

# **Survival of Russian Firms during the Crisis Period: 2006-2015**

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Why do firms fail? This question, which is central to understanding the growth of a country as well as firm dynamics, has attracted much attention and produced a large body of the literature. Among factors determining firm survival and growth, firm-specific ones are regarded as the most likely explanations. Studies find that differences in ownership and corporate governance account for firm performance (Mata and Portugal, 1994; Classens et al, 1999; Mitton, 2002; Anderson and Reeb, 2003; Commander and Svejnar, 2011). Outsider ownership including foreigners and independent board of directors are suggested as the typical characteristics of surviving firms. Firm size and age are found to be correlated with firm failure: Large firms are less likely to fail whereas the effect of firm age is non-linear (Audretsch and Mahmood, 1995; Dunne and Hughes 1994; Mata and Portugal, 1994; Agarwal et al, 2002). In addition, there is evidence that the orientation of firms affects firm survival. Firms oriented toward innovation, export and diversification survive longer (Audretsch, 1991; Tybout, 2003; Commander and Svejnar, 2011).

Why do firms fail during economic crisis? This is a related question but the answers to this are not necessarily the same as those to one on firm survival and failure during normal periods. Using the data from Indonesia, Korea, Malaysia, the Philippines, and Thailand during the East Asian financial crisis of 1997–1998, Mitton (2002) finds that firms that were focused rather than diversified performed better in terms of stock market price. Heavy exposure to bank lending and firms affiliated with conglomerates are also associated with failure during the crisis period (Baek et al, 2004; Boeri et al, 2013). It is also found that board independent of owners or managers and institutional ownership suffered less from the economic shock (Kang et al, 2010; Erkens et al., 2012; Francis et al, 2012).

This paper uses the survey data of Russian firms more than 70,000 from 2007 to 2015 to understand the determinants of firm survival. We contribute to the literature in the following respects. First, this paper is the first one in contrasting factors determining firm survival during normal periods with those during crisis periods. The Russian case provides an excellent

opportunity for this empirical exercise because it 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 from the United States in 2008 and thus shed GDP by 7.8% in 2009. Thanks to a surge in oil price from 2010 to 2012, however, the Russian economy rebounded and recorded a 4.1% growth per annum during the above period. This trend reversed again from 2013 at least partially by decreases in the oil price and economic sanctions because of Russia's annexation with 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 down 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, heterogeneity in firm-specific factors is more pronounced in Russia as a transition country than in other non-transition countries. During a transition from socialism to a market economy some features inherited from socialism still remains with those consistent with a market and an open economy. For example, a substantial extent of state ownership coexists with private ownership including foreign one and with cooperatives. Some firms began to employ an international audit as an external auditor but other firms rely on Russian audit firms. We take advantage of such diversity in understanding the effects of various firm-specific factors on survival. Third, 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 one caused by decreases in the oil price and economic sanctions. Are there any differences in the mechanism that a crisis influences firm survival depending upon the nature of an economic crisis? This paper aims to answer to this question.

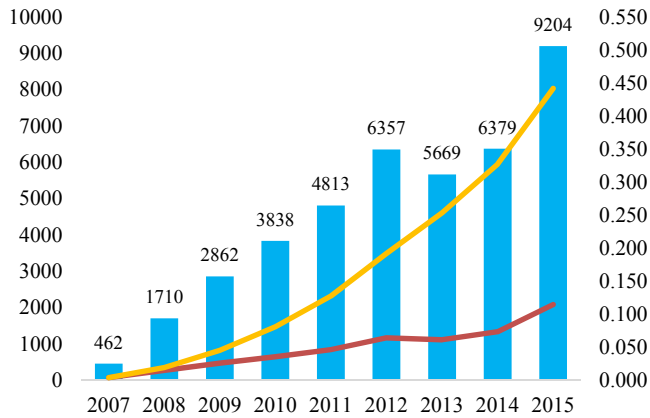
**Table 1.** Standard theory of the determinants of firm survival

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

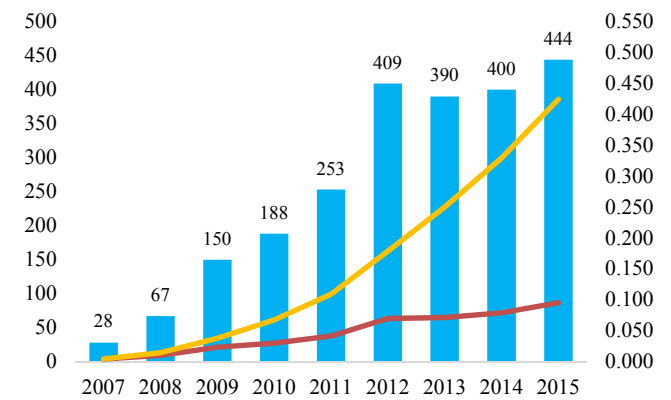
Note: The sign '+' denotes a positive correlation between a given factor and the survival probability, '-' for a negative correlation. The question mark, "?," means that the impact is unpredictable.

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

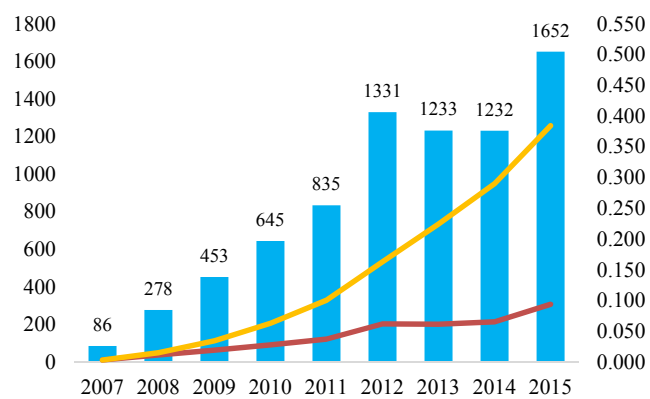
(a) All industries (Sections A-S)



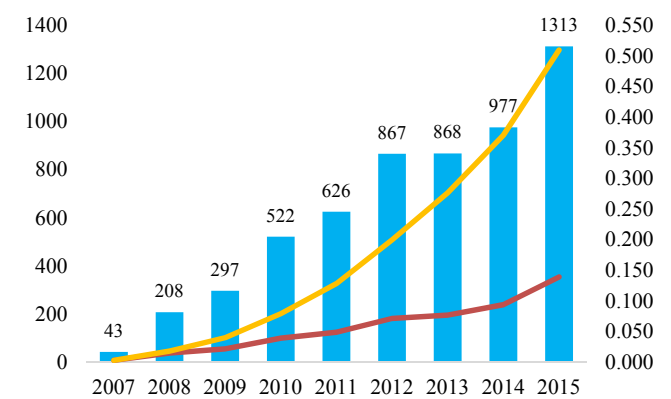
(b) Agriculture, forestry and fishing (Section A)



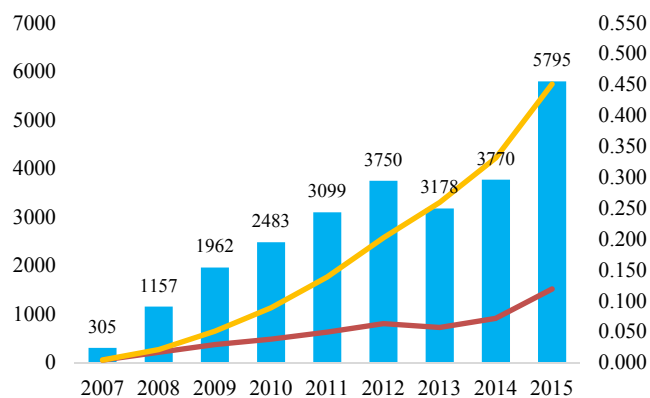
(c) Mining and manufacturing (Sections B-E)



(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 1.

Source: Illustrated by the authors

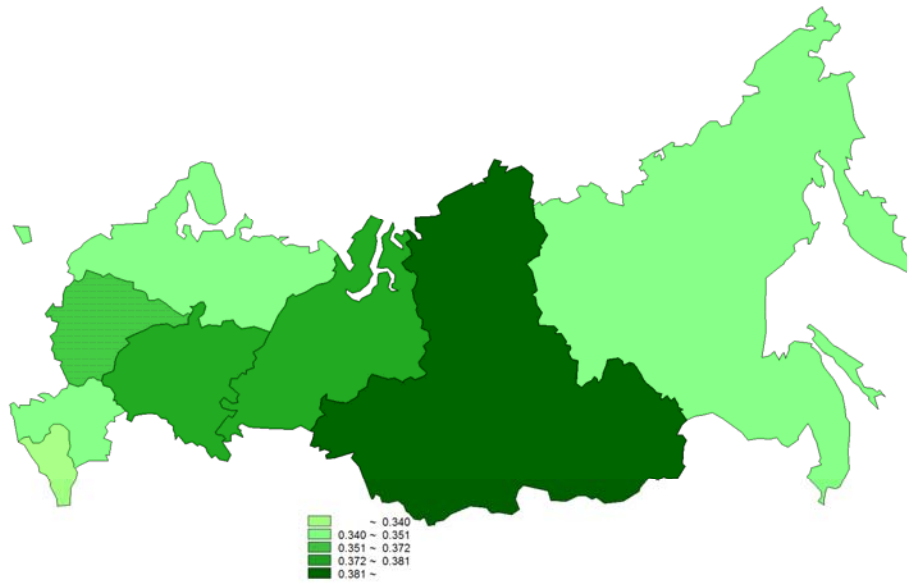
**Table 2.** Detailed breakdown of the firm survival status

NACE Rev 2 section	Number of operating firms in the end of 2006 (i)	Number of surviving firms 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; sewerage, 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 ( $\chi^2$ ) test for independence													1400.00	***		
Cramer's coefficient of association ( $V$ )													0.1097			
Log-rank test for equality of survivor functions ( $\chi^2$ )															1321.2	***

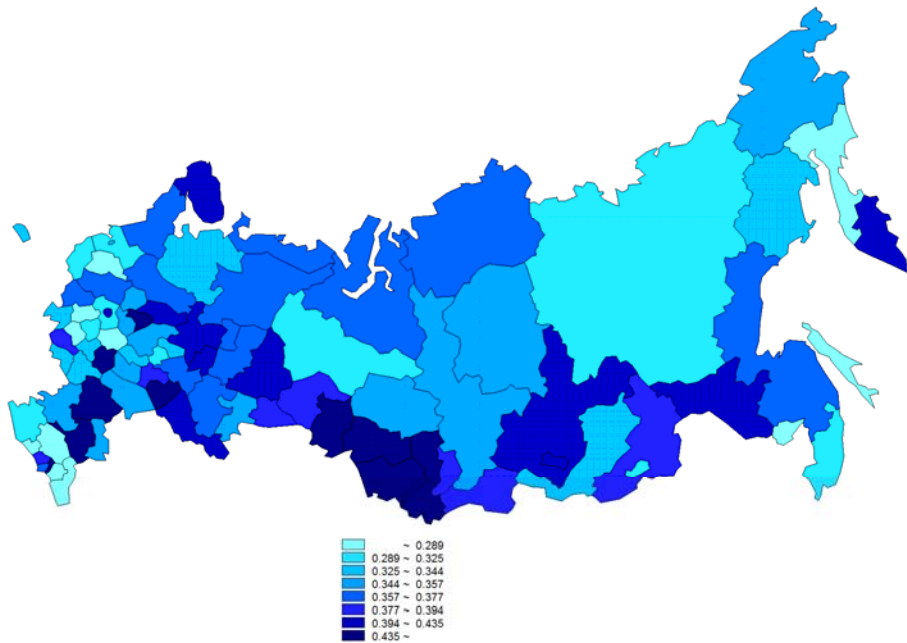
Source: Authors' calculation and estimation

**Figure 2.** Geographical distribution of firm exit rate

(a) Federal districts<sup>a</sup>



(b) Federal regions<sup>b</sup>



Notes:

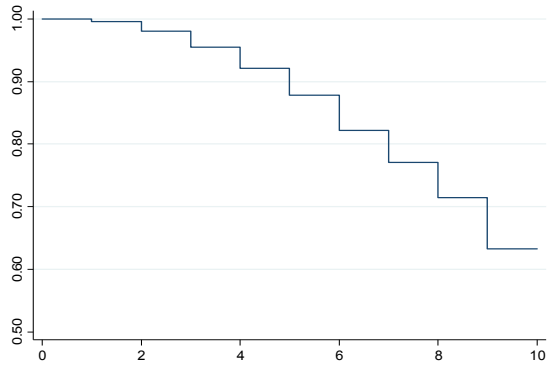
<sup>a</sup> Descriptive statistics are as follows: Mean 0.359; S.D. 0.042; Kurtosis 1.380; Skewness -0.217. Kolmogorov-Smirnov test for normality:  $D=0.1982$  ( $p=0.296$ ).

<sup>b</sup> Descriptive statistics are as follows: Mean 0.365; S.D. 0.076; Kurtosis 3.038; Skewness 3.038. Kolmogorov-Smirnov test for normality:  $D=0.1097$  ( $p=0.016$ ).

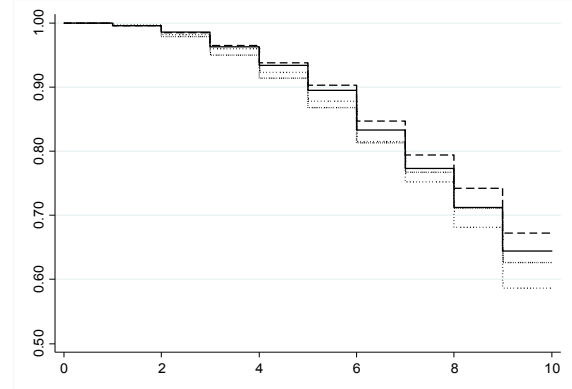
Source: Authors' illustration

**Figure 3. Kaplan-Meier survivor function of the firm survival probability<sup>a</sup>**

(a) All firms

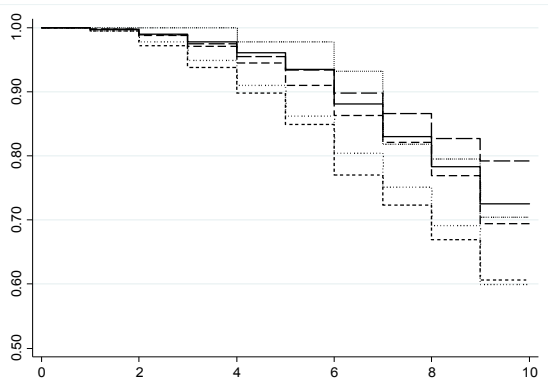


(b) Industry - Agriculture, forestry and fishing (solid); Mining and manufacturing (dash); Construction (dot); Services (tight dot)



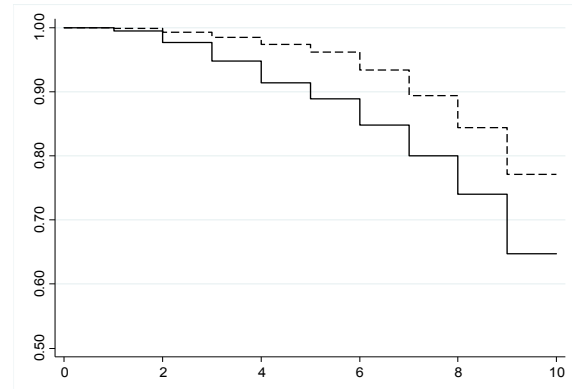
Log-rank test for equality of survivor functions:  $\chi^2=288.87, p=0.000$

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



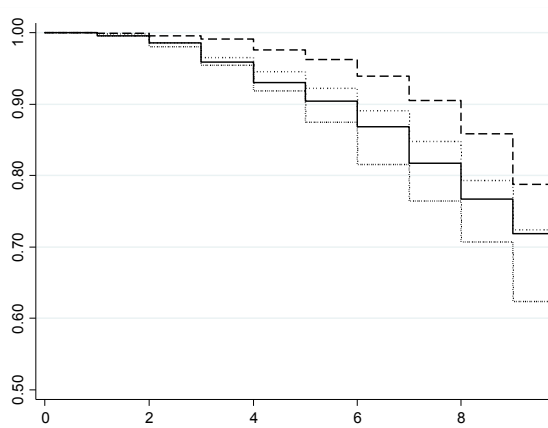
Log-rank test for equality of survivor functions:  $\chi^2=1383.19, p=0.000$

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

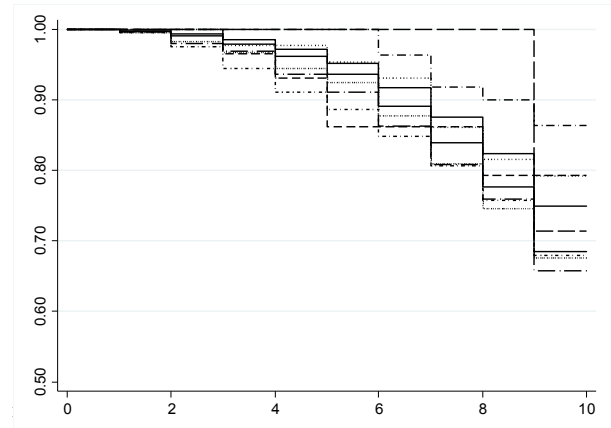


Log-rank test for equality of survivor functions:  $\chi^2=1734.65, p=0.000$

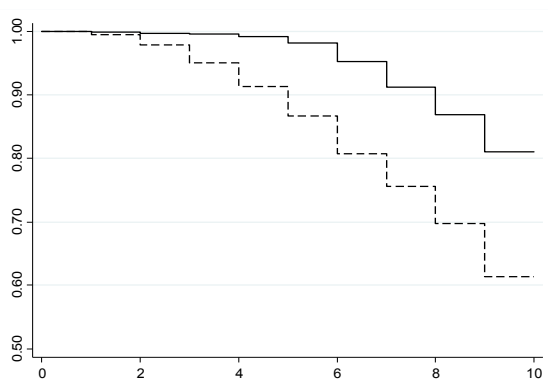
(e) Foreign and state ownership - Foreign ownership (solid); Federal state ownership (dash); Regional state ownership (dot); Others (tight dot)



(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)

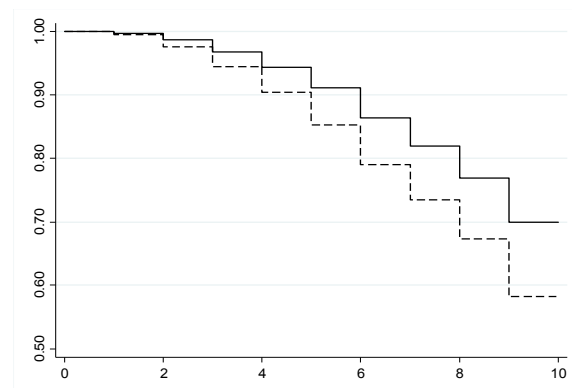


(g) Number of board directors - Companies with upper number of board directors (solid); Companies with lower number of board directors (dash)<sup>b</sup>



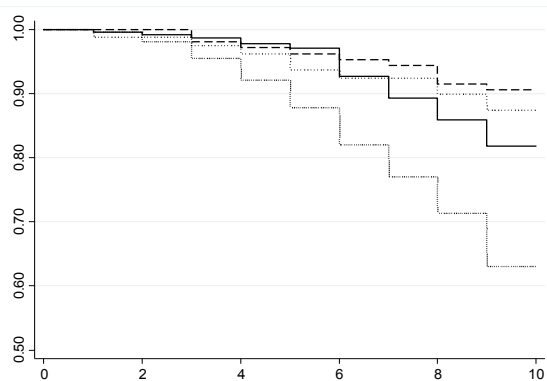
Log-rank test for equality of survivor functions:  $\chi^2=1594.65, p=0.000$

(h) Number of auditors - Companies with upper number of auditors (solid); Companies with lower number of auditors (dash)<sup>b</sup>



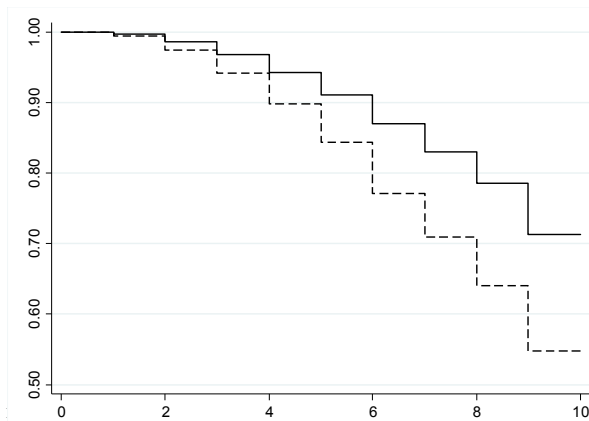
Log-rank test for equality of survivor functions:  $\chi^2=1692.48, p=0.000$

(i) Quality of external audit - International audit firm (solid); Russian large audit firm (dash); Russian local audit firm (dot); No external auditor (tight dot)

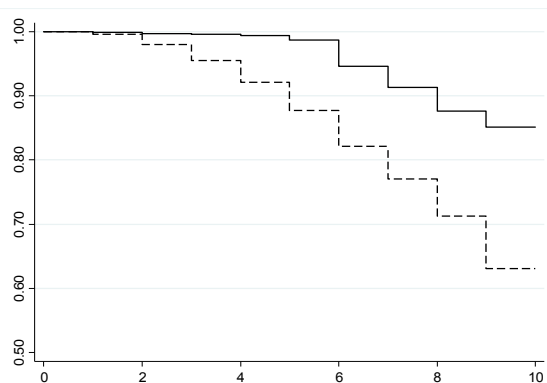


Log-rank test for equality of survivor functions:  $\chi^2=142.55, p=0.000$

(j) Firm performance - Companies with upper ROA (solid); Companies with lower ROA (dash)

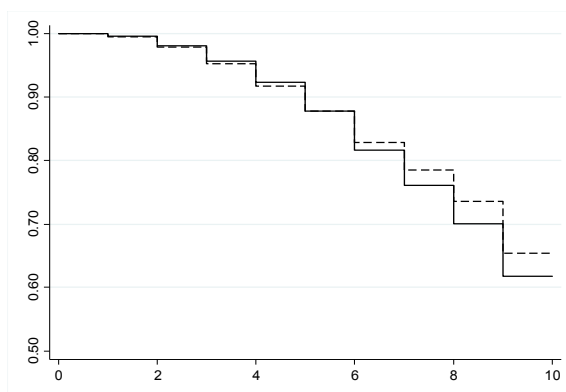


(k) Dependence on stock market - Listed companies (solid); Unlisted companies (dash)



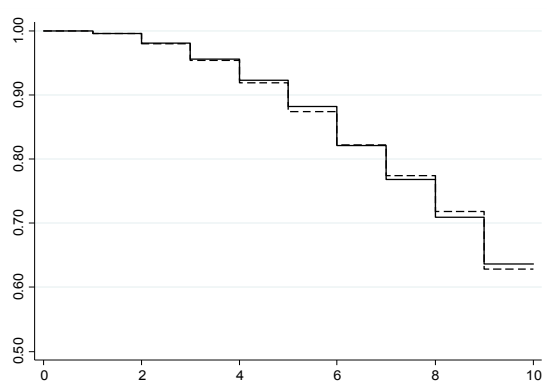
Log-rank test for equality of survivor functions:  $\chi^2=129.31, p=0.000$

(l) Dependence on fund procurement from outside - Companies with upper gearing (solid); Companies with lower gearing (dash)



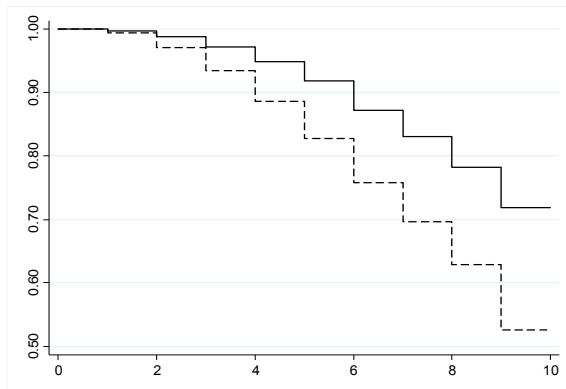
Log-rank test for equality of survivor functions:  $\chi^2=33.75, p=0.000$

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



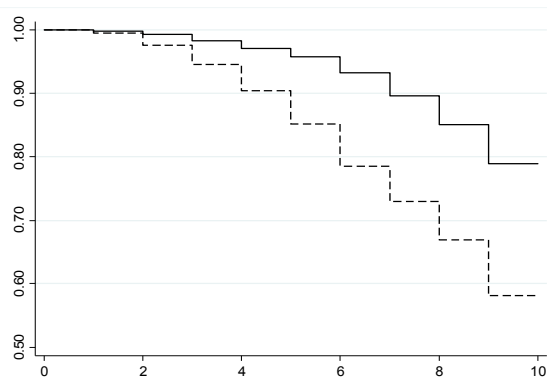
Log-rank test for equality of survivor functions:  $\chi^2=4.03, p=0.045$

(n) Firm age - Upper-age companies (solid); Lower-age companies (dash)



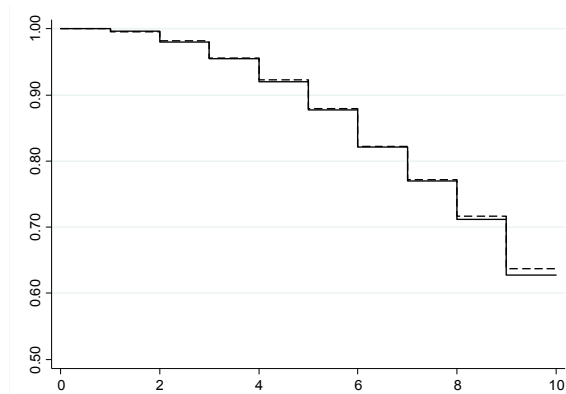
Log-rank test for equality of survivor functions:  $\chi^2=33.75, p=0.000$

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



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

(p) Business diversification - Higher diversified companies (solid); Less diversified companies (dash)



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

Notes:

<sup>a</sup> See Table 3 for definitions and descriptive statistics of variables used for comparison

<sup>b</sup> Observations are divided by medium value of the variable in question

Source: Authors' illustration and estimation



**Table 3.** Definitions and descriptive statistics of the variables used in the empirical analysis and comparison of surviving and failed firms based on these variables

Variable name	Definition	Descriptive statistics					Comparison of surviving and failed firms				Correlation coefficients with the survival probability <sup>c</sup>
							Surviving firms		Failed firms		
		Mean	S.D.	Median	Max.	Min.	Mean/proportion	Median	Mean/proportion <sup>a</sup>	Median <sup>b</sup>	
Open JSC (default category)	Dummy variable for open joint-stock companies	0.1076	0.3099	0	1	0	0.1234	0	0.0805 †††	0 ***	0.067 ***
Closed JSC	Dummy variable for closed joint-stock companies	0.1477	0.3548	0	1	0	0.1622	0	0.1229 †††	0 ***	0.053 ***
Limited liability company	Dummy variable for limited liability companies	0.6567	0.4748	1	1	0	0.6228	1	0.7151 †††	1 ***	-0.094 ***
Partnership	Dummy variable for partnerships	0.0004	0.0198	0	1	0	0.0004	0	0.0003	0	0.003
Cooperative	Dummy variable for cooperatives	0.0247	0.1552	0	1	0	0.0310	0	0.0139 †††	0 ***	0.053 ***
Other corporate forms	Dummy variable for companies with a corporate form other than listed above	0.0629	0.2429	0	1	0	0.0602	0	0.0673 †††	0 ***	-0.014 ***
Number of large shareholders	Total number of dominant and block shareholders	1.5944	2.9463	1	222	0	1.8554	1	1.1457 ***	1 ***	0.116 ***
Foreign ownership	Dummy for ultimate ownership of foreign investors	0.0089	0.0941	0	1	0	0.0101	0	0.0068 †††	0 ***	0.017 ***
Federal state ownership	Dummy for ultimate ownership of the Russian federal government	0.0230	0.1500	0	1	0	0.0286	0	0.0133 †††	0 ***	0.049 ***
Regional state ownership	Dummy for ultimate ownership of Russian regional governments	0.0366	0.1877	0	1	0	0.0419	0	0.0274 †††	0 ***	0.037 ***
Managerial discretion	BvD independent indicator (0: D; 1: C; 2: C+; 3: B-; 4: B; 5: B+; 6: A-; 7: A; 8: A+) <sup>d</sup>	3.3887	3.6347	0	8	0	3.3982	0	3.3683	0	0.004
Number of board directors	Number of recorded members of the board of directors	1.4990	1.8786	1	36	0	1.6610	1	1.2207 †††	1 ***	0.113 ***
Number of auditors	Number of recorded corporate auditors	0.4722	0.6730	0	27	0	0.5300	0	0.3729 †††	0 ***	0.113 ***
International audit firm	Dummy for firms which employ an international audit firm as external auditor	0.0007	0.0272	0	1	0	0.0010	0	0.0002 †††	0 ***	0.013 ***
Russian large audit firm	Dummy for firms which employ a Russian large audit firm as external auditor	0.0009	0.0307	0	1	0	0.0014	0	0.0002 †††	0 ***	0.017 ***
Russian local audit firm	Dummy for firms which employ a Russian local audit firm/auditor as external auditor	0.0063	0.0789	0	1	0	0.0081	0	0.0031 †††	0 ***	0.031 ***
ROA	Return on total assets (%) <sup>e</sup>	10.5969	20.6488	5.9900	100.0000	-100.0000	12.9252	8.1100	6.5851 ***	3.2100 ***	0.148 ***
Gross margin	Gross margin (%) <sup>f</sup>	14.2612	20.4413	9.7900	100.0000	-100.0000	15.9532	11.5800	11.3403 ***	6.9200 ***	0.109 ***
Listed	Dummy variable for listed companies	0.0062	0.0784	0	1	0	0.0083	0	0.0025 †††	0 ***	0.036 ***
Gearing	Gearing (%) <sup>g</sup>	71.3754	160.5372	1.1600	1000.0000	0.0000	64.4100	1.5700	85.5435 ***	0.4400 ***	-0.062 ***
Company size	Natural logarithm of total assets	10.0985	1.7179	10	22.82788	0	10.1370	10.06407	10.0311 ***	10.02977 ***	0.030 ***
Firm age	Years in operation	16.7947	9.1338	15	304	8	17.7397	17	15.1689 ***	14 ***	0.136 ***
Firm network	Number of recorded subsidiaries	0.7380	3.8969	0	628	0	0.9718	0	0.3352 ***	0 ***	0.079 ***
Business diversification	Number of operating industries according to the NACE Rev 2 secondary codes	6.7701	3.8192	7	24	0	6.7355	7	6.8305 ***	7 ***	-0.012 ***

Notes:

<sup>a</sup> \*\*\* denotes statistical significance at the 1% level according to the *t* test (or Welch test if the *F* test on the equality of variances rejects the null hypothesis that the 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 ( $\chi^2$ ) test in terms of the differences in the proportion between the two types of firms.

<sup>b</sup> \*\*\*, \*\*, 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.

<sup>c</sup> \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively, in terms of the correlation coefficient with the survival probability.

<sup>d</sup> Class A: Attached to any company with known recorded shareholders, none of which having 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: As above, but includes companies with 4 or 5 identified shareholders; A-: 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 with an ownership percentage (direct, total or calculated total) over 50%, but having one or more shareholders with an ownership percentage above 25%. The further qualification as B+, B and B- is 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 a 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: This is allocated to any company with a recorded shareholder with a direct ownership of over 50% (quotation from the BvD Orbis database website manual).

<sup>e</sup> Computed using the following formula: (profit before tax / total assets) × 100

<sup>f</sup> Computed using the following formula: (gross profit / operating revenue) × 100

<sup>g</sup> 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>

**Table 4.** Determinants of firm survival: Baseline estimation of Cox proportional hazard 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: Open JSC)					
Closed JSC	0.6082 *** (-11.64)	0.5530 *** (-4.16)	0.6211 *** (-6.37)	0.6469 *** (-3.79)	0.6094 *** (-7.32)
Limited liability company	0.6881 *** (-9.04)	0.5645 *** (-4.06)	0.6997 *** (-5.10)	0.6874 *** (-3.40)	0.6581 *** (-6.40)
Partnership	0.6478 (-1.19)	0.5510 (-1.31)	0.1480 *** (-41.57)	2.5263 *** (3.75)	0.3800 *** (-46.01)
Cooperative	0.3536 *** (-13.24)	0.3949 *** (-6.37)	0.3752 ** (-2.52)	0.2846 * (-1.70)	0.2999 *** (-7.92)
Other corporate forms	1.0425 (0.83)	0.8973 (-0.70)	0.9715 (-0.29)	1.1591 (0.93)	1.2931 *** (3.42)
Ownership structure					
Number of large shareholders	0.8388 *** (-9.24)	0.9878 (-0.83)	0.9081 *** (-2.60)	0.8630 *** (-6.69)	0.7665 *** (-16.14)
Foreign ownership	0.9975 (-0.03)	2.0756 ** (2.17)	0.7911 (-1.53)	0.9710 (-0.07)	1.0775 (0.76)
Federal state ownership	0.8786 ** (-2.50)	0.8940 (-0.59)	1.0340 (0.36)	1.3090 * (1.83)	0.8205 ** (-2.55)
Regional state ownership	0.7872 *** (-5.26)	0.6745 ** (-2.21)	0.7539 *** (-3.03)	0.9452 (-0.41)	0.8094 *** (-3.29)
Corporate governance					
Managerial discretion	1.0240 *** (11.70)	0.9919 (-0.79)	0.9944 (-1.07)	1.0274 *** (5.31)	1.0318 *** (12.66)
Number of board directors	0.8587 *** (-9.95)	0.8296 *** (-3.49)	0.8517 *** (-6.77)	0.8524 *** (-3.64)	0.8615 *** (-6.84)
Number of board directors <sup>2</sup>	1.0068 *** (6.31)	1.0068 * (1.62)	1.0071 *** (4.39)	1.0085 *** (2.61)	1.0059 *** (4.28)
Number of auditors	0.8716 *** (-8.35)	0.9424 (-0.76)	0.8945 *** (-3.45)	0.9094 * (-1.84)	0.8964 *** (-4.90)
Number of auditors <sup>2</sup>	1.0103 *** (6.26)	1.0202 (0.82)	1.0056 ** (2.54)	1.0101 (0.46)	1.0111 *** (2.78)
International audit firm	1.1366 (0.22)		1.6973 (0.95)		0.1070 *** (-54.01)
Russian large audit firm	1.1362 (0.31)	0.2940 *** (-39.98)	0.8752 (-0.26)	1.6511 (0.41)	1.9479 (0.88)
Russian local audit firm	1.7863 *** (4.22)	0.8922 (-0.15)	1.5127 ** (2.40)	0.6235 (-0.66)	2.0049 *** (2.93)
Firm performance					
ROA	0.9919 *** (-19.45)	0.9860 *** (-3.97)	0.9910 *** (-8.33)	0.9939 *** (-5.06)	0.9930 *** (-14.05)
Gross margin	0.9954 *** (-10.25)	0.9924 *** (-3.32)	0.9943 *** (-4.48)	0.9954 *** (-3.03)	0.9978 *** (-4.18)
Linkage with capital market					
Listed	1.9087 *** (4.63)	3.5319 ** (2.04)	1.3766 * (1.70)	4.1022 *** (4.90)	1.0673 (0.19)
Gearing	1.0003 *** (6.57)	1.0007 *** (3.95)	1.0004 *** (4.33)	1.0002 * (1.82)	1.0002 *** (3.97)
Firm size and age					
Firm size	0.9872 ** (-2.42)	0.9220 ** (-2.46)	0.9668 ** (-2.49)	1.0005 (0.03)	0.9845 ** (-2.38)
Firm age	0.9481 *** (-16.58)	0.9712 *** (-3.78)	0.9858 *** (-3.84)	0.9358 *** (-12.11)	0.9308 *** (-21.07)
Business organization					
Business network	0.9399 *** (-5.81)	0.9088 ** (-2.47)	0.9304 *** (-5.25)	0.9500 *** (-3.06)	0.9536 *** (-2.89)
Business diversification	0.9995 (-0.26)	0.9939 (-0.81)	1.0012 (0.27)	0.9954 (-0.82)	0.9957 * (-1.71)
Federal-region 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	-225347.68	-8194.28	-34435.82	-27715.02	-132855.55
Harrell's C concordance statistic	0.6817	0.6851	0.6734	0.6634	0.6973
Wald test ( $\chi^2$ ) <sup>a</sup>	7319.39 ***	84713.18 ***	3532.82 ***	11754.37 ***	16367.43 ***

Note: This table contains the results from the survival analysis using the Cox proportional hazard model. Table 3 provides the detailed definitions and descriptive statistics of the independent variables. Regression coefficients are 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 tests the null hypothesis that all coefficients are zero. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

<sup>a</sup> Null hypothesis: All coefficients are zero.

Source: Authors' estimation

**Table 5.** Estimation of Cox proportional hazard model using industry-adjusted variables, 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: Open JSC)					
Closed JSC	0.6323 *** (-10.67)	0.5117 *** (-4.64)	0.5658 *** (-7.52)	0.6601 *** (-3.59)	0.6517 *** (-6.25)
Limited liability company	0.7249 *** (-7.97)	0.5448 *** (-4.29)	0.5869 *** (-7.48)	0.6927 *** (-3.32)	0.6899 *** (-5.66)
Partnership	0.6282 (-1.30)	0.5083 (-1.53)	0.3940 *** (-38.26)	2.3236 *** (2.87)	0.3564 *** (-36.87)
Cooperative	0.3427 *** (-13.79)	0.3590 *** (-7.04)	0.3954 ** (-2.37)	0.2551 * (-1.85)	0.3116 *** (-7.71)
Other corporate forms	0.9106 * (-1.90)	0.7705 * (-1.69)	0.8750 (-1.36)	1.0824 (0.50)	1.1926 ** (2.34)
Ownership structure					
Number of large shareholders (industry-adjusted)	0.6190 *** (-34.31)	0.6379 *** (-4.69)	0.6889 *** (-12.39)	0.6927 *** (-11.52)	0.5989 *** (-28.33)
Foreign ownership	0.9891 (-0.14)	2.3012 ** (2.32)	0.7506 * (-1.87)	0.9354 (-0.16)	1.1189 (1.14)
Federal state ownership	0.8321 *** (-3.57)	0.8570 (-0.82)	1.0309 (0.33)	1.3124 * (1.84)	0.8328 ** (-2.37)
Regional state ownership	0.7774 *** (-5.66)	0.6512 ** (-2.44)	0.7386 *** (-3.30)	0.9521 (-0.36)	0.8317 *** (-2.90)
Corporate governance					
Managerial discretion (industry-adjusted)	1.0549 *** (12.61)	0.9830 (-0.81)	1.0014 (0.13)	1.0539 *** (5.09)	1.0801 *** (12.14)
Number of board directors (industry-adjusted)	0.8049 *** (-11.01)	0.7303 *** (-4.84)	0.8092 *** (-6.57)	0.8151 *** (-3.85)	0.7990 *** (-6.91)
Number of auditors (industry-adjusted)	1.0191 (1.44)	0.9612 (-0.60)	0.9745 (-0.79)	0.9430 (-1.47)	0.9360 *** (-3.27)
International audit firm	0.7449 (-0.55)		1.1487 (0.24)		0.1954 *** (-82.69)
Russian large audit firm	0.9292 (-0.19)	0.1430 *** (-37.98)	0.8655 (-0.27)	1.0520 (0.05)	1.5186 (0.56)
Russian local audit firm	1.3639 ** (2.36)	1.2868 (0.36)	1.4021 ** (2.02)	0.5466 (-0.89)	1.7989 ** (2.50)
Firm performance					
ROA (industry-adjusted)	0.9574 *** (-19.27)	0.9259 *** (-4.33)	0.9511 *** (-8.63)	0.9694 *** (-4.44)	0.9570 *** (-15.74)
Gross margin (industry-adjusted)	0.9752 *** (-10.78)	0.9685 ** (-2.32)	0.9717 *** (-4.72)	0.9682 *** (-4.03)	0.9807 *** (-6.74)
Linkage with capital market					
Listed	2.0392 *** (5.38)	3.9260 ** (2.31)	1.4757 ** (2.20)	4.1186 *** (5.34)	1.1399 (0.39)
Gearing (industry-adjusted)	1.0059 *** (6.59)	1.0160 *** (3.99)	1.0046 ** (2.25)	1.0065 ** (2.40)	1.0029 ** (2.55)
Firm size and age					
Firm size (industry-adjusted)	0.9955 *** (-2.65)	0.9999 (-0.57)	0.9998 (-0.18)	1.0001 * (1.73)	0.9929 (-0.97)
Firm age (industry-adjusted)	0.8820 *** (-30.44)	0.9356 *** (-3.46)	0.8809 *** (-12.55)	0.8592 *** (-13.84)	0.8549 *** (-27.00)
Business organization					
Business network (industry-adjusted)	0.7928 *** (-17.82)	0.7362 *** (-6.16)	0.8233 *** (-7.23)	0.8379 *** (-5.41)	0.8351 *** (-9.72)
Business diversification (industry-adjusted)	0.9875 *** (-3.08)	0.9889 (-0.66)	1.0001 (0.00)	0.9930 (-0.61)	0.9896 ** (-2.02)
Federal-region 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	-224871.27	-8124.25	-34237.64	-27645.63	-132545.05
Harrell's C concordance statistic	0.6820	0.7117	0.6904	0.6714	0.7024
Wald test ( $\chi^2$ ) <sup>a</sup>	6340.63 ***	57325.13 ***	1376.81 ***	5260.13 ***	13999.64 ***

Note: This table contains the results from the survival analysis using the Cox proportional hazard model. Table 3 provides the detailed definitions and descriptive statistics of the independent variables. Regression coefficients are 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 tests the null hypothesis that all coefficients are zero. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

<sup>a</sup>Null hypothesis: All coefficients are zero.

Source: Authors' estimation

**Table 6.** Estimation of Cox proportional hazard model in different periods

Model	Table 4 Model [1]	[1]	[2]	[3]	[4] <sup>a</sup>	[5] <sup>a</sup>	[6] <sup>a</sup>
Estimation period	2007-2015	2007-2008	2007-2010	2007-2013	2009-2010	2011-2013	2014-2015
Legal form (Default: Open JSC)							
Closed JSC	0.6082 *** (-11.64)	0.2737 *** (-6.01)	0.4047 *** (-7.60)	0.4463 *** (-14.42)	0.4648 *** (-5.39)	0.4649 *** (-11.84)	0.8994 * (-1.68)
Limited liability company	0.6881 *** (-9.04)	0.4618 *** (-4.07)	0.6117 *** (-4.44)	0.5688 *** (-10.63)	0.6813 *** (-2.86)	0.5354 *** (-10.13)	0.8966 * (-1.77)
Partnership	0.6478 (-1.19)	0.3580 *** (-11.88)	0.2910 *** (-15.38)	0.6728 (-1.02)	0.1250 *** (-148.24)	0.9137 (-0.23)	0.5540 (-0.83)
Cooperative	0.3536 *** (-13.24)	0.1565 *** (-4.08)	0.2399 *** (-6.60)	0.2515 *** (-12.42)	0.2790 *** (-5.16)	0.2650 *** (-10.16)	0.5458 *** (-5.50)
Other corporate forms	1.0425 (0.83)	0.9659 (-0.15)	1.1524 (1.09)	0.9661 (-0.53)	1.2274 (1.34)	0.8624 * (-1.95)	1.1167 (1.46)
Ownership structure							
Number of large shareholders	0.8388 *** (-9.24)	0.6318 *** (-7.41)	0.6409 *** (-4.99)	0.7160 *** (-9.63)	0.6445 *** (-3.79)	0.7528 *** (-7.89)	0.9398 *** (-3.39)
Foreign ownership	0.9975 (-0.03)	0.6582 (-0.72)	1.7822 *** (3.29)	1.2892 *** (2.60)	2.1167 *** (4.06)	1.1443 (1.16)	0.7162 *** (-2.69)
Federal state ownership	0.8786 ** (-2.50)	1.0256 (0.07)	1.1210 (0.68)	0.7495 *** (-3.68)	1.1593 (0.78)	0.6453 *** (-4.90)	1.0401 (0.57)
Regional state ownership	0.7872 *** (-5.26)	0.9464 (-0.22)	1.1454 (1.08)	0.7332 *** (-5.02)	1.2282 (1.43)	0.6256 *** (-6.50)	0.8935 * (-1.71)
Corporate governance							
Managerial discretion	1.0240 *** (11.70)	1.1606 *** (15.01)	1.1523 *** (27.63)	1.0486 *** (17.12)	1.1492 *** (23.24)	1.0004 (0.12)	0.9940 ** (-2.04)
Number of board directors	0.8587 *** (-9.95)	0.4535 *** (-4.62)	0.3822 *** (-7.15)	0.7887 *** (-11.86)	0.3496 *** (-5.32)	0.8382 *** (-8.76)	0.9475 ** (-2.51)
Number of board directors <sup>2</sup>	1.0068 *** (6.31)	1.0286 *** (5.67)	1.0333 *** (8.52)	1.0103 *** (8.22)	1.0353 *** (5.47)	1.0073 *** (6.07)	1.0022 (1.40)
Number of auditors	0.8716 *** (-8.35)	0.8413 * (-1.84)	0.9105 ** (-1.98)	0.8870 *** (-5.11)	0.9347 (-1.24)	0.8939 *** (-4.13)	0.8631 *** (-6.51)
Number of auditors <sup>2</sup>	1.0103 *** (6.26)	1.0132 (0.87)	1.0056 (0.44)	1.0110 *** (6.09)	1.0037 (0.24)	1.0101 *** (5.45)	1.0096 *** (4.83)
International audit firm	1.1366 (0.22)	0.0946 *** (-30.36)	0.5430 *** (-53.15)	0.4636 (-0.69)	0.1970 *** (-45.40)	0.5467 (-0.55)	2.1973 (1.27)
Russian large audit firm	1.1362 (0.31)	0.1020 (-24.43)	1.2327 *** (3.73)	1.6283 (0.91)	1.9740 *** (4.00)	0.8734 (-0.22)	0.7412 (-0.49)
Russian local audit firm	1.7863 *** (4.22)	14.4070 *** (3.64)	9.1540 *** (4.12)	2.1499 *** (3.74)	6.5793 *** (2.61)	1.6698 ** (2.46)	1.4520 ** (2.00)
Firm performance							
ROA	0.9919 *** (-19.45)	0.9871 *** (-6.29)	0.9911 *** (-8.38)	0.9913 *** (-14.89)	0.9926 *** (-6.05)	0.9918 *** (-11.78)	0.9928 *** (-12.12)
Gross margin	0.9954 *** (-10.25)	1.0003 (0.15)	0.9970 *** (-2.79)	0.9961 *** (-6.28)	0.9957 *** (-3.35)	0.9957 *** (-5.66)	0.9948 *** (-8.04)
Linkage with capital market							
Listed	1.9087 *** (4.63)	0.8833 (-0.10)	0.4987 (-0.69)	2.9855 *** (5.77)	0.3735 (-0.72)	3.1932 *** (6.44)	1.2272 (0.98)
Gearing	1.0003 *** (6.57)	0.9996 * (-1.70)	0.9998 ** (-2.18)	1.0001 ** (2.48)	0.9998 (-1.50)	1.0003 *** (4.91)	1.0004 *** (7.60)
Firm size and age							
Firm size	0.9872 ** (-2.42)	1.0355 (1.33)	1.0476 *** (3.61)	1.0092 (1.26)	1.0517 *** (3.41)	0.9903 (-1.11)	0.9610 *** (-5.07)
Firm age	0.9481 *** (-16.58)	0.8897 *** (-8.76)	0.9104 *** (-14.93)	0.9401 *** (-13.25)	0.9176 *** (-12.17)	0.9548 *** (-8.29)	0.9579 *** (-10.03)
Business organization							
Business network	0.9399 *** (-5.81)	0.8462 *** (-2.62)	0.8427 *** (-4.83)	0.9142 *** (-7.26)	0.8406 *** (-4.06)	0.9306 *** (-5.64)	0.9617 *** (-2.66)
Business diversification	0.9995 (-0.26)	0.9994 (-0.06)	0.9968 (-0.66)	0.9975 (-0.95)	0.9960 (-0.73)	0.9977 (-0.73)	1.0020 (0.75)
Federal-region 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	73434	70913	63364
Log pseudolikelihood	-225347.68	-9302.04	-36215.14	-119466.27	-26824.18	-82556.71	-105447.65
Harrell's C concordance statistic	0.6817	0.8155	0.7886	0.7117	0.7868	0.6854	0.6550
Wald test ( $\chi^2$ ) <sup>a</sup>	7319.39 ***	630381.00 ***	194504.44 ***	4744.76 ***	195293.50 ***	1732.66 ***	33191.70 ***

Note: This table contains the results from the survival analysis using the Cox proportional hazard model. Table 3 provides the detailed definitions and descriptive statistics of the independent variables. Regression coefficients are 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 tests the null hypothesis that all coefficients are zero. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels, respectively.

<sup>a</sup> Estimation without the observations of failed firms before the period in question

<sup>b</sup> Null hypothesis: All coefficients are zero.

Source: Authors' estimation

**Table 7.** Estimation of parametric survival model for robustness check, 2006-2015

Model	Table 4 Model [1]	[1]	[2]	[3]	[4]	[5]	[6]
Assumption of survival distribution	Cox proportional hazard	Exponential	Weibull	Gompertz	Lognormal	Loglogistic	Generalized gamma
Legal form (Default: Open JSC)							
Closed JSC	0.6082 *** (-11.64)	0.6383 *** (-11.25)	0.6002 *** (-11.52)	0.5995 *** (-11.48)	0.2369 *** (11.32)	0.2193 *** (11.66)	0.2092 *** (11.49)
Limited liability company	0.6881 *** (-9.04)	0.7146 *** (-8.74)	0.6816 *** (-8.95)	0.6804 *** (-8.94)	0.1295 *** (6.09)	0.1603 *** (8.71)	0.1552 *** (8.84)
Partnership	0.6478 (-1.19)	0.6648 (-1.18)	0.6391 (-1.19)	0.6410 (-1.17)	0.2601 * (1.67)	0.2043 (1.37)	0.1869 (1.24)
Cooperative	0.3536 *** (-13.24)	0.3764 *** (-12.88)	0.3462 *** (-13.20)	0.3456 *** (-13.17)	0.4895 *** (14.10)	0.4444 *** (13.74)	0.4323 *** (13.27)
Other corporate forms	1.0425 (0.83)	1.0419 (0.88)	1.0455 (0.85)	1.0453 (0.84)	-0.0590 ** (-2.33)	-0.0240 (-1.07)	-0.0200 (-0.94)
Ownership structure							
Number of large shareholders	0.8388 *** (-9.24)	0.8551 *** (-8.74)	0.8323 *** (-9.44)	0.8320 *** (-9.45)	0.0324 *** (3.62)	0.0711 *** (8.71)	0.0730 *** (9.24)
Foreign ownership	0.9975 (-0.03)	0.9922 (-0.11)	0.9855 (-0.18)	0.9821 (-0.22)	-0.0533 (-1.40)	-0.0180 (-0.51)	0.0011 (0.03)
Federal state ownership	0.8786 ** (-2.50)	0.8942 ** (-2.24)	0.8768 ** (-2.45)	0.8755 ** (-2.46)	0.0634 *** (2.61)	0.0540 ** (2.45)	0.0538 ** (2.48)
Regional state ownership	0.7872 *** (-5.26)	0.8082 *** (-4.97)	0.7812 *** (-5.23)	0.7798 *** (-5.23)	0.0983 *** (4.52)	0.0992 *** (5.01)	0.0998 *** (5.20)
Corporate governance							
Managerial discretion	1.0240 *** (11.70)	1.0201 *** (10.59)	1.0247 *** (11.52)	1.0242 *** (11.24)	-0.0136 *** (-13.08)	-0.0116 *** (-12.51)	-0.0103 *** (-11.22)
Number of board directors	0.8587 *** (-9.95)	0.8675 *** (-10.44)	0.8566 *** (-9.76)	0.8568 *** (-9.90)	0.0828 *** (12.14)	0.0680 *** (9.45)	0.0637 *** (9.72)
Number of board directors <sup>2</sup>	1.0068 *** (6.31)	1.0063 *** (6.86)	1.0069 *** (6.19)	1.0069 *** (6.34)	-0.0037 *** (-7.79)	-0.0031 *** (-5.88)	-0.0029 *** (-6.15)
Number of auditors	0.8716 *** (-8.35)	0.8765 *** (-8.36)	0.8675 *** (-8.38)	0.8670 *** (-8.38)	0.1008 *** (11.13)	0.0647 *** (8.37)	0.0596 *** (8.59)
Number of auditors <sup>2</sup>	1.0103 *** (6.26)	1.0098 *** (6.16)	1.0107 *** (6.43)	1.0107 *** (6.50)	-0.0065 *** (-3.40)	-0.0047 *** (-3.28)	-0.0044 *** (-6.17)
International audit firm	1.1366 (0.22)	1.1707 (0.28)	1.1322 (0.21)	1.1309 (0.21)	-0.2394 (-0.87)	-0.1035 (-0.39)	-0.0642 (-0.27)
Russian large audit firm	1.1362 (0.31)	1.1370 (0.32)	1.1265 (0.28)	1.1205 (0.27)	-0.3596 * (-1.87)	-0.1200 (-0.68)	-0.0698 (-0.41)
Russian local audit firm	1.7863 *** (4.22)	1.7414 *** (4.17)	1.8139 *** (4.22)	1.8150 *** (4.20)	-0.3252 *** (-4.94)	-0.2733 *** (-4.54)	-0.2501 *** (-4.34)
Firm performance							
ROA	0.9919 *** (-19.45)	0.9924 *** (-19.37)	0.9916 *** (-19.37)	0.9916 *** (-19.34)	0.0042 *** (20.20)	0.0037 *** (19.61)	0.0035 *** (19.28)
Gross margin	0.9954 *** (-10.25)	0.9956 *** (-10.39)	0.9952 *** (-10.22)	0.9952 *** (-10.24)	0.0023 *** (10.48)	0.0021 *** (10.54)	0.0020 *** (10.31)
Linkage with capital market							
Listed	1.9087 *** (4.63)	1.8200 *** (4.51)	1.9348 *** (4.60)	1.9416 *** (4.60)	-0.2691 *** (-3.95)	-0.2797 *** (-4.63)	-0.2689 *** (-4.61)
Gearing	1.0003 *** (6.57)	1.0003 *** (7.15)	1.0003 *** (6.47)	1.0003 *** (6.52)	-0.0001 *** (-5.99)	-0.0001 *** (-6.45)	-0.0001 *** (-6.46)
Firm size and age							
Firm size	0.9872 ** (-2.42)	0.9848 *** (-3.07)	0.9861 ** (-2.51)	0.9857 *** (-2.56)	0.0108 *** (3.39)	0.0059 ** (2.46)	0.0057 ** (2.51)
Firm age	0.9481 *** (-16.58)	0.9519 *** (-15.87)	0.9455 *** (-17.06)	0.9452 *** (-17.11)	0.0152 *** (8.25)	0.0222 *** (14.64)	0.0224 *** (16.29)
Business organization							
Business network	0.9399 *** (-5.81)	0.9431 *** (-5.66)	0.9383 *** (-5.89)	0.9381 *** (-5.90)	0.0188 ** (2.36)	0.0254 *** (5.57)	0.0256 *** (5.74)
Business diversification	0.9995 (-0.26)	0.9996 (-0.22)	0.9996 (-0.22)	0.9996 (-0.21)	0.0002 (0.19)	0.0003 (0.38)	0.0002 (0.24)
Federal-region 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	-225347.68	-51484.60	-44469.10	-45170.30	-45156.84	-44468.30	-44463.04
Wald test ( $\chi^2$ ) <sup>a</sup>	7319.39 ***	4903.90 ***	4764.00 ***	4739.41 ***	4472.04 ***	3982.19 ***	3846.71 ***

Note: This table contains the results from the survival analysis using 6 parametric estimators for robustness check. Table 3 provides the detailed definitions and descriptive statistics of the independent variables. Models [1] to [3] report hazard ratio, 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 tests the null hypothesis that all coefficients are zero. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% levels,

<sup>a</sup>Null hypothesis: All coefficients are zero.

Source: Authors' estimation