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Review of Industrial Organization
An International Journal Published for the Industrial Organization Society

ISSN 0889-938X
Volume 42
Number 3

Rev Ind Organ (2013) 42:345-363
DOI 10.1007/s11151-012-9353-9

Springer

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Published online: 9 June 2012

Abstract This paper examines the employment effects of acquisitions for acquired European firms, taking non-random selection of acquisition targets explicitly into account. Following the empirical firm growth literature and theories put forward in the mergers and acquisition (M&A) literature, we control for convergence dynamics in firm size and distinguish between different types of acquisitions. Empirically, we estimate an endogenous treatment model using accounting data for a newly created sample of acquired and non-acquired European firms. Our results reveal positive employment effects for different types of acquisitions indicating that M&As likely induce efficiency gains.

Keywords Merger and acquisitions · Employment effects · Firm growth · Gibrat's law · Endogenous treatment model

1 Introduction

During the last decades of globalization, production processes have been organized more internationally, and, therefore, the importance of cross-border M&As has also been increasing (see, e.g., Gugler et al. 2003; Makaew 2010).

With regard to these cross-border M&A activities the European Union ranks first among developed economies, with $116 and $90 billion worth of sales and purchases

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in 2009, respectively (Unctad 2010). Moreover, from 2005 to 2010 a break-down by cases indicates that, on average, the European Commission arrives at final decisions for approximately 315 cases per year (European Commission 2010). It is clear that the European Union is characterized by pronounced M&A activities. Further, from political and a policy maker's point of view, the employment effects of M&As are of special interest.[1]

In order to address the question of whether takeovers (on average) lead to a reduction in employment in acquired firms, this paper combines the empirical firm growth literature with theories put forward in the M&A literature. In particular, this paper estimates endogenous treatment models for firm growth equations à la *Gibrat's law*.

Empirically, we utilize accounting data obtained from a newly created sample of acquired and non-acquired European firms. Our estimation results reveal positive employment effects for acquired firms when non-random selection of takeover targets and convergence dynamics in firm size are both taken into account. In particular, on average, an acquired firm raises its post-acquisition employment growth rate by approximately 15 percentage points in comparison to similar non-acquired firms. Given this robust result we are not able to confirm the view that acquisitions lead to additional job layoffs in the acquired firms.

The remainder of the paper is organized as follows: Sect. 2 briefly surveys the related literature with regard to empirical firm growth models and discusses the previous literature on M&A activities and their employment effects. Section 3 introduces the empirical firm growth model and explains the econometric framework. Section 4 describes the data, while Sect. 5 discusses the empirical findings. Finally, Sect. 6 provides the conclusions.

2 Related Literature on Firm Growth and Acquisitions

Our empirical approach relates this paper to four different strands of Industrial Organization literature: the empirical firm growth literature; the empirical literature on employment effects of M&As; the literature on motives for M&As; and the literature on endogenous selection of acquisition targets.

The empirical firm growth literature historically has put its focus on the relationship of firm growth and firm size, typically measured in terms of employment.[2] Gibrat (1931) formulated the hypothesis that firm growth is independent of firm size and thus firm size follows a random walk. This relationship has become known as *Gibrat's law* of proportionate growth. The majority of the subsequent empirical contributions,

[1] The negotiations with regard to the potential acquisition of the German *Opel A.G.* by different international investors in 2009 can serve as a textbook example for the involvement of policy-makers in private business deals. There, the German Federal Government favored the offer from *Magna International Inc.* because, in comparison to its competitors, Magna guaranteed the largest number of Opel jobs in Germany. Finally, however, the US-headquartered *General Motors* (GM) company (as owner of Opel) decided not to sell its German subsidiary, and, therefore, the effort of the German Federal Government did not succeed.

[2] For a similar discussion of the firm growth literature see, e.g., Oberhofer (2012).

however, rejects Gibrat's law.[3] In particular, a robust finding indicates that, within a given industry, initially smaller firms exhibit higher growth rates. This in turn, implies that firm size tends to convergence over time.

With regard to firm age, the empirical firm growth literature unambiguously provides evidence for enhanced growth dynamics in young firms. Typically, the impact of firm age on firm growth is found to follow a non-linear relationship, which implies that a firm's growth performance changes over its life time. Moreover, the literature reveals that, for older firms, firm size tends to follow a random walk. If we combine these findings, Gibrat's law seems to describe well the growth performance of large and old firms, while it fails to explain the growth performance of small and young firms (see, e.g., Hart 2000).

Given these robust deviations from Gibrat's law, economists have formulated theories that are able to explain why (within cross-sections of firms) especially small and young firms exhibit enhanced firm growth dynamics. The most established theories among them are learning theories (Jovanovic 1982), Penrose effects (Penrose 1959), adjustment cost theories (Hamermesh and Pfann 1996), financial constraints (Fazzari et al. 1988; Cabral and Mata 2003), and organizational capabilities (Slater 1980).

The passive learning model that has been proposed by Jovanovic (1982) assumes that start-up firms are not aware of their productivity when entering the market and thus tend to produce at an inefficiently small scale. Over time, each firm learns its level of productivity, and the least productive firms will leave the market. By contrast, the more productive ones will rapidly adjust their firm size to the efficient level.

Other theories that have been put forward in the firm growth literature stress the key role that is played by various types of constraints. In line with Fazzari et al. (1988) and Cabral and Mata (2003), proponents of financial constraints argue that newly created firms have limited access to (internal and external) financial resources and thus are not able to finance all of their profitable investment projects. Consequently, they are forced to start production at a lower scale. Over time successful firms are able to build internal financial resources and gain reputation in external capital markets. These financial resources, finally, allow them to increase their scale of production to an efficient level.

Theories with regard to organizational capabilities and managerial limitations solely focus on internal constraints to firm growth. Proponents of these theories argue that managerial resources will eventually be limited if firm-specific 'growth knowledge' is crucial for the identification of growth opportunities. Thereby, managerial limitations (also referred to as Penrose effects) seem to be of particular relevance for smaller firms.

With regard to the specification of the typical empirical firm growth equation these theories commonly suggest modeling a firm's annual average growth rate as a function of (log) initial firm size and (log) firm Age (see, e.g., Geroski 2000; Geroski and Gugler 2004). In order additionally to test Gibrat's law for old firms, some non-linearities are typically incorporated using a squared term of firm age and an

[3] Surveys on the empirical firm growth literature are available in Evans (1987a), Sutton (1997), Audretsch et al. (2004), Bellak (2004), and Cabral (2007). Most recently, Coad (2009) provides an extensive survey on the theories and the empirics of firm growth.

interaction term of initial firm size with firm age (see, e.g., Evans 1987b; Geroski and Gugler 2004).

So far, the traditional empirical firm growth literature has put its focus on examining continuous growth patterns. Alternatively, firms might acquire competitors in order to adjust their (overall) firm size discretely to the efficient level. Such growth strategies would be well in line with adjustment costs theories of firm growth, which argue that employment adjustment is lumpy and discontinuous.

With regard to the second strand of related literature, a few empirical studies investigate the impact of M&A's on firm or plant level employment. Thereby, these studies commonly investigate the two countervailing theoretical arguments that are related to potential post-M&A employment effects. a) Merging firms might exploit short-run economies of scale by reducing overall employment in the newly created entity (see, e.g., Gugler and Siebert 2007); or b) M&A-related efficiency gains might allow the newly combined entity to reduce its prices. This, together with a sufficiently large (price) elasticity of demand, might induce an overall increase in a firm's market position, which would increase its labor demand and, thus, lead to an increase in (overall) employment.

From an empirical perspective, three different econometric approaches have been put forward: First, some authors simply regress a firm's observed level of employment on a set of contemporaneous and/or lagged dummy variables that capture whether a firm has been the target of an acquisition (Siegel and Simons 2010) and incorporate several control variables such as five-year lagged level of employment and industry fixed effects (Lichtenberg and Siegel 1990).

Other authors estimate econometrically more sophisticated dynamic labor demand equations that treat acquisitions as exogenously determined. More precisely, Conyon et al. (2001, 2002) and Gugler and Yurtoglu (2004) model the current level of employment within a newly combined entity as a function of the one-year lagged level of combined employment, other control variables that are derived from a Cobb-Douglas production function with quadratic adjustment costs (Nickell 1984), and dummy variables that capture acquisition-specific information (e.g., hostile takeover, home country of the acquiring firm, etc.).

These latter models are typically estimated with the use of standard dynamic panel data methods that are not able explicitly to account for the endogenous selection of acquisition targets. Unfortunately, econometric estimators for dynamic panel data models with endogenous selection into treatment have not thus far been available in the econometrics tool box.

Finally, the most closely related category of merger studies uses models which analyze the impact of training on workers' earnings and employment. These models are well established in labor economics, and their empirical specifications are similar to a typical Gibrat's law type of regression. In particular, the changes in employment or wages within a given time period are modeled as a function of predetermined firm size, firm age, other controls, and a dummy variable that capture whether a firm (plant) experienced an ownership change in the respective time period (Brown and Medoff 1988; McGuckin et al. 1998; McGuckin and Nguyen 2001).

Empirically, the majority of the above-mentioned studies report negative employment effects of M&A's for acquired firms or the newly combined entity. In comparison

to non-acquired firms takeover targets tend to exhibit lower or even negative growth rates. In line with the findings in this paper a remarkably different result is obtained by McGuckin and Nguyen (2001), who provide evidence for an increase in both the number of jobs and the quality of the existing jobs after plant takeover.

Within the economic community the motives for M&A's have attracted special attention. Historically, two different viewpoints have emerged: First, the neoclassical theory of the firm argues that profit-maximizing motives determine acquisition decisions. An acquisition might lead to an increase in market power and/or cause efficiency gains via cost savings through rationalization and (short-run) economies of scale. Whenever these benefits outperform the costs associated with an acquisition, a profit maximizing firm will accomplish the respective acquisition.

In contrast, exponents of the non-neoclassical theory of the firm argue that separation of ownership and control gives managers discretion over their decisions and allow them to maximize their own utility rather than maximizing the profits of the firm. Accordingly, managers might choose to maximize the size of the firm under their control and use acquisition policies as a tool to increase the firm's size via external growth (Baumol 1962; Williamson 1963; Marris 1964).

A related argument explicitly focuses on asymmetric information between principals and agents in firms where ownership and control is separated. In particular, Manne (1965) argues that a principal (e.g., a member of the board of directors) is only able to collect incomplete information concerning the performance of a manager. By contrast, managers of rival firms are better able to evaluate the performance of competing firms and will try to acquire those with poorly performing management. As a consequence a market for corporate control emerges.

Methodologically, some recent studies that focus on post-M&A outcomes have started to account for the non-random selection of acquisition targets. Thereby, the econometric literature on policy intervention offers a broad range of methods that can be applied to the economic evaluation of acquisitions.[4]

With regard to the endogenous occurrence of acquisitions three different types of models have been used so far: McGuckin and Nguyen (2001) use a traditional instrumental variable procedure where pre-merger plant characteristics such as relative productivity are used to construct the probability of an ownership change for all firms in their sample.

Second, in a study on market power and efficiency effects of M&A's versus research joint ventures (Gugler and Siebert 2007) estimate an endogenous switching model, where the decision to acquire a competing firm depends on the expected 'with-acquisition' versus 'without-acquisition' market shares.[5]

Recently, Egger and Hahn (2010) and Stiebale and Trax (2011) among others apply a specific type of matching estimator to evaluate the performance effects of M&A's.

[4] Some recently published surveys on the econometrics of (policy) evaluation are provided by, Cobb-Clark and Crossley (2003), Blundell and Costa Dias (2009), and Imbens and Wooldridge (2009).

[5] Technically, endogenous switching models are estimated using a two-stage procedure that combines maximum likelihood (ML) methods for the selection equation with (adjusted) ordinary least squares (OLS) estimates for the prediction of the 'with' and 'without-acquisition' market shares; see Lee (1978), for details on the estimation procedure.

In particular, based on propensity scores that are obtained from standard binary choice models, both contributions compare the performance outcomes of merged and non-merged firms with similar merging probabilities using a difference-in-difference (DID) approach.

To sum up, the existing literature indicates that Gibrat's law type of regressions constitute a suitable framework to analyze the employment effects of acquisitions. Further, the neoclassical and non-neoclassical theories of the firm provide potential motives for the non-random selection of acquisition targets. Finally, the econometrics literature on treatment effects evaluation provide suitable methods for analyzing the research question at hand.

3 Empirical Specification and Estimation Strategy

Following Geroski (2000, 2005), Geroski and Gugler (2004) and Oberhofer and Pfaffermayr (2012), a typical specification of the cross-sectional firm growth model à la Gibrat's law can be written as:

$$g_i = \alpha_i + \pi S_{0i} + \mathbf{x}_i^{'}\boldsymbol{\gamma} + \epsilon_i, \tag{1}$$

where g_i denotes the average annual growth rate of firm i which is measured in the log differences of actual and initial firm size and S_{0i} is the log of the first observed firm size (see, e.g., Oberhofer and Pfaffermayr 2012).[6] $\mathbf{x}_i^{'}$ is a vector of additional control variables including the log of firm Age (A_i), A_i^2, industry fixed effects, and country fixed effects as well as years of growth effects (see footnote 6). ϵ_i represents an iid error term. Following previous results, we assume that differences in firm size increase with firm age (see, e.g., Oberhofer and Pfaffermayr 2012). Econometrically, this suggests the inclusion of an additional interaction term between log initial firm size and log firm age. Formally, the model is generalized so that $\pi = \beta_0 + \beta_1 A_i$, where (based on previous findings) we expect $\beta_0 < 0$ and $\beta_1 > 0$.

In order to evaluate the employment effects of acquisitions the baseline equation (1) is augmented with a dummy variable (D_i), which equals one if a firm i has been taken over within our sample period and zero otherwise:

$$g_i = \alpha_i + \pi S_{0i} + \mathbf{x}_i^{'}\boldsymbol{\gamma} + \delta D_i + \epsilon_i. \tag{2}$$

Additionally, in this case g_i for the acquired firms is calculated as average annual post-acquisition employment growth rate (as discussed in footnote 6). In a similar vein, for this group of firms, firm size and firm age are both measured at the take-over year. In this model the (average) post-acquisition employment effect, which is

[6] It is worth noting that the quality of the dataset at hand (to be discussed below) with regard to its longitudinal dimension is relatively poor. This implies that for the calculation of average annual firm growth rates the number of years of growth differ across firms. More specifically, the average (median) number of observed years is 6.35 (7) for non-acquired firms. For acquired firms where initial firm size is measured at the time of the acquisition, the average and median number of years amount to 2.90 and 3, respectively. In our empirical specification we additionally include a set of years of growth dummy variables, which control for these differences across firms.

given by δ, is only correctly estimated in case of random selection into the acquisition treatment. According to the above mentioned neoclassical and non-neoclassical motives for acquisitions, the random selection hypothesis seems rather implausible. Consequently, we reformulate the model to account for endogenous selection:

$$\begin{aligned} g_i &= \alpha_i + \pi S_{0i} + \mathbf{x}_i^{'}\boldsymbol{\gamma} + \delta D_i + \epsilon_i, \text{ where} \\ D_i^* &= \mathbf{z}_i^{'}\boldsymbol{\theta} + \mu_i, \quad \text{and} \\ D_i &= 1 \quad \text{if } D_i^* > 0, 0 \text{ otherwise,} \end{aligned} \tag{3}$$

where ϵ_i and μ_i are correlated and are drawn from a joint normal distribution.

Here, we assume that D_i takes on a value of one if the latent variable $D_i^* > 0$ and zero otherwise. Thereby, the specific values for D_i^* are determined by $\mathbf{z}_i^{'}\boldsymbol{\theta}$, where is $\mathbf{z}_i^{'}$ is another vector of covariates with the corresponding parameter estimates collected in $\boldsymbol{\theta}$. In particular, $\mathbf{z}_i^{'}$ includes pre-acquisition information on a firm's initial size, its firm age, labor productivity, profitability, its capital intensity, and its initial market share. Unobserved country and industry characteristics, which influence the takeover target probability are captured by respective fixed effects.

In line with the discussion from above, the managerial discretion theory (Baumol 1962; Williamson 1963; Marris 1964) argues that firm size positively affects a manager's utility. Consequently, if firm-size-maximizing managers decide to acquire competitors in order to increase the size of the firms under their control they will (ceteris paribus) select larger takeover targets.

By contrast, the very largest firms (in any given industry) already possess sufficient market power in order to profit from additional acquisitions. Moreover, initially larger firms might more easily be able to obtain the financial resources necessary for takeovers. For these two reasons, we include additional non-linearities of initial firm size (i.e., the squared term of initial employment) in all but one specification of our selection equation. With that said, we expect that the very largest firms exhibit lower takeover target probabilities. The inclusion of firm age as an additional determinant of acquisitions allows us to investigate at which stage of a firm's life cycle firms are more exposed to a takeover threat.

With regard to Manne (1965) theory concerning the market for corporate control, labor productivity measured in terms of value added per employee and profitability serve as valuable information concerning the (relative) performance of an individual firm. Empirically, profitability is proxied by return on assets, which is defined by earnings before interest and taxes (EBIT) over total assets. Firms with a low level of labor productivity and/or an unsatisfactory return to assets might suffer from poor management and, thus, will be more likely to be acquired by better-performing competitors.

On the other hand, the neoclassical theory of the firm suggests that profit-maximizing managers will select already efficient and profitable targets. Hence, the expectation concerning the direction of influence of productivity and profitability on the probability of being an acquisition target remains ambiguous.

An alternative profit-maximizing argument for a takeover might be related to the appropriation of efficient production technologies. Firms with superior production technologies tend to be attractive to the market and, therefore, might be regarded as

valuable acquisition targets. Our data at hand unfortunately do not include information on innovation such as patents or R&D expenditures, and, thus, this analysis is limited to test whether more capital intensive firms are more likely to be selected as takeover targets. Empirically, we measure capital intensity in terms of total assets per employee.

Finally, the neoclassical theory of the firm also suggests that acquisitions aim at increasing the market power of the acquiring firms. Market power is typically measured in terms of individual market shares. Using the below described databases we are able to construct these market share numbers for all firms in our sample. In line with the argument from above, only very large firms are able to influence significantly their market concentration. As a consequence, firms with already high market shares have more incentives to acquire smaller competitors. This in turn, implies a negative impact of initial market shares on a firm's takeover target probability.

Econometrically, our model represents a simultaneous system of equations with an endogenous dummy variable for which Heckman (1978) proposed consistent estimators. A straight-forward method to estimate this system of equations is full information maximum likelihood (FIML), where the model is simultaneously solved for all parameters in both equations.

An advantage of this procedure is that it simultaneously allows us to incorporate a selection equation and to condition on control variables in the outcome equation. In comparison to standard IV-methods, the FIML approach additionally accounts for the correlation between ϵ_i and μ_i, leading to more efficient parameter estimates.

4 Data and Descriptive Statistics

In our empirical analysis we focus on manufacturing firms (NACE Rev 2 codes: 1000–3340) and utilize data provided by two different sources.[7] Balance sheet data, financial statements, and profit and loss accounts for the years 1994 to 2007 are obtained using update 170 (November 2008) of Bureau van Dijk's AMADEUS database. These accounting data are combined with acquisition information compiled by Bureau van Dijk in their ZEPHYR database. The ZEPHYR database includes daily updated business deal data from all over the world starting with deals announced in 1993. Stiebale and Trax (2011) made use of the same data sources in order to evaluate the impact of M&As on the performance of acquiring firms that are located in the United Kingdom and France.

Here, it is worth noting that for corporate networks consisting of more than one single firm, the AMADEUS database separately provides consolidated and unconsolidated accounting data. While in the former case all subsidiaries of a firm are consolidated in the annual reports of the parent firms, the unconsolidated accounts are compiled at the establishment level. Consequently, for acquired firms both accounts are available in our dataset. Thus, we solely utilize information stemming from

[7] The NACE system was established by the European Union and classifies industrial activities in Europe. Since NACE Rev 1.1 these codes are harmonized with ISIC code system provided by the United Nations.

unconsolidated accounts (both for acquired and non-acquired firms) in order to examine the individual employment growth performance of an acquired firm after a takeover.

In a similar vein, Stiebale and Trax (2011) utilize the unconsolidated accounts available for the acquiring firms. Moreover, they provide a brief comparison of their data set with more commonly used data sources, such as the Thompson Financial Securities data. There, it turns out that the coverage of M&As for large transactions is strikingly similar in both databases, while the data sources provided by Bureau van Dijk additionally capture transactions with a deal value of less than U.S. $10 million. From this and based on Bureau van Dijk's data collection efforts, Stiebale and Trax (2011) conclude that a combined dataset that includes information from the AMADEUS and ZEPHYR databases, incorporates all relevant M&As in Europe.

With regard to acquisitions, the ZEPHYR database reports the percentage of shares involved and the total after-transaction percentage of shares controlled by the acquiring firm for each takeover. Therefore, and in line with previous literature (see, e.g., Gugler and Yurtoglu 2004) we define that an acquisition takes place if the before-transaction fraction of shares controlled is less than 50 %, while the acquirer holds more than 50 % of all shares after the respective transaction.[8]

Firms that are already majority owned subsidiaries and firms which become minority controlled during the observational period are both excluded from our analysis. The control group of non-acquired firms consists of all other manufacturing firms where all relevant characteristics are available. Firms in industries and countries in which no acquisition took place are excluded from the control group.

To ensure that the empirical analysis does not suffer from endogeneity or errors-in-variables problems. a number of exclusion criteria are defined: First, Gibrat's law type of regressions contain firm age as an important covariate, which is calculated using information on the date of incorporation of a firm. During (at least) some takeovers the target firms change their legal form. In such cases the date of (re-)incorporation does not reflect the true age of a firm inducing a systematic measurement error. Thus, we exclude these firms from our analysis.

Second, our selection equation contains pre-acquisition information on various firm characteristics as discussed above. Unfortunately, the AMADEUS database is very unbalanced over time, which leads to a huge number of missing observations. Therefore, our final sample comprises some acquired firms for which not all necessary pre-acquisition characteristics are observable, and thus we have to exclude the respective firms from our analysis.

Third, we exclude firms that (within our observational period) had been acquired more than once. For this group of firms different post-acquisition policies might overlap each other. This, in turn, makes an estimation of different causal effects of each respective acquisition impossible.

The ZEPHYR database explicitly differentiates between mergers and acquisitions. A merger takes place when two independent firms join together and form one single firm, while in an acquisition one firm takes over the other one. However, the literature

[8] In order to investigate the sensitivity of our results with regard to this definition of acquisitions, we alternatively focus on 100 % acquisitions where the acquiring firm takes over all shares of the acquired firm with only a single transaction in our robustness analysis.

on M&As, in practice does not distinguish between these two types of transactions because it can be difficult to differentiate the respective strategic intents of managers (see, e.g., Lipczynski et al. 2009, p. 499). In our analysis we generally follow this approach.[9]

Finally, we drop a number of outliers. In particular, we exclude firms in the highest and lowest percentiles of the employment growth rate distribution, firms with a leverage ratio above 100 %, firms with negative or zero value added, and firms with negative total costs of employment from the analysis. In a similar vein, we trim our labor productivity measure in order to exclude outlying observations. Hereafter, we obtain a final sample of 139,011 firms with 500 acquisition targets located in 12 European countries.[10]

Following the traditional Gibrat's law literature we construct a cross-section of firms and estimate employment growth dynamics across firms. This approach allows the use of the above-mentioned endogenous treatment estimation strategy. Unfortunately, the cross-sectional framework precludes our accounting for unobserved firm heterogeneity. However, since smaller and younger firms tend systematically to grow more quickly and this is identified to be the main reason why firm growth is not entirely stochastic (see Hart 2000), the outcome Eq. (3) should be well specified.

Additionally, we utilize the time structure of our data and distinguish between pre- and post-acquisition information concerning the variables of interest. In particular, as already discussed in footnote 6 we use the last and first available employment figures to construct the annual average employment growth rate for the control group. By contrast, for the group of acquired firms the post-acquisition employment growth rate is based on the number of employees at the takeover year and the last observed employment record.

Moreover, for acquired firms we include the pre-takeover number of employees in the selection equation. In a similar vein, we calculate a firm's age relative to the last observed year (firm age) in the outcome equation, while the selection equation includes firm age at the takeover year (initial firm age).

We calculate initial market shares for all firms using revenue data from more than 390,000 firms that are included in the AMADEUS database. Thereby, for the calculation of total market size we aggregate all individual revenues within each NACE 2-digit industry in each country where at least one acquisition is observed. The individual market share is given by a firm's initial level of revenues over total market size.

Table 1 briefly summarizes the definitions of our variables, while Table 2 separately reports descriptive statistics for the non-acquired and acquired firms in the final sample. In comparison to the control group of non-acquired firms, takeover targets systematically differ in their relevant characteristics. In particular, the latter group of firms, on average, exhibits a zero annual average growth rate, while the average firm in the control group grows at an annual rate of about 2.2 %. Moreover, acquired firms

[9] However, excluding the eight classified merger cases from our analysis has virtually no impact on our estimates. The respective results are available from the author upon request.

[10] Among these countries are Belgium, Bosnia and Herzegovina, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Spain, and the United Kingdom.

Table 1 Variables and definitions

Variable	Definition
Firm size	Number of employees
Firm age	Number of years since incorporation
Labor productivity	Value added per employee (in thousands of Euros)
Return on Assets	Earnings before interest and taxes (EBIT) over total assets
Capital intensity	Total assets per employee (in thousands of Euros)
Market share	Share of revenues within a firm's market, which is defined by its NACE 2-digit industry within its country

Table 2 Summary statistics for the full sample

Variable	No. of. obs.	Mean	SD	Min	Max
Non-acquired					
Employment growth rate	138,511	0.022	0.103	−0.366	0.549
Initial firm size	138,511	55.806	442.000	1	44,326
Firm age	138,511	20.800	15.071	1	323
Initial firm age	138,511	20.800	15.071	1	323
Initial labor productivity	138,511	40.533	27.702	2	242.500
Initial return on assets	138,511	0.075	0.107	−0.468	0.548
Initial capital intensity	138,511	114.636	123.545	3.250	836
Initial market share	138,511	0.008	0.047	0	1
Acquired					
Employment growth rate	500	0.003	0.096	−0.364	0.472
Initial firm size	500	282.904	1, 161.546	2	23,782
Firm age	500	29.046	20.111	5	138
Initial firm age	500	24.780	20.112	1	132
Initial labor productivity	500	48.764	27.226	2.400	221.750
Initial return on assets	500	0.082	0.116	−0.432	0.445
Initial capital intensity	500	140.327	131.312	5.519	831.088
Initial market share	500	0.083	0.186	0	1

are initially approximately 5 times larger and 8.25 years older than their non-acquired counterparts.

A comparison of the variables included in the selection equation across both groups indicates the following: Acquired and non-acquired firms tend to obtain comparable pre-acquisition return on assets while labor productivity seems to be higher in acquired firms. Finally, the average takeover target tends to be more capital intensive and possesses substantially larger market shares.

In a next step, we follow the European Union's definition of small and medium-sized enterprises (SMEs) and classify firms as micro, small, medium-sized and large

Table 3 Employment growth: acquired versus non-acquired firms by firm size class

Variable	Acquired			Non-acquired			Difference
	Obs.	Mean	SD	Obs.	Mean	SD	
Micro firms							
Employment growth	19	0.049	0.116	61,227	0.044	0.126	0.005
Firm size	19	6.105	2.183	61,227	4.739	2.480	1.366***
Firm age	19	16.421	7.198	61,227	15.831	10.477	0.590
Small firms							
Employment growth	150	0.025	0.099	56,221	0.006	0.079	0.019**
Firm size	150	29.773	11.930	56,221	22.013	10.662	7.760***
Firm age	150	22.393	9.614	56,221	22.872	13.740	−0.479
Medium firms							
Employment growth	221	0.000	0.091	16,335	0.000	0.070	0.000
Firm size	221	117.584	52.554	16,335	107.368	51.685	10.216***
Firm age	221	29.407	16.911	16,335	28.482	20.072	0.925
Large firms							
Employment growth	110	−0.030	0.085	4,728	−0.009	0.068	−0.021***
Firm size	110	1, 008.036	2, 341.625	4,728	940.800	2, 207.703	67.236
Firm age	110	39.573	30.637	4,728	33.957	29.133	5.616**

The last column reports results obtained from simple two-sample t tests with unequal variances
*, ** and *** Significance at 10, 5, and 1 % levels, respectively

firms (see Eurostat 2008).[11] Table 3 provides information about (average) employment growth, firm size and firm age for acquired and non-acquired firms in these different size classes. The last column of the table reports the results of simple mean comparison tests for the groups of acquired and non-acquired firms.

The classification of the number of acquisitions by firm size classes in Table 3 documents that micro firms only rarely become acquisition targets, while the majority of acquisitions involves small and medium-sized firms. In line with the discussion from above, the very largest firms also tend to be less exposed to a takeover threat. This is indicated by the relatively small number of 110 acquisitions involving a target firm with more than 249 employees.

When we compare acquired and non-acquired firms within the four firm size classes, some interesting results emerge: First, within the group of micro firms acquisition targets tend to be larger than their non-acquired counterparts. Second, in comparison to the control group firms, acquired small firms are larger and exhibit higher post-acquisition growth rates. Third, within the cohort of medium-sized firms, acquisition targets are larger but grow in a similar manner to non-acquired firms. Finally, the largest acquired firms exhibit lower employment growth rates but are significantly older than the respective control group firms.

[11] Accordingly, firms with less than 10 employees are classified as micro firms, while small firms operate with 10–49 employees. Medium-sized and large enterprises possess 50–249 and more than 249 employees, respectively.

To sum up, Table 3 shows that even within pre-defined size classes acquired and non-acquired firms tend to differ significantly in their individual firm sizes. Moreover, in most different size classes acquired firms are older than their non-acquired counterparts. This difference, though, is only significant within the largest firms cohort. If we take these findings together, an econometric analysis of the distinct impact of acquisitions on an acquired firm's employment growth performance should control for firm heterogeneity with regard to firm size and firm age. Put differently, our raw data again support the view that Gibrat's law type of regressions are a suitable framework to address the research question at hand.

5 Estimation Results

We estimate Eq. (3) for the full sample of 139,011 observations including 500 acquired firms, for two different specifications of the selection equation. We further investigate the robustness of our results by re-estimating our baseline specification for subsamples of 100 % acquisitions, cross-border acquisitions, domestic acquisitions, horizontal acquisitions, and non-horizontal acquisitions. Here, 100 % acquisitions refer to transactions where the acquiring firm takes over all shares of the acquired firm with only a single transaction. The subsample of only cross-border acquisitions, where the acquiring firm and its target are located in two different countries, allows us to analyze whether differing national laws concerning employment protection regulations affect post-acquisition employment growth.

Table 4 indicates that firm size and firm age are important determinants of a firm's growth performance. Column 1 of Table 4 reports OLS-based estimation results for the assumption of exogenous selection of takeover targets. In line with the related Gibrat's law literature, firm size and firm age are able to explain differences in the employment growth performance. In particular, as is indicated by significant negative parameter estimates, small and young firms grow more rapidly, while these effects diminish for old firms (as indicated by the parameter on Age^2) and differ across age cohorts (see the interaction effect). The growth performance of firms differs across countries, industries, and years of growth, as can be seen by the significant fixed effects, respectively.

Most important, if acquisitions were carried out randomly (which is assumed when applying OLS estimation) the average employment effect for acquired firms in our sample would be 0.027 and statistically significant. Put differently, in comparison with identical non-acquired firms, acquisition targets, on average, exhibit 2.7 percentage points higher employment growth rates.

Column 2 of Table 4 presents estimation results for an endogenous treatment model that does not condition on firm size and firm age in the outcome equation.[12] Evidently, and in line with descriptive statistics from above, this estimator provides a highly significant and negative employment effect of acquisitions. Since the initially small-

[12] Econometrically, these results are to some extent comparable to a simple (propensity score) matching approach, which would only account for the endogenous treatment.

Table 4 Estimation results for employment growth: full sample

Variable	Exog. acquisition	Without size and age controls	Baseline	Initial size
log Initial size	−0.054 ∗ ∗∗		−0.054 ∗ ∗∗	−0.055 ∗ ∗∗
	(0.001)		(0.001)	(0.001)
log Age	−0.088 ∗ ∗∗		−0.088 ∗ ∗∗	−0.088 ∗ ∗∗
	(0.002)		(0.002)	(0.002)
(log Age)^2	0.005 ∗ ∗∗		0.005 ∗ ∗∗	0.005 ∗ ∗∗
	(0.000)		(0.000)	(0.000)
log Initial size × log age	0.013 ∗ ∗∗		0.013 ∗ ∗∗	0.013 ∗ ∗∗
	(0.000)		(0.000)	(0.000)
Fixed effects (F test)				
Country	212.02 ∗ ∗∗	2, 528.70 ∗ ∗∗	2, 477.69 ∗ ∗∗	2, 521.37 ∗ ∗∗
3-Digit industry	12.33 ∗ ∗∗	1, 287.84∗ ∗ ∗	1, 573.38 ∗ ∗∗	1, 570.55 ∗ ∗∗
Years of growth	48.98∗ ∗ ∗	1, 846.16∗ ∗ ∗	595.7∗ ∗ ∗	595.23∗ ∗ ∗
Acquisition	0.027∗ ∗ ∗	−0.172∗ ∗ ∗	0.142∗ ∗ ∗	0.157∗ ∗ ∗
	(0.005)	(0.007)	(0.007)	(0.006)
log Initial size		0.364∗ ∗ ∗	0.324∗ ∗ ∗	0.961∗ ∗ ∗
		(0.013)	(0.014)	(0.062)
(log Initial size)^2				−0.074∗ ∗ ∗
				(0.007)
log Initial age		0.052∗	−0.126∗ ∗ ∗	−0.153∗ ∗ ∗
		(0.028)	(0.025)	(0.025)
log Initial labor productivity		−0.086∗∗	0.169∗ ∗ ∗	0.192∗ ∗ ∗
		(0.036)	(0.045)	(0.046)
Initial return on assets		0.214	0.280	0.336∗
		(0.192)	(0.194)	(0.196)
log Initial capital intensity		0.041	0.173∗ ∗ ∗	0.184∗ ∗ ∗
		(0.027)	(0.030)	(0.031)
Initial market share		−0.710∗ ∗ ∗	−0.656∗ ∗ ∗	0.136
		(0.209)	(0.214)	(0.199)
Fixed effects (F test)				
Country		127.73∗ ∗ ∗	175.94∗ ∗ ∗	167.02∗ ∗ ∗
2-Digit industry		51.73∗ ∗ ∗	33.17∗	35.38∗∗
$\rho = 0$		207.05∗ ∗ ∗	181.35∗ ∗ ∗	258.40∗ ∗ ∗
Acquisitions	500	500	500	500
Observations	139,011	139,011	139,011	139,011

Parameter estimates for fixed effects and the constant are not reported. Standard errors in parentheses
*, ** and *** Significance at 10, 5, and 1 % levels, respectively

est firms exhibit higher employment growth rates and are less likely to be acquired, this result clearly suffers from an omitted variable bias.

The combination of Gibrat's law type of control variables and the endogenous treatment equation results in the baseline specification reported in column 3.[13] In general, a test on the assumption of two independent equations (i.e., outcome equation and selection equation, respectively) is rejected as indicated by the significant test statistic on $\rho = 0$ at the bottom of column 3. Accordingly, the FIML estimation procedure for the whole system provides more efficient results. With regard to firm size and firm age the results are virtually identical with the exogenous treatment specification that is reported in column 1. These results once more confirm the robust findings from previous empirical firm growth literature.

Focusing on the selection equation we are able to provide evidence in favor of the managerial discretion and external growth theory and the neoclassical foundation for acquisition activities. Furthermore, we are not able to confirm the market for corporate control theory. More precisely, initially larger firms are more likely to be a takeover target. However, column 4 reveals that firm size exhibits a non-linear impact and, thus, the initially largest firms face lower acquisition hazards. This result is well in line with the discussion from above and supported by our descriptive evidence.

Additionally, younger, more productive, and more capital intensive firms are more likely to be acquired. Firms with initially smaller market shares seem to be more attractive takeover targets. This effect, however, disappears when we additionally include firm size squared in the selection equation. A firm's profitability has only a minor impact on the acquisition probability, as illustrated by the insignificant parameter estimate in the treatment equation. Country and industry fixed effects exhibit a significant impact on the variation in takeover probabilities. The former result points to the relevance of time invariant differences across countries (e.g., legal system with regard to acquisitions).

Most importantly, in comparison with columns 1 and 2 the average employment effect of an acquisition for the target firm is now again significantly positive and considerably exceeds the one obtained in the exogenous treatment specification. In comparison to a non-acquired firm an acquisition target, ceteris paribus, exhibits a 15.3 (17.0 in column 4) percentage points higher employment growth rate.

Table 5 provides estimation results for subsamples that consist of 100 % acquisitions, cross-border acquisitions, domestic acquisitions, horizontal acquisitions, and non-horizontal acquisitions.[14] Here, we additionally exclude firms from the control group that operate in industries and countries where in the respective subsamples no acquisition took place.

In short, the estimated average employment effects in all subsamples are virtually identical with the result obtained from the full sample. For this reason, we conclude

[13] The working paper version of this paper also incorporates leverage as an additional variable in the selection equation. However, the empirical results indicate that leverage is not able to explain differences in acquisition hazards across firms (see, e.g., Oberhofer 2010). Alternatively, we also estimated a specification without age-squared and the interaction term of firm size and firm age in the outcome equation. The estimation results are virtually unchanged. These results are available from the author upon request.

[14] Thereby, we define a horizontal acquisition to take place if the acquirer and its target firm primarily operate in the same NACE 2-digit industry. Based on (relative) revenue information, AMADEUS database reports the NACE primary code for those firms that operate in more than one single industry.

Table 5 Estimation results for employment growth: different sub-samples of firms

Variable	100 %	Cross-border	Domestic	Horizontal	Non-horizontal
log Initial size	−0.055***	−0.054***	−0.055***	−0.055***	−0.055***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
log Age	−0.088***	−0.086***	−0.088***	−0.089***	−0.088***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
(log Age)^2	0.005***	0.004***	0.005***	0.005***	0.005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log Initial × log age	0.013***	0.013***	0.013***	0.013***	0.013***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fixed effects (F test)					
Country	2, 505.19***	2, 262.25***	2, 360.38***	2, 235.00***	2, 462.11***
3-Digit industry	1, 570.09***	1, 520.40***	1, 559.10***	1, 498.54***	1, 583.71***
Years of growth	592.40***	544.60***	600.27***	577.36***	597.66***
Acquisition	0.164***	0.167***	0.157***	0.168***	0.157***
	(0.007)	(0.011)	(0.008)	(0.009)	(0.008)
log Initial size	1.120***	0.889***	0.954***	1.185***	0.816***
	(0.080)	(0.100)	(0.074)	(0.111)	(0.071)
(log Initial size)^2	−0.093***	−0.067***	−0.074***	−0.100***	−0.059***
	(0.009)	(0.011)	(0.008)	(0.012)	(0.008)
log Initial age	−0.167***	−0.173***	−0.130***	−0.157***	−0.141***
	(0.028)	(0.038)	(0.030)	(0.037)	(0.031)
log Initial labor productivity	0.261***	0.159**	0.207***	0.121*	0.237***
	(0.053)	(0.071)	(0.054)	(0.065)	(0.057)
Initial return on assets	0.394*	0.625**	0.205	1.123***	−0.191
	(0.215)	(0.316)	(0.229)	(0.285)	(0.243)
log Initial capital intensity	0.144***	0.251***	0.131***	0.206***	0.150***
	(0.035)	(0.051)	(0.036)	(0.046)	(0.038)
Initial market share	−0.004	0.203	0.052	0.230	0.093
	(0.250)	(0.280)	(0.254)	(0.279)	(0.245)
Fixed effects (F test)					
Country	141.44***	46.93***	124.62***	74.97***	96.12***
2-Digit industry	34.71**	20.10	41.24***	41.27***	34.66**
$\rho = 0$	226.67***	93.27***	179.10***	139.53***	143.08***
Acquisitions	403	173	327	197	303
Observations	138,814	131,699	137,797	132,838	138,814

Parameter estimates for fixed effects and the constant are not reported. Standard errors in parentheses
*, ** and *** Significance at 10, 5, and 1 % levels, respectively

that the positive impact of acquisitions on an acquired firm's employment growth performance carries over to all of the different types of acquisitions that were mentioned above. With regard to cross-border acquisitions, our results suggest that firms do

not exploit differences in national laws concerning employment protection regulations in order to lay off employees.[15]

To sum up, our empirical results point to the importance of non-random selection of acquisition targets and highlight the suitability of Gibrat's law type of regressions for the analysis of the impact of acquisitions on a target firm's employment growth performance. Quantitatively, we provide robust evidence for a positive and economically significant impact of acquisitions on the average employment growth rate of acquired firms.

6 Conclusions

In daily news media coverage and political discussions acquisitions of large domestic firms are usually viewed with scepticism. In particular, policy-makers tend to fear that takeovers will reduce employment in the respective domestic firms and lead to an increase in unemployment in certain areas. However, the economic literature on the employment effects of acquisitions is still ambiguous.

In order to address the question of whether takeovers (on average) lead to a reduction in employment in acquired firms, this paper combines the empirical firm growth literature with theories that have been put forward in the M&A literature. Thus, this paper examines the post-acquisition employment growth performance of acquired European firms taking non-random selection of acquisition targets into account. Additionally, the proposed econometric model allows us to control for convergence dynamics in firm size.

Our estimation results reveal positive average employment effects for targets of acquisitions when both non-random selection of acquired firms and convergence dynamics in firm size are taken into account. This result varies only little for different types of acquisitions such as cross-border or domestic acquisitions and horizontal versus non-horizontal acquisitions.

In comparison with firms of the same size and age, targets of acquisitions increase their post-acquisition employment growth rates by approximately 15–17 percentage points. Therefore, this paper provides (indirect) evidence for efficiency gains that are triggered by acquisitions. With regard to the non-random selection of acquisition targets, our results support the view that, with the exception of the very largest firms, larger, younger, and more productive firms are more likely to be acquired.

Acknowledgments I would like to thank two anonymous referees, the General Editor Lawrence J. White, Jesus Crespo Cuaresma, Klaus Gugler, Michael Pfaffermayr, Matthias Stöckl and Hannes Winner for valuable discussions and helpful suggestions. I am also grateful for all comments received during the annual meetings of the European Association for Research in Industrial Economics (EARIE) 2010 in Istanbul, the Spanish Economic Association 2010 in Madrid, the Austrian Economic Association (NOeG) 2011 in Graz and the Swiss Society of Economics and Statistics 2011 in Lucerne. I also would like to thank the participants of the research seminars at the University of Innsbruck and the Vienna University of Economics and Business and the participants of the Workshop of the national research network *Labour Economics and*

[15] This result is in contrast to Lehto and Böckerman (2008), who find negative employment effects of cross-border M&As for Finnish manufacturing firms applying propensity score matching methods.

the Welfare State in Salzburg in May 2010 for their comments. Financial support from the 'Oesterreichische Nationalbank' (OeNB, grant numbers 12831 and 14383) is gratefully acknowledged.

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