *	0.014
Standard deviation	0.014	0.028	0.038
95 percent confidence interval	[0.022; 0.078]	[-0.103; 0.006]	[-0.060; 0.089]

Productivity … sales per employee (at 2000 prices); profitability ... earnings before interest and taxes (EBIT) over total assets; *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent. DID … difference-in-difference estimator.

Table 13: Treatment Effects, conditioned on the Multiple-Option Mode

Panel A: DID-Treatment Effect for the Treated (ATT^m): Productivity

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATT	10.009	37.944 ***	17.156
Standard deviation	6.363	12.847	10.572
95 percent confidence interval	[-2.463; 22.480]	[12.764; 63.123]	[-3.564; 37.877]
Post-treatment period			
ATT	28.538 ***	30.823	55.953 **
Standard deviation	10.745	22.882	26.268
95 percent confidence interval	[7.478; 49.599]	[-14.025;75.671]	[4.469; 107.438]

Panel B: DID-Treatment Effect for the Treated (ATT^m): Profitability

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATT	-0.032 ***	-0.006	-0.013
Standard deviation	0.012	0.017	0.014
95 percent confidence interval	[-0.055; -0.008]	[-0.040; -0.027]	[-0.040; 0.015]
Post-treatment period			
ATT	0.014	-0.057 ***	0.013
Standard deviation	0.015	0.020	0.018
95 percent confidence interval	[-0.015; 0.043]	[-0.097; -0.018]	[-0.022; 0.048]

Panel C: DID-Average Treatment Effect (ATE^m): Productivity

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATE	21.683	6.562	4.263
Standard deviation	23.529	14.097	10.120
95 percent confidence interval	[-24.433; 67.798]	-21.069; 34.192]	[-15.572; 24.098]
Post-treatment period			
ATE	35.863	28.819 *	32.609 **
Standard deviation	35.934	24.797	12.867
95 percent confidence interval	[-34.566; 106.291]	[-19.782; 77.420]	[7.390; 57.829]

Panel D: DID-Average Treatment Effect (ATE^m): Profitability

Period and statistic	ACQ	IPO	MBO
Treatment period			
ATT	0.030	-0.057 **	0.000
Standard deviation	0.011	0.024	0.023
95 percent confidence interval	[0.009; 0.051]	[-0.103; -0.011]	[-0.046; 0.046]
Post-treatment period			
ATT	0.052 ***	-0.047 *	0.011
Standard deviation	0.014	0.027	0.035
95 percent confidence interval	[0.024; 0.080]	[-0.101; 0.006]	[-0.058; 0.080]

Productivity … sales per employee (at 2000 prices); profitability ... earnings before interest and taxes (EBIT) over total assets; *** significant at 1 percent; ** significant at 5 percent; * significant at 10 percent. DID … difference-in-difference estimator.

Table 12 reports the findings, conditioned on the single-option mode, Table 13 the findings, conditioned on the multiple-option mode, respectively. Note that the outcome variables under study and the observable covariates are averaged over the respective years within periods $t-1$, t, and $t+1$.

The time-variant treatment effects are estimated by applying the PSM estimator as outlined in (6) using exact matching with respect to Z_i (see, Table 5). Period t refers to 1999-2002. With

a treatment in t (i.e., $w_{it}^{m} = 1$ but $w_{it+1}^{m} = 0$), ATT^{m} and ATE^{m} are computed for period t (treatment period) and $t+1$ (post-treatment period), respectively.

The estimates of the treatment effects based on both option modes are rather similar suggesting that the one-option model may be closer to the truth than the multiple-option model. According to these estimates, ACQ and MBO are likely to have a positive and significant impact on company productivity (at least, at the 10 percent significance level). Both ATT and ATE estimates signal that the positive impact is strongest in the post-treatment period (2003 to 2005) as compared to the treatment period (1999 to 2002). This can be taken as an indication that the positive shift effects may be lasting ones. However, there appear to be no permanent contribution to economic growth due to ACQ or MBO, respectively. This is suggested by our finding that both ownership changes do not appear to affect profitability positively after treatment. That is to say, according to our rationale as specified in Table 2 neither acquisitions nor management buyouts are likely to foster long-lasting growth but may cause shift-effects.

Initial public offerings appear to exert a positive impact on productivity in the treatment period. The respective estimates suggest that the productivity of firms being acquired is not significantly affected in the post-treatment period. This is particularly due to ATT estimates. Interestingly, IPOs may lessen profitability in the post-treatment period.

The findings are in line with the reasoning that the efficiency gains due to corporate governance activities are strongest for those corporate governance regimes that exert the lowest principal-agent problems (and costs). This is suggested by the presented estimates of the treatment effect for the treated (ATT) associated with MBOs. The ATT estimate for the outcome variable "productivity" is quantitatively largest for management buyouts.

Among the three investigated corporate governance-related interventions, management buyouts are certainly the ones causing both the lowest principal-agent costs and the strongest incentives for managers to perform at the highest level possible. The latter is induced by high leverage, the immense monitoring and disciplining power of the LBO specialists, and the fact that the managers become their own principals.

On the other end of the spectrum are initial public offerings where the principal-agent problem may be most critical. By going public incentives on the parts of investors may be diminished to monitor effectively management due to a more dispersed ownership structure.

6. Conclusions

At the centre of our analysis is the view that the performance evaluation of ownership change activities be similar in spirit to the assessment of treatment effects in the evaluation literature. As evaluation technique we used the matching approach in order to resolve the missing data and the selection problem. The study also stresses the importance of both a well-designed identification strategy and the availability of high quality data. Accordingly, in

this study the matching procedure was applied to conduct an in-depth analysis of the impact of acquisitions, initial public offerings, and management buyouts on productivity and profitability of a large sample of Europe-based manufacturing companies covering the period from 1996 to 2005.

We found evidence corroborating the view that efficiency gains due to ownership changes are strongest for those corporate governance structures which arguable face the least principal-agent costs. Among the investigated types of ownership changes, acquisitions and management buyouts are those which are least likely to cause principal-agent problems and, simultaneously, provide the strongest incentives for managers to perform at the highest level possible. The latter is primarily induced by high leverage frequently associated with acquisitions and management buyouts and the immense monitoring and disciplining powers of the leveraged buyout specialists. Thus, the results presented suggest that going private is superior to going public in that the former may contribute to economic growth, at least temporarily, by fostering efficiency improvements due to lowering principal-agent costs.

References

Abadie, A. (2005), Semiparametric Difference-in-Differences Estimators, Review of Economic Studies, 72(1), 1-19.

Abadie, A., Imbens, G. (2002), Simple and Bias-corrected Matching Estimators for Averaged Treatment Effects, NBER, Technical Working Paper, (283).

Aghion, P., Howitt, P. (1998), Endogenous Growth Theory, MIT Press, Cambridge, MA.

Becker, S.O., Egger, P. (2010), Endogenous Product versus Process Innovation and a Firm's Propensity to Export, Empirical Economics, forthcoming.

Blundell, R., Costa-Dias, (2002), XXX, Portuguese Economic Review, XXX.

Caliendo, M., Hujer, R. (2005), The Microeconometric Evaluation of Treatment Effects – An Overview, IZA Discussion Paper, (1653).

Caliendo, M., Kopeinig, S. (2005), Some Practical Guidance for the Implementation of Propensity Score Matching, IZA Discussion Paper, (1588).

Cobb-Clark, D. A., Crossley, T. (2003), Econometrics for Evaluations: An Introduction to Recent Developments, The Economic Record, (79), 491-511.

Egger, P., Hahn, F. R. (2010), Endogenous Bank Mergers and their Impact on Banking Performance – Some Evidence from Austria, International Journal of Industrial Organization, (28), 155-166.

Focarelli, D., Panetta, F., Salleo, C. (2002), Why Do Banks Merge?, Journal of Money, Credit and Banking, (34), 1047-1066.

Gugler, K., Mueller, D., Yurtoglu, B., Zulehner, Ch. (2003), The Effects of Mergers: An International Comparison, International Journal of Industrial Organization, 21(5), 625-653.

Heckman, J. J. (1978), Dummy Endogenous Variables in a Simultaneous Equation System, Econometrica, 46(4), 931-959.

Heckman, J. J., Ichimura, H., Todd, P. (1998), Matching as an Econometric Evaluation Estimator, Review of Economic Studies, 65(2), 261–294.

Imbens, G. (2004), Nonparametric Estimation of Average Treatment Effects Under Exogeneity: A Review, Review of Economics and Statistics, 86(1), 4–29.

Lechner, M. (2001), Identification and Estimation of Causal Effects of Multiple Treatments under the Conditional Independence Assumption, In: Lechner M., Pfeiffer F. (eds.) Econometric Evaluation of Labor Market Policies. ZEW Economic Studies, vol. 13, pp. 43-58.

Magerl, Ch., Hahn, F. R. (2009), Competitiveness Indicators by Industries for OECD countries, mimeo.

Rosenbaum, P. R., Rubin, D. B. (1983), The Central Role of the Propensity Score in Observational Studies for Causal Effects, Biometrika, 70(1), 41–55.

Rosenbaum, P. R., Rubin, D. B. (1984), Reducing Bias in Observational Studies Using Subclassification on the Propensity Score, Journal of the American Statistical Association, 79(387), 516–524.

Tirole, J. (2006), The Theory of Corporate Finance, Princeton University Press, Princeton, NJ.

Williamson, O. E. (1968), Economies as an Antitrust Defense: The Welfare Tradeoffs, American Economic Review, (58), 407-426.

Wooldridge, J. M. (2002), Econometric Analysis of Cross Section and Panel Data, MIT-Press, Cambridge, MA.

Zingales, L. (1995), Inside Ownership and the Decision to Go Public, Review of Economic Studies, (62), 425-448

Appendix: Data

Table A1: Summary Performance of the Companies in the Sample

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Productivity										
Minimum	0.5	0.4	0.5	1.1	2.0	3.7	3.1	4.1	3.3	2.1
Maximum	3,093.2	3,426.5	3,926.6	4,114.9	3,648.5	3,408.3	3,423.9	3,550.4	3,960.6	5,535.6
Mean	189.6	189.2	194.9	199.9	201.7	204.0	203.8	208.1	218.0	220.6
Median	147.4	146.5	151.0	154.7	154.7	157.0	156.5	156.7	164.2	167.7
Standard deviation	175.1	178.6	186.0	187.3	188.7	189.7	194.2	202.9	217.0	221.9
Coefficient of variation	0.92	0.94	0.95	0.94	0.94	0.93	0.95	0.98	1.00	1.01
Capital Ratio										
Minimum	-1.4	-2.1	-1.7	-1.0	-2.2	-2.1	-3.9	-4.7	-3.9	-6.9
Maximum	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Median	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Standard deviation	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3
Coefficient of variation	0.59	0.58	0.56	0.55	0.56	0.57	0.59	0.60	0.61	0.71
Profitability										
Minimum	-0.64	-0.51	-0.55	-0.55	-0.75	-0.81	-1.19	-0.78	-1.10	-1.02
Maximum	0.84	0.94	0.68	0.68	0.79	0.75	0.97	1.11	0.93	0.80
Mean	0.09	0.10	0.10	0.09	0.08	0.08	0.07	0.07	0.07	0.06
Median	0.08	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.05
Standard deviation	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11
Coefficient of variation	1.05	1.03	1.00	1.10	1.19	1.26	1.37	1.45	1.51	1.78
Wages per employee										
Minimum	0.5	0.4	0.5	0.7	0.6	0.5	0.4	0.4	0.3	0.2
Maximum	232.0	161.8	152.3	156.9	173.9	179.9	157.6	201.4	217.6	203.7
Mean	30.9	30.4	31.1	32.5	31.8	32.4	33.2	34.3	35.4	35.8
Median	30.7	30.2	30.5	31.8	30.9	31.0	31.5	32.9	33.8	34.1
Standard deviation	13.3	12.8	13.0	13.5	13.3	13.6	14.3	14.9	15.1	15.8
Coefficient of variation	0.43	0.42	0.42	0.41	0.42	0.42	0.43	0.43	0.43	0.44
Total assets per employee										
Minimum	2.2	1.8	2.3	2.5	2.0	3.0	2.7	3.1	3.3	5.0
Maximum	62,805.6	66,227.0	61,082.7	66,747.2	93,381.4	85,362.1	69,749.6	57,963.5	70,607.1	244,384.5
Mean	155.5	156.3	157.6	170.7	184.0	181.9	180.2	185.7	205.4	249.3
Median	103.3	103.5	106.9	114.8	117.2	115.7	118.2	120.5	125.7	128.0
Standard deviation	987.5	1,041.5	959.5	1,049.7	1,502.8	1,378.9	1,143.3	1,061.6	1,410.7	3,865.5
Coefficient of variation	6.35	6.67	6.09	6.15	8.17	7.58	6.35	5.72	6.87	15.50

Source: AMADEUS, WIFO. Number of observations: 4,151.

Table A2: Sales per Employee by Sector

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Consumer goods										
Minimum	9.3	7.6	6.3	6.9	7.4	8.8	9.3	11.2	11.5	11.2
Maximum	3,093.2	3,426.5	3,926.6	4,114.9	3,648.5	3,408.3	3,423.9	3,550.4	3,960.6	5,535.6
Mean	265.1	263.1	269.0	274.5	274.3	278.8	281.2	288.1	301.2	301.9
Median	189.2	192.7	199.2	205.1	199.7	206.1	200.9	205.9	207.3	215.8
Standard deviation	272.1	279.5	288.1	288.8	284.5	287.2	298.9	317.4	343.0	349.7
Coefficient of variation	1.03	1.06	1.07	1.05	1.04	1.03	1.06	1.10	1.14	1.16
Number of observations	849	849	849	849	849	849	849	849	849	849
Basic products										
Minimum	0.5	0.4	0.5	5.9	5.3	6.4	7.0	7.4	7.6	7.7
Maximum	2,532.0	2,413.9	2,438.4	2,303.7	2,853.3	2,296.5	2,643.5	2,314.5	2,276.6	2,224.7
Mean	181.5	181.9	186.9	192.4	194.1	195.8	196.0	199.7	207.8	209.3
Median	145.7	145.7	149.0	153.4	152.8	155.4	154.3	154.7	161.2	163.2
Standard deviation	142.3	143.8	147.7	152.1	160.9	159.5	162.8	167.7	176.7	179.7
Coefficient of variation	0.78	0.79	0.79	0.79	0.83	0.81	0.83	0.84	0.85	0.86
Number of observations	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280
Technical products										
Minimum	1.6	2.6	2.4	1.1	2.0	3.7	3.1	4.1	3.3	2.1
Maximum	1,358.9	1,544.9	2,302.5	1,929.3	1,402.2	1,625.9	1,471.9	1,364.7	1,653.3	2,044.7
Mean	145.1	144.3	151.4	154.4	158.4	160.0	156.9	160.4	171.9	178.3
Median	130.3	129.0	134.1	137.1	139.6	137.7	137.6	138.0	147.7	152.6
Standard deviation	105.1	109.4	128.2	122.0	115.8	119.3	112.6	114.6	126.3	137.9
Coefficient of variation	0.72	0.76	0.85	0.79	0.73	0.75	0.72	0.71	0.74	0.77
Number of observations	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022

Source: AMADEUS, WIFO.

Table A3: Earnings before Interest and Taxes over Total Assets by Sector

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Consumer goods										
Minimum	-0.32	-0.43	-0.25	-0.45	-0.57	-0.28	-0.96	-0.41	-0.31	-0.95
Maximum	0.84	0.94	0.68	0.64	0.79	0.67	0.64	0.72	0.64	0.63
Mean	0.09	0.09	0.09	0.08	0.07	0.08	0.07	0.07	0.07	0.06
Median	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.05	0.05
Standard deviation	0.10	0.11	0.10	0.10	0.10	0.09	0.10	0.09	0.09	0.09
Coefficient of variation	1.16	1.20	1.15	1.26	1.35	1.25	1.30	1.20	1.26	1.55
Number of observations	849	849	849	849	849	849	849	849	849	849
Basic products										
Minimum	-0.64	-0.36	-0.55	-0.44	-0.75	-0.81	-0.68	-0.78	-1.10	-0.94
Maximum	0.69	0.69	0.62	0.68	0.78	0.60	0.75	0.71	0.82	0.80
Mean	0.09	0.09	0.09	0.09	0.08	0.07	0.07	0.07	0.06	0.06
Median	0.08	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05
Standard deviation	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11
Coefficient of variation	1.03	0.99	1.00	1.06	1.19	1.27	1.30	1.50	1.68	1.89
Number of observations	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280	2,280
Technical products										
Minimum	-0.43	-0.51	-0.35	-0.55	-0.57	-0.64	-1.19	-0.58	-0.35	-1.02
Maximum	0.57	0.57	0.62	0.64	0.56	0.75	0.97	1.11	0.93	0.70
Mean	0.10	0.10	0.11	0.10	0.09	0.08	0.07	0.07	0.08	0.07
Median	0.08	0.08	0.09	0.08	0.07	0.07	0.07	0.06	0.06	0.06
Standard deviation	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Coefficient of variation	1.01	0.97	0.90	1.06	1.09	1.25	1.59	1.55	1.38	1.73
Number of observations	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022	1,022

Source: AMADEUS, WIFO.

Table A4: Summary Statistics

Explanatory variables	Minimum	Maximum	Mean	Median	Standard deviation	Coefficient of variation
Firm-specific:						
rent	-0.464	0.618	0.080	0.066	0.077	0.960
capital	-2.077	0.968	0.397	0.390	0.208	0.524
wages	0.958	170.371	32.995	31.625	13.544	0.410
prod	3.676	3,561.942	204.493	157.836	191.449	0.936
sales	616.841	5,105,322.000	47,705.170	12,928.280	176,988.500	3.710
emp	5.600	27590.500	268.064	88.900	810.692	3.024
size	0.010	455.980	2.125	0.390	11.467	5.396
wageq	0.000	3.928	0.307	0.271	0.191	0.621
profit	-5.028	0.408	0.056	0.048	0.121	2.163
grow	-0.369	0.633	0.036	0.033	0.067	1.860
prodg	-0.105	0.448	0.017	0.014	0.037	2.189
Industry-specific:						
size_i	1.626	30.190	10.644	11.224	4.369	0.410
grr_i	1.000	4.000	2.034	2.000	0.949	0.466
crr_i	1.000	4.000	2.557	3.000	1.083	0.423
Country-specific:						
inc_c	5,727.225	29,790.000	20,721.450	21,700.330	3,815.942	0.184
fin_c	4.550	150.920	72.554	71.508	36.634	0.505

Source: WIFO.