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Firm survival in new EU member states

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Executive Summary

In this study we investigate the firm survival determinants in the Visegrad group countries (V4) using a Cox proportional hazards model that is commonly used in medicine. By analogy with the study of patient survival factors, in our sample, there are companies that have ceased to operate on the market during the period from 2006 to 2015 and their characteristics are compared to enterprises that have been still active during that period, i.e. "survivors".

Overall, we work with a sample of 41,496 companies of which 5,682 have exited the market; thus, the overall market exit rate is 13.7%. In some cases, the data were not complete, so in our models we finally have data on 36,498 enterprises from the Czech Republic (12,203), Poland (13,836), Hungary (6,976), and Slovakia (3,483). The basic overview of extinct enterprises in the given period is shown in Figure 1. As we can see, despite the regional and economic proximity of the V4 countries, the number of failed firms varies considerably from country to country and the overall pattern is clearly different.

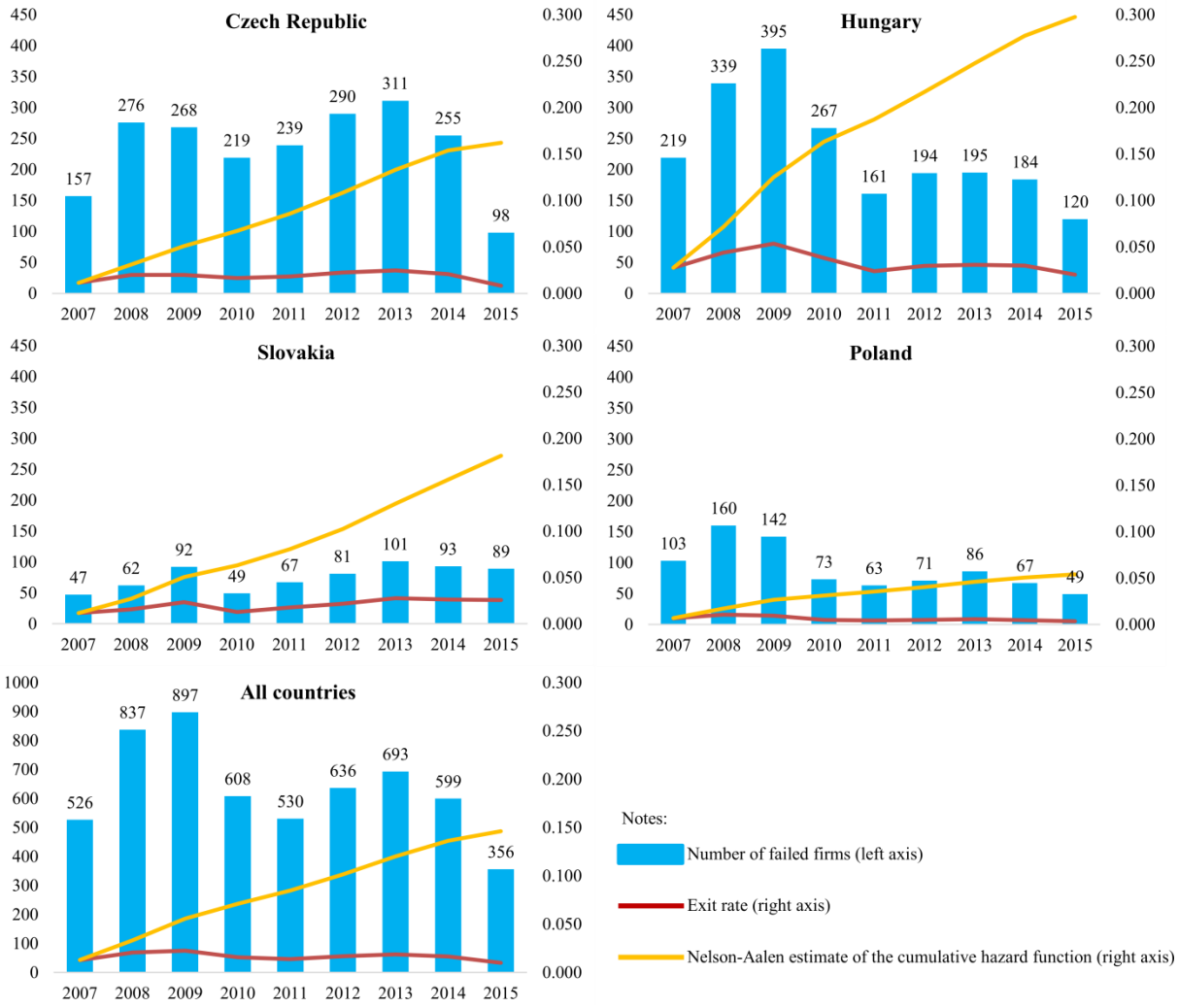

Figure 1. Number of failed firms

When examining the determinants of firm survival in V4 countries, we use a quite wide range of different indicators. In addition to the standard variables of financial performance (ROA, gross margin, labor productivity, and solvency), variables such as legal form of companies, ownership structure, corporate governance, linkage with capital market, firm size, firm age, and business diversification are utilized in our models.

Variables such as the number of large shareholders, number of board directors, foreign ownership, as well as the involvement of an international audit firm, have proven to be important factors affecting firm survival. Among other things, the results of this study point to the fact that despite the regional and economic proximity of the V4 countries, their business environment is significantly different, and as such, the survival determinants of companies have different effects across countries and industries. Our results are robust for different estimation setups.

Firm survival in new EU member states

Eduard Baumöhl[a*], Ichiro Iwasaki[b], Evžen Kočenda[c]

Abstract

We analyze firm survival determinants in four new European Union member states (the Czech Republic, Hungary, Poland, and Slovakia). We employ the Cox proportional hazards model on firm-level data for the period of 2006 to 2015. We show that in all four countries, less concentrated control of large shareholders, higher solvency, and more board directors are linked with the increased probability of firm survival. However, an excessive number of board directors has a detrimental effect. Firms with foreign owners and higher returns on their assets exhibit better survival chances. Conversely, across countries and industries, larger firms and those hiring international auditors have lower probabilities of survival. A number of specific determinants influence firm survival in different ways, emphasizing the importance of country and industry differences when studying firm survival. We also document that in an economic sense, determinants associated with the legal form, ownership structure and corporate governance show the most beneficial effects with respect to firm survival.

Keywords: firm survival; new EU member states; survival and exit determinants; hazards model
JEL Classification: D22, G01, G33, G34, P34

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1. Introduction

Firm entry and exit produce important effects on competition and industry structures. Justifiably, they have received significant attention in the industrial organization literature (Sutton, 1997; Caves, 1998). Understandably, the core of the research has focused on firms in developed economies in North America, Japan and Europe. However, firms from the new member states of the European Union (EU) are underrepresented in empirical firm-survival analyses. This finding is surprising, as (i) these firms face tough survival conditions due to increased competition and changing market structures (Hanousek et al., 2017) and (ii) the importance of new EU countries is increasing as they become more integrated in the EU economy via trade and production networks (Frensch et al., 2016). The economic reforms of the 1990s in Central and Eastern Europe (CEE) were aimed at creating competitive market economies and more efficient enterprises by firm restructuring, privatization, and supporting institutional reforms (Aussenegg and Jelic, 2007; Kočenda and Hanousek, 2012a). Large numbers of new firms were entering the market at that time, and while the firms' entry might have been quite easy, their survival on the market was often difficult (McDermott, 2004). This fact is particularly important for firms from the new EU member states that first had to go through a difficult transformation process before their EU accession (Estrin et al., 2009) and that almost immediately had to cope with the global financial crisis (GFC), which, in general, negatively affected their performance (Hanousek et al., 2015). Hence, in new EU countries, the existence of healthy companies and an understanding of the determinants of the firms' failures are particularly vital, especially from the long-term perspective of European integration, employment, and economic growth. Therefore, in this paper, we aim to contribute to the literature and analyze firm survival in four new EU members: the Czech Republic, Hungary, Poland, and Slovakia. To the best of our knowledge, this article describes the first analysis of firm survival in these four new EU countries.

We chose these four countries by considering several criteria. The first criterion is related to foreign trade. As early as December 1991, the former Czechoslovakia, Poland, and Hungary signed the so-called "Europe Agreements" with the European Union. These countries have striven to establish a workable framework for international trade and cooperation. Such an arrangement was institutionalized in March 1993 in the form of the Central European Free Trade Agreement (CEFTA), consisting of the founding countries, namely, the Czech Republic, Slovakia, Hungary, and Poland (and Slovenia). Second, the

formation of CEFTA reflected the importance of international trade as a means of economic coordination, mirrored in the high degree of economic convergence achieved among the four countries by the late 1990s (Kočenda, 2001; Kočenda et al., 2006). Third, by the early 1990s, to further their European integration and economic and energy cooperation, the four countries had formed a cultural and political alliance called the Visegrád Group. Fourth, all four countries adopted relatively expedient privatization programs and transformed their planned economies into market economies more effectively than did other transition countries (Estrin et al., 2009). Fifth, as an attestation of similar economic developments and after complying with the *acquis communautaire*, all four members of the Visegrád Group joined the European Union on May 1, 2004. Sixth, the four countries are key participants in the international East-West production networks in Europe (Frensch et al., 2016). Hence, the four countries form a relatively homogeneous group of economies that in terms of their economic advancement, share common features that are also mirrored in their production structures.

It has to be stressed that majority of the firm survival studies is conducted on samples of firms from developed countries and the lack of empirical survival analyses in emerging markets might be caused by data limitations. To overcome this defect, we build an extensive data set of 41,496 firms paired with a set of potential determinants of the firms' exits and deliver a corporate survival analysis for the four new EU members. In this way, we bridge an existing gap in the literature on the determination of factors with a potential impact on the firms' ability to survive.

Most of the survival studies have focused on financial variables in order to predict corporate distress (Kumar and Ravi, 2007). However, especially in small and medium companies, financial statements might be quite misleading, reflecting not only fraudulent accounting practices (Koskivaara, 2004) but also "creative accounting" or practices involving "cooking the books" within the legal limits. According to Kirkos et al. (2007), financial statement fraud costs US businesses approximately $400 billion annually. As noted by Hajek and Henriques (2017), financial fraud may be an effective indicator of substantial financial problems that can cause bankruptcy. Hence, there are many reasons why it might be difficult or even impossible to predict the companies' distress using their own financial statements.

Perhaps that is why there is still no single broadly accepted method of evaluating a company's financial health. Apart from studies that use a wide set of utilized variables,

research methods also vary greatly and range from statistical methods, neural networks, decision trees, and fuzzy logic to many other artificial intelligence and soft computing techniques; Kumar and Ravi (2007) provide an excellent survey of the methods, data sources, and financial ratios frequently employed when evaluating corporate financial health.

In our estimation strategy, we mostly follow a resource-based theory of the firm (Wernerfelt, 1984; Barney, 1991): due to the firms' use of heterogeneous resources and employment of varying strategies, this theory allows for substantial heterogeneity in firms and their performance. In terms of survival determinants, we account for the heterogeneity in resources and strategies (i) by employing several corporate finance variables used in the mainstream literature and (ii) by using a wide set of firm survival determinants that characterize a firm from many less explored angles. Specifically, we employ some indicators that are quite widely used in other empirical studies (firm performance, linkage with capital market, firm size and age). Conversely, we employ variables that are not frequently used in analyses targeting emerging markets—these are indicators that capture firm characteristics related to their legal form, ownership structure, corporate governance, and business organization (details are provided in Section 3). To make our analysis easy to compare with other studies, we apply the Cox proportional hazards model (Cox, 1972), which is by far the most commonly used model in empirical studies in firm survival literature (Manjón-Antolín and Arauzo-Carod, 2008).

To summarize, our contribution to the literature is thus threefold: First, we analyze firm survival in a fairly homogenous group of countries that experienced a transition from planned to market economies and managed to rapidly join the EU after their transformations. Second, our analysis is based on a representative set of firms from various industries, and we account for industry-specific effects. Further, our time span covers both the GFC and post-crisis periods, enabling us to test the robustness of the standard results obtained in the studies of tranquil periods. Third, we analyze firm survival with a rich set of determinants that characterize firms from various aspects and that are not commonly used as opposed to the standard firm performance indicators. Specifically, we use indicators related to the firms' legal form, ownership structure, corporate governance, and business organization – many of them are shown to be quite informative variables in terms of their correlation with survival probability.

In terms of the empirical evidence, we identify several factors that increase the probability of firm survival in all new EU states: the *number of large shareholders*, the *number of board directors*, and the *solvency ratio*. Both *foreign ownership* and *return on assets* (*ROA*) are determinants with a positive effect on firm survival in all countries, except Slovakia. For risk factors that lower the probability of firm survival in all countries, we have identified two determinants—the squared term of the *number of board directors* and, surprisingly, *firm size*—for all countries, except Hungary. Another, seemingly unexpected result is that employing an *international audit firm* lowers the probability of firm survival (with the exception of Hungarian firms; an explanation for such a result is provided further). Several other determinants exhibit a specific influence in each of the countries in the study. This fact emphasizes that country differences are important when studying firm survival. Further, in terms of economic significance, we also document that determinants associated with *legal form*, *ownership structure* and *corporate governance* show the most beneficial effects with respect to firm survival.

In the remainder of the paper, we review related literature in Section 2, followed by a description of the data and the employed methodology in Section 3. We present our detailed results along with empirically supported inferences in Section 4. The last section presents the study's conclusions.

2. Related studies and research hypotheses

The formulation of our hypotheses is based on the empirical studies and several theoretical frameworks that we describe in more detail in the following text.[1] However, note that the firm-level analyses on survival do not generally follow a unified or rigorous model (Scarpetta et al., 2002) and that no such model, currently exists. Researchers in the area of firm survival are prone to use reduced-form models (such as Proportional Hazard or Accelerated Failure Time models) in which "economic theory simply provides guidelines on what the relevant regressors are and possibly what their impact is on the likelihood of exit" (Manjón-Antolín and Arauzo-Carod, 2008; p. 11).

Since the seminal work of Beaver (1966) and Altman (1968), there has been a considerable amount of research examining firm failure and survival (for relevant

[1] Our hypotheses are formulated in a negative way because they are null hypotheses, which is in line with the logic of statistical hypothesis testing. They can easily be transformed into alternative hypotheses to describe existence of the relationship between variables. In hypotheses, we use a term "correlate" to make clear that we do not address causality.

reviews, see Santarelli and Vivarelli, 2007; Manjón-Antolín and Arauzo-Carod, 2008). Hence, we present an overview of studies that are directly related to our analysis and deliberately do not cover less relevant parts of the firm survival literature. To the best of our knowledge, Harhoff et al. (1998) conducted the first study to consider a company's legal form as an indicator of riskiness and to establish the empirical impact of a company's legal form on growth and firm exit. They used the Cox proportional hazards model based on a sample of approximately 11,000 West German companies operating in all major economic sectors. They showed that limited liability companies have higher insolvency rates than those companies with full liability have. Such result is in line with theoretical results obtained by Stiglitz and Weiss (1981) who show that under limited liability, entrepreneurs choose projects with a relatively high expected return and a relatively high risk of failure. Thus, in our empirical work, limited liability companies are set as a default legal form in our estimations, and our first hypothesis is as follows:

H1: Various corporate legal forms do not correlate with firm survival.

Another stylized fact inferred from the abundant empirical evidence is that firm survival depends on the industry in which the firm operates (Dunne et al., 1989) and Agarwal and Audretsch (2001) argue that expanding industries exhibit better survival rates. From a theoretical perspective, in formulating our second hypothesis, we refer to evolutionary economics (Nelson and Winter, 1982). Scholars in this stream of literature state that over their life cycles, industries go through a number of stages in which technology and market conditions vary, determining how easy it is to enter and survive in a given market. Therefore, we formulate our second hypothesis as follows:

H2: Industry does not correlate with firm survival.

Ownership structure appears to be a significant factor for firm survival, as suggested by Bridges and Guariglia (2008). Based on a sample of UK firms, they confirmed that global engagement (i.e., a foreign owned or exporting company) enhances a firm's survival probability. Many European countries, especially the new ones, have active policies for attracting foreign direct investment. However, as stated by Mata and Portugal (2002), benefits from foreign direct investment become more relevant with higher rates of survival of foreign-owned firms and the greater ability of foreign firms to overcome obstacles to survival. Further, Taymaz and Özler (2007; p.40) claim that "foreign ownership and the presence of foreign firms in the market do not have any significant

impact on the survival of domestic (and foreign) firms." Given the ambiguity in the empirical literature, our third hypothesis is as follows:

H3: Foreign ownership does not correlate with higher probability of firm survival.

Firm survival literature focusing on the firms' governance is rather sparse. Among the earliest literature, Gilson (1990) focused on the ownership and board composition of US firms in default or bankruptcy. Daily and Dalton (1994) found the relationships among governance structures and corporate bankruptcy quite significant and concluded that a corporate governance structure is a good predictor of a company's financial distress in the US. Later, Dalton et al. (1998) conducted a meta-analysis of 54 empirical studies addressing board composition and 31 studies of board leadership structure and their relationship to the firms' financial performance: only slight evidence of a systemic relationship between governance structure and financial performance was provided.

The effect of ownership concentration is "theoretically complex and empirically ambiguous" (Earle et al., 2005, p. 254). In fact, with respect to the agency problem, Shleifer and Vishny (1986) argued that the presence of large shareholders who have a strong incentive to monitor and discipline top management can help avoid the traditional "free-rider" problem associated with ownership dispersion, thus mitigating firm failure (i.e., the alignment hypothesis). This argument, however, is intensely refuted by Claessens et al. (2000), who noted that because large shareholders exercise the control rights to maximize their profits, they could put the firm at risk of management failure (i.e., the expropriation hypothesis). Due partly to the ambiguity of the above-mentioned theoretical debates, the previous studies' empirical results regarding the effect of ownership concentration on firm performance are diverse in their content and views (Wang and Shailer, 2015). Accordingly, the impact of ownership concentration on firm survival is also theoretically unpredictable, and our fourth hypothesis is formulated as follows:

H4: Ownership concentration does not correlate positively with firm survival.

Using the Cox proportional hazards model and a sample of 125 Australian firms, Chancharat et al. (2012) showed that the survival time of the initial public offerings (IPO) of the "new economy" firms is positively related to board independence. Moreover, company size and leverage are found to be negatively correlated with firm survival. Iwasaki (2014) analyzed the survival status of approximately 750 Russian firms after the

financial crisis using unique survey data from 2005 and 2009. The significance of this study is that it paid attention to the role of governance bodies in influencing firm survival. In particular, the board of directors and the audit committee were identified as determinants with vital roles in reducing the potential exit risk. In addition, Chancharat et al. (2012) and Iwasaki (2014) also suggested and partly verified the positive effects of the auditor's reputation and the quality of the external audit on firm survival. Finally, Helmers and Rogers (2010) found that UK firms with more directors exhibit higher survival rates and linked the number of directors to the firm's human, managerial, and technological capital. We formulate our fifth hypothesis as follows:

H5: Corporate governance indicators do not positively correlate with firm survival.

Financial health and firm performance are obviously important determinants of firm survival (Görg and Spaliara, 2014). Additionally, access to external financial resources positively impacts firm growth and survival (Musso and Schiavo, 2008). Recently, Guariglia et al. (2016) used the ratio of shareholders' funds to total assets (i.e., solvency) in their models as a control variable and proved that it was positively associated with UK firm survival in all cases. Our sixth hypothesis is therefore straightforward:

H6: Financial performance does not correlate with higher probability of firm survival.

Some determinants of firm survival might already be considered as stylized facts, such as firm age and size (Geroski, 1995, 2010). Buehler et al. (2006) confirmed that larger Swiss firms have lower hazard rates of exiting than do smaller firms and that a similar finding applies to age, i.e., bankruptcy rates decrease with age. Esteve-Pérez et al. (2004) showed that smaller Spanish firms carry a higher exit risk, and Esteve-Pérez and Mañez-Castillejo (2008) found that the probability of exit for larger Spanish firms is approximately 32%–39% lower than that of small firms. They also confirmed that firm age is important for explaining firm survival; however, the effect is not straightforward. They observed a relatively unusual relationship between the hazard rate and age, i.e., the risk of exit is high in the early days of a firm and then decreases before later increasing. Our seventh hypothesis is as follows:

H7: Firm size and age do not correlate positively with firm survival.

Business organization is also regarded as an influential factor for firm survival. A series of studies regarding industrial organization provides evidence that the business

network and diversification of a firm tend to keep the firm alive, *ceteris paribus* (Staber, 2001; Agarwal and Gort, 2002; Kimura and Fujii, 2003; Kosova and Lafontaine, 2010). These two factors can potentially allay the business risk caused by external shocks. Thus, we also expect that the degree of business networking and diversification is positively related to firm survival in the new EU countries. Our eighth hypothesis is as follows:

H8: Business organization does not positively correlate with firm survival.

This list of related studies is far from exhaustive, but it quite clearly shows that the results are highly sample-dependent. Thus, to establish the effect of governance on firm survival, it is beneficial to update the empirical results using the latest data coming from different industries and different countries.

The reviewed literature offers a motive for formulating the hypothesized effects related to various determinants. All survival determinants under our consideration are summarized in Table 1 where their hypothesized expected effects are shown. These effects are based on the summary found in the existing empirical literature surveyed above. Because of our use of Cox's (1972) proportional hazards model, all the formal hypotheses can also be understood in terms of a firm's exit probability. More details on the quantitative assessment are provided in Section 3.2.

Table 1. Factors and their expected effects on firm survival

[Table 1 around here]

3. Data and methodology

3.1 Data: Indicators and coverage

In our empirical analysis, we employed data from Bureau van Dijk's Orbis database for 41,496 firms from the new EU member states. We covered firms that satisfied two conditions: (i) they were actually operating at the end of 2006 (just before the GFC erupted), and (ii) they provided their survival status information at the end of 2015. Further, failed firms were considered to be those with a status of dormant/inactive, in liquidation/bankruptcy, or dissolved. [2]

[2] We obtained these 41,496 companies using Orbis 2006 archive data and checked their survival status by referring to the website database during the second half of 2016. In our four countries of interest, the 2006 archive data contain 10 times more companies than the ones we selected. However, due to a large number of dropouts after 2007 and other technical reasons, we were not able to trace the survival status of many firms at the end of 2015. This issue does not constitute a serious selection bias because an overwhelming majority of the untraceable firms

Of these 41,496 firms, a total of 5,682 failed during the examined period (2007–2015); hence, the exit rate was 13.7%. Further, for some companies, ownership and/or financial data were incomplete, and we were not able to trace them from other sources. Therefore, in our estimations, we used a set of 36,498 primarily medium and large firms from the Czech Republic (12,203), Poland (13,836), Hungary (6,976), and Slovakia (3,483).

Further, we collected an adequate set of company-specific variables that can be considered determinants of firms exiting the market. They come from seven different categories: legal form, ownership structure, corporate governance, firm performance, linkage with capital market, firm size and age, and business organization. The collected determinants are widely employed and established in the literature; as such, they allow for the direct comparison of our results with relevant studies performed on firm survival in developed markets. More details about the data are provided in Table 2.

Table 2. Definitions and descriptive statistics of variables used in the empirical analysis

[Table 2 around here]

In terms of the legal form, we distinguish five key categories used in the four researched countries: joint-stock company, limited liability company, partnership, cooperative, and other legal form.[3] The ownership categories are constructed as mutually exclusive dummy variables. The limited liability company structure is the most common legal form, and it is also defined identically in all four countries. Therefore, we use the limited liability company as a default legal form category. This approach guarantees a comparable basis across all countries in the sample and helps in exact interpretation of the coefficients.

We capture the most important aspects of ownership structure with four important categories: number of large shareholders, foreign ownership, central state ownership, and regional state ownership. The number of large shareholders characterizes the

are one-person businesses, micro-enterprises, and small firms. Hence, our empirical evidence relates primarily to medium and large companies, which is in accord with our research strategy. On the other hand, in terms of legal form and firm size, our results might be biased towards the largest firms and joint-stock companies, as the best performing small companies and limited liability companies are more likely to be in our sample. Another limitation of our sampling strategy is that different exit routes might be possibly driven by different firm-level and industry characteristics, as recently shown by Ponikvar et al. (2018).

[3] Central European countries adopt some country-specific legal forms, which are not common across the region and thus not comparable. Other legal forms are the least represented category in the sample (5.2%).

concentration of control in a firm. From Table 2, we see that, on average, firms are dominated either by a single shareholder or a pair of blockholders. As this variable quantifies ownership power, it is not restricted to only private ownership. The state may be included in this category if the government is a dominant shareholder or a blockholder. We created this particular category of ownership control because it was empirically shown that dominant owners and blockholder groups exert important effects on the firms' performance in the European context (Hanousek et al., 2012, 2015). Other categories distinguish private foreign ownership from two forms of state ownership, and they are defined as mutually exclusive dummy variables.

In our list of factors, corporate governance is represented by three recognized variables that play a key role, as shown in Shleifer and Vishny (1997). First, we include the number of board directors, as more than one director limits the potential misuse of management power in a company. Second, the number of audit committee/board members (shortened to number of auditors) provides important information on the level of oversight and safety checks within the company. Third, we include a dummy variable for firms that employ an international audit firm in an attempt to further improve their corporate governance or are simply required to do so by law (Sucher and Kosmala-MacLullich, 2004).

Firm survival is intuitively closely related to firm performance (Shiferaw, 2009). We capture this factor with three widely used (financial) performance measures: the return on assets (ROA), the gross margin and the solvency ratio. The ROA percentage is calculated as [(profit before tax/total assets) × 100]. The gross margin is computed as [(gross profit/operating revenue) × 100]. The solvency ratio is calculated as [(shareholders' funds/total assets) × 100]. All measures capture different aspects of firm performance: The ROA provides information on the productivity of the firm's capital, the gross margin shows the firm's relative profitability, and the solvency ratio indicates a firm's less dependence on debt and its financial stability in the long run.

Furthermore, we employ various firm characteristics that elucidate important aspects of the firm's status. The linkage of a firm with the capital market is captured by a dummy variable for firms listed on the capital market. Next, we use the log of total assets to measure firm size and use the number of years a firm has operated to capture its age.[4]

[4] Many other papers follow many cohorts and use information on the founding date of the firm.

Finally, we trace the business organization of firms: the number of subsidiaries is a quantitative factor that defines a firm's network or the extent to which a firm spreads its business activities via its subsidiaries; business diversification is a qualitative factor that based on a firm's operations in different double-digit industries, captures the variety of activities in which a firm is engaged.

3.2 Methodology: Cox proportional hazards model

We analyze the effects of various determinants on firm survival by using the Cox proportional hazards model (Cox, 1972). The underlying idea behind the model is to estimate the probability that an event of interest, in our case, firm survival, will not have occurred by a certain time. Assuming that T is a continuous random variable with the probability density function $f(t)$ and the cumulative distribution function $F(t)$, the probability of surviving beyond time t is given by the so-called surviving function:

$$S(t) = \Pr(T > t) = 1 - F(t) = \int_0^{\infty} f(x)dx. \tag{1}$$

As an alternative, we define a hazard function $h(t)$, denoting the probability of an event (firm exiting the market) during the next small interval of time:

$$h(t) = \lim_{dt \to 0} \frac{\Pr\{t \le T < t + dt \mid t \le T\}}{dt}. \tag{2}$$

The survival and hazard functions provide alternative but equivalent characterizations of the distribution of T. Following the procedure of Hosmer et al. (2008), the relationship between $h(t)$ and $S(t)$ can be established as:

$$S(t) = \exp\left(-\int_0^t h(x)dx\right), \; h(t) = -\frac{f(t)}{S(t)}. \tag{3}$$

The Cox proportional hazards model assumes that the baseline hazard $h_0(t)$ depends on time t and a set of relevant covariates x_{in}:

$$h(t \mid x_{i1}, \ldots, x_{in}) = h_0(t)\exp(\beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_n x_{in}) = h_0(t)\exp(\mathbf{x}^{\mathrm{T}}\boldsymbol{\beta}), \quad h_0(t) > 0, \tag{4}$$

where β_1, β_2,..., and β_n are the parameters to be estimated. Specification (4) defines the hazard rate at time *t* for subject *i*, which depends on a vector of covariates ***x***.

Further, we consider two observations, *i* and *í*, that differ in their covariates (*x*-values), with the following linear representation:

$$\eta_i = \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_n x_{in} \tag{5}$$

and

$$\eta_i' = \beta_1 x_{i1}' + \beta_2 x_{i2}' + \ldots + \beta_n x_{in}'. \tag{6}$$

The hazard ratios for these two observations are then independent of time *t*, and they are defined as:

$$\frac{h_i(t)}{h_{i'}(t)} = \frac{h_0(t)\exp(\eta_i)}{h_0(t)\exp(\eta_{i'})} = \frac{\exp(\eta_i)}{\exp(\eta_{i'})}. \tag{7}$$

Since the baseline hazard $h_0(t)$ depends only on time *t*, it can take any form, while covariates enter the model linearly. Therefore, the Cox model is a semi-parametric model, and regardless of how the survival time *T* is distributed, the estimates from the Cox model are robust.

The estimates of parameters β are obtained from the maximum likelihood estimation of the logarithmic transformation of specification (4), which is represented by the following linear model:

$$\ln h(t \mid x_{i1}, \ldots, x_{in}) = \ln h_0(t) + \sum_{j=1}^{n} b_j x_{ij}\ . \tag{8}$$

Each parameter β represents a hazard ratio that we will interpret in the same way as Iwasaki (2014). Specifically, a hazard ratio indicates how the probability of a firm exiting the market is multiplied when a specific covariate *x* (e.g., firm survival determinant in the form of an independent variable) changes by one unit. If an estimate is over 1, we may consider a determinant (covariate *x*) to be a risk factor causing firm exit. Similarly, if an estimate is below 1, such a determinant (covariate) is considered a preventive factor

inhibiting firm exit from the market. In this respect, our estimation strategy follows the example of approaches adopted by Esteve-Pérez et al. (2004), Taymaz and Özler (2007), Iwasaki (2014), or Iwasaki and Kočenda (2019).

Finally, one important point has to be made with respect to the issue of endogeneity that frequently occurs in applied analyses. The survival analysis is basically designed to regress the probability of an event occurring on *ex ante* conditions. By doing so, this method avoids the endogeneity problem arising from simultaneity between the dependent and independent variables (Iwasaki, 2014). Endogeneity issues may occur in the survival analysis if: (a) an independent variable is a future variable, (b) the estimation period is very short or (c) the dependent variable is continuous. In these cases, an instrumental variable (IV) method or a two-stage residual inclusion method (2SRI) should be applied (Liu, 2012; Carlin and Solid, 2014). In our case, all independent variables are pre-determined, the estimation period is sufficiently long (several years), and the dependent variable is a discretional one (on a yearly basis). Hence, based on the above arguments that follow Liu (2012), our survival analysis should be free from the endogeneity issue.[5]

4. Results

Figure 1 captures the number of failed firms during the analyzed period, 2007–2015. There was a sharp increase in failed firms after the crisis year of 2007, which was visible in all countries. The effects of the crisis began to materialize in late 2008 and 2009. The global financial crisis represented a shock to new EU countries in which its impact occurred with a time lag, allowing domestic firms to adapt to new conditions or the impact to diminish (Kovac et al., 2016). A decline in GDP growth was recorded in 2009 in all new EU countries, except Poland; this evidence correlates with the fact that the post-crisis analyses of firm and industry levels in the EU consider 2009 to be an initial post-crisis year (Hanousek et al., 2015, 2017). Another drop in economic activity resulting in

[5] However, we acknowledge that if a firm starts downscaling before closing, the variables under study may change, and this change could be a predictor for the decision to exit. In our case, we take the information on the economic situation of firms at the end of 2006 and their survival status information at the end of 2015. Hence, for most of the firms, it is highly unlikely that data from 2006 would indicate their intention to downscale and exit later. Second, we also acknowledge that some firms might be established for a certain purpose with a time frame known in advance. Based on the economic development in the four countries under research, we believe that error involving this issue is quite minimal. These are issues that we are not able to fully capture. Nevertheless, the basic aim of survival analysis is to test whether or not an initial condition is a good predictor of the event in question. We also would like to make clear that there is no causal inference here.

negative GDP growth occurred in 2012 but only in the Czech Republic and Hungary; however, the other two countries experienced stagnation, which was also translated into higher exit rates for the new EU firms.

To provide a better perspective, in Appendix Table A.1, for the analyzed period, we show the number of failed firms by industry, along with the Nelson-Aalen cumulative hazard functions and the Kaplan-Meier survivor functions. The highest exit rate and hazard function are found in the arts, entertainment, and recreation industry, which, considering the highly cyclical nature of this business, is not surprising. In absolute terms, the highest number of firm failures was in the largest industries, i.e., manufacturing, wholesale and retail sales, and construction, where a total of 3,775 failed firms were identified by the end of 2015.

In the next subsections, we will discuss the results we obtained using the Cox proportional hazards model. Table 3 presents the overall results and findings for each country separately, and Table 4 contains estimations of firm survival in different industries, divided into four groups according to NACE Rev. 2 classification: agriculture, forestry, and fishing (Section A), mining and manufacturing (Sections B–E), construction (Section F), and services (Sections G–S).

[Figure 1 around here]

Figure 1. Number of failed firms, exit rate, and Nelson-Aalen estimate of cumulative hazard functions by country and year

4.1 Legal form

A company's legal form is an economically significant factor affecting firm survival (Table 3). The economic significance of the legal form's effect is observed because the majority of the coefficients are either decisively lower or higher than 1, which is a threshold, as explained in Section 3.2. However, in terms of statistical significance, the results differ across countries. In Slovakia, only the legal form categorized as *other legal forms* is a significant factor, and it increases the probability of survival, as the estimated hazard ratio is below 1. A lack of statistical significance associated with this legal form hints that other factors are more important in driving the ability to survive in the Slovakian business environment. In Hungary and Poland, the legal form of *joint-stock company* is a significant preventive factor, as it lowers the probability of a firm exiting the market. For Czech firms,

cooperative and association, as well as *other legal forms*, represent significant preventive factors.

When all countries are analyzed jointly, the results correspond to those of Esteve-Pérez and Mañez-Castillejo (2008), who concluded that limited liability firms survive longer. However, this does not hold for the Slovakian and Czech environments. This finding is in line with a strand of previous findings that limited liability firms have higher insolvency rates than do those under full liability (Harhoff et al., 1998). Such a discrepancy clearly demonstrates that determinants of firm survival may have different effects in various countries. [6] Our results suggest that various corporate legal forms do have different impacts on firm survival; thus, we can reject our Hypothesis 1.

The results for specific industries are also not that straightforward (see Table 4): across all industries (except Section A), we identify a positive impact on firm survival for *partnership*; however, we identify a positive impact for the *joint-stock company* legal form in the Services industry only. Firm survival clearly depends on the industry in which the firm operates, as suggested by theory (Dunne et al., 1989; Agarwal and Audretsch, 2001). Such result allows us to reject our Hypothesis 2.

4.2 Ownership structure

Determinants related to ownership structure are economically important factors affecting firm survival because the associated coefficients either notably surpass the threshold of 1 or lie markedly below it. Their effective influence on firm survival is then evaluated based on their statistical significance. The *number of large shareholders* is a significant preventive factor in all countries, suggesting that in new EU member countries, concentrated ownership tends to tighten the monitoring of top management and, consequently, mitigates the risk of management failure. Furthermore, large shareholders are often perceived as the guardians of the firm's assets (Frantz and Instefjord, 2009). In the Czech Republic, Hungary, and Poland, the same applies to *foreign ownership* as a determinant in lowering the probability of firm exit; statistical insignificance precludes a judgment for Slovakian companies (thus we can reject Hypothesis 3 for all countries, except Slovakia).

[6] When we set "other legal forms" as the default category, the effect of the limited liability company legal form is a statistically significant preventive factor for a joint estimation for all countries and for industries that belong to Section A and Sections B-E.

Both types of findings are fully in line with the recent analysis of the firms' efficiency in the EU: Hanousek et al. (2015) specifically showed that (i) firm efficiency increases when a majority owner must account for the presence of strong minority shareholders and that (ii) foreign majority owners improve firm efficiency in companies where minority shareholders hold a substantial fraction of the firm's equity. Both results offer direct support for our findings that a reasonable number of large shareholders along with foreign ownership are factors contributing to firm survival, as more efficient firms are also likely to be better protected against exit.

This finding is good news for new EU countries and their foreign direct investments because the above results are in line with many empirical studies from the past, suggesting that the business and legal environment is becoming more similar to that of the developed world. Successful governance systems in developed countries provide significant legal protection combined with an important role for large investors (Shleifer and Vishny, 1997; La Porta et al., 2000), making firms with large shareholders less prone to unexpected financial distress.

Further, we found that *regional state ownership* is a preventive factor in Czech and Polish companies. *Central state ownership* is a statistically and economically significant risk factor for Czech companies, which is in line with the fact that government ownership is mostly recognized as inefficient and political (Ullah, 2017). This finding is further supported by Kočenda and Hanousek (2012b), who show that state control resulted in the decline and even negative corporate performance in Czech firms where the state was engaged in various means of control.

Practically the same results are obtained from estimations of individual industries, i.e., ownership structure is a preventive factor for all industries, although *number of large shareholders* in agriculture is not significant, and *foreign ownership* is not significant in the construction industry.

4.3 Corporate governance

The group of corporate governance determinants exhibits a mostly economically significant impact on firm survival, as the relevant coefficients mostly lie a non-negligible distance from the threshold of 1; the squared control terms are the exception. However, the economic effect has to be judged only for the statistically significant coefficients. Hazard ratios are significant for both the *number of board directors* and its squared term.

The results show that the relationship between the variable and firm survival exhibits an inverted U-shaped pattern: the probability of exit for firms with larger board of directors is initially low; then, it increases to reach a peak, and eventually, an excessive board means an increase in the probability of failure. This finding is in line with outcomes based on the meta-analysis of Dalton et al. (1998) and the results of Helmers and Rogers (2010). The turning point in the U-shaped pattern indicates an optimal board size (thus, apparently, our Hypothesis 5 cannot be rejected). Based on additional computation, we show that the optimal board size exceeds the mean value of the number of board directors in the full sample (close to 3) and in each of the 4 countries analyzed (between 2 and 4). A policy implication from the above analysis is that for most firms in the analyzed countries, there is some room to improve the monitoring and advisory role of the corporate board by hiring additional directors to reduce the risk of firm failure. A reasonable increase in the number of independent directors on the board might be a feasible and beneficial measure.

The effect of the *number of auditors* is significant only in the case of Hungary. However, the hazard ratio shows that the number of audit committee members exhibits a positive effect because it increases the probability a firm will survive. Further, if a firm employs an *international audit firm*, this significantly increases the probability of the firm's exit in the Czech Republic, Poland, and Slovakia. The magnitude of this effect is quite large, especially for Slovak companies. The result might come as a surprise at first glance because international auditors are often associated with superior services. However, the international auditors' market in new EU countries is monopolized by the Big Four auditing firms[7], and recent empirical evidence suggests that Big Four auditors do not necessarily provide higher quality audits, as these depend to a large extent on client characteristics (Lawrence et al., 2011). The negative impact has a more down-to-earth explanation that is grounded in current auditing standards and practices.

For the financial statements of firms, international auditors are used to perform audits according to the International Financial Reporting Standards (IFRS), which are dominated by a sense of caution and discretion; the IFRS are issued by the IFRS Foundation and the International Accounting Standards Board (IASB). Based on the set of the International Standards on Auditing (ISA), the auditors accentuate that in their financial statements, accounting units (firms) should include all risks (according to the

[7] Deloitte, Ernst & Young, KPMG, PricewaterhouseCoopers.

ISA 315, ISA 330) that could affect the ability of a firm to continue its operation (i.e., the going concern basis according to ISA 560).[8] In doing so, the auditors press the firms to create reserves and provisions without regard to whether these reserves and provisions are tax-deductible. Such reserves and provisions are substantially higher than those that the firms previously considered as necessary. Thus, the auditors require the presentation of financial statements in a fair and truthful manner that is not affected by external factors. In effect, the application of accounting estimates, including fair value accounting estimates and related disclosures in an audit of financial statements (according to the ISA 540), leads to the requirement not to overvalue the assets and not to undervalue the liabilities. In the end, the strict application of the standards leads to a decrease in the financial performance of firms, and the financial performance is even lower in firms that are in a worse economic position in the first place. Surely, there might also be other factors at work.[9] However, we believe that a legitimate application of the IFRS by international audit firms might effectively result in lowering survival chances of the (internationally audited) firms. Given the above results, we conclude that not all corporate governance indicators positively influence firm survival, which means that we do not reject our Hypothesis 5.

With respect to different industries, our results for the *number of board directors* (and its squared term) and employing an *international audit firm* are quite strong and remain significant across all industries (one exception is the construction industry, where employing an international audit firm is not a significant factor).

4.4 Firm performance

In our models, we control for financial efficiency by including three firm performance indicators (*return on assets* (*ROA*), *gross margin*, *solvency ratio*) employed in the extensive literature that uses financial variables to study firm survival. Our results show that in the

[8] When preparing financial statements, management shall make an assessment of an entity's ability to continue as a going concern unless management either intends to liquidate the entity or to cease trading or has no realistic alternative but to do so. For details, see International Accounting Standard 1: Presentation of Financial Statements (IAS 1), adopted by the IASB.

[9] A few research studies, such as that of Sucher and Kosmala-MacLullich (2004), indicate that "there are also much broader issues that impact on and question the nature of auditor independence in transitional economies." Their analysis is based on a review of Czech law, professional regulation, and media coverage. Their analysis is also complemented by interviews with audit practitioners, regulators, and financial statement users in the Czech Republic. Sucher and Kosmala-MacLullich (2004) concluded that in new EU countries (after their transition from centrally planned to market economies), a plethora of laws and regulations have been adopted to facilitate the auditors' independence. Still, socioeconomic and cultural backgrounds appear to prevail over any formal safeguards executed to foster professional integrity and competence in the region.

firms in most of the new EU countries, the three covariates are positively correlated with firm survival: the one exception is Slovak companies, where although the size of the coefficients is very similar to that of firms in other countries, the estimated hazard ratios are not statistically significant. Thus, due to the lack of statistical evidence, we are not able to reject Hypothesis 6 for Slovakia, but we reject it for the other three countries.

The evidence in the existing literature of a positive relationship between good financial health and firm survival is quite convincing (Tsoukas, 2011), and our results in this regard are in line with empirical findings from other countries. On the other hand, since the coefficients are below but very close to the threshold of 1, the economic impact of the performance determinants seems to be rather low.

The results for industries are not very strong; a higher *ROA* lowers the probability of firm exit in the services and mining and manufacturing industries, while *gross margin* lowers the probability of exit only in the agriculture sector. However, *solvency ratio* exhibits a straightforward effect, as it improves the firms' survival chances in all countries and in all industries as well. Although the economic significance of the above determinant is low (the coefficient is very close to the threshold of 1), in overall terms, the access to external financial resources has a positive effect on the growth of firms (Musso and Schiavo, 2008).

4.5 Linkage with capital market

Joint-stock companies listed on a local stock exchange are more closely monitored than are the other legal form companies. Based on the statistical significance, whether a firm is *listed* only matters in the case of Poland, where the stock market is the largest in the entire Central and Eastern European region in terms of the number of listed companies, liquidity, and market capitalization. However, our results suggest that Polish listed companies have a lower probability of surviving than do non-listed firms, and the effect is economically meaningful, as the specific coefficient is much above the threshold of 1. In developed markets, the opposite should be true. For example, Tsoukas (2011) showed that traditionally used measures of financial development significantly influence firm survival. The findings correspond to the fact that due to their access to capital, larger and more liquid stock markets enhance the firms' survival chances.

Our results should be viewed in light of some specifics posed by the new EU stock markets. Stock markets in these countries have been established as vehicles to support

the privatization process of state-owned enterprises as former command economies began pursuing market reforms (Megginson and Netter, 2001). As such, they ended up with a large number of listed companies but with insufficient liquidity (Bonin and Wachtel, 2003; Baumöhl and Lyócsa, 2014). Although the new EU stock markets researched have been the most liquid and are the largest in terms of market capitalization in the region (Égert and Kočenda, 2007), these markets are still less suited to providing capital and might exhibit properties different from those of developed stock markets elsewhere. As such, unlike a firm listed in developed stock markets, a firm listed in an emerging stock market does not necessarily need to exhibit a higher probability of survival. Moreover, as noted by Iwasaki (2014), through creating a significant capital crunch and/or unrealized losses on assets, the global financial crisis caused considerable damage to listed and bond-issuing companies.

4.6 Firm size and age

We have mentioned that the impact of company size and age might already be considered stylized facts and should have a positive effect on firm survival (Geroski, 1995; Buehler et al., 2006; Esteve-Pérez and Mañez-Castillejo, 2008). However, our results indicate that in new EU member countries, the probability of exit for larger firms is higher than that for smaller ones; this result holds for all industries, except agriculture, where the coefficient is not statistically significant. Based on the information presented in Tables 3 and 4, this result is clearly not specific to a country or industry, as none of the coefficients indicate an opposite effect. Hence, our finding for the new EU firms is opposite to that of Esteve-Pérez et al. (2004), who show that the risk of failure is higher for small Spanish firms than for large ones. On the other hand, it is fair to state that the economic significance of the firm-size effect is low, as the coefficients are not much larger than the threshold of 1.

Nevertheless, our finding is indirectly supported by Hanousek et al. (2015), who found that, in general, larger EU firms can be associated with less efficiency. Compared to smaller firms, large firms are less efficient and consequently naturally prone to increased exit risk that might be driven by a higher bureaucracy level, higher communication costs, and a greater resistance to change. Thus, in its impact on firm survival, *firm size* (the natural logarithm of total assets) is a determinant that has an effect opposite to what one would expect based on the results of other empirical studies analyzing companies from

different countries. As such, our findings underline the necessity of conducting firm survival research on firms from emerging markets.

Furthermore, the *age* of a firm appears to be a statistically insignificant factor across countries; its economic effect is trivial as well. This finding resonates with the results of Hanousek et al. (2015), who reported that the age of EU firms only negligibly affects the firms' efficiency. In terms of industries, firm age shows some positive effects for improving the survival of firms operating in the service sector. To sum up, we cannot reject Hypothesis 7, as the effect of firm size and age is to an extent ambiguous.

4.7 Business organization

A firm might spread its business activities via its subsidiaries. The number of subsidiaries, then, defines the extent of the *business network* variable. This factor is shown to lower failure probability in the Czech Republic and Poland; the hazard ratios in the other two countries are not statistically significant. We again do not reject our Hypothesis 8, as the results are not conclusive across all countries. With respect to industries, this is also the case for agriculture, mining and manufacturing, and services. *Business diversification* helps firms survive in the Czech Republic, but it is not a statistically significant factor in other countries. For firms in agriculture, diversification also lowers the probability of their exit, which, given the highly cyclical and weather-dependent nature of this industry, is a reasonable result. However, the economic significance of both factors seems to be rather marginal.

Table 3. Determinants of firm survival: Baseline estimation of the Cox proportional hazards model

Table 4. Determinants of firm survival in different industries

[Tables 3 and 4 around here]

4.8 Robustness check

We performed two additional exercises to assess the robustness of our results presented in Sections 4.1–4.7. We re-estimated the Cox hazards model with different assumptions on survival distribution, including the exponential, Weibull, Gompertz, log-normal, log-logistic, and generalized gamma distributions (see Table A.2). Further, we considered some aspects of the firms as potentially relevant for our survival analysis. For example,

La Porta et al. (1999) used 20% as a threshold for control of a company. This widely accepted threshold theoretically allows for a maximum of 5 large shareholders. From this perspective, our variable *number of large shareholders*, indicating the total number of dominant and block shareholders, should not exceed 5 to avoid losing its implication of control. Hence, we eliminated all firms with more than 5 large shareholders. Another case relates to the age of the firms. For example, some firms, especially some Hungarian agricultural and service companies, date their beginning to before World War II. For the purpose of a robustness check, we also eliminated such old firms. Finally, following the same logic, we also eliminated firms with an excessive number of board directors (more than 50) and subsidiaries (more than 200).

The above procedure resulted in a reduction of the sample by 1,534 firms. Based on a reduced data set, we re-estimated all of the models, including those with different assumptions of survival distribution. The outcome of this exercise is that our main results are robust with respect to the data sample's reduction that was conditioned on some of the firms' characteristics, as the main results are practically the same (these results are available upon request).

In addition, in Table A.3, we provide the results for a step-wise estimation, i.e., we estimated our baseline model separately with different variable groups to see their isolated effects. All results still remain the same, except firm size, which is now a preventive factor increasing the probability of firm survival (with an effect of 0.98). To check the robustness of our results with respect to firm size, in Table A.4, models [4] and [5] report estimates of a Cox model for smaller firms and larger firms, respectively. Observations were divided into these two subcategories referring to the median of firm size (i.e., total assets). Again, there are no remarkable differences among these two models and the baseline estimation. However, a joint-stock company legal form is now a significant preventive factor for larger firms.

Finally, Model [1] in Table A.4 shows estimates of a Cox model without the ROA, the gross margin, and the solvency ratio. The idea is that firm performance could be a mechanism driving other covariates to be significant. If the coefficients of other variables are significant even when controlling for performance, these covariates should also have a direct effect, not only an indirect one, via performance. We can see that there are not any significant differences of other covariates from the baseline estimations in Model [1]

in Table 3. Hence, the results indicate the existence of a direct link from our determinants to firm survival, not only a link that would propagate via firm performance.

Model [2] in Table A.4 presents results with labor productivity as a firm performance factor (measured as the natural logarithm of operating revenue per employee) but without ROA and gross margin. Labor productivity is estimated with a hazard ratio less than 1.0 at the 1% significant level, i.e., the firms with higher productivity tend to survive. However, as shown in Model [3], when the ROA and the gross margin are controlled for simultaneously, the statistical significance of the labor productivity variable does not reach the 10% level. Additionally, once we control for labor productivity, the impact of other legal forms is no longer significant, which might suggest that certain legal types are not independent from firm productivity and that they might take on some of the productivity effects when labor productivity is not controlled for. The above results suggest that in new EU member states, financial performance is a better predictor of firm survival than productivity.

5. Conclusions

We analyzed firm survival after the global financial crisis in four new EU member states (the Czech Republic, Hungary, Poland, and Slovakia) by employing a large and detailed firm-level data set. Based on the Cox hazards model, we detected a number of firm survival determinants. In accord with the earlier literature, we confirmed the validity of several determinants. At the same time, in the new EU firms, we also found several firm-specific determinants that affected the probability of survival. Our main results can be summarized as follows.

First, significant preventive factors exist that increase the probability of firm survival in at least three of the four countries in our sample. The *number of large shareholders*, the *number of board directors*, and the *solvency ratio* improve the probability of firm survival for firms in all four countries. Both *foreign ownership* and *ROA* increase firm survival in all countries, except Slovakia. Conversely, the legal form of the *limited liability* company is a significant preventive factor only for Hungarian firms.

Second, across these countries, we identified several significant risk factors that reduced the probability of firm survival and thus increased the probability of firm exit. In terms of corporate governance, a board of directors that is too large seems to be detrimental because the squared term of the *number of board directors* reduces firm

survival probability in all four new EU countries. Two other factors negatively impact firm survival in three countries, excluding Hungary: *firm size* and the firm's employment of an *international audit firm*.

Third, several other determinants exhibit a specific influence on firms in each of the countries studied. Several of our results are in line with other studies in this area of research. However, we also found specific impacts that contradict some of the stylized facts regarding firm survival. One result is that employing an international audit firm reduced the survival probability of new EU companies. As discussed earlier, one of the possible explanations of this result is that a legitimate application of the IFRS by international audit firms might result in reducing the survival chances of (internationally audited) firms.

The country-specific results suggest that country differences are important when studying firm survival. Hence, we believe that studying new EU member states and their transformed economies provides useful insights for practitioners and policy makers.

Our results also provide some clear policy implications. We show that a number of standard determinants employed in the literature exhibit only a marginal economic impact on firm survival. On the other hand, the factors related to the legal form, ownership structure and corporate governance represent determinants with notable economic significance. Hence, policymakers in new EU countries should favor the introduction or observation of the rules and standards that directly impact the determinants (associated with the legal form, ownership structure and corporate governance) that have the most beneficial effects with respect to firm survival.

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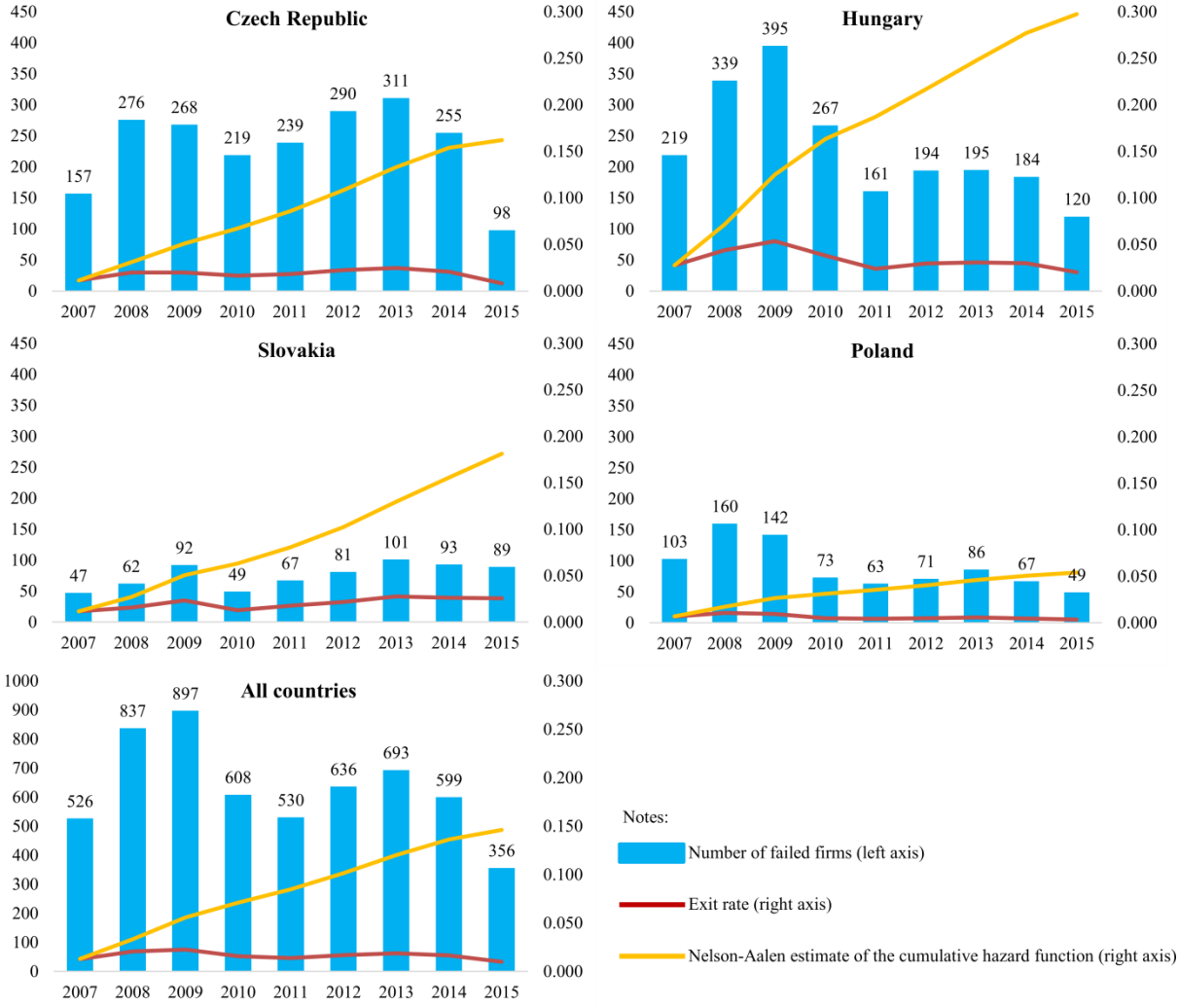

Figure 1. Number of failed firms, exit rate, and Nelson-Aalen estimate of the cumulative hazard functions by country and year

Table 1. Factors and their expected effects on firm survival

Factor field	Factor	Predicted impact on firm survivability
Legal form	Openness of the legal form	+
Ownership structure	Ownership concentration	?
	Foreign ownership	+
	State ownership	+
Corporate governance	Number of board directors (squared term)	+ (–)
	Number of auditors (squared term)	+ (–)
	Quality of the external audit	+
Firm performance	Financial performance	+
Linkage with capital market	Dependence on the stock market	+
	Dependence on fund procurement	+
Firm size and age	Firm size	+
	Firm age	+
Business organization	Business network	+
	Business diversification	+

Table 2. Definitions and descriptive statistics of the variables used in the empirical analysis

Variable name	Definition	Descriptive statistics		
		Mean	S.D.	Median
Legal form				
Joint-stock company	Dummy variable for open joint-stock companies	0.172	0.378	0.000
Limited liability	Dummy variable for limited liability companies	0.537	0.499	1.000
Partnership	Dummy variable for partnerships	0.182	0.386	0.000
Cooperative	Dummy variable for cooperatives	0.056	0.230	0.000
Other legal forms	Dummy variable for companies with a corporate form other than that listed above	0.052	0.223	0.000
Ownership structure				
Number of large	Total number of dominant and block shareholders	1.611	2.110	1.000
Foreign ownership	Dummy for the ultimate ownership of foreign investors	0.092	0.289	0.000
Central state ownership	Dummy for the ultimate ownership of the central government	0.018	0.132	0.000
Regional state	Dummy for the ultimate ownership of regional governments	0.013	0.113	0.000
Corporate governance				
Number of board	Number of recorded members of the board of directors	2.510	2.781	2.000
Number of auditors	Number of recorded corporate auditors	1.696	1.456	2.000
International audit firm	Dummy for firms that employ an international audit firm as an external auditor	0.058	0.234	0.000
Firm performance				
ROA	Return on total assets (%) [a]	7.448	15.017	5.020
Gross margin	Gross margin (%) [b]	4.063	10.740	2.860
Labor productivity	Natural logarithm of the operating revenue per employee in euro	2.22	2.85	1.802
Solvency ratio	Solvency ratio (%) [c]	43.7	28.7	44.115
Linkage with capital				
Listed	Dummy variable for the listed companies	0.005	0.071	0.000
Firm size and age				
Company size	Natural logarithm of the total assets in euros	7.583	1.924	7.716
Firm age	Years in operation	14.539	15.579	12.000
Business organization				
Firm network	Number of recorded subsidiaries	0.433	2.874	0.000
Business diversification	Number of operating industries according to the NACE Rev. 2 secondary codes	5.019	6.115	2.000

Notes:
a ROA is computed using the following formula: (profit before tax/total assets) × 100.
b Gross margin is computed using the following formula: (gross profit/operating revenue) × 100.
c Solvency ratio is computed using the following formula: (shareholders' funds/total assets) × 100.

Table 3. Determinants of firm survival: Baseline estimation of the Cox proportional hazards model

Model	[1]		[2]		[3]		[4]		[5]	
Target industry	All industries (Sections A–S)									
Target country	All countries		Czech Republic		Poland		Hungary		Slovakia	
Legal form (default category: LLC)										
Joint-stock company	0.96603		1.14332		0.64901	***	0.27588	***	0.82481	
	(-0.64)		(1.32)		(-3.05)		(-7.72)		(-0.90)	
Partnership	0.51394	***	0.96271		1.14079		0.19715	***	0.46826	
	(-9.44)		(-0.11)		(0.78)		(-10.44)		(-0.66)	
Cooperative and association	0.54393	***	0.57235	**	0.17831	***	0.89671		0.87308	
	(-4.77)		(-2.45)		(-6.86)		(-0.25)		(-0.39)	
Other legal forms	1.47876	***	0.39877	***	1.08912		0.76779		0.38754	*
	(5.16)		(-5.03)		(0.40)		(-1.58)		(-1.78)	
Ownership structure										
Number of large shareholders	0.76650	***	0.54919	***	0.34115	***	0.97206	**	0.38799	***
	(-11.77)		(-7.73)		(-11.19)		(-2.31)		(-4.40)	
Foreign ownership	0.68413	***	0.73709	***	0.66364	***	0.61259	***	0.95979	
	(-5.93)		(-3.07)		(-2.93)		(-3.25)		(-0.23)	
Central state ownership	0.83981		2.91949	***	0.87527		0.85495		1.72222	
	(-1.01)		(2.81)		(-0.68)		(-0.19)		(0.74)	
Regional state ownership	0.03442	***	0.05300	***	0.05185	***				
	(-3.36)		(-50.02)		(-2.96)					
Corporate governance										
Number of board directors	0.85260	***	0.54810	***	0.70000	***	0.94882	***	0.67151	***
	(-12.83)		(-16.86)		(-5.29)		(-4.41)		(-6.97)	
Number of board directors ^2	1.00153	***	1.02399	***	1.01296	***	1.00060	***	1.01428	***
	(12.45)		(12.34)		(5.07)		(4.39)		(3.88)	
Number of auditors	1.03506		0.97552		1.01087		0.78496	***	0.72542	
	(0.94)		(-0.31)		(0.05)		(-3.55)		(-1.00)	
Number of auditors ^2	0.97226	***	1.03355		0.94547		1.02089	*	0.94541	
	(-4.32)		(1.28)		(-0.77)		(1.92)		(-0.20)	
International audit firm	1.40018	***	1.51117	**	2.37369	***	0.95912		4.00975	**
	(4.41)		(2.08)		(6.93)		(-0.35)		(2.23)	
Firm performance										
ROA	0.99105	***	0.99482	*	0.99211	*	0.99247	**	0.99330	
	(-5.61)		(-1.94)		(-1.69)		(-2.54)		(-1.52)	
Gross margin	0.99538	**	0.99541		0.99628		0.98937	***	0.99772	
	(-2.19)		(-1.37)		(-0.60)		(-2.71)		(-0.45)	
Solvency ratio	0.99095	***	0.99138	***	0.99535	***	0.98761	***	0.99286	***
	(-15.93)		(-9.99)		(-3.07)		(-11.18)		(-3.74)	
Linkage with capital market										
Listed	1.35186		1.25341		5.56284	**	0.36208		1.31900	
	(1.00)		(0.15)		(2.31)		(-1.39)		(0.69)	
Firm size and age										
Firm size	1.07296	***	1.13852	***	1.14069	***	1.01468		1.09699	**
	(5.09)		(5.35)		(3.46)		(0.64)		(2.54)	
Firm age	0.99660	*	1.00794		1.00101		1.00026		0.99612	
	(-1.80)		(1.45)		(0.55)		(0.05)		(-0.48)	
Business organization										
Business network	0.95388	***	0.91211	*	0.69528	***	1.00258		1.01956	
	(-2.95)		(-1.85)		(-2.72)		(0.23)		(0.31)	
Business diversification	1.00080		0.98371	**	0.94551		1.00983		1.00768	
	(0.20)		(-2.55)		(-0.38)		(1.44)		(0.80)	
Country-level fixed effects	Yes		No		No		No		No	
NACE division-level fixed effects	Yes		Yes		Yes		Yes		Yes	
N	36498		12203		13836		6976		3483	
Log pseudolikelihood	-47083.42		-15483.59		-6215.90		-14267.30		-4187.99	
Wald test (χ^2)	41844.85	***	6067.82	***	197478.28	***	1246.68	***	82646.91	***

*Notes: This table contains the results from a survival analysis conducted using the Cox proportional hazards model. N denotes the number of firms. The regression coefficients are hazard ratios. The standard errors are computed using the Huber-White sandwich estimator. The Z-statistics are reported in parentheses beneath the hazard ratios. The Wald test examines the null hypothesis that all coefficients are zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table 4. Determinants of firm survival in different industries

Model	[1]		[2]		[3]		[4]	
Target industry (NACE Rev. 2 classification)	Agriculture, forestry, and fishing (Section A)		Mining and manufacturing (Sections B–E)		Construction (Section F)		Services (Sections G–S)	
Legal form (default category: LLC)								
Joint-stock company	1.95617	**	1.10821		1.07168		0.79732	***
	(2.01)		(1.26)		(0.47)		(-2.65)	
Partnership	1.63002		0.47889	***	0.59914	**	0.46917	***
	(1.18)		(-6.65)		(-2.24)		(-6.91)	
Cooperative and association	1.27022		0.78135		1.96273	**	0.27274	***
	(0.63)		(-1.36)		(2.03)		(-5.13)	
Other legal forms	5.97346	***	1.70199	***	1.53928		1.12062	
	(4.85)		(4.39)		(1.58)		(1.01)	
Ownership structure								
Number of large shareholders	0.91586		0.74831	***	0.80264	***	0.74513	***
	(-1.10)		(-7.52)		(-3.98)		(-9.06)	
Foreign ownership	0.22505	*	0.62713	***	1.04028		0.71203	***
	(-1.65)		(-4.82)		(0.14)		(-3.75)	
Central state ownership	0.62336		1.17430		0.47253		0.76270	
	(-0.51)		(0.64)		(-0.72)		(-1.09)	
Regional state ownership	0.03130	***	0.05856	***	0.01770	***		
	(-28.74)		(-2.81)		(-78.18)			
Corporate governance								
Number of board directors	0.73413	***	0.83617	***	0.79733	***	0.84571	***
	(-4.93)		(-8.99)		(-5.07)		(-9.02)	
Number of board directors ^2	1.01051	***	1.00389	***	1.00492	***	1.00156	***
	(4.77)		(10.14)		(3.35)		(9.34)	
Number of auditors	1.14624		1.09421		0.84391		1.04212	
	(0.64)		(1.59)		(-1.60)		(0.74)	
Number of auditors ^2	0.95435		0.95023	***	1.00547		0.98077	**
	(-1.29)		(-4.89)		(0.29)		(-2.00)	
International audit firm	3.58688	*	1.32745	**	1.58485		1.41164	***
	(1.74)		(2.44)		(1.26)		(3.26)	
Firm performance								
ROA	0.99913		0.99032	***	0.99781		0.98913	***
	(-0.06)		(-3.58)		(-0.36)		(-5.21)	
Gross margin	0.98283	*	0.99555		0.99437		0.99690	
	(-1.95)		(-1.39)		(-0.48)		(-1.02)	
Solvency ratio	0.98421	***	0.98988	***	0.98714	***	0.99349	***
	(-4.27)		(-11.38)		(-5.86)		(-7.98)	
Linkage with capital market								
Listed	0.02140	***	1.28722		1.53269		1.63931	
	(-8.04)		(0.61)		(0.56)		(0.84)	
Firm size and age								
Firm size	1.10464		1.09795	***	1.17977	***	1.03513	*
	(1.14)		(4.35)		(3.94)		(1.67)	
Firm age	0.99738		0.99980		0.98661		0.99251	**
	(-0.19)		(-0.10)		(-1.43)		(-2.21)	
Business organization								
Business network	0.82338	**	0.90687	***	1.01809		0.96220	**
	(-2.50)		(-2.60)		(0.56)		(-2.04)	
Business diversification	0.96668	*	1.00898		0.98947		0.99894	
	(-1.69)		(1.38)		(-1.01)		(-0.17)	
Country-level fixed effects	Yes		Yes		Yes		Yes	
NACE division-level fixed effects	Yes		Yes		Yes		Yes	
N	2112		15184		3449		15753	
Log pseudolikelihood	-1157.92		-17727.74		-4257.11		-18605.52	
Wald test (χ^2)	14147.00	***	18764.91	***	8596.55	***	157251.93	***

*Notes: This table contains the results from a survival analysis conducted using the Cox proportional hazards model. N denotes the number of firms. The regression coefficients are hazard ratios. The standard errors are computed using the Huber-White sandwich estimator. The Z-statistics are reported in parentheses beneath the hazard ratios. The Wald test examines the null hypothesis that all coefficients are zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Appendix

Table A.1. Breakdown of firm survival status by industry

NACE Rev. 2 section	Number of operating firms at the end of 2006 (i)	Number of surviving firms through the end of 2015	Number of failed firms										Entire period exit rate (ii/i)	Entire period Nelson-Aalen cumulative hazard function	Entire period Kaplan-Meier survivor function
			Total failures through the end of 2015 (ii)	Breakdown by year											
				2007	2008	2009	2010	2011	2012	2013	2014	2015			
All industries (A–S)	41496	35814	5682	526	837	897	608	530	636	693	599	356	0.137	0.146	0.863
Agriculture, forestry, and fishing (A)	2391	2175	216	24	28	31	11	14	26	37	25	20	0.090	0.094	0.910
Mining and quarrying (B)	236	207	29	2	4	4	5	1	3	3	2	5	0.123	0.130	0.877
Manufacturing (C)	15163	13048	2115	200	361	260	196	203	251	261	240	143	0.139	0.149	0.861
Electricity, gas, steam, and air conditioning supply (D)	548	493	55	0	6	9	6	7	10	7	6	4	0.100	0.105	0.900
Water supply; sewage, waste management, and remediation activities (E)	948	853	95	4	15	17	11	4	11	8	16	9	0.100	0.105	0.900
Construction (F)	3866	3212	654	56	68	103	81	52	81	91	69	53	0.169	0.183	0.831
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	7694	6688	1006	78	135	207	118	96	112	120	89	51	0.131	0.139	0.869
Transportation and storage (H)	1899	1611	288	35	39	53	26	38	20	33	34	10	0.152	0.163	0.848
Accommodation and food service activities (I)	915	781	134	13	18	23	29	13	7	12	15	4	0.146	0.157	0.854
Information and communication (J)	1140	950	190	27	14	45	15	15	25	17	17	15	0.167	0.180	0.833
Financial and insurance activities (K)	398	332	66	5	9	16	3	9	5	3	9	7	0.166	0.179	0.834
Real estate activities (L)	1295	1140	155	14	28	25	20	12	20	21	9	6	0.120	0.126	0.880
Professional, scientific, and technical activities (M)	1681	1457	224	20	36	34	28	19	21	30	24	12	0.133	0.142	0.867
Administrative and support service activities (N)	1535	1290	245	22	29	44	33	22	29	31	26	9	0.160	0.172	0.840
Public administration and defense; compulsory social security (O)	17	13	4	0	2	1	0	0	0	0	1	0	0.235	0.256	0.765
Education (P)	335	322	13	1	3	1	1	0	1	3	3	0	0.039	0.039	0.961
Human health and social work activities (Q)	931	852	79	7	14	10	12	6	8	11	6	5	0.085	0.088	0.915
Arts, entertainment, and recreation (R)	295	214	81	17	22	7	7	14	4	3	6	1	0.275	0.313	0.725
Other service activities (S)	209	176	33	1	6	7	6	5	2	2	2	2	0.158	0.170	0.842
Multiple comparison among the 19 sections															
Chi-square (χ^2) test for independence													222.43 ***		
Cramer's coefficient of association (V)													0.0732		
Log-rank test for equality of survivor functions (χ^2)															229.98 ***

Notes: This table is provided to obtain a better perspective of our data. We do not take into account the backfilling bias, i.e., the possibility that during the analyzed period, some new firms might have been established.

Table A.2. Estimations with different assumptions about the distribution

Model	Table 3 Model [1]	[1]	[2]	[3]	[4]	[5]	[6]
Assumptions about the survival distribution	Cox proportional hazards	Exponential	Weibull	Gompertz	Log-normal	Log-logistic	Generalized gamma
Legal form (default category: LLC)							
Joint-stock company	0.96603	0.96495	0.96103	0.96456	-0.01699	-0.01488	-0.01228
	(-0.64)	(-0.65)	(-0.70)	(-0.65)	(-0.38)	(-0.27)	(-0.27)
Partnership	0.51394 ***	0.51142 ***	0.49818 ***	0.51012 ***	0.55291 ***	0.62404 ***	0.55977 ***
	(-9.44)	(-9.40)	(-9.49)	(-9.42)	(8.12)	(9.30)	(8.10)
Cooperative and association	0.54393 ***	0.54193 ***	0.54326 ***	0.54199 ***	0.45114 ***	0.47164 ***	0.45593 ***
	(-4.77)	(-4.77)	(-4.70)	(-4.76)	(4.76)	(4.38)	(4.81)
Other legal forms	1.47876 ***	1.47021 ***	1.48308 ***	1.47122 ***	-0.49818 ***	-0.42177 ***	-0.49011 ***
	(5.16)	(5.03)	(4.99)	(5.02)	(-7.16)	(-6.13)	(-7.00)
Ownership structure							
Number of large shareholders	0.76650 ***	0.76383 ***	0.76042 ***	0.76344 ***	0.20236 ***	0.22872 ***	0.20583 ***
	(-11.77)	(-11.74)	(-11.68)	(-11.74)	(9.21)	(11.51)	(10.06)
Foreign ownership	0.68413 ***	0.68129 ***	0.67664 ***	0.68078 ***	0.33460 ***	0.33203 ***	0.33412 ***
	(-5.93)	(-5.93)	(-5.97)	(-5.93)	(6.26)	(6.00)	(6.25)
Central state ownership	0.83981	0.84218	0.84116	0.84217	0.21446 *	0.17007	0.21057
	(-1.01)	(-0.99)	(-0.99)	(-0.99)	(1.66)	(1.19)	(1.62)
Regional state ownership	0.03442 ***	0.03431 ***	0.03414 **	0.03430 ***	2.07169 ***	2.59485 ***	2.09946 ***
	(-3.36)	(-3.36)	(-3.36)	(-3.36)	(4.36)	(3.40)	(4.24)
Corporate governance							
Number of board directors	0.85260 ***	0.85141 ***	0.84790 ***	0.85105 ***	0.14089 ***	0.15993 ***	0.14067 ***
	(-12.83)	(-12.76)	(-12.75)	(-12.78)	(13.54)	(3.26)	(13.82)
Number of board directors ^2	1.00153 ***	1.00155 ***	1.00159 ***	1.00155 ***	-0.00166 ***	-0.00264 ***	-0.00161 ***
	(12.45)	(12.47)	(12.51)	(12.50)	(-5.09)	(-5.73)	(-5.25)
Number of auditors	1.03506	1.03651	1.03748	1.03665	-0.00561	-0.03284	-0.00765
	(0.94)	(0.96)	(0.97)	(0.97)	(-0.18)	(-1.00)	(-0.24)
Number of auditors ^2	0.97226 ***	0.97187 ***	0.97072 ***	0.97175 ***	0.01991 ***	0.02580 ***	0.02041 ***
	(-4.32)	(-4.32)	(-4.40)	(-4.33)	(3.48)	(4.41)	(3.51)
International audit firm	1.40018 ***	1.39989 ***	1.40093 ***	1.39994 ***	-0.39481 ***	-0.34817 ***	-0.38965 ***
	(4.41)	(4.36)	(4.29)	(4.35)	(-6.04)	(-5.15)	(-5.89)
Firm performance							
ROA	0.99105 ***	0.99095 ***	0.99072 ***	0.99093 ***	0.00791 ***	0.00846 ***	0.00798 ***
	(-5.61)	(-5.60)	(-5.59)	(-5.60)	(5.21)	(5.61)	(5.26)
Gross margin	0.99538 **	0.99531 **	0.99537 **	0.99531 **	0.00492 **	0.00467 **	0.00488 **
	(-2.19)	(-2.20)	(-2.12)	(-2.19)	(2.41)	(2.31)	(2.40)
Solvency ratio	0.99095 ***	0.99082 ***	0.99066 ***	0.99080 ***	0.00771 ***	0.00803 ***	0.00775 ***
	(-15.93)	(-15.95)	(-15.90)	(-15.93)	(15.01)	(15.74)	(14.95)
Linkage with capital market							
Listed	1.35186	1.35490	1.36529	1.35598	-0.27253	-0.26103	-0.27565
	(1.00)	(1.00)	(1.01)	(1.00)	(-1.05)	(-1.03)	(-1.07)
Firm size and age							
Firm size	1.07296 ***	1.07371 ***	1.07631 ***	1.07397 ***	-0.05301 ***	-0.06187 ***	-0.05370 ***
	(5.09)	(5.08)	(5.13)	(5.09)	(-4.39)	(-5.10)	(-4.42)
Firm age	0.99660 *	0.99658 *	0.99643 *	0.99656 *	0.00208	0.00256 *	0.00212
	(-1.80)	(-1.80)	(-1.83)	(-1.80)	(1.56)	(1.71)	(1.58)
Business organization							
Business network	0.95388 ***	0.95398 ***	0.95302 ***	0.95390 ***	0.05074 ***	0.04780 ***	0.05018 ***
	(-2.95)	(-2.91)	(-2.91)	(-2.91)	(3.86)	(3.43)	(3.81)
Business diversification	1.00080	1.00098	1.00112	1.00099	0.00196	0.00109	0.00183
	(0.20)	(0.24)	(0.27)	(0.25)	(0.55)	(0.31)	(0.51)
Country-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	36498	36498	36498	36498	36498	36498	36498
Log pseudolikelihood	-47083.42	-	-16124.97	-16204.42	-15976.23	-16026.01	-15975.67
Wald test (χ^2)	41844.85 ***	9346.38 ***	9232.76 ***	8543.61 ***	6049.29 ***	6063.78 ***	3809.20 ***

*Notes: This table contains results from a survival analysis conducted using 6 parametric estimators for a robustness check. Models [1] to [3] report hazard ratios, while Models [4] to [6] report regression coefficients. N denotes the number of firms. The standard errors are computed using the Huber-White sandwich estimator. The Z-statistics are reported in parentheses. The Wald test examines the null hypothesis that all coefficients are zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table A.3. Step-wise estimation results

Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]
Target industry	All industries (Sections A-S)						
Target country	All countries						
Legal form (default category: LLC)							
Joint-stock company	1.0085						
	(0.19)						
Partnership	0.6346 **						
	(-7.11)						
Cooperative and association	0.5199 **						
	(-5.58)						
Other legal forms	2.0792 **						
	(10.89)						
Ownership structure							
Number of large shareholders		0.7754 **					
		(-					
Foreign ownership		0.7314 **					
		(-5.25)					
Central state ownership		0.9024					
		(-0.65)					
Regional state ownership		0.0374 **					
		(-3.28)					
Corporate governance							
Number of board directors			0.87358 **				
			(-11.41)				
Number of board directors ^2			1.00138 **				
			(11.56)				
Number of auditors			1.01895				
			(0.54)				
Number of auditors ^2			0.97687 **				
			(-3.69)				
International audit firm			1.60608 **				
			(6.77)				
Firm performance							
ROA				0.99084 **			
				(-6.05)			
Gross margin				0.99378 **			
				(-3.04)			
Solvency ratio				0.98973 **			
				(-18.71)			
Linkage with capital market							
Listed					0.53235		
					(-1.51)		
Firm size and age							
Firm size						0.97758 **	
						(-2.10)	
Firm age						0.99211 **	
						(-3.61)	
Business organization							
Business network							0.93025 **
							(-4.43)
Business diversification							1.00110
							(0.28)
Country-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	36498	36498	36498	36498	36498	36498	36498
Log pseudolikelihood	-	-	-	-	-	-	-
Wald test (χ^2)	2202.6 **	2323.2 **	50761.7 **	20941.7 **	35601.1 **	34063.3 **	1984.27 **

*Notes: This table contains results from a survival analysis conducted using the Cox proportional hazards model. Regression coefficients are hazard ratios. N denotes the number of firms. The standard errors are computed using the Huber-White sandwich estimator. The z-statistics are reported in parentheses beneath the hazard ratios. The Wald test examines the null hypothesis that all coefficients are zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*

Table A.4. Estimations with labor productivity and controlling for firm size

Model	Table 3 Model [1]		[1]		[2]		[3]		[4]		[5]	
Target industry / country	All industries (Sections A-S) – All countries											
Target firms	All firms								Smaller firms		Larger firms	
Legal form (default category:												
Joint-stock company	0.96603		0.93878		0.91167		0.92994		1.13729		0.84884	**
	(-0.64)		(-1.16)		(-1.45)		(-1.13)		(1.60)		(-2.21)	
Partnership	0.51394	**	0.49515	**	0.52656	**	0.54519	**	0.60224	**	0.46066	**
	(-9.44)		(-10.17)		(-5.85)		(-5.36)		(-4.14)		(-8.34)	
Cooperative and association	0.54393	**	0.47272	**	0.35944	**	0.45776	**	0.91262		0.28381	**
	(-4.77)		(-5.84)		(-7.14)		(-5.58)		(-0.58)		(-5.52)	
Other legal forms	1.47876	**	1.49607	**	1.03482		1.05086		1.63490	**	1.30338	**
	(5.16)		(5.62)		(0.37)		(0.50)		(3.87)		(2.54)	
Ownership structure												
Number of large shareholders	0.76650	**	0.74868	**	0.58839	**	0.61360	**	0.80266	**	0.72181	**
	(-11.77)		(-12.57)		(-12.61)		(-11.69)		(-7.08)		(-9.82)	
Foreign ownership	0.68413	**	0.71750	**	0.72378	**	0.69035	**	0.76189	**	0.62702	**
	(-5.93)		(-5.24)		(-4.62)		(-5.20)		(-2.65)		(-5.70)	
Central state ownership	0.83981		0.87721		0.98667		0.94142		1.29073		0.68302	*
	(-1.01)		(-0.78)		(-0.08)		(-0.34)		(0.87)		(-1.81)	
Regional state ownership	0.03442	**	0.03062	**	0.04048	**	0.04384	**	0.02960	**	0.04288	**
	(-3.36)		(-3.47)		(-3.19)		(-3.11)		(-16.08)		(-3.13)	
Corporate governance												
Number of board directors	0.85260	**	0.84403	**	0.74378	**	0.75541	**	0.72065	**	0.86459	**
	(-12.83)		(-13.48)		(-15.75)		(-15.03)		(-11.98)		(-9.28)	
Number of board directors ^2	1.00153	**	1.00163	**	1.00574	**	1.00551	**	1.01496	**	1.00142	**
	(12.45)		(13.16)		(15.41)		(14.96)		(9.09)		(9.62)	
Number of auditors	1.03506		0.99658		1.07841	*	1.11104	**	0.96010		1.02737	
	(0.94)		(-0.09)		(1.77)		(2.41)		(-0.81)		(0.40)	
Number of auditors ^2	0.97226	**	0.98055	**	0.96184	**	0.95452	**	0.99399		0.96706	**
	(-4.32)		(-3.05)		(-3.90)		(-4.58)		(-0.67)		(-2.87)	
International audit firm	1.40018	**	1.48919	**	1.68289	**	1.61597	**	1.82099	**	1.34187	**
	(4.41)		(5.34)		(5.82)		(5.19)		(3.33)		(3.45)	
Firm performance												
ROA	0.99105	**					0.99381	**	0.99369	**	0.98669	**
	(-5.61)						(-3.26)		(-3.07)		(-4.89)	
Gross margin	0.99538	**					0.99520	**	0.99284	**	0.99788	
	(-2.19)						(-2.10)		(-2.13)		(-0.75)	
Solvency ratio	0.99095	**					0.99185	**	0.98972	**	0.99283	**
	(-15.93)						(-12.34)		(-13.34)		(-8.01)	
Labor productivity					0.93220	**	0.95962					
					(-3.15)		(-1.45)					
Linkage with capital market												
Listed	1.35186		1.31671		1.41302		1.52063		1.21402		2.00777	
	(1.00)		(0.90)		(1.05)		(1.28)		(0.53)		(1.32)	
Firm size and age												
Firm size	1.07296	**	1.03786	**	1.07976	**	1.10953	**	1.07118	**	1.11250	**
	(5.09)		(2.67)		(4.39)		(5.72)		(2.84)		(4.17)	
Firm age	0.99660	*	0.99557	**	0.99717		0.99772		0.99533		0.99812	
	(-1.80)		(-2.16)		(-1.43)		(-1.24)		(-1.43)		(-0.88)	
Business organization												
Business network	0.95388	**	0.95615	**	0.94347	**	0.94003	**	0.92391	*	0.95913	**
	(-2.95)		(-2.86)		(-2.61)		(-2.64)		(-1.84)		(-2.52)	
Business diversification	1.00080		1.00084		0.99591		0.99765		0.99477		1.00756	
	(0.20)		(0.21)		(-0.90)		(-0.50)		(-0.97)		(1.28)	
Country-level fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
NACE division-level fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
N	36498		36498		30341		30012		18129		18369	
Log pseudolikelihood	-		-		-		-		-23888.89		-	
Wald test (χ^2)	41844.8	**	25445.5	**	97347.97	**	81022.30	**	127211.7	**	52414.41	**

*Notes: This table contains results from a survival analysis conducted using the Cox proportional hazards model. The regression coefficients are hazard ratios. N denotes the number of firms. The standard errors are computed using the Huber-White sandwich estimator. The Z-statistics are reported in parentheses beneath the hazard ratios. The Wald test examines the null hypothesis that all coefficients are zero. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.*