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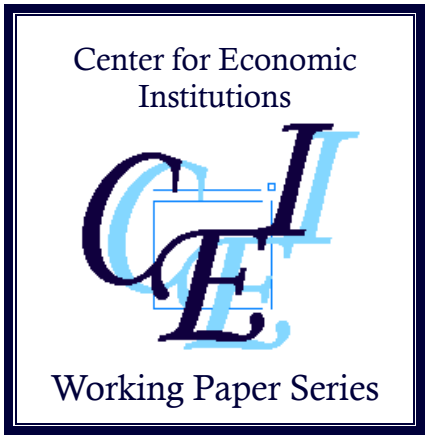

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Institutions, Financial Development, and Small Business Survival: Evidence from European Emerging Markets*

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Abstract: In this paper, we traced the survival status of 94,401 small businesses in 17 European emerging markets from 2007–2017 and empirically examined the determinants of their survival, focusing on institutional quality and financial development. We found that institutional quality and the level of financial development impact the survival probability of the researched SMEs in statistically significant and economically meaningful ways. The evidence holds even when we control for a set of firm-level characteristics such as ownership structure, financial performance, firm size, and age. The findings are also uniform across industries and country groups and robust beyond the difference in assumption of hazard distribution, firm size, region, and time period.

Keywords: small business; institutions; financial development; survival analysis; European emerging markets
JEL Classifications: C14, D02, D22, G33, M21

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1 Introduction

Small and medium enterprises (SMEs) are the backbone of the economy in Europe; in the EU alone, approximately 23 million SMEs represent 99% of all businesses and provide nearly 70% of all private sector employment.[1] Yet, the ability of SMEs to survive in the market is challenged by harsh conditions brought about by recent economic developments, in the form of the global financial crisis (GFC), the European sovereign debt crisis, and the Corona crisis, whose impacts have yet to be evaluated.[2] In times of heightened uncertainty, financial flows and the internal stability of firms are often disrupted, and two sets of external factors might improve the survival chances for some (Alfaro and Chen, 2012; Ono and Uesugi, 2014). First, the quality of institutions affects the business environment, enforcement of the law, and economic freedom (North, 1990; Porter, 1998; De la Croix and Delavallade, 2009; Che et al., 2017; Baumöhl et al., 2019). Second, the level of financial development impacts the operational quality of the economy in which firms operate and improves conditions for entrepreneurs in terms of risk, monitoring, and discipline (Musso and Schiavo, 2008; Tsoukas, 2011; LiPuma et al., 2013; Kelly et al., 2015; Kočenda and Iwasaki, 2020). As there are substantial differences in institutions and financial development globally, the weight of both external factors is likely even more important in emerging markets than in developed economies (Chari et al., 2010; Fan et al., 2011; Urbano et al., 2019). In our analysis, we assess the impact of institutions and financial development on the survival of small firms in emerging European economies, as no literature has tackled this issue yet. In this introduction, we intentionally bring forth the key facts and evidence from the related literature (rather than its formal review), as this arrangement provides better perspective on our further motivation.

Why do we analyze emerging European economies? Three decades ago, a massive wave of political, economic, and social changes accompanied the demise of the command

[1] https://ec.europa.eu/growth/smes_en. A similar pattern can be observed in the USA, where 28 million small businesses account for 99.7% of all firms. Moreover, family firms, which are often SMEs, constitute the pillars of the economy in most countries (La Porta et al., 1999).

[2] SMEs were among those firms facing very difficult challenges, and large numbers had to exit the market—the uncertainty regarding the economic policies and regulations in which enterprises operate has increased dramatically since the outbreak of the GFC. As a result, SMEs were probably the hardest hit economic units due to their limited capacity to absorb large shocks as well as their sensitivity to uncertainty in the economic environment (Potter and Thompson, 2011).

economic system and the advent of the market economy in Central and Eastern Europe (CEE). The microeconomic part of the transition was based on the privatizations of state enterprises and the emergence of new private firms, the majority of which were SMEs (Iwasaki and Mizobata, 2018). Economic reforms in the CEE countries aimed to establish competitive markets and to create or reform supporting institutions (Aussenegg and Jelic, 2007; Kočenda and Hanousek, 2012). However, many firms entering the market at that time soon found it difficult to survive (McDermott, 2004). Moreover, an uneasy transformation process, along with the ensuing GFC, negatively impacted firms' performance and consequent survivability (Estrin et al., 2009; Hanousek et al., 2015; Baumöhl et al., 2019; Iwasaki and Kim, 2020).

In many respects, firms in CEE countries faced greater challenges than those in developed European countries. Economic reforms were stressful, and advancements in building institutions were not seen as a priority, since they also had the potential to reduce the power of local governments (Bateman, 2000). This seems unfortunate, because high-quality institutions are indispensable for economic growth, as they facilitate efficient transactions among firms (North, 1993). Since greater fairness and greater protection of property rights help to reduce firm exit rates, these institutional factors are particularly important in less-developed markets (Desai et al., 2005). More recent research provides ample evidence that the quality of the institutional environment strongly affects entrepreneurship and entrepreneurial behavior (Urbano et al., 2019). Actually, Boudreaux and Nikolaev (2019) argued that quality market-oriented institutions positively affect risk taking, experimentation, rates of innovation, and net business formation. All of these aspects are also likely to impact firm survival. The important mechanism through which institutions propagate can be characterized by the transactional costs approach (Acs, 2006; Acs and Szerb, 2007; Acs et al., 2008)—high-quality institutions reduce firms' costs associated with the regulatory burden and uncertainty. Institutions ensuring the protection of the law, democracy, and national governance or those aiming to control corruption can be hypothesized to reduce the regulatory burden and uncertainty. This, in turn, increases firms' probability of survival. An empirical link between firm survival and quality of institutions has been shown by Baumöhl et al. (2019) for large European firms, but until now, no evidence has been available regarding SMEs. Hence, in this paper, we

empirically test the following null hypothesis: *Institutional quality does not affect the survivability of small businesses in European emerging markets.*

For firm survival, financial development in a country plays a vital role, as evidenced below. From this perspective, financial development is critical, since emerging economies generally possess less-developed financial markets. Their development naturally varies among CEE countries, and the differences can be expected to affect the behavior of firms and their owners. More-developed financial markets exhibit a greater capacity to enforce capital market discipline, and entrepreneurs may perceive them as better insurance against the risk of asset expropriation and contract repudiation (LiPuma et al., 2013). In general, weak financial development is recognized as negatively affecting economic performance and augmenting instability (Henisz and Williamson, 1999). However, literature that examines the causal relationship between country-level financial development and firm survival is scarce. Still, based on a set of Asian firms, Tsoukas (2011) showed that improvements in financial development can be linked to improved survival chances in general, but small firms benefit less than larger firms. In the EU context, a link between financial development and firm survival can be documented only imperfectly. Schäfer and Talavera (2009) reported that financial constraints negatively affect the survival probability of German entrepreneurs. Furthermore, Musso and Schiavo (2008) obtained similar results from a survival analysis of the French manufacturing industry, which is largely composed of SMEs. Finally, Farinha et al. (2019) documented that SMEs borrowing from banks exposed to funding outflow tend to fail in Portugal. On the other hand, Kočenda and Iwasaki (2020) showed that sounder financial development can be directly linked to the improved survival of banks in CEE economies. Still, there is no such evidence for SMEs in CEE, and the scarcity of literature further motivates our approach. In order to assess the impact of financial development, we also test the following null hypothesis: *Financial development does not influence the survivability of small businesses in European emerging markets.*

In our empirical assessment, we adopt the following research strategy: We analyze the impact of the quality of institutions based on a set of variables that characterize the rule of law, degree of democracy, development of national governance and civil society, and level of corruption control. Further, we assemble a rich set of variables that representatively characterize the extent of financial development in each country; details

on institutional quality and financial development variables are provided in the data section. With both types of measures, we are able to control for cross-country differences due to the heterogeneity of economic, social, and political features. We also perform a principal component analysis to create comprehensive indices of the institutional quality and financial development (i) to analyze the aggregate impact of both types of external factors without omitting any particular measure and (ii) to avoid correlations existing among different institutional indices as reported by Fidrmuc et al. (2017).

In our analysis, we further employ firm-specific factors and industry-level fixed effects to effectively control for their impact on firm survival. Specifically, we account for key firm-specific characteristics such as firm size and age, ownership structure, and financial performance. These factors affect the general ability of a firm to survive (Alfaro and Chen, 2012; Kočenda and Hanousek, 2012; Baumöhl et al., 2020; Iwasaki and Kim, 2020). At the same time, these factors, especially the size and age of the firm associated with the ability to attract financial resources, also affect small business failures; thus, they are repeatedly examined as control variables in prior studies. In fact, Audretsch (1991), Persson (2004), Box (2008), Esteve-Pérez and Mañez-Castillejo (2008), Cader and Leatherman (2011), Ebert et al. (2019), and Rico et al. (2020) repeatedly verified that firm size and age are closely related to the survival of small businesses beyond differences in periods, industries, and regions. Furthermore, based on empirical evidence from Irish firm data, Kelly et al. (2015) pointed out the existence of a nonlinear survival bias that older companies are less likely to become insolvent and have greater resiliency in a recessionary period. In recent literature, Cucculelli and Peruzzi (2020) studied the post-crisis survival of Italian companies and showed that SMEs have a higher probability of defaulting. They also found that poor financial performance, family ownership, and smaller firm size make it difficult for SMEs to adopt default-reducing strategies, leading to the end of business operations. SMEs are vulnerable, particularly during economic turbulence, because they have a limited capacity to downsize and diversify their activities, and they face severe financial conditions. Moreover, Mata and Portugal (2004) showed a sharp difference between domestic and foreign firms in the processes of entry, survival, and post-entry growth.

As a departure point in our analysis, we specified testable (null) hypotheses stating that country-level institutional quality and financial development do not affect the

survivability of small businesses in European emerging markets. We assessed the hypotheses with a quantitative tool of the Cox proportional hazards model and estimated the survival probabilities related to specific survival determinants; this is the same process used by Esteve-Pérez and Mañez-Castillejo (2008) and Baumöhl et al. (2019) in their analyses of SMEs and large firms, respectively.

Our empirical contribution to the existing literature on firm survival is based on analyzing almost 94,000 SMEs from 17 European emerging markets. Our key results show that institutional quality is an important factor that positively affects firm survival, but its effect is less pronounced for smaller firms. The same evidence is obtained with respect to financial development, but the variation of the impact between smaller and larger SMEs is less pronounced. Further, we show that differences in ownership structure also have different impacts on survival probability. Financial performance and firm age are consistently linked to improved survival, while the impact of firm size seems to be industry specific. Otherwise, our results are robust across indicators of institutional quality and financial development, country groups, industries, time periods, and assumptions on survival distributions.

The remainder of the paper is organized as follows. Section 2 describes the data and applied methodology. In Sections 3 and 4, we discuss extensive and detailed results. In Section 5, we present a series of robustness checks. Section 6 is the conclusion.

2 Data and Methodology

The use of the Bureau van Dijk (BvD)'s Orbis database enables us to quantitatively investigate what factors affect the survival probability of small businesses and to what extent. We obtained detailed information regarding 94,401 companies in Central and Eastern European emerging markets. The small companies extracted from the database meet the following three conditions: (1) they were active at the end of 2006; (2) their survival status can be traced until the end of 2017—we identified 36,060 firms failed by the end of 2017, and 58,341 companies that continued operating for the entire period under research; (3) the number of employees is no more than 50, i.e., the firms meet the 2003 European Commission's definition of SMEs with less than 50 employees.[3] Using

[3] The European Commission (2003) defined small and medium-sized enterprises (SMEs) as companies with fewer than 250 employees that operate independently from larger companies. To

the compiled dataset, we identify which companies failed and when during the period from 2007–2017.[4] In this paper, we treat bankruptcy as a business failure event. Our dataset covers four regions, namely (a) Central European (Czech Republic, Hungary, Poland, and Slovakia), (b) Eastern European (Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Montenegro, Romania, and Serbia), (c) Baltic (Estonia, Latvia, and Lithuania), and (d) former Soviet Union (FSU) countries (Moldova, Russia, and Ukraine).

As discussed in the introduction, the explanatory factors in which we are most interested are institutional quality and financial development. For that, we compile a set of country-specific variables that reflect these two types of external factors, and we complement it with firm-level dependent variables to control for firm-level characteristics.

Following the example of Baumöhl et al. (2019), we use the institutional quality (IQ) in 2006 as the initial condition of our analysis, and we measure it with five different indices. The *Rule of Law* of the Worldwide Governance Indicators reflects how the population perceives the quality of the enforcement of law and order in a country. Further, from Freedom House's *Nations in Transit* (Freedom House, 2018), we borrowed the measures of *Democracy*, *National governance*, *Civil society*, and *Corruption control*. *Democracy* is an average aggregate score of all ratings listed in *Nations in Transit*—beginning with the 2004 edition. *National governance* is an index that considers the degree of democracy and the stability of the governing regime. We employ the measure of *Civil society* to capture the degree of development and maturity of a society, considering nongovernmental and social organizations, the political involvement of the population, and political extremism in a country. Last, we introduce the index of *Corruption control* to capture people's perception of the extent of corruption, the

be classified as an SME, a company should have a maximum annual turnover of €50 million or a maximum annual balance sheet of €43 million. There are three types of SMEs: micro-SMEs, with fewer than 10 employees; small SMEs, with 10–49 employees; and medium-sized SMEs, with 50–249 employees. https://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en

[4] The Orbis database keeps all entry firms with their legal status—including bankrupted companies—without any time limitation unless local data providers stop supplying company information. We carefully checked the original source of our data and detected that as of 2017 (the end of our research period), data are available for more than 95% of firms registered in the 2006 archive. Hence, only a very limited number of firms were dropped from the Orbis database during the observation period of 2007–2017.

economic interest of policymakers, measures against it, and laws regarding financial disclosure and conflicts of interest. Panel (a) of **Appendix Table A1** shows the country score of each IQ variable. We observe that Central European and Baltic countries have the highest IQ scores, while Russia, Ukraine, and Eastern European countries suffer from inferior institutions. As shown in Panel (b) of **Appendix Table A1**, these IQ variables have strong positive correlations with each other (findings are in line with those of Fidrmuc et al. (2017)); therefore, we do not use them simultaneously in estimations.

Earlier studies argued that financial development and the presence of alternative external financing sources contribute to the growth and reduced failure probability of businesses (Musso and Schiavo, 2008; Gagliardi, 2009; Tsoukas, 2011). Thus, in our study, we use multiple indicators that capture differences in financial development among countries. Specifically, financial development (FD) indices measure the depth of the financial system in terms of its diversity, size, and liquidity. Modern financial institutions consist of banks and various types of financial (nonbank) institutions; at the same time, in financial markets, stocks, bonds, and other equities are traded. Hence, a single indicator is not sufficient to assess the diversity and depth of a financial system (Sahay et al., 2015; Svirydzenka, 2016).

Therefore, we have adopted five variables to capture the development of financial systems in European emerging markets. The first three variables are taken from the World Bank: (1) *Liquid liabilities* represent the ratio of broad money (M3) to GDP and reflect the relative size of the financial intermediation; (2) *Private credit* (defined as a percentage ratio of the private sector domestic credit to a country's GDP) and (3) *Bank assets* (defined as a percentage ratio of deposited money bank assets to central bank assets) are two measures that reflect the extent of the financial market in terms of private financing and banking. The second and third variables measure how financial resources are accessible to firms (Baltagi et al., 2008; Tsoukas, 2011), since, for example, bank credit is the essential financing source, especially for small and medium-sized firms (Gagliardi, 2009). Furthermore, we have introduced two variables that characterize the financial market: *Market capitalization*, as a ratio to GDP, and *Stock trading volume*, as a ratio to market capitalization; both variables are taken from the EBRD's structural and institutional change indicators. They represent the depth of the financial market in terms of size and degree of activity. As many SMEs in emerging markets rely on self-funding

or borrowing from friends or relatives (Bukvič and Bartlett, 2003), better financial market development will ease their financial burdens. However, one can also expect that the effect of market development varies among firms, as Tsoukas (2011) argued that large firms enjoy better access to the financial market as compared with small firms.

In contrast to IQ measures, FD variables are not strongly correlated with each other. **Appendix Table A2** suggests that financial institutions and markets do not develop simultaneously, and each country has its own form of financial system. In fact, *Market capitalization* and *Stock trading volume* are negatively associated with some other variables, ranging between maximum values of -0.52 and 0.45. Central European countries are generally equipped with a more-developed indirect financing system; however, the Czech Republic and Slovakia have uniquely developed financial intermediation systems and have higher *Liquid liability* scores. The backwardness of banking institutions (*Bank assets*) is remarkable in Russia, Moldova, and Romania. Moreover, other economies are financially underdeveloped, although the deepening of the Russian financial market can compete with that of developed economies in terms of *Market capitalization* and *Stock trading volume*. In sum, it is hard to find regional specificity in financial systems.

All IQ and FD variables are standardized to have a mean of zero and a standard deviation of one, ensuring comparability. We first examine the impact of each index individually. Then, we introduce *Comprehensive indices* to assess the institutional quality of a country and its degree of financial development. The use of principal component analysis allows us to make general assessments of IQ and FD without missing any particular factors (Fidrmuc et al., 2017). According to the eigenvectors of the first components reported in **Appendix Table A3**, higher values of the *Comprehensive IQ index* indicate better institutional quality, while higher values of the *Comprehensive FD index* represent more advanced indirect financial systems. We confirm that the first components of IQ and FD explain more than 94.6% and 67.8% of all variances, respectively.

Additionally, we introduce a set of control variables to assess the impact of firm-specific factors on survival. We refer to factors that impact firm growth, as they are potentially related to a company's survival probability. Although earlier studies have explored the roles of ownership structure and concentration, legal form, and corporate

governance in firm survival (Baumöhl et al., 2019), we consider these factors less relevant for small businesses. Hence, we include only ownership structure, corporate performance, and size and age of the company. *State ownership* and *Foreign ownership*, as dummy variables, take a value of 1 if the company is under state or foreign ownership. The continuing existence of state ownership in SMEs is due to long-lasting ownership positions by the state documented in earlier literature (Kočenda, 1999; Hanousek and Kočenda, 2008; Iwasaki and Kočenda, 2017). Furthermore, *Profit margin*, defined as profit before tax/operating revenue, and *Solvency ratio*, defined as shareholder funds divided by total assets, serve as market-adjusted values of the company's performance indicators. Finally, we examine the impact of the size and age (and age squared) of the firm, as it is generally thought that larger and older firms are more likely to survive (Geroski, 1995; Tsoukas, 2011; Rico et al., 2020). **Table 1** shows the definitions and descriptive statistics of variables used in later empirical estimations.

The main objective of our analysis is to assess the impact of institutions, financial development, and key firm-specific factors on small business survival—for that, we employ the Cox proportional hazards model (Cox, 1972), the approach that begins with the following survival function:

$$S(t) = \Pr(T > t) = \int_0^\infty f(t)dt.$$

Here, the survival function $S(t)$, described as a cumulative distribution function of probability density $f(t)$, gives the probability that the duration of firm operations T exceeds a specific time t. It takes a value of 1 at the initial time point ($t = 0$) and goes down to zero, according to increased t. The survival function is known to simultaneously produce its reverse cumulative distribution function of hazard function $h(t)$. It gives the instantaneous probability per time unit, that is, a company's conditional failure rate—the likelihood of its ceasing operation during a given time interval between t and $t + \Delta t$:

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t \le T < t + \Delta t | t \le T)}{\Delta t}.$$

Two functions have the following relationship:

$$S(t) = \exp\left\{-\int_0^t h(u)du\right\},\ h(t) = -\frac{S'(t)}{S(t)}.$$

The hazard function increases from zero to infinity over time.

Let x_i and β_i denote covariates for the *i*-th firm and their parameters, and let the hazard function take the Cox proportional hazards model, so that we have the following equation:

$$h(t|x_{it},\cdots,x_{in}) = h_0(t)\exp(\beta_1 x_{i1} + \cdots + \beta_n x_{in}),\ h_0(t) > 0.$$

$h_0(t)$ is the baseline hazard function that considers changes in firm failure risk over time when all covariates take a value of zero. Because the baseline hazard function is a semiparametric model and corresponds to a model that has no covariate, we do not have to specify it nor make any assumption regarding the survival distribution. Additionally, the second term in the above equation—the linear sum of the products of parameters β_i and time-dependent variable x_i—enables us to measure the impact of the covariates' effect on the survival time of a company without specifying the baseline hazard function. The use of a proportional hazard model also allows us to interpret the estimation results easily, as shown below.[5]

Following the recent practice in survival literature (Esteve-Pérez et al., 2004; Taymaz and Özler, 2007; Iwasaki and Kočenda, 2020; Baumöhl et al., 2019, 2020), we estimated a linear model of the Cox proportional hazards function through the maximum likelihood method, which takes the following logarithmic form:

$$\ln h(t|x_{it},\cdots,x_{in}) = \ln h_0(t) + \textstyle\sum_{j=1}^{n} \beta_j x_{ij}.$$

In the above specification, we introduce country-level variables of institutional qualities and financial development as well as firm-level control variables as covariates *x*. During the estimation, we adopted the Breslow approximation to deal with the right censoring of firms that survived the entire observation period, since we identified 58,341 companies that continued operating for the entire observation period.

[5] In order to address concerns regarding reverse causality, authors typically estimate their models using financial development indicators in the initial year of the estimation period. This is exactly the approach we take, and we employ 2006 values as predetermined variables both for the country-level and firm-level covariates to avoid any endogeneity issues. This is also a methodological standard of the survival analysis based on the Cox hazards model. An alternative approach in the literature is to use annual values of financial development indicators to avoid significant loss of information. We do not adopt this alternative approach, as it does not fit into the methodology we use for our analysis, since the basic aim of survival analysis is to test whether an initial condition is a good predictor of the event in question.

In tables with our results, we present each parameter β in the form of a hazard ratio, due to its straightforward interpretation; a hazard ratio indicates how the probability of a firm's exiting the market is multiplied when a specific covariate x (e.g., a 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, increasing the probability of a firm's exit. Similarly, if an estimate is below 1, such a determinant (covariate) is considered to be a preventive factor, improving a firm's probability of staying in business. Statistically significant estimates below 1 are economically more significant preventive factors the farther they are from 1; the opposite applies to estimates larger than 1.

The following example can serve as a useful illustration of how to interpret the economic significance of results. A statistically significant estimate of a hazard ratio denotes the percent of change in survival probability by a one-unit change of the covariate in question.[6] If we have two estimates of hazard ratios (of two covariates) with values of 0.9 (covariate A) and 0.7 (covariate B), then a unit improvement in these covariates is linked to a 10% (covariate A) and 30% (covariate B) increase in the probability of firm survival, respectively (because 1 – 0.9 = 0.1, and 1 – 0.7 = 0.3). Since covariate B is associated with higher survival probability, it is economically more significant than covariate A.

3 Univariate Tests of Small Business Survival by Region, Industry, Institution, and Financial Development

Before proceeding to the survival analysis, we briefly overview the survival dynamics of small businesses in European emerging markets. We also carry out univariate analyses focusing on region, industry, institutional quality, and financial development.

Tracing the survival status of the 94,401 companies, we identified 36,060 failed firms by the end of 2017; accordingly, the exit rate for the entire period was 38.2%, as reported in **Table 2**. It is noteworthy that the exit rate of small businesses in our dataset is much higher than that of business in general. Baumöhl et al. (2019) reported that the exit rate

[6] Statistical significance is assessed via the z statistics reported in parentheses beneath the hazard ratios. For all estimations, we also report the results of the Wald test and show that all standard regression coefficients are statistically different from zero.

of companies (including small businesses) in 15 European emerging markets from 2007 to 2015 was 24.7%. We had 28,813 failed companies in 17 economies over the same period; thus, the exit rate is 30.5%. In our dataset, the number of failed firms and the annual exit rate show increasing trends, reaching their peaks in 2015. As **Figure 1** shows, the Nelson-Aalen estimate of the cumulative hazard function also increased to 0.468 in 2017, implying that around half of operating companies went bankrupt in the next period.

Now we turn to the regional and sectoral aspects of small business failure. In our dataset, companies located in the former Soviet Union (FSU) and Eastern European countries account for 77.4% and 13.1% of the failures, respectively. In contrast, businesses of Central European and Baltic countries form a relatively small portion of the dataset. **Table 2** clearly shows a wide variation in the exit rates among regions. The exit rate of FSU countries is 45.2%, which is more than twice as high as that of Central European countries. Rates of Eastern European and Baltic countries lie between those of the above two regions. These findings suggest that small businesses face the most competition in FSU countries. In contrast, Central European countries enjoy relatively preferable environments that encourage small business development.

In terms of industry structure, service companies dominate in the dataset, accounting for 57.6%, followed by the mining and manufacturing (23.1%) and construction (13.9%) sectors. The remaining share (5.4%) corresponds to agriculture, forestry, and fishing. Sectoral variations in firm exit rates are relatively small, ranging from 32.3% in the primary sector to 44.2% in the construction sector.

The Kaplan-Meier survival curves in **Figure 2** confirm the above description of regional and sectoral variations in rates of small business survival. The log-rank test results in the figure reject the null hypothesis that there is no difference in survival probability among regions and sectors.

We further performed a univariate test and compared the survival functions of countries, focusing on institutional quality and financial development. The results are shown in **Figure 3**. We divide countries into two groups using the median of each IQ and FD index as reference criteria: countries with superior or inferior institutional qualities; financially developed or less-developed (developing) countries. As Panel (a) of **Figure 3** illustrates in the case of *Rule of law*, Kaplan-Meier survival curves with better institutional qualities lie below those with inferior institutions, suggesting that institutions

have a positive relationship with the survival probability of small businesses in European emerging markets. Interestingly, gaps between curves are quite extensive between groups in *National governance* and *Corruption control* with larger chi-square statistics (Panels (c) and (e)). Meanwhile, the relationship between survival functions and the extent of financial development is ambiguous. In fact, with regard to *Liquid liabilities*, *Private credit*, and *Bank assets*, survival curves with higher scores lie above those with lower scores, leading us to expect that financial institution development will extend throughout the duration of business operations (Panels (g), (h), and (i)). In contrast, as Panel (c) of **Figure 3** demonstrates, *Market capitalization* is likely to adversely affect survival time. *Stock trading volume* shows a pattern similar to that of *Market capitalization* (Panel (k)). Thus, in European emerging markets, small businesses possibly experience great survival competition in countries with advanced financial markets and developed capital markets. As displayed in Panels (b) and (d) of **Figure 3**, both in terms of institutional quality and financial development, we observe that a higher *Comprehensive index* score reduces the risk of company failure.

4 Multivariate Survival Analysis

This section estimates a Cox proportional hazards model in a multivariate setting. The baseline estimation results are reported in **Tables 3** and **4**.

Table 3 shows that all IQ indices and the *Comprehensive IQ index* have statistically significant effects of reinforcing a firm's survivability. Thus, improved institutional qualities are strongly associated with a business's lower risk of failure. In line with the findings of Baumöhl et al. (2019), our study emphasizes the particular importance of institutional qualities for small businesses. Results here revealed that small firms are subject to institutional attributes more than companies in general and that *Democracy* and *Civil society*, among others, have the greatest effects and increase the survival probability of small businesses by nearly 25%. Among single IQ factors, the level of *Democracy* exhibits the largest economic significance among the rest of factors, albeit their impact seems to be similar.

When looking at **Table 4**, which introduces FD variables, we see a complicated picture. Factors reflecting deepening financial institutions—*Liquid liabilities*, *Private credit*, and *Bank assets*—are shown to have statistically significant effects that enhance

firm survival; of these, *Liquid liabilities* has the largest economic significance by far, as it improves a firm's survival probability by about 22%. This finding goes against that of Tsoukas (2011), who found that the development of banking intermediation in Asian countries increased bank-dependent firm management as well as the risk of failure. However, we believe that the discrepancy stems from differences in financial systems. Bukvič and Bartlett (2003) provided supporting evidence that Slovenian SMEs consider the difficulties associated with banking and credit as more severe financial barriers obstructing business expansion. Mc Namara et al. (2017; p. 123) also argued that the "European financial system can be described as strongly bank based, where the significant reliance on bank finance for SMEs reinforces the importance of countries' lending infrastructure in the capital structure of SMEs." This is a stance that corroborates our result that shows the beneficial impact of financial development related specifically to the banking industry.

In contrast, *Market capitalization* and *Stock trading volume*, as variables corresponding to the depth of financial markets, take values higher than one and are statistically significant. From this, we expect that financial development, especially in capital markets, brings an increasingly competitive environment and makes it harder for small businesses to continue operations. However, one should note that market capitalization indirectly provides information regarding the proportion of large and listed companies in the economy. Its higher level, thus, indicates that there is less room in the economy for SMEs, in terms not of their numbers but of their economic capacity. Furthermore, it is worth mentioning that stock markets in the CEE region were established primarily as vehicles connected to mass privatization schemes; thus, in the 2000s, they still substantially differed from mature Western stock markets in terms of capitalization, information processing, and as alternative sources of financing (Hanousek et al., 2009). Hence, the negative impact of market capitalization on survival probability might not come as a complete surprise. Since the measures of market capitalization and stock trading volume are, to an extent, substitute measures (with a correlation of 0.32), a similar analogy can be drawn for the latter indicator as well.

Overall, estimates of the IQ and FD variables in **Tables 3** and **4** prove that both institutional quality and financial development have been very important for keeping small businesses alive in European emerging markets during the recent period. In fact, a

one-point increase in the *Comprehensive IQ* and *FD indices* reduces the risk of business failure in these economies by about 10%. Despite similar impacts of both measures, the aggregate institutional quality seems to produce an effect of marginally stronger economic significance than that of financial development. When we take into account the remarkable gap between 17 countries in terms of both *IQ* and *FD* indices, as shown in **Appendix Tables A1** and **A2**, improving institutional quality and financial development is an effective policy measure that protects SMEs from exogenous macroeconomic shocks.[7]

In addition to the baseline estimations, we also performed estimations by sector. We found that the results shown in **Table 5** well coincide with the results shown in **Tables 3** and **4**. Actually, the *Comprehensive IQ* and *FD indices* significantly increase firm survivability in all sectors. Hence, we expect that the positive effects of institutional and financial development on small business survival prevail beyond sectoral boundaries. We observe that these preventive factors exhibit the highest economic significance in the agriculture, forestry, and fishing sector (columns [1] and [5]), where the hazard ratios of the *Comprehensive IQ* and *FD indices* are 0.75 and 0.83, respectively. These contributing effects are also found in other sectors, but their impact is weaker (columns [2] to [4], [6] to [8]) as compared to that found in the agriculture industry. Our results are consistent with those of Baumöhl et al. (2019), who showed that the quality of institutions becomes the most significant factor preventing business failure in the agricultural sector.

Regarding firm-level variables, we obtained robust results that support previous survival findings for firms in general, small businesses, as well as those in specific sectors (Musso and Schiavo, 2008; Baumöhl et al., 2019; Iwasaki and Kočenda, 2019; Cucculelli and Peruzzi, 2020; Rico et al., 2020). As Harrell's C-statistic values range between 0.6410

[7] In our paper, we accentuate the role of two "macro" dimensions, namely, institutional quality and financial development. In order to deal with the omitted variable bias, we also considered other macro factors, namely GDP growth rate, CPI annual average, GDP per capita, population size, and current account to GDP. All factors produced statistically significant hazard ratios, with the exception of the current account to GDP (not reported). These additional macro variables impact the probability of firm survival within a range of 1–9%. Hence, their economic significance is decisively smaller than that of individual characteristics of institutional quality and financial development reported in **Tables 3** and **4**. The use of a three-year average (2004–06) generated similar results. As a result, we focus on the effect of IQ and FD variables to assess the survival of SMEs in European emerging economies.

and 0.6780, our estimation models have sufficient predictive power. In **Tables 3** and **4**, dependent variables are highly statistically significant in all models, with the exception of firm size in columns [4] and [6] in **Table 4**. Based on these findings, we conclude that (1) *Foreign ownership* and better corporate performance in terms of *Profit margin* and *Solvency ratio* reduce the failure risk of small businesses. Moreover, the impact of ownership by foreign investors (*Foreign ownership*) exhibits by far the strongest economic significance among all firm-specific variables (coefficients exhibit more than a 30% contributing effect with respect to survival, as their values are 0.68 and 0.65 for *Comprehensive IQ* and *FD indices*, respectively. Furthermore, (2) the effect of a company's *Age* has a nonlinear and positive relationship with its survival probability (risk-reducing effect). At the same time, (3) *State ownership* and the company's *Size* seem to endanger small business survival.[8] As **Table 5** shows, these findings are generally confirmed at the industry level. However, the effects of ownership structure and company size vary by sector. Different from business in general, state and foreign ownership is statistically insignificant in the primary sector, and firm size only affects non-financial services.

It is interesting to note that our findings on the effect of firm size contradict the earlier studies mentioned above. For example, using Spanish manufacturing data, Esteve-Pérez and Mañez-Castillejo (2008) confirmed the positive effect of firm size based on a resource-based theory. Cader and Leatherman (2011), Ebert et al. (2019), and Rico et al. (2020) agreed with Esteve-Pérez and Mañez-Castillejo (2008), based on US, German, and Spanish SMEs. This discrepancy is probably due to our study's limitation, in that it examines only small business with no more than 50 employees, whereas their datasets include medium-sized firms too.

5 Robustness Checks

We additionally carried out regressions for robustness checks with respect to the parametric hazard function, limiting the size of the company, clustering the regions, examining differences in time periods, and expanding firm-level control variables.

[8] We also ran regressions introducing the square of the firm size but obtained statistically insignificant results. It follows that firm size does not seem to exhibit a nonlinear relationship with respect to small business survival probability in European emerging markets.

Appendix Table A4 shows the estimation results based on alternative hazard functions. The Weibull survival models in columns [1] and [5] assume that the hazard function is monotonically increasing over time, while the log-logistic models in columns [2] and [6] are based on the non-monotonic hazard. In columns [3] and [7], we assess the covariates' multiplicative effect with survival time, using the Weibull accelerated failure time. Last, complementary log-log models in columns [4] and [8] use the proportional hazards model, in which the dichotomous dependent variable takes a value of 1 if company failure occurs during the observation period. We obtain estimation results consistent with those of the Cox proportional hazards models. Despite using four different assumptions of distributions, the findings again strongly suggest that institutional and financial development reduces the failure risk of small businesses.

Furthermore, the estimation results in **Appendix Table A5** confirm the above findings, even if we use a subsample of the dataset, dividing companies into two groups according to the median size and age. In the same way, the failure risks of smaller and larger firms, as well as younger and older firms, are influenced by institutional and financial development. We notice that the impacts of IQ and FD indices are somewhat bigger in larger firms than in smaller ones. This finding indicates that even among small businesses, larger firms gain more benefits from better institutions. The conclusion is intuitively in line with the transactional costs approach (Acs, 2006; Acs and Szerb, 2007; Acs et al., 2008), in that high-quality institutions reduce firms' costs associated with the regulatory burden and uncertainty. In line with the economic theory of economies of scale, the reduction in cost associated with the regulatory burden should be greater for larger firms, since their unit costs decrease with scale as firms grow their operations.

Next, we checked the regional variation of the impact of covariates that is reported in **Appendix Table A6**. The low quality of institutions and relatively less-developed indirect financial institutions are distinctive features of FSU countries. In contrast, Central European countries develop better institutions and financial intermediation. Using a subsample of our dataset without either region, we can examine firm survivability in relatively developed and less-developed European emerging markets. A subsample without either Eastern European or Baltic countries presumably lies between these two cases. Carrying out regressions, we obtained robust estimation results, even when excluding a particular region. All results provide supporting evidence that the quality of

institutions and financial development serve as factors preventing firm failure. We notice the weakest effects of institutional quality and financial development in the subsample without the FSU countries (column [4]) and that without Central Europe (column [5]), respectively. Conversely, we expect that marginal improvement in the institutional quality will have the most substantial impact in FSU firms; the incremental development of indirect financing contributes most to the duration of firm operations in Central Europe. Regarding firm-level variables, we confirmed the expected results, except for *State ownership* in the subsample without FSU countries (columns [4] and [8]), where the coefficient of the variable is statistically insignificant. From this finding, we can conclude that state ownership only affects firm survival in FSU countries.

Furthermore, since the period covered in our paper includes the global financial crisis, we also assessed the potential impact of this important event. For that, we re-estimated the Cox proportional hazards model for different periods, for which we also adjusted the number of analyzed (failed and survived) firms. We opted for this direct approach (i) to keep our model parsimonious and (ii) to provide direct results on the effect of IQ and FD over time. The results, presented in **Appendix Table A7**, show that coefficients associated with both IQ and FD indices have a relatively small failure-inducing impact that is statistically insignificant during the most severe part of the GFC period (2007–2009) and, for the FD index, until 2011. However, as we get further in time from the GFC, both indices exhibit positive and statistically significant impacts that also gain economic significance since the values of the IQ and FD indices become smaller (columns [2] to [4] and [7] to [8], respectively). From the quantitative findings, we infer that the effect of the GFC is only temporary, and for the rest of the period being researched, the quality of institutions and financial development serve as factors that improve the probability of SME survival. The results are consistent with a similar observation by Baumöhl et al. (2019) for large European firms; however, the statistical significance of both IQ and FD indices in **Table A7** is much higher than that reported by Baumöhl et al. (2019), which suggests that the business environment characterized by the quality of institutions and financial development is even more important for SMEs than for large companies. From the statistically significant coefficients, we also see that the effect of firm-specific controls is largely time invariant. The exception is the category of *Foreign ownership*, which is greater failure-preventive factor during the GFC as compared to later periods. This

finding seems to reflect better resilience of firms with foreign owners during the GFC; its smaller impact during the post-crisis period was also documented by Alfaro and Chen (2012).

Finally, we examined whether the expansion of firm-level controls affects the estimation results. For that, we added additional firm-level control variables, which are listed in **Table 1**. We present the results in **Appendix Table A8**, where we show that neither stepwise regressions (columns [1] to [3] and [5] to [7]) nor regressions with all firm-level control variables (columns [4] and [8]) materially affect estimates of the *Comprehensive IQ* and *FD indices* or the basic set of firm-level characteristics. In other words, the main findings of this paper are robust even under these amplified model specifications. The results in **Table A8** also reveal that differences in legal forms, listing on the stock exchange, as well as the business network impact the survival of small businesses in European emerging markets.

6 Conclusions

Post-crisis development left many scars on Europe's economic landscape. Small enterprises faced some of the hardest challenges, and many had to exit the market. In our analysis, we traced the survival status of 94,401 SMEs in 17 Central and Eastern European countries from 2007 to 2017. Specifically, we examined the impacts of institutional quality and financial development on the survival probability of small firms in these emerging markets, where 36,060 of 94,401 small businesses had gone bankrupt by the end of 2017. The market exit rate in all 17 countries reached more than 38%. Despite the total toll, remarkable differences in the exit rates were observed between different country groups and industries. Specifically, the risk of management failure was higher for firms operating in the construction and service industries as compared to agriculture and mining/manufacturing. Firm survival was also lower in Baltic and FSU states than in Central and Eastern European countries.

Our quantitative survival analysis is based on estimating the Cox proportional hazards model. We show that the institutional quality and the level of financial development exhibit statistically significant and economically meaningful impacts on the survival probability of the SMEs researched. The evidence holds when we control for a set of standard firm-level characteristics such as ownership structure, financial

performance, firm size, and age. From our results, it follows that aggregate improvements in institutional quality can be strongly associated with the lower failure risk in small enterprises in European emerging markets. In terms of specific factors, our results reveal that, especially, the attainment of higher levels of democracy and civil society function as protective factors during uncertainty and increase the survival probability of small businesses by nearly 25%.

The impact of financial development on the survival probability of SMEs was not uniform, however. The measures of financial development related to the banking industry exhibit a positive effect on firm survival, while measures related to capital market development show a negative impact. Both results should be understood against the backdrop of historical development. While the European financial system is chiefly bank based (Mc Namara et al., 2017), the intensity of the banking industry development naturally plays a strong and positive role with respect to SMEs. On the other hand, capital markets in emerging European economies differ from their Western counterparts and cannot yet be considered a full-scale alternative source of financing.

Our results also show that the impact of institutions or financial development varies across countries as well as industries. Economically, the most significant impact is found for firms operating in agriculture, forestry, and fishing; in other sectors, the impact is weaker and relatively equalized. The key observation is that the impact is less pronounced for smaller firms. Hence, even among small businesses, larger ones reap more benefits from better institutions. The conclusion is intuitively in line with the transactional costs approach combined with the economies of scale theory: quality-institutions-initiated reduction in costs associated with the regulatory burden should be greater for larger firms, since their unit costs decrease as firms grow their operations.

The last two decades have brought enormous pressure on and distress to SMEs globally. We believe that our analysis not only provides empirical evidence regarding the positive impact of institutions on small business survival but also shows that their economic impact seems to be economically even greater or on par with other firm-specific characteristics. In a nutshell, our findings show that, during periods of heightened uncertainty (GFC, European sovereign debt crisis, Corona crisis), factors characterizing the external environment in which small businesses operate matter more than we typically believe.

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Table 1. Definitions and descriptive statistics of covariates used in the empirical analysis

Variable group and name	Definition	Descriptive statistics[a]		
		Mean	S.D.	Median
Institutional quality (IQ) variables				
Rule of law	World Bank indicator of the rule of law[b]	0.000	1.000	-0.241
Democracy	Freedom House index of democracy[b c]	0.000	1.000	-0.113
National governance	Freedom House index of national democracy governance[b c]	0.000	1.000	0.000
Civil society	Freedom House index of civil society[b c]	0.000	1.000	-0.138
Corruption control	Freedom House index of corruption[b c]	0.000	1.000	0.174
Comprehensive IQ index	First principal component score of the five IQ variables above	1.271	2.524	1.287
Financial development (FD) variables				
Liquid liabilities	World Bank indicator of liquid liabilities to GDP[b]	0.000	1.000	-0.240
Private credit	World Bank indicator of credit to private sector to GDP[b]	0.000	1.000	-0.210
Bank assets	World Bank indicator of deposit money bank assets to total bank assets[b]	0.000	1.000	0.364
Market capitalization	EBRD indicator of stock market capitalization to GDP[b]	0.000	1.000	-0.201
Stock trading volume	EBRD indicator of stock trading volume to market capitalization[b]	0.000	1.000	-0.241
Comprehensive FD index	First principal component score of the five FD variables above	1.568	1.300	1.753
Firm-level control variables				
State ownership	Dummy for state-owned companies	0.0253	0.1572	0
Foreign ownership	Dummy for foreign-owned companies	0.0270	0.1620	0
Profit margin	Profit margin (%)[d e]	0.3708	2.7697	0.5196
Solvency ratio	Solvency ratio (%)[e f]	0.0217	5.2121	-1.2530
Size	Natural logarithm of total number of employees	3.4517	0.4835	3.5553
Age	Years in operation since the company's establishment	8.6581	6.1433	8
Additional firm-level control variables[g]				
Joint-stock company	Dummy for joint-stock companies	0.1250	0.3307	0
Limited liability company	Dummy for limited liability companies	0.6464	0.4781	1
Partnership	Dummy for partnerships	0.1081	0.3106	0
Cooperative	Dummy for cooperatives	0.0295	0.1693	0
Listed	Dummy for listed companies	0.0085	0.0919	0
Gearing	Gearing (%)[h]	66.0779	146.6807	1.8300
Business network	Number of subsidiaries	0.2586	1.7750	0
Business diversification	Number of industries operated according to NACE Rev 2 secondary codes	4.1541	4.2863	3

Notes :

[a] Variables from the Rule of law to the Comprehensive FD index computed using country-level data; Variables from State ownership to Age computed using firm-level data

[b] Standardized to have a mean of zero and a standard deviation of one (i.e., z score)

[c] Computed as 7 minus the value of the original index, which ranges between 1.00 (best) and 7.00 (worst)

[d] Computed using the following formula: (profit before tax/operating revenue) × 100

[e] Industry-adjusted value based on the method proposed by Eisenberg et al. (1998)

[f] Computed using the following formula: (shareholder funds/total assets) × 100

[g] Used in Online Appendix Table A8

[h] Computed using the following formula:((non current liabilities + loans) / shareholders' funds) × 100

Source : Covariates from Rule of law to Corruption control and from Liquid liabilities to Stock trading volume were obtained from the website of the World Bank, Freedom House, and the European Bank for Reconstruction and Development (EBRD) (https://data.worldbank.org/; https://freedomhouse.org/; http://www.ebrd.com/home). Comprehensive IQ and FD indices were estimated by the author. Appendix Tables A1 and A2 provide the country score and correlation matrix of IQ and FD variables, respectively. Appendix Table A3 reports the estimation results of the principal component analysis to produce the Comprehensive IQ and FD indices. Covariates from State ownership to Business diversification were extracted from the Bureau van Dijk (BvD) Orbis database (https://webhelp.bvdep.com).

Table 2. Survival status of 94,401 small firms in 17 European emerging markets by country group and industry: 2007–2017

	Number of firms operating at the end of 2006 (A)	Number of failed firms by the end of 2017 (B)	Exit rate (B/A)	Nelson-Aalen cumulative hazard function			
				Coef.	S.E.	[95% confidence interval]	
All 17 European emerging economies	94,401	36,060	0.3820	0.4682	0.0025	0.4634	0.4731
Breakdown by country group							
Central European countries [a]	11,058	2,056	0.1859	0.2026	0.0045	0.1940	0.2115
Eastern European countries [b]	17,348	4,740	0.2732	0.3132	0.0046	0.3043	0.3222
Baltic countries [c]	4,183	1,358	0.3246	0.3817	0.0104	0.3619	0.4027
FSU countries [d]	61,812	27,906	0.4515	0.5795	0.0035	0.5726	0.5864
Breakdown by industry (NACE Rev. 2 section)							
Agriculture, forestry, and fishing (Section A)	5,144	1,663	0.3233	0.3817	0.0094	0.3637	0.4006
Mining and manufacturing (Sections B–E)	21,811	7,151	0.3279	0.3887	0.0046	0.3797	0.3978
Construction (Section F)	13,103	5,791	0.4420	0.5631	0.0075	0.5486	0.5780
Non-financial services (Sections G–J, L–S)	54,343	21,455	0.3948	0.4880	0.0034	0.4814	0.4946

Notes:

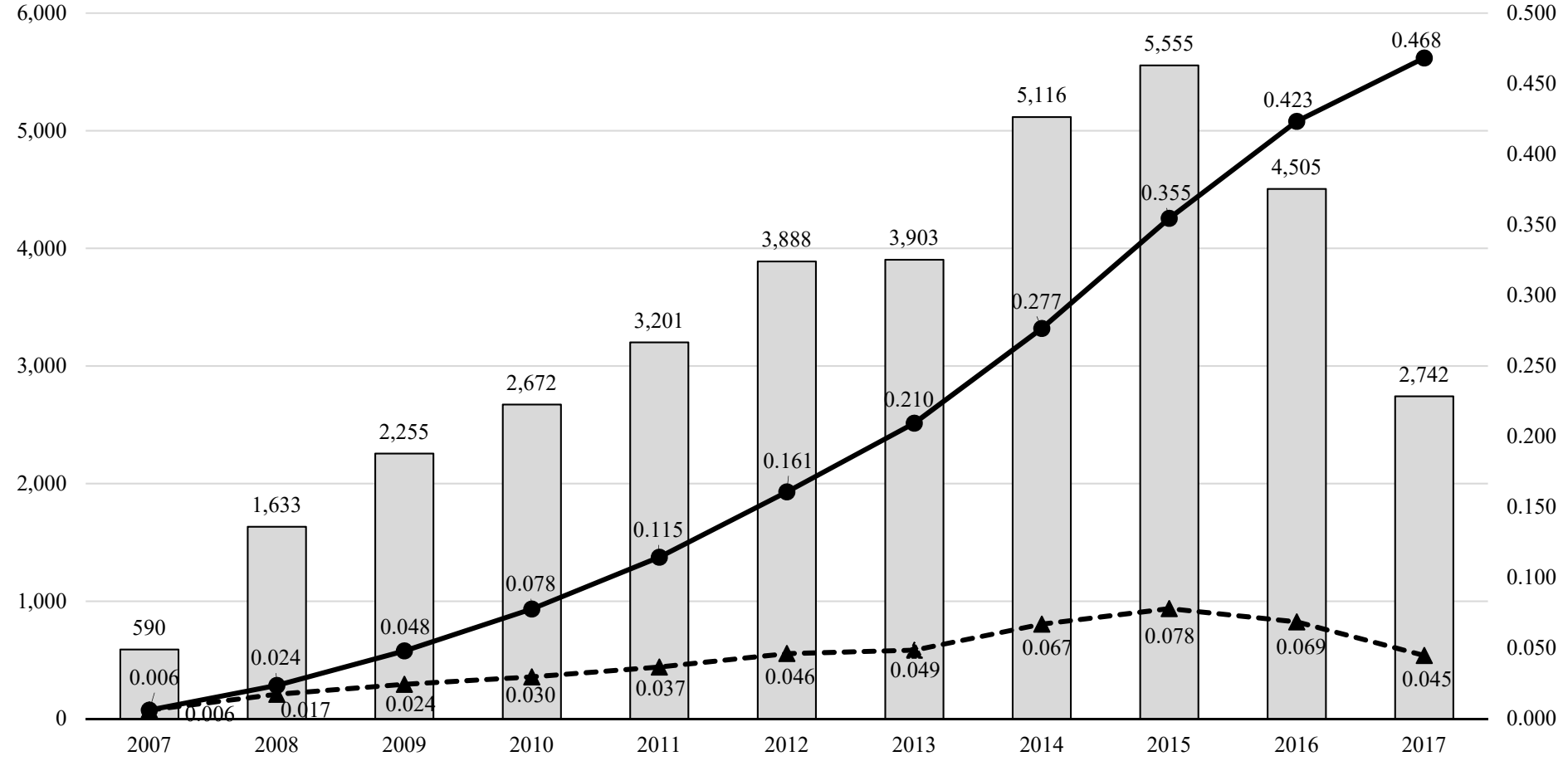
[a] Czech Republic, Hungary, Poland, and Slovakia

[b] Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Montenegro, Romania, and Serbia

[c] Estonia, Latvia, and Lithuania

[d] Moldova, Russia, and Ukraine

Figure 1. Numbers of failed firms, exit rates, and Nelson-Aalen estimates of the cumulative hazard function in 17 European emerging markets, 2007–2017



Notes:

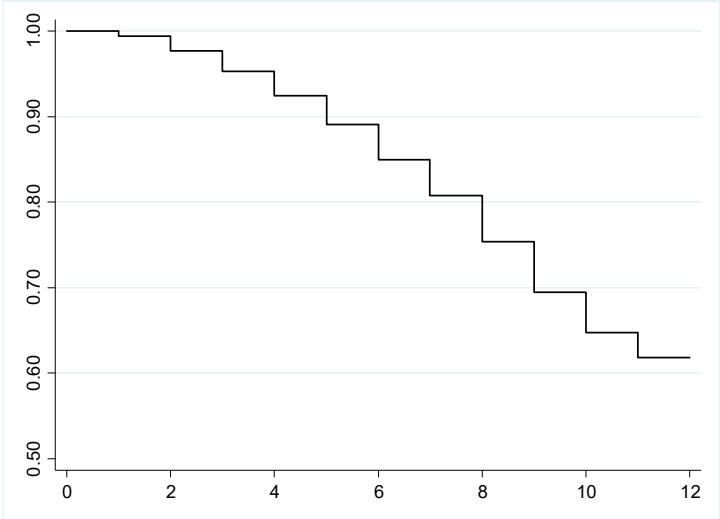
Number of failed firms (left axis)

Exit rates (right axis)

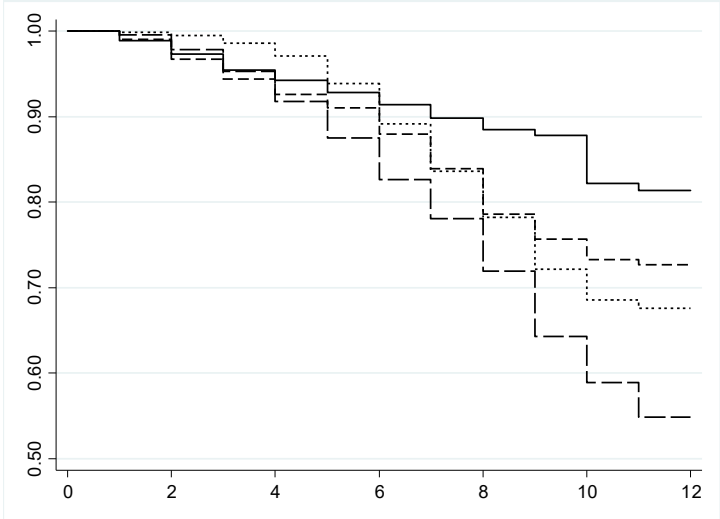
Nelson-Aalen estimates of the cumulative hazard function (right axis)

Figure 2. Kaplan-Meier survival function by country group and industry

(a) All 17 European emerging markets

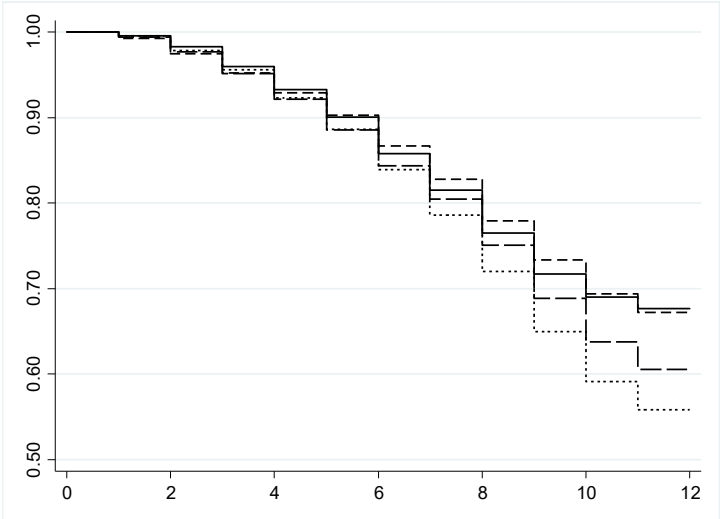


(b) Country group: Central European countries (solid line); Eastern European countries (dashes); Baltic countries (short dashes); FSU countries (long dashes)



Log-rank test for equality of survivor functions: χ^2=3518.67, p=0.000

(c) Industry (NACE Rev. 2 section): Agriculture, forestry, and fishing (Section A) (solid line); Mining and manufacturing (Sections B–E) (dashes); Construction (Section F) (short dashes); Non-financial services (Sections G–J, L–S) (long dashes)

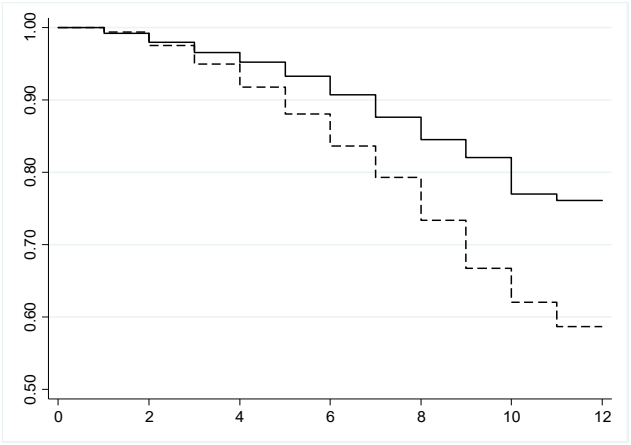


Log-rank test for equality of survivor functions: χ^2=513.65, p=0.000

Note: The industrial classification in Panel (c) corresponds with the sectoral breakdown in Table 2.

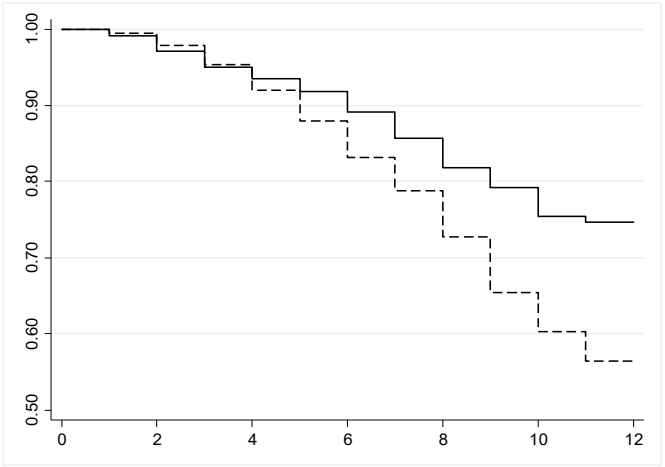
Figure 3. Kaplan-Meier survivor function by the level of institutional quality and financial development

(a) Rule of law



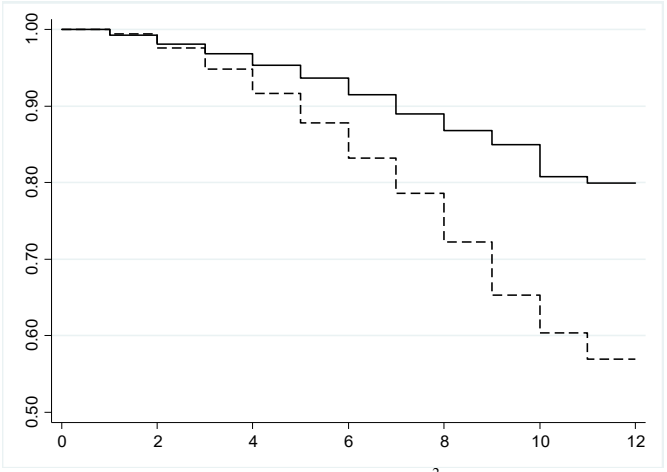
Log-rank test for equality of survivor functions:χ^2=1642.60, p=0.000

(b) Democracy



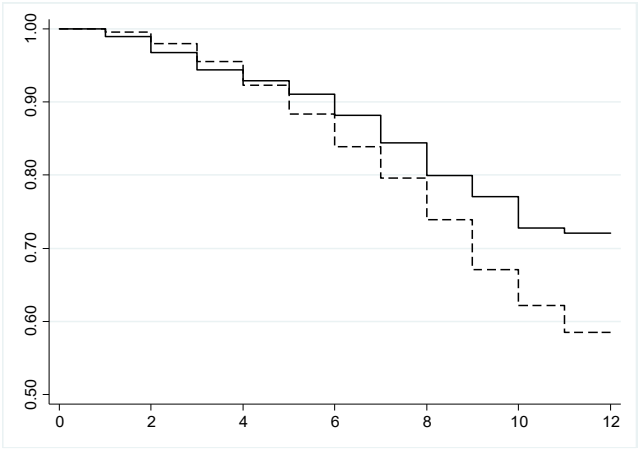
Log-rank test for equality of survivor functions:χ^2=2430.83, p=0.000

(c) National governance



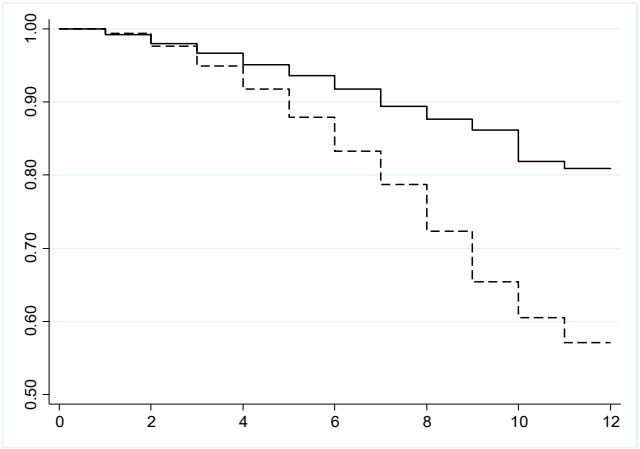
Log-rank test for equality of survivor functions:χ^2=3189.41, p=0.000

(d) Civil society



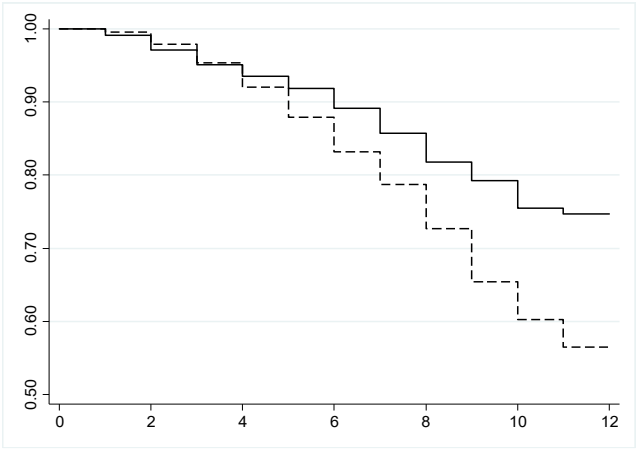
Log-rank test for equality of survivor functions:χ^2=1160.39, p=0.000

(e) Corruption control



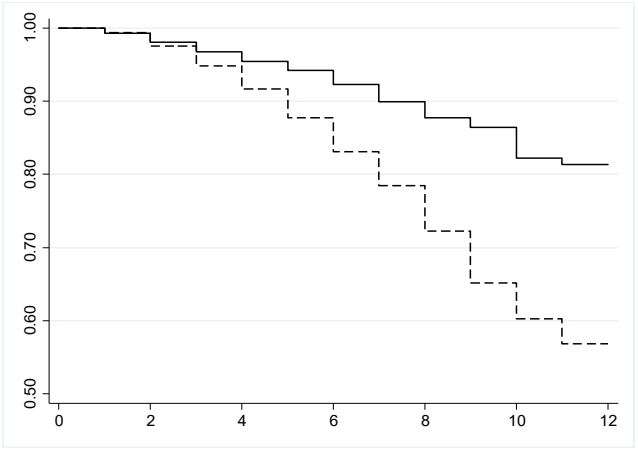
Log-rank test for equality of survivor functions:χ^2=3196.17, p=0.000

(f) Comprehensive IQ index



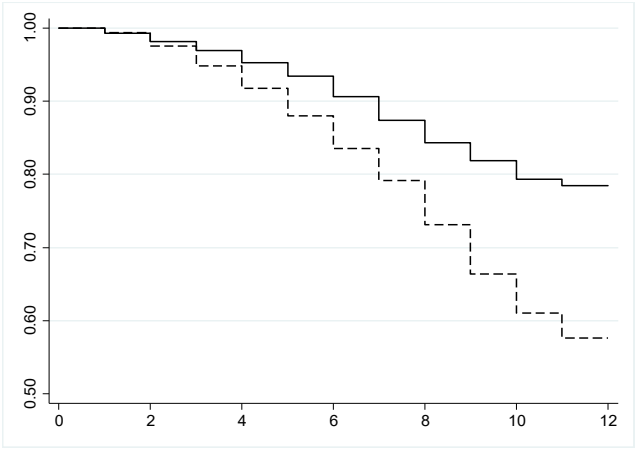
Log-rank test for equality of survivor functions:χ^2=2430.83, p=0.000

(g) Liquid liabilities



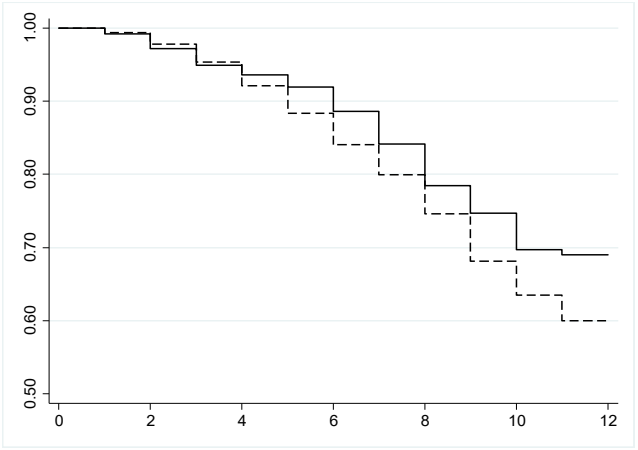
Log-rank test for equality of survivor functions: χ^2=3490.39, p =0.000

(h) Private credit



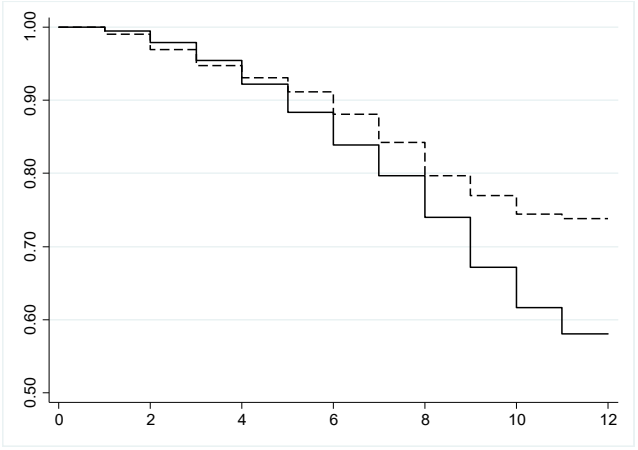
Log-rank test for equality of survivor functions: χ^2=2456.59, p =0.000

(i) Bank assets



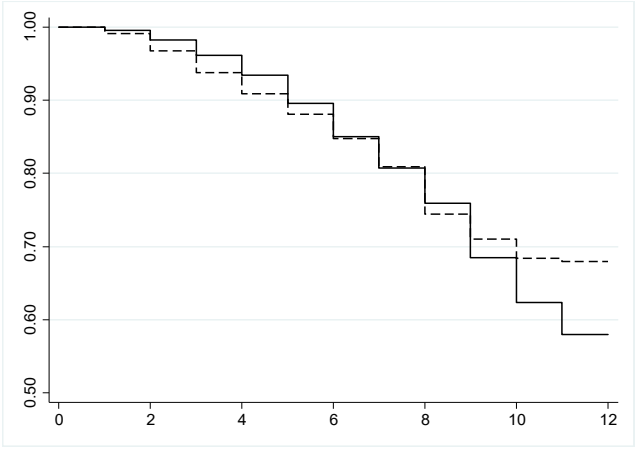
Log-rank test for equality of survivor functions: χ^2=465.74, p =0.000

(j) Market capitalization



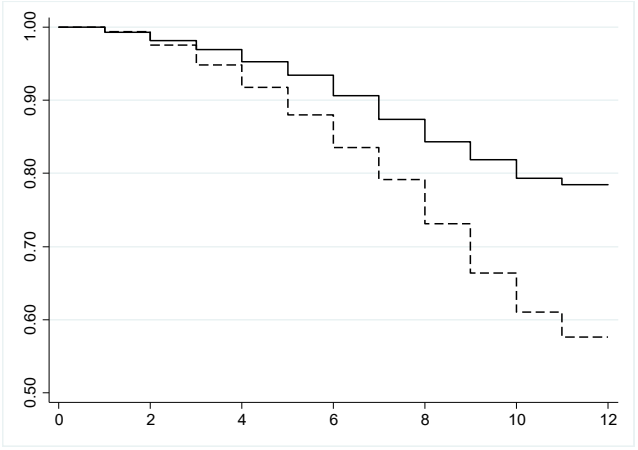
Log-rank test for equality of survivor functions: χ^2= 1498.47, p =0.000

(k) Stock trading volume



Log-rank test for equality of survivor functions: χ^2= 627.07, p =0.000

(l) Comprehensive FD index



Log-rank test for equality of survivor functions: χ^2=2456.59, p =0.000

Notes: See Table 1 for definitions and descriptive statistics of variables used for comparison. Observations are divided by the median value of the variable in question. In each panel, the solid (dashed) line displays the survivor function of firms in countries with upper (lower) values of the variable used for comparison.

Table 3. Impacts of institutional quality on small business survival

Model	[1]	[2]	[3]	[4]	[5]	[6]
Rule of law	0.8072 ***					
	(-27.51)					
Democracy		0.7681 ***				
		(-29.77)				
National governance			0.78202 ***			
			(-26.72)			
Civil society				0.76916 ***		
				(-23.93)		
Corruption control					0.79787 ***	
					(-30.13)	
Comprehensive IQ index						0.90672 ***
						(-28.37)
State ownership	1.2084 ***	1.2110 ***	1.2152 ***	1.2452 ***	1.2087 ***	1.2126 ***
	(5.44)	(5.51)	(5.60)	(6.29)	(5.46)	(5.54)
Foreign ownership	0.6754 ***	0.6849 ***	0.6725 ***	0.6436 ***	0.6996 ***	0.6823 ***
	(-8.87)	(-8.55)	(-8.98)	(-9.98)	(-8.05)	(-8.63)
Profit margin	0.9487 ***	0.9498 ***	0.9499 ***	0.9481 ***	0.9503 ***	0.9496 ***
	(-23.92)	(-23.37)	(-23.26)	(-24.22)	(-23.06)	(-23.46)
Solvency ratio	0.9593 ***	0.9589 ***	0.9585 ***	0.9590 ***	0.9588 ***	0.9589 ***
	(-34.67)	(-35.07)	(-35.40)	(-34.74)	(-35.22)	(-35.05)
Size	1.0461 ***	1.0412 ***	1.0353 **	1.0606 ***	1.0335 **	1.0418 ***
	(3.00)	(2.68)	(2.31)	(3.94)	(2.18)	(2.73)
Age	0.9370 ***	0.9376 ***	0.9367 ***	0.9337 ***	0.9385 ***	0.9373 ***
	(-37.33)	(-36.81)	(-37.50)	(-39.67)	(-36.04)	(-37.05)
Age^2	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***
	(14.81)	(14.44)	(15.02)	(15.16)	(14.27)	(14.60)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	89083	89083	89083	89083	89083	89083
Log-pseudolikelihood	-377792.90	-377726.77	-377817.57	-377926.25	-377724.88	-377775.62
Harrell's C-statistic	0.6598	0.6610	0.6596	0.6582	0.6611	0.6602
Wald test (χ^2)	9969.47 ***	10071.59 ***	9993.05 ***	9695.01 ***	10140.06 ***	10020.11 ***

Notes : This table contains results from a survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the covariates. Regression coefficients are hazard ratios. Standard errors are computed using the Huber-White sandwich estimator. z statistics are reported in parentheses beneath the regression coefficients. 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. Impacts of financial development on small business survival

Model	[1]	[2]	[3]	[4]	[5]	[6]
Liquid liabilities	0.77538 ***					
	(-33.68)					
Private credit		0.83030 ***				
		(-16.35)				
Bank assets			0.90935 ***			
			(-26.24)			
Market capitalization				1.10668 ***		
				(25.51)		
Stock trading volume					1.05356 ***	
					(9.35)	
Comprehensive FD index						0.91265 ***
						(-27.34)
State ownership	1.1919 ***	1.2501 ***	1.1837 ***	1.1866 ***	1.2752 ***	1.1791 ***
	(5.03)	(6.38)	(4.82)	(4.89)	(6.93)	(4.70)
Foreign ownership	0.6306 ***	0.5812 ***	0.6588 ***	0.6534 ***	0.5786 ***	0.6468 ***
	(-10.48)	(-12.43)	(-9.48)	(-9.68)	(-12.53)	(-9.93)
Profit margin	0.9420 ***	0.9435 ***	0.9429 ***	0.9430 ***	0.9435 ***	0.9421 ***
	(-27.06)	(-26.20)	(-26.37)	(-26.29)	(-26.04)	(-26.75)
Solvency ratio	0.9619 ***	0.9606 ***	0.9625 ***	0.9623 ***	0.9603 ***	0.9627 ***
	(-31.98)	(-32.94)	(-31.30)	(-31.49)	(-32.99)	(-31.10)
Size	1.0492 ***	1.0600 ***	1.0258 *	1.0229	1.0539 ***	1.0251
	(3.18)	(3.90)	(1.68)	(1.49)	(3.51)	(1.63)
Age	0.9366 ***	0.9309 ***	0.9354 ***	0.9347 ***	0.9284 ***	0.9353 ***
	(-39.22)	(-42.52)	(-39.48)	(-40.15)	(-44.31)	(-39.86)
Age^2	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***
	(15.93)	(16.89)	(16.71)	(17.02)	(17.66)	(16.95)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	89083	89083	89083	89083	89083	89083
Log-pseudolikelihood	-377585.29	-378039.32	-377863.34	-377877.06	-378163.20	-377828.99
Harrell's C-statistic	0.6630	0.6565	0.6578	0.6575	0.6546	0.6584
Wald test (χ^2)	10223.03 ***	9483.37 ***	10248.13 ***	10227.53 ***	9347.35 ***	10312.77 ***

Notes : This table contains results from a survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the covariates. Regression coefficients are hazard ratios. Standard errors are computed using the Huber-White sandwich estimator. z statistics are reported in parentheses beneath the regression coefficients. 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 5. Estimation by industry

Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Target industry (NACE Rev. 2 section classification)	Agriculture, forestry, and fishing (Section A)	Mining and manufacturing (Sections B–E)	Construction (Section F)	Non-financial services (Sections G–J, L–S)	Agriculture, forestry, and fishing (Section A)	Mining and manufacturing (Sections B–E)	Construction (Section F)	Non-financial services (Sections G–J, L–S)
Comprehensive IQ index	0.7496 ***	0.9183 ***	0.9589 ***	0.8932 ***				
	(-13.21)	(-13.10)	(-5.37)	(-22.59)				
Comprehensive FD index					0.8322 ***	0.8973 ***	0.9450 ***	0.9178 ***
					(-12.39)	(-15.20)	(-7.31)	(-18.91)
State ownership	0.9433	1.1450 *	1.3834 ***	1.2364 ***	0.9108	1.0803	1.3394 ***	1.2249 ***
	(-0.41)	(1.78)	(2.90)	(4.86)	(-0.64)	(1.01)	(2.61)	(4.61)
Foreign ownership	1.0369	0.6417 ***	0.7545 *	0.7017 ***	0.9335	0.6209 ***	0.7734	0.6454 ***
	(0.13)	(-5.45)	(-1.66)	(-6.19)	(-0.27)	(-5.89)	(-1.51)	(-7.77)
Profit margin	0.9294 ***	0.9457 ***	0.9638 ***	0.9497 ***	0.9224 ***	0.9374 ***	0.9611 ***	0.9415 ***
	(-10.05)	(-11.93)	(-6.36)	(-17.27)	(-10.68)	(-13.61)	(-6.84)	(-19.91)
Solvency ratio	0.9599 ***	0.9486 ***	0.9562 ***	0.9617 ***	0.9710 ***	0.9541 ***	0.9587 ***	0.9651 ***
	(-7.31)	(-19.49)	(-13.89)	(-25.43)	(-5.14)	(-16.87)	(-12.81)	(-22.71)
Size	1.0442	1.0341	1.0068	1.0605 ***	0.9728	1.0161	0.9899	1.0503 **
	(0.72)	(1.01)	(0.20)	(2.85)	(-0.42)	(0.47)	(-0.29)	(2.37)
Age	0.9755 ***	0.9536 ***	0.9197 ***	0.9288 ***	0.9539 ***	0.9527 ***	0.9205 ***	0.9266 ***
	(-3.09)	(-13.06)	(-17.55)	(-33.48)	(-6.01)	(-13.68)	(-17.39)	(-35.04)
Age^2	1.0002	1.0004 ***	1.0012 ***	1.0007 ***	1.0004 *	1.0004 ***	1.0012 ***	1.0007 ***
	(1.35)	(9.01)	(8.98)	(14.73)	(1.91)	(10.19)	(8.52)	(14.74)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4820	20194	12501	51568	4820	20194	12501	51568
Log-pseudolikelihood	-12690.19	-63903.82	-50565.86	-214127.05	-12732.79	-63879.74	-50554.02	-214231.70
Harrell's C-statistic	0.6780	0.6560	0.6410	0.6635	0.6630	0.6562	0.6415	0.6598
Wald test (χ^2)	525.17 ***	1842.38 ***	1337.67 ***	6098.75 ***	542.56 ***	1948.81 ***	1392.37 ***	6183.69 ***

Notes : This table contains results from a survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the covariates. Regression coefficients are hazard ratios. Standard errors are computed using the Huber-White sandwich estimator. z statistics are reported in parentheses beneath the regression coefficients. 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 A1. Country score and correlation matrix of IQ variables

(a) Country score

Country	Rule of law	Democracy	National governance	Civil society	Corruption control	Comprehensive IQ index
Bosnia and Herzegovina	-0.850	-0.886	-1.136	-1.480	-0.054	-1.214
Bulgaria	-0.241	0.300	0.454	-0.138	0.402	1.662
Croatia	-0.090	-0.587	0.000	-0.474	-0.509	0.377
Czech Republic	1.221	0.959	0.454	1.204	0.629	3.669
Estonia	1.627	1.258	1.136	0.533	1.539	4.369
Hungary	1.410	1.073	1.136	1.204	1.084	4.400
Latvia	0.913	1.145	1.363	0.868	1.084	4.116
Lithuania	0.984	0.918	0.909	0.868	0.174	3.366
Macedonia	-0.905	-0.659	-0.227	-1.145	-0.509	-0.601
Moldova	-0.886	-1.834	-2.045	-1.816	-1.646	-3.178
Montenegro	-0.509	-0.773	-0.909	-0.809	-1.191	-0.945
Poland	0.512	0.846	0.227	1.204	1.084	3.358
Romania	-0.278	-0.113	0.000	0.197	0.174	1.287
Russian Federation	-1.426	-1.103	-1.136	-0.474	-1.419	-1.559
Serbia	-0.904	-0.515	-0.227	-0.474	-0.281	0.015
Slovakia	0.728	1.073	1.136	1.204	0.857	3.981
Ukraine	-1.304	-1.103	-1.136	-0.474	-1.419	-1.502

(b) Correlation matrix

	Rule of law	Democracy	National governance	Civil society	Corruption control	Comprehensive IQ index
Rule of law	1.000					
Democracy	0.922	1.000				
National governance	0.858	0.954	1.000			
Civil society	0.827	0.922	0.853	1.000		
Corruption control	0.859	0.934	0.888	0.789	1.000	
Comprehensive IQ index	0.934	0.995	0.958	0.933	0.933	1.000

Note : For definitions and descriptive statistics of the variables, see Table 1.

Appendix Table A2. Country score and correlation matrix of FD variables

(a) Country score

Country	Liquid liabilities	Private credit	Bank assets	Market capitalization	Stock trading volume	Comprehensive FD index
Bosnia and Herzegovina	0.557	0.371	0.522	0.968	-0.717	2.119
Bulgaria	1.174	0.148	0.026	-0.298	-0.241	2.355
Croatia	1.406	1.159	0.523	0.823	-0.666	2.999
Czech Republic	1.890	-0.210	0.364	-0.280	1.940	1.794
Estonia	0.150	1.790	0.521	-0.161	-0.206	3.012
Hungary	0.538	0.942	0.297	-0.179	2.256	1.753
Latvia	-0.240	2.095	0.440	-1.101	-0.837	3.533
Lithuania	-0.305	0.380	0.520	-0.245	-0.117	1.948
Macedonia	-0.534	-0.911	-0.064	-0.942	-0.132	1.119
Moldova	-0.303	-0.982	-1.875	-0.686	-0.775	0.758
Montenegro	-1.210	-0.857	0.357	1.065	-0.202	0.344
Poland	0.086	-0.535	0.520	0.135	0.760	1.131
Romania	-1.264	-1.170	0.525	-0.593	-0.382	0.794
Russian Federation	-1.180	-0.935	-3.162	2.887	1.492	-1.950
Serbia	-1.503	-0.807	0.114	-0.201	-0.370	0.653
Slovakia	1.052	-0.190	0.520	-1.281	-0.935	2.811
Ukraine	-0.315	-0.288	-0.148	0.086	-0.869	1.480

(b) Correlation matrix

	Liquid liabilities	Private credit	Bank assets	Market capitalization	Stock trading volume	Comprehensive FD index
Liquid liabilities	1.000					
Private credit	0.452	1.000				
Bank credit	0.339	0.411	1.000			
Market capitalization	-0.204	-0.163	-0.517	1.000		
Stock trading volume	0.166	-0.069	-0.214	0.321	1.000	
Comprehensive FD index	0.633	0.777	0.729	-0.606	-0.373	1.000

Note : For definitions and descriptive statistics of the variables, see Table 1.

Appendix Table A3. Estimation results of principal component analysis

(a) IQ variables

Eigenvalue of the correlation matrix				Eigenvectors of the first component	
Component no.	Eigenvalue	Difference	Cumulative percentage of total variance	Variables	Eigenvector
1	4.7276	4.540	0.946	Rule of law	0.4529
2	0.1879	0.143	0.983	Democracy	0.4585
3	0.0450	0.013	0.992	National governance	0.4463
4	0.0321	0.025	0.999	Civil society	0.4301
5	0.0074	.	1.000	Corruption control	0.4478

(b) FD variables

Eigenvalue of the correlation matrix				Eigenvectors of the first component	
Component no.	Eigenvalue	Difference	Cumulative percentage of total variance	Variables	Eigenvector
1	3.3898	2.412	0.678	Liquid liabilities	0.4097
2	0.9780	0.547	0.196	Private credit	0.4031
3	0.4309	0.252	0.086	Bank assets	0.5187
4	0.1793	0.157	0.036	Market capitalization	-0.5144
5	0.0221	.	0.004	Stock trading volume	-0.3687

Note : For definitions and descriptive statistics of the variables, see Table 1.

Appendix Table A4. Estimation of alternative models for a robustness check

Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Estimator	Weibull survival model	Log-logistic survival model	Weibull accelerated failure time model	Complementary log-log model	Weibull survival model	Log-logistic survival model	Weibull accelerated failure time model	Complementary log-log model
Comprehensive IQ index	0.9019 ***	0.0522 ***	0.0541 ***	-0.1097 ***				
	(-28.89)	(27.15)	(29.11)	(-31.27)				
Comprehensive FD index					0.9049 ***	0.0446 ***	0.0523 ***	-0.1175 ***
					(-28.63)	(23.44)	(29.02)	(-34.20)
State ownership	1.2257 ***	-0.1111 ***	-0.1066 ***	0.2281 ***	1.1847 ***	-0.1035 ***	-0.0887 ***	0.1802 ***
	(5.55)	(-5.49)	(-5.55)	(6.08)	(4.59)	(-5.07)	(-4.59)	(4.76)
Foreign ownership	0.6684 ***	0.2053 ***	0.2110 ***	-0.3941 ***	0.6354 ***	0.2432 ***	0.2375 ***	-0.4325 ***
	(-8.82)	(8.19)	(8.81)	(-8.78)	(-10.02)	(9.83)	(10.01)	(-9.72)
Profit margin	0.9479 ***	0.0321 ***	0.0280 ***	-0.0506 ***	0.9397 ***	0.0361 ***	0.0325 ***	-0.0605 ***
	(-23.26)	(24.31)	(23.13)	(-22.44)	(-26.66)	(27.18)	(26.52)	(-26.34)
Solvency ratio	0.9568 ***	0.0242 ***	0.0231 ***	-0.0441 ***	0.9610 ***	0.0222 ***	0.0208 ***	-0.0391 ***
	(-35.16)	(35.06)	(34.97)	(-35.43)	(-31.08)	(31.65)	(30.89)	(-30.66)
Size	1.0508 ***	-0.0109	-0.0260 ***	0.0633 ***	1.0314 *	-0.0050	-0.0162 *	0.0386 **
	(3.16)	(-1.21)	(-3.16)	(4.29)	(1.94)	(-0.55)	(-1.94)	(2.56)
Age	0.9339 ***	0.0386 ***	0.0358 ***	-0.0681 ***	0.9322 ***	0.0403 ***	0.0368 ***	-0.0695 ***
	(-37.22)	(33.73)	(36.93)	(-36.13)	(-39.88)	(35.22)	(39.46)	(-38.40)
Age^2	1.0006 ***	-0.0004 ***	-0.0003 ***	0.0006 ***	1.0006 ***	-0.0004 ***	-0.0003 ***	0.0006 ***
	(14.36)	(-13.02)	(-14.35)	(13.27)	(16.62)	(-12.89)	(-16.60)	(14.97)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	89083	89083	89083	89083	89083	89083	89083	89083
Log-pseudolikelihood	-71150.59	-71003.19	-71150.59	-53922.60	-71180.09	-71125.32	-71180.09	-53846.73
Wald test (χ^2)	9881.47 ***	9466.99 ***	9324.14 ***	9569.76 ***	10215.92 ***	9529.21 ***	9726.11 ***	9975.85 ***

Note: This table contains estimation results using four alternative estimators for a robustness check. Table 1 provides detailed definitions and descriptive statistics of the independent variables. Models [1] and [5] report hazard ratios, while other models report regression coefficients. Standard errors are computed using the Huber-White sandwich estimator. z statistics are reported in parentheses beneath the coefficients. 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 A5. Estimation with specific sample restriction by firm size and age for a robustness check

Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Sample restriction	Smaller firms [a]	Larger firms [a]	Younger firms [b]	Older firms [b]	Smaller firms [a]	Larger firms [a]	Younger firms [b]	Older firms [b]
Comprehensive IQ index	0.9317 ***	0.8853 ***	0.9086 ***	0.9024 ***				
	(-12.92)	(-26.50)	(-18.47)	(-21.82)				
Comprehensive FD index					0.9269 ***	0.8927 ***	0.9193 ***	0.9133 ***
					(-15.09)	(-24.37)	(-17.48)	(-19.02)
State ownership	1.2910 ***	1.1537 ***	0.9444	1.3075 ***	1.2519 ***	1.1134 **	0.9265	1.2863 ***
	(4.28)	(3.33)	(-0.91)	(6.47)	(3.76)	(2.47)	(-1.22)	(6.00)
Foreign ownership	0.5754 ***	0.7802 ***	0.5990 ***	0.8313 ***	0.5665 ***	0.7202 ***	0.5815 ***	0.7468 ***
	(-8.11)	(-4.27)	(-8.69)	(-2.79)	(-8.40)	(-5.70)	(-9.23)	(-4.46)
Profit margin	0.9602 ***	0.9399 ***	0.9571 ***	0.9365 ***	0.9551 ***	0.9297 ***	0.9511 ***	0.9280 ***
	(-12.94)	(-19.94)	(-14.90)	(-19.65)	(-14.57)	(-23.09)	(-16.88)	(-22.10)
Solvency ratio	0.9599 ***	0.9571 ***	0.9641 ***	0.9552 ***	0.9626 ***	0.9624 ***	0.9667 ***	0.9588 ***
	(-23.37)	(-26.70)	(-22.22)	(-26.12)	(-21.57)	(-22.64)	(-20.33)	(-23.50)
Size	0.9647 *	1.2137 ***	1.0562 ***	1.0442	0.9350 ***	1.3848 ***	1.0300	1.0448
	(-1.81)	(2.89)	(3.01)	(1.58)	(-3.31)	(4.90)	(1.60)	(1.58)
Age	0.9301 ***	0.9435 ***	0.9021 ***	0.9695 ***	0.9308 ***	0.9396 ***	0.9066 ***	0.9535 ***
	(-30.15)	(-24.87)	(-6.00)	(-8.76)	(-30.11)	(-27.90)	(-5.72)	(-13.05)
Age^2	1.0007 ***	1.0005 ***	1.0025	1.0003 ***	1.0007 ***	1.0005 ***	1.0024	1.0004 ***
	(13.61)	(11.63)	(1.19)	(6.89)	(13.15)	(13.91)	(1.16)	(10.20)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	41996	47087	41115	47968	41996	47087	41115	47968
Log-pseudolikelihood	-171504.96	-182461.54	-209256.63	-145258.42	-171477.54	-182540.65	-209283.79	-145336.41
Harrell's C-statistic	0.6514	0.6718	0.6261	0.6354	0.6514	0.6683	0.6241	0.6314
Wald test (χ^2)	5011.37 ***	5968.20 ***	5632.75 ***	3050.02 ***	5112.02 ***	6150.35 ***	3781.98 ***	2905.63 ***

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

[a] Divided according to the median of firm size (3.5553)

[b] Divided according to the median of firm age (8 years)

Appendix Table A6. Estimation with specific sample restriction by country group for a robustness check

Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Sample restriction	Without Central Europe	Without Eastern Europe	Without Baltic countries	Without FSU countries	Without Central Europe	Without Eastern Europe	Without Baltic countries	Without FSU countries
Comprehensive IQ index	0.9458 ***	0.9031 ***	0.8830 ***	0.9702 ***				
	(-12.22)	(-26.90)	(-31.04)	(-3.92)				
Comprehensive FD index					0.9386 ***	0.9192 ***	0.9017 ***	0.9059 ***
					(-18.15)	(-22.36)	(-28.85)	(-6.97)
State ownership	1.2274 ***	1.1959 ***	1.2013 ***	1.1022	1.1824 ***	1.1762 ***	1.1658 ***	1.0800
	(5.78)	(5.04)	(5.27)	(0.60)	(4.71)	(4.53)	(4.37)	(0.48)
Foreign ownership	0.5988 ***	0.7190 ***	0.7252 ***	0.7410 ***	0.6032 ***	0.6475 ***	0.6679 ***	0.7295 ***
	(-9.75)	(-5.71)	(-7.01)	(-5.86)	(-9.65)	(-7.63)	(-8.91)	(-6.17)
Profit margin	0.9500 ***	0.9452 ***	0.9490 ***	0.9636 ***	0.9450 ***	0.9372 ***	0.9402 ***	0.9637 ***
	(-22.79)	(-23.51)	(-23.36)	(-7.75)	(-25.08)	(-26.57)	(-27.07)	(-7.73)
Solvency ratio	0.9609 ***	0.9620 ***	0.9598 ***	0.9292 ***	0.9640 ***	0.9659 ***	0.9643 ***	0.9282 ***
	(-32.54)	(-30.60)	(-33.91)	(-24.46)	(-29.56)	(-26.75)	(-29.36)	(-24.86)
Size	1.0569 ***	1.0776 ***	1.0486 ***	0.9408 ***	1.0414 **	1.0601 ***	1.0321 **	0.9352 **
	(3.50)	(4.16)	(3.04)	(-2.87)	(2.53)	(3.20)	(1.99)	(-3.16)
Age	0.9333 ***	0.9376 ***	0.9386 ***	0.9556 ***	0.9346 ***	0.9333 ***	0.9355 ***	0.9563 ***
	(-37.64)	(-34.66)	(-35.17)	(-14.85)	(-37.56)	(-38.81)	(-38.81)	(-14.65)
Age^2	1.0006 ***	1.0005 ***	1.0006 ***	1.0005 ***	1.0006 ***	1.0006 ***	1.0006 ***	1.0004 ***
	(12.57)	(14.02)	(13.63)	(11.70)	(12.92)	(16.63)	(16.29)	(11.35)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	78357	74297	85226	29369	78357	74297	85226	29369
Log-pseudolikelihood	-352425.61	-325411.79	-362525.48	-74123.18	-352337.91	-325553.09	-362629.89	-74103.90
Harrell's C-statistic	0.6474	0.6607	0.6609	0.6611	0.6479	0.6570	0.6581	0.6620
Wald test (χ^2)	7976.62 ***	10711.54 ***	9539.31 ***	16483.73 ***	8303.41 ***	8681.52 ***	9862.42 ***	23245.24 ***

Notes : This table contains results from a survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the covariates. Regression coefficients are hazard ratios. Standard errors are computed using the Huber-White sandwich estimator. z statistics are reported in parentheses beneath the regression coefficients. 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 A7. Estimation in different periods for a robustness check

Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Estimation period	2007–2009	2007-2011	2007-2013	2007-2015	2007–2009	2007-2011	2007-2013	2007-2015
Comprehensive IQ index	1.0601	0.9652 ***	0.9528 ***	0.9173 ***				
	(0.13)	(-5.73)	(-10.45)	(-22.64)				
Comprehensive FD index					1.0573	1.0066	0.9715 ***	0.9535 ***
					(1.04)	(1.11)	(-3.94)	(-12.13)
State ownership	0.9146	0.9584	1.0297	1.1445 ***	0.9217	0.9912	1.0502	1.1675 ***
	(-0.73)	(-0.55)	(0.54)	(3.40)	(-0.66)	(-0.11)	(0.89)	(3.87)
Foreign ownership	0.4719 ***	0.6369 ***	0.7051 ***	0.6600 ***	0.5003 ***	0.5906 ***	0.6543 ***	0.5864 ***
	(-5.73)	(-5.48)	(-5.90)	(-8.31)	(-5.31)	(-6.45)	(-7.22)	(-10.76)
Profit margin	0.9218 ***	0.9301 ***	0.9401 ***	0.9468 ***	0.9266 ***	0.9284 ***	0.9371 ***	0.9413 ***
	(-12.47)	(-17.31)	(-19.82)	(-22.32)	(-11.82)	(-17.74)	(-20.77)	(-24.48)
Solvency ratio	0.9671 ***	0.9614 ***	0.9575 ***	0.9588 ***	0.9649 ***	0.9612 ***	0.9582 ***	0.9605 ***
	(-9.09)	(-16.74)	(-24.86)	(-31.16)	(-9.81)	(-16.61)	(-24.07)	(-29.18)
Size	0.8869 ***	0.9455 **	0.9752	0.9982	0.8892 ***	0.9602	0.9834	1.0065
	(-3.32)	(-2.15)	(-1.26)	(-0.11)	(-3.24)	(-1.56)	(-0.84)	(0.40)
Age	0.9236 ***	0.9267 ***	0.9351 ***	0.9373 ***	0.9254 ***	0.9225 ***	0.9315 ***	0.9323 ***
	(-17.11)	(-24.48)	(-28.80)	(-34.51)	(-16.59)	(-26.11)	(-30.90)	(-38.41)
Age^2	1.0007 ***	1.0006 ***	1.0006 ***	1.0005 ***	1.0007 ***	1.0007 ***	1.0006 ***	1.0006 ***
	(14.22)	(14.89)	(14.87)	(14.97)	(13.60)	(15.72)	(15.90)	(16.90)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	89083	89083	89083	89083	89083	89083	89083	89083
Log-pseudolikelihood	-45995.18	-107491.13	-189751.54	-302086.10	-46000.31	-107507.05	-189798.58	-302277.40
Harrell's C-statistic	0.6605	0.6640	0.6577	0.6589	0.6611	0.6631	0.6564	0.6558
Wald test (χ^2)	54023.92 ***	27969.40 ***	4848.96 ***	7910.82 ***	1318.26 ***	27807.47 ***	4741.82 ***	7552.02 ***

Notes : This table contains results from a survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the covariates. Regression coefficients are hazard ratios. Standard errors are computed using the Huber-White sandwich estimator. z statistics are reported in parentheses beneath the regression coefficients. 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 A8. Estimation with additional firm-level control variables for a robustness check

Model	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Additional control	Control for legal form	Control for linkage with capital market	Control for business organization	With all additional firm-level controls	Control for legal form	Control for linkage with capital market	Control for business organization	With all additional firm-level controls
Comprehensive IQ index	0.8940 ***	0.8966 ***	0.9082 ***	0.8875 ***				
	(-29.20)	(-27.38)	(-26.81)	(-25.97)				
Comprehensive FD index					0.8974 ***	0.9071 ***	0.9081 ***	0.8945 ***
					(-27.34)	(-22.72)	(-23.01)	(-22.48)
State ownership	1.1214 ***	1.2554 ***	1.2208 ***	1.1504 ***	1.0110 **	1.2355 ***	1.2022 ***	1.0418 **
	(3.20)	(6.19)	(5.73)	(3.68)	(2.30)	(5.70)	(5.26)	(1.97)
Foreign ownership	0.6505 ***	0.7619 ***	0.6911 ***	0.7349 ***	0.6069 ***	0.6824 ***	0.6229 ***	0.6724 ***
	(-9.63)	(-5.44)	(-8.30)	(-6.08)	(-11.27)	(-7.73)	(-10.75)	(-7.90)
Profit margin	0.9501 ***	0.9427 ***	0.9499 ***	0.9432 ***	0.9437 ***	0.9339 ***	0.9426 ***	0.9360 ***
	(-23.16)	(-23.22)	(-23.18)	(-22.79)	(-25.87)	(-26.70)	(-26.46)	(-25.48)
Solvency ratio	0.9578 ***	0.9613 ***	0.9591 ***	0.9607 ***	0.9607 ***	0.9662 ***	0.9621 ***	0.9645 ***
	(-35.60)	(-27.05)	(-34.73)	(-27.12)	(-32.65)	(-23.09)	(-31.58)	(-24.08)
Size	1.0483 ***	1.0813 ***	1.0408 ***	1.0696 **	1.0386 **	1.0315	1.0407 ***	1.0389
	(3.16)	(3.11)	(2.63)	(2.01)	(2.51)	(1.40)	(2.61)	(1.35)
Age	0.9343 ***	0.9348 ***	0.9388 ***	0.9326 ***	0.9319 ***	0.9305 ***	0.9353 ***	0.9286 ***
	(-37.82)	(-33.74)	(-35.29)	(-33.62)	(-41.01)	(-37.57)	(-38.92)	(-36.97)
Age^2	1.0006 ***	1.0006 ***	1.0005 ***	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***	1.0006 ***
	(14.54)	(12.63)	(14.39)	(12.64)	(16.94)	(14.50)	(16.65)	(14.39)
Joint-stock company	0.8263 ***			0.8019 ***	0.6884 ***			0.6859 ***
	(-7.64)			(-7.67)	(-14.57)			(-12.98)
Limited liability company	0.7810 ***			0.7451 ***	0.6509 ***			0.6315 ***
	(-11.48)			(-12.15)	(-19.56)			(-18.89)
Partnership	1.1078 ***			1.1117 ***	1.0267 ***			1.0826 ***
	(3.66)			(3.43)	(7.04)			(6.34)
Cooperative	0.9078 **			0.8993 **	0.7213 ***			0.7224 ***
	(-2.18)			(-2.22)	(-7.41)			(-6.90)
Listed		0.6783 ***		0.7183 ***		0.6579 ***		0.6864 ***
		(-3.91)		(-3.29)		(-4.21)		(-3.73)
Gearing		1.0000		1.0000		1.0000		1.0000
		(0.62)		(0.80)		(0.71)		(1.18)
Business network			0.9447 ***	0.9609 **			0.9437 ***	0.9593 **
			(-3.11)	(-2.08)			(-3.06)	(-2.06)
Business diversification			1.0050 ***	1.0095 ***			1.0087	1.0030 *
			(3.72)	(5.94)			(0.91)	(1.80)
NACE division-level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	89083	74227	88808	73976	89083	74227	88808	73976
Log-pseudolikelihood	-377573.24	-288096.16	-376970.86	-287249.79	-377625.35	-288205.89	-377064.10	-287343.58
Harrell's C-statistic	0.6647	0.6574	0.6612	0.6636	0.6633	0.6547	0.6594	0.6614
Wald test (χ^2)	9996.95 ***	7560.48 ***	10082.68 ***	7615.46 ***	10217.11 ***	7497.54 ***	10014.02 ***	7668.07 ***

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