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Firm Failure in Russia during Economic Crises and Growth: A Large Survival Analysis*

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Abstract: In this paper, we trace the survival status of more than 110,000 Russian firms in the years of 2007–2015 and examine the determinants of firm survival across periods of economic crisis and growth. Applying the Cox proportional hazards model, we find that the effects of some variables regarded as key determinants of firm survival are not always robust across business cycles. Among the variables that constantly affect firm survival across business cycles and industries, concentration of ownership, the number of board directors and auditors, firm age, and business network are included. By contrast, the effects of some ownership-related variables on firm survival vary depending on the nature of economic recessions such as a global crisis and a local one. There is also evidence that an international audit firm increases the probability of firm survival; however, gaps in the quality between international audit firms and those from Russia decrease over time. These findings suggest that one should not make hasty generalizations regarding the determinants of firm survival by looking at a specific economic period or industry.

Keywords: Firm failure; Economic crises and growth; Cox proportional hazards model; Russia

JEL Classifications: D22, G01, G33, G34, P34

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Introduction

Why do firms survive or fail? This question is central to understanding the growth of a country as well as firm dynamics; thus, it has attracted much attention. There is now a large body of literature on this topic. Studies find that differences in ownership and corporate governance account for firm performance (Mata and Portugal, 1994; Claessens et al., 2000; Mitton, 2002; Anderson and Reeb, 2003; Commander and Svejnar, 2011). More specifically, outsider ownership that includes foreigners and an independent board of directors are suggested as typical characteristics of surviving firms. Firm size and age also matter for firm survival. Large firms are less likely to fail, whereas the effect of firm age is nonlinear (Dunne and Hughes, 1994; Mata and Portugal, 1994; Audretsch and Mahmood, 1995; Agarwal and Gort, 2002). In addition, there is evidence that the orientation of firms affects their survival. Firms oriented toward innovation, export, and diversification survive longer than those that are not (Audretsch, 1991; Commander and Svejnar, 2011).

A question closely related to the one above is why firms fail during economic crisis. Using data from Indonesia, Korea, Malaysia, the Philippines, and Thailand during the East Asian financial crisis of 1997–1998, Mitton (2002) found that firms whose activities were concentrated rather than diversified performed better in terms of stock market price. Heavy exposure to bank lending and affiliation with conglomerates are positively associated with failure during the crisis period (Baek et al., 2004; Boeri et al., 2013). It was also found that boards independent of owners or managers and institutional ownership suffered less from economic shocks (Kang et al., 2010; Erkens et al., 2012; Francis et al., 2012).

This paper uses the survey data of more than 110,000 Russian firms from 2007 to 2015 to understand the determinants of firm survival. We contribute to the literature in the following respects. First, this paper contrasts factors determining firm survival during normal periods with those during crisis periods. It is possible that factors affecting firm survival during normal periods are different from those during an economic crisis. However, this asymmetry is often ignored in the relevant literature. The Russian case provides an excellent opportunity for this empirical exercise because Russia experienced both booms and recessions from 2007 to 2015. The Russian economy grew by 8.5% in 2007 but suffered from the financial crisis started in the United States in 2008 and, thus, shed Gross Domestic Product (GDP) by 7.8% in 2009. Thanks

to a surge in oil prices from 2010–2012, however, the Russian economy rebounded and recorded 4.1% growth per annum during the above period. This trend reversed again from 2013, at least partially due to decreases in the oil price and economic sanctions due to Russia's annexation of Crimea and military intervention in Ukraine: Russia's annual growth rates declined to 1.3% and 0.7% in 2013 and 2014, respectively, and tumbled to -2.8% in 2015 as the crisis became more severe. The two economic crises are rather unexpected and, thus, can serve as exogenous events. This is an important advantage because otherwise, expecting an economic crisis would have affected firm behavior in the preceding period.

Second, Russia can provide an interesting case study to reveal the channels through which economic crises affect the economy. In this regard, the period of 2008–2009 contrasts with that of 2013–2015 in that the former is affected by a global financial crisis but the latter by a Russia-specific crisis caused by decreases in the price of oil and economic sanctions. Hence, one can distinguish the different effects of a global and a local crisis on firm survival. Are there any differences in the mechanisms by which a crisis influences firm survival depending upon the nature of the economic crisis? This paper aims to answer to this question as well.

Third, heterogeneity in firm-specific and industry-specific factors is more pronounced in Russia as a post-communist transition country than in other non-transition countries. During a transition from a planned system to a market economy, some features inherited from socialism remain, while those consistent with a market and an open economy are newly introduced. For example, to a substantial extent, state ownership coexists with private ownership, including those with foreign ownership and cooperatives. Some firms began to utilize an international audit as an external auditor, but other firms rely on domestic audit firms. In addition, these features are expected to vary across industries. Market rules are more dominant in some industries than in others. Central and local governments may still exert significant influence in some traditional industries. We took advantage of such diversity to help us understand the effects of various firm-specific factors on survival.

We found that the legal status of a firm as an open joint-stock company (JSC) is positively associated with firm survivability but such an effect is weaker as compared to more closed legal forms of incorporation. In addition, being listed in the stock market and using a local Russian audit firm are negatively correlated with firm survival. By contrast, well-developed business

networks and the number of large shareholders appear to protect firms from failure. Some differences in the effects of factors are observed in the crisis period as compared with those in the normal period. Foreign ownership undermined the probability of firm survival in the crisis period; however, such an effect disappeared in the normal period. In the crisis period, larger firms experienced higher rates of failure than did smaller firms.

This paper is laid out as follows: Section 2 reviews the relevant literature. In section 3, the data and the methodology used in this paper are explained. Section 4 provides the results from the firm survival analysis. In this analysis, we not only discuss factors associated with firm survival during 2007–2015 as a whole but also compare those in different periods. The last section summarizes our main findings.

1. Literature Review

What determines firm survival has been frequently debated by economists. An economic crisis is regarded as an especially good test field for understanding why firms fail or survive. From such exercises, it is found that ownership and disclosure quality are main determinants of firm survival and performance. For instance, using the Korean financial crisis of the 1990s, Baek et al. (2004) found that unaffiliated foreign ownership improved the survival probability while firms with concentrated ownership, particularly by Korean conglomerates (*Chaebols*), undermined it. Furthermore, high disclosure quality and an alternative source of external financing reduce the exit rate of firms from markets, while the excessive voting rights of the controlling shareholders beyond cash flow rights and those firms that borrowed more from the main banks are more likely to exit. These results are in line with the outcome of previous research, such as that of Kang et al. (2010), Lemmon and Lins (2003), and Mitton (2002). In more detail, Kang et al. (2010) discovered that the differences between cash flow rights and control rights of controlling shareholders, especially for *Chaebol* firms in Korea, decreased the confidence of investors; however, equity ownership by unaffiliated financial institutions can mitigate such risks. Lemmon and Lins (2003)'s findings from the analysis of 800 firms in eight East Asian countries also support the negative effect of separating control rights from cash flow rights: such a separation reduces stock returns of firms by 10–20 percentage points. Mitton (2002) analyzed firms from five Asian countries and found that higher outside ownership

concentration and disclosure quality were positively associated with stock prices.

Details of corporate governance, such as board independence, are also found to determine firm success or failure during a crisis. Johnson et al. (2000) used the data from 25 emerging markets affected by the Asian financial crisis of 1997–1998, stating that weak corporate governance, in the form of the expropriation of minority shareholders by managers, led to lower asset prices. Along this line, Francis et al. (2012) found that firm-level differences, particularly related to the corporate board, significantly determined firm performance. More specifically, outside directors less connected with current CEOs and board meeting frequencies are positively associated with firm performance. This finding also applies to financial firms (Yeh et al., 2011; Erkens et al., 2012). Erkens et al. (2012) confirmed that financial firms with more independent boards increased stock returns during the 2007–2008 financial crisis. Similarly, Yeh et al. (2011) found that financial institutions with more independent directors on auditing and risk committees performed better during a crisis.

The activities of firms also play an important role in firm survival. Bridges and Guariglia (2008) used UK firms from 1997–2002 to determine that higher leverage leads to higher probabilities of failure; however, such an effect is more pronounced for domestic firms but somewhat mitigated for globally engaged firms. Guariglia et al. (2016) confirmed the earlier finding using the UK data but for a different period; they maintained that an economic crisis tended to hit bank-dependent and non-exporting firms hard through higher interest rates. This channel of interest rates during a financial crisis is also echoed by Boeri et al. (2013), who stated that firms that have borrowed more are found to experience larger layoffs, and by Byrne (2016), who emphasized that bank-dependent non-public firms end up with higher rates of failure due to increased uncertainty.

One would raise a question as to whether findings of firm failures during a crisis can apply during normal periods. The number of works on firm failure during normal periods is sparser than that during economic crises. Nevertheless, some factors appear to significantly affect firm failure both in normal periods and in recessions. Board composition is a prime example. Perry and Shivdasani (2005) found that firms with a majority of outside directors on the board are associated with more active restructuring and, thus, better ex-post performance. Moreover, Iwasaki (2014a) argued that not only board directors but also corporate auditors and audit firms

with a high degree of independence from top management are able to reduce the exit risk by fulfilling an effective supervision function and preventing possible strategic deviation led by the malpractice of top executives and/or their management. Having said that, Yermack (1996) and other follow-up studies claimed that the size of corporate governance bodies may have a nonlinear effect on firm performance. This suggests that company organs have an optimal size in terms of the efficiency of managerial discipline (Raheja, 2005).

The literature also suggests that firm size and age are good predictors of firm survival (Geroski, 1995; 2010; Buehler et al., 2006). Geroski (1995) summarized works on the entry of firms and concluded that firm size decreases the probability of firm failure. This is in line with the findings of Buehler et al. (2006) and Esteve-Pérez and Mañez-Castillejo (2008), that firm size is negatively correlated with the hazard rate of firm exit. However, the above works differ somewhat in the effect they suggest of firm age on failure: Buehler et al. (2006) confirmed that age reduces firm failure, while Esteve-Pérez and Mañez-Castillejo (2008) found that the relationship between age and firm failure follows a "U" shape—initially high, but lower afterward before becoming high again. In fact, the effect of firm size on failure may differ across industries. Audretsch et al. (1999) found that the relationship between the size of start-up firms and firm failure is positive in nine of thirteen industries, but it turns out to be insignificant in all but three industries.

Given the possibility of heterogeneity in the determinants of firm failure according to different economic environments, one can argue that robust findings should be derived not only from the period of the economic crisis but also from a normal period. In addition, the nature of economic crises may affect firm failure differently. A global economic recession is likely to hit harder firms with more exposure to global markets than firms oriented to domestic markets. By contrast, it is believed that an economic crisis occurring only locally heavily affects the failure of firms whose activities are confined to domestic markets. Pooling together results from various countries may ignore substantial differences in their industrial structures, business environments, and government policies. A better approach is to investigate cases of firm failure within a country and to analyze the causes of failure by different periods and various industries. This also helps us to control for unobservable factors that are different across countries and, thus, to find robust results.

2. Data and Methodology

We constructed a large hand-crafted dataset of Russian companies from Bureau van Dijk (BvD)'s Orbis database. From this dataset, we identified companies that satisfy the following two conditions: first, they were operating at the end of 2006; second, their survival status was traceable until the end of 2015. As a result, we found a total of 112,280 Russian companies that met the above conditions. In addition to the survival status, we collected from the Orbis database a series of firm-level profiles related to the legal form of incorporation, ownership structure, corporate governance, financial performance, linkage with the capital market, firm size, firm age, and business organization. We were able to extract all variables to be used in our empirical analysis of the determinants of firm survival from the Orbis database for 74,308 of the 112,280 firms. The variables we compiled from this dataset are displayed in **Table 1**.

According to **Table 1**, with regard to the legal form of a company, a majority of companies (65.7%) are limited liability companies, followed by closed joint-stock companies (14.8%) and open joint-stock companies (10.8%).[1] The average number of dominant and block shareholders is 1.59. Although the absolute majority of firms are owned by domestic private investors and legal entities, some companies have a foreign investor(s) (0.1% in total sample), the federal government (2.3%), and the regional government (3.7%) as their ultimate owners. In terms of management discretion, the average is 3.4, which is between C+ and B-, according to the BvD independence indicator. On average, the number of board directors is 1.5, but the maximum number is 36. The average number of board directors and auditors is 1.5 and 0.47, respectively.[2]

[1] According to Russian law, the essential difference in the institutional settings of closed and open JSCs is share transferability. A shareholder of an open JSC may freely transfer his/her shares to any third party, other than another shareholder of the company or the company itself; on the other hand, a shareholder of a closed JSC must sell his/her shares first to another shareholder of the company or the company itself, due to the right of preferential purchase. In addition, there are statutory distinctions between these two types of corporate forms in the required minimum capitalization, the number of shareholders, government funding, and disclosure obligations (Iwasaki, 2014b).

[2] *Auditors* refers to members of the audit committee. The audit committee (*revizionnaya komissiya*, in Russian) is the statutory company body of corporate auditors. Unlike in the USA and many European countries, in Russia, the audit committee is not a board subcommittee comprised of members of the board of directors. In this sense, the audit committee in a Russian firm is rather closely related to the board of corporate auditors in Japan and the board of statutory auditors in Italy (Iwasaki, 2014c).

Financial features of the firms, including return on assets, gross margin, and gearing, are also presented. On average, firms had been operating for 16.8 years.

Using the survival status information of the above 112,280 Russian firms, we first computed the exit rate and estimated the Nelson-Aalen cumulative hazard function for all firms and those in different industries in each year of the period 2006–2015. We also estimated the Kaplan-Meier survivor function and conducted a log-rank test for equality of survivor functions to test the difference in firm survivability between industrial sectors and that between sample groups divided by a company profile in question.

To identify which factors strongly affected the survivability of Russian companies during the observation period, we perform a survival analysis using the data of 74,308 Russian firms, company profiles of which are complete in the dataset as mentioned above. The main objective of the survival analysis was to estimate the following survival function:

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

where *t* refers to time; *T* represents the survival time; and $f(t)$ is a density function of *T*. The survival function reports the probability of surviving beyond time *t*. The hazard, which means the instantaneous probability of an event (in our case, the market exit of a given Russian firm) within the next small interval of time, is defined as:

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

When this function is expressed as $h(t)$, the following relationship can be established between $S(t)$ and $h(t)$:

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

These equations indicate that if either one of them is determined, the other is also determined simultaneously. Concerning the hazard function $h(t)$, the Cox proportional hazards model assumes its form in the following way:

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

where $x_{i1}, x_{i2}, x_{i3,} \cdots, x_{in}$ are covariates associated with the *i*th observation; and

$\beta_1, \beta_2, \beta_3, \cdots, \beta_n$ are their respective parameters to be estimated. In this model, the baseline hazard $h_0(t)$ depends only on time *t* and, thus, can take any form, while covariates enter the model linearly. For this reason, the Cox model is called a semiparametric model. As compared to parametric models, the Cox model has an advantageous feature, namely, that regardless of how the survival time *T* is distributed, the results obtained from the estimation of the Cox model are robust.

The above-expressed Cox model can be estimated through the maximum likelihood method by taking the logarithms of both sides and transforming the equation into the following linear model:

$$\ln h(t|x_{i1}, \cdots, x_{in}) = \ln h_0(t) + \sum_{j=1}^{n} \beta_j x_{ij} .$$

To deal with the right censoring that refers to firms that survived during the entire observation period, we adopted the Breslow (1974) approximation. Every parameter estimate β to be reported in this paper is a hazard ratio that shows, when a certain covariate (an independent variable) changes by one unit, how the event probability will be multiplied. In other words, if an estimate exceeds 1.0, this covariate can be regarded as a risk factor that causes the event. Conversely, if an estimate takes a value of less than 1.0, this means that the corresponding covariate is a preventive factor that inhibits the event from occurring.[3]

Figure 1 shows the survival status of 112,280 Russian firms in the period of 2007–2015. A total of 41,294 firms, 35.6% of the firms in our dataset, failed during the observation period. This failure rate is much higher than the comparable figure in Central and Eastern Europe (CEE). In fact, in 15 CEE countries, of 96,877 companies registered in the ORBIS database, 19,635 firms or 20.3% were forced to exit during the same period. Accordingly, the exit rate in the CEE region is 15.3% lower than that in Russia.[4]

[3] An endogeneity issue may arise in the survival analysis under certain conditions if: (i) an independent variable is a future variable, (ii) the estimation period is very short, or (iii) the dependent variable is continuous. Under these circumstances, an instrumental variable (IV) method or a two-stage residual inclusion method (2SRI) should be applied. However, all independent variables in our analysis are predetermined, which rules out the endogeneity problem arising from simultaneity between dependent and independent variables. Furthermore, the estimation period of 9 years is sufficiently long, and the dependent variable observed on a yearly basis is, thus, a discretional variable. On the basis of the above arguments, we conclude that our survival analysis is not plagued by endogeneity.

[4] More detailed information concerning the 15 CEE countries is available upon request.

Figure 1 also illustrates the number of failed firms, exit rate, and Nelson-Aalen estimates of the cumulative hazard function by industry and year. As shown in Panel (a) of this figure, in 2007, only 462 Russian companies were plunged into financial distress and forced to exit the market. However, the number of bankrupt Russian firms rose sharply after 2008 due to the global financial crisis. In fact, the number of failed firms had increased to 6,357 by 2012, and, as a result, the exit rate jumped from 0.004 in 2007 to 0.064 in 2012. Following the rather stable period of 2013 and 2014 in terms of firm failure, a remarkable surge occurred in 2015; the number of failed firms and exit rate reached 9,204 and 0.115, respectively. This might have been associated with a drop in the price of oil as well as the effects of sanctions against Russia due to its invasion of Ukraine and annexation of Crimea. Consequently, the Nelson-Aalen cumulative hazard function of the entire period reached 0.442.

Panels (b) through (e) of **Figure 1** show the dynamics of firm failure in different industrial sectors. Here, we confirm that a similar pattern of company bankruptcy can be observed in all four industries. The exit rate in agriculture, forestry, and fishing; mining and manufacturing; construction; and service industries has risen considerably from 0.004 to 0.095, 0.004 to 0.094, 0.003 to 0.139, and 0.004 to 0.119 from 2007 to 2015, respectively. As a consequence of this synchronous increase, the Nelson-Aalen cumulative hazard function of the entire period ranged between 0.385 and 0.510 across industries.[5]

In **Figure 2**, the geographical distribution of the firm exit rate on the federal region level is illustrated. The figure indicates that, by and large, the exit rate of Russian companies tends to be higher in the western regions than in the eastern counterparts and to be higher in the south than in the north. Nevertheless, some regions in the Central and North Caucasus federal districts have exit rates of the lowest class (less than 0.289). Although the region-level firm exit rate has a wide distribution, ranging from 0.200 (Chechen Republic) to 0.649 (Altai Republic), its mean and standard deviation are 0.365 and 0.076, respectively, suggesting that most Russian regions experienced similar negative impacts on firms during the years 2007–2015.

In sum, Russia was faced with a significant increase in the periods affected by the global financial crisis and by the Russian crisis, and this tendency had common features across different industries and regions in the country. Keeping these facts in mind, we conduct a

[5] **Appendix 1** provides a more detailed breakdown of firm survival status by industrial sector and year.

survival analysis in the next section to identify factors that strongly affected the survivability of Russian firms in recent years.

3. Empirical Results

We analyze the determinants of firm failure in the following order. First, we perform a univariate analysis on the basis of the discussion of the potential factors of firm failure. This helps us to understand the likely effects of each determinant in the Russian context. Second, we estimate a Cox proportional hazards model in a multivariate setting. We start by estimating our baseline model based on all industries in the whole period. Subsequently, we look at heterogeneity in the determinants of firm failure across industries and across periods. Third, we conduct robustness checks of our main results using a set of industry-adjusted variables, taking into account geographical similarities and different estimators, and check whether our main results alter when we change assumptions regarding estimators.

4.1 Univariate Analysis

Table 2 reports the results from univariate comparative analysis between surviving and failed firms using company-profile variables. In line with the standard theory of the determinants of firm survival, these results suggest that, as compared with failed firms, company survival was associated with status as a joint-stock company, foreign investors and/or the state as an ultimate owner, the number of board directors and auditors, contract with an audit firm as an external auditor, better financial performance, listing on the stock market, firm size, being operated for a longer period, and the number of subsidiaries as the initial conditions. Moreover, it also reveals that there are more large shareholders in the surviving firms than in the failed firms. By contrast, the results regarding the effect of managerial discretion, fund procurement from the outside, and business diversification on firm survivability appear not to be in line with findings from the existing literature.

Figure 3 displays the time-series changes in the survival probability of Russian firms using the results from estimates of the Kaplan-Meier survival function for the period of 2007–2015. As shown in these panels, the log-rank test rejects the null hypothesis of equality of survivor functions in all cases at a significance level of 5% or less. In terms of industry, the survival rate of manufacturing tended to be the highest, followed by that of agriculture, forestry, and fishing.

By contrast, service and construction suffered more failures over time. Particularly, during 2014–2015, the rate of firm failure was highest in construction.

The estimates of the Kaplan-Meier survival function displayed in Panels (c) to (p) in **Figure 3** further show that a company's profile—from the openness of the legal form of incorporation to the degree of business diversification—may be associated with the survivability of Russian firms. In more detail, Panel (c) indicates substantial differences in survival according to the legal status of firms. Panel (d) confirms that the survivability of companies with a block shareholder exceeds that of those having no such owner. This result infers that ownership concentration is positively associated with firm survival in the case of Russia. Other results—regarding foreign and state ownership in Panel (e), the number of board directors and auditors in Panels (g) and (h), financial performance in Panel (j), dependence on the stock market in Panel (k), firm age in Panel (n), and business network in Panel (o)—corroborate the existing findings from the literature.

The time profile presented in **Figure 3** can also be used to understand the effects of different periods on firm survival. For example, the variables of ownership concentration, number of board directors, number of auditors, ROA, dependence on stock markets, firm age, and business network appear to exert constant influence on firm survival across periods. By contrast, the survival effects of some variables—such as legal status of a firm, quality of external audit, and gearing—tend to change in different periods. For instance, in terms of survival probability, firms with an international audit firm outperformed those having either a large Russian audit firm or a local Russian audit firm in Periods 3–5. However, from Period 6 and onwards, firms with a large Russian audit firm perform better than those with an international audit firm. These results indicate heterogeneity in the determinants of firm failure depending on periods. Of course, these results must be taken with caution partly because no covariates are controlled and partly because the statistical significance in each period is not tested.

4.2 Multivariate Survival Analysis of Firm Survival in Different Industries

We use a Cox proportional hazards model to examine whether the results of the univariate analysis reported in the previous subsection are still valid when we simultaneously control for various company profiles. **Table 3** provides the results for different industries as well as

industries as a whole. On the right-hand side of the model, a set of dummy variables is introduced to control for the fixed effects in the federal regions and industrial sectors together with the company-profile variables. In all models, robust standard errors are computed using the Huber-White sandwich estimator. The value of Harrell's C-statistic ranges between 0.6634 and 0.6973, hence, indicating sufficient predictive power of the fitted Cox models.

According to the estimates of Model [1] using 74,308 observations throughout all industries in **Table 3**, we found that, from the viewpoint of firm survivability, open joint-stock companies (JSCs) compare unfavorably with firms that have a less open legal form of incorporation. In more detail, the hazard ratios of closed JSCs, limited liability companies, and cooperatives are 0.5239, 0.5859, and 0.3290, respectively, with statistical significance at the 1% level, and are significantly lower than the coefficient associated with open JSCs.

With respect to the impact of ownership structure on firm survival, the number of large shareholders is estimated with a hazard ratio of 0.8449 at the 1% significance level. This result denotes that the presence of one block and/or dominant shareholder improves a firm's survival probability by 15.5%. It is also revealed that the presence of a regional government as the ultimate company owner decreases the exit risk by 21.0%, while foreign investors and the federal government have no effect on the survivability of their owned enterprises, irrespective of the theoretical expectations.

Regarding the relationship between corporate governance and firm survival, the estimate of managerial discretion suggests that, in Russia, top management with stronger decision-making power is prone to lead the company to bankruptcy, *ceteris paribus*. The numbers of board directors and auditors are estimated with a hazard ratio of 0.8564 and 0.8731, respectively, while both coefficients of these squared terms exceed the threshold of 1.0. These estimates suggest that the size effect of the board of directors and audit committee on the probability of firm survival is curvilinear in line with the standard findings. Concerning external auditing, Model [1] does not provide supporting evidence of the positive relationship between audit quality and firm survivability as a whole.

Furthermore, the estimation results of Model [1] demonstrate that Russian companies with good financial performances successfully avoid the risk of failure during the observation period. In fact, the hazard ratios of both ROA and gross margin are estimated at the 1% significance

level with a value of less than 1.0. On the contrary, the effect of linkage with the capital market on firm survival is negative, which is not in line with previous findings. In fact, the hazard ratio of being listed on the stock market implies that, other things being equal, listed companies faced an exit risk 82.2% higher than that of unlisted firms. In addition, the risk of market exit was found to rise by 0.2% when gearing increased by 10%.

With regard to the impact of firm size and firm age on survivability, Model [1] provides strong evidence that Russian corporations with larger assets and longer management experience were more likely to survive, as the hazard ratios of these two variables are statistically significant, with values of 0.9827 and 0.9514, respectively. In addition, the hazard ratio of the business network is also estimated to be 0.9445 at the 1% significance level, suggesting that networking among subsidiaries is an effective tool for risk management. By contrast, the insignificant estimate of business diversification implies that management of multiple entities is unlikely to improve a company's survivability in Russia.

Models [2] to [5] in **Table 3** present estimation results by industry. Reflecting industry-specific factors and circumstances, there are some notable differences in the reported estimates as compared with those of Model [1]. First, in the mining and manufacturing industry and services, partnerships enjoyed significantly lower risk of firm failure, while those in the construction industry faced a high danger of bankruptcy. Second, foreign-owned companies operating in the primary industries were in a hazardous state while foreign ownership had little effect on firm failure in other industries. Third, construction enterprises owned by the federal government were more likely to exit from the market than were their counterparts in the same industry, while federal state ownership exhibited a positive role in firm survival in the service industry. Fourth, external auditing by large Russian audit firms in the primary industries and that by international audit firms in the services helped avoid firm failure. These results contrast with those regarding the negative role of local Russian audits in the mining and manufacturing industries, as well as the service sector. Fifth, it is probable that the diversification strategy increases the probability of survival for service companies, even during nationwide crises.

Overall, in spite of the fact that Russians experienced diverse economic conditions, our results on the variables of the membership of board directors and auditors, financial performance, firm size and age, and business networking correspond with the existing findings

on firm survival. However, they differ from standard predictions regarding the effects of the openness of the legal form and linkage with the capital market on firm survivability. In addition, it is noteworthy that concentrated ownership was effective in keeping Russian companies alive despite conflicting arguments in the existing literature on corporate governance.

Although the major findings obtained from the estimation results of Model [1] are still valid in those based on industry-specific models [2] to [5], there are substantial differences between these two in some variables. The effects of partnership and foreign ownership on firm survival are quite different across industries. Similar findings are obtained from the results of having an international audit firm and large Russian audit firm. Hence, one should be careful in deriving general results without fully investigating industry-specific effects, particularly for these variables.

4.3 Multivariate Survival Analysis of Firm Survival in Different Periods

To understand whether the determinants of firm survival exert similar influences in spite of different economic conditions, we divided the period of 2007–2015 into the following four sub-periods. The first sub-period, 2007–2008, can be regarded as a normal period. The Russian economy experienced rapid growth in 2007, recording 8.5% GDP growth. Although the effect of the global financial crisis began to eat into the economic performance in late 2008, Russia was able to manage strong growth in 2008, with an annual growth rate of 5.2%. In the second sub-period, 2009–2010, the Russian economy was hit hard by the global financial crisis. The average growth rate for the two years remained at -1.7%. The third sub-period denotes the years of 2011–2013. Russia was able to recover from the crisis and record strong positive growth—5.3%—in 2011. Although it decreased during 2011–2012, and further in 2013, the average growth rate for the three years was close to 4%. The last sub-period is 2014–2015, when the Russian economy was affected by a decrease in oil price and economic sanctions imposed by the international community following Russia's annexation of the Crimea and invasion of Ukraine in 2014. The western countries' sanctions against Russia included financial sanctions, travel bans, and sanctions on targeted individuals, some energy firms, and state banks. In response to Western sanctions, Russia implemented sanctions against the West, mainly targeting the import of agricultural products into Russia. As a result of these two-way sanctions, Russia's average growth rate for the two years deteriorated to -1%.

As the above discussion reveals, Russia's economic performance in 2009–2010 and 2014–2015 was affected by global and local factors, respectively. Moreover, these two downturns can be regarded as being exogenous because they were rather unexpected shocks to economic agents. Hence, one can argue that Russia provides an interesting case study for understanding heterogeneity in the determinants of firm survival based on the different natures of shocks. In addition, two normal periods can be used for contrast with recession periods, thus, helping us to identify whether determinants of firm failure differ between normal periods and recession periods.

Table 4 presents estimation results by period together with those for the whole period, which is the same as those appearing in Column 1 from **Table 3**, for comparison. We first compared the results in normal periods with those in periods of recession. It turns out that the probability of survival of open JSCs is higher than that of the reference legal form (other corporate firms), but only in periods of recession. However, the performance of open JSCs is compared unfavorably both in normal and recession periods with closed JSCs and limited liability companies. These results might be caused by the relatively unstable ownership as compared with that of firms having other legal status. In fact, it has been said that, in Russia, outside shareholders often exhibit hostility toward top managers; consequently, companies in open organizational architectures are more likely to be involved in internal conflict between principals and agents and, as a result, are exposed to a higher risk of failure as compared with those in a more closed organization (Iwasaki, 2014a, 2014b). The above results can be interpreted to support such arguments.

Results regarding ownership effect are particularly interesting. It is found that state ownership reduces firm failure in a normal period. The variable of federal state ownership is significant in Model [3], which refers to the period of 2011–2013. Regional state ownership affects firm survival significantly and positively in both the period of 2011–2013 and that of 2014–2015; however, the hazard ratio is lower in the former period than in the latter one. One can understand this finding from the fiscal perspective of the government. State-owned firms can be better protected by the state in normal periods because the central or regional government is able to provide these firms with fiscal resources when they are in trouble. By contrast, it is difficult to protect state-owned firms during economic recessions because of constrained fiscal

expenditures.

Audit quality also matters for firm failure. According to Model [2], the variable of large Russian audit firms suffers from higher probability of firm failure in the period of global financial crisis, while such an effect disappears during subsequent periods, as indicated in Models [3] and [4]. This finding might be related to the lower quality of audit as compared to that provided by international audit firms. The effect of audit quality on firm survival may not be pronounced in normal periods but is clearly differentiated in a recession period. Another interpretation is that the quality of Russian audit firms vis-a-vis international audit firms improved over time because the differences in the coefficients of international audit firms and large or local Russian audit firms became smaller over the periods. For instance, the coefficients on international audit firms, large Russian firms, and local Russian audit firms in the first period were 0.0946, 0.1020, and 14.4545, respectively, but became much smaller in the last period.

Comparing the determinants over two recession periods led to the following observations. First, foreign ownership was negatively related to the global financial crisis during 2009–2010 but positively with the local recession of 2014–2015. This can be understood by recognizing that foreign-owned firms were more likely to be exposed to global markets than were firms owned by domestic agents, and thus hit hard by the global financial crisis. However, these firms suffered less from failure in 2014–2015 because the recession was geographically confined to Russia. Second, the effect of managerial discretion was also asymmetric, in that it induced more firm failure during the global financial crisis but less during the local recession. This can be accounted for by the possibility that managerial discretion limited checks and balances but, at the same time, increased flexibility and speed in decision making. However, the advantages associated with managerial discretion were not able to realize during a global crisis because there was little room for managers to avoid shocks. At the same time, weaknesses resulting from limited checks and balances could worsen during this period. By contrast, during a local recession, the advantages could be exploited effectively by managers using their power of discretion. Third, the effects of firm size were also opposite in the two recession periods. A larger firm was more likely to fail during the global crisis, while a smaller one was more likely to exit during the local recession. This finding could be related to the fact that a larger firm is more exposed to global trade and, thus, is more likely to be negatively affected by the global

crisis.

4.4 Robustness Check

To check the statistical robustness of the estimation results of the Cox proportional hazards model reported in Subsections 4.2 and 4.3, we performed a supplementary survival analysis using a set of industry-adjusted variables, which represent the distances from the median performance in each industry, and found that this change in the model specification does not affect parameter estimate β remarkably (**Appendix 2**).

Moreover, to address the issue of the heterogeneity of the Russian regions, we also estimated a Cox hazards model by dividing observations into four subsample groups, taking historical and geographical similarities of the federal districts into consideration. Despite the fact that the estimation results of these region-specific models demonstrate that the effect size and statistical significance of variables related to the legal forms, regional state ownership, managerial discretion, and listing on the stock market are responsive to differences in the target region, the main conclusions obtained from this attempt are largely unchanged (**Appendix 3**).

Lastly, as discussed in the data and methodological section, the Cox proportional hazards model has significant merit, in the sense that it enables us to estimate covariate effects without any special assumption about the form of the baseline hazard $h_0(t)$. On the other hand, the Cox model strongly depends on the proportional hazard assumption, which implies that the hazard ratio remains constant over time. If this assumption is not satisfied, survival analysis using the Cox model should be avoided. There is no guarantee that all independent variables used in our empirical analysis meet this assumption. To examine possible estimation bias caused by the use of the Cox model, we estimated a series of parametric survival models that strongly assumed the survival distribution and confirmed that the estimates of these parametric models are very similar to those of the Cox model (**Appendix 4**). These observations indicated that the estimation results in **Tables 3** and **4** are robust across various model specifications.

4. Conclusion

Using a hand-crafted dataset of 112,280 Russian firms during the period from 2007 to 2015, this paper investigated why firms fail. Given the diversity of institutions related to firms and repeated experiences of economic upswing and downturns, it was expected that Russia would

provide an interesting test field of the determinants of firm failure. We relied on the relevant literature to identify potential determinants of firm failure and to test whether the failure of Russian firms is also affected by such determinants. In particular, we analyzed whether the effects of the standard determinants of firm failure exerted similar influence across industries and across different periods.

We found that the firm survival effects of some variables, regarded as key factors in the literature, were indeed robust. These include the numbers of board directors and auditors, which were positively associated with firm survival in a nonlinear manner. The relationship between the number of large shareholders as an indicator of the concentration of ownership and firm survival was also positive in all periods and most industries. In addition, firm age and network were found to increase the probability of firm survival, regardless of the industry or business cycle. We also found that more closed types of legal forms, such as closed JSCs and cooperatives, performed better in terms of survival than open forms, represented by open JSCs. Particularly, closed JSCs, limited liability forms of companies, and cooperatives experienced lower rates of exit from markets in all periods and all industries. Finally, variables directly related to firm performance, such as ROA and gross margin, significantly contributed to firm survival.

Surprisingly, we discovered that the effect of foreign ownership depended on the nature of the business cycle. In a period of global financial crisis (2009–2010), such an effect turned out to be negative but became positive in a period of crisis confined to Russia (2014–2015). Similarly, managerial discretion was found to increase bankruptcy during the global financial crisis but to decrease it during the recession period of 2014–2015. The effect of state ownership was positive in normal periods but not in periods of recession, perhaps because governments were constrained by financial resources to protect state-owned firms. The quality of audit, measured by the type of firms such as international, large Russian, and local Russian firms, affected the probability of firm survival; however, the differences in such a probability became smaller over the periods, suggesting that Russian audit firms were able to catch up with international audit firms.

Some variables were insignificant in determining the probability of firm survival or their effects were difficult to characterize. Business diversification was found to have little

correlation with firm survival. Gearing was negatively associated with firm survival; however, the magnitude of the impact was negligent, altering it by 0.02–0.07%. Being listed on the stock market was found to increase the hazard ratio; however, its effect was significant only in the period of 2011–2013.

The above findings suggest that firms significantly reduce the probability of failure by increasing the number of directors and employing high quality of auditors. Such a positive effect remains constant regardless of the business cycles. Hence, the Russian economy can be benefitted by stipulating that firms are required to have a minimum number of directors and to appoint auditors satisfying certain qualities. The Russian government should also promote the concentration of ownership by facilitating equity transactions among shareholders toward block shareholders.

Our findings demonstrate that the determinants of firm survival suggested by the literature need to be reexamined if studies were based only on a certain period, such as economic recession or crisis, because findings from economic recessions cannot be generalized. Furthermore, the nature of recessions, whether global or local crises, also affects the impact of the determinants. Industrial heterogeneity also matters in understanding the determinants of firm survival. Ignoring heterogeneity in time and industry could lead to hasty generalizations by limiting our full understanding of why firms fail.

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Table 1. Definitions and descriptive statistics of the variables used in the empirical analysis and comparison of surviving and failed firms

Variable name	Definition	Descriptive statistics				
		Mean	S.D.	Median	Max.	Min.
Open JSC	Dummy variable for open joint-stock companies	0.1076	0.3099	0	1	0
Closed JSC	Dummy variable for closed joint-stock companies	0.1477	0.3548	0	1	0
Limited liability company	Dummy variable for limited liability companies	0.6567	0.4748	1	1	0
Partnership	Dummy variable for partnerships	0.0004	0.0198	0	1	0
Cooperative	Dummy variable for cooperatives	0.0247	0.1552	0	1	0
Other corporate forms (default category)	Dummy variable for companies with a corporate form other than listed above	0.0629	0.2429	0	1	0
Number of large shareholders	Total number of dominant and block shareholders	1.5944	2.9463	1	222	0
Foreign ownership	Dummy for ultimate ownership of foreign investors	0.0089	0.0941	0	1	0
Federal state ownership	Dummy for ultimate ownership of the Russian federal government	0.0230	0.1500	0	1	0
Regional state ownership	Dummy for ultimate ownership of Russian regional governments	0.0366	0.1877	0	1	0
Managerial discretion	BvD independent indicator (0: D; 1: C; 2: C+; 3: B-; 4: B; 5: B+; 6: A-; 7: A; 8: A+) [a]	3.3887	3.6347	0	8	0
Number of board directors	Number of recorded members of the board of directors	1.4990	1.8786	1	36	0
Number of auditors	Number of recorded coorporate auditors	0.4722	0.6730	0	27	0
International audit firm	Dummy for firms that employ an international audit firm as an external auditor	0.0007	0.0272	0	1	0
Large Russian audit firm	Dummy for firms that employ a large Russian audit firm as an external auditor	0.0009	0.0307	0	1	0
Local Russian audit firm	Dummy for firms that employ a local Russian audit firm/auditor as an external auditor	0.0063	0.0789	0	1	0
ROA	Return on total assets (%) [b]	10.5969	20.6488	5.9900	100.0000	-100.0000
Gross margin	Gross margin (%) [c]	14.2612	20.4413	9.7900	100.0000	-100.0000
Listing on the stock market	Dummy variable for listed companies	0.0062	0.0784	0	1	0
Gearing	Gearing (%) [d]	71.3754	160.5372	1.1600	1000.0000	0.0000
Firm size	Natual logarithm of total assets	10.0985	1.7179	10	22.82788	0
Firm age	Years in operation	16.7947	9.1338	15	304	8
Business network	Number of recorded subsidiaries	0.7380	3.8969	0	628	0
Business diversification	Number of operating industries according to the NACE Rev 2 secondary codes	6.7701	3.8192	7	24	0

Notes:

[a] Class A: Definition—Attached to any company with known recorded shareholders, none of which have more than 25% of direct or total ownership [A+: Companies with 6 or more identified shareholders (of any type) whose ownership percentage is known; A: Same as above, but includes companies with 4 or 5 identified shareholders; A-: Same as above, but includes companies with 1 to 3 identified shareholders]. Class B: Definition—Attached to any company with a known recorded shareholder, none of which has an ownership percentage (direct, total, or calculated total) over 50%, but which has one or more shareholders with an ownership percentage above 25%. The further qualifications of B+, B, and B- are assigned according to the same criteria relating to the number of recorded shareholders as for indicator A. Class C: Definition—Attached to any company with a recorded shareholder with total or a calculated total ownership over 50%. The qualification C+ is attributed to C companies in which the summation of direct ownership percentage (all categories of shareholders included) is 50.01% or higher. Indeed, this means that the company surely does not qualify under Independent Indicator D (since it cannot have an unknown direct shareholder with 50.01% or higher). Class D: Definition—This is allocated to any company with a recorded shareholder with direct ownership of over 50% (quotation from the BvD Orbis database website manual).

[b] Computed using the following formula: (profit before tax/total assets) × 100

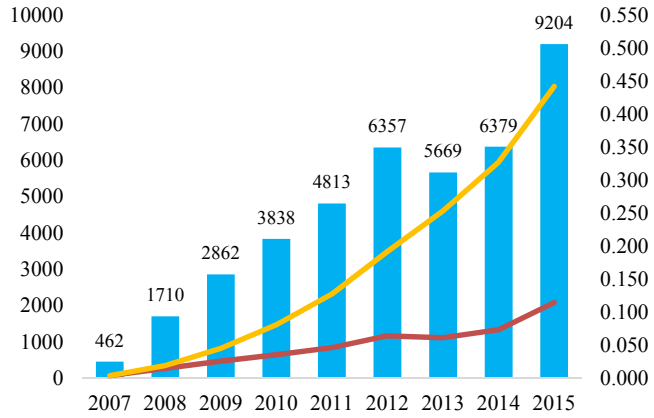
[c] Computed using the following formula: (gross profit/operating revenue) × 100

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

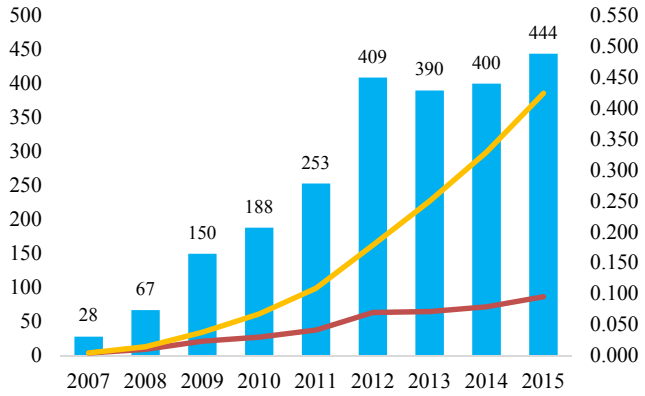
Source: Authors' compilation and estimation. Raw data was extracted from the Bureau van Dijk (BvD) Orbis database. For more details of the database and data, see the BvD website: https://webhelp.bvdep.com.

Figure 1. Number of failed firms, exit rate, and Nelson-Aalen estimate of the cumulative hazard function by industry and year, 2007–2015

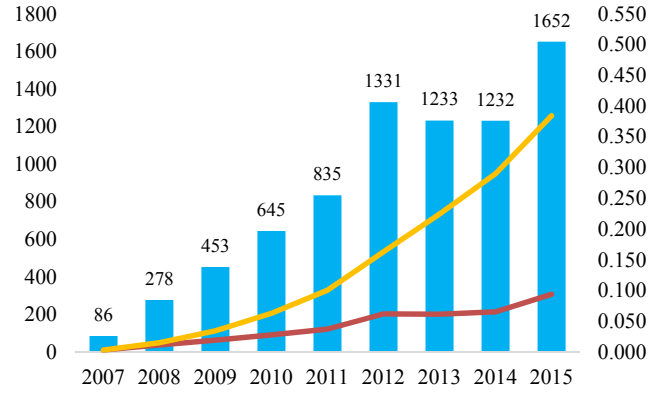
(a) All industries (Sections A–S)



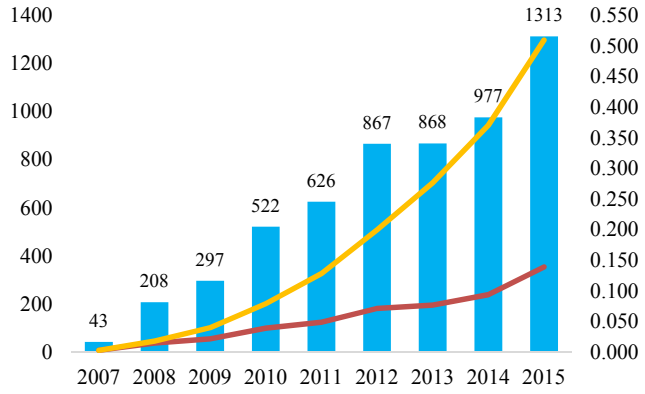
(b) Agriculture, forestry, and fishing (Section A)



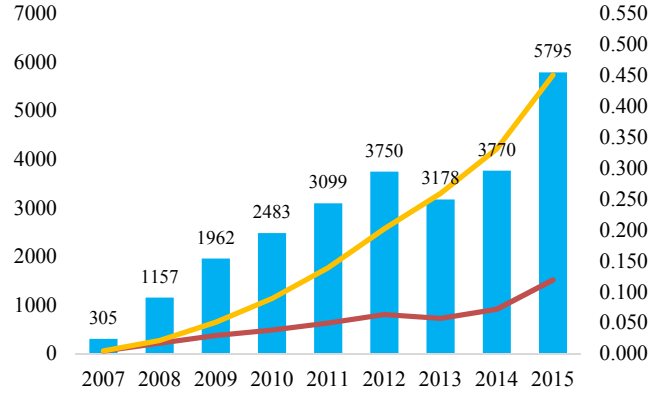
(c) Mining and manufacturing (Sections B–E)



(d) Construction (Section F)



(e) Services (Sections G–S)



Notes:

Number of failed firms (left axis)

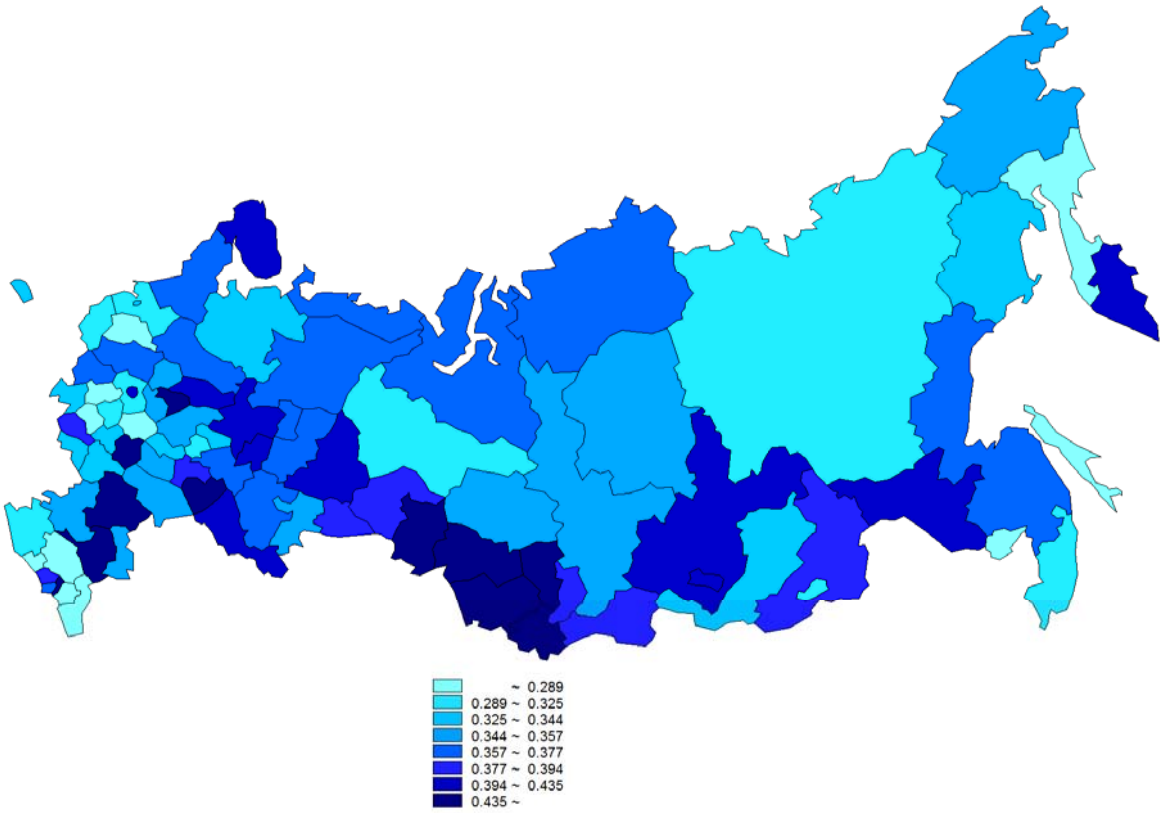
Exit rate (right axis)

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

NACE Rev. 2 section classification is indicated in parentheses. For more details, see Table 3.

Source: Authors' illustrations

Figure 2. Regional distribution of firm exit rate during the period of 2007–2015



Note: Descriptive statistics of the regional-level firm exit rate are as follows: Mean, 0.365; S.D., 0.076; Kurtosis, 3.038; Skewness, 3.038. Kolmogorov-Smirnov test for normality: D =0.1097 (p =0.016).

Source: Authors' illustrations

Table 2. Univariate comparative analysis between surviving and failed firms[a]

Company-profile variable	Surviving firms		Failed firms		Correlation coefficients with survival probability [d]
	Mean/ proportion	Median	Mean/ proportion [b]	Median [c]	
Open JSC	0.1234	0	0.0805 †††	0 ***	0.067 ***
Closed JSC	0.1622	0	0.1229 †††	0 ***	0.053 ***
Limited liability company	0.6228	1	0.7151 †††	1 ***	-0.094 ***
Partnership	0.0004	0	0.0003	0	0.003
Cooperative	0.0310	0	0.0139 †††	0 ***	0.053 ***
Other corporate forms	0.0602	0	0.0673 †††	0 ***	-0.014 ***
Number of large shareholders	1.8554	1	1.1457 ***	1 ***	0.116 ***
Foreign ownership	0.0101	0	0.0068 †††	0 ***	0.017 ***
Federal state ownership	0.0286	0	0.0133 †††	0 ***	0.049 ***
Regional state ownership	0.0419	0	0.0274 †††	0 ***	0.037 ***
Managerial discretion	3.3982	0	3.3683	0	0.004
Number of board directors	1.6610	1	1.2207 †††	1 ***	0.113 ***
Number of auditors	0.5300	0	0.3729 †††	0 ***	0.113 ***
International audit firm	0.0010	0	0.0002 †††	0 ***	0.013 ***
Large Russian audit firm	0.0014	0	0.0002 †††	0 ***	0.017 ***
Local Russian audit firm	0.0081	0	0.0031 †††	0 ***	0.031 ***
ROA	12.9252	8.1100	6.5851 ***	3.2100 ***	0.148 ***
Gross margin	15.9532	11.5800	11.3403 ***	6.9200 ***	0.109 ***
Listing on the stock market	0.0083	0	0.0025 †††	0 ***	0.036 ***
Gearing	64.4100	1.5700	85.5435 ***	0.4400 ***	-0.062 ***
Firm size	10.1370	10.06407	10.0311 ***	10.02977 ***	0.030 ***
Firm age	17.7397	17	15.1689 ***	14 ***	0.136 ***
Business network	0.9718	0	0.3352 ***	0 ***	0.079 ***
Business diversification	6.7355	7	6.8305 ***	7 ***	-0.012 ***

Notes:

[a] See Table 1 for definitions and descriptive statistics of variables used for comparison

[b] *** denotes statistical significance at the 1% level according to the t test (or Welch's test if the F test on the equality of variances rejects the null hypothesis that population variances are equal) in terms of the differences in the means. ††† and † denote statistical significance at the 1% and 10% levels, respectively, according to the Chi-square (χ^2) test in terms of the differences in the proportion between the two types of firms.

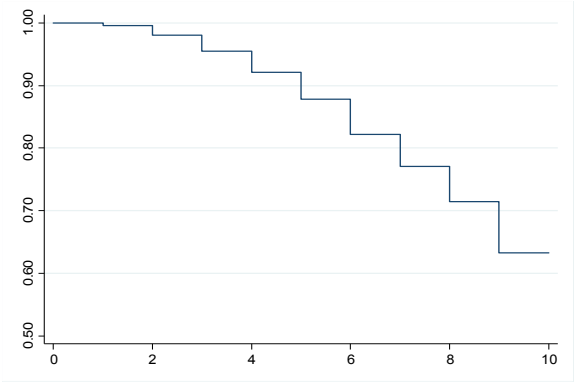
[c] ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, according to the Wilcoxon rank sum test in terms of the differences between the two types of firms.

[d] ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in terms of the correlation coefficient with the survival probability.

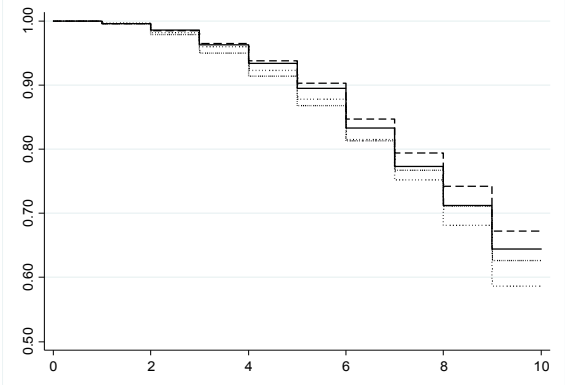
Source: Authors' estimations

Figure 3. Kaplan-Meier survivor function of firm survival probability[a]

(a) All firms

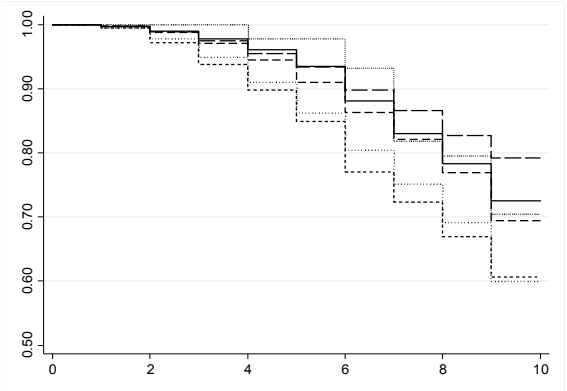


(b) Industriy—Agriculture, forestry, and fishing (solid); Mining and manufacturing (dash); Construction (dot); Services (tight dot)



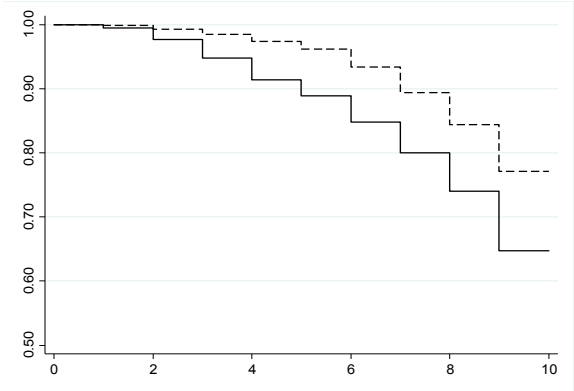
Log-rank test for equality of survivor functions: χ^2=288.87, p =0.000

(c) Openness of legal form—Open JSC (solid); Closed JSC (dash); Limited liability company (dot); Partnership (tight dot); Cooperative (long dash); Others (short dash)



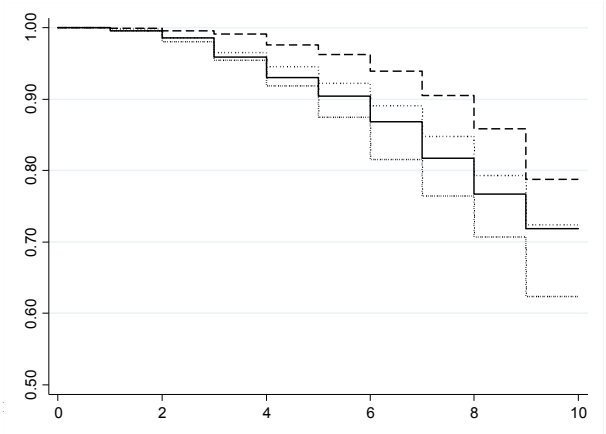
Log-rank test for equality of survivor functions: χ^2=1383.19, p =0.000

(d) Ownership concentration—Companies with a block shareholder(s) (solid); Companies without a block shareholder (dash)

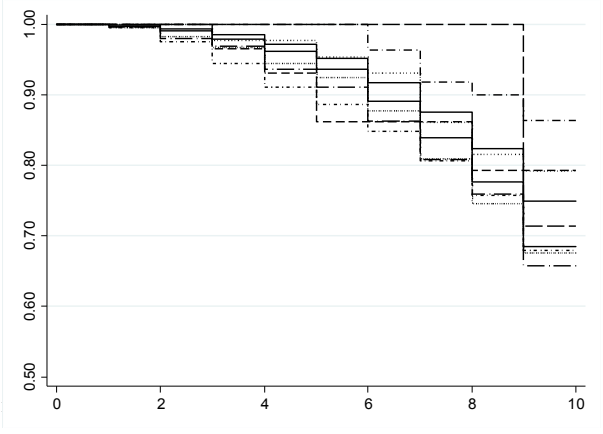


Log-rank test for equality of survivor functions: χ^2=1734.65, p =0.000

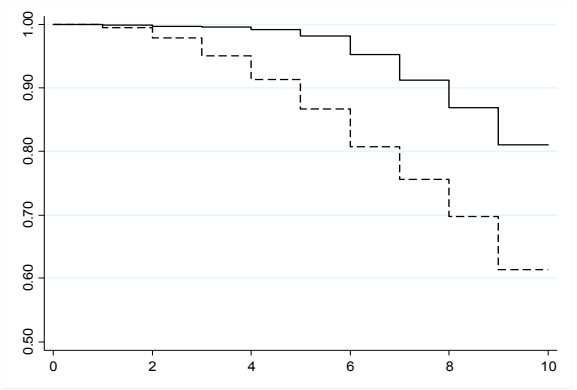
(e) Foreign and state ownership—Foreign ownership (solid); Federal state ownership (dash); Regional state ownership (dot); Others (tight dot)



(f) Managerial discretion—BvD independent indicator is D (solid); C (dash); C+ (dot); B- (tight dot); B (long dash); B+ (short dash); A- (long dash dot); A (dash dot); A+ (short dash dot)

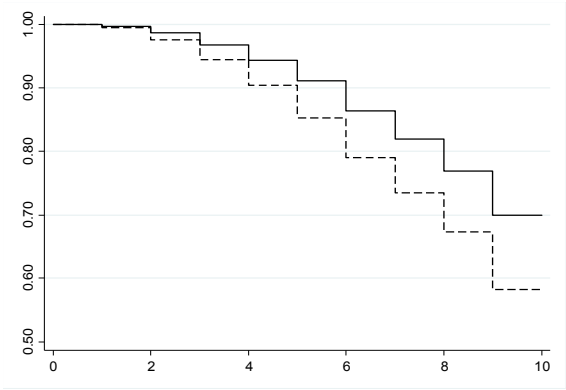


(g) Number of board directors—Companies with the upper number of board directors (solid); Companies with the lowest number of board directors (dash) [b]



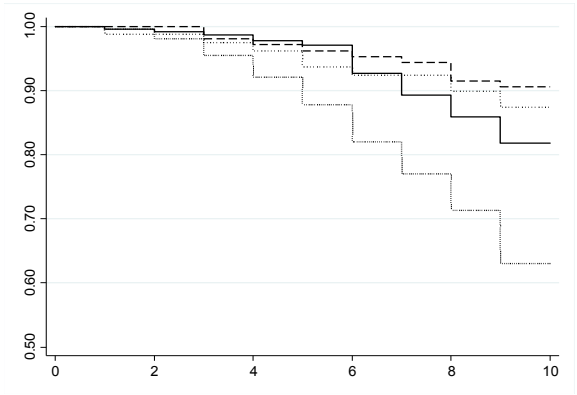
Log-rank test for equality of survivor functions: χ^2=1594.65, p =0.000

(h) Number of auditors—Companies with upper number of auditors (solid); Companies with lower number of auditors (dash) [b]



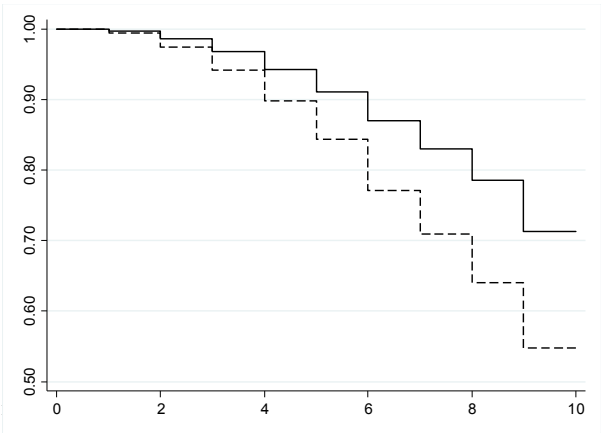
Log-rank test for equality of survivor functions: χ^2=1692.48, p =0.000

(i) Quality of external audit—International audit firm (solid); Large Russian audit firm (dash); Local Russian audit firm (dot); No external auditor (tight dot)

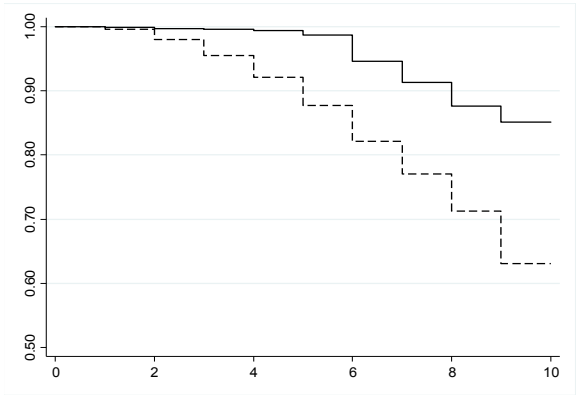


Log-rank test for equality of survivor functions: χ^2=142.55, p =0.000

(j) Firm performances—Companies with upper ROA (solid); Companies with lower ROA (dash) [b]

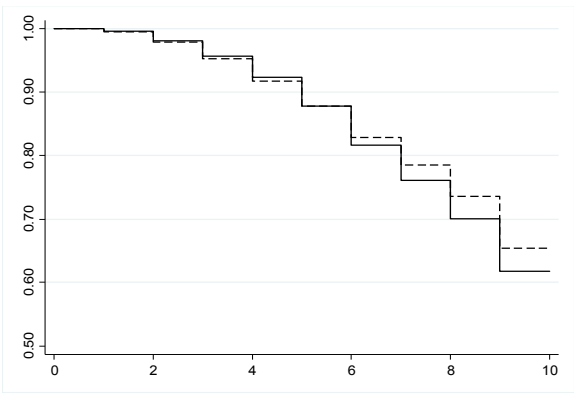


(k) Dependence on the stock market–Listed companies (solid); Unlisted companies (dash)



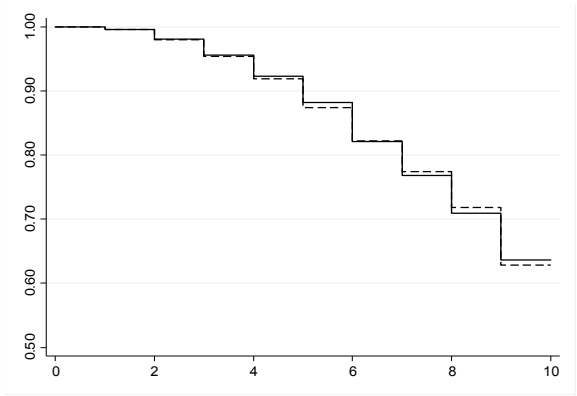
Log-rank test for equality of survivor functions: χ^2=129.31, p =0.000

(l) Dependence on fund procurement from outside—Companies with upper gearing (solid); Companies with lower gearing (dash) [b]



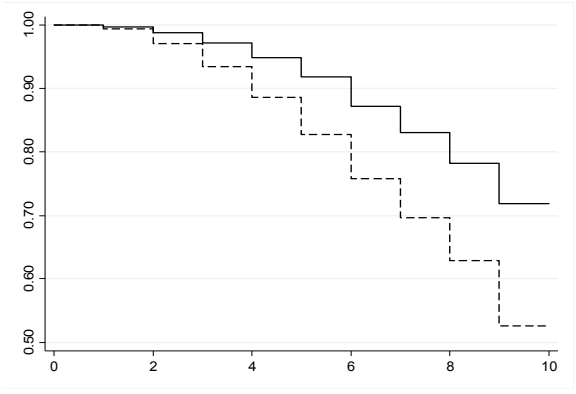
Log-rank test for equality of survivor functions: χ^2=33.75, p =0.000

(m) Firm size—Upper-scale companies in terms of total assets (solid); Lower-scale companies (dash) [b]



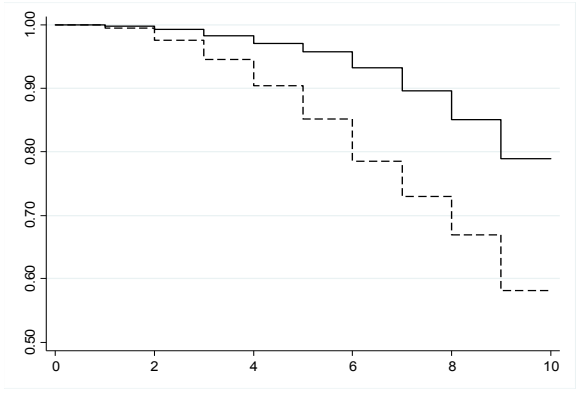
Log-rank test for equality of survivor functions: χ^2=4.03, p =0.045

(n) Firm age—Upper-age companies (solid); Lower-age companies (dash) [b]



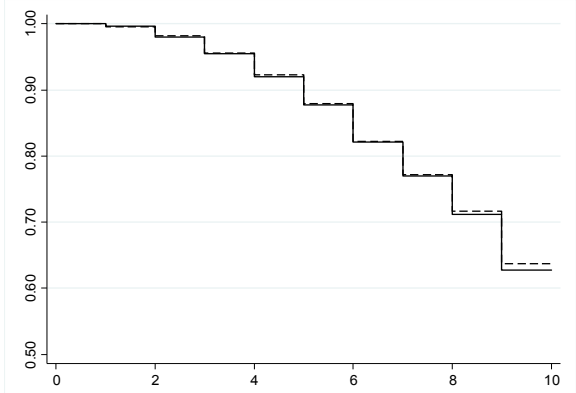
Log-rank test for equality of survivor functions: χ^2=33.75, p =0.000

(o) Business network–Companies having a subsidiary(ies) (solid); Companies not having a subsidiary (dash)



Log-rank test for equality of survivor functions: χ^2=3910.49, p =0.000

(p) Business diversification—More highly diversified companies (solid); Less-diversified companies (dash) [b]



Log-rank test for equality of survivor functions: χ^2=9.41, p =0.002

Notes:

[a] See Table 1 for definitions and descriptive statistics of variables used for comparison

[b] Observations are divided by median value of the variable in question

Source: Authors' illustrations and estimations

Table 3. Determinants of firm survival: Baseline estimation of Cox proportional hazards model, 2007–2015

Model	[1]	[2]	[3]	[4]	[5]
Target industry (NACE Rev2 section classification)	All industries (Sections A–S)	Agriculture, forestry, and fishing (Section A)	Mining and manufacturing (Sections B–E)	Construction (Section F)	Services (Sections G–S)
Legal form (Default: Other corporate forms)					
Open JSC	0.8891 **	1.1145	1.0294	0.8627	0.7733 ***
	(-2.29)	(0.70)	(0.29)	(-0.93)	(-3.42)
Closed JSC	0.5239 ***	0.6163 ***	0.6393 ***	0.5581 ***	0.4713 ***
	(-14.33)	(-3.56)	(-4.67)	(-4.22)	(-12.28)
Limited liability company	0.5859 ***	0.6291 ***	0.7202 ***	0.5930 ***	0.5089 ***
	(-12.30)	(-3.41)	(-3.58)	(-3.95)	(-11.72)
Partnership	0.5633	0.6141	0.1120 ***	2.1795 ***	0.2930 ***
	(-1.58)	(-1.08)	(-38.58)	(3.35)	(-46.39)
Cooperative	0.3290 ***	0.4401 ***	0.3862 **	0.2455 *	0.2320 ***
	(-13.91)	(-5.83)	(-2.42)	(-1.89)	(-9.69)
Ownership structure					
Number of large shareholders	0.8449 ***	0.9878	0.9081 ***	0.8630 ***	0.7665 ***
	(-8.89)	(-0.83)	(-2.60)	(-6.69)	(-16.14)
Foreign ownership	1.0027	2.0756 **	0.7911	0.9710	1.0775
	(0.03)	(2.17)	(-1.53)	(-0.07)	(0.76)
Federal state ownership	0.9308	0.8940	1.0340	1.3090 *	0.8205 **
	(-1.36)	(-0.59)	(0.36)	(1.83)	(-2.55)
Regional state ownership	0.7904 ***	0.6745 **	0.7539 ***	0.9452	0.8094 ***
	(-5.05)	(-2.21)	(-3.03)	(-0.41)	(-3.29)
Corporate governance					
Managerial discretion	1.0227 ***	0.9919	0.9944	1.0274 ***	1.0318 ***
	(11.04)	(-0.79)	(-1.07)	(5.31)	(12.66)
Number of board directors	0.8564 ***	0.8296 ***	0.8517 ***	0.8524 ***	0.8615 ***
	(-10.31)	(-3.49)	(-6.77)	(-3.64)	(-6.84)
Number of board directors ^{2}	1.0070 ***	1.0068 *	1.0071 ***	1.0085 ***	1.0059 ***
	(6.71)	(1.65)	(4.39)	(2.61)	(4.28)
Number of auditors	0.8731 ***	0.9424	0.8945 ***	0.9094 *	0.8964 ***
	(-8.25)	(-0.76)	(-3.45)	(-1.84)	(-4.90)
Number of auditors ^{2}	1.0097 ***	1.0202	1.0056 **	1.0101	1.0111 ***
	(5.91)	(0.82)	(2.54)	(0.46)	(2.78)
International audit firm	1.0839		1.6973		0.1070 ***
	(0.14)		(0.95)		(-54.01)
Large Russian audit firm	1.1122	0.1590 ***	0.8752	1.6511	1.9479
	(0.26)	(-36.83)	(-0.26)	(0.41)	(0.88)
Local Russian audit firm	1.7349 ***	0.8922	1.5127 **	0.6235	2.0049 ***
	(4.02)	(-0.15)	(2.40)	(-0.66)	(2.93)
Firm performance					
ROA	0.9925 ***	0.9860 ***	0.9910 ***	0.9939 ***	0.9930 ***
	(-17.85)	(-3.97)	(-8.33)	(-5.06)	(-14.05)
Gross margin	0.9962 ***	0.9924 ***	0.9943 ***	0.9954 ***	0.9978 ***
	(-8.19)	(-3.32)	(-4.48)	(-3.03)	(-4.18)
Linkage with capital market					
Listing on the stock market	1.8218 ***	3.5319 **	1.3766 *	4.1022 ***	1.0673
	(4.32)	(2.04)	(1.70)	(4.90)	(0.19)
Gearing	1.0002 ***	1.0007 ***	1.0004 ***	1.0002 *	1.0002 ***
	(5.89)	(3.95)	(4.33)	(1.82)	(3.97)
Firm size and age					
Firm size	0.9827 ***	0.9220 **	0.9668 **	1.0005	0.9845 **
	(-3.23)	(-2.46)	(-2.49)	(0.03)	(-2.38)
Firm age	0.9514 ***	0.9712 ***	0.9858 ***	0.9358 ***	0.9308 ***
	(-15.41)	(-3.78)	(-3.84)	(-12.11)	(-21.07)
Business organization					
Business network	0.9445 ***	0.9088 **	0.9304 ***	0.9500 ***	0.9536 ***
	(-5.44)	(-2.47)	(-5.25)	(-3.06)	(-2.89)
Business diversification	0.9971	0.9939	1.0012	0.9954	0.9957 *
	(-1.49)	(-0.81)	(0.27)	(-0.82)	(-1.71)
Federal-regional level fixed effects	Yes	Yes	Yes	Yes	Yes
NACE-division level fixed effects	Yes	Yes	Yes	Yes	Yes
N	74308	4363	16301	9317	44327
Log pseudolikelihood	-225059.16	-8194.28	-34435.82	-27715.02	-132855.55
Harrell's C-statistic	0.6866	0.6851	0.6734	0.6634	0.6973
Wald test (χ^2) [a]	5181.03 ***	72113.98 ***	3191.52 ***	5064.96 ***	16367.43 ***

Note: This table contains results of the survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the independent variables. Regression coefficients are the hazard ratio. 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] Null hypothesis: All coefficinents are zero.

Source: Authors' estimations

Table 4. Estimation of Cox proportional hazards model in different periods

Model	Table 3 Model [1]	[1]	[2] [a]	[3] [a]	[4] [a]
Estimation period	2007–2015	2007–2008	2009–2010	2011–2013	2014–2015
Legal form (Default: Other corporate forms)					
Open JSC	0.8891 **	0.8859	0.7496 *	1.0785	0.8387 **
	(-2.29)	(-0.49)	(-1.81)	(0.98)	(-2.29)
Closed JSC	0.5239 ***	0.2226 ***	0.3381 ***	0.4858 ***	0.7346 ***
	(-14.33)	(-6.28)	(-7.26)	(-10.17)	(-4.65)
Limited liability company	0.5859 ***	0.3698 ***	0.4841 ***	0.5560 ***	0.7247 ***
	(-12.30)	(-4.52)	(-5.24)	(-8.62)	(-5.01)
Partnership	0.5633	0.3580 ***	0.2382 ***	0.9864	0.4402
	(-1.58)	(-11.88)	(-18.11)	(-0.03)	(-1.16)
Cooperative	0.3290 ***	0.1446 ***	0.2184 ***	0.3062 ***	0.4712 ***
	(-13.91)	(-4.17)	(-5.96)	(-8.83)	(-6.71)
Ownership structure					
Number of large shareholders	0.8449 ***	0.6381 ***	0.6504 ***	0.7580 ***	0.9451 ***
	(-8.89)	(-7.20)	(-3.68)	(-7.73)	(-3.16)
Foreign ownership	1.0027	0.6535	2.0916 ***	1.1394	0.7282 **
	(0.03)	(-0.73)	(4.04)	(1.13)	(-2.55)
Federal state ownership	0.9308	0.9680	1.1970	0.6846 ***	1.1134
	(-1.36)	(-0.09)	(0.92)	(-4.15)	(1.53)
Regional state ownership	0.7904 ***	0.9219	1.2476	0.6154 ***	0.8965 *
	(-5.05)	(-0.31)	(1.51)	(-6.58)	(-1.72)
Corporate governance					
Managerial discretion	1.0227 ***	1.1609 ***	1.1483 ***	0.9990	0.9926 **
	(11.04)	(14.96)	(23.04)	(-0.30)	(-2.54)
Number of board directors	0.8564 ***	0.4532 ***	0.3491 ***	0.8375 ***	0.9454 ***
	(-10.31)	(-4.57)	(-5.33)	(-8.82)	(-2.56)
Number of board directors ^{2}	1.0070 ***	1.0285 ***	1.0357 ***	1.0074 ***	1.0023
	(6.71)	(5.62)	(5.52)	(6.18)	(1.43)
Number of auditors	0.8731 ***	0.8316 *	0.9289	0.8967 ***	0.8675 ***
	(-8.25)	(-1.94)	(-1.36)	(-4.02)	(-6.29)
Number of auditors ^{2}	1.0097 ***	1.0130	1.0035 ***	1.0095 ***	1.0090 ***
	(5.91)	(0.87)	(0.22)	(5.11)	(4.54)
International audit firm	1.0839	0.0946 ***	0.4240 ***	0.5302	2.0860
	(0.14)	(-30.36)	(-54.08)	(-0.58)	(1.19)
Large Russian audit firm	1.1122	0.1020 ***	1.6410 ***	0.8638	0.7082
	(0.26)	(-24.43)	(3.96)	(-0.24)	(-0.57)
Local Russian audit firm	1.7349 ***	14.4545 ***	6.4567 ***	1.6163 **	1.4093 *
	(4.02)	(3.65)	(2.57)	(2.31)	(1.84)
Firm performance					
ROA	0.9925 ***	0.9877 ***	0.9930 ***	0.9924 ***	0.9934 ***
	(-17.85)	(-5.85)	(-5.58)	(-10.64)	(-10.99)
Gross margin	0.9962 ***	1.0014	0.9964 ***	0.9963 ***	0.9959 ***
	(-8.19)	(0.65)	(-2.75)	(-4.75)	(-6.18)
Linkage with capital market					
Listing on the stock market	1.8218 ***	0.7658	0.3604	3.0704 ***	1.1685
	(4.32)	(-0.22)	(-0.74)	(6.22)	(0.75)
Gearing	1.0002 ***	0.9996 *	0.9998 *	1.0003 ***	1.0004 ***
	(5.89)	(-1.85)	(-1.72)	(4.52)	(7.23)
Firm size and age					
Firm size	0.9827 ***	1.0412	1.0542 ***	0.9848 *	0.9541 ***
	(-3.23)	(1.50)	(3.50)	(-1.72)	(-5.95)
Firm age	0.9514 ***	0.8938 ***	0.9202 ***	0.9583 ***	0.9608 ***
	(-15.41)	(-8.25)	(-11.63)	(-7.65)	(-9.34)
Business organization					
Business network	0.9445 ***	0.8546 **	0.8457 ***	0.9345 ***	0.9664 **
	(-5.44)	(-2.44)	(-3.92)	(-5.42)	(-2.38)
Business diversification	0.9971	0.9994	0.9963	0.9955	0.9985
	(-1.49)	(-0.06)	(-0.65)	(-1.38)	(-0.54)
Federal-regional level fixed effects	Yes	Yes	Yes	Yes	Yes
NACE-division level fixed effects	Yes	Yes	Yes	Yes	Yes
N	74308	74308	71262	70913	63364
Log pseudolikelihood	-225059.16	-9265.15	-26786.42	-82419.83	-105279.85
Harrell's C-statistic	0.6866	0.8224	0.7897	0.6913	0.6643
Wald test (χ^2) [a]	5181.03 ***	4898.54 ***	301961.48 ***	2050.22 ***	28796.43 ***

Note: This table contains the results from the survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the independent variables. Regression coefficients are the hazard ratio. 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] Estimation without the observations of failed firms before the period in question

[b] Null hypothesis: All coefficinents are zero.

Source: Authors' estimations

Appendix 1. Detailed breakdown of firm survival status

NACE Rev2 section	Number of firms operating at the end of 2006 (i)	Number of firms surviving until 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 until the end of 2015 (ii)	Breakdown by year											
				2007	2008	2009	2010	2011	2012	2013	2014	2015			
Agriculture, forestry, and fishing (A)	6550	4221	2329	28	67	150	188	253	409	390	400	444	0.356	0.424	0.644
Mining and quarrying (B)	1191	796	395	6	15	31	35	46	58	73	69	62	0.332	0.391	0.668
Manufacturing (C)	19133	13106	6027	60	190	319	490	645	1018	972	962	1371	0.315	0.367	0.685
Electricity, gas, steam, and air conditioning supply (D)	1989	1204	785	15	45	63	73	95	152	104	112	126	0.395	0.484	0.605
Water supply; sewage, waste management, and remediation activities (E)	1329	791	538	5	28	40	47	49	103	84	89	93	0.405	0.499	0.595
Construction (F)	13838	8117	5721	43	208	297	522	626	867	868	977	1313	0.413	0.510	0.587
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	42881	25300	17581	212	846	1396	1725	2154	2494	2208	2554	3992	0.410	0.506	0.590
Transportation and storage (H)	4886	3230	1656	21	69	100	148	195	246	233	250	394	0.339	0.400	0.661
Accommodation and food service activities (I)	1366	1010	356	2	13	23	24	63	42	38	51	100	0.261	0.294	0.739
Information and communication (J)	2808	1964	844	8	33	63	97	100	102	92	131	218	0.301	0.347	0.699
Financial and insurance activities (K)	1564	914	650	6	16	43	62	67	115	84	111	146	0.416	0.513	0.584
Real estate activities (L)	4348	2843	1505	21	51	121	151	173	319	179	223	267	0.346	0.412	0.654
Professional, scientific, and technical activities (M)	6344	4486	1858	20	86	138	186	224	270	231	282	421	0.293	0.338	0.707
Administrative and support service activities (N)	1675	1112	563	8	22	40	54	66	83	62	88	140	0.336	0.396	0.664
Public administration and defense; compulsory social security (O)	49	36	13	0	1	0	2	1	4	0	2	3	0.265	0.298	0.735
Education (P)	437	378	59	1	2	6	0	4	8	9	11	18	0.135	0.143	0.865
Human health and social work activities (Q)	881	742	139	3	5	11	6	18	20	13	23	40	0.158	0.169	0.842
Arts, entertainment, and recreation (R)	409	275	134	1	6	10	14	19	23	17	22	22	0.328	0.386	0.672
Other service activities (S)	602	461	141	2	7	11	14	15	24	12	22	34	0.234	0.261	0.766
Multiple comparison among the 19 sections															
Chi-square (χ^2) test for independence													1400.00 ***		
Cramer's coefficient of association (V)													0.1097		
Log-rank test for equality of survivor functions (χ^2)															1321.2 ***

Source: Authors' calculations and estimations

Appendix 2. Estimation of Cox proportional hazards model using industry-adjusted variables

Model	[1]	[2]	[3]	[4]	[5]
Target industry (NACE Rev2 section classification)	All industries (Sections A–S)	Agriculture, forestry, and fishing (Section A)	Mining and manufacturing (Sections B–E)	Construction (Section F)	Services (Sections G–S)
Legal form (Default: Other corporate forms)					
Open JSC	0.9863	1.2979 *	1.1429	0.9238	0.8385 **
	(-0.27)	(1.69)	(1.36)	(-0.50)	(-2.34)
Closed JSC	0.5890 ***	0.6642 ***	0.6466 ***	0.6098 ***	0.5465 ***
	(-12.02)	(-3.04)	(-4.60)	(-3.61)	(-9.99)
Limited liability company	0.6234 ***	0.7071 ***	0.6707 ***	0.6399 ***	0.5785 ***
	(-11.41)	(-2.58)	(-4.44)	(-3.41)	(-9.72)
Partnership	0.6190	0.6597	0.1940 ***	2.1466 ***	0.1400 ***
	(-1.35)	(-0.94)	(-41.12)	(2.74)	(-37.96)
Cooperative	0.3704 ***	0.4660 ***	0.4519 **	0.2357 *	0.2613 ***
	(-12.50)	(-5.60)	(-2.01)	(-1.94)	(-8.97)
Ownership structure					
Number of large shareholders (industry adjusted)	0.6374 ***	0.6379 ***	0.6889 ***	0.6927 ***	0.5989 ***
	(-32.07)	(-4.69)	(-12.39)	(-11.52)	(-28.33)
Foreign ownership	1.0111	2.3012 **	0.7506 *	0.9354	1.1189
	(0.14)	(2.32)	(-1.87)	(-0.16)	(1.14)
Federal state ownership	0.9328	0.8570	1.0309	1.3124 *	0.8328 **
	(-1.33)	(-0.82)	(0.33)	(1.84)	(-2.37)
Regional state ownership	0.7903 ***	0.6512 **	0.7386 ***	0.9521	0.8317 ***
	(-5.12)	(-2.44)	(-3.30)	(-0.36)	(-2.90)
Corporate governance					
Managerial discretion (industry adjusted)	1.0497 ***	0.9830	1.0014	1.0539 ***	1.0801 ***
	(10.41)	(-0.81)	(0.13)	(5.09)	(12.14)
Number of board directors (industry adjusted)	0.8083 ***	0.7303 ***	0.8092 ***	0.8151 ***	0.7990 ***
	(-10.79)	(-4.84)	(-6.57)	(-3.85)	(-6.91)
Number of auditors (industry adjusted)	0.9411 ***	0.9612	0.9745	0.9430	0.9360 ***
	(-3.99)	(-0.60)	(-0.79)	(-1.47)	(-3.27)
International audit firm	0.7819		1.1487		0.1280 ***
	(-0.46)		(0.24)		(-48.14)
Large Russian audit firm	0.9710	0.2620 ***	0.8655	1.0520	1.5186
	(-0.07)	(-42.74)	(-0.27)	(0.05)	(0.56)
Local Russian audit firm	1.4937 ***	1.2868	1.4021 **	0.5466	1.7989 **
	(3.03)	(0.36)	(2.02)	(-0.89)	(2.50)
Firm performance					
ROA (industry adjusted)	0.9559 ***	0.9259 ***	0.9511 ***	0.9694 ***	0.9570 ***
	(-19.43)	(-4.33)	(-8.63)	(-4.44)	(-15.74)
Gross margin (industry adjusted)	0.9752 ***	0.9685 **	0.9717 ***	0.9682 ***	0.9807 ***
	(-10.41)	(-2.32)	(-4.72)	(-4.03)	(-6.74)
Linkage with capital market					
Listing on the stock market	1.9095 ***	3.9260 **	1.4757 **	4.1186 ***	1.1399
	(4.87)	(2.31)	(2.20)	(5.34)	(0.39)
Gearing (industry adjusted)	1.0040 ***	1.0160 ***	1.0046 **	1.0065 **	1.0029 **
	(4.42)	(3.99)	(2.25)	(2.40)	(2.55)
Firm size and age					
Firm size (industry adjusted)	0.9965 ***	0.9999	1.0000	1.0001 *	1.0000
	(-2.67)	(-0.57)	(0.18)	(1.73)	(0.97)
Firm age (industry adjusted)	0.8630 ***	0.9356 ***	0.8809 ***	0.8592 ***	0.8549 ***
	(-33.25)	(-3.46)	(-12.55)	(-13.84)	(-27.00)
Business organization					
Business network (industry adjusted)	0.8281 ***	0.7362 ***	0.8233 ***	0.8379 ***	0.8351 ***
	(-14.28)	(-6.16)	(-7.23)	(-5.41)	(-9.72)
Business diversification (industry adjusted)	0.9917 **	0.9889	1.0010	0.9930	0.9896 **
	(-2.04)	(-0.66)	(0.00)	(-0.61)	(-2.02)
Federal-regional level fixed effects	Yes	Yes	Yes	Yes	Yes
NACE-division level fixed effects	Yes	Yes	Yes	Yes	Yes
N	74308	4363	16301	9317	44327
Log pseudolikelihood	-224204.08	-8124.25	-34237.64	-27645.63	-132545.05
Harrell's C-statistic	0.6955	0.7117	0.6904	0.6714	0.7024
Wald test (χ^2) [a]	13208.31 ***	72083.03 ***	3943.43 ***	10250.87 ***	13418.30 ***

Note: This table contains results from the survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the independent variables. Regression coefficients are the hazard ratio. 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] Null hypothesis: All coefficinents are zero.

Source: Authors' estimations

Appendix 3. Estimation of Cox proportional hazards model by regional group

Model	[1]	[2]	[3]	[4]	[5]
Targeted federal district(s)	North Caucasus and Southern Districts	Northwestern District	Central District	Volga and Ural Districts	Siberian and Far East Districts
Legal form (Default: Other corporate forms)					
Open JSC	1.3021	0.9286	0.7441 ***	1.1432	0.9090
	(1.31)	(-0.43)	(-3.15)	(1.18)	(-0.57)
Closed JSC	0.5723 ***	0.4169 ***	0.5606 ***	0.6000 ***	0.4919 ***
	(-2.86)	(-6.10)	(-6.84)	(-5.08)	(-4.98)
Limited liability company	0.5962 ***	0.5094 ***	0.6320 ***	0.6201 ***	0.5391 ***
	(-2.84)	(-4.88)	(-5.59)	(-4.90)	(-4.70)
Partnership	0.2120 ***		0.9438	2.5399 ***	0.3510 ***
	(-32.33)		(-0.05)	(4.11)	(-44.81)
Cooperative	0.3733 *	0.2236 ***	0.1634 ***	0.2489 ***	0.2415 **
	(-1.93)	(-3.19)	(-4.63)	(-3.68)	(-2.29)
Ownership structure					
Number of large shareholders	0.8959 ***	0.8019 ***	0.8198 ***	0.8022 ***	0.8072 ***
	(-3.01)	(-6.58)	(-7.80)	(-4.43)	(-6.22)
Foreign ownership	0.6330	1.3041	0.8980	1.2779	1.0430
	(-0.92)	(1.27)	(-0.96)	(1.32)	(0.14)
Federal state ownership	0.7972	1.1345	1.0352	0.9910	0.8496
	(-1.15)	(0.80)	(0.37)	(-0.08)	(-1.16)
Regional state ownership	0.7852	0.5863 ***	1.0511	0.7631 ***	0.5712 ***
	(-1.30)	(-3.55)	(0.55)	(-2.77)	(-3.86)
Corporate governance					
Managerial discretion	1.0107	0.9967	1.0422 ***	1.0173 ***	1.0128 **
	(1.30)	(-0.52)	(13.53)	(3.78)	(2.17)
Number of board directors	0.8171 ***	0.9221 **	0.8844 ***	0.7957 ***	0.8658 ***
	(-4.37)	(-2.08)	(-4.70)	(-6.73)	(-3.02)
Number of board directors ^{2}	1.0058 **	1.0014	1.0064 ***	1.0111 ***	1.0066 **
	(1.98)	(0.60)	(4.12)	(4.58)	(2.02)
Number of auditors	1.0013	0.6858 ***	0.8696 ***	0.9239 **	0.9800
	(0.02)	(-6.56)	(-4.86)	(-2.23)	(-0.41)
Number of auditors ^{2}	0.9748	1.0458 ***	1.0140 ***	1.0051 **	1.0121 *
	(-0.54)	(3.26)	(3.59)	(2.10)	(1.71)
International audit firm	0.1310 ***	3.5974	0.8526	0.6834	0.3110 ***
	(-14.84)	(1.04)	(-0.14)	(-0.32)	(-35.16)
Large Russian audit firm	1.5069	0.3190 ***	0.9249	2.1987	1.2545
	(0.41)	(-46.74)	(-0.10)	(1.07)	(0.31)
Local Russian audit firm	0.7967	1.2713	2.3442 ***	1.7912 **	1.0350
	(-0.27)	(0.59)	(3.42)	(2.15)	(0.09)
Firm performance					
ROA	0.9922 ***	0.9923 ***	0.9942 ***	0.9916 ***	0.9892 ***
	(-4.72)	(-5.54)	(-9.46)	(-8.66)	(-8.52)
Gross margin	0.9952 **	0.9939 ***	0.9970 ***	0.9960 ***	0.9787
	(-2.21)	(-3.59)	(-4.75)	(-3.46)	(-0.02)
Linkage with capital market					
Listing on the stock market	2.5139 **	3.0520 ***	1.2647	3.2304 ***	0.9601
	(2.44)	(2.62)	(0.89)	(4.15)	(-0.08)
Gearing	1.0003 *	1.0002	1.0002 ***	1.0002 **	1.0003 ***
	(1.91)	(1.30)	(2.72)	(2.21)	(3.19)
Firm size and age					
Firm size	0.9976	0.9694	0.9988	0.9575 ***	0.9629 **
	(-0.10)	(-1.60)	(-0.17)	(-3.22)	(-2.23)
Firm age	0.9595 ***	0.9733 ***	0.9413 ***	0.9496 ***	0.9293 ***
	(-4.25)	(-3.20)	(-13.42)	(-7.83)	(-11.15)
Business organization					
Business network	0.9439 **	0.9966	0.9454 ***	0.9292 ***	0.9577 **
	(-2.22)	(-0.10)	(-5.48)	(-4.92)	(-2.18)
Business diversification	0.9924	0.9933	0.9999	0.9966	1.0035
	(-1.00)	(-1.05)	(-0.04)	(-0.79)	(0.61)
Federal-regional level fixed effects	Yes	Yes	Yes	Yes	Yes
NACE-division level fixed effects	Yes	Yes	Yes	Yes	Yes
N	6241	9098	32318	17082	9569
Log pseudolikelihood	-11215.77	-17535.17	-85876.06	-38633.70	-21137.39
Harrell's C-statistic	0.6797	0.6915	0.6959	0.6911	0.6976
Wald test (χ^2) [a]	64846.36 ***	33693.37 ***	19703.12 ***	33330.81 ***	25227.92 ***

Note: This table contains results from the survival analysis using the Cox proportional hazards model. Table 1 provides detailed definitions and descriptive statistics of the independent variables. Regression coefficients are the hazard ratio. 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] Null hypothesis: All coefficinents are zero.

Source: Authors' estimations

Appendix 4. Estimation of a parametric survival model for a robustness check

Model	Table 3 Model [1]	[1]	[2]	[3]	[4]	[5]	[6]
Assumption of survival distribution	Cox propotional hazards	Exponential	Weibull	Gompertz	Log-normal	Log-logistic	Generalized gamma
Legal form (Default: Other corporate forms)							
Open JSC	0.8891 **	0.8922 **	0.8845 **	0.8843 **	0.0959 ***	0.0573 **	0.0525 **
	(-2.29)	(-2.40)	(-2.31)	(-2.30)	(3.76)	(2.53)	(2.41)
Closed JSC	0.5239 ***	0.5536 ***	0.5136 ***	0.5128 ***	0.3471 ***	0.2887 ***	0.2751 ***
	(-14.33)	(-13.99)	(-14.24)	(-14.17)	(15.38)	(14.41)	(14.23)
Limited liability company	0.5859 ***	0.6128 ***	0.5762 ***	0.5749 ***	0.2501 ***	0.2347 ***	0.2256 ***
	(-12.30)	(-12.05)	(-12.22)	(-12.19)	(11.21)	(12.03)	(12.13)
Partnership	0.5633	0.5779	0.5523	0.5536	0.3639 **	0.2691 *	0.2493 *
	(-1.58)	(-1.59)	(-1.59)	(-1.57)	(2.35)	(1.83)	(1.66)
Cooperative	0.3290 ***	0.3505 ***	0.3206 ***	0.3199 ***	0.5601 ***	0.4781 ***	0.4653 ***
	(-13.91)	(-13.58)	(-13.90)	(-13.86)	(15.73)	(14.47)	(14.03)
Ownership structure							
Number of large shareholders	0.8449 ***	0.8612 ***	0.8387 ***	0.8384 ***	0.0309 ***	0.0681 ***	0.0696 ***
	(-8.89)	(-8.38)	(-9.08)	(-9.08)	(3.58)	(8.38)	(8.81)
Foreign ownership	1.0027	0.9943	0.9909	0.9873	-0.0498	-0.0187	-0.0016
	(0.03)	(-0.08)	(-0.11)	(-0.16)	(-1.32)	(-0.53)	(-0.05)
Federal state ownership	0.9308	0.9454	0.9317	0.9310	0.0316	0.0289	0.0291
	(-1.36)	(-1.11)	(-1.30)	(-1.30)	(1.29)	(1.30)	(1.32)
Regional state ownership	0.7904 ***	0.8130 ***	0.7851 ***	0.7839 ***	0.0918 ***	0.0967 ***	0.0974 ***
	(-5.05)	(-4.73)	(-5.00)	(-5.00)	(4.16)	(4.81)	(4.96)
Corporate governance							
Managerial discretion	1.0227 ***	1.0188 ***	1.0233 ***	1.0228 ***	-0.0132 ***	-0.0111 ***	-0.0098 ***
	(11.04)	(9.92)	(10.85)	(10.56)	(-12.78)	(-11.94)	(-10.69)
Number of board directors	0.8564 ***	0.8659 ***	0.8541 ***	0.8543 ***	0.0831 ***	0.0681 ***	0.0649 ***
	(-10.31)	(-11.07)	(-10.07)	(-10.29)	(12.58)	(10.01)	(10.11)
Number of board directors^2	1.0070 ***	1.0065 ***	1.0072 ***	1.0071 ***	-0.0037 ***	-0.0032 ***	-0.0030 ***
	(6.71)	(7.59)	(6.54)	(6.79)	(-8.21)	(-6.39)	(-6.57)
Number of auditors	0.8731 ***	0.8781 ***	0.8691 ***	0.8686 ***	0.0980 ***	0.0646 ***	0.0593 ***
	(-8.25)	(-8.26)	(-8.26)	(-8.25)	(11.03)	(8.31)	(8.50)
Number of auditors^2	1.0097 ***	1.0092 ***	1.0100 ***	1.0101 ***	-0.0063 ***	-0.0046 ***	-0.0041 ***
	(5.91)	(5.87)	(6.06)	(6.14)	(-3.31)	(-3.02)	(-5.79)
International audit firm	1.0839	1.1182	1.0793	1.0781	-0.2034	-0.0805	-0.0473
	(0.14)	(0.20)	(0.13)	(0.13)	(-0.76)	(-0.31)	(-0.20)
Large Russian audit firm	1.1122	1.1119	1.1022	1.0957	-0.3321 *	-0.1090	-0.0649
	(0.26)	(0.27)	(0.23)	(0.22)	(-1.77)	(-0.62)	(-0.38)
Local Russian audit firm	1.7349 ***	1.6918 ***	1.7599 ***	1.7606 ***	-0.3083 ***	-0.2610 ***	-0.2395 ***
	(4.02)	(3.97)	(4.02)	(4.00)	(-4.79)	(-4.38)	(-4.18)
Firm performance							
ROA	0.9925 ***	0.9929 ***	0.9922 ***	0.9921 ***	0.0038 ***	0.0033 ***	0.0032 ***
	(-17.85)	(-17.77)	(-17.77)	(-17.73)	(18.43)	(18.00)	(17.76)
Gross margin	0.9962 ***	0.9964 ***	0.9961 ***	0.9960 ***	0.0019 ***	0.0017 ***	0.0016 ***
	(-8.19)	(-8.33)	(-8.15)	(-8.17)	(8.51)	(8.48)	(8.25)
Linkage with capital market							
Listing on the stock market	1.8218 ***	1.7398 ***	1.8455 ***	1.8525 ***	-0.2363 ***	-0.2571 ***	-0.2487 ***
	(4.32)	(4.21)	(4.29)	(4.29)	(-3.57)	(-4.37)	(-4.31)
Gearing	1.0002 ***	1.0002 ***	1.0002 ***	1.0002 ***	-0.0001 ***	-0.0001 ***	-0.0001 ***
	(5.89)	(6.51)	(5.79)	(5.84)	(-5.15)	(-5.81)	(-5.78)
Firm size and age							
Firm size	0.9827 ***	0.9804 ***	0.9814 ***	0.9809 ***	0.0121 ***	0.0076 ***	0.0077 ***
	(-3.23)	(-3.93)	(-3.33)	(-3.39)	(3.86)	(3.16)	(3.31)
Firm age	0.9514 ***	0.9551 ***	0.9488 ***	0.9485 ***	0.0140 ***	0.0206 ***	0.0209 ***
	(-15.41)	(-14.75)	(-15.85)	(-15.90)	(8.08)	(13.56)	(14.98)
Business organization							
Business network	0.9445 ***	0.9476 ***	0.9431 ***	0.9429 ***	0.0172 **	0.0233 ***	0.0234 ***
	(-5.44)	(-5.30)	(-5.51)	(-5.52)	(2.34)	(5.19)	(5.33)
Business diversification	0.9971	0.9972	0.9970	0.9970	0.0011	0.0014	0.0012
	(-1.49)	(-1.50)	(-1.46)	(-1.46)	(1.15)	(1.56)	(1.47)
Federal-regional level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NACE-division level fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	74308	74308	74308	74308	74308	74308	74308
Log pseudolikelihood	-225059.16	-51219.16	-44160.05	-44857.43	-44807.73	-44153.59	-44151.38
Wald test (χ^2) [a]	5181.03 ***	6806.54 ***	6783.80 ***	6583.53 ***	6215.91 ***	5321.92 ***	5126.43 ***

Note: This table contains results from the survival analysis using 6 parametric estimators for a robustness check. Table 1 provides detailed definitions and descriptive statistics of the independent variables. Models [1] to [3] report hazard ratios, while Models [4] to [6] report regression coefficients. 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] Null hypothesis: All coefficinents are zero.

Source: Authors' estimations