Explaining the performance of Russian export: what role does the soft and hard infrastructure play?

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Abstract: In this paper, we estimate the effects of 'hard' and 'soft' infrastructure on export performance in Russian regions. We use data for export flows from 20 Russian regions to 124 countries in 2002–2010. Empirical estimates employ continuous-time Cox model and discrete-time complementary log-log and probit models and account for size and time effects for export flows. We find positive effects of hard and soft infrastructure that are falling over time and are more important for larger exporters. This paper contributes to the literature by demonstrating potential gains from investments into 'hard' infrastructure and improvements in 'soft' infrastructure for export performance in the Russian economy.

Keywords: export performance; export survival; hard infrastructure; soft infrastructure; Russian regions; Russia.

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1 Introduction

In recent empirical studies, the effects of doing business environment and trade facilitation on trade performance have been intensively studied, specifically focusing on developing and transition countries. In this paper, we consider the following two dimensions of doing business environment: a 'hard' dimension of infrastructure related to tangible resources such as energy infrastructure, roads, ports, exhibition spaces, telecommunications, and a 'soft' dimension of infrastructure, related to such intangible resources as transparent tax administration and regulatory framework.

Recent literature focusing on trade (largely based on gravity models) supports the view that better institutions can foster international trade. In particular, Levchenko (2007) and Anderson and Marcouiller (2002) find that bilateral trade volumes are positively influenced by the trading countries' institutional quality. Jae and Ranjan (2004) look at a particular aspect of institutions, the enforcement of contracts, and its impact on the volume of international trade. Using a gravity model, Depken and Sonora (2005) estimate the effects of economic freedom on US consumer exports and imports, and find that better institutional quality of the partner country has a positive effect on the amount of exports from the USA to that country. Helble et al. (2007) look at the impact of institutional transparency on trade of countries in the Asia-Pacific Region. They find that higher transparency of the trading environment through greater predictability and simplification of regulations has an important impact on trade costs. De Groot et al. (2004) also find that institutional quality and the quality of governance has a significant, positive, and substantial impact on bilateral trade flows. Democratic institutions have also been shown to have positive effects on trade. For example, Yu (2010) estimates an augmented gravity model, and finding that democratisation significantly increases trade, potentially contributing by 3%–4% overall to bilateral trade growth.

The literature also provides evidence on the effects of infrastructure on international trade. Limao and Venables (2001) show that infrastructure is quantitatively important in determining total transport costs. They argue that poor infrastructure accounts for 40% of predicted transport costs for coastal countries and up to 60% for landlocked countries. Using a gravity model (Bougheas et al., 1999), also provide evidence from European countries linking infrastructure to transport costs and, hence, trade. Wilson et al. (2005) have quantified the effects of trade facilitation by considering four aspects of trade facilitation effort: ports, customs, regulations, and e-business (which are a proxy for the service sectors of telecommunications and financial intermediation, which are key for all types of trade). The authors find that the scope and benefit of unilateral trade facilitation reforms are very large and that the gains fall disproportionately on exports. Brun et al. (2005) also highlight the importance of the quality of physical infrastructure for trade. Using particular infrastructure measures (quality of rail roads, telecommunications, ports, and airports) Nordås and Piermartini (2004) find that all measures are important with ports having the biggest impact on trade. Focusing on logistics, Behar et al. (2013) argue that one-standard deviation improvement in logistics is equivalent to a 14% reduction in distance. Puertas et al. (2014) provide the estimations of the gravity models using the two-stage Heckman model for 26 EU countries using the logistics performance index (LPI) and its components as characteristic proxy variables of trade facilitation and show that logistics were more important for exporting nations than importing nations in both 2005 and 2010. Focusing on Africa, Iwanow and Kirkpatrick (2009) construct aggregated indicators of trade facilitation and infrastructure and find a positive impact of the indicators on exports, while Portugal-Perez and Wilson (2012) examine the impact of soft and hard infrastructure on the export performance of developing countries. Their results suggest that trade facilitation measures have a positive impact on export performance.

Francois and Manchin (2013) examine the influence of infrastructure, institutional quality, colonial and geographic context, and trade preferences on the pattern of bilateral trade. They match bilateral trade and tariff data and control for tariff preferences, country size, and standard trade cost measures, and find that infrastructure, and institutional quality, are significant determinants of export levels. These results support the notion that trade volumes in general, and the propensity of low income countries in particular to take part in the trading system at all, depends on institutional quality and on access to well developed transport and communications infrastructure.

The article is organised as follows. Section 2 describes data and variables. Section 3 provides non-parametric Kaplan-Mayer estimates of survival functions of export flows with regard to different availability of hard and soft infrastructure at the regional level. Section 4 describes empirical strategy and discusses empirical results. Section 5 concludes.

2 Data

This study is based on the data on export flows at the region-industry-destination market level. The data on export are from the database of the Federal Customs Service of the Russian Federation, and consists of electronic copies of customs declarations from 2002–2010 on a yearly basis. The commodity nomenclature includes four-digit level data from the Foreign Trade Nomenclature of Goods of the Federal Customs Service of the Russian Federation, which corresponds to HS four-digit classification. The dataset allows to identify export market (country of destination) for each trade flow and export value measured by free on board (FOB) price. Our classification of export markets is based on Akin and Kose (2008), who distinguish between DS = Developing South, ES = Emerging South and N = North countries. We add a fourth region – group of SECIS = South-Eastern Europe and post-soviet countries, since SECIS countries are among main trade partners of Russian regions and exclusion of SECIS countries could lead to biased results. See Appendix 1 for details of country classification. Russian regions are highly heterogeneous in terms of export share in gross regional product, we believe that improvements in business environment affect export performance only from a certain level of export activity in a region. Thus, we consider the data only for 30 Russian regions, which have an export quota of more than 10%. The structure of the available data consists of 132,995 export flows.

The following groups of explanatory variables are used. Firstly, we consider hard and soft infrastructure measures at the regional level. The peculiarity of this study is the regional dimension of hard and soft infrastructure, which significantly narrows the range of potential variables within existing databases. For example, the Doing Business project was carried out at the regional level in Russia – in 2009 for the ten cities, and in 2012 for 30 cities. However not all the cities in the sample are capital cities, therefore not all the data for the aim of the current study might be employed. We employ the data from the study 'Entrepreneurship Environment in Russia: Opora's Index', provided by the All-Russian Non-Governmental Organization of Small and Medium Business – 'Opora Russia'. The data is based on interviews with small and medium enterprises in 35 Russian regions and assesses the quality of the business climate in manufacturing industries by four indices: quality of infrastructure, financial resources, human resources, administrative barriers. Indices are measured between 1 and 35, with 1 corresponding to the region with the best conditions in the respective sub-index. We proxy the measure of hard infrastructure by the index Quality of infrastructure of Opora's Index, that measures availability of electric power supply, exhibition spaces, transport and logistics infrastructure, ICT infrastructure at the regional level. In similar way, we proxy the measure of soft infrastructure by the index Administrative barriers of Opora's Index, that measures quality of tax administration, corruption and organised crime at the regional level.

Secondly, gravity variables and product characteristics are basic explanatory variables employed in the vast majority of empirical papers on the determinants of trade flow performance. A large number of empirical studies, including recent results of meta-analysis, Disdier and Head (2008) and Head and Mayer (2013) have shown that the gravity model explain fairly well the volume of trade between countries. Gravity variables therefore may also explain the duration of trade flows. We employ standard the gravity equation variables proposed by Anderson and van Wincoop (2003) and the results of meta-analysis of the factors of international trade proposed by Disdier and Head (2008) and Head and Mayer (2013). The list of our gravity variables includes: exporter GRP per capita (in logs), importer GDP per capita (in logs), dummy for common border, dummy for post-soviet countries, dummy if landlocked. Definitions and data sources for the variables are listed in Appendix 2. One of the major explanatory variables in the gravity model is transportation costs. In order to account for transportation costs during exports we use two proxy variables – distance to the closest seaport in km (in logs) and distance from the closest seaport to destination market in km (in logs).

Thirdly, we employ variables to control for endogeneity problem caused by probable simultaneity between regional characteristics and survival of export flows and existence of self-selection into exporting. Among others, the endogeneity problem was recently mentioned by Faruq (2011), who estimated the impact of institutional variables (level of corruption, efficiency of bureaucracy and legal rights) on the quality of exports. The other work by Commander et al. (2008) considered the issue of the empirical relationship between firm performance and business environment. Commander et al. (2008) argue that it is necessary to account for possible unobserved heterogeneity and hence to isolate the effect of inputs, perceived business environment and structural factors on a firm's performance from the effects of performance on explanatory variables. A number of studies highlight the endogeneity of transport costs and markets in foreign trade (Hummels et al., 2009; Sequeira and Djankov, 2008). In this paper, to control for possible endogeneity we employ a set of variables created by pairwise multiplications of hard and soft infrastructure measure with duration and average size of export flows. We believe, that introductions of these pairwise multiplications allows to control for time-dependent and size-dependent effects of export performance, which in turn may be proxied by learning-by-exporting effects.

Fourthly, one of the major problems is the product heterogeneity. According to Besedeš and Prusa (2006b), trade flows of differentiated products on average last longer, and have lower initial volumes associated with higher search costs and initial investments. To control for product-specific heterogeneity we include a set of variables that allow to take into account sectoral and geographical features of export flows from Russian regions. We follow (Rauch, 1999) approach, and distinguish the following three product groups: homogeneous products traded on organised markets, reference priced products prices for which can be quoted without mentioning the name of the manufacturer and differentiated (the rest) (for goods classification see Rauch (1999, pp.8–9). Following Feng et al. (2012) and Albornoz et al. (2014), we add a variable reflecting the logarithm of the average volume of exports, which is supposed to reflect size effects for export flows. Following Fugazza and Molina (2016), we include in the regression a variable which reflects import competition on destination markets and is calculated as the average number of Russian regions that export product i to country j. To control for possible omissions of the data we add a dummy variable for those export flows which are interrupted and resumed again in line with Besedeš and Blyde (2010), Besedeš and Prusa (2006b, 2006a), Cadot et al. (2013) and Fu and Wu (2014).

Finally, in all specifications we employ industry-, destination market and year-dummies and use robust standard errors clustered at the region-industry level to account for possible demand shocks, which are simultaneously correlated across regional and industry level.

Since we deal with trade data in the form of single export relationships, we need to account for several issues. First of all, there is the problem of data censoring. Besedeš and Prusa (2006b) note that it is often unknown whether a trade relationship ends because of a failure or for another reason. Consequently, there is an uncertainty about the beginning or the end date (or both) for some trade relationships. In our case, we apply a left censoring procedure since for trade flows starting in 2002 it is unknown whether they started in that year or earlier. Therefore, we excluded some of this data and left only those trade flows that were initialised as of 2003.

The second issue is the problem of goods classification due to the fact that the Russian Federal Customs Service periodically revises its product definition, sometimes splitting a single code into multiple codes and other times combining multiple codes into fewer codes. Unfortunately, there is no available information to allow us to map old product codes into new ones. We recognise that these code changes may affect trade flows and attempted to ensure that we always used the correct classification of the time that the data was selected.

Thirdly, there is an issue with the interruption of trade flows. Trade flow may be suspended and then resumed after one or more years for economic or other reasons. In the database 18% of the trade flows are interrupted one or more times, although this could be attributed to human error. Moreover, the probability of an error when the interruption period lasted only one year is quite high.

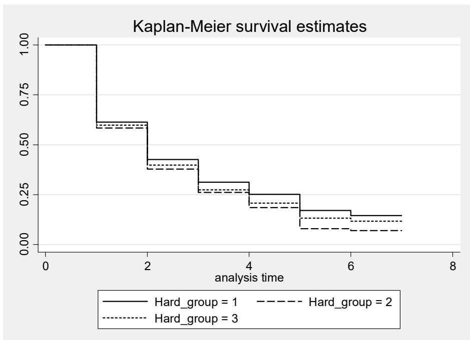
As shown above, the choice of explanatory variables impose several restrictions on the database. Firstly, it concerns the limitations on censoring data described above. Secondly, the fact that the Opora's Index provides data only for 35 Russian regions and the sample of the regions are not fully consistent with the sample used in this study.

Thirdly, the choice of four geographic regions of the world imposes some constraints on the sample. Finally, following the strategy of a number of empirical studies (Freund and Pierola, 2010; Fugazza and Molina, 2016), we include in the sample only those export flows which exceed 1,000 USD. Therefore, taking into account all limitations, export survival analysis will be carried out on the data of 57,682 flows from 20 Russian regions to 124 countries of the world economy in 2002–2010, classified by the four-digit HS classification.[1] According to the data from Federal State Statistics Service (Rosstat) on average 20 Russian regions covered in the database account for 29% of the Russian gross domestic product and 37% of Russian gross domestic product, excluding Moscow. In addition regions considered in the database account for 24% of the gross Russian exports and about 40% of gross Russian exports, excluding exports from Moscow and strongly oil-oriented regions Khanty-Mansiysk and Yamalo-Nenets Autonomous District.

3 Stylised facts on export survival in Russian regions

Before empirical estimation of export survival factors, we perform the duration analysis and employ a non-parametric Kaplan-Mayer estimator to examine differences in exit rates across trade flows from Russian regions. More specifically, we examine survival functions of trade flows for regions with regard to the quality of hard and soft infrastructure. Figure 1 presents Kaplan-Mayer survival curves plotted for three groups of regions with different positions in rating according to the quality of hard infrastructure. As shown in Figure 1, survival rates of export flows in regions ranked among top ten according to the availability of hard infrastructure are on average higher than those ranked lower. The differences in hazard rate between regions ranked in top ten and the others are increasing with higher duration of export flows. These results suggest that better quality of hard infrastructure, including logistics and transport infrastructure, electricity supply and exhibition facilities might increase export duration.

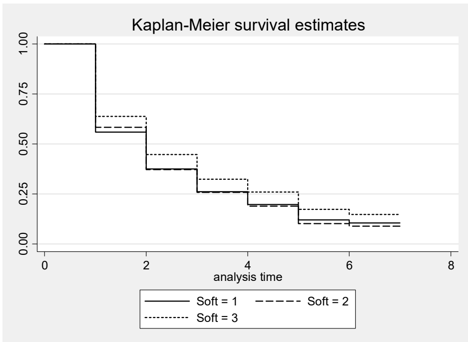
Figure 1 Survival functions by the quality of hard infrastructure



Notes: Group 1 (40,991 obs.) represents survival function for regions ranked from 10 to 1 in Opora Russia according to the index measuring financial resources in a region; group 2 (19,655 obs.) – represents survival function for regions ranked from 20 to 11; group 3 (35,983 obs.) – for regions ranked from 35 to 21.

In a similar way, Figure 2 presents survival functions for three groups of regions with regard to different quality of soft infrastructure. The results shown on the graph are quite puzzling. We find that export flows from regions ranked among top ten according to the quality of soft infrastructure have lower survival rates in comparison to the other export flows. We believe that industry- and region-specific effects could affect these results. In particular, regions with high administrative burden could have a number of experienced exporters in sectors of traditional regional specialisation. We might observe relatively higher export survival despite of low institutional quality. In the methodology of empirical analysis, described above, we already discussed the issue of possible endogeneity problems. Thus, intuition given for the interpretation of Figure 2 confirms the differences in export flows for regions with different quality of soft infrastructure, however, it should be more accurately empirically tested according to provided empirical methodology.

Figure 2 Survival functions by the quality of soft infrastructure



Notes: Group 1 (22,808 obs.) represents survival function for regions ranked from 10 to 1 in Opora Russia according to the index measuring soft infrastructure in a region; group 2 (31,890 obs.) – represents survival function for regions ranked from 20 to 11; group 3 (41,931 obs.) – for regions ranked from 35 to 21.

Finally, we carry out a series of log-rank tests of equality of hazard functions across groups of regions. Table 1 indicates that the hypothesis is easily rejected indicating that there are statistically significant differences across export flows from regions ranked in different groups according to the quality of hard and soft infrastructure resources. However, it should be noted that the non-parametric analysis is a univariate approach without controlling for the effects of other explanatory variables and unobserved effects. Thus, it is necessary to conduct a deeper empirical analysis in order to investigate the effects of the availability of financial and human resources on export survival.

Table 1 Cox test for equality of survivor functions*

		Log-rank	*Wilcoxon*	*Taron-Ware*	*Peto-Peto*	*Log-rank + industry fixed effects*
Hard infrastructure	Chi^2	406.80	169.32	259.07	215.55	304.64
	$Pr > Chi^2$	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Soft infrastructure	Chi^2	756.52	641.47	714.33	683.27	818.81
	$Pr > Chi^2$	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: Regions are grouped in the way as presented in Figures 1 to 2.

4 Empirical strategy and results

We employ as a baseline estimation procedure a pioneering semi-parametric approach proposed by Cox (1972), which has the following specification in the general form:

$$h(t, x, \beta) = h_0(t)\exp(x'\beta),$$

where x is the vector of independent variables, β is the vector of estimated coefficients. The baseline hazard $h_0(t)$ is characterised as a function of time. A particular advantage of the Cox model is that the baseline hazard is left unspecified and is not estimated (Besedeš and Prusa, 2006b). However, Cox model has been criticised for the problem of unobserved heterogeneity and the validity of the hazard proportionality assumption (see Hess and Persson, 2012). First, unobserved heterogeneity problem may potentially cause parameter bias and bias in the estimated survivor function. Second, assumption of proportionality of hazards means that the effects of explanatory variables on survival are constant over time. Obviously, the effects of explanatory variables may be intrinsically non-proportional. This is especially important if among explanatory variables are time-varying covariates, which are included in this study (exporter GRP per capita, importer GDP per capita). Additionally, it is reasonable to assume time-dependent hazard rate because of well represented in recent empirical literature learning-by-exporting effects (Martins and Yang 2009; Silva et al., 2012), which may decrease hazard rates and, in other words, increase survival of export flows.

We follow (Hess and Persson, 2012; Ilmakunnas and Nurmi, 2010; Fu and Wu, 2014) and employ an alternative discrete-time duration model, in which the hazard rate is assumed to be of a complementary log-log (cloglog) form, which is, in the nature, a discrete time form of the continuous time proportional hazards model. In addition, as a robustness check we estimate the probit model with random effects. This method corresponds to Hess and Persson (2012) and has been implement in a number of papers (Fugazza and McLaren, 2014; Fugazza and Molina, 2016). The main advantage of probit estimation with random effects is that it explicitly allows to control for unobserved heterogeneity in the hazard specification.

Empirical equation to be estimates is given in the following form:

$$\Pr\left(x_{jdt,i} > 0 \middle| X_{idt,j}\right) = F\left(GRP_{it}\alpha + GDP_{dt}\beta + Exp_{ijd}\theta + G_{id}\rho + Hard_i\vartheta \right.$$
$$\left. + Soft_i\mu + M_{jd}\varphi D^1{}_j + D_d^2 + D_t^3 + u_{jdt,i}\right)$$

where $x_{jdt,i}$ denotes the export from region i to country d in sector j at time t. When the model is estimated using the complementary log-log model, $F(\cdot) = 1 - \exp[-\exp(\cdot)]$, when the model is estimated with probit, $F(\cdot)$ takes the form of the cumulative distribution function of the standard normal distribution function. Our variables of interest are $Hard_i\vartheta$ and $Soft_i\mu$ which measure, respectively, hard and soft dimensions of infrastructure available in the region. Variables GRP_i and GDP_{dt}, measure, respectively, gross regional product per capita of exporting region and gross domestic product per capita of importing region. The set of export flow specific characteristics $Exp_{ijd}\theta$ includes the average export value of export flow and a dummy variable that shows whether the export flow has been interrupted and resumed. The set of variables $G_{id}\rho$ reflects the variables of the gravity model and includes distance to the closest seaport, distance from the seaport to the destination market, whether the region has common language and common border with destination market, whether the exporting region is landlocked and whether the destination market is a post-soviet country. The set of variables $M_{jd}\varphi$ allows to control for unobserved heterogeneity on the destination markets and includes two variables – average applied import tariff for the period and average number of export flows from other Russian regions on this destination market. The proposed model includes a series of fixed effects for industries $D^1{}_j$, destination markets D_d^2 and time periods D_t^3. Both complementary log-log and probit models employ random effects, thus the error term takes the following form:

$$u_{jdt,i} = \left(\varepsilon_{jd,i} + \epsilon_{jdt,i}\right).$$

Results are shown in Table 2 columns (1), (4) and (7) present estimation results for the baseline specification. Columns (2), (5) and (8) show estimation results for the modified model where we include pairwise multiplications of the variables measuring the quality of hard and soft infrastructure resources and duration of export flow, the latter allows to capture the current length of the spell of activity for each trade relationship. These variables allow to additionally control for unobserved heterogeneity caused by time effects and account for possible learning-by-exporting effects. Finally, columns (3), (6) and (9) present estimation results where we include both pairwise multiplications of the variables measuring the availability of human and financial resources with duration and average value of export flow. This allows to control for both duration-specific and size-specific effects on export survival.

The empirical results show that Cox model, cloglog and probit estimation approaches provide similar impact levels of the coefficients. Results are also robust to additional time- and size-specific controls provided by pairwise multiplications with hard and soft infrastructure variables. Before interpreting the results it is important to mention that variables of hard and soft infrastructure are proxied by position of regions in rating, thus, lower value of a variable means higher availability of resources.

According to the results in Table 2, better availability of hard and soft infrastructure in a region increases export survival. The effects are even larger if we add pairwise multiplications to control for possible time- and size-effects. An improvement of a region in Opora Russia rating according to the availability of hard infrastructure by 1 position increases export survival and lowers hazard risks by 2.4%–3.4% [columns (3), (6), (9)]. Similarly, an improvement of a region in Opora Russia rating according to the availability of soft infrastructure by 1 position increases export survival by 3.8%–5.8% depending on the estimated model and specification. However, these effects are falling over time. Interaction terms between hard and soft infrastructure and export duration are negative and statistically significant. In addition, the empirical results suggest complementary effect of average export value and hard and soft infrastructure. In other words, the positive effect of improving the availability of hard and soft infrastructure in the region is higher for larger exporters. With regard to revealed size- and time-specific effects empirical results suggest that exporters learn over life-cycle that helps in treating with deficit/low quality of hard and soft infrastructure across Russian regions.

Table 2 Estimation results for 2003–2010 four-digit data

	Cox			*Probit*			*cloglog*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
Average export value (log)	–0.0282***	–0.0127***	–0.0397***	–0.0960***	–0.0377***	–0.0543***	–0.0951***	–0.0350***	–0.0461***
	(0.0016)	(0.0017)	(0.0039)	(0.0034)	(0.0024)	(0.0039)	(0.0036)	(0.0023)	(0.0039)
Hard infrastructure	0.0012***	0.0306***	0.0240***	0.0038***	0.0292***	0.0238***	0.0040***	0.0388***	0.0339***
	(0.0005)	(0.0017)	(0.0016)	(0.0012)	(0.0022)	(0.0027)	(0.0011)	(0.0026)	(0.0031)
Soft infrastructure	–0.0057***	0.0459***	0.0377***	–0.0122***	0.0433***	0.0384***	–0.0133***	0.0599***	0.0577***
	(0.0006)	(0.0021)	(0.0024)	(0.0015)	(0.002)	(0.0028)	(0.0014)	(0.0024)	(0.0031)
Hard infrastructure * Duration		–0.0194***	–0.0193***		–0.0137***	–0.0136***		–0.0214***	–0.0213***
		(0.0011)	(0.0011)		(0.001)	(0.001)		(0.0014)	(0.0014)
Soft infrastructure * Duration		–0.0300***	–0.0300***		–0.0228***	–0.0226***		–0.0348***	–0.0346***
		(0.0014)	(0.0014)		(0.0009)	(0.0009)		(0.0013)	(0.0013)
Hard infrastructure * Export value			0.0007***			0.0006***			0.0005***
			(0.0001)			(0.0002)			(0.0002)
Soft infrastructure * Export value			0.0009***			0.0005***			0.0002
			(0.0001)			(0.0002)			(0.0002)
Distance to seaport (log)	–0.0405***	–0.0200***	–0.0183**	–0.1629***	–0.0769***	–0.0764***	–0.1503***	–0.0524***	–0.0523***
	(0.0058)	(0.0073)	(0.0072)	(0.0144)	(0.0102)	(0.0101)	(0.0135)	(0.0091)	(0.0091)
Distance to export market (log)	0.0199***	0.0046	0.0048	0.0215*	0.0062	0.0051	0.0279**	0.0112	0.0105
	(0.0055)	(0.0044)	(0.0044)	(0.013)	(0.0079)	(0.0079)	(0.013)	(0.0071)	(0.0071)
Common language	–0.0502***	–0.0544***	–0.0552***	–0.1104***	–0.0399**	–0.0389**	–0.1151***	–0.0340**	–0.0334**
	(0.0124)	(0.0121)	(0.0119)	(0.0227)	(0.0165)	(0.0166)	(0.0249)	(0.0151)	(0.0152)

Notes: Standard errors are clustered at two–digit region–industry level. Cluster–robust standard errors in parenthesis. Cox regressions employ the Breslow method for ties.
Beta–coefficients for Cox model are provided. Marginal effects are provided for probit and cloglog models.
***Significance level: $p < 0.01$; **Significance level: $p < 0.05$; *Significance level: $p < 0.10$.

Table 2 Estimation results for 2003–2010 four-digit data (continued)

	Cox			*Probit*			*cloglog*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
Common border	–0.1568***	–0.0184	–0.0235	–0.3621***	–0.1206***	–0.1209***	–0.4144***	–0.0849***	–0.0852***
	(0.0177)	(0.0225)	(0.0228)	(0.0295)	(0.0252)	(0.0254)	(0.0336)	(0.0242)	(0.0243)
Post–soviet	0.0095	–0.0117	–0.0127	0.0291	–0.0069	–0.0094	0.0309	–0.0022	–0.0037
	(0.0107)	(0.0092)	(0.0093)	(0.0212)	(0.0168)	(0.0169)	(0.023)	(0.0152)	(0.0152)
Landlocked	–0.0739***	–0.0094	–0.0141	–0.1580***	–0.0455*	–0.0473**	–0.1652***	–0.0102	–0.0122
	(0.0121)	(0.0168)	(0.0166)	(0.0343)	(0.0242)	(0.0237)	(0.0314)	(0.0221)	(0.0219)
Exporter GRP per capita (log)	0.1420***	0.2087***	0.2057***	0.4098***	0.2186***	0.2176***	0.4106***	0.2259***	0.2239***
	(0.0258)	(0.037)	(0.0363)	(0.0755)	(0.0452)	(0.0449)	(0.0709)	(0.0406)	(0.0405)
Importer GDP per capita (log)	0.0110***	–0.0122***	–0.0112***	0.0322***	–0.0025	–0.0024	0.0295***	–0.0096*	–0.0094*
	(0.0042)	(0.0034)	(0.0034)	(0.0094)	(0.006)	(0.006)	(0.0099)	(0.0057)	(0.0057)
Import tariff	–0.0001	–0.0006	–0.0005	0.0059***	0.0031**	0.0031***	0.0037**	0.0032***	0.0033***
	(0.0007)	(0.0007)	(0.0006)	(0.0015)	(0.0012)	(0.0012)	(0.0015)	(0.0012)	(0.0012)
Competition	–0.0066***	–0.0006	–0.0004	–0.0148***	0.0023*	0.0026**	–0.0154***	0.0031***	0.0033***
	(0.0009)	(0.0012)	(0.0012)	(0.0017)	(0.0012)	(0.0012)	(0.0019)	(0.0012)	(0.0012)
Sector dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Export market dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Multiple spells	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cons	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	4.878	4.878	4.878	4.878	4.878	4.878	4.878	4.878	4.878

Notes: Standard errors are clustered at two-digit region-industry level. Cluster-robust standard errors in parenthesis. Cox regressions employ the Breslow method for ties.
Beta-coefficients for Cox model are provided. Marginal effects are provided for probit and cloglog models.
***Significance level: $p < 0.01$; **Significance level: $p < 0.05$; *Significance level: $p < 0.10$.

Among other results, we find that gravity variables have expected effects on export survival which is in line with traditional effects of gravity variables on international trade flows. In particular, a common border between Russian region and foreign market lowers hazard rate of respective bilateral flows from 2.4% to 12.1% depending on the specification [see columns (3), (6), (9) in Table 2). Similarly, survival of export flows for region closer located to the seaport is higher, which is in line with the idea of negative effects of transportation costs on export survival, found in recent literature. If an exporting region is landlocked, it will have on average higher survival rates of export flows. This result could be a counterintuitive at some extent. However, taking in account that more developed Russian regions are landlocked, while less developed are located closer to the borders and sea ports, this effect could be reasonably expected. We do not find any statistical effects of the distance from the closest seaport to the destination market on export survival. This could be the evidence of the fact that the transportation costs within the country and to the border are much more important for local exporters than international transportation costs.

5 Conclusions

This paper studies the effects of hard and soft infrastructure on export flows survival in Russian regions. We employ the data on export flows from 20 Russian regions to 124 destination markets in 2002–2010 and build an empirical estimation strategy based on recent theoretical and empirical findings.

Based on traditional Cox approach, probit and cloglog with random effects models our empirical estimations show that both the quality of hard and soft infrastructure affects export survival. Controlling for size and time-specific effects, we show that better quality of hard infrastructure proxied by the quality of energy, transport, logistics and ICT infrastructure, and better quality of Soft infrastructure measured by administrative burden and regulation, provide lower hazard risks for export flows. Moreover, positive effects of hard and soft infrastructure are higher for larger exporters, but decreasing over time. It provides an evidence of learning-by-exporting effects for Russian exporters, when poor hard and soft infrastructure conditions provide smaller negative effects for more experienced exporters. In addition, results support that hard and soft infrastructure in the Russian economy has resembling effects on export survival and, thus, might be considered as complements.

Empirical results suggest that one way to improve export survival rates is to increase export values and, in turn, to increase export revenues. Indeed in the case where the perspectives of business climate improvements are limited to some extent, it was shown that experienced exporters of higher values have larger effects of business climate on survival and on average live longer. In line with this, Das et al. (2007) study Colombian manufacturing industries and find that producers do not begin to export unless the present value of their expected future export profit stream is large. In a similar vein (Easterly and Reshef, 2014), on a database of African firms find that success stories as exports were accompanied by dramatic increase in export revenues.

We believe that our results on positive complementary effects of hard and soft infrastructure have important economic policy implications at the national and regional level. In particular, they contribute to the understanding of potential gains in investment into transport, logistics, energy, ICT and other hard infrastructure to improve export performance in Russian regions. The results also allow to understand the potential gains from improvements in institutions, administrative and tax burden for export performance in Russian regions. An important policy standpoint also comes from the result of complementary effects of hard and soft infrastructure and, thus, suggests that policies oriented towards better export performance to have larger positive effects should be complex and simultaneously provided.

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Notes

1 Descriptive statistics for the variables used is presented in Appendix 3, correlation matrix – in Appendix 4.

Appendix 1

Sample of countries

Country	*Group*	*Country*	*Group*	*Country*	*Group*
Afghanistan	DS	Trinidad and Tobago	DS	Romania	SECIS
Algeria	DS	Tunisia	DS	Serbia	SECIS
Angola	DS	Tanzania, United Rep.	DS	Tajikistan	SECIS
Bahamas	DS	Uganda	DS	Turkmenistan	SECIS
Bahrain	DS	United Arab Emirates	DS	Uzbekistan	SECIS
Bangladesh	DS	Uruguay	DS	Ukraine	SECIS
Bolivia	DS	Vietnam	DS	Australia	N
Cambodia	DS	Yemen	DS	Austria	N
Cameroon	DS	Zambia	DS	Belgium	N
Congo, Rep.	DS	Zimbabwe	DS	Canada	N
Costa Rica	DS	Argentina	ES	Czech Republic	N
Côte d'Ivoire	DS	Brazil	ES	Denmark	N
Dominican Republic	DS	Chile	ES	Estonia	N
Ecuador	DS	China	ES	Finland	N
El Salvador	DS	Colombia	ES	France	N
Guatemala	DS	Cuba	ES	Germany	N
Honduras	DS	Egypt	ES	Greece	N
Iran	DS	India	ES	Hungary	N

Note: DS = Developing South, ES = Emerging South, SECIS = South-Eastern Europe and Post-Soviet countries, N = North.

Sample of countries (continued)

Country	*Group*	*Country*	*Group*	*Country*	*Group*
Iraq	DS	Indonesia	ES	Ireland	N
Jamaica	DS	Jordan	ES	Iceland	N
Kenya	DS	Malaysia	ES	Israel	N
Kuwait	DS	Mexico	ES	Italy	N
Laos	DS	Morocco	ES	Japan	N
Lebanon	DS	Pakistan	ES	Korea, Rep.	N
Liberia	DS	Peru	ES	Latvia	N
Mauritania	DS	Philippines	ES	Lithuania	N
Mongolia	DS	Singapore	ES	Netherlands	N
Mozambique	DS	South Africa	ES	New Zealand	N
Myanmar (Burma)	DS	Taiwan (China)	ES	Norway	N
Namibia	DS	Thailand	ES	Poland	N
Nepal	DS	Turkey	ES	Portugal	N
Nicaragua	DS	Venezuela	ES	Slovakia	N
Niger	DS	Azerbaijan	SECIS	Slovenia	N
Nigeria	DS	Armenia	SECIS	Spain	N
Oman	DS	Bosnia and Herzegovina	SECIS	Sweden	N
Panama	DS	Byelorussia	SECIS	Switzerland	N
Paraguay	DS	Croatia	SECIS	Great Britain	N
Qatar	DS	Georgia	SECIS	USA	N
Saudi Arabia	DS	Kazakhstan	SECIS		
Senegal	DS	Kyrgyzstan	SECIS		
Sri Lanka	DS	Macedonia	SECIS		
Sudan	DS	Moldavia	SECIS		
Syria	DS	Montenegro	SECIS		

Note: DS = developing south, ES = emerging south, SECIS = South-Eastern Europe and post-soviet countries, N = north.

Appendix 2

Independent variables

Variable	*Description*	*Source*
Average export value (log)	Average export value in USD	Authors' calculations
Soft infrastructure	Measure of entrepreneurial environment, including quality of tax administration, corruption and organised crime at the regional level. Index is between 1 and 35, where 1 corresponds to the region with the best conditions for doing business with regard to the quality of institutions.	All-Russian Non-Governmental Organization of Small and Medium Business – 'Opora Russia'
Hard Infrastructure	Measure of the availability of infrastructure, including availability of electric power supply, exhibition spaces, transport and logistics infrastructure, ICT infrastructure at the regional level. Index is between 1 and 35, where 1 corresponds to the region with the best conditions for doing business with regard to hard infrastructure availability and quality.	All-Russian Non-Governmental Organization of Small and Medium Business – 'Opora Russia'
Distance to sea port (log)	Distance in km between the capital city in region and sea port of export shipment	Authors' calculations
Distance to export market (log)	Distance in km between Sea port and capital city in foreign market	Authors' calculations
Common language	Dummy variable, equals 1 if common language	CEPII
Common border	Dummy variable, equals 1 if common border	Authors' calculations
Common history	Dummy variable, equals 1 if country is post-communist	Authors' calculations
Landlocked	Dummy variable, equals 1 if country is landlocked	Authors' calculations
Exporter GRP per capita (log)	Average GRP per capita in mln roubles for the period 2003–2010	Federal State Statistics Service (Rosstat)
Importer GDP per capita (log)	Average GDP per capita in USD for the period 2003–2010	World Development Indicators
Import tariff	Applied tariff including preferential tariffs, which is importer-exporter-pair specific, %	World Development Indicators
Competition	Average number of countries that export product I from Russian regions over the spell	Authors' calculations
Multiple entry	Dummy variable, equals 1 if multiple entry	Authors' calculations

Appendix 3

Descriptive statistics

Variable obs	*Obs*	*Mean*	*Std. dev.*	*Min*	*Max*
Duration	57,682	1.58	1.13	1	7
Average export value (log)	57,682	9.46	2.67	4.61	21.43
Hard infrastructure	57,682	16.45	10.70	1	35
Soft infrastructure	57,682	17.97	9.11	1	33
Distance to sea port (log)	57,682	9.07	0.67	5.78	9.73
Distance to export market (log)	57,682	7.77	0.78	5.75	9.74
Common language	57,682	0.11	0.32	0	1
Common border	57,682	0.04	0.20	0	1
Post-soviet	57,682	0.45	0.50	0	1
Landlocked	57,682	0.81	0.39	0	1
Exporter GRP per capita (log)	57,682	11.80	0.19	11.45	12.22
Importer GDP per capita (log)	57,682	8.52	1.41	5.35	11.20
Import tariff	57,682	4.65	5.22	0	47.92
Competition	57,682	7.55	6.31	1	33

Appendix 4

Correlation matrix

	Average export value (log)	*Hard infrastructure*	*Soft infrastructure*	*Distance to sea port (log)*	*Distance to export market (log)*	*Common language*	*Common border*	*Post–soviet*	*Landlocked*	*Exporter GRP per capita (log)*	*Importer GDP per capita (log)*	*Import tariff*	*Competition*	*Duration*
Average export value (log)	1													
Hard infrastructure	0.02	1												
Soft infrastructure	–0.03	0.25	1											
Distance to sea port (log)	0.00	–0.06	–0.02	1										
Distance to export market (log)	0.00	–0.03	0.04	–0.02	1									
Common language	–0.05	0.00	–0.07	0.01	0.09	1								
Common border	–0.04	0.03	–0.07	–0.09	–0.05	0.37	1							
Post-soviet	–0.05	0.01	–0.06	0.04	–0.36	0.40	0.19	1						
Landlocked	0.04	–0.17	–0.38	0.36	0.15	0.03	–0.01	0.00	1					
Exporter GRP per capita (log)	0.03	–0.18	0.01	0.21	0.07	0.01	–0.08	–0.01	0.39	1				
Importer GDP per capita (log)	0.04	–0.02	–0.04	0.01	–0.10	–0.12	–0.02	–0.42	–0.04	0.04	1			
Import tariff	0.04	0.02	0.05	0.00	0.29	–0.17	–0.11	–0.19	0.03	0.01	–0.27	1		
Competition	0.11	–0.01	–0.14	–0.07	–0.08	0.31	0.08	0.33	0.02	0.01	–0.06	–0.12	1	
Duration	0.22	–0.02	0.04	0.10	–0.04	0.12	0.11	0.11	0.04	0.00	–0.03	–0.04	0.17	1