FACULTY OF BUSINESS STUDIES AND ECONOMICS
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DOCTORAL THESIS

The economic impact of international uncertainties

Sanctioning effects, foreign direct investment and firm behaviour in Russia

A thesis submitted to the Doctoral Commission Dr. rer. pol. of the University of Bremen in fulfilment of the requirements for the degree of Dr. rer. pol.

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Contents

List of Figures

List of Tables

List of Abbreviations

2SLS	Two Stage Least Squares
AIC	Akaike Information Criterion
bln	billion
BP	British Petroleum
CBR	Central Bank of Russia
CDM	Crépon, Duguet, and Mairesse
CEECs	Central and Eastern European countries
CGE	Computable General Equilibrium
CIS	Commonwealth of Independent States
CN	Combined Nomenclature
Comecon	Council for Mutual Economic Assistance
CPA	Classification of Products by Activity
CPI	Consumer Price Index
EBRD	European Bank for Reconstruction and Development
EDC	Eurasia Drilling Company
EU	European Union
EUR	Euro
FDI	Foreign Direct Investment
FSU	Former Soviet Union
GDP	Gross Domestic Product
GNP	Gross National Product
GPS	Global Positioning System
GVC	Global Value Chain
H-O	Hecksher-Ohlin
IB	International Business
ICRG	International Country Risk Guide

ICT	Information and Communications Technology
IMF	International Monetary Fund
IO	Input-Output
IOT	Input-Output Table
ISIC	International Standard Industrial Classification of All Economic Activities
ISO	International Organization for Standardization
IT	Information Technology
IV	Instrumental Variable
JV	Joint-Venture
mn	million
MNCs	Multinational Companies
MNEs	Multinational Enterprises
NACE	Statistical Classification of Economic Activities in the European Community
NEG	New Economic Geography
NIE	New Institutional Economics
NTT	New Trade Theory
OECD	Organisation for Economic Co-operation and Development
OFDI	Outward Foreign Direct Investment
OLI	Ownership Location Internationalization
OLS	Ordinary Least Squares
OPEC	Organization of the Petroleum Exporting Countries
R&D	Research and Development
Rosstat	Russian Federal State Statistics Service
RUB	Ruble
S&P	Standard & Poor's
SITC	Standard International Trade Classification
SME	Small and Medium-sized Enterprise
SOE	State-Owned Enterprise
TE	Technical Efficiency
TFP	Total Factor Productivity
thd	thousand

U.S.	United States
UK	United Kingdom
UN	United Nations
UNIDO	United Nations Industrial Development Organization
USSR	Union of Soviet Socialist Republics
VAR	Vector Autoregression
WIOD	World Input-Output Database
WTO	World Trade Organization
WWII	Second World War

Chapter 1

Rationale

1.1 Introduction

The present thesis deals with various sources and costs of economic uncertainties, such as sanctions and political risks, as well as the resulting behaviour patterns of economic actors in the context of the global interaction between emerging and developed economies. A unique geopolitical environment revolving around the Crimea in combination with a post-transition setting makes the present study interesting from the point of modern economic history, and can help draw important political implications. Under the effect of this geopolitical environment, it is not only the Russian economy that is being altered but also Russia's integration into the global economy.

Geopolitical uncertainty is by far the most important factor in its potential to hamper global investment flows (UNCTAD, 2017) by reversing their direction towards developed countries and away from emerging ones (Caldara and Iacoviello, 2018). High geopolitical risks, one of the "uncertainty trinity" along with economic and political uncertainties, can drive business and financial cycles by evoking a decline of real output and a decrease in stock returns (Bussire and Mulder, 2000; Baker, Bloom, and Davis, 2016; Balcilar et al., 2018).

Transition reforms in emerging economies are believed to lead to better firm performance, resulting mainly from structural transformations, support of market institutions and openness to international trade and investment. The recent history of reforms suggests that the productivity gap between firms in transitional economies and those in developed economies has been gradually closing, though more slowly and more costly than expected.

The empirical evidence indicates that Russia's transition path was somewhat different than other Central and Eastern European countries. Thus, the initial economic downturn in the 1990s and the reaction to the global financial crisis of the 2008 was significantly deeper, and the degree of global integration has been much lower than elsewhere. It has been argued that weaker institutions, path dependence and vested interest groups have defined this specific transition trajectory (Yasin, 2002; Bessonova and Gonchar, 2015; Gurvich, 2016). To wit, the political landscape in Russia began to change significantly after the 2008 crisis, followed by the reverse of globalization, increased government regulation, and disappointment with the consequences of its accession to the World Trade Organization (WTO) in 2012, which marked the climax of Russian globalization.

The current change in Russian economic policy, regulation, and firm behaviour, induced by a reaction to increased political uncertainties, have complemented the problems associated with an incomplete structural transformation. Thus, increased uncertainties, weak institutions and structural problems seem to reinforce each other and are further strengthened when combined with exogenous idiosyncrasies.

This thesis delivers a comprehensive contribution to several fields of studies, including: international economics, political economy, international business and industrial organization literature, as well as institutional and innovation economics. Another unique feature of this research is related to the application of various econometric and mathematical methods, including vector autoregressions, survival analysis, input-output analysis, stochastic frontier analysis, instrumental variables regressions etc., as well as the construction of unique data sets.

Chapters 2 - 4 form the empirical part of this dissertation. In Chapter 2, we begin by quantifying the economic cost for the sanction sender, the EU-27, in the aftermath of the geopolitical crisis, triggered by Russia's involvement in the Ukrainian conflict. We find that direct costs are mainly born by the countries closely connected with Russia in terms of trade, whereas indirect costs are mainly induced by the tight embeddedness in the European trade network. The findings also imply that the aspired economic convergence within the EU can be threatened or reversed as a result of geopolitical tensions.

In the empirical part that follows, we turn to the question of whether political risks affect the behaviour of multinational companies (MNCs) in Russia. The research shows that political risks not only affect Foreign Direct Investment (FDI) exits in the host economy, but that their impact is intensified through sanctioning policies. Since an increasing cross-border integration is an acknowledged factor of productivity growth that can be implemented through integration into global value chains (GVCs) via foreign direct investment, these findings have a direct implication for the current sanction debate.

In our final empirical analysis, we take a different perspective that is still highly relevant for an emerging economy stuck in the geopolitical crisis while simultaneously requiring reforms that would guarantee sustainable long-term growth. This growth becomes possible by boosting productivity and building institutions that foster investment in human and physical capital, as well as innovation, in both the high and low-tech manufacturing sectors. This type of investment should become Russia's top policy objective, since it is a feasible source of productivity growth. Thus, in the empirical study on the innovation-performance link, we scrutinize the factors that might contribute to an improved efficiency of the Russian manufacturing sector.

The purpose of this introductory chapter is to lay the necessary ground work for placing the empirical evidence presented in Chapters 2 – 4 in a broader economic context. After a review of the main milestones in Russian economic history, we outline Russia's integration into the global economy. We consider FDI and trade as the most relevant components of Russia's globalization process, a process that is currently being reversed as a result of geopolitical tensions. The Rationale concludes by focusing on our research questions, and providing an outline of the three empirical papers that make up the rest of this dissertation. Finally, we offer several comments about the limitations and potential extensions of our research.

1.2 Russia's newest economic history

To comprehend Russia's current economic and geopolitical position, it is necessary to begin before the collapse of the Soviet Union in 1991. The Soviet Union's economic and political heritage played a significant role in defining the path of present-day

Russian economic development, and is still relevant today. Many of today's economic concerns in Russia, such as the nature of path dependence, severe structural imbalances and weak institutions, stem from the suboptimal trajectory of reforms in the recent past. After briefly discussing the theoretical foundations of the transition process, we will describe the main stages of Russia's economic past.

1.2.1 Transition path

In the aftermath of the collapse of the Soviet Union, a large body of related economic and political research emerged and can be subdivided into three major fields: analysis of policy design, theoretical analysis, and empirical studies. Because of their shared objectives, the modern debate no longer separates the economics of transition from the sub-field of development economics (Olofsgård, Wachtel, and Becker, 2018). In spite of all of these studies and analyses, the literature remains inconclusive.

At the beginning of the transition process, a centrally debated theoretical issue was the "big bang vs. gradualism" dichotomy that revolved around the speed of the transition (see Kornai, 1990; Blanchard et al., 1991; Fischer and Gelb, 1991; Roland, 2000). In a nutshell, the big-bang reform strategy proposed a rapid and simultaneous introduction of multiple reforms (Berg et al., 1999; Lipton and Sachs, 1990; Boycko, 1992; Berg et al., 1992; Murphy, Shleifer, and Vishny, 1992; Balcerowicz, 1994; Sachs, 1994; Frydman and Rapaczynski, 1994; Woo, 1994 etc.). This sort of "shock therapy" approach was considered by its proponents to be the most efficient way of introducing a market economy and relied on specific policy and reform prescriptions established by The Washington Consensus. These prescriptions are shared by Washington-based international financial institutions (IFIs), such as the International Monetary Fund (IMF), the World Bank and the United States Department of the Treasury and are designed for countries undergoing a transition or experiencing a crisis. In their narrowest interpretation, these measures are designed to address macroeconomic stabilization, privatization and liberalization (Williamson, 1990; Williamson, 2004).

In retrospect, however, this approach has been criticized for failing to deliver the desired results (Stiglitz, 1998; Rodrik, 2002; Rodrik, 2006). The inability of this approach to bring about substantive institutional reforms is often cited as a cause for its failure (Murrell, 1996). Not surprisingly, the gradualist or evolutionary-institutional mode has become more popular. It has been suggested that this approach is more sustainable because it minimizes adjustment costs and public unrest (e.g. see Aghion and Blanchard, 1994 for their theoretical model of optimal speed of transition; Blanchard and Kremer, 1997; Boeri, 2000; Marangos, 2005; Portes, 1991; McKinnon, 1993; Roland, 2000; Dewatripont and Roland, 1992; Dewatripont and Roland, 1995; McMillan and Naughton, 1992; Murrell, 1995).

However, the ongoing scholarly debate dealing with the "big bang vs. gradualism" dilemma suggests that considering only the speed of transition reforms is too limited in its view. Focusing only on "speed" disregards other important dimensions, for instance the timing and sequencing of reforms (e.g., Godoy and Stiglitz, 2006; Havrylyshyn, 2001). Furthermore, as the transition was underway a new theoretical approach emerged known as New Institutional Economics (NIE) (Williamson, 2000). The emergence of this approach shifted the focus from the optimal speed or sequencing of reforms to implementing reforms that would create enduring institutions (Havrylyshyn, 2007). The core idea being that a successful transition to a market economy can only occur if market institutions are functioning optimally (Murrell, 2008).

Today, more than 25 years after the transition began, scholars are still arguing about which transition strategy proved most successful, and even whether or not the transition process has run its course. For example, Sonin presents a summary outlining the end of the transition process (Sonin, 2013), while Pistor presents opposing arguments suggesting that the process is still ongoing (Pistor, 2013).

In the meantime, numerous empirical studies on the effects of the speed of transition on economic growth have struggled to shed unequivocal light on the theoretical debate. There are any number of studies that argue in favour of either approach (e.g., Havrylyshyn, 2007; Gros and Steinherr, 2004 for big-bang proponents, or e.g., Popov, 2007; Berr, Combarnous, and Rougier, 2005 for gradualist proponents). Dell'Anno and Villa suggest that a big bang approach entails higher initial adjustment costs that are, however, compensated by long term benefits (Dell'Anno and Villa, 2013).

Fidrmuc and Tichit, 2013, looking at a sample of post-communist countries, show that the severity of crisis after the start of the transition has a positive effect on the ensuing pace of economic reform, economic growth and a subsequent investment and institutional change. Obviously, there is no "one size fits all" solution, as real life shows. Whereas some countries adopted the gradual approach (e.g., Hungary, Romania, Slovenia, Kazakhstan), others opted for the big-bang strategy (e.g., Czech Republic, Estonia, Poland).

Table A.1 in the Appendix presents the list of all transition economies according to the type of transition. The list includes both Central and Eastern European countries (CEECs), and countries that were part of the former Soviet Union (FSU). Apart from this criterion, we depict the European Bank for Reconstruction and Development transition measure (EBRD, 2019), as well as the ratio of Gross Domestic Product (GDP) at the beginning of the transition and GDP in 2000 and 2017, 25 years after transition (Di Weder Mauro, 2001; Gros and Steinherr, 2004). Sorted by the average EBRD indicator in 2014, the top five countries (Estonia, Poland, Latvia, Lithuania and Slovak Republic) are big-bangers and also CEECs. They are followed by Hungary and Croatia, both of which underwent a gradual reform process. Similar results occur when sorted according to the highest GDP 1992/GDP 2000 ratio. The data clearly highlight that CEECs outperform FSU, no matter which transition path was chosen. This is in line with Balcerowicz, 1995 who argues that economic outcomes are not only determined by the reform policies, but that the initial economic situation and exogenous economic developments also play a role. **Brenton.1997** suggest that the compatibility of the initial informal institutions with the specific reform measures was more crucial than the speed of the transition.

It was initially assumed that Russia was a big-bang implementer, but because the initial rapid market reforms were ineffective in achieving macroeconomic stability, this approach was partially reversed. In spite of extensive transition reforms in the beginning of the 1990s, and the fact that Russia inherited a rather vast industrial base of the Soviet Union, its restructuring proved to be difficult because of the size, specific market structure, technological specificity, priorities given to defense consumption, and internal barriers to capital and material flows (Gonchar and Kuznetsov, 2008).

As Figure 1.1 shows, Russia's most recent economic history can be subdivided into four major periods with the end of each period being marked by an economic crisis. Crude oil prices are also depicted in Figure 1.1, since Russia's industrial and export base still mostly relies on energy sources (Šmelev and Popov, 1990; Braginskij and Javlinskij, 2000; Gaidar, 2012). Both curves clearly show similarities and also share common slumps. Abundant in natural resources, Russia's economic development was always closely related to the oil prices. One of the main reasons for the collapse of the Soviet Union was a drastic drop in oil prices in 1986, which also held back the transformation process in the early 1990s. As Russia's GDP hit rock bottom, so did the oil prices. In August 1998, the zenith of Russia's economic crisis, it amounted to $8 per barrel. After 1999, oil prices began to recover, and so did the Russian economy. The second phase of the post-transformation development is characterized by continuous growth, not least because of the impressive oil revenues streaming into the Russian treasury. After a brief drop in 2008-2009, oil prices remained at a constantly high level during the years of 2011-2014 (over $100 per barrel in current prices). This period was followed by another dramatic fall to less than $50 per barrel in 2015-2016.

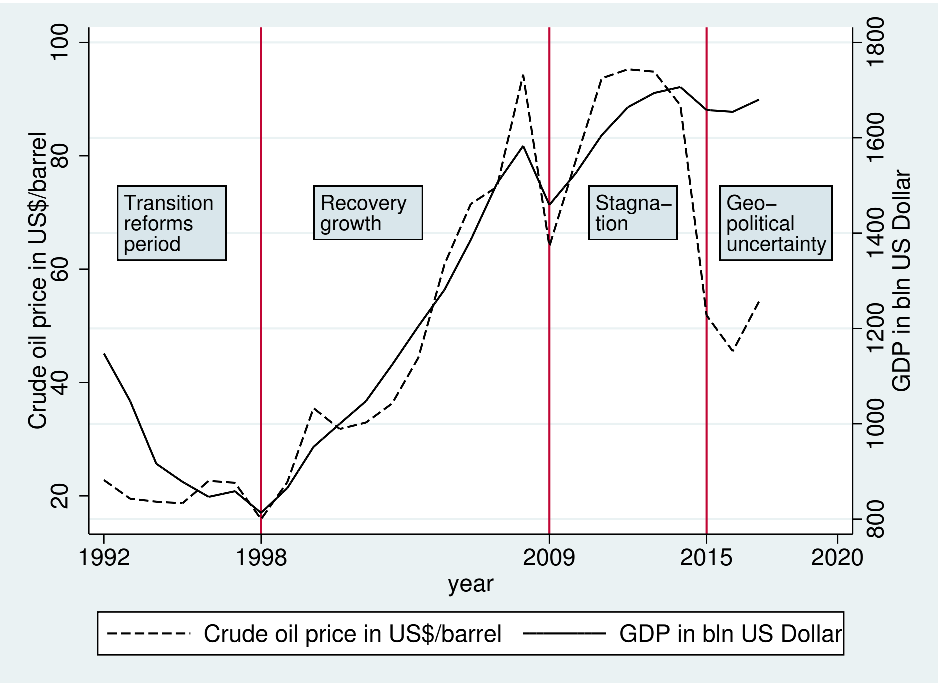

FIGURE 1.1: Four stages of Russian economic history

Note: GDP and oil prices are presented in constant 2010 US$. Oil prices are depicted on the left y-axis, GDP - on the right.
Source: World Bank

The first of the four stages, 1992-1998, is a period of active market transformation that resulted in the currency default crisis. However, it was also during this period that market reforms started to become effective. The second stage, between 1999 and 2008, also called "the fat years", is marked by high hydrocarbon revenues and a continuous regenerative economic growth. Overall, GDP increased by 83% during these years. The end of this stage coincides with the global financial crisis, which significantly impacted Russia and brought about a 7.8% plummet in GDP. The third stage is characterized by relatively slow initial economic growth followed by a period of stagnation. Geopolitical tensions combined with the plunge of oil prices in 2014 resulted in another GDP drop in. The fourth and final stage begins with a slight upturn in economic growth, but it is too early to determine if this upturn can be sustained. We will now consider each period in more detail.

1.2.2 First stage: a period of transition reforms

The downfall of the Soviet system was triggered by political reforms. The decay of the Council for Mutual Economic Assistance (Comecon, an economic organization of the communist states under the flagship of Soviet Union) led to a disintegration of the Soviet market, which in turn significantly decreased demand for Russian goods in the former common Soviet market. The economy opened, the defence industry was shocked by the severe decrease of military procurement, and attempts to adjust defence technologies to meet civil needs mostly failed. There was a concomitant deficit of consumer goods and services, and labour income and savings were critically devalued (Akindinova, Kuzminov, and Yasin, 2016). It became apparent that the Soviet system, unable to provide long-term economic growth or even basic stability, was in need of reform.

The initial intention was to transform the planned Soviet economy into a market economy within 500 days, starting October 15, 1990 (Nellis, 2016). Although this goal was not met, Russian reformists continued to pursue a big-bang transformation strategy relying on the above-mentioned pillars of the Washington Consensus: macroeconomic stabilization, privatization, liberalization (Yasin, 2002). However, the prevailing negative political and social environment led to poor implementation and hindered the most important market transformations and social reforms.

Based on the Washington Consensus notion of liberalization, Russia began a transition from state-controlled trade and prices to free trade and free prices. In particular, the systems of planned distribution and allocation were removed, and the state foreign trade monopoly was abolished. A further step was the creation of a free, non-regulated national currency that was convertible is introduced. Price liberalization is closely tied to a restructuring of the economy that takes place in stages. New market prices indicate a real demand. Resources, no longer being allocated as a part of a planned economy, are allocated into specific sectors based on market mechanisms. Against the background of the restructuring processes, while inefficient production facilities became uncompetitive and were forced to shut down, new efficient firms began to appear and grow.

Price liberalization was implemented in Russia on January 2, 1992, also known as D-day. This process entailed removing price controls on 80% of wholesale and 90% of retail commodities. In addition to price liberalization, import restrictions were temporarily lifted and a zero import tariff was set (Yasin, 2002). As a consequence, inflation initially surged at exorbitant rates, finally settling down by June 1994. Overall, this period of great economic and political reforms was characterized by severe economic hardships, financial instability, dwindling output accompanied by rising unemployment, and social calamities (OECD, 1997). Wage liberalization led to increasing inequality (Gruen and Klasen, 2012), and already by 1994, the Gini coefficient amounted to 0.4 (Yasin, 2002). Wages, despite their deregulation, could not keep pace with inflation and most of the population became impoverished.

Liberalization is expected to cause a certain amount of instability and hardship. Because of this expectation, macroeconomic stabilization reforms represent an effort to achieve price, production and employment stability after these parameters have become unbalanced. Stabilization in the Russian experience was only achieved after the "Black Tuesday" of October 11, 1994, when the ruble fell by almost 30 percentage points in one day. Finally, by 1996, consumer prices rose by only two-digits (21.8%) during the year, marking the completion of macroeconomic stabilization (Yasin, 2002).

The notion of private property and ownership is an important aspect of any market economy. At the beginning of the 1990s, 90% of production capacities were in state ownership (Gaidar, 2012). Privatization refers to the transfer of responsibility and risk from the state to private owners. By offering most of the state property to the private sector, a new system of economic incentives and full-fledged market agents is created. Privatization in Russia occurred in two stages. The first stage, or voucher privatization, took place between mid-1992 and mid-1994. As a result, approximately two thirds of the GDP were generated by the private sector. The second stage involved consolidation of private property. The process of consolidation is the most controversial part of the Russian privatization program. Loans for shares schemes were applied to selected cases of privatization for large properties in commodities. The lack of transparency and open competition draws into question the legitimacy of some of these deals (Boycko, Shleifer, and Vishny, 1997; Treisman, 2010). It is this very privatization method that gave rise to a class of oligarchs who are accused of stripping the state of its assets at effectively no personal cost (Aven and Kokh, 2013).

Consequently, privatization debate remained in place many years after the privatization itself took place. Denisova, Eller, and Zhuravskaya, 2010 claim that by 2006 about half of the population was still very dissatisfied with the transition results. There was a significant demand from the population for a "strong state", requesting state intervention in all spheres of economic life. Astonishingly, this demand coexists with a deep mistrust of state institutions. This puzzling finding is explained by Aghion et al., 2010 by the low levels of trust and civic capital, when the optimal behavioural strategy in society is to not be active in civil society (see Murphy, Shleifer, and Vishny, 1993 and Roland, 2000, for a basic theoretical model of equilibria existence). Another study on the attitudes toward privatization in Russia by Dower and Markevich, 2014 draws a connection between privatization in the 1990s in contemporary Russia and a mass privatization reform in Imperial Russia, the 1906 Stolypin land reform, and relates historical privatization antagonism with favouring state ownership today.

Although by 1996 a degree of financial stability, signs of economic growth and merely double-digit inflation indicated that the initial market reforms had been successful, by 1998 several alarming fiscal trends had developed. These included: a malfunctioning tax system, the concentration of financial and economic activities within groups closely related to the government, and economic policies that lacked transparency with respect to competition and privatization, among other developments. The existing problems made the Russian economy highly vulnerable to external and internal shocks. The considerable government debt could not be served due to a shift in global prices, and in 1998 the financial crisis broke out. The main economic indicators fell again, and monthly inflation jumped. In fact, 1999 is the year that marks the beginning of more stable positive trends.

Shleifer and Treisman, 2000 were important witnesses to the Russian reform process. They consulted with the Russian government in the 1990s, and conclude in their writings about the Russian reforms that the privatization process that began in 1992, and the macroeconomic stabilization in 1995–1996, can be considered to be successful. By contrast, other reforms (e.g., fiscal reforms) were less successful when compared to other transition economies. Yasin, 2002 cites several reasons why Russia's transformational crisis was deeper and longer than other transition countries (Yasin's observations do not include countries belonging to the Commonwealth of Independent States (CIS)). First, the Russian socialist experience spanned over 70 years, compared to only 40 years in the CEECs. Yasin also notes that for Russia socialism was not an imported ideology, but a grassroots nationalist movement. Second, market reforms were implemented against the background of the collapse of the Union of Soviet Socialist Republics (USSR). Third, a huge share of the expenditures for the military-industrial complex (in comparison with other countries) became a serious burden for Russia. Moreover, the conditions of the Russian transition were complicated by a quick rise of oligarchs that resulted in the largely negative social perception of capitalism and a market economy.

1.2.3 Second stage: a period of recovery growth

Starting in 2000, Russia entered a new phase of its economic development, also called the recovery growth or modernization phase. It is no coincidence that this phase coincides with the increase in export prices for hydrocarbons. Russia's growth rate between 2000 and 2008 averaged 6.9%. In the group of developing and emerging economies, only China had a higher rate of 10.4% (Kudrin and Gurvich, 2015).

This period was characterized by continuous productivity growth and a healthy integration into the global economy. The newly elected government embarked upon a new reform programme and created new rules of the game: customs procedures were simplified, a flat income tax rate was established, and most importantly numerous trade barriers were removed or abolished as part of the negotiation process with the WTO. The oligarchs were deprived of their political power and eventually their strategic assets. Energy assets were re-nationalized. All these measures and achievements helped to stabilize Russia's budget, raise effective household demand and strengthen Russia's position on the global market by integrating Russian businesses and banks into the system of global capital markets.

1.2.4 Third stage: a period of economic stagnation

Russia's economy was seriously impacted by the 2008 global financial crisis. Even though the GDP fell by 7.8% in 2009 (higher than most other transition countries), the economy managed to recover relatively quickly due to a slow growth of disposable incomes. The recovery, however, was relatively stagnant with growth of only 1.5 percent between 2009 and 2013 (for comparison, Chinese GDP growth was 8.9 percent). This sluggish growth persisted in spite of the recovery of oil prices (IMF, 2014).

One explanation offered by the literature for slow economic growth is an inadequate change in the institutional environment (North, 1990; Rodrik, 2005; Acemoglu and Johnson, 2005). Institutions that provide investment incentives are considered of high importance (North, 1990; Williamson, 1985; Acemoglu, Johnson, and Robinson, 2002). Empirical literature also shows that an inferior institutional environment hinders global integration and decreases FDI (Javorcik and Wei, 2009) and a country's competitiveness in foreign trade (Nunn and Trefler, 2014). High quality institutions, on the other hand, provide incentives for innovative activity (Tebaldi and Elmslie, 2013 and Silve and Plekhanov, 2018).

The rigidity of Russian institutions is supposed to be the reason why the large-scale developing programs that were undertaken during the first decade of the twenty-first century did not deliver the desired results (Gurvich, 2016). Kudrin and Gurvich, 2015 identify several key problems with the Russian economy that led to the stagnation of the 2009-2013 period. These issues can be summarized as follows: an exorbitant proportion of State-Owned Enterprises (SOEs), a policy of industrial paternalism (e.g., soft budget constraints and non-functioning creative destruction mechanism, which implies the unreasonable backing of inefficient industries and companies) and an inefficient public administration mechanism. Gurvich, 2016 adds weak property rights protection and vulnerability of property, as well as an ongoing struggle for rents to the list of key institutional limitations.

Although the issue of weak Russian institutions became obvious in this period, it is still of high relevance for Russia today. The Soviet legacy that shaped modern informal and formal institutions malfunctioned in terms of market allocation. The quality of social goods (support for retirees, unemployed persons, educational and other institutions) delivered by the state remains insufficient. In recent years, a continuous decline of Russian regional democratic institutions took place, and coincided with an all-embracing trend of political and economic centralization (Alexeev and Mamedov, 2017).

1.2.5 Fourth stage: a period of geopolitical uncertainty

In 2014 the Russian economy entered another recession that coincided with the decline of oil prices and culminated in a GDP decrease of 2.8 percent in 2015 (1.1). In the second half of 2014, oil prices began to decline rapidly, and by January 2015 they fell to the lowest level since March 2009. According to the World Bank report, several factors contributed to this decline: a change in expectations of demand and supply mainly due to the growth of shale oil production in the USA, a shift of the OPEC targets from maintaining prices to maintaining market share, resistance of oil supply towards existing geopolitical risks in the Arab world, and the strengthening of the United States dollar against other currencies (World Bank Group, 2015). Although oil prices are bound to follow boom and bust cycles, some experts believe that there are fewer reasons to expect a rapid and continuous growth of oil prices (Akindinova and Yasin, 2015). The shale oil revolution created the conditions for the expansion of oil production in the U.S. and other non-traditional hydrocarbon exporters, and reduced OPEC's influence on oil market pricing and forced the cartel to move from a policy of maintaining high prices to retaining its market share.

An additional factor that burdened the Russian economy during the latest economic crisis is the fall of the ruble against the dollar and the euro beginning in the autumn of 2014. The Bank of Russia introduced a floating exchange rate regime in November 2014 and drastically increased the key interest rate. These measures enabled the stabilization of the exchange rate. Simultaneously, a painful increase of the key rate, although amplified the borrowing costs, improved the attractiveness of deposits, halting the capital flight. It was a necessary step since capital flight was yet another major issue of the latest crisis, underlying the radical deterioration of Russia's investment attractiveness.

Ruble devaluation, together with the effect of the introduction of trade restrictions on imports of goods from countries that joined the sanctions against Russia, led to an acceleration of inflation to 11.4% in 2014, as well as an increase in inflationary expectations. In 2015, the inflation rate amounted to 15.6%. The implementation of a tight monetary policy helped decrease the inflation rate to 7.1% in 2016. High inflation is a significant obstacle to economic development, since it devalues savings and makes investments unattractive. Compared to 2015, disposable incomes in 2016 continued to contract. In 2016, the poverty rate increased by 0.2%. Nearly 20 million people, or 13.5% of the population, were living below the subsistence level in 2016.

As Akindinova and Yasin, 2015 note in their paper, even if we consider the resolution of the currency crisis to be the end of the first phase of the latest 2015 crisis, the next phase will be longer and more painful. The authors anticipate that overcoming the negative consequences of this stage will be associated with a restructuring of the economy on the basis of acquired competitive advantages, the extinction of unprofitable and inefficient enterprises with a transition capital leading to the growth of promising industries. This difficult and painful process must be completed before new sources of private investment and the implementation of economic, legal and political institutional reforms can take place.

1.3 Mapping Russia on the economic globe

After having looked at the recent economic history of Russia, we now turn to today's economic development, which is closely connected to entering the global market.

In order for the Russian economy to move forward, it must create a common worldwide economic space, theoretically leading to a productivity increase and economic prosperity (e.g., Doucouliagos and Ulubasoglu, 2006; Dreher, 2006). The process of globalization is multifaceted, the scope and focus of our thesis allows us to examine only a few of these facets. Our primary focus will be on Russia's involvement in global trade and global capital flows. Although integration in global financial systems is an inherent part of globalization, our specific focus precludes us from its consideration (for a recent work on financial globalization, Broner and Ventura, 2016). To list just a few other facets we will not investigate: the drawbacks and failures of globalization associated with increased inequality (e.g., comprehensive literature surveys by Helpman, 2016 or Ravallion, 2018; Bergh and Nilsson, 2010; Mills, 2009; Goldberg and Pavcnik, 2007), existing institutional discontinuities (Rodrik, Subramanian, and Trebbi, 2004), environmental issues (e.g., Newell and Roberts, 2017; Frankel and Rose, 2005; Böhringer et al., 2015 for a study on Russia), and even the growth of political populism generated by globalization (e.g. Burgoon, Oliver, and Trubowitz, 2017; Rodrik, 2018).

Throughout the transition process, Russia gradually became more integrated into the global economy. Russia was able to access foreign financial resources and technology through GVCs, FDI and direct trade relations (Golikova et al., 2017). During the first period of the Russian economic history (1992-1998) that we consider, the newly founded country applied for membership in international organizations such as the World Bank and the International Monetary Fund. In 1993 Russia applied for membership in the World Trade Organization, and after a tedious process was admitted in 2012, thus laying another foundation stone in the globalization process.

Most of the studies that analysed the impact of joining the WTO conclude that there has been a positive net effect for Russia. The welfare gains are considered to amount to 3.3% of Russian GDP in the medium run, and up to 24% in the long run (Rutherford, Tarr, and Shepotylo, 2005; Jensen, Rutherford, and Tarr, 2006; Jensen, Rutherford, and Tarr, 2007; Rutherford and Tarr, 2008; Rutherford and Tarr, 2010). Furthermore, 72% of all globalization gains are calculated to be due to FDI in services (Jensen, Rutherford, and Tarr, 2007). The reason why FDI liberalization is so important is connected to the fact that FDI is often considered to be the fastest way to access advanced technology and managerial know-how from foreign investors. Section 1.3.3 of this chapter will pay special attention to the theoretical and empirical evidence of FDI spillovers.

1.3.1 Globalization-induced technology transfer

Globalization is commonly considered to be a vehicle that enables the creation and dissemination of technology through various viable conduits: exporting and importing activities, foreign licensing agreements and FDI (Hoekman, Maskus, and Saggi, 2005). Imitating and adopting foreign technology is especially relevant for emerging and developing economies, because firms in these economies rarely engage in their own R&D activities (Fatima, 2017). Thus, even though these firms may contribute little to technological innovation, a cross-border technology transmission enables them to approach the world technology frontier (Dahlman, 2007).

Empirical evidence on the relationship between globalization and technology adoption for developing countries is vast and addresses some specific if not all aspects of globalization. Alvarez and Robertson, 2004 find that exports are positively connected to innovation, and that imported intermediates are likely to boost product innovation (Goldberg et al., 2010). Several other studies endorse exporting and importing activities, and suggest that minority-owned foreign firms and foreign licensing agreements are important channels for technology transfer in developing and emerging economies (Gorodnichenko, Svejnar, and Terrell, 2010; Fatima, 2017). Evidence on Russia suggests that foreign-owned manufacturing firms become rather pro-active in investment and innovation than domestically oriented firms (Bessonova, Kozlov, and Yudaeva, 2003; Gonchar and Kuznetsov, 2018).

1.3.2 International trade

Free trade has been increasingly favoured under the WTO regime. In spite of the still existing belief that a country participating in international trade is better off than a country not actively embedded in the global trade network (Samuelson, 1938), it remains a rather inconclusive theoretical and empirical debate (Deraniyagala and

Fine, 2000). This debate will be briefly introduced in this section, before we tackle the major stylized facts in Russia's trade integration.

The classical trade theories originate in the works of Adam Smith (1723-90) and David Ricardo (1772-1823). Smith endorses the trade in what a country specializes. Ricardo, whose theory dominated the field until the Second World War (WWII), argues that gains from trade arise when a country increases production in what it relatively does well, thus underlying the notion of comparative advantage.

The Hecksher-Ohlin (H-O) trade theory builds on the Ricardian theory and dominated the field of international trade and the policy debate in favour of trade liberalization between 1920 and 1980 (Flam and Flanders, 1991). According to the H-O theory, a country's exports depend on its relative factor endowment. This implies that developing countries are likely to specialize in the production of labour and natural resources intensive goods, whereas developed countries are more likely to specialize in human capital and capital-intensive production. Apart from factor endowment, the product cycle theory and the new trade theory incorporate other factors that affect a country's export performance.

The product cycle theory was initially developed to analyze US postwar trade after World War II (Vernon, 1966; Markusen, 1984). When explaining trade patterns, it focuses on the characteristics of the domestic market and includes three stages: 1) a new product is introduced, and exported to other developed countries, 2) domestic product demand increases and moderate demand from developing countries appears (i.e., the US exports not only to advanced, but also developing countries), 3) market saturation (i.e., the US becomes a net exporter of the standardized product). It is a viable alternative to the H-O trade theory since it is able to explain the Leontief paradox (Leontief, 1953) of exporting labour-intensive products by a capital rich country through the location in the first and the second stages of the product cycle. The deterministic nature of this model is its main limitation.

The new trade theory (NTT) was introduced in the 1980s (Ethier, 1982; Krugman, 1985; Grossman and Helpman, 2001) and tries to overcome the shortcomings of standard trade theory by accounting for more complex aspects of modern trade, such as market imperfections or strategic behavior, as well as new industrial economics, new growth theory and political economy (rent-seeking) arguments (Deraniyagala and Fine, 2000). NTT explains the fact that the large bulk of world trade takes part between countries with similar factor endowments (Poon et al., 2000), because of increasing returns to scale and imperfect competition (Krugman, 1985; Helpman and Krugman, 2002).

Much of the NTT literature deals with its nexus to new growth theory through the channel of technology and knowledge spillovers (Frankel and Romer, 1999; Irwin and Terviö, 2002). Grossman and Grossman and Helpman, 2001 endorse the notion that international trade leads to an expansion of the R&D sector, which in turn drives economic growth. Countries that have a more established position within the global trade network (i.e., stronger trade relations with better connected and/or numerous amount of countries) tend to have higher growth and development rates (Önder and Yilmazkuday, 2016). It should be noted that this effect is strongest for countries with higher institutional quality and vaster human capital (Herzer, 2013). Other studies emphasize the positive effect of international trade through new technologies that are embodied in imported capital goods that promote economic growth (Romer, 1994; Coe and Helpman, 1995; Lee, 1995; Pissarides, 1997). This mechanism is however conditional on the absorptive capacity, and in the long run, the growth of output is forced down to the rate of human capital growth, as Keller, 1996 shows in his work.

Stylized facts on Russia-related trade

Russia's participation in world trade and its relative importance to the country is still very modest. Russia's primary trade partners are high-income countries. Many of these countries are also involved in the Russian sanctions conflict. What follows in this section is a description of several stylized facts on Russian trade patterns and will provide a foundation for the empirical analysis in Chapter 2 of the thesis.

Even after the onset of the geopolitical crisis, EU-28 countries remain Russia's most important trading partners. Among these countries, trade with Germany is the most substantial. Russia imports mainly capital goods from the EU. From an EU perspective, the relative importance of Russia as a trading partner varies significantly across EU countries. The Russian market is quite relevant for German machinery and equipment commodities, whereas the Baltic and CEECs countries export primarily agricultural products to Russia. As an exporter, Russia is integrated into the global economy mainly through hydrocarbon and other minerals resources, on which the EU is highly dependent. The dynamics of Russian exports in general, and oil exports in particular, are heavily dependent on global commodity prices. Russian exports are especially vulnerable to cyclical price movements and idiosyncratic challenges such as geopolitical tensions.

In 2017, the Russian share of total world exports amounted to less than 2% (in 2013 this indicator stood at 2.75%), whereas the import share is even more modest at 1.32% (vs. 1.8% in 2013). The Russian trade-to-GDP ratio, which measures the relative importance of international trade and is calculated as the sum of exports and imports divided by the GDP, amounted to 46.8% in 2017 and showed a downward trend beginning in the early 2000s (Appendix, Figure A.1). This is the smallest value among other transition economies, many of which exhibit a ratio of over 100, an indication that they are more tightly integrated into the global economy (Appendix, Figure A.2).

According to Johnson, 2014 value-added exports (domestic value added contained in final expenditure in each targeted country) amounted to 92% for Russia in 2008, which is equal to 8% of intermediate inputs, suggesting that Russia is relatively independent of the global market. It also implies a relatively small share of Russian manufacturing in exports.

Figures A.3 and A.4 in the Appendix show the worldwide distribution of Russia's export and import partners. The EU is the largest export and import market for Russia, followed by China, Kazakhstan and the U.S. Since the expansion of the EU in 2004, its importance as a trading partner has been increasing. And even today, although the cooperation between the EU and Russia is hampered by mutual sanctions, the prominence of bilateral trade relations cannot be underestimated. Germany is the most important importer in 20 out 33 sectors of the Russian economy, including technological, agricultural, metalworking equipment and machinery (Khoroshun, 2015). Germany's total share in Russian imports amounted to over 10% in 2016.

Russian imports from European and, in particular, German market, are dominated by machinery and transportation equipment, which make up around one third of all imports from both the EU and Germany, respectively. Chemicals are responsible for 18% of all European exports to Russia. Other important products flowing from the EU-28 to Russia, are crude materials and manufactured goods (18%, and around 5%, respectively). Figure B.5 in the appendix shows the structure of EU exports. As can be seen, there has been little change since the beginning of the geopolitical crisis in 2014.

According to the 2016 World Bank trade data, fuels account for nearly half of all Russian exports to global markets. For the EU, the share of mineral fuels, lubricants and related materials imported from Russia amounts to 75% for these types of imports together, (Appendix, Figure B.5). It pinpoints the fact that the EU remains Russia's most important energy market. The share of mineral fuels, lubricants and related materials imported from Russia to Germany is roughly the same. Metals (13%) and by chemicals and related products (around 3%) make up the next largest share of Russian exports to the EU.

From the EU perspective, there was an export boost to Russia at the beginning of the 2000s. This was followed by a period of relatively stability of European exports in absolute values that continued until the financial crisis of 2008-2009. After a sharp recovery, however, European exports to Russia started to deteriorate beginning in 2012. The share of EU-28 exports to Russian fell to less than 5% at the beginning of the geopolitical crisis in 2014 and has not since recovered. Figure B.1 in the Appendix depicts the development of this share. Compared with 2013, EU-28 exports to Russia have decreased by nearly 30% by 2017. At the same time, exports by European countries outside the EU increased by more than 8%, making the EU share even smaller in total export volume. One possible reason for this considerable increase by extra-EU countries is the 2014 devaluation fact of Euro. This devaluation made European exports cheaper when compared to the rest of the world.

Economic sanctions against Russia that were first imposed in 2014 and are currently in force, primarily address military equipment and related materiel and uses, equipment used for the exploration of oil and gas (including technologies used in deep water, Arctic and shale oil extraction), as well as restrictions on capital market issuance of and trade in certain bonds, equity or similar financial instruments. As a response to the Western sanctions, Russia boycotted agrarian products, foodstuffs, and raw materials from countries that adopted sanctions against Russia, namely: EU, US, Norway, Canada and Australia. At the moment of writing this thesis, the so called counter-sanctions by Russia are still in effect.

Although Russia is the second largest market for European agricultural products, the GDP share of agriculture in the EU as well as its export of agricultural products was relatively low (1.7% and 6.6% respectively in 2013) when Russia adopted its counter-sanctions. It is expected that Nordic and Baltic states will be impacted the most towards by Russia's boycott. Out of all EU countries, Germany can be affected considerably in absolute terms because it is Russia's main trade partner. Relatively to other German export destinations, the expected losses are manageable. The situation might be different for other sanctioning countries that are Russia's immediate neighbours – Belarus, Ukraine, Moldova, Latvia, Lithuania and Eastland. For them, Russia remains one of the most important destinations. Their exports to Russia accounted for more than 5% of their GDPs in 2013.

1.3.3 Foreign Direct Investment

Due to its growing importance in the globalization process, FDI has becoming a prominent field of academic research during the past three decades. This section deals with the study of the role of FDI in transition economies, with a special focus on Russia. Two main questions are addressed: (1) How has FDI affected the nature and pace of transition reforms since the early 1990s; (2) What factors influence the investment and disinvestment decisions of multinational corporations (MNC's). First, we review the broad theoretical foundations developed by FDI studies, before turning to the specific effects of FDI in host economies and how decisions are made by MNC's concerning the choice of location for investment and disinvestment. We also present the results of empirical literature that tests the above theories based on datasets developed for emerging countries. Finally, we discuss the primary stylized facts concerning the latest developments in international capital flows in Russia.

Theoretical foundations

The theoretical foundation of FDI literature is vast, and as Ietto-Gillies, 2012 concluded in her literature survey, there are at least twelve important theoretical frameworks that seek to explain why a firm makes a decision in favour of foreign production rather than exporting or contracting (Heckscher, 1991; Ohlin, 1933; Melitz, 2003), why it chooses to become an international firm in general (McManus, 1972; Buckley and Casson, 1976; Teece, 1977; Rugman, 1981; Caves, 2007), how it chooses the host location (Helpman, 1984; Markusen, 1984; Krugman, 1985; Krugman, 1987; Krugman, 1991; Krugman, 1998; Markusen and Venables, 1998), why some firms become more successful than others in their internalization activities (Cantwell, 1995; Cantwell and Iammarino, 2005) and whether the firms in the host economy benefit or are hurt by the market steeling effect and fierce competition of technologically more advanced newcomers (Findlay, 1978; Borensztein, Gregorio, and Lee, 1998; Wang and Blomström, 1992; Markusen and Venables, 1998; Rodriguez-Clare, 1996). After discussing main theoretical literature, we will examine two families of models in more detail. These models address the nature of spillover effects in catch-up economies and decisions made by multinationals concerning the location of overseas affiliates.

FDI theories have their origins in the classical trade theory and its comparative advantage concept as a result of differences in relative production costs (Ricardo, David, 1772-1823, 1817). Drawing on these considerations, Heckscher and Ohlin developed the neoclassical theory of international trade in the 1920s (Heckscher, 1991; Ohlin, 1933). In the neoclassical 2x2x2 model (two countries with two factors of production, each producing one product), strict homogeneity assumptions concerning countries‘ technologies, knowledge, production methods and perfectly competitive markets with constant returns to scale are held. Under the assumption of production factor immobility and product mobility, capital movements are mainly explained by interest rate disparities (Iversen, 1935) in the world when no transportation costs, trade barriers and uncertainty exist. Thus, up until the 1960s, there was no differentiation between international portfolio investment and FDI. FDI was seen a by-product of the neoclassical theory of international trade (Ietto-Gillies, 2012).

Contrary to trade theories, which assume a perfect market system and immobile factor inputs across countries and non-existing incentives for resource mobility across nations, firms choose to become MNCs and venture abroad to exploit market failures in host countries. It was the seminal work of Hymer that brought this notion into focus. He also provides a critique of the unrealistic neoclassical approach and acknowledges market imperfections (Hymer, 1960). Based on the concept of control over operations abroad, he strictly separates portfolio investment from direct investment. He develops an important theory of determinants of FDI, the main components of which are firms' advantages and a removal of conflicts. This industrial organization approach emphasizes possible externalities from FDI inflows.

The dynamic theory of international production (Vernon, 1966) originates in technological gap theory (Posner, 1961) and the product life cycle theory (Kuznets, 1953; Hirsch, 1967). It considers the changes in a firm, industry and market and links the stages in the product's life to geographical location of production and the competitive structure of the industry. The countries are placed hierarchically with respect to their state of economic development and innovative capacity, which breeds the idea of technology transfer. Based on Vernon's theory, Knickerbocker, 1973 attempts to explain the geographical clustering of FDI. He assumes an oligopolistic structure and conflicts between rivalling oligopolists.

Coase's seminal paper on the opening of the obscure "black box" of a firm (Coase, 1937) gave rise to a work by Williamson, 1975 who introduces the concepts of bounded rationality, opportunistic behaviour and asset specificity. These concepts highlight the internalization strategies of firms and how these strategies relate to operations in the home market. The theory was extended to international firms by Buckley and Casson, 1976, Teece, 1977, Rugman, 1981, Casson and Caves, 1984 and Hennart, 1991, all of whom put an emphasis on the organization of production, and analyse internalization of knowledge-based products in the post-WWII period.

The International Business (IB) literature with respect to FDI is usually dominated by the eclectic OLI-paradigm developed Dunning, 1977, and is largely based on Hymer's work (Hymer, 1960). It represents a fundamental analytical framework for the determinants of FDI. The paradigm comprises various factors based on multiple strands of economic literature: firm-specific ownership advantages (O) (e.g., patents, trademarks, human capital, managerial and technological expertise), location advantages (L) (such as, local endowments, institutional framework, labour market characteristics) and internationalization advantages (I) (allowing Multinational Enterprises (MNEs) to reduce transaction costs through the internationalization of input use).

A more recent strand of literature acknowledges the heterogeneity of MNEs and as a consequence, their varied impact on the host economy. According to Penrose's resource-based view of the firm (Penrose, 2009), there is an unequal distribution of resources across firms. Simultaneously, firms are concentrated on the exploitation of its existing potential for growth by expansion into new markets. In contrast to the neoclassical, incentive alignment and transaction cost perspectives, this view accounts for different production cost levels of firms due to various competences and capabilities. Penrose's ideas gave rise to the competence-based theory of the firm (Nelson and Winter, 1982b;Winter, 1984; Cantwell, 1989; Nelson, 1991; Teece et al., 1994; Cantwell, 1995), which sees a firm as an institution with internal learning processes that take the form of evolutionary experimentation (Cantwell and Piscitello, 2000).

Cantwell's analysis (Cantwell, 1989) deals mainly with the question of why some firms are more successful than others and focuses on their endogenous ownership advantages, as well as interactions within both internal and external networks. Innovation activities foster spillover effects to the host domain and the industry. Location advantages are, therefore, also endogenously created and lead to positive agglomeration effects. Thus, Cantwell links innovation and internalization (as does Vernon), but contrary to Vernon's approach, Cantwell sees the MNC as the innovation leader rather than some specific country. Cantwell also considers FDI to be not only a cross-border transmitter, but at the same time a creator of technology and related corporate competences (Cantwell, 2017).

Technology diffusion and adoption is, however, conditional on, e.g., absorptive capacity (Cohen and Levinthal, 1990) and own technological efforts (Lall, 2001). Technology transfer is associated not only with FDI, but also with imports, internationalization of R&D activities by MNCs, inter-firm and intra-firm networks and integration into global value chains (Fu, Pietrobelli, and Soete, 2011)

The new economic geography (NEG) approach (Krugman and Venables, 1995; Krugman and Venables, 1996) is based on a general equilibrium model with increasing returns to scale. It considers transportation and other spatial transaction costs, and underlines the role of agglomeration forces in the decision-making process of foreign firms. Increasing returns are either internal (related to the plant/firm) or external (spillovers related to the industry). Contrary to neoclassical theory, potential trade barriers are assumed. Home and host countries are differently endowed endogenously, which helps to explain FDI location either in developed or developing countries. Three factors of agglomeration are underlined: technological spillovers, the labour force condition and the proximity to upstream and downstream industries. The industrial concentration is conditioned through proximity to markets and suppliers.

FDI's role in a transition economy

In this section we will relate some of these theories to how foreign capital flows impact transition economies, many of which are located in today's CEECs Host locations are typically characterized by weaker institutions and economies, technology gaps, some significant factor endowments, weaker bargaining power and volatile markets. Some of these factors may mitigate the usual consequences of FDI entry, mostly impacting FDI flows from developed economies.

The impact of MNEs in host countries has been studied extensively in the recent past. According to the neoclassical perspective, FDI increases capital stock, contributing to economic growth through the channel of capital formation. Under the assumption of diminishing returns to capital, economies converge to some steady-state growth rate in the long run, even if exogenous capital expansion via FDI temporarily increases production. Thus, FDI impacts short-run growth only, leaving long-run growth unaffected (Solow, 1957). In contrast, the endogenous growth model underlines the role of technological change (Romer, 1986). By adopting new technologies, developing countries have a chance to catch up. One of the most important sources of technological diffusion and human capital is FDI. Within this theoretical framework, capital enters the economy in the form of human capital accumulation and R&D. Externalities that arise from these types of capital are emphasized. Technologies introduced by foreign firms may spillover to domestic firms. Positive spillover effects and higher productivity created by foreign capital rather than domestic capital offset diminishing capital returns, allowing FDI to stimulate economic growth.

A number of scholars argue that FDI's impact on economic growth is conditional on a variety of factors, e.g., size of the host's sufficient absorptive capacity in form of the accumulated human capital stock (Benhabib and Spiegel, 1994) or some threshold development level of the financial system of the host (Hermes and Lensink, 2003).

There is an empirically established bidirectional dynamic relationship between FDI and economic growth (Iamsiraroj, 2016). Caves, 1974 laid the empirical foundation for numerous other studies. These studies indicate that FDI is an important source of: employment and knowledge transfer (Aitken and Harrison, 1999), economic growth in catching-up economies (Fillat and Woerz, 2011; Damijan, Kostevc, and Rojec, 2013; Weber, 2011) and the development of local institutions (North, 1990). Kolk and van Tulder, 2006 show that these effects may be caused by MNEs raising various standards. There is, however, some indication that MNCs might simultaneously crowd out local firms. It is also important to note that technology and knowledge transfer are neither sustainable in the long run (Aitken and Harrison, 1999), nor necessarily efficient in alleviating poverty (Oetzel and Doh, 2009).

During the Soviet era, firms in today's transition economies often lagged behind the world technological frontier, except for some strategic fields, e.g., nuclear technology, space engineering and military hardware. By attracting FDI after the fall of the Soviet Union, domestic firms in transition economies seek knowledge transfer opportunities that are directly embodied in FDI. These transfers can then become an integral part of the production process. This is the logic behind the idea that FDI is a mechanism that acts as an important driver of economic growth in the transition economies.

The empirical literature, dealing with the role of aggregate FDI, particularly in transition economies, usually distinguishes between direct (i.e., performance-related) and indirect (also called spillover) effects (Hanousek, Kočenda, and Maurel, 2011; Iwasaki and Tokunaga, 2016). One aspect of direct effects is how foreign ownership impacts transition economies. Most empirical studies show than foreign firms outperform local ones, usually exhibiting higher levels of productivity compared to domestic firms. It has been shown for most CEECs that foreign ownership improves total factor productivity (TFP) and/or labour productivity (e.g., Sgard, 2001 for Hungary; Djankov and Hoekman, 2000 for the Czech Republic; and Konings, 2001 for Romania, Bulgaria and Poland). Yudaeva et al., 2003 provide empirical evidence about how FDI acts as a source of productivity improvement among Russian manufacturing. A link has also been established between FDI and regional economic development in Russia, as well as support for the absorptive capacity hypothesis. It has been shown that local R&D potential exhibits a strong synergistic relationship with FDI (Iwasaki and Suganuma, 2015).

Determining whether technology transfers from foreign firms spillover to domestic firms not affiliated with foreign owners, is the primary focus of empirical studies dealing with indirect effects of FDI. Positive spillover effects through valued added chains might occur, but domestic firms might also benefit from imported managerial experience. Foreign companies contribute to the development of the value chain and creating skilled jobs in the source country. Exposed to tough foreign competition, domestic firms are often forced to innovate in order to survive. This leads to a catching up process towards the production frontier and FDI is seen as an accelerator of technical progress at the macro-level (Javorcik and Spatareanu, 2011; Sánchez-Sellero, Rosell-Martínez, and García-Vázquez, 2014). However, at the micro-level negative spillover effects can also take place. If the competitive pressure created by FDI is too high, domestic firms can be confronted by shrinking markets (Aitken and Harrison, 1999).

Usually, studies distinguish between horizontal (intra-industrial) and vertical (inter-industrial) spillover effects. Vertical effects imply technology transfers that occur along the production chain. These transfers occur either through forward linkages or backward linkages. Forward linkages relate to the upstream industries in the sense that domestic firms benefit from intermediates by foreign firms. Backward linkages relate to downstream industries given the scenario of local firms selling to foreign-owned firms. Horizontal spillovers are specific to firms operating in the same sector. Studies looking at these relationships are interested in determining whether domestic firms are able to catch up and/or benefit from FDI presence in markets.

The evidence presented by studies on spillover effects in the CEECs is manifold and mixed, ranging from positive effects to no (see e.g. Kinoshita, 2001 for Czech Republic or Konings, 2001 for Bulgaria and Romania) or even negative spillover effects by FDI (see e.g. Konings, 2001 for Poland). Positive spillovers are often conditioned by some factors, e.g., the adoption of new technologies by domestic firms (Javorcik, 2004 for in the Czech Republic and Latvia), the export-oriented nature of FDI, or the absorptive capacity of domestic firms (Tytell and Yudaeva, 2006 for Russia, Ukraine, Poland, and Romania). Sgard, 2001 provides evidence for positive spillovers in Hungary, driven by export-oriented foreign-owned firms. Gorodnichenko, Svejnar, and Terrell, 2013 demonstrate consistent positive backward spillover effects based on a vast sample of 17 transition economies. Yudaeva et al., 2003 find positive horizontal spillover effects for Russian manufacturing firms due to, among other things, the stock of human capital attracted by FDI to specific locations. However, negative spillovers occur to domestic firms that are vertically connected to foreign firms.

Additionally, the intensity of spillover effects may be conditioned by various firm- or country-specific characteristics, such as size of affiliate, ownership structure, industry, FDI source, institutional environment, firm's distance to the technological frontier, etc. (Gorodnichenko, Svejnar, and Terrell, 2013). Small firms benefit more from the presence of FDI (Sinani and Meyer, 2004) and firms wholly owned by a foreign investor generate positive horizontal spillovers compared to joint ventures (Javorcik and Spatareanu, 2008 for Romania).

Other features contribute to the moderation of expected FDI spillover effects. These features include MNCs selecting the most productive local firms in the process of acquisition, and gaps in technological development and human skills between the home and host locations that are too wide. Acemoglu, Aghion, and Zilibotti, 2003 and Aghion et al., 2005, for example, refer to a Schumpeterian model claiming that firms located closer to the efficiency frontier are more likely to benefit from the foreign presence and increased competitive pressure than technological laggards.

MNC behaviour

The next family of theoretical and empirical FDI literature deals with location choice and disinvestment. This stream of literature analyzes factors that influence the decisions concerning the place, size and time of FDI. This research is important for policy makers in transition countries, and deals with how foreign multinationals respond to the circumstances that attract/repel MNCs to/from host markets.

Theoretically, entry decisions for FDI are usually explained through two main motives (see literature survey by Faeth, 2009): horizontal market-seeking (HFDI) and vertical resource-seeking (VFDI). Foreign establishments from the first category utilize host market opportunities when there are high trade costs combined with a sufficient local demand and intra-industry firm heterogeneity. MNCs motivated by VFDI exploit factor endowments, such as lower wages, natural resources etc. (Markusen, 1984; Helpman, 1984; Helpman, Melitz, and Yeaple, 2004). A combination of horizontal and vertical factors is considered to be a hybrid and fits within the knowledge-capital model (e.g. Carr, Markusen, and Maskus, 2001). This model takes into account a wide variety of factors, including: natural resource endowment, labor costs, market size and saturation, third country effects, agglomeration externalities, institutional factors.

In the real world, the types of motivations influencing decisions for FDI usually overlap and may change over time and in scope. Over time there has been a shift towards horizontal motives for FDI that flows into CEECs (Stack, Ravishankar, and Pentecost, 2017). Ledyaeva, 2009 comes to the opposite conclusion with respect to Russia, and claims a shift towards VFDI after the crisis of 1998.

Additional empirical evidence on Russia shows the critical role of the vertical motives (i.e., the natural resource endowment) for FDI location decisions (Iwasaki and Suganuma, 2015; Bevan and Estrin, 2004; Ledyaeva, 2009). The issue of a "resource curse" is often considered in connection with FDI location decisions. The basic premise is that resource-seeking FDI crowds out non-resource-seeking FDI. A plethora of resources is often penalized by decreasing levels of aggregate FDI.

Studies dealing with issues related to vertical FDI consider the side-effects of the so called Dutch disease. In this scenario, resource-seeking FDI invests in businesses with primary resources, crowding out investment in other industries that are capable of generating higher spillover effects. (Corden and Neary, 1982; van der Ploeg and Poelhekke, 2009).

Using micro data, Gonchar and Marek, 2014 diverge from the established vertical hypothesis drawn from Russian data, and provide evidence for a more complex link between FDI flows and resource endowment in emerging economies. Namely, they find that factor endowment adequately explains the behaviour of export-platform firms that sell in third markets rather than host or home markets, and prove that even in resource-rich regions, there is ample service investment. Generally speaking, the authors dispel the crowding out argument.

Across Russian regions, a sluggish judicial system and the strong political power of local authorities combined with poor governance quality are key institutional characteristics that discourage entry decisions by multinationals. However, MNEs tend to adjust to weaker local courts though structural mechanisms, i.e., larger size and partnership (Bessonova and Gonchar, 2017; Kuzmina, Volchkova, and Zueva, 2014). Ledyaeva, Karhunen, and Kosonen, 2013 confirm the importance of a shared political culture between the foreign investors and specific Russian regions. Specifically, FDI from less corrupt and more democratic countries flows into less corrupt and more democratic Russian regions, and vice versa. However, round-tripping FDI is positively associated with the host region corruption (Ledyaeva et al., 2015).

Less discussed in the literature is the issue of disinvestment decisions of multinationals that is not only linked to location, institutions and political risks, but is also subject to delays and a configuration of different factors that influence the decision to exit or to enter. The above debated advantages offered by foreign firms to host economies (Section 1.3.3) evaporate when they decide to disinvest. Chapter 3 of this thesis provides an empirical analysis of divestment decisions by MNCs in Russia. Besides firm characteristics established in the literature, we find that political risks in both host and home countries have significant effects on the MNC's decision to exit. In this sense, if the MNC has established a large subsidiary or a greenfield investment the exit probability is reduced.

The following section presents major FDI trends connected to location-choice decisions with Russia being a home country (outward FDI) as well as host country (inward FDI).

Stylized facts about FDI in Russia and data description

Russia as an interesting setting for the empirical analysis of the multinationals' behaviour.

Russia is an interesting setting for the empirical analysis of multinationals' behaviour. First, compared to other transition economies, Russia was a latecomer to international investment flows. Several factors mattered: problematic investment climate; low prices on commodities in the 1990s; a ban on the participations of foreign investors in mass privatization; a lack of corresponding infrastructure. As a result, Russia lagged behind peers in per capita accumulated flows, though it led in absolute flows and the size of selected deals in the natural gas and oil sectors. Second, this is the largest recipient in CEECs and FSU in absolute terms and a home market for mega-deals in the oil and natural gas sector, which did not cease to be concluded in the aftermath of the global financial crisis as of 2008 and geopolitical crisis starting from 2014. Third, contrary to the smallest transition economies, the overall economic importance of FDI in Russia is fairly marginal, being however large enough in some sectors and sub-national territories. Fourth, the modern economic history of Russia has witnessed significant ups and downs in the inflow and outflow dynamics, driven by various factors, including the global economic crisis as well as trends in commodity prices. The recent FDI trends are dependent on the growth of political risks that result in decrease of inflows and departures of MNCs from the country. Fifth, FDI outflow is a new phenomenon and has the following features: (1) outflow takes place mainly to financial hubs, and havens for the conclusion of exporting deals; (2) an existence of the round-tripping capital; (3) OFDI takes place mainly in search of access to technologies and less so – markets.

In order to place the empirical results presented in Chapter 3 of this dissertation in a broader economic context, we will examine the above mentioned trends in more detail. The investment climate in Russia has always been rather unwelcoming (Radziwill and Vaziakova, 2015). After the introduction of sanctions and conflicts between Russia and Ukraine, Russia's country risk heightened, and its creditworthiness was downgraded by ranking agencies such as S&P, Moody's and Fitch. Russia's country risk, measured by the PRS group, shows a risk increase of over 4.3% in 2014. This amounts to around a 30% increase compared to 2007. As Chapter 3 shows, there is a negative relationship between FDI and country risk levels. Table A.2 in the Appendix presents the connection and development of country risk and FDI in Russia between 2007 and 2017.

After the transition began in the early 1990s, the inflow levels of FDI remained low for a while compared to most CEECs. On average, between 1990-2002 inflow levels were around 16 Euro per capita, or less than 1% of GDP. Whereas the Czech Republic, for example, received 276 Euro per capita, or 5.3% of GDP, and Hungary received 242 Euro per capita, or 6.4% of GDP. This situation changed around 2003, when the oil prices rose substantially, making the oil- dependent Russian economy an attractive location for FDI. FDI inflows have become 13 times greater within a span of 6 years between 2002 and 2008, with 2008 being the year with maximum FDI inflows, to this point. FDI inflows amounted to 4.6% of GDP, compared to 2017 when it was only 1.7% (wiiw, 2019). Overall, in spite of relatively low levels of accumulated FDI, in absolute terms, Russia became an attractive FDI location, even under conditions of poor institutions and increasing political risks, as Figure A.6 in the Appendix shows. Moreover, Russia is among top 20 FDI hosts worldwide and the most attractive location among the transition economies (see Table A.3 in the Appendix).

If we examine characteristics of the most recent economic crisis, the economy started to recover after the contraction in GDP in 2015 and the Russian Federation saw its FDI inflows surging back to 33.6 billion Euro in 2016. Nevertheless, bilateral trade restrictions motivated the Ukrainian crisis in 2014 have hampered FDI flows. The flows recorded in 2016 were still only slightly higher than half of the 2008 record of 51.7 billion Euro, and 16% below the 40.2 billion Euro recorded in 2013. The current investment drought Russia is experiencing might lead to an ever increasing technological gap in Russia, increase the structural shortcomings of the economy. This is especially true when taking into account the high dependence of Russia's economy on foreign technologies and international borrowing.

The structure of FDI in Russia is illustrated in Table A.2 in the Appendix. The FDI inflow to the oil and gas sectors, in spite of several mega-deals, has decreased, following the drastic fall in oil prices, the political crisis, the ban on technologies transfer and the deteriorating conditions of international borrowing for Russian companies. The introduced Western sanctions limit Russian cooperation with foreign oil companies, which should have expanded oil exploration in Russia's Arctic shelf in the Barents Sea and the Kara Sea by Rosneft. Because of the sanctions and a more complicated equipment supply, an expansion of the currently stagnating oil production far to the east is also not probable (Čwiek-Karpowicz and Secrieru, 2015).

The EU is the biggest supplier of FDI to Russia. Since 2010, EU's FDI stock has never dropped below 30% of all FDI stock (wiiw, 2019). However, an average investment flow to Russia between the years 2010 and 2017 amounted to 0.1% of the EU's GDP. In 2013, the average investment flow reached 0.2%, and after hitting rock bottom in 2015 slowly recovered to 0.04% in 2017. The largest FDI flows come from the European countries that are tax havens. Cyprus and Luxembourg accounted for nearly 60% and 22% of all European FDI to Russia in 2017. Since 2010, based on average percent of GDP, the FDI flow to Russia from Luxembourg and Ireland amount to 5.4% and 1.5%, respectively. In the previous decade, the three largest EU economies (Germany, Great Britain and France) provided FDI to Russia that is less than 0.12% of their GDPs. In absolute terms regarding each individual country, Germany is the largest supplier of FDI in Russia excluding European tax heavens. Over 15 billion Euro of German capital had accumulated in Russia by 2017. More than 2000 German subsidiaries operated in 60 Russian regions in 2017, producing goods worth around 51.3 billion Euro and employing over 170 000 people (Orbis, 2019). After Germany, the major EU investors are France (FDI stock of 12.6 billion Euro in 2017), Austria (4.7 billion Euro) and Sweden (4.3 billion Euro).

Investments in the Russian Federation by MNEs from developing economies increased beginning in 2014. China increased FDI to Russia by nearly 1.5 time in 2014 compared to the previous year. Compared to 2013, Turkey invested nearly 70% more in Russia in 2015. In the same year, Kazakhstan increased its FDI flows by nearly 1.5 times. An increase of FDI from China and Kazakhstan continued in 2016, by an increase of over 100% in each case against the previous year.

Globally, the terrain of outward FDI (OFDI) is still heavily dominated by developed countries, accounting for over 70% of the world's outward investment in 2017 (Figure A.7 in the Appendix). Russia remains, however, the world's largest outward investing transition country, contributing about 1.2% of the world OFDI, compared with 25% held by the biggest investor worldwide, the USA (Table A.4 in the Appendix). Russia's more than 12 times larger OFDI, lies far beyond the second-ranked Poland in 2017, and holds around 338 billion Euro of outward investment stock. Although (based on 2000-2015 averages) Russia possesses about 70% of the total OFDI stock from post-transition economies , compared to the biggest global investors, its stake remains more than modest, less than 5% of OFDI stock from the US and 3.6% of OFDI from the EU-28 in 2017 (UNCTAD, 2018).

The development of Russian OFDI in the 1990s was rather modest and never exceeded 20 Euro per capita (wiiw, 2019). It sky-rocketed between 2000 and 2008 by more than 13 times to over 38 billion Euro in 2008. The crisis of 2008 had a dramatic effect on Russian OFDI, not only due to disinvestment, but also due to a dearth of external financing. Within the space of one year, outward investment decreased by a dramatic 36%. Russian OFDI took off again in 2010. Despite a dramatic surge in 2013 (rising to over 53 billion Euro, a 140% increase over 2012), by 2017 it remained close to the pre-crisis level of 2007. This can be explained in part by the geopolitical crisis that occurred between 2014 and 2016 when OFDI retreated significantly and amounted to around half of 2013 OFDI (wiiw, 2019).

Although not directly subjected to Russian counter-sanctions, state-owned enterprises still have to comply with the country's sanction policy as some of them are directly hit by Western sanctions. This is especially critical when taking into account that Russia's largest MNE, Gazprom Germania GmbH (a turnover of over 20 billion Euro in 2017), is directly sanctioned. Sanctions against Russia target specific persons and important firms (e.g., Rosneft, Gazprom) or banks (e.g., Sberbank, Vneshekonombank,) directly. It should be noted, however, that increasing interest rates and a deteriorating exchange rate, both of which cripple OFDI, might exert an even higher impact on Russian OFDI, compared with the decreasing effect of sanctions (Liuhto, 2015).

A 30% OFDI growth in 2017 offered the first signs of recovery and propelled the country to the twelfth largest home country for FDI, improving its 2016 position by 4 ranking points. Round-tripping OFDI is a typical capital runaway strategy for Russia among other post-communist transition economies (PTEs) (Liuhto and Majuri, 2014). The geographical distribution of Russian OFDI favours the EU, with an average of 14% flowing into the EU-27 between the years 2009 and 2017 (excluding the tax heaven Cyprus, with 55% in 2017). Russian OFDI into PTEs as host countries remained extremely moderate throughout 2009-2017 and amounted to 0.3%, on average. Russian investors employ both market-seeking and resource-seeking strategies when making OFDI decisions. Market-seeking strategies are implemented in markets that share a Soviet heritage (e.g., CIS and CEECs countries), as well as certain Western European countries. Resource-seeking strategies in the CIS and Africa are oriented towards oil, gas, mining.

1.4 Conclusions

The benefits of the global integration for emerging and transition economies are widely recognized in the literature. However, Russia is characterized by still highly underdeveloped globalization potential compared to other transition economies. This chapter considers data trends, theoretical frameworks and existing empirical evidence that support this notion.

The ongoing globalization process in Russia has been interrupted and partly reversed as a result of a geopolitical crisis caused by tensions related to the annexation of Crimea and the Russian-Ukrainian conflict. The bilateral sanctions that were introduced in response to the crisis partially reversed the gradual improvement of domestic institutions, and led to the deterioration of newly established institutions that facilitated global integration (Romanova, 2016). Beginning in 2014, Russia found itself caught simultaneously in a domestic economic crisis as well as a geopolitical crisis.

The foundation laid in this Rationale provides a solid basis for a further empirical investigation on Russia's transition economy. The great paradox is that, on the one hand, Russia's economy is in need of technology transfer, yet on the other hand, Russia's political landscape is responsible for isolating the country from the global economic system. It is the goal of this thesis to empirically study the behaviour of various economic agents given Russia's current (geo)political and economic circumstances that have dramatically increased uncertainties and have forced domestic and foreign firms to shift their decision-making processes.

The next section will highlight the main contributions of the present thesis on the issue of the costs of economic sanctions born by the sender (Chapter 2), the role of the political risks in altering the behaviour patterns of MNCs in the host country a subject to international sanctions (Chapter 3) as well as factors, associated with the movement of individual firms towards the production frontier that is highly relevant for the transition economy (Chapter 4).

1.4.1 Results, limitations and further research

The encompassing objective of this thesis is driven by the desire to understand the relevance of increased global uncertainties and concomitant economic instabilities on Russia's emerging economy. After the escalation of the Ukraine conflict in 2014, the European Union and Russia imposed bilateral sanctions on each other. Most existing empirical studies quantify the economic loss for Russia as the targeted country. However, the theoretical models also predict welfare losses for the implementer of the sanctions (Dorussen and Mo, 2001; Baldwin, 2000; Caruso, 2003; Hufbauer et al., 2010). Chapter 2 of this thesis paper focuses on the impact of sanctions on one of their imposers, the EU-27. To that end, we address the following first set of research questions:

(1) What are overall production effects of the EU sanctions on EU-27?

(2) How strong are spillover effects within EU-27 within the magnitude of the crisis?

(3) What does a ranking of European loss bearers look like?

We first apply a two-step methodology that allows us to disentangle the losses for each individual economy that occurred as a result of sanctions, from the losses that would have occurred anyway due to stagnating growth in Russia and a collapse of oil prices in 2014. In a second step, we consider indirect losses along the supply chain in each economy, as well as spillover effects within Europe.

To the best of our knowledge, this empirical investigation is the first attempt to comprehensively quantify EU-27 losses caused by sanctions against Russia. This analysis not only accounts for direct trade relationships with Russia on a highly disaggregated two-digit sectoral level, but also for the complex trade network within the EU-28 and the sector interconnectedness of the economies of each member of the EU-28.

The results indicate a clear division of EU-27 countries into two groups: Western European countries that recovered from the sanctions shock by the end of 2016, and Eastern European and Baltic countries where the negative consequences are still in effect. The sectoral losses are distributed as predicted, with the highest losses in the food and beverages sector, and the lowest in the service sectors.

The datasets used in this study only extend to the year 2016. However, in the meantime new developments have taken place, producing further sources of uncertainty. Thus, further research on this topic would benefit from extending the time series until at least 2018. This extension would not only expose new opportunities for different research strategies, but might also reveal exciting insights on the outcomes of relevant policy considerations. Moreover, this study does not account for the high heterogeneity that characterizes European firms serving the Russian market. Therefore, taking a micro perspective when studying the impact of the sanctions on the EU represents another important research extension.

Box 1. *Highlights of the study*

- In 2014, mutual sanctions between Russia and the EU were imposed
- The sanctions impact during 2014-2016 on the EU-27 is investigated
- Among biggest losers are Baltic and Eastern European countries
- Germany is strongly affected due to the spillover effects within the European Union
- Methods used: VAR and input-output modelling

We shift our perspective in Chapter 3, not only on a nation state level, but with respect to the data disaggregation. While we are still interested in examining the broader topics of economic uncertainty and international relationships of Russia, we focus on how MNCs located in Russia react to increasing political risks. The growing interest in political risks as a driver of FDI disinvestment decisions is mostly propelled by the increased interaction of firms from countries with weak or strong institutions. This process of globalization confronts MNCs with increased risks, such as corruption, political interventions, or even being taken over by the host state. Guided by multiple strands of literature, including: industrial organization (Dunne, Roberts, and Samuelson, 1988; Caves, 1998; Li, 1995), institutional economics (North, 1990), real options approach (Dixit, 1995; Dixit and Pindyck, 1994), power bargaining (Vernon, 1971; Teece, 1986b; Moon and Lado, 2000), and resource-based FDI (Kobrin, 1987; Moran, 1975; Henisz, 2000), we pose the second set of research questions:

(1) How do political risks affect the decision to exit by multinationals?

(2) Does the effect of political risk on exit depend on the political differences between the home and host locations?

(3) What mechanisms can protect a multinational subsidiary in a host country that is characterized by weak institutions and high political risks?

(4) How do national and sub-national risks interact in determining an exit strategy?

(5) Have sanctions catalysed the effect of political risks?

Using multinational plant-level data for Russia in the period 2000-2016, and applying the Cox hazard proportional model, we find significant effects of political risk on exits. Multinational companies (MNCs) are particularly sensitive to problems associated with low democratic accountability, a military presence in the political arena, as well as conflict and corruption. We also show that, as the political pressure to exit Russia increases, institutional similarity does not tend to reduce the hazard of MNCs leaving the market of developing countries. This is especially true for subsidiaries that originate from countries with higher home risks compared to Russia. "Round-tripping" investments are the only exception: subsidiaries established by multinationals of Russian origin through international financial hubs and tax havens do not react to the growth of host political risks by exiting the market. Their disinvestment decision probably depends on types of political harassment by the host government not studied in this paper. We also find that sanctions significantly catalyse the effects of home political risk on exits, and are particularly threatening for subsidiaries from implementing states with weak institutions. Large subsidiaries, or organizations developed as a greenfield or joint-venture with a local partner, as well as the existence of an intergovernmental investment treaty help subsidiaries to build resistance against the political risks of host countries. These findings provide empirical evidence that help draw conclusions in the debate about FDI volatility in countries with high levels of risk.

Our thesis delivers a valuable contribution not only to the above mentioned strands of theoretical literature, we also reveal a vast palette of factors affecting exits beyond political risks and explore mechanisms that might protect firms from exiting the market, we also engage in the sanctions debate. The finding that MNCs that originate in weaker states are penalized more when they impose sanctions is related to the separation of European countries into two groups based on the evidence presented in Chapter 2. In that instance, we see that European countries with traditionally weaker institutions were more detrimentally affected by the imposition of sanctions.

Another research extension might deal with a comparison between domestic and foreign firms with respect to their productivity levels and forces that shape industry dynamics in response to a changing geopolitical environment. Along those lines, an in-depth analysis of domestic firms' survival strategies might reveal hidden strengths or weaknesses of domestic human capital.

Box 2. *Highlights of the study*

- Political risks have significant effects on MNC decision to exit
- Firms are most sensitive to low democratic accountability, military in politics, conflict and corruption
- Institutional similarity does not tend to reduce hazard of exit for MNCs from developing countries
- Sanctions catalyze the effects of home risk and are particularly threatening for subsidiaries from sender states with weak institutions
- Large size, organization as a greenfield or joint-venture with a local partner, an investment treaty help to build resistance against host risks
- Methods: Survival analysis

In the final empirical Chapter of the thesis (Chapter 4), we address an important issue that stands as a high priority on the agendas of emerging countries, namely the sources of productivity growth that would allow them to approach the world frontier. The research presented in this thesis draws on the Schumpeterian and evolutionary school of thought (Dosi, 1988; Klepper and Thompson, 2006; Nelson and Winter, 1982b; Pavitt, 1999), since we believe that this theoretical framework is especially relevant for the emerging economies that might take advantage of existing advanced technologies prevalent in developed countries. Therefore, we formulate a third set of research questions:

(1) Which performance characteristic - productivity gains, output growth, or survival - is rewarded by innovation in the presence of relatively low competition, high uncertainty, and a weak market selection mechanism?

(2) To what extent is performance influenced by various forms of innovation?

(3) How does the effect differ across different sources of knowledge inputs?

(4) How do size, location, and market selection intervene in the innovation / performance relationship?

Using survey data drawn from Russian manufacturing firms and merging that data with registry data, this thesis studies how firm innovation strategies affect various features of firm performance. A multi-stage structural model is used that relates the firm's decision to undertake R&D to its innovation output, technical efficiency (TE), labour productivity, and growth. Additionally, we include imports into the knowledge production function, because catching up economies may adopt technologies that are part of imported hardware. The Cox proportional hazard model is employed to link productivity and innovation output to survival.

We find that both types of knowledge input – R&D and imports – strongly determine innovation. Innovations yield the strongest performance return for those firms that are catching up to the technological frontier (TE). Product innovation is more beneficial than process innovation in all performance features except for labour productivity. However, higher efficiency does not improve the growth rates or survival time of manufacturing firms. Taken together, these results show that innovation is not uniformly rewarded across all features of firm performance. Therefore, firms that maximize output or market share, rather than their technological advance, may make different R&D and innovation decisions. This pattern most probably influences further strategic choices of Russian manufacturing firms in, as well as the evolution of the industry and the product market structure.

This study contributes to the theoretical and empirical literature by introducing four important novelties. First, we compile a unique dataset comprised of matched survey and registry data that allows us to compare the innovation impact on three performance indicators: productivity, growth, and survival. Second, we account for Russia's globalization process and thereby include the knowledge input generated by imports of machines and equipment – the most typical source of technologies for the firms in emerging economies. Third, when calculating the impact of innovation on firm performance, we refine technological and cost competitiveness features by introducing technical efficiency (TE) in terms of firms' distance to the production frontier by using a more intuitive and simple productivity measure, namely, labour productivity. Finally, we extend the framework of the innovation/performance link by accounting for two crucial performance characteristics: survival and growth.

In the thesis, we acknowledge several limitations. First, the dataset is biased towards larger firms. Although the sample is weighed where possible, it is difficult to account for the bias because the full population of small firms in Russia is not well known. Second, although we use the most detailed level of price deflators (4-digit) that is available for Russian manufacturing sector, the results involving growth rates should be interpreted with caution. Further research on this topic will benefit by extending the time series, since the short panel employed in this thesis might underestimate the notion of firms' natural life cycles. Also, by extending the time period, a more refined econometric strategy could be applied. It would be interesting to find out whether the obtained results hold for a growing rather than for a stagnating industry when the growth is balanced by commodities' prices and more favourable terms of trade. The duration of the performance effects of innovations is another interesting topic for further analysis, especially using a comparative perspective.

Box 3. *Highlights of the study*

- Firm's decision to undertake R&D to innovation output, technological efficiency (TE), labour productivity and growth is studied
- Both types of knowledge input – R&D and imports – strongly determine innovation
- Innovations bring the highest performance return when catching up to technological frontier
- More productive and faster growing firms have higher survival rates, and innovation decreases mortality, especially for small firms
- Positive relationship between firm growth and both product and process innovation is revealed, however, the "growth of the fittest" doesn't hold unconditionally
- Methods: Survival analysis, stochastic frontier analysis, 2SLS IV, Heckman two-step estimation

Chapter 2

EU and Russian sanctions: how big is the economic impact within the European Union?

Autor: Maria Kristalova

Abstract[1]

Followed by the escalation of the Ukraine conflict in 2014, the European Union and Russia applied bilateral sanctions towards each other. This paper focuses on the impact of sanctions on one of their senders, the EU-27. An applied two-step methodology allows in the first step to disentangle losses resulted out of sanctions for each individual economy from the losses which would have occurred anyway due to a stagnating growth in Russia and a collapse of oil prices in 2014. In the second step, indirect losses along the supply chain in each economy as well as spillover effects within Europe are considered. The results indicate a clear division of all EU-27 countries into two groups: Western European countries which meanwhile recovered from the sanctions shock, and Eastern European and Baltic countries where the negative consequences by the end of 2016 are still very sustainable.

JEL classification: F17, F15, E65

Key words: economic sanctions, trade policy, politics and economics of EU-27

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2.1 Introduction

The Ukraine conflict in 2014 launched a crisis between the European Union (EU) and Russia, which some scholars consider as the most critical and controversial confrontation in Europe's latest past (Howorth, 2017; Orenstein and Kelemen, 2017; Schilde, 2017). The EU members applied various sanctions to Russia, and consequently, Russia responded with different sectoral restrictions towards the imposers. Apart from the financial restrictions, economic sanctions by the EU include arms and related materials, dual use goods for military purposes or military end-users, and equipment for the oil and gas sectors for use of the exploration, extraction of deep sea, Arctic and shale oil. Russian counter-sanctions ban the agri-food and raw material imports. Due to close trade, energy and investment relations between Russia and the EU, the introduced bilateral sanctions affect noticeably not only the Russian economy, but also have large-scale effects on many EU economies as well. Taking into account continuous extensions of the sanctions on both sides (European Council, 2018), it's becoming of ever higher importance to understand what economic effects these political settlements are accompanied by.

European exports into the world increased by 6% between 2013 and 2016, whereas the exports to Russia dropped by nearly 40% within the same time period. As a result, the relative meaning of the Russian market became less significant for the EU-27. In 2013 the relative share of exports to Russia amounted to 2.61% of all world exports from the EU. The equivalent share in 2016 hardly reached 1.5%[2].

A comparison of the European exports to Russia in absolute numbers before and after the crisis, reveals that Germany remained the only country, which sustained the amount of the exports over 10 billion Euro throughout the crisis, namely 21.7 billion Euro in 2015 (although the pre-crisis number of the year 2013 equals 35.8, which still indicates a substantial loss of nearly 40%)[3]. An even clearer pattern of the crisis consequences can be recognized when looking at the relative numbers. Figure 1 compares a relative importance of the EU-27 exports to Russia before the Ukraine conflict and afterwards. Obviously, Eastern European and Baltic countries remained strongly tied to Russia, whereas the Western European countries became

[2]The export share dynamics over 2000-2016 can be found in Figure B.1 of the appendix

[3]The corresponding figure B.2 underlying this comparison can be in the appendix

less dependent on Russian exports. We expect this trend to be traced when the total losses are calculated.

However, apart from the political crisis and an introduction of the sanctions, the Russian economy was recently exposed to a number of other factors which would, supposedly, have depressed its trade relations with Europe anyway, such as a stagnating economic growth by 2014 as well as a drastic fall of oil prices which entailed a weakening of the Russian national currency, the rouble. Therefore, the contribution of this paper is to provide a comprehensive empirical framework for capturing both direct and indirect losses that have incurred in the European economies during 2014-2016, by taking into account the exogenous factors apart from sanctions which played a role during the time of the crisis and their consequences as well as the interconnectedness of the European economies. For this purpose, in the first step a vector autoregression methodology (VAR) is employed, which allows to separate the sanctions' effect from the losses, due to a weakening ruble; a stagnating growth in Russia; and, a collapse of oil prices – estimating this way a direct loss due to sanctions. In the second step, an input-output method is applied for estimating additional indirect effects as well as spillover effects resulting through the interconnectedness of the European countries with each other.

The remainder of this paper is organized as follows: section two provides the definitions of the key concepts, applicable to the conflict under study, followed by a brief literature review on economic sanctions in general and the Ukraine conflict in particular. Section three establishes an empirical framework and gives an overview on data used in the study. In section four the results are presented. Finally, section five concludes.

2.2 Literature review and theoretical framework

2.2.1 Theoretical foundation

Economic sanctions, understood in this paper as a political instrument whose aim is to coerce the target state into changing its political behaviour by lowering target's economic welfare through various economic restrictions (Pape, 1997; Hufbauer et al., 2010), have become the most frequently deployed instrument of the contemporary

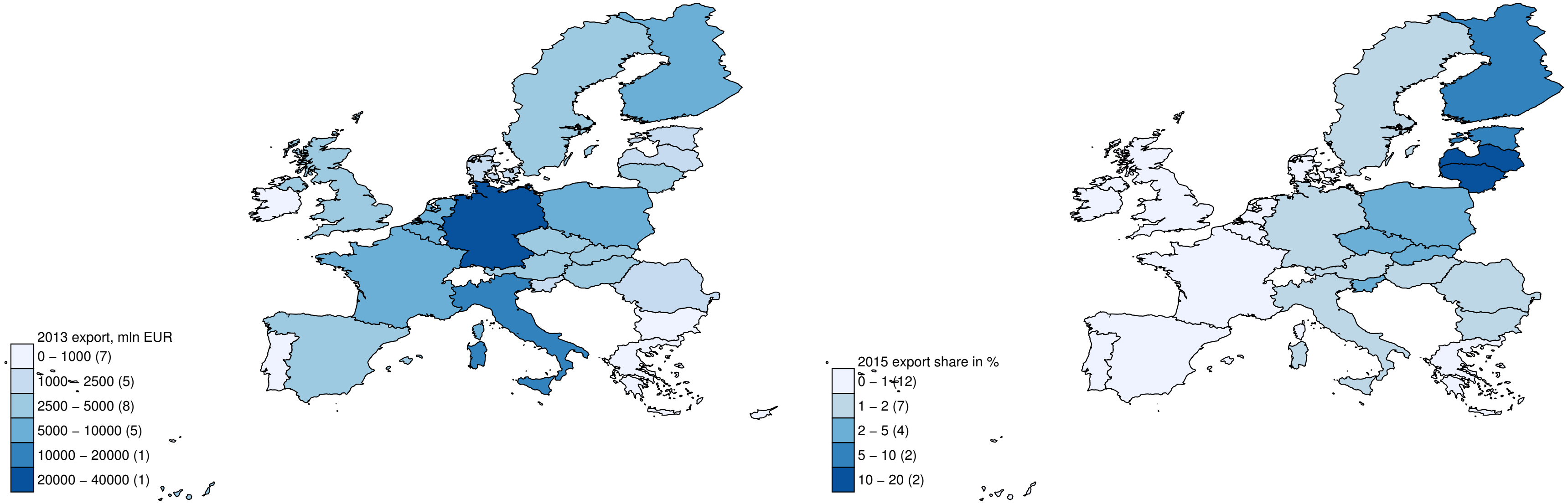

FIGURE 2.1: EU-27 exports to Russia as a share of total world exports, in %

Note: EU-27 exports to Russia relative to total world exports before the Ukraine conflict in 2013 (left) and in the second sanctions year, 2015 (right). The number of countries in each category is shown in parenthesis in the legend.
Source: Eurostat

foreign policy toolbox in the post-cold war world since they are often considered as nearly a single possible alternative to a military statecraft (Blanchard and Ripsman, 1999). For example, the EU is currently engaging in 39 sanction episodes, both against states and organizations, for instance, Al Qaeda or ISIL (*European Union. Restrictive measures (sanctions) in force* 2016). The growing popularity of sanction activity in the last two decades has multidimensional economic and social consequences and is reflected in the modern scholarly research.

Several theoretical frameworks are usually applied to the analysis of sanctions. Generally, theoretical models dealing with economic sanctions display (1) the reaction of the target economy, (2) importance of the sanctioned goods, (3) the role and response of various interest groups (Caruso, 2003) and (4) the welfare deprivation as a result of sanctions.

According to Rudolf, 2007 there are two basic kinds of models, macro- and micro-models, which explain the relation of sanctions and their political influence.

The classical macro-models are based on a cost-benefit function and suggest that a high maintenance in eliminations of the sanctions effects like supply shortages, increased unemployment etc., which is necessary for securing the power, will make a rational government give in when the costs of domestic support exceed the benefit of not conceding to the demands.

According to the Solow model (Solow, 1957), the scarcity of capital increases the rate of return, which in turn leads to a higher growth in the short run. However, an assumption of the capital availability for investment, necessary for the growth determination, is usually violated under the condition of sanctions. Sanctions in a target country lower the level of both foreign and domestic investment. It happens either directly or through worsening a general investment climate and making foreign and domestic investment also less attractive. An own empirical analysis (Chapter 3) with respect to the FDI also supports this conclusion concerning the negative impact of sanctions with respect to the foreign investment. In other words, imposed export restrictions may bring about a lower growth rate for the target economy through inefficiencies in employing labour and capital, worsening domestic expectations, drops in savings, investment, employment and a devaluation of the local currency. This would lead in turn to an inward shift of the target's production possibilities frontier

(Carbaugh and Wassink, 1988).

A group of theoretical models refer to welfare losses born by the target country, which is straightforward taking into account the formal definition of sanctions. Without proper welfare deprivation, according to the sanctions idea, a successful cohesion of the target state is impossible. In line with this expectation, neo-classical general equilibrium models (see e.g. Porter, 1979 or Kaempfer and Lowenberg, 2007) show that a targeted state ends up with worse terms of trades as a result of trade sanctions compared to the sender state. A higher level of elasticity of offer curves of both sender and target, the greater is the bilateral dependence on the mutual trade among all involved parties.

The micro-models are based on a plurality of interests of different groups and actors, which are variously affected by sanctions. According to this view, sanctions should target political elite and its closest supporters individually. These models comply with a concept of so called smart sanctions which was developed in the aftermath of devastating humanitarian consequences of the comprehensive sanctions imposed on Iraq (Lopez and Cortright, 1997; Cortright, Lopez, and Gerber, 2002; Beladi and Oladi, 2015). Smart sanctions are especially associated with a game-theoretical approach (Eaton and Engers, 1992; Drezner, 2003 etc.).

The empirical sanctions literature deals primarily with two questions: whether the sanctions work and how to improve their effectiveness. Most researches, however, agree on the ineffectiveness of the sanctions, judging upon the compliance of the target (Drury, 1998; Galtung, 1967; Pape, 1997; Wallensteen, 1968).

A prominent strand of the sanctions literature is dealing with the regime type. Democracies are likely prone to comply with the sender demands rather than authoritarian regimes (Allen, 2008; Bolks and Al-Sowayel, 2000; Nooruddin, 2002). In non-democracies, the economic burden is shifted on the governed broad masses, like in case of Iraq which lost 48% of its Gross National Product (GNP) (Bolks and Al-Sowayel, 2000; Pape, 1997). A political and/or economic instability of the target also strengthens success (Hufbauer et al., 2010; Jing, Kaempfer, and Lowenberg, 2003; Lam, 1990). An anti-government behaviour within the target state is generally positively correlated with the event of sanctions, although it is more likely to occur in more democratic target states (Allen, 2008). Sanctions can thus increase a popular support of the ruling regime, contribute to a rise of a new (industrial) elite benefiting from a country's international isolation (Galtung, 1967; Kirshner, 1997).

A country regime of the sender also plays a role in the effectiveness: more democratic senders achieve higher success levels (Lektzian and Souva, 2007). They are also more frequent sanctions imposers compared to other regime types (Cox and Drury, 2006; Lektzian and Souva, 2003). It can be explained through a broader group of interests to be satisfied. Democracies are also more likely to impose sanctions against non-democracies due to the goals which are more often applicable to other regime types (Cox and Drury, 2006; Lektzian and Souva, 2003).

Empirical evidence on export restrictions is quite controversial and did not find much confirmation (Bonetti, 1998; Lam, 1990), unless a pre-sanctioned target depended heavily on the trade with the sender (Hufbauer et al., 2010). Financial sanctions tend to be more successful (Allen, 2008; Dashti-Gibson, Davis, and Radcliff, 1997; Drury, 1998), although this fact is not always proved empirically (Hufbauer et al., 2010).

The duration of sanctions is also found to be controversial: whereas some scholars observe increasing welfare costs of sanctions with time (Brady, 1987), others argue the opposite (e.g. Bolks and Al-Sowayel, 2000; Miyagawa, 1992). It might be due to a so-called selection bias (Drezner, 1999; Nooruddin, 2002). The main argument of these studies is that the potential target changes its policies before the event of sanctions imposition and then alters its behaviour. In this case, coercion never materializes and the event of sanctions doesn't exist, which creates a problem for the (previous) studies which look at the imposed sanctions.

A discussion about the effectiveness of sanctions is not possible without an analysis of their impact in terms of welfare deprivation (Dorussen and Mo, 2001). Costs, both to the sender and the target, are carefully considered in the sanctions' analysis (Baldwin, 2000). The logic behind this argument is that higher costs of compliance for the target go along with a higher probability of the government altering its behaviour. The target country is stripped of trade gains and loses its welfare (Caruso, 2003). Harshness of the costs to the target is proved to be crucial for the success of sanctions (Bonetti, 1998; Dashti-Gibson, Davis, and Radcliff, 1997; Drury, 1998; Jing, Kaempfer, and Lowenberg, 2003; Lam, 1990; Lektzian and Souva, 2007). Dependent on the degree of mutual integration and a resulting damage of the interactions, a sender can also be affected heavily. Despite some existing empirical evidence on the negative relationship between the costs of sanctions to the sender (Drezner, 1999), costs to the sender still often remain disregarded in the dominant sanctions research (Caruso, 2003; Dorussen and Mo, 2001). Economic costs of the sanctions are sometimes expressed by a significant drop in a bilateral trade (Hufbauer et al., 2010), especially multilateral and/or comprehensive sanctions are likely to disrupt trade (Caruso, 2003). The pre-sanctions trade acts as a measure for pre-sanctions linkage between the countries and influences a potential welfare loss (Bonetti, 1998; Miyagawa, 1992). When disentangled, international sanctions depress trade to a higher degree rather than war, not only between the belligerent parties, but also with third countries (Lamotte, 2012).

Determining the costs of sanctions for the sender is also the primary object of the current empirical analysis.

2.2.2 Literature review on the Ukraine conflict

Since the beginning of the conflict, an increasing number of publications dealing with the conflict appeared. They predominantly concentrate on the effects of the conflict on the Russian economy (e.g. Gurvich and Prilepskiy, 2015; Vercueil, 2014 etc.). This is natural since the economic impact on Russia is generally considered as rather heavy compared to the Western countries and the political behaviour of Russia is of higher interest (Deutsche Bank Research, 2014). Existing empirical analyses apply various tools: (macro)econometric growth forecasting (e.g. see Rautava, 2014; Vercueil, 2014), computable general equilibrium (CGE) modelling (Barry, 2014; Kutlina-Dimitrova, 2017), and input-output modelling (Christen et al., 2016; Oja, 2015).

Macroeconomic analyses focus primarily on growth forecasts, curtailing initial growth forecasts of Russia to a different degree (Christen et al., 2016). In case of a further conflict escalation and a low variant of oil prices a Russian economy was supposed to contract by 3% in 2015 (Vercueil, 2014)[4]. Economic sanctions' costs up to

[4]Besides a drop in GDP in 2015, increased inflation and worsening of other macroeconomic indicators, the poverty level in Russia has increased steadily since the introduction of sanctions in 2013:

10% of GDP (Shirov, A.A., Yantovskiy, V.V., Potapenko, V.V., 2015; Folkerts-Landau, 2014) and a resumed growth of 1.5% in the medium perspective were initially predicted for Russia, whereas sanction-specific drop in real GDP would amount to 1-1.5% as well as a cumulative impact of 9 percent of GDP in the mid-term (IMF, 2015). Tuzova and Qayum, 2016 anticipated a contraction of GDP by 19% and a rate of inflation of almost 20% in the next two years, after the start of the conflict. It is becoming clear now, that such gloomy prospects for Russia, as well as its potential failure to preserve the macroeconomic equilibrium longer than until 2016, in case the Central Bank of Russia (CBR) keeps trying to maintain the standard of living, squandering its reserves, did not hold (World Bank, 2017).

However, enduring sanctions continue to weaken the Russian economy by reducing both domestic and foreign direct investment as well as Russian stock returns, and significantly continue to increase a volatility in the sectoral indices. However, it ought to be said that the direct effects of sanctions on the Russian economy are not as detrimental as is the deteriorating price of oil (Dreger et al., 2016; Hoffmann and Neuenkirch, 2017). However, it is simultaneously not possible to explain the drop in GDP only through the decline of oil prices. A part of Russian GDP decline is necessarily sanctions-driven. Even when being estimated 3.3. times lower than the impact of the oil price shock (Gurvich and Prilepskiy, 2015), it should not be neglected due to its sustainable impact on the Russian economy.

Because of highly strong trade ties with senders, Russia's trade loss in just two years, 2014 and 2015, amounted to $US 62.94 billion (Hinz, 2017). The trade ban also led to a depreciation of the real exchange rates (Kholodilin and Netšunajev, 2019), although the depreciation was primarily caused by the decline of oil prices (Dreger et al., 2016). Aganin and Peresetsky, 2018 show that imposed sanctions increased the volatility of the ruble exchange rate and its dependence on oil price volatility. Although, as the authors claim, the impact of sanctions evaporates with time, as the Russian economy becomes more and more adjusted. One of the possible reasons for this notable adjustment process was a switching to a floating exchange rate regime, undertaken by the CBR in November 2014.

according to the World Bank, 2017, the poverty headcount ratio at national poverty lines (% of population) increased from 10.8% in 2013 to 11.2% in 2014 and by over 2% the following year, reaching 13.4% in 2015

Investigations on a micro-level, exploiting a "smart" nature of the sanctions, find that sanctions negatively impact financial health of the targeted firms and increase a firm exit probability. An average directly sanctioned or affiliated company lost around 25% of its operating revenue and 30% of employees during the period from March 2014 until December 2016, compared to non-sanctioned counterparts (Ahn and Ludema, 2017). A study, evaluating risks perception, associated with sanctions, by Russian manufacturing companies, concludes that sanctions can be catastrophic not only for directly targeted firms, but also for top-performing, globally integrated firms with firm ties to the EU and/or Ukraine (Golikova and Kuznetsov, 2017). It makes the recent sanctions shock different from a usual cyclical crisis which would eliminate the least efficient firms, having a creative destruction effect. The sanctions in place also resulted in a significant fall in Russian stock prices and an increase in volatility and heavy-tailless of stock returns in the aftermath of sanctions (Naidenova and Novikova, 2018; Ankudinov, Ibragimov, and Lebedev, 2017).

However, one should not ignore some increase of economic activities related to the demand pull from investments into Crimea's assets and infrastructure. This shock, introduced to a system which rests in equilibrium, might result in an increase of Russia's GDP by 1.42%, an increase of production in all sectors by 19.3 bln Dollar, an increase in a trade balance by 699.2 mn Dollar, a decrease of market prices by 0.6%, and finally a decrease of price of all production factors (Barry, 2014).

Several studies, dealing with the welfare losses on both conflict sides, agree on more serious consequences for Russia than for the Western economies and predict only minor losses in GDPs of the EU (Deutsche Bank Research, 2014). For instance, Kholodilin and Netšunajev, 2019 do not find a strong evidence of an adverse effect of sanctions on the growth rate of Euro area's GDP. However, considering a modest growth of the EU economies, a danger of the growth reversal, which can be easily turned into stagnation, exists. Moreover, it is expected that Baltic countries, especially Lithuania, Finland and Poland face the largest losses, although Germany remains one of the biggest exporters to Russia (Boulanger et al., 2016; Giumelli, 2017; Oja, 2015).

An Austrian study on the macroeconomic effects of the current trade conflict reports a fall in value-added of EU-27 by 0,2-0,9% (depending on the scenario) and the negative employment effects of 0,2-1,1% (depending on a scenario). The negative effects for Germany can add up to somewhat 1.2% of GDP and up to 500 thousand unemployed in the worst-case scenario. The realized impact of the conflict in terms of value-added amounts to 6.65 billion Euro (Christen et al., 2014). A successor study, released by the same researcher group, predicts even gloomier consequences for the German economy (Christen et al., 2016).

It is known from the literature, that the main areas of EU exposure to the Russian sanctions are the food industry, the textile industry, the pharmaceutical industry, the electronics industry, the machine tool industry and the industry of transport means (Havlik, 2014). The industries listed above are in peril, mostly, in the long term, although financial institutions may conceivably sustain large short-term damage (Shirov, A.A., Yantovskiy, V.V., Potapenko, V.V., 2015). A ban on agri-food products is supposed to cause the EU-28 a welfare loss of 126 million Euro, which is remarkably below an expected welfare loss in Russia that amounts to about 3.4 billion Euro (Boulanger et al., 2016). Agriculture, engineering and energy sectors are the most vulnerable sectors of the EU in terms of a long-term negative sanctions impact, whereas financial restrictions are even more destructive in the short term: European financial institutions can lose up to 10 billion US Dollars annually, caused by a reduction in interest payments (Shirov, A.A., Yantovskiy, V.V., Potapenko, V.V., 2015).

There have been warnings for Europe concerning any premature decision-taking resulting into observed ineffectiveness of the sanctions (Vries, A.W.d., Portela, C., Guijarro-Usobiaga, B., 2014). The literature indicates the institutional weaknesses of EU foreign policies undermined by the current crisis (Sjursen and Rosén, 2017).

2.3 Empirical approach and data

The empirical approach comprises of two parts. In the first part, a simulation for the period from July 2014 until December 2016 is carried out. For this purpose, a Vector Autoregression (VAR) model for each sector, with a substantial export history of every EU-economy is estimated[5]. This way, we get a "what-would-have-happened"

[5]For several countries it was only possible to forecast a total of exports, since a sectoral disaggregation contained a lot of gaps due to a weak trade relation with Russia in particular sectors. The group of

scenario for each group of goods, taking into consideration such factors as the weakening rouble, the stagnating growth in Russia, and the collapse of oil prices, but excluding the event of sanctions itself. Therefore, by subtracting the forecasted values from the statistically observed ones we can determine a so called "due to sanctions effect", i.e. direct losses caused by sanctions.

However, a profound economic analysis is not complete without considering inter-sectoral ties within each sender economy since a decrease in the output of one sector consequently affects all other sectors of the economy through the system of production links, or the backward linkages (Shirov, A.A., Yantovskiy, V.V., Potapenko, V.V., 2015). The spreading of the impulses (both positive and negative) in an economy is triggered through a chain mechanism. To imagine how such system works, a simplified example can be considered: if a demand for Volkswagen in Russia sinks by 100 cars, an automobile industry "A" in Germany has to decrease its production of cars accordingly[6], but it will also demand less intermediate inputs in form of, for example, rubber from a sector "B" producing rubber and plastic products for its 100 steering wheels, and a sector "C", producing textiles and textile products for its 100 seat covers. It means that "B" and "C" also must decrease their outputs although no primary negative impulse was imposed on them. To estimate such total effects, or welfare losses, on an economy of changes in elements that are defined exogenously to that model, an input-output model is employed (Miller and Blair, 2009).

A negative demand shock imposed on any EU-economy because of the bilateral sanctions represents an exogenous demand change. Obviously, as explained above, not only directly sanctioned companies (and sectors) are affected, but also their suppliers, and suppliers of the suppliers etc. In the current study both direct and indirect (supply chain) production effects at sectoral level as well as total macroeconomic effects shall be calculated.

Moreover, it is crucial to consider the intensive economic ties within the EU. Supposedly, some countries are less affected through the sanctions, but are tightly

these countries includes: Ireland, Luxembourg, Portugal, Romania, Slovak Republic and Slovenia. For these countries a following assumption was made: forecasted values of total exports were laid over the sectoral export structure of the pre-crisis year, 2013. It was not possible to make any forecasts for Cyprus and Malta. For the latter two only spillover effects were calculated.

[6]We do not consider a substitution of export markets here.

connected to the countries with a serious damage. It leads to negative spillover effects within Europe as well.

The concrete research questions can be formulated as follows: (1) What are overall production effects of the EU sanctions on EU-27? (2) How strong are spillover effects within EU-27 within the magnitude of the crisis? (3) What does a ranking of European loss bearers look like?

2.3.1 Econometric approach and data

Considering the nature of the study, a chosen econometric approach seems to be intuitive. We are seeking to forecast export values within a scenario, as if sanctions had never happened. For this purpose, we use a VAR model iterative forecasting based on the past values of exports, domestic demand in Russia and an exchange rate, as well as present values of exogenous factors, oil prices and a proxy for the world economic development. The model of the following setup is applied:

$$\boldsymbol{y_t} = \boldsymbol{v} + \boldsymbol{A_1 y_{t-1}} + ... + \boldsymbol{A_p y_{t-p}} + \boldsymbol{B_0 x_t} + \boldsymbol{B_1 B_{t-1}} + ... + \boldsymbol{B_s x_{t-s}} + \boldsymbol{u_t} \tag{2.1}$$

where $\boldsymbol{y_t} = (y_{t1}, ...y_{Kt})'$ is a vector comprising of endogenous variables; the $\boldsymbol{A_i}$'s are $(K \times K)$ coefficient matrices; $\boldsymbol{x_t} = (x_{t1}, ...x_{Mt})'$ is a vector of exogenous variables; the $\boldsymbol{B_i}$'s are $(K \times M)$ coefficient matrices; $\boldsymbol{v}$ is a $(K \times 1)$ constant term; the u_t's are K-dimensional serially uncorrelated vector of residuals with mean zero and non-singular covariance matrix $\sum u$.

The data used in the study are per month and run from January 2000 through December 2016. The following endogenous variables are included:

$EXPORT_t$ stands for sectoral exports to Russia. The model is estimated for each sector in each country which has real exports reflected in the Eurostat statistics. The sectoral data are drawn at the most detailed five-digit level of SITC classification and are converted into the ISIC classification of the necessary level in accordance with the WIOD table for the second part of empirical analysis.

$INPROD_t$ is the index of the industrial production in Russia. The data are obtained from OECD.

$EXRATE_t$ is a real exchange rate EUR/RUB[7] obtained from the European Central bank.

Following exogenous variables are included in each model as well:

$BRENT_t$ stands for Crude Oil Prices: Brent - Europe, measured in US dollars per Barrel. The data are retrieved from the U.S. Energy Information Administration. This variable accounts for the oil price slump which would have affected the Russian economy regardless of the sanctions.

$BADI_t$ is the Baltic Dry Index, a proxy for the world economic development. This variable helps to account for a financial crisis in 2008/2009.

For the purpose of a seasonal adjustment, a set of seasonal dummies is included in each estimated model in its exogenous part. A constant term is also treated as exogenous.

To make sure all variables are stationary, they are expressed in the first-difference form of their logs. An important step in working with VAR models is the selection of the VAR lag order. Recalling that Akaike Information Criterion (AIC) is considered the strongest, when applied to monthly data, it is chosen to establish an optimal number of lags (Ivanov and Kilian, 2005). Throughout the estimated models the optimal number of lags varies between 1 and 12[8], depending on the country and the respective sector. Some countries show a clear tendency towards one lag order throughout all sectors.

After estimating the individual sectoral model for each country over the sample period between February 2001 and June 2014 and obtaining the corresponding impulse response functions, we proceed to the goal of the VAR-modelling within this study: dynamic forecasting. It is conducted for the period from July 2014 to December 2016. The forecasted sectoral exports are summed up to total exports. The discussion of concrete numbers is offered in the results section.

The quality of each model is tested in several ways: first, each estimated model is tested for stationarity. All the eigenvalues of each companion matrix lie inside the unit circle, which means that each VAR model satisfies a stability condition. An

[7] For the countries which remain outside of the Euro-zone throughout the whole period of analysis exchange rates were calculated using EUR/RUB exchange rates. The list of these countries include Great Britain, Romania, Sweden, Bulgaria, Czech Republic, Hungary, Poland and Denmark.

[8] A summary of a number of lags for each country for each sector as well as the values of the AIC can be found in Tables B.1, B.2 and B.3 of the appendix.

individually implemented Lagrange-multiplier test for a residual autocorrelation indicates that a lag order was chosen properly. Moreover, a formal ex post test of the significance of the lags in each equation is carried out. As a rule, in the export's equations all lags are significant, even when the VAR is considered as a whole.

2.3.2 Input-output analysis

The second step of the analysis is an application of the input-output analysis. The core of the input-output analysis is the input-output table (IOT). IOT is a part of national accounts. The table comprises four quadrants. The columns of the matrix in the first quadrant represent the economic activities in form of many industries, assigned respectively to primary, secondary and tertiary sectors, whose interrogations are displayed in the production matrix. The interconnectedness of sectors is captured in the input coefficients (Miller and Blair, 2009). Quadrant II presents a final demand, which comprises consumption, investment and exports. Through exogenous changes in final demand = direct effect (primary impulse through loss of exports = demand shock) a chain reaction is triggered: not only companies which engage in an export activity with Russia (and sectors) are negatively affected, but also their suppliers, and suppliers of the suppliers etc. This impact is captured through an indirect effect. Quadrant III is a matrix of the primary inputs (labour, capital, land) and contains various components of value added (wages and salaries, operating surplus etc.) and imports. Quadrant IV sometimes may contain, for instance, imports by household for private consumption, but mostly, it is published without any data.

Mathematically, an input-output system comprises of a set of linear equations which contains n unknowns (Miller and Blair, 2009). The solution of this system is obtained by means of the inverse coefficients derived from the basic I-O equation

$$x = (I - A)^{-1} y \tag{2.2}$$

where $(I - A)^{-1}$ inverse Input coefficients, $(I - A)$ – Leontief-Matrix, y – demand, x – output.

To estimate the effect of the exogenous demand shock on outputs of the sectors of each economy, a standard input-output methodology is applied: the vector of a sectoral output x is calculated by multiplying an inverse Leontief matrix IO of the domestic and import inputs with the vector y, comprising sectoral export losses in each of the conflict year, derived from the VAR forecasting from the previous methodological step. The latter vector represents an exogenous demand shock imposed on the system.

Total macroeconomic output effects can be decomposed into the direct effects (firms/sectors-exporters of the sanctioned products to Russia) as well as the indirect effects (firms/sectors linked to the affected firms/sectors as suppliers). In other words, the sum of both direct and indirect effects measures a total impact on the economy resulting from a loss of final demand in one of its sectors. Spillover effects due to the European trade interconnectedness are derived for each country.

To measure the macroeconomic and sectoral impact of the Ukraine crisis on the EU, a World IOT for the year 2011 out of Release 2013 of the World Input Output Database (WIOD) is used for calculations. It is appropriate for an ex-ante estimation because a structure of a developed economy does not change a lot in such a short term. Input coefficients for domestic production and imports are used.

2.4 Results

2.4.1 Macroeconomic results

Figure 2.2 shows a development of the real and forecasted sum of total exports of the EU-27 to Russia. At the first sight it is possible to recognize that the oil price dynamics are the main, but not the only one, determinant of the export curves.

In the first year of implementing the sanctions, total production losses in the EU-27 amounted to 29 billion Euro; in the second year, over 22 billion euro; and, already in 2016, signs of recovering at the whole EU-level were clear. If taking into account the interconnectedness of the countries within the EU, the EU-27 experienced additional 12.5 billion Euro losses within the first two years since the imposition of sanctions. Therefore, by the end of the second year with the sanctions in force, the

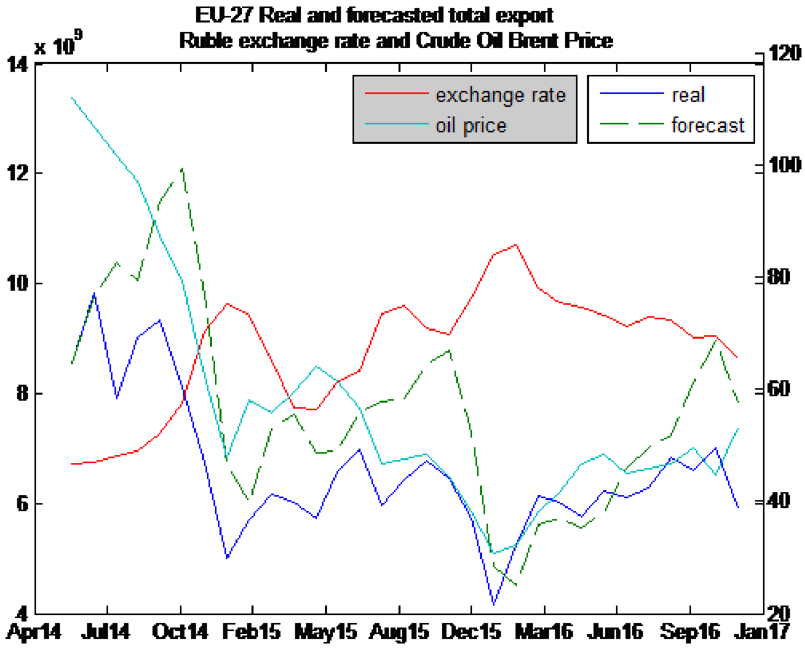

FIGURE 2.2: EU-27 real and forecasted export, exchange rate and oil price, monthly dynamics

Source: Eurostat, World Bank, own calculations

cost of sanctions amounted to nearly 64 billion Euro production losses for the EU-27. Table 2.1 provides a short overview over the suffered yearly losses.

TABLE 2.1: EU-27 losses due to sanctions, in million Euro

	Immediate losses (direct + indirect)	Total losses (direct + indirect + spillover)
2014	-28.767,81	-36.199,07
2015	-22.577,45	-27.650,44
2016	2.032,72	1.980,71
2 years	-51.345,26	-63.849,51
3 years	-49.312,54	-61.868,79

Source: Own calculations

The impact of sanctions is distributed differently across the countries over the years. Overviews of the yearly losses in 2014 and 2016 which took place in each country individually, are presented in Figure 2.3. It contains the intra-EU spillover effects and enables us to obtain a full picture of analysis. An overview over the year 2015 is provided in Figure B.4 of the appendix. An overview for 2014 and 2016 excluding intra-EU spillover effects can be found in Figure B.5 of the appendix. Table

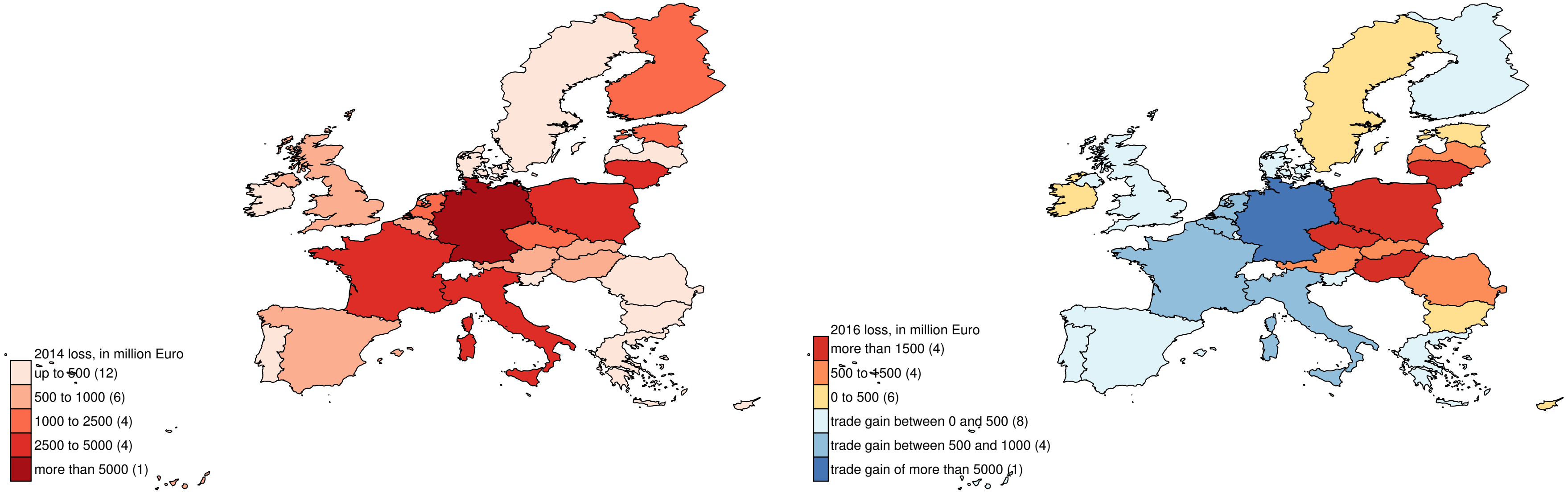

FIGURE 2.3: Export losses due to sanctions in 2014 (left) and 2016 (right), including spillover effects

Note: EU-27 export losses due to intra-EU trade connectedness. The number of countries in each category is shown in parenthesis in the legend. The scale on the right is reverted and shows the biggest losses on the top, countries recovered from losses to a different extent by 2016 are depicted in blue.
Source: own calculations

B of the appendix presents a summary for all years by country.

In 2014, all economies of the EU were hit through sanctions, although to a different degree. In the ranking of the European loss bearers Germany comes top with over 5.6 billion country losses and additional 1.9 billion Euro due to the trade connectedness with other EU-countries and is coloured the darkest in Figure 2.3. The fact that over 33% of total losses in Germany are due to the trade relations within Europe indicates a strong embeddedness of Germany into the European trade structure. Italy ranks the second with a total of nearly 4.8 billion Euro of output losses, followed by France and Poland with around 3.7 and 3.6 billion Euro respectively.

Obviously, smaller EU-economies are affected less in absolute terms but taking into account their higher dependence on the trade relations with Russia, a relative impact is very high. So, the share of Lithuanian exports to Russia out of total world exports amounted to 21% in 2014 and decreased up to 14% in 2015 and 2016, still underlining a substantial meaning of the Russian market. Latvia follows with 15% of Russian exports in total exports in 2014, whereas this share decreases up to 11% in 2015 and 2015. Estonia, Estonia, Finland, Poland, Slovenia, Slovak and Czech Republic are following next in descending order. Therefore, it seems intuitive to expect the impact on these countries to be the highest, when comparing the losses suffered as a share of exports to Russia in the pre-crisis year, 2013. So, Estonia's and Lithuania's exports to Russia were deprived by around 73% and 54% respectively in 2014 compared to the 2013 numbers. Whereas Germany lost "only" around 22% of the 2013 Russian exports in 2014.

A gap between the countries which start recovering after the sanctions shock in 2014 and those which suffer even more devastating losses the longer the sanctions endure, appears already in 2015. Looking again at the absolute loss bearers, a slight change of the picture can be observed: although Italy still ranks as the second, exhibiting a total loss of nearly 5 billion Euro, the first position is taken by Lithuania with nearly 5.7 billion Euro of output losses. Only a small fraction, around 1%, of this amount is due to the European embeddedness which reconciles with the importance of the Russian market on one hand and, as a consequence, a weaker trade connection towards Europe on the other. On the contrary, Germany's solid integration and a very strong position within the European trade network is indicated by the fact that the output losses caused by the intra EU-trade connectedness are nearly 5 times higher than the direct and indirect losses which took place within the country immediately.

Moreover, in 2015 a losses pattern towards Eastern European and Baltic countries becomes clear. Poland ranks as the third biggest loss bearer with nearly 3 billion Euro, followed by Czech Republic with almost 1.9 billion Euro losses. Hungary ranks high as well with 1.4 billion Euro losses. Great Britain is an interesting case. The economy does not suffer any country losses which would indicate a recovery from the sanctions shock, but alone due to a close trade intertwining with other European economies, an output loss of over 370 million is imposed on the country, which places it along the other countries onto the loss bearer list. The situation might look different if Brexit is executed before the sanctions conflict with Russia is resolved.

As it can be seen from Figure 2.3 a clear division of Europe in two groups can be observed by 2016. Group 1, so called 'less dependent countries', comprises predominantly of Western European economies, which managed to recover from the sanctions shock by the end of 2016. This group includes the following countries: Belgium, Germany, Denmark, Spain, Finland, France, Great Britain, Greece, Italy, Luxembourg, the Netherlands, Portugal and Slovenia. It should be noted that Belgium, Great Britain[9], Greece, Portugal and Slovenia were not affected any more by the sanctions crisis after 2015. Group 2 covers essentially Eastern European and Baltic countries, which include: Bulgaria, Czech Republic, Estonia, Hungary, Ireland, Lithuania, Latvia, Poland, Romania, Slovakia, Sweden and Austria. Cyprus and Malta belong into this group as well, however, only losses resulted out of the trade embeddedness into the EU-27 could be considered[10].

[9] Great Britain still suffered some loss, if taking the intra-EU trade connectedness into consideration.

[10] Forecasts for selected countries as values in levels as well as real export development can be found in a graphical form in Figure B.3 of the appendix. The list of both groups can be is provided in Table B.5 of the appendix.

2.4.2 Sectoral results

Export decline to Russia is reflected across different sectors across European economies to various degrees. An execution of the sectoral analysis provides an important insight into the structural weaknesses at the individual country level. The sectors with the strongest backward linkages within each country are affected the most, but simultaneously recover sooner when the adjustment process is ongoing.

Overall, it can be concluded that the aggregated sector Food, Beverages and Tobacco (15t16) is the most frequently impacted (43 times out of 375). This could indicate that Russian counter-sanctions were successful in terms of absolute production losses across the European countries. This sector appears to be among the top 5 loss bearing sectors in each year in the following countries: Finland, Great Britain, Italy, Ireland, Lithuania, Latvia and Sweden. It should be noted that in most countries this sector does not appear in the ranking of 2016 even if the losses in the first and the second year of sanctions are significant in this sector.

Chemicals and Chemical Products (sector No. 24) is mentioned 40 times in the ranking and, therefore, is the second most affected sector across Europe. Bulgaria, Spain, Finland and Romania indicate heavy losses within this sector for each year. Chemicals and Chemical Products sector is followed by Machinery (sector No. 29 – 38 references), Electrical and Optical Equipment (sector No. 30t33 – 32 references) and Agriculture, Hunting, Forestry and Fishing (sector No. AtB – 30 references). Czech Republic, Romania, Slovak Republic and Sweden, contain Machinery among the top 5 loss bearing sectors in each year. In a similar manner, Czech Republic, Hungary, Lithuania and Slovak Republic contain Electrical and Optical Equipment; and, Hungary, Lithuania and Poland contain Agriculture, Hunting, Forestry and Fishing. There seems to be a pattern in group 2, the "dependent countries," where the same sectors tend to be affected more heavily in each year of the sanctions, whereas within group 1, a higher diversification is observable. It could indicate a better adjustment to the crisis conditions and a reorientation of the economy within the group 1.

Overall, the service sectors seem to be affected only moderately or not at all. Two service sectors with the highest frequency citation (both 14 references) are Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles (sector No.

51) and Renting of M&Eq and Other Business Activities (sector No. 71t74).

2.5 Discussion and conclusion

Followed by Russia's political destabilization of Eastern Ukraine and the annexation of Crimea in the beginning of 2014, European Union and several other Western countries applied various sanctions to Russia. Russia responded with different sectoral restrictions towards the imposers. The sanctions introduced by both conflict parties affect not only products concerned but have large-scale effects on many European economies as well as noticeable macroeconomic effects on Russia itself. However, considering Russia's strong dependency on natural resource exports, declining oil prices since summer 2014 would have led to a currency devaluation anyway (Dreger et al., 2016), which in turn would have influenced a domestic demand for European imports in Russia.

This paper aims to solve an uneasy task of disentangling between a pure sanctions effect and all the other factors when estimating imposed economic losses on individual European economies. Using high frequency data on disaggregated European exports, domestic production in Russia, exchange rates, oil prices and a world economic development, a two-step methodology, comprising of a VAR modelling and an input-output analysis, was employed. A clear advantage of using an input-output method is a possibility to consider indirect effects along the value-added chain which are greater than the directly imposed effects.

The results indicate a development of a clear pattern concerning sustainable loss bearers in Europe throughout the Ukraine conflict: as the most Western European economies managed to recover from the sanctions shock, the Eastern European and Baltic countries seem to suffer ever greater consequences of the conflict as the sanctions remain in force and the Russian economy starts to recover. Spillover effects within Europe indicate a different integration of individual countries in the European trade structure, which could explain differences in recovery process. At the same time this fact raises the question of a desired convergence within Europe, which could remote ever further because of the uniform sanctioning politics in the EU-28.

Chapter 3

Impact of political risk on FDI exit decisions: the case of Russia

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Abstract

In this paper we study exit decisions by multinationals in the host country that is characterized by weak institutions and high political risks. Using multinational plant-level data for Russia in the period 2000-2016, and applying the Cox hazard proportional model, we find significant effects of political risk on exits. Multinational companies (MNCs) are particularly sensitive to problems associated with low democratic accountability, military in politics, conflict and corruption. Institutional similarity between the host and home country makes MNCs more vulnerable to political risk. Sanctions significantly catalyse the effects of political risk on exits and are particularly threatening for subsidiaries from sender states with weak institutions. Large size of the subsidiary, organization as a greenfield or joint-venture with a local partner, as well as the existence of an intergovernmental investment treaty help subsidiaries to build resistance against host political risks. These findings provide empirical evidence, which can help to reach conclusions in the debate about FDI volatility in countries with high levels of risk.

JEL classification: E02, E61, F21, F23, L10, P26

Key words: multinational company (MNC); foreign subsidiary; political risk; exit; Russia; transition economy

[1]For detailed information about the contributions of the authors see Appendix C.

3.1 Introduction

There has been a decrease of accumulated FDI stock in Russia since the global financial crisis of 2008 and FDI inflows have been fragile compared to the 2000s. A number of high-profile and large-scale divestments have been reported. For example, ConocoPhillips, sold its oil and gas assets and quit Russia (Financial Times, 2015). General Motors closed its St. Petersburg assembly plant and took a $600 million write-off soon after U.S. sanctions were imposed on Russia (Fortune, 2015). Shell was harassed by the Russian government into reducing its 55% stake in the Sakhalin-2 project to 25% in favor of the local energy group, Gazprom (The Guardian, 2006).

On the other hand, the period also saw a number of landmark FDI entries, notably those which followed the partial privatization of diamond miner Alrosa and of oil company Rosneft. Multinationals, which recently increased their operations in Russia, include BP, ExxonMobil, Glencore, Daimler and Schlumberger. Schlumberger made its entry by purchasing 51% of Eurasia Drilling Company (EDC). However, the Russian government has said that operational and ownership control of EDC by the multinational could be reversed if the U.S. sanctions regime intensifies (Kommersant, 2018).

The main scope of our study is to analyse the influence of political risk on exit decisions by multinationals. These effects remain relatively understudied in the literature, which has tended to focus on choice of entry location as a function of political risk. The present paper helps to fill this research gap by analysing the factors that increase or decrease the length of stay of an MNC in a politically troubled market. Several new aspects are introduced into the exit analysis: we study the effects of risks on exit during various time periods and distinguish the exit strategies of genuine and round-tripping MNCs; we analyse how national and sub-national risks interact in a large transition country with heterogeneous regional institutions; and we incorporate relations between the home and host countries into the analysis, including the imposition of sanctions and the impact of political risks in the home country.

Divestment in general is one of the principal stresses faced by multinationals and host economies (Rodrik, 1997), while plant closure is one of the few unambiguous observed signals of plant performance and thus of inherent interest at a micro level (Bernard and Jensen, 2007). All multinationals face political risks, especially when firms from countries with weak and strong institutions interact in the process of globalization. Some multinationals are more sensitive to political tension than others and choose to divest. However, the decision to divest involves substantial risk and costs in itself. If policy makers want to retain foreign direct investments, it is important for them to gain a better understanding of behaviour by multinationals in order to design measures to prevent exits, and to protect the jobs, business activity and technology learning that are associated with FDI. From the point of view of businesses, it is important to spot the divestment activators, which sometimes make exit unavoidable.

We understand exit – the main outcome that we seek to explain in this paper – as a decision to liquidate or sell a subsidiary in a host market. Thus, like Dunne, Klimek, and Roberts 2003, we are not studying the mortality of plants, but rather decisions to stop producing output in the Russian geographical market. Our chief explanatory factor is political risk, which we understand as the assessment of the business environment in the host or home country, deriving from political change and governance, which may affect firm operations and profit. We deal with political risks and constraints arising from politics in the host and home country or in third countries.

Five main research questions are studied: (1) How does political risk in host and home country affect the decision to exit and does it have different effects across time and industries? (2) Does the effect of political risk on exit depend on political differences between the home and host locations? (3) What mechanisms can protect multinational firms from political distress in the host country and make them less likely to exit? (4) How do national and sub-national risks interact in determining exit strategy? (5) Have sanctions catalysed the effect of political risks?

Our theoretical approach is to explain exit by political risk, which is in line with the industrial organization literature, real options concept and the theory of power bargaining. Based on this literature, we hypothesize that factors associated with political risks contribute to the decision by a multinational to exit. We expect that multinationals, which do not experience high political risks in their home countries, will we more risk-averse than their counterparts that originate from a more distressed political environment. Finally, we expect that a larger subsidiary, local partnership or bilateral investment treaty and a favourable location in a sub-national region increases the bargaining power of the MNC and protects it from political intervention of the host government or pressure from the home country.

Russia is an appropriate empirical setting for studying the effects of political risks on multinational exit behaviour. Russia is a country with high levels of instability but is endowed with natural resources and a large domestic market. Financial difficulties and limited freedom of action due to conditions imposed by sanctioning countries constrain the institutional authorities of the host government in their relations with MNCs. Divestments of various kinds have taken place in practically all industries, and there were instances of direct expropriations of foreign firms in 2014, immediately after the annexation of Crimea, when more than two hundred Ukrainian firms were expropriated on the pretext of "unfair prior privatization" (RIA News, 2015). So, Russia is an appropriate case for the analysis of divestment behaviour by MNCs in response to political risks.

In our empirical analysis, we find that foreign multinationals are highly vulnerable to overall political risks, which motivate market withdrawals. MNCs are particularly sensitive to problems associated with low democratic accountability, corruption, military involvement in politics and conflict. Political similarity does not tend to make multinationals from developing countries "weather the storm" better in Russia: on the contrary, the greater the contrast between the home and host location (i.e. the better the political environment in the home country), the less likely it is that a multinational will exit.

Contrary to expectations, tolerable sub-national risks do not reduce the impact of national political risk, except in the city of Moscow.

Sanctions make exit more likely and add to the contribution of home risks to exit decisions. Various structural factors may shield foreign subsidiaries from political problems: large size of the subsidiary, greenfields and joint-ventures with local partners give greater resistance to exit.

In the next section (Section 2) of this paper we outline the literature which inspired our study and relate it to the hypotheses of our research. Section 3 describes the data. Section 4 provides the empirical strategy and discusses the construction of dependent and explanatory variables. Section 4 reports the results of a Cox-Hazard proportional model of plant exit, and section 5 summarizes results.

3.2 Literature overview

The industrial organization literature shows that the exit process reflects underlying productivity shocks that generate uncertainty (Dunne, Roberts, and Samuelson, 1988; Caves, 1998; Li, 1995). Several regularities described by this literature are important for our research: traditional structural entry barriers affect the decision to exit; major economic and political disturbances affect the firm turnover process; and the likelihood of exit declines with greater size of the subsidiary.

Increased political risk may cause defensive divestment driven by the higher costs and reduced profit of FDI operation in a weak institutional setting (North, 2017). So political risk affects FDI decisions (Busse and Hefeker, 2007), though it is rarely the principal factor, and in most cases it interacts with other specific features of firms and markets (Wei, Andreosso-O'Callaghan, and Wuntsch, 2007).

This brings us to our first hypothesis:

H1. Political risk determines exit by multinationals.

Multinationals do not immediately decide to exit when risks increase. Real options theory (Dixit, 1995; Dixit and Pindyck, 1994) explains that most divestment decisions are taken with a delay or not taken at all because of the existence of sunk costs that cannot be recouped if the firms changes its mind later on. If the firm cannot divest without costs or may regret having exited, a period of delay enables it to learn more about the uncertainties ahead. This model predicts that postponing a final decision is the optimal strategy in conditions of uncertainty and leads us to suggest dependence of the exit decision on internal and external resistance to exits. Large size of the plant, for example, may entail that sunk costs of exit are particularly high, increasing probability that the decision to exit will not be made (Dial and Murphy, 1995).

Next, we were guided by the family of theories of power bargaining, developed by international business research, which can be applied to specific risks generated by a host government. This theory establishes that all multinationals face the risk of post-entry costs that the host government may impose on foreign subsidiaries (Vernon, 1971; Teece, 1986b; Moon and Lado, 2000). So multinationals are exposed to changes in the political landscape of the host and to changes in the balance of power between the MNC and the host government. In this context exit can be understood as an issue, over which the MNC and host country engage in bargaining, and, if exit actually occurs, that represents a failure of the attempt to keep the business going. Although the motives of the sides involved in bargaining cannot be observed directly, the exit outcome is in most cases undesirable for both the MNC and the host government.

The power bargaining literature explains that the impact of political risk on exit decisions is not a simple function of the degree of political instability in the host country. The impact also depends on how the host risks relate to the institutional situation in the home country. Changes in international markets and political or economic disturbances at home can affect the power of MNCs in certain situations. Several mechanisms are at work: the coercive power of the home government; differences between political risk levels that are considered tolerable; and barriers to communication and knowledge transfer. Stress and confusion among foreign employees may entail the payment of additional premiums and higher turnover of personnel (Berry, Guillén, and Zhou, 2010; Alcacer and Ingram, 2013; Kogut and Singh, 1988).

Although the host government is the main source of political risks, there are other institutional instruments that may facilitate a risk-exit link. The bargaining theory envisages that political risk may be influenced by the home country of the multinational, if that country uses coercive power exogenous to the transaction (Kobrin, 1987; Tallman, 1988). In particular, trade restrictions and sanctions could be viewed as a coercive tool used by the home government in order to influence the outcome. Although such threats do not relate directly to disputes between MNCs and the Russian government and do not include a direct ban on investments in Russia, they may have an effect on these disputes. Vadlamannati, Janz, and Berntsen, 2018, for example, discuss how UN "shaming resolutions" against human rights violations affect FDI behaviour through damaged bilateral relations, less favourable trade and investment agreements, and possible reputation losses for MNCs that may be held accountable for ignoring human rights abuse in host countries. The same line of thought can be applied to investments from countries that have sanctions in place against the host country.

Another mechanism behind the political distance argument is discussed in Deseatnicov and Akiba, 2016: MNCs have their vision of the optimal level of political risk that they can tolerate; MNCs from the North are less likely to tolerate political risk in developing countries, though they may tolerate these risks in developed countries if the overall level of stability there is sufficient for their needs. Cuervo-Cazurra and Genc, 2008, in turn, report that institutional similarity may be an advantage for MNCs from developing-countries, especially in host countries with even worse regulation and a higher level of corruption than at home.

Our second and third hypotheses, based on real options and policy bargaining theories, are that:

H2. A multinational will be more likely to divest when the differences in political institutions and governance between home and host countries are greater.

H3. Sanctions against a host country encourage departure of MNCs that originate from the country imposing the sanctions (the "sending country"). Sanctions catalyse the effect of political risk on exits.

Finally, the resource-based literature suggests that multinational firms may differ in their response to political pressure. Moon and Lado, 2000, explain that bargaining power relative to the host government enables MNCs to generate economic rents and achieve superior performance in a particular host country. Such MNCs are less likely to be affected by government interventions. This bargaining power or additional rent may stem from various sources, which might be generally described as the social and economic relations between MNCs and local actors, including business partners and government, within the concept of embeddedness (Granovetter, 1985). So joint-ventures (JVs) may show greater resilience to political pressure, since exit is politically costlier for the host government if a local firm is affected (Henisz, 2000). In general, this literature establishes that a joint-venture is a better solution for an environment characterized by high uncertainty and governance problems (Kogut and Singh, 1988), and that multinationals will minimize political risks through partnerships with resident firms.

An MNC may also enjoy better protection from overall political risks thanks to location of its subsidiary in an institutionally strong sub-national territory, especially in a large and diverse country such as Russia, where weak country-level institutions are compensated by better-than-average governance in some of the country's regions (Bessonova and Gonchar, 2015).

The power bargaining theory finds the role of investment size to be indefinite. It may be a source of power for the multinational, especially if the host country is constrained in its financial and technological capabilities and needs the employment provided by the MNC subsidiary. On the other hand, large size of the subsidiary may have "hostage value", increasing the bargaining power of the host country when sunk costs cause relative immobility of a large investment (Kobrin, 1987; Moran, 1975).

These points lead us to test the following interaction hypothesis:

H4. MNCs facing an unfavourable political environment do not abandon their subsidiaries, when they are protected from political risk by large size of the subsidiary, local networks and more favourable location at the sub-national level.

Previous empirical work offers conflicting answers to our research questions. Many studies are sceptical about political environment as a powerful explanatory factor for international business flows. On this view, political institutions are sometimes statistically related to decisions by MNCs, but that relationship does not hold much power to predict real-world outcomes (Arel-Bundock, 2017; Li and Vashchilko, 2010; Oetzel and Oh, 2014; Biglaiser and DeRouen, 2007). Nil effects are reported by Globerman and Shapiro, 2003, for U.S. FDI flows to 43 countries in the 1990s: political instability does not prevent entry but reduces the inflow. Counter findings are provided by Busse and Hefeker, 2007; Jensen, 2003; Vu, Yamada, and Otsuki, 2017.

Several studies have particular relevance for our work on issues of exit in response to political risks. Lankes and Venables, 1996, show that political risk increases the likelihood of FDI project termination in transition economies. Using data on Japanese multinationals, Dhanaraj and Beamish, 2009, show that increased political openness increases the longevity of international joint-ventures and reduces exits from greenfield investments. Components of political risk may interact: good governance in a host country reduces the likelihood of MNC divestment in response to terrorist attacks (Oh and Oetzel, 2011). Cuypers and Martin, 2010 report that divestment may be caused by changes in exchange rates, demand and institutions. Smaller cultural distance reduces the likelihood of exit decisions (Sousa and Tan, 2015).

Two studies of MNC exits use Russian data. Johns and Wellhausen, 2016 use data on U.S. multinationals in Russia to model the effects of economic links and value of the subsidiary on the level of expropriation risk to which the multinational is exposed in the host country. They find evidence that a greater proportion of domestic suppliers reduces probability that the host government will breach its contract. Gurkov and Saidov, 2017, in a case study of exits in Russia, report that the exit rate of multinationals has been lower than might be expected in view of the severity of recent political and economic upsets. They explain this by MNC-host government negotiations and low asset liquidity.

3.3 Dataset

The data consist of observations of plants with no less than 10% foreign ownership, collected from the Ruslana-Amadeus data source between 2000 and 2016, including information on financial accounts, ownership structure, and date of incorporation of all registered FDI plants. We can also identify the location of the plant within a particular Russian sub-national region and the home country of the foreign investor. At the time of writing financial data are available for sixteen years, which is a reasonably long period of time for observing multinational subsidiaries. Exit is said to have occurred when a subsidiary is not operational in year t as compared to year t-1, and has either permanently departed, is in the process of liquidation, or was acquired by another firm. We identify entry, exit and continuous operations based on the firm's ID number: entry is represented by a new ID in the registry, exit is when the ID has been removed from the registry and/or changed its status from active to non-active, and a continuing subsidiary is when the ID stays unchanged.

The exact date of exit is defined as the year when an inactive plant, which has changed its legal status (i.e., most commonly, has been dissolved as a legal entity) ceased to report financial data. Financial reporting usually ceases 2-3 years prior to the year of legal dissolution. The time gap between the change of the legal status and the cessation of financial reporting reduces the endogeneity risk, since the decision to exit itself may add to the political problems in the host location. A comparable strategy was applied by Dunne, Roberts, and Samuelson, 1988 (although, unlike Dunne, Roberts, and Samuelson, 1988, we can observe subsidiaries which entered and exited between the start and end years of the dataset).

We organize the data as the full sample and several sub-samples. The full data set includes foreign subsidiaries, i.e., plants in which no less than 10% belongs to the foreign investor, including continuing subsidiaries and plants which entered and exited between 2000 and 2016. A total of 48,494 observations are incorporated in this data set. Next, we split the full sample into two sub-samples of genuine investors and plants established by investors of Russian origin through tax havens and financial hubs (round-tripping investments), which may have lower sensitivity to political problems than plants set up by authentic investors. At the end of 2014 the Russian government passed an anti-offshore law, which led to a decline of the FDI stock held by countries that are centres for round-tripping FDI, most notably Cyprus.

We identify round-tripping investments based on a list issued by the Russian finance ministry. About 23,900 subsidiaries are genuine investments and about 24,600 are round-trippers. We use the sub-sample of round-trippers in some specifications, where it is interesting to study the different reaction of genuine foreign investors and round-trippers to political constraints. Between 2000 and 2016 more than 13,000 foreign subsidiaries exited the Russian market, including 6,556 genuine multinationals. The mean survival period is 8.42 years and is a little longer for genuine investors compared to round-trippers.

In some specifications we split the sample into investments in various sectors and test whether political constraints are particularly important for FDI in services (Kolstad and Villanger, 2008). Other sub-samples account for the group of home countries that imposed sanctions on Russia and the group of countries that concluded an investment treaty with Russia: probability of exit would be expected to increase in the first group and decrease in the second. Additionally, we suggest that the relationship between behaviour by multinationals and political risk is unstable across years (Méon and Sekkat, 2012), and run our regressions on two time sub-samples (2008-2011 and 2012-2016), supposing that in the first time period multinationals may have been most sensitive to home political risk due to the world financial crisis, while in the later period Russian political risk would have been the chief factor.

Statistics on multinational exit rates (Table 3.1) show that the worst affected sector was construction, which lost half of all foreign subsidiaries and where the number of exits was more than three times higher than entries. The financial and insurance sectors lost one third of foreign subsidiaries, and the number of exits relative to entries is almost six times higher. The exit rate is lower in manufacturing (27%), but the sector experienced a very low number of new entries.

Exit numbers rocketed in the period after 2012, when the average exit rate was 38.5%, though the worst ratio between exits and entries was observed between 2008 and 2011.

With respect to source country groups, we observe a clear difference in exit rates between countries, which imposed and did not impose sanctions (59.5% and 23.2% respectively). Variations between means for other subgroups are modest. The map below (Figure 3.1) shows the geographical distribution of exit intensity (exit share in entries) across home countries.

3.4 The variables and econometric strategy

In this paper we test an empirical model of exit that allows political risks in host and home country, plant characteristics, and industry and sub-national characteristics to affect the decision by a multinational to divest. We suggest that post-entry behaviour of multinationals remains risk-averse and profit-maximizing, though entry and post-entry attitudes towards political risks are not necessarily equivalent, because, for a subsidiary already in place, the risk of politically induced losses has to be balanced by the MNC against the risks and losses arising from the divestment decision.

TABLE 3.1: Exits of multinationals by sector, time period and home country group, 2000-2016, full sample

	Exits N obs.	Entries N obs.	Exit rate, %	Exits as % of entries	Total N obs.
Sector					
Agriculture	250	102	45.0	198.4	556
Mining	160	126	21.8	127.0	733
Manufacturing	1489	470	26.9	316.8	5543
Electricity	72	39	25.4	184.6	284
Water supply	64	20	42.4	320.0	151
Construction	1029	292	51.4	352.4	2002
Trade	4832	1662	34.6	290.7	13956
Transportation	591	197	26.2	300.0	2253
Accomodation	147	66	20.2	222.7	727
ICT	609	192	28.5	317.2	2140
Finances. insurance	962	165	31.6	583.0	3042
Real estate	1268	400	20.8	317.0	6107
Professional, R&D	1251	365	26.3	342.7	4764
Administration	427	121	32.3	352.9	1320
Public administration, defense	3	1	30.0	300.0	10
Education	16	8	45.7	200.0	35
Healthcare	41	30	30.	136.7	133
Arts, recreation	94	26	51.4	361.5	183
Other services	50	9	40.3	555.6	124
Others	408	3873	9.2	10.5	4431
Time period					
2000-2007	328	877	11.7	37.4	2815
2008-2011	7332	1864	24.6	393.3	29810
2012-2016	6103	5423	38.5	112.5	15869
Home country group					
Investment treaty	4597	3084	26.4	149.1	17407
No investment treaty	9166	5080	29.5	180.4	31087
Sanctions	4147	2316	59.5	179.1	6968
No sanctions	9616	5848	23.2	164.4	41526
Lower political risk	9530	5316	27,0%	179.3	35318
Higher political risk	4233	2848	32,1%	148.6	13176
Genuine investors	6443	4135	27.0	155.8	23885
Round-trippers	7320	4029	29.7	181.7	24609

Source: Our dataset

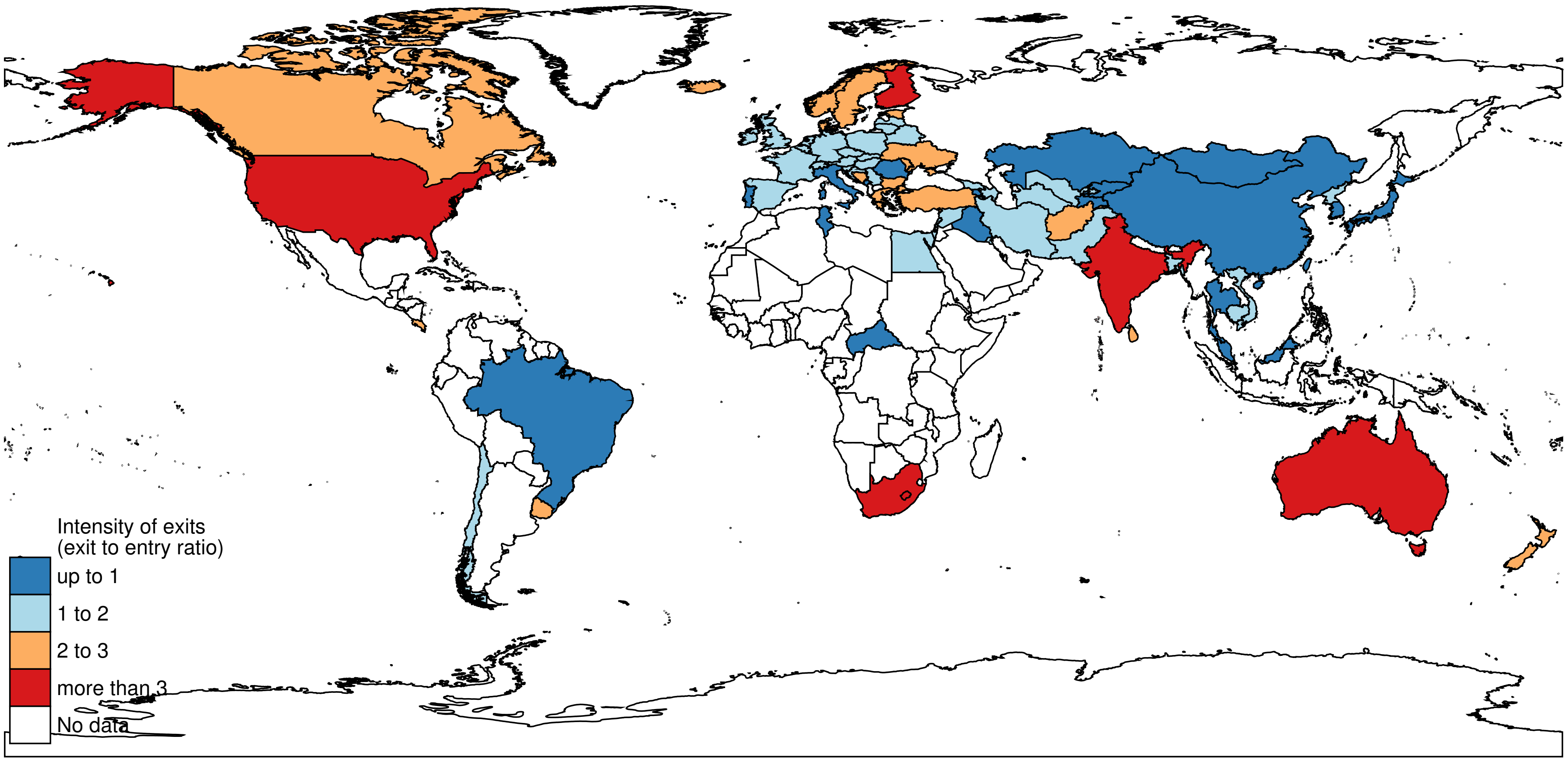

FIGURE 3.1: Exit intensity by home country

Note: Geographical distribution is calculated as the share of total exits in the total entries by the FDI source country during the whole time period 2000-2016. The number of countries in each category is shown in parenthesis in the legend. Round-tripping investments are excluded.

We use several specifications. First, we analyse the data as a panel over a reasonably long time period from 2000 to 2016, which lets us combine differences at the microlevel with the cross-home-country, cross-sector and cross-regional specificity. All models are proportional Cox-Hazard regressions, which are most commonly used in event history analysis and relate the survival time of the foreign subsidiary to changes in political risk in the host or home country. The model produces estimates of the hazard rate, i.e., the instantaneous rate of failure at which a subsidiary i will exit at time t on the condition that it survived at $t-1$.

In order to obtain the hazard rate of subsidiary i at time t, $h_i(t)$, the non-parametric baseline hazard function $h_0(t)$, is multiplied by a parametric part capturing the impact of the vector of covariates $X_ik(t)$ by means of parameter estimates b_k.

$$h_i(t) = h_0(t)exp\{\sum_{j=1}^{n} b_j P_{ij}(t) + \sum_{k=3}^{m} b_k X_{ik}(t)\} \quad (1)$$

The vector of main predictors P, comprising home and host political risks, is used in the equation 1 together with the vector of covariates X referring to several levels of analysis: country (existence of a bilateral investment treaty, participation in sanctions, and exchange rate of the local currency relative to the home currency); sub-national region (size of the subnational market, proximity and investment risk, number of foreign investors in the region); industry (sector dynamics); and characteristics of the subsidiary (size, age, liquidity, organization).

3.4.1 Political risk and political distance

We measure our main explanatory variable of interest in three different ways, all based on the political country risk index published by PRS group: the level of 12 separate political risks, the composite indicator of all risks and the gap between political risk in the host and home locations (political distance) in absolute terms. We choose PRS instead of other available sources because it provides a combination of indicators, which are most typical in the Russian political and socio-economic context, has the widest country coverage for the years under review and takes account of risk generated inside and outside the host destination.

The index includes 12 weighted variables covering both political and social attributes and reflects the subjective perceptions of experts as to the political stability of countries analysed by the International Country Risk Guide (ICRG) on a comparable basis (Howell, 2014). In the original index the lower the number of points assigned to a predefined group of political risk components, the higher the risk. However, for ease of reading and interpretation, we have reversed this rule and made lower risk equal to lower total points. Not all components of the PRS index are purely political in nature. The components are: government stability, socio-economic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability and quality of the bureaucracy. In one specification of our model we treat the sub-divisions of political risk as stand-alone variables and include them stepwise in the regression.

Additionally, the composite indicator of political risk was calculated by summing-up scores of separate risks, because the original political risk index was based on 100 points. The same composite methodology is widely accepted in the FDI literature (see e.g., Neumayer and Spess, 2005). In our dataset cumulative political risk in the host country has mean value of 39.85 and is scored between 31.67 and 47.67 over the whole time period, with higher score indicating a higher political risk (Table 3.2).

Next, we replace the political risk indicator by a measurement, which is calculated as the gap between political risk in the host and home locations (political distance) in absolute terms. By doing so, we test the possibility that firms from emerging countries and in general countries with a comparable political environment, would be more likely to tolerate risky markets than their global peers (Aleksynska and Havrylchyk, 2013; Satyanand, 2011). Additionally, by estimating the effects of political distance on exits, we take account of recent changes in the political and economic environment in home countries. We cannot exclude that some exit decisions by multinationals in Russia since 2008 have been determined not only by political risks in Russia, but were also driven by conditions at home, measured in our data as home political risk and political similarity.

TABLE 3.2: Definition of variables and descriptive statistics, for genuine investors in 2016

Variable name	Definition	Source	Mean	Std	Min	Max
Exit	MNC decision to liquidate or sell subsidiary in the host market	Ruslana-Amadeus	0.184	0.388	0	1
Host political risk	Country risk measure, incorporating 12 political and social attributes of the business environment in Russia. Higher score indicates higher risk	PRS group data	43.50	0	43.50	43.50
Home political risk	Country risk measure, incorporating 12 political and social attributes of the business environment in the home country. Higher score indicates higher risk	PRS group data	24.97	11.74	11.83	58.33
Political distance	Absolute difference between the political risk index in Russia and the home country	PRS group data	24.26	8.115	9.375	35.75
Countries with political risk assessment worse than Russia	Dummy for the difference between the political risk index in Russia and the home country, =1 when negative (the same or worse than Russia) and =0 otherwise (better than Russia)	PRS group data	0.202	0.402	0	1

Continued on the next page

Table 3.2 Definition of variables and descriptive statistics, for genuine investors in 2016 (continued)

Variable name	Definition	Source	Mean	Std	Min	Max
Countries with political risk assessment better than Russia	Dummy for the difference between the political risk index in Russia and the home country, =1 when positive (better than Russia) and =0 otherwise	PRS group data	0.798	0.402	0	1
Characteristics of the subsidiary						
Size	Categorical variable for small (=3), medium (=2) and large (=1) subsidiaries, based on Ruslana estimation of plant size by combination of employment and output with control for the sector	Ruslana	2.247	0.746	1	3
Age	Number of years in the market	Ruslana	8.374	6.979	0	98
Liquidity	Dummy for reported loss, =1 if loss in the year prior to exit	Ruslana	0.185	0.389	0	1
Greenfield	Wholly owned foreign subsidiary	Ruslana	0.336	0.473	0	1
JV local	Joint-venture with at least one local partner	Ruslana	0.254	0.435	0	1
JV foreign	Joint-venture with foreign partners only	Ruslana	0.409	0.492	0	1

Continued on the next page

Table 3.2 Definition of variables and descriptive statistics, for genuine investors in 2016 (continued)

Variable name	Definition	Source	Mean	Std	Min	Max
Home country characteristics						
Investment treaty	Dummy = 1 if the home country has concluded an investment treaty with Russia and =0 otherwise	WTO	0.776	0.417	0	1
Sanctions	Dummy = 1 if the home country imposed sanctions against Russia after 2014 and =0 otherwise	TASS, information agency, tass.ru	0.704	0.456	0	1
Host country characteristics						
Exchange rate volatility	Exchange rate of the host currency relative to the home currency	FXTop currency converter, fxtop.com	47.06	34.29	2.20e-05	178.1
Geographical proximity	Proximity between the capital of the host region and the home country	Own calculation using GPS coordinates, gps-coordinates.org	2828	2319	272.8	16557
Sector dynamics	Share of entries by new firms in the total number of firms in the sector at 4-digit level	Own estimation from Ruslana total population of plants	0.00177	0.00726	0	0.333

Continued on the next page

Table 3.2 Definition of variables and descriptive statistics, for genuine investors in 2016 (continued)

Variable name	Definition	Source	Mean	Std	Min	Max
Subnational characteristics						
Regional investment risk	Score measure of regional investment risk, associated with the quality of governance, financial and economic situation, criminal situation and environment. Higher score indicates higher risk	Expert rating agency, expert.ru	1.692	1.040	0	7.694
MNCs in the region	Logged number of MNC subsidiaries in the subnational region	Ruslana	6.378	1.829	0	8.355
Market size	Logged population of the subnational region	Rosstat	15.31	1.032	11.89	16.33

3.4.2 Factors that affect the impact of political risk on exit decisions

In the next set of regressions, we test the extent to which reactions of foreign subsidiaries to the same levels of political risk differ. Some plants are long-lived in spite of problems. We hypothesize possible non-linear reaction of multinationals to changes in political risk and test several shifters, which may cause differing impact of risk on exits (eq.2). In technical terms, we interact the indicator of political risk or political distance with the covariates that measure the factors, which complement or reduce political risk.

$$h_i(t) = h_0(t)exp\{\sum_{j=1}^{n} b_j P_{ij}(t) + \sum_{k=3}^{m} b_k X_{ik}(t) + \sum\sum b_l P_{ij} X_{ik}\} \quad (2)$$

The first set of factors that may compound the effect of risk on exits is sanctions imposed on Russia in 2014 and bilateral investment treaties between Russia and other countries. Although the sanctions imposed on Russia do not go as far as a ban on foreign investments, we may assume a connection between sanctions and the relationship between home and host governments, which could affect divestment decisions (Biglaiser and DeRouen, 2007; Vadlamannati, Janz, and Berntsen, 2018). The expectation is that, for subsidiaries that originate from sanctioning countries, the effects of home political risks will be catalysed by sanctions. Non-sanctioning countries, by contrast, may profit from sanctions if their subsidiaries act as sanction-busters (Barry and Kleinberg, 2015), so the effects of political risk on subsidiaries from such countries would be reduced. Descriptive statistics are inconclusive in this respect. For example, U.S. subsidiaries have topped the list of exiting firms since 2008 (six years prior to sanctions), accounting for 8-13% of departures by genuine investors in various years. UK subsidiaries account for 9-11% of departures in the same period.

As microeconomic shifters, we test the structure and organization of the subsidiary, comparing joint-ventures between multinational and local firms with wholly foreign-owned greenfields and joint-ventures that have exclusively foreign owners. A local partner may help to mitigate political threats if the harm experienced by the foreign owner will spill over and hurt local business (Johns and Wellhausen, 2016). Theoretically, a joint-venture with a local partner should be negatively associated with exits and reduce political risk effects, while the effects of organization as a greenfield may be both positive and negative (Nocke and Yeaple, 2007).

As regards scale, we suppose that larger subsidiaries may be more embedded in the host economy and have higher costs and risks associated with exit. Larger firms have more bargaining power in negotiations with government and local competitors. On the other hand, large and profitable firms are more likely to be the target for government harassment than less important smaller firms (Kobrin, 1987).

Thirdly, we suppose that macro-level political variables may not be sufficient to predict the effects of risks on exit in a large country with highly heterogeneous political institutions at the sub-national level. Country-level political risk may be reduced if a subsidiary is located in a sub-national region, where political risks at national level are mitigated by more favourable institutional and economic conditions compared with less advanced regions. In technical terms, we use the same proportional Cox-Hazard model and add interactions of predictors, which are responsible for size, joint-venture status, and regional investment risk, with the indicator of political risk. We estimate these models only on the sample of genuine investors.

Below we report the results of graphical analysis of our data and use the Kaplan-Meier estimator. Figure 3.2 shows that genuine investors survive longer than round-trippers. Home location matters: there is a significant difference between the failure rate of subsidiaries that originate from countries, which imposed sanctions on Russia, and from countries, which did not impose sanctions. Affiliates representing the sender states (countries imposing sanctions) were less likely to exit at the beginning of the observation period and more likely to exit after 2012. A bilateral investment treaty makes exit less likely. Political distance also counts, though the effect is the opposite of what was predicted: subsidiaries from the country group with negative political distance (better than Russia) are less likely to exit compared to home countries with political risk assessment that is the same or worse than Russia. There is a higher likelihood of exit for smaller subsidiaries in comparison with larger plants, and for plants organized as joint-ventures between several foreign investors as against joint-ventures with a local partner and greenfields. The city of Moscow is the most vulnerable sub-national location as regards exit probability. These results depict patterns of exit by multinationals from Russia and need to be tested by our econometric analysis.

3.4.3 Controls

The patterns of multinational exit decisions indicate that plant- and sector-specific shocks are likely to play an important role in addition to political risk. We therefore also use controls that are frequently applied in the FDI literature. Surviving plants tend to be bigger, older and more productive than exiting subsidiaries, so we control the model for size and age. Our data do not allow us to measure factor productivity directly, so we rely on the findings reported by Helpman, Melitz, and Yeaple, 2004, and Yeaple, 2009, which establish that productivity affects multinational entry and exit behaviour, and is strongly correlated with size. We also take account of liquidity to allow the possibility that making losses is what causes the MNC to divest.

External insecurity may arise from major changes in exchange rates and levels of demand (Cuypers and Martin, 2010). We capture the demand conditions by industrial dynamics using measures of the entry rate across 4-digit industrial sectors. This approach takes account of entry and exit occurring during the same period in each sector, and reflects the industrial shocks better than sales data, which are subject to biases because available price indexes are excessively aggregated in conditions of high inflation. The entry rate was calculated by the authors from the total population of firms in Ruslana. We expect hazard of exit to be reduced by higher entry rates.

We control the model for exchange rate volatility of the Russian currency relative to the currency of the home country and expect that appreciation of the home country's currency reduces probability of exit (see Blonigen, 1997, for the link between exchange rate and FDI flows).

Some characteristics of sub-national host markets are considered. Size of the sub-national market is proxied by logged population, which we assume is a power resource (source of bargaining power) for the host government. Proximity is measured by the Euclidian distance between the capital of the host sub-national region and the capital of the home country. When we study the interaction of national and

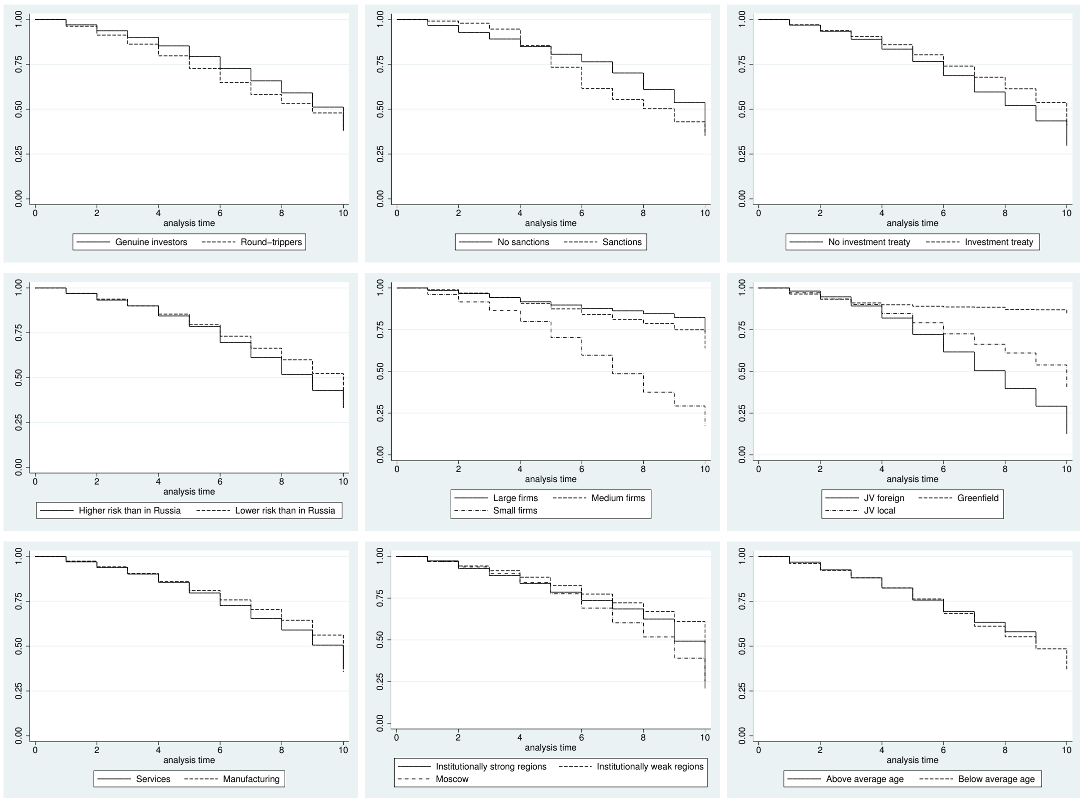

FIGURE 3.2: Kaplan-Meier survival across various groups of subsidiaries by affiliate size, age, organization, home country and characteristics of the host region

Note: We use the sub-sample of genuine investors only, except for the first graph, where the survival estimates of genuine and round-tripping investors is shown. The horizontal axis shows the number of years, the vertical axis displays the Kaplan-Meier survival estimates. Failure is defined as exit of the subsidiary from the Russian market sub-national risks, we replace control for market size by the number of foreign subsidiaries in the region.

In some specifications we split the sample across industrial sectors. The expectation is that when sunk capital shifts bargaining power to the host government, a subsidiary working in services and other mobile industries will be in a worse position than a subsidiary working in traditional extractive industries and manufacturing (Kobrin, 1987).

3.5 Results

3.5.1 Do political risks drive FDI exits?

Table 3.3 summarizes estimates of the determinants of hazard of exiting the Russian market. Column one refers to all years of observation and all foreign investors. The hazard ratios (exponentiated coefficients) are the expected ratios of failed firms per surviving firm, so that hazards greater than one indicate an increasing hazard rate and are thus associated with reduction of subsidiary survival time. Hazard ratios less than one imply that MNCs postpone or do not consider exit. Columns 2-3 split the sample between the two sub-samples of round-tripping and genuine investors to test whether round-trippers, being more familiar with the Russian political context, will be less likely to exit in response to growing political risk in Russia than genuine investors. Next, we investigate whether the influence of host and home political risk on exit differs between the period of the world financial crisis (2008-2011) and the later time period mainly characterized by growing political risks in Russia (2012-2016). The threshold can be seen in Figure 3.2, where survival curves change in 2011-2012. We then examine whether the impact of political risk varies across sectors (columns 6-9).

TABLE 3.3: Political risk as a determinant of MNC exit decision, baseline results

	All subsidiaries	Round-trippers	Genuine investors						
	All years	All years	All years	2008-2011	2012-2016	Mining	Manufacturing	Construction	Services
Host political risk	1.014**	0.805***	1.040***	1.077**	1.023*	0.993	1.004	1.088**	1.048***
	(2.71)	(-3.52)	(7.51)	(2.89)	(1.73)	(-0.12)	(0.33)	(2.54)	(7.97)
Home political risk	1.001	0.957	1.005***	0.998	1.008***	0.983	1.003	1.001	1.007***
	(0.92)	(-1.26)	(3.92)	(-0.93)	(5.43)	(-0.85)	(0.86)	(0.25)	(4.63)
Medium size	1.208***	1.139	1.227***	1.029	1.273***	2.477**	1.519***	0.772	1.135*
	(3.82)	(1.10)	(3.75)	(0.30)	(3.71)	(2.01)	(3.61)	(-1.08)	(1.90)
Small size	3.183***	2.100***	3.321***	2.393***	3.219***	4.415***	4.149***	2.327***	3.080***
	(26.48)	(6.80)	(24.81)	(10.31)	(20.66)	(3.61)	(13.75)	(4.32)	(18.89)
Greenfield	0.298***	0.352***	0.304***	1.887***	0.103***	0.206***	0.268***	1.137	0.295***
	(-33.78)	(-6.41)	(-26.30)	(9.49)	(-30.65)	(-3.53)	(-10.51)	(0.56)	(-23.73)
JV with the local partner	0.675***	0.428**	0.685***	1.354***	0.575***	0.514**	0.703***	0.911	0.676***
	(-13.57)	(-2.39)	(-12.77)	(4.78)	(-16.15)	(-2.32)	(-5.03)	(-0.79)	(-11.15)

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Table 3.3 Political risk as a determinant of MNC exit decision, baseline results (continued)

	All subsidiaries	Round-trippers	Genuine investors						
	All years	All years	All years	2008-2011	2012-2016	Mining	Manufacturing	Construction	Services
Liquidity	3.356***	6.842***	3.304***	25.397***	2.223***	3.429**	4.674***	3.504***	2.897***
	(32.76)	(12.87)	(31.11)	(44.66)	(18.47)	(3.22)	(16.83)	(8.43)	(22.85)
Age	1.002	1.013**	1.000	0.999	0.999	1.013	1.005**	0.999	0.996
	(1.09)	(2.74)	(0.22)	(-0.32)	(-0.40)	(0.40)	(2.06)	(-0.11)	(-1.28)
Sector dynamics	0.023***	0.051**	0.033***	1.646	0.008***	0.005	0.016***	0.012	0.021***
	(-11.90)	(-2.27)	(-10.64)	(0.67)	(-12.60)	(-1.22)	(-3.77)	(-1.33)	(-10.79)
Market size	1.124***	1.060	1.124***	0.982	1.131***	1.137	1.079**	1.226***	1.122***
	(9.20)	(1.10)	(8.76)	(-0.66)	(8.09)	(1.01)	(2.41)	(3.60)	(6.87)
Proximity	1.000	1.000	1.000	1.000**	1.000*	1.000	1.000	1.000	1.000
	(-1.24)	(-1.37)	(0.31)	(-2.16)	(1.79)	(-0.34)	(-0.55)	(0.24)	(0.56)
Exchange rate volatility	1.001**	1.013	1.003***	1.002*	1.004***	1.010	1.006***	1.003	1.002**
	(2.72)	(1.14)	(4.95)	(1.87)	(6.28)	(1.28)	(3.79)	(1.52)	(2.90)

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Table 3.3 Political risk as a determinant of MNC exit decision, baseline results (continued)

	All subsidiaries	Round-trippers	Genuine investors						
	All years	All years	All years	2008-2011	2012-2016	Mining	Manufacturing	Construction	Services
No. of obs	119951	21105	98846	40293	56100	1337	17395	4801	72719
No. of subjects	27973	6995	21600	15045	18394	260	3566	841	16477
No. of failures	6324	568	5756	1432	4324	54	872	411	4263
BIC	113336.405***	8656.452***	100674.346***	23199.929***	70831.259***	537.691***	12095.519***	5032.379***	71943.100***
Log pseudolikelihood	-56598.034***	-4268.482***	-50268.165***	-11536.341***	-35350.020***	-225.656***	-5989.176***	-2465.330***	-35904.384***
Wald chi2(10)	5377.138***	537.698***	4657.381***	3696.257***	3462.347***	90.230***	931.376***	199.834***	3279.050***

Notes: All estimations use the Cox proportional hazard model. Regression coefficients are the hazard ratio (exponentiated coefficients). Z statistics are reported in parentheses beneath the coefficients. Robust standard errors are used. ***, ** and * denote statistical significance at 1% 5% and 10% (the reference value is 1, meaning 'no effect'). The Wald test checks the null hypothesis that all (non-exponentiated) coefficients equal zero. The reference category of the size dummy is large and very large subsidiaries; the reference category for type of organization is joint-ventures with several foreign owners.

Host political risk has strong explanatory power in all specifications of the model: in the full sample increase of host political risk by one unit makes exit 1.4% more likely. Genuine investors react to both host and home political risk: the first increases hazard by 4% and the second by 0.5%. Round-trippers are immune to home political risk, and their specific institutional knowledge and capabilities apparently even enable them to extract advantage from political risks in Russia: if the host political risks increase by one unit, round-trippers are 19.5% less likely to exit. Home political risks do not affect the divestment behavior of round-trippers. In our further analysis we exclude firms created by round-trippers from the sample and keep only subsidiaries founded by genuine investors, since change in the regulation of offshore business after 2014 changed the nature of political harassment against round-trippers in Russia. This change is not captured by our measurement of host political risks.

When we split the sample into two time periods, we find that the nature of political hazards, typical for the two periods of observation, does not change the strong and positive hazard ratio associated with host political risks: in both periods the host risk effects are hazardous and significant. However, the results with the control variable show that liquidity had a big effect on exit decisions in the years immediately after the financial crisis: subsidiaries that reported losses were more than 25 times more likely to exit than profitable firms in that period, while loss-making plants were only about twice more likely to exit between 2012 and 2016.

The findings also imply that construction and services are more exposed to political risks than industry: the likelihood of an exit grows by 4.8% in trade and services and by 8.8% in construction when political risks intensify. This confirms the finding of Kolstad and Villanger, 2008, of higher vulnerability of more mobile sectors. However, service sectors with a positive industry trend are less likely to fail: if the share of entries in the total population of firms in the services sector doubles, the hazard of exit in the services subsample is reduced by nearly 98%.

As regards the control variables, plant features, size and liquidity are correlated with the exit decision in the expected way: smaller and loss-making plants are more likely to exit. Age does not vary significantly from one in most specifications. Greenfields and joint-ventures with local partners have much lower exit hazard (70% and 32.5% lower, respectively, for the full sample) compared to joint-ventures set up by several foreign investors. Exchange rate volatility relative to the home currency is an exit determinant mainly for genuine investors. Larger subnational markets are more likely to be associated with divestment, thus confirming the expectation that larger markets provide additional bargaining power to the host government rather than to the MNC. This finding is in line with the theoretical considerations mentioned above (Dial and Murphy, 1995; Kobrin, 1987). Geographical proximity, which the literature finds to have a strong impact on entry decisions, does not seem to have a significant impact on exits.

Important findings emerge when we study the effects of the separate components of political risk (Table 3.4, column 1). Various components of political risk have varying impact and not all of them are exit determinants. Problems with democratic accountability and military in politics seem to drive the hazard ratio most strongly: the reported hazards are 90% higher for the former component and 85% for the latter. Our result confirms prior findings that investor confidence is higher when host regimes are democratic (Jensen, 2008). Corruption in the political system – mostly understood in the data source as excessive patronage, favors for favors and close ties between politics and business, rather than as pressure to pay bribes – troubles multinationals and significantly determines exits (68.7%). Our finding confirms empirical evidence advanced by Wei, 2000, on the negative link between corruption in a host country and inward FDI as well as recent findings for Russia by Zakharov, 2018.

The hazard ratios for home political risks are the highest for law and order (10.5%), bureaucracy (7.9%) and socio-economic conditions (Table 3.4, column 2). The only components of home political risk, which significantly reduce the failure rate, are problems with democratic accountability of the home government and religious tensions in the home country. With respect to democratic accountability, it is worth considering work by Li and Resnick, 2003, who claim that democracy may discourage FDI due to costs associated with labour protection, antitrust laws and public pressure for the fair distribution of capital. Another point to consider is that weak democracy at home may provoke risk-diversification behaviour, making multinationals from such countries immune to low democratic accountability in Russia (Aguiar et al., 2012).

TABLE 3.4: The effects of political risk components and political similarity on exits (genuine investors only)

	Host political risk	Home political risk	Political distance
Government stability	1.068***	1.040***	0.986
	(4.69)	(3.64)	(-1.07)
Socioeconomic conditions	0.739***	1.054***	0.941***
	(-6.42)	(7.46)	(-5.65)
Investment profile	1.069***	1.006	0.973**
	(3.36)	(0.90)	(-2.40)
Internal conflict	1.426***	1.025**	0.985
	(4.84)	(2.37)	(-1.30)
External conflict	1.124***	1.050***	0.987
	(7.52)	(5.28)	(-1.29)
Corruption	1.687***	1.040***	0.969**
	(7.54)	(3.73)	(-2.98)
Military in politics	1.849***	1.047***	0.864***
	(8.57)	(4.65)	(-7.04)
Religious tensions	0.000	0.959**	0.950**
	(.)	(-2.63)	(-2.38)
Law and order	1.322***	1.105***	0.970**
	(7.88)	(6.70)	(-2.00)
Ethnic tensions	0.000	1.006	1.056**
	(.)	(0.49)	(3.16)
Democratic accountability	1.900***	0.983**	1.024**
	(10.33)	(-2.15)	(2.02)
Quality of the bureaucracy	1.000	1.079***	0.923***
	(.)	(6.30)	(-6.42)
All controls included	Yes	Yes	Yes
No. of obs.	102676	98846	98846
No. of subjects	22326	21600	21600
No. of failures	6032	5756	5756

Notes: All estimations use the Cox proportional hazard model. Regression coefficients are the hazard ratio (exponentiated coefficients). Z statistics are reported in parentheses beneath the coefficients. Robust standard errors are used. ***, ** and * denote statistical significance at 1% 5% and 10% (the reference value is 1, meaning 'no effect'). The Wald test checks the null hypothesis that all (non-exponentiated) coefficients equal zero. The reference category of the size dummy is large and very large subsidiaries; the reference category for type of organization is joint-ventures with several foreign owners.

3.5.2 Does political difference have impact on an MNE's exit decision?

Next, we turn to the impact of institutional similarity with respect to political risks between source and destination countries and analyze the effect of political distance in absolute terms on the exit decision of an MNC (Table 3.5). The hypothesis is that ability to cope with high political risks in the home country might benefit MNCs operating in a similarly challenging institutional environment abroad, so they will feel less pressure to exit. MNCs from developing countries might feel more "at home" on the Russian market.

The results show that political similarity is indeed relevant in determining exit decisions, but the direction of the effect is the opposite of what was expected. The estimates show that institutional similarity does not bring advantages to foreign subsidiaries: if the political distance increases by one unit, the probability of exit decreases by 0.4% (Table 3.5, column 1). The result persists when we use the alternative measurement of political distance (splitting the sample between home countries that are better and those that are worse than Russia in terms of country political risk). Multinationals from countries with better political conditions are less likely to suffer divestment hazard than multinationals from countries with comparable or higher political risks than exist in Russia: for the former the hazard rate of host political risk is 3.6%, while for the second it is 10%. Home political risk is only a problem for multinationals from countries with better political risk scores than Russia. In the real world, this means that the likelihood of exit for German multinationals, which have one of the largest political distances to Russia, is much lower than for their Turkish counterparts, even though Turkey is very similar to Russia as regards political risk.

Finally, we study how an investment treaty with Russia changes the relationship between risks and exit. An investment treaty may offer additional protection to a subsidiary and reduce the hazard of exit under pressure from political risks. To test this, we run the same regressions on subsamples of subsidiaries originating from countries with and without an investment treaty with Russia. The findings show that subsidiaries from countries that have an investment treaty with Russia are 0.9% less likely to fail in response to increasing political risk (Table 3.5, column 4). This result is in line with the empirical literature, which provides evidence that bilateral

TABLE 3.5: Impact of institutional similarity on MNC exit decisions (genuine investors only)

	Political distance	Subsample of countries with lower political risk than Russia	Subsample of countries with higher political risk than Russia	Subsample: investment treaty with Russia	Subsample: no investment treaty with Russia
Political distance	0.996**			0.991***	1.001
	(-2.22)			(-3.80)	(0.19)
Host political risk		1.036***	1.100***		
		(6.26)	(4.86)		
Home political risk		1.004**	0.986		
		(2.31)	(-1.02)		
Investment treaty	0.855***	0.814***	1.159		
	(-5.23)	(-6.31)	(1.35)		
All controls included	Yes	Yes	Yes	Yes	Yes
No. of obs.	98846	88944	9902	75052	23794
No. of subjects	21600	20473	3517	16581	5755
No. of failures	5756	5117	639	4181	1575
BIC	100702.830***	88299.212***	8423.315***	70714.947***	23263.721***
Log pseudolikelihood	-50282.407***	-44075.534***	-4151.854***	-35295.731***	-11576.436***
Wald chi2(10)	4638.692***	4429.086***	357.253***	3501.515***	1121.847***

Notes: All estimations use the Cox proportional hazard model. Regression coefficients are the hazard ratio (exponentiated coefficients). Z statistics are reported in parentheses beneath the coefficients. Robust standard errors are used. ***, ** and * denote statistical significance at 1% 5% and 10% (the reference value is 1, meaning 'no effect'). The Wald test checks the null hypothesis that all (non-exponentiated) coefficients equal zero. The reference category of the size dummy is large and very large subsidiaries; the reference category for type of organization is joint-ventures with several foreign owners.

investment treaties protect FDI in developing countries with poor domestic institutional quality (Neumayer and Spess, 2005). In the subsample of countries without an investment treaty the effect is not significantly different from one.

The pattern when larger distance leads to lower probability of exit is confirmed for separate measurements of gaps in political risk (Table 3.4, column three). However, two important exceptions are observed: the theoretically predicted effect (larger distance, higher probability of exit) remains valid for ethnic tension and democratic accountability. An increase of absolute distance between the home location and Russia as regards ethnic tension and democracy induces a 5.6% and 2.4% higher hazard of a subsidiary's exit from the Russian market.

Overall, however, it is clear that familiarity with a high-risk political environment does not compensate MNCs from developing markets for disadvantages in terms of technology, management and political bargaining power relative to MNCs from more developed markets.

3.5.3 The importance of sanctions

Next, we focus on how multinationals react to political relations between home and host countries and, specifically, whether MNCs are responsive to their home country's imposition of sanctions against Russia after 2014. In Table 3.6 we report the results for our measure of how sanctions affect the hazard of exit (columns 1 and 3) and the results of interaction of both our indicators of political risks with the dummy for belonging to the group of sender states (columns 2 and 4).

The indicator of host political risks is excluded from the study of interaction between sanctions and political risk due to high endogeneity of host risks and sanctions. The imposition of sanctions has itself been a major contributor to Russia's political risk scores since 2014. The individual components of host political risk are also highly correlated with sanctions.

As seen in column one of Table 3.6, the impact of sanctions on an MNC's decision to exit is positive and significantly different from one at the 1% level. The economic significance of the effect suggests that subsidiaries established by firms from sender states experience 9.9% growth of the likelihood of exit. So the community of subsidiaries from non-sender countries would be expected to be more permanent.

TABLE 3.6: The impact of sanctions on exit decisions (genuine investors only)

	Home political risk	Interaction of risks and sanctions	Political distance	Interaction of distance and sanctions
Home political risk	1.007***	1.003**		
	(5.08)	(2.28)		
Interaction of home political risk with sanctions		1.017***		
		(6.23)		
Political distance			0.990***	1.000
			(-4.88)	(-0.11)
Interaction of political distance with sanctions				0.972***
				(-7.06)
Sanctions in force	1.099**	0.730***	1.126***	2.153***
	(2.82)	(-4.06)	(3.38)	(8.26)
All controls included	Yes	Yes	Yes	Yes
No. of obs.	98846	98846	98846	98846
No. of subjects	21600	21600	21600	21600
No. of failures	5756	5756	5756	5756
BIC	100713.297***	100696.007***	100714.164***	100685.162***
Log pseudolikelihood	-50287.641***	-50273.245***	-50288.074***	-50267.822***
Wald chi2(10)	4612.036***	4665.262***	4609.698***	4705.893***

Notes: All estimations use the Cox proportional hazard model. Regression coefficients are the hazard ratio (exponentiated coefficients). Z statistics are reported in parentheses beneath the coefficients. Robust standard errors are used. ***, ** and * denote statistical significance at 1% 5% and 10% (the reference value is 1, meaning 'no effect'). The Wald test checks the null hypothesis that all (non-exponentiated) coefficients equal zero. The reference category of the size dummy is large and very large subsidiaries; the reference category for type of organization is joint-ventures with several foreign owners.

These results support our third hypothesis, according to which sanctions are positively connected with exits.

As regards political similarity and sanctions (Table 3.6, columns 3 and 4), the results confirm the previous finding that political similarity is not an advantage for subsidiaries that represent countries with weak institutions. Participation in sanctions makes the situation even worse for them. Subsidiaries from sender states that are similar to Russia in the measurement of political risks are more likely to exit than MNCs from non-sender states, which have a level of home political risk comparable to that in Russia. The economic significance of sanctions grows to 12.6% in this specification.

Next, we examine whether the positive effect of political risk on exit is conditional on the home country's association with sanction sender states. Interaction terms between political risk measurement and sanctions are reported in column 2 of Table 3.6. The interaction term is positive and significant at 1%, suggesting that the positive effect of risk on exit decisions is more severe when the home country joins sanctions against Russia. When we turn to the alternative measure of political risk, calculated as political similarity between home and host location, and examine whether the effect of political similarity is conditional on sanctions (Table 3.6, column 4), the interaction term is negative, below one and significant at 1%. This suggests that the tendency of increasing political distance to reduce exit probability becomes less pronounced when the home country is a sender.

We quantify the economic result of the risk/sanctions interaction terms in Figures 3.3 and 3.4. The marginal plots in the figures allow much more intuitive interpretation of the regression results in the Cox hazard model, especially if they include interaction terms. They allow us to observe how differences across various groups (sanctioning vs. non-sanctioning states in this case) change when any other variable of interest increases (Williams, 2012). Thus, Figure 3.3 demonstrates the adjusted prediction of the failure ratio at various levels of home political risk for the groups of subsidiaries aligned and not aligned with sender states. We see that sanctions increase the impact of political risks on exit: subsidiaries originating from sender

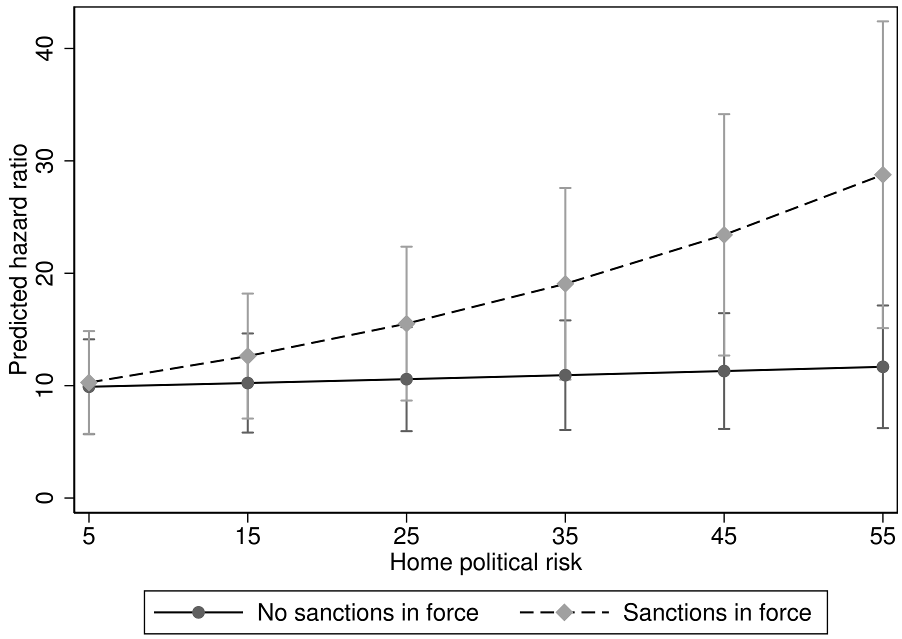

FIGURE 3.3: Adjusted predictions of interaction between home political risks and sanctions

Note: Figure 3.3 presents the regression results of equation 2 (Table 3.6, column 2) for the sanctions/risk interaction. 95% confidence intervals are marked by vertical lines. Relative hazards are estimated separately for each of two groups (sanctioning vs. non-sanctioning states) at hypothetical fixed values of home political risk between 5 and 55, using the actual observed values for all other variables.

countries with the highest political risk at home have almost three times higher hazard ratios than other countries with highest home risk, which do not impose sanctions. In the real world this result means that Bulgarian subsidiaries with a 35.5 score for home political risk in 2016 are approximately 1.76 times more likely to exit than Brazilian subsidiaries, which have the same home political risk score.

Figure 3.4 shows that if the home country's political distance to Russia is approximately 13 points and the country joins sanctions against Russia (this is the exact situation of Moldova), its subsidiary is about twice more likely to exit than a subsidiary from Algeria, which has the same political distance but is not a sender state. However, sanctions make no difference to the impact of risks on exits for sender states with high political distance to Russia.

Overall, our analysis provides evidence that the imposition of sanctions adds to pressure on sender-state subsidiaries to exit the Russian market and adds to existing home political risks. Our results offer confirmation from detailed micro-data of

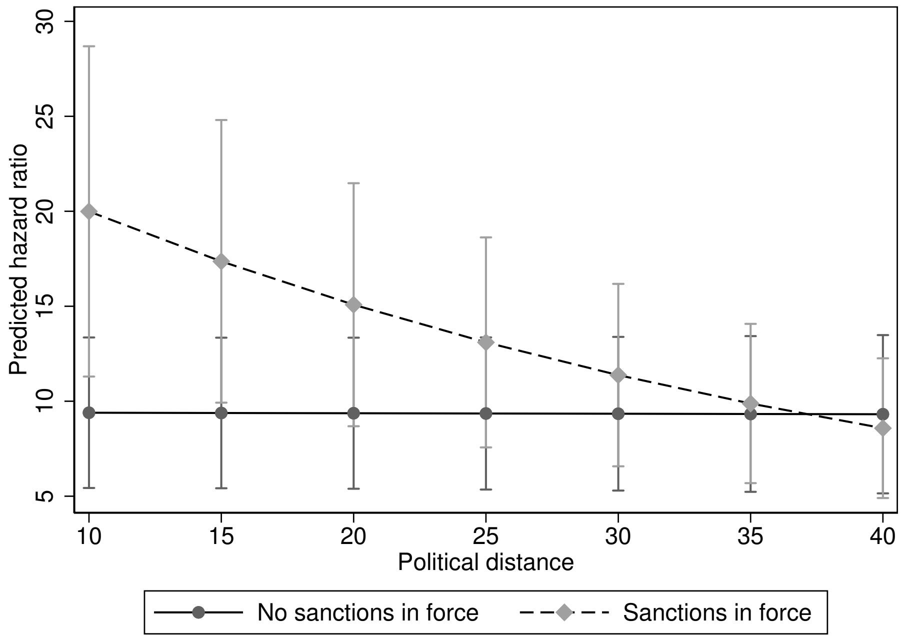

FIGURE 3.4: Adjusted predictions of interaction between political distance and sanctions

Note: Figure 3.4 presents the regression results of equation 2 (Table 3.6, column 4) for the sanctions/political distance interaction. 95% confidence intervals are marked by vertical lines. Relative hazards are estimated separately for each of two groups (sanctioning vs. non-sanctioning states) at hypothetical fixed distance levels between 10 and 40, using the actual observed values for all other variables.

the earlier findings of Mirkina, 2018, who shows that aggregated FDI flows from sender states fell much more sharply in the short-run than FDI from non-sender states. The chilling effect of sanctions on the business interests of home and host countries is confirmed. Whether or not the departure of MNCs means that sanctions have been successful and whether these effects promote the foreign policy interests of the sender state is another issue. More work is needed to establish the link between the economic costs of sanctions and their contribution to the sender's foreign policy goals.

3.5.4 Structural factors that may reduce the impact of political risk on exit

Our fourth hypothesis is that MNCs exposed to an unfavourable political environment are less likely to exit if they are protected by large size of the subsidiary, local networks and a more favourable location at the sub-national level. In this section we examine whether the effects of political risk on exits are conditional on sub-national investment risk and on the size and type of organization of the subsidiary.

How do national and sub-national risks interact?

We have already shown the direct effect of some sub-national characteristics on exit decisions, following the FDI literature, which reports how market size and proximity affect the decision. Our results suggest that larger markets lose more MNC subsidiaries, while the results for proximity are inconclusive (Table 3.3). We now examine whether the effects of national political risks on exit are conditional on the level of sub-national investment risk and hypothesize that the effect of national political risk may be mitigated if the subsidiary is located in an institutionally favourable territory (H4). We introduce interaction terms between country and regional risks following equation 2 (Table 3.7, columns 3, 5 and 7).

The estimation results for the conditional effects of national and sub-national risks are not conclusive when the regression is run on the total sample of genuine investors (Table 3.7, column 1), national political risks remain positive and are economically and statistically significant, while sub-national risks are negative and insignificant.

What if this result is driven by the city of Moscow, which is one of the best regions regarding investment risks (though not in all years of observation) and hosts more than half of all foreign subsidiaries? As the Kaplan-Meier estimator in Figure 3.2 demonstrates, at the beginning of the observation period, there is hardly any difference in propensity to exit between subsidiaries located in Moscow and elsewhere. However, since around 2012 subsidiaries located in Moscow have been more likely to exit than subsidiaries elsewhere. We rerun the same regression on the sub-samples of subsidiaries located in the city of Moscow and in the regional groups of institutionally strong and weak locations. Institutionally strong regions are defined as the 10% of regions with the lowest investment risks (Moscow excluded) on a yearly basis. This strong group consists of about 7 regions which host approximately one third of the sampled subsidiaries.

The results prove that subsidiaries in Moscow are significantly affected by both national and sub-national risks, but the impact of regional risk is much higher there

TABLE 3.7: Conditional effects of regional and country risks on exit decisions

	All regions	Moscow sub-sample	Interaction of regional investment risk and country political risk for Moscow	Subsample of institutionally strong regions	Interaction of regional investment risk and country political risk for strong regions	Subsample of institutionally weak regions	Interaction of regional investment risk and country political risk for weak regions
Regional risk	0.910***	1.389***	0.149**	1.002	623.985***	0.944**	1.427
	(-6.10)	(4.78)	(-2.53)	(0.01)	(4.51)	(-2.54)	(1.35)
Political risk	1.042***	1.091***	1.027	1.018	1.084***	1.037***	1.058***
	(8.16)	(10.40)	(1.24)	(1.55)	(4.61)	(4.05)	(3.64)
No. of MNCs	1.022**	0.822***	0.855***	0.964	0.968	0.944**	0.936**
	(3.28)	(-6.55)	(-4.56)	(-1.57)	(-1.38)	(-2.68)	(-2.96)
Pol. risk			1.057**		0.854***		0.990
x regional risk			(3.01)		(-4.52)		(-1.58)
All controls included	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	102372	46807	46807	18512	18512	37053	37053
No. of subjects	22259	10803	10803	5875	5875	9350	9350
No. of failures	6000	3080	3080	1040	1040	1880	1880
BIC	105309.192***	49748.741***	49751.497***	14741.071***	14736.218***	28943.692***	28952.177***
Log pseudolikelihood	-52585.378***	-24809.848***	-24805.849***	-7311.578***	-7304.239***	-14408.725***	-14407.708***
Wald chi2(10)	4710.926***	2036.423***	2058.724***	1106.110***	1144.370***	1595.229***	1594.011***

Notes: All estimations use the Cox proportional hazard model. Regression coefficients are the hazard ratio (exponentiated coefficients). Z statistics are reported in parentheses beneath the coefficients. Robust standard errors are used. ***, ** and * denote statistical significance at 1% 5% and 10% (the reference value is 1, meaning 'no effect'). The Wald test checks the null hypothesis that all (non-exponentiated) coefficients equal zero. The reference category of the size dummy is large and very large subsidiaries; the reference category for type of organization is joint-ventures with several foreign owners.

than the impact of national political risk: Moscow-based subsidiaries are 38.9% more likely to exit if the regional investment risk increases by one unit.

In the sub-sample of subsidiaries located in institutionally strong regions (Moscow excluded) both national and sub-national political risk have slightly positive, but insignificant impact. In institutionally weak regions national risk is highly significant and has the expected sign. However, regional risks in the weak regions show results, which conflict with H4: higher regional risks are associated with lower probability of failure.

Interaction of national and regional risks (Table 3.7, columns 3, 5 and 7) show that only Moscow experiences significant and positive impact from both national and sub-national risks: lower sub-national risks in the capital may mitigate hazards associated with growth of national political risk. This does not apply to the rest of the sample: interaction terms for the institutionally strong regions are negative and significant, and for the group of institutionally weak regions they are negative and insignificant. Overall, we find that institutional heterogeneity of sub-national regions in Russia offers only partial confirmation of H4. Local risks affect exits in the expected way in the city of Moscow (mitigating national political risks), but not elsewhere in Russia.

Does the subsidiary's size, type of organization and sector affiliation shift the effects of political risk on exits?

The size of the subsidiary has the anticipated effect in all of the specifications, which we have dealt with so far. A medium-size subsidiary increases the probability of exit by 22.7% compared to a large subsidiary, and the hazard rate for small subsidiaries is 3.3 times higher than for large ones (Table 3.3, column 3, for genuine investors). Sensitivity to scale is mostly typical for the mining and manufacturing industries, where small MNC plants exit over 4 times more often than large plants (Table 3.3, columns 6-7).

Is the effect of host political risks smaller for bigger plants? To answer this question we interact the host political risk indicator with the size group dummies and present the graphical result of our regression analysis in Figures 3.5 and 3.6. The

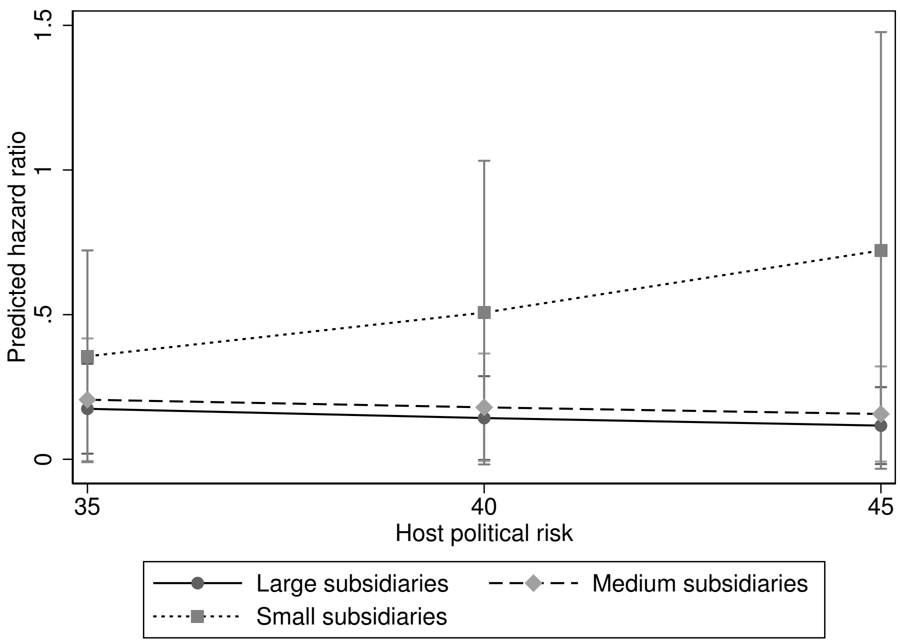

FIGURE 3.5: Adjusted predictions of interaction between host political risk and subsidiary size

Note: Figure 3.5 presents the regression results of equation 2 (and corresponds to column 1 in Table 3.8) for the size/risk interaction. 95% confidence intervals are marked by vertical lines. Relative hazards are estimated separately for each of three size groups (large, medium and small subsidiaries) at hypothetical fixed values of host political risk between 35 and 45, using actual observed values for all other variables.

corresponding regression results with interaction of size dummies and host political risks are presented in Table 3.8.

We see in Figure 3.5 that the gap between medium and large subsidiaries does not change, regardless of the level of political risks in Russia. This visually confirms the regression result that indicates an insignificant interaction term between medium size of a plant and host political risk. However, large subsidiaries remain most resistant to market exit at all risk levels. This finding is consistent with Dial and Murphy, 1995, who find that large sunk costs associated with bigger size of the plant discourage exit. This is exemplified by the fact that, when political risk in Russia reached its highest observed score of 44.25 in 2015, small subsidiaries had almost six times higher hazard ratios than large subsidiaries.

As political risks increase, greenfields and joint-ventures with local partner have obvious advantages over joint-ventures consisting of foreign investors only (Figure 3.6) (greenfields reduce the effect of political risk on exit decisions to the greatest extent).

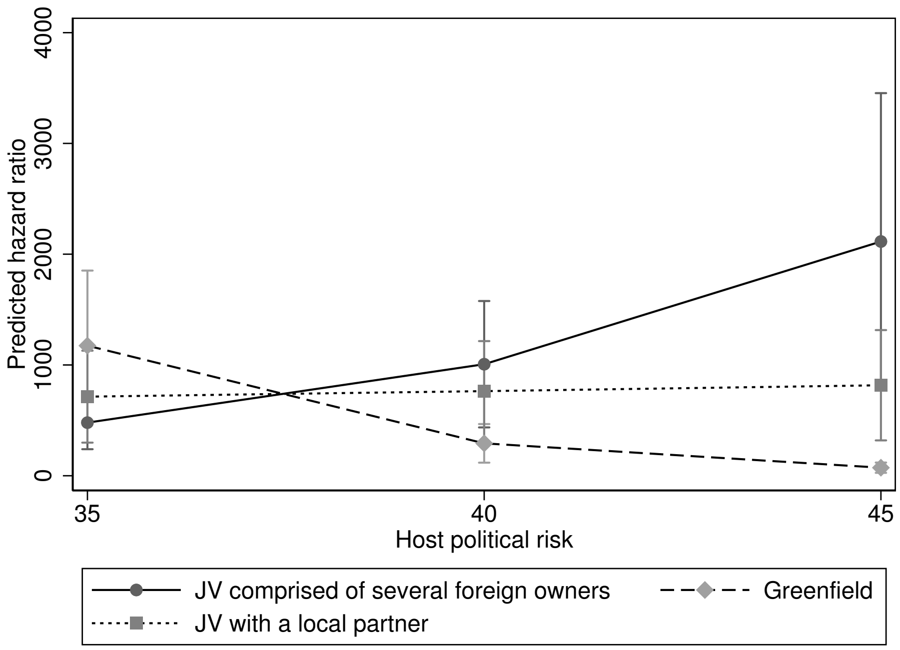

FIGURE 3.6: Adjusted predictions of the interaction between host political risk and mode of entry

Note: Figure 3.6 presents the regression results of equation 2 (and corresponds to Table 3.8, column 2) for the mode of entry/risk interaction. 95% confidence intervals are marked by vertical lines. Relative hazards are estimated separately for each of two groups (Greenfields; joint-ventures comprised of several foreign owners; and joint-venture between foreign and local owners) at hypothetical fixed values of host political risk between 35 and 45, using the actual observed values for all other variables.

This finding confirms results in the literature, which establish the advantages of a joint-venture with the local partner for managing political hazards (Demirbag, McGuinness, and Altay, 2010; Henisz, 2000). However, Figure 3.6 shows that the most resistant type of organization, for reducing exits due to political risk, is a wholly-owned subsidiary. This result is consistent with the theoretical prediction by Nocke and Yeaple, 2007. The economic significance of this effect is quite high: exits from greenfield investments have been low in the period of growing Russian political risk since 2008. For example, in 2011 greenfields were about 50% less likely to fail compared with joint-ventures comprised of foreign investors only and in 2015 they were more than 20 times less likely to fail.

TABLE 3.8: Results of Cox proportional hazard model analysis for genuine investors. Interaction effects of political risk with firm size and mode of entry

	Interaction of political risk with size	Interaction of political risk with entry mode
Political risks	0.960** (-3.14)	1.160*** (21.18)
Greenfield	0.301*** (-26.57)	9.33e+06*** (31.83)
At least one Russian shareholder	0.657*** (-14.25)	180.622*** (14.31)
Medium size	0.720 (-0.55)	1.220*** (3.61)
Small size	0.034*** (-6.29)	3.254*** (24.44)
Interaction of pol. risk with greenfield		0.653*** (-33.09)
Interaction of pol. risk with at least one Russian shareholder		0.874*** (-15.48)
Interaction of pol. risk with medium size	1.013 (0.89)	
Interaction of pol. risk with small size	1.118*** (8.50)	
All controls included	Yes	Yes
No. of obs.	98850	98850
No. of subjects	21600	21600
No. of failures	5756	5756
BIC	100634.466***	99597.472***
Log pseudolikelihood	-50242.474***	-49723.977***
Wald chi2(10)	4962.885***	5557.267***

Notes: All estimations use the Cox proportional hazard model. Regression coefficients are the hazard ratio (exponentiated coefficients). Z statistics are reported in parentheses beneath the coefficients. Robust standard errors are used. ***, ** and * denote statistical significance at 1% 5% and 10% (the reference value is 1, meaning 'no effect'). The Wald test checks the null hypothesis that all (non-exponentiated) coefficients equal zero. The reference category of the size dummy is large and very large subsidiaries; the reference category for type of organization is joint-ventures with several foreign owners.

3.6 Conclusions

This paper presents empirical results regarding exit decisions by multinationals in response to the growth of political risks in Russia and political factors in their home countries Our findings strongly support what has already been suggested by the literature on industrial organization and institutions by showing that political risk is an influential factor in decisions by MNCs to quit the Russian market. Such risk interacts not only with the firm's size, structure and market specifics, but also with relations between the home and host countries. This paper compares the effects of political risk on exit during various periods of economic and geopolitical instability, and reports that the effects are economically and statistically significant in all the years of observation, although liquidity issues determined exits to a much greater extent in years immediately following the global financial crisis than in later years. We find striking differences in the combination and statistical significance of policy risk indicators between genuine and round-tripping investors. Round-trippers, which have special institutional knowledge and strong embeddedness in the local economy, are not sensitive to political risk factors.

Our findings do not fully support the idea that decisions by entrants to exit mirror traditional structural entry barriers. In particular, tolerable sub-national risks, which have been reported to stimulate entries, do not bring advantages with respect to exits. On the contrary, institutionally strong sub-national regions lose foreign subsidiaries and business activities even more rapidly than institutionally weak territories in face of increasing political risk at national level. The city of Moscow is the only exception in this trend.

Our results confirm the theoretical prediction that, in making an exit decision, an MNC faces a trade-off between the economic benefits of remaining longer against the costs associated with uncertainties and risks in the difficult political environment. The findings suggest that multinational companies may in fact increase the duration of their stay in a troubled market if their subsidiaries there are large-scale or are greenfields or are working in the capital-intensive resource sector with deep roots in the host economy, enabling them to build resistance to political pressure from host and home governments. Economic ties in destination areas through joint venturing with local partners also reduce the probability of failure.

The study finds that patterns of multinational behaviour in response to political risks differ, depending on the institutional gap between the home and the host location. We had expected that MNCs from countries with high levels of political risk would be more tolerant to the political situation in the host country. However, we find, on the contrary, that closer institutional match makes foreign subsidiaries more likely to exit and more vulnerable to political risk. This may be explained by weaker bargaining power and smaller financial and technological resources of subsidiaries from home countries with comparable and higher political risks.

Our paper contributes to the sanctions debate, not by answering the question of whether sanctions ultimately work, but as regards the economic cost of sanctions in terms of losses of functioning businesses and damage to economic relations. This article gives attention to a specific aspect of political pressure that has been overlooked in previous literatures, namely the connectivity between sanctions and home political risk. We find that political pressure from sender states has strong influence on multinational exit decisions. Alignment with the group of countries that imposed sanctions makes subsidiaries more likely to exit, and sanctions penalizing Russia's record of political behaviour complement political risks, associated with home policy and governance. There is no evidence that subsidiaries of third countries fill the vacuum left by sender-state firms, expanding their business in Russia. Overall, when sender states impose economic sanctions, the risk for multinationals in the targeted country strongly increases and they respond to the risk by divesting. MNCs from weaker sender states are most vulnerable to the pressure of sanctions.

Chapter 4

How innovation affects performance

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Abstract[2]

This paper studies how innovation strategies of Russian manufacturing firms affect various features of firm performance. A multi stage model is used, which relates the firm's decision to undertake R&D to its innovation output, technical efficiency, labour productivity, and growth. We also include imports into the knowledge production function, because catching up economies may adopt technologies embodied in imported hardware. Additionally, we link productivity and innovation output to survival. We find that both types of knowledge input – R&D and imports – strongly determine innovation. Innovations yield the strongest performance return in the case of catching up to technological frontier. Product innovation is more beneficial than process innovation in all performance features except for labour productivity. However, higher efficiency does not improve the growth rates or survival time of manufacturing firms. Taken together, these results show that innovation is not uniformly rewarded across all features of firm performance.

JEL classification: C30, D24, O30

Key words: innovation; productivity, growth, survival, Russia

[1] For detailed information about the contributions of the authors see Appendix C.

[2] The authors wish to acknowledge the valuable assistance with the preparation of the data by Olga Uvarova and insightful comments by Professor Jutta Guenther, Professor Torben Klarl, and participants of the ierp seminar at the University of Bremen

4.1 Introduction

Despite sound theoretical claims that technological changes determine growth and productivity differences across firms, these expectations are not always supported by empirical data in emerging countries. Firms in Russia could raise output and productivity on the basis of little investment or innovation by drawing on under-employed stocks of capital and labour and increased private consumption (Ahrend, 2004). The ability of firms to receive a return from innovations is reduced by a low degree of competition and a weak market selection mechanism, which allows inefficient firms to remain in the market and even grow. For example, Bogetić and Olusi, 2013 establish that Russian manufacturing firms' survival is weakly correlated to productivity (TFP). They conclude that managerial incentives in incumbent firms may not strongly favour the productivity-innovation link when competition is weak. In general, factors which affect the technological advance and connection between firm innovation and the performance in transition countries are still poorly understood. The empirical literature frequently identifies financial constraints as the main barrier restraining the ability of firms to catch up to the technological frontier (Hall and Lerner, 2009; Gorodnichenko and Schnitzer, 2013). The innovation-performance link in latecomer countries, as compared to frontier economies, may be reduced by a low market value of the novel products and resulting smaller profits from innovation (Hu, Kang, and Wu, 2017). Additionally, the more incremental and less radical nature of innovation renders a conventional measurement methodology inappropriately designed to quantify the innovation effort and its performance effect in this group of countries (Cirera and Muzi, 2016).

This paper attempts to contribute to the understanding of the relation between innovation and firm performance in transition economies by analysing the innovation strategies of Russian manufacturing firms. The main research question is which performance characteristic -productivity gains, output growth, or survival - is rewarded by innovation in the presence of relatively low competition, high uncertainties, and a weak market selection mechanism? To what extent is performance influenced by various forms of innovation? How does the effect differ across different sources of knowledge inputs? How do size, location, and market selection intervene in the innovation-performance relation?

The Russian manufacturing industry is a motivating empirical setting for the analysis of the performance-innovation link in transition economies. It is large and structurally sophisticated: the manufacturing value added accounted for 12% of GDP in 2016, which is comparable to Brazil (10.3%) and Poland (18.1%), and half the level of the Czech Republic (24.4%) and China (28.8%) (World Development Indicators, 2018). The industry went through several boom and bust cycles in recent years in response to transition and cyclical dynamics. It contracted severely in 2009 during the world economic crisis and again in 2015, when the geopolitical situation, the fall of commodity prices, sanctions, and a national currency devaluation caused a major downturn. In total, the Russian manufacturing industry lost more than two million jobs between 2002 and 2015 (Rosstat, 2018).

This paper builds on the previous literature treating the innovation-performance link and is mostly inspired by the Schumpeterian and evolutionary school of thought and contributes to this literature by introducing four important novelties. Firstly, by using a unique dataset comprised of matched survey and registry data to compare the innovation impact on three performance indicators – productivity, growth, and survival. The modified Crépon, Duguet, and Mairesse (Crépon, Duguet, and Mairesse, 1998) — henceforth CDM — model is estimated for the cross-section and panel data. Post-innovation performance is analyzed for the next three years after the survey was conducted. Studies of innovation effects on various performance characteristics rarely overlap. Therefore, this paper provides new insights into the innovation-performance literature. Secondly, innovation input is not limited to R&D expenditures but is complemented by knowledge input generated by imports of machines and equipment – the most typical source of technologies for the firms in emerging economies. Thirdly, we distinguish effects of innovation on labor productivity and on technical efficiency (TE) in terms of their distance to the production frontier, thus emphasizing nuances of technological and cost competitiveness. Finally, by using the Cox proportional hazard model, we investigate how innovation, growth, and productivity advantages translate into a longer survival time and thus expand the CDM concept into the most critical performance characteristic of the firm.

The findings show the complexity of the innovation-performance link: in general, innovations are rewarded, but not across all components of overall performance and not across all types of innovation. The highest return is found for catching up to the technological frontier: product innovation is a strong contributor to the shortening of the distance to the most efficient firm in 4-digit sector and is furthermore beneficial for growth and survival. Process innovation contributes mostly to labour productivity and growth. In turn, achieved technical efficiency results in greater innovation output, whereupon technological superiority decides further innovation. Innovation improves the growth rate and increases the achieved survival time, though both growth and survival are mostly dependent on the overall evolution of the industry. Contrary to expectation, more efficient firms do not survive longer and, as a consequence, the efficiency of resource allocation and market selection mechanisms may be questioned.

The implication of these results is that in spite of the specificity of the Russian market structure and institutional setting, our findings are consistent with the predictions of the evolutionary literature concerning the innovation-performance relationship. The departure from the theory relates to the low correlation between productivity advantages and survival and growth.

The rest of the paper is structured as follows. Section 2 reviews the relevant literature. Section 3 describes the data and key variables used in analysis. Section 4 presents the empirical strategy. Section 5 describes the findings, Section 6 concludes.

4.2 Theory and findings of the empirical literature

We build our research on the conceptual framework of the Schumpeterian and evolutionary approach to innovation activity as a main engine of change. It establishes that technological advances develop as an evolutionary process in which innovations shape all of the three dimensions of a firm's performance we seek to study in this paper: productivity, growth rates and survival behavior (Dosi, 1988; Klepper and Thompson, 2006; Nelson and Winter, 1982b; Pavitt, 1999). This framework is particularly relevant for the emerging economies that often adopt productive technologies employed before in high-income countries.

Firms are viewed as complex dynamic organizations that explore the technological frontier as they learn from new technologies. Technical change within firms is related to technological opportunities in the industry and to the environment with a selection mechanism, applying when innovation benefits are dependent on product demand and factor supply conditions, as well as on the behaviour of other firms in the sector. According to this perspective, if productivity depends on technological opportunities within sectors, then R&D and innovations in some sectors are more productive than in others. Additionally, differences in the selection environment lead to various speeds of diffusion of technologies and new products.

The firm learns not only as a result of R&D. It often seeks to complement or balance inventions with an application of existing knowledge from external sources (Dosi, 1988). Imports of machines and equipment may therefore be viewed as a carrier of specific productive knowledge, provided that importing firms can learn from the R&D investments made earlier by their trade partners (Coe and Helpman, 1995).

This leads us to the first hypothesis:

H1. Productivity evolution is determined by the firms' innovation decisions, which in turn depend on knowledge input provided by R&D and imports.

The next important prediction of evolutionary economics refers to the role of achieved productivity and profit as mechanisms stimulating the search for novel products and the departure from existing routines (Hall and Jones, 1999; Winter, 1975; Witt, 1996). This sequence of evolutionary knowledge creation, learning, and a further application of knowledge determines the intensity and efficiency of innovation. Thus, we hypothesize the bidirectional causality between innovation and productivity:

H2. Not only does innovation stimulate productivity, but innovation may also be driven by economic returns from previous innovation. Therefore, former advantages in technical efficiency strengthen further innovation.

Within the same theoretical framework of evolutionary economics, gaps in productivity across firms as an outcome of the search and learning process consequently result in differences in growth rates among firms (Aghion and Howitt, 1992; Nelson and Winter, 1982a). Innovation should result in economic growth due to the greater variety of products, their superior quality, the unique nature of new technologies and products, and cost advantages. However, the outcome is not guaranteed and is conditioned by various factors (Griliches, 1998; Hall and Jones, 1999). The positive effects may be curtailed by liquidity problems, inefficient allocation, and other difficulties the firm faces. Innovating firms may fail to obtain an economic return from innovation, leading them to shrink and die even though they are innovation leaders. They may, for example, not have sufficient capacities and complementary assets, or a new product might not meet sufficient demand (Teece, 1986a). The recent model by (Hommes and Zeppini, 2014) shows the role of demand in technological change: when the demand is elastic, technological progress leads to an ever-increasing fraction of innovators. With inelastic demand, technological progress is characterised by fewer and fewer innovators instead.

The extended Nelson and Winter model (Winter, 1984) introduces entry dynamics as a pattern of the broader evolution of the industry, outlining a situation in which the incumbents are challenged by the new firms which enter with the new technologies, thus forcing the mature firms to innovate or to contract. This expectation is complemented by the notion of the industry life cycle (Klepper and Sleeper, 2005) with the various backgrounds of the entrants in different industries.

Hence, our hypothesis for an innovation-growth link may be formulated as follows:

H3. Innovation and related productivity gains are associated with growth conditional on firm's survival and positive industry dynamics.

In turn, the survival perspectives of the firms depend on how they transform advantages in productivity, profitability, and scale economies into the better survival chances (Aghion, Howitt, and García-Peñalosa, 1998; Audretsch, 1995; Griliches, 1979). Several factors may cause a variation in the probability of survival, depending on innovations. First, the market selection mechanism matters: a turnover of firms occurs when competitive pressure induces the exit of inefficient firms (Hopenhayn, 1992), therefore if the selection mechanism is inefficient, the productivity-survival link may be disrupted. Second, the survival-innovation link in mature industries has certain specificities. As Agarwal and Gort, 2002 write, a mature market is characterized by fewer technological opportunities, a shift of innovation to minor product refreshments and cost reduction, and from pure innovation to imitation. All this leads to more intense competition and lower rates of survival. Moreover, technologically intense industries may be associated with higher hazard rates because of the speedy obsolescence of the initial endowment in such industries. Firm age and economies of scale are other important factors: Jensen, Webster, and Buddelmeyer, 2008 study the innovation-survival link for young and mature firms and report that young firms are more prone to an early death in general, but they more likely succeed in risky and innovative industries than do mature firms.

From this follows the fourth hypothesis:

H4. Innovations and higher productivity lead to a higher chance of survival, especially for small firms, which are usually more likely to die.

The empirical literature reports various outcomes of innovation efforts regarding the various performance characteristics, types of innovation, and level of development of the host economy. With respect to the innovation-productivity link, the existing literature generally documents large and persistent productivity differences among producers and traces these differences to innovation efforts (Syverson, 2011). A survey of the productivity-innovation literature (Hall, 2011) shows that most research at the microlevel finds positive effects of product innovation on productivity, though the elasticities for developed countries are considerably higher than for less developed countries. The effects in the manufacturing industry are found to be higher than in services, and in the low technology sectors they are lower than in mid- and high technology. Concerning imports as a source of knowledge for innovation, the literature is quite conclusive: imports contribute to innovation and performance (see (Wagner, 2012) for a literature review). The mechanisms behind import spillovers include the improvement of technologies, the quality of products (Damijan, Konings, and Polanec, 2014), and the development of new routines which are adopted through imitation and reverse engineering (Goldberg et al., 2010).

The estimation results for process innovation and productivity are less consistent, the effects found being negative, zero, and rarely positive. This may be explained by the different mechanisms behind the effects of product and process innovations on productivity and by the difficulties of measuring new production technology in an appropriate manner (Mohnen and Hall, 2013; Crespi and Pianta, 2008). In general, product innovations increase productivity by increasing output, entering the new markets, and increasing demand, while process innovations reduce costs and lead to higher capital intensity, which contributes to cost advantages. Both ways to accumulate dynamic capabilities entail significant costs and risks, which can be disruptive in a weak economy. Therefore, the expected benefits of innovation on performance in weaker economies are lower compared to more developed countries

Regarding the innovation-growth perspective, there remains a degree of ambiguity in the empirical literature. Some studies conclude that innovation matters for firm output growth, some however do not find a strong link between innovation and sales growth (for the extensive literature survey see Coad, 2009). The ambiguous effects are explained by the large time lags between the time of invention and introduction of the new product, as well as by the combination of cost and risk involved (Coad and Rao, 2008). Uncertainties also force firms to delay risky investment decision needed to bring innovative products to the market (Bloom and van Reenen, 2002). Additionally, markets often fail to serve as effective selectors for delivering the rewards of economic growth according to a firm's productivity advantage (Audretsch, Segarra, and Teruel, 2014). A low persistence of growth rates over time may also present difficulties for finding the effects of innovation on firm growth (Audretsch, Coad, and Segarra, 2014).

Recent empirical studies claim that innovation interacts with third factors when it determines the growth effects. Therefore, the link is positive only for some firm groups and in general there appear to be limits to this positive relationship. (Coad and Rao, 2008), for example, report that R&D and patents increase the growth rates of fast-growing firms, while for others the effect may be zero or negative. (Grillitsch, Schubert, and Srholec, 2019) show that only broader sources of knowledge and their combinations, as opposed to just R&D, drive innovation and firm growth. They also find evidence of a non-linear link between knowledge and growth according to which, beyond certain thresholds, an increase of the knowledge base results in decreasing firm growth. Conditions for a positive innovation-growth link may include types of innovation activities under which product innovation rather than process contributes to growth (Santi and Santoleri, 2017). Furthermore, the continuity of the innovation process may also matter (Triguero, Córcoles, and Cuerva, 2014; Deschryvere, 2014). A favorable location and geographical knowledge spillovers may condition pertaining positive effects (Audretsch and Lehmann, 2005). In turn, (Demirel and Mazzucato, 2012) report that restrictions of an effective innovation-growth link are incurred due to insufficient economies of scale and a lack of persistence in patenting.

A weak selection mechanism conditioned by weak competition is often quoted as a serious barrier to firm turnover based on efficiency advantages. For example, (Tybout, 2000) suggests a higher patience of markets toward inefficient firms in developing economies, where large incumbents may be protected from death irrespective of their innovation and productivity. (Ugur, Trushin, and Solomon, 2016) report on UK data that R&D active firms survive longer in more concentrated industries. However, despite the ambiguity of protection policy in emerging economies, large protected incumbents often carry out significant innovation efforts.

Upon the whole, empirical studies on data relating to transition economies do not indicate that the innovation-survival link follows a special pattern in this group of countries. For example, in China, where the government largely protects state-owned firms, the studies show a positive relationship between survival and productivity (Audretsch et al., 2016; Yu et al., 2015). Some studies suggest an inverted U-shaped relationship (see Zhang and Mohnen, 2013 for the link between R&D intensity and survival). A comparable relationship is demonstrated for Chile (Fernandes and Paunov, 2015), where product innovation is shown to be beneficial for the survival of plants, though the effect is confirmed only for multi-product plants and relatively low levels of risks.

Previous research on the Russian data generally finds some positive performance effects of innovation. Regarding the innovation-productivity link, (Roud, 2018) uses the CDM modelling on the data of the national innovation survey. He reports that innovation output, measured as innovation sales per employee, positively influences labor productivity. Imports as an input into innovation decisions are studied on survey manufacturing data by (Gonchar and Kuznetsov, 2018): the paper reports beneficial effects of importing on firm innovation between 2005 and 2009 and a higher impact of imports on product innovation rather than on process innovation. Concerning growth effects, (Chadee and Roxas, 2013), using the World Bank survey data for 2009 within the structural equation modelling, report a positive influence of innovation on sales growth, conditional on the quality of the institutional environment. Golikova et al., 2017 describe how Russian manufacturing firms which invested in tangible assets prior to the 2008-2009 crisis have been more likely to demonstrate higher growth rates during the recovery and the immediate post-crisis period. Finally, González, Iacovone, and Subhash, 2013, using the United Nations Industrial Development Organization (UNIDO) dataset, study the productivity-survival link and conclude that in general more productive manufacturing firms are less likely to exit than less productive ones, though this finding does not hold for sectors where competition is less intense and unproductive firms are less likely to exit. Furthermore, improved productivity improves companies' survival chances mostly during economic surges rather than during slumps. To the best of our knowledge we are not aware of studies that use TE measures to analyse the relationship between innovation and productivity in Russia and compare various performance outcomes of innovation efforts.

4.3 Data and descriptives

4.3.1 Data sources

The data we use for estimation come from a manufacturing firms' survey of about 2,000 manufacturing plants of all sizes, carried out by the National Research University Higher School of Economics in 2014 in the framework of face-to-face interviews[3]. The resulting main sample includes firms randomly stratified by manufacturing sectors and size groups of enterprises, but not by sub-national regions. The sample is somewhat skewed towards larger firms; therefore, where possible, we

[3] The dataset, questionnaire and methodology of sampling and data collection may be found under https://iims.hse.ru/rusfirms

weight data to bring our sample close to the structure of the general population of manufacturing firms. For the weights we use the inverse of the observations' sampling probabilities across 2-digit sectors and size groups of firms.

We merge survey-related establishment level indicators to later performance data from the Ruslana dataset collected by Bureau van Dijk. Additionally, we use sector-specific data, calculated by the authors using the manufacturing industry population data as reported by Ruslana. This allows us to take into consideration that, when the innovation decision is made, this may affect revenue subject to a time lag and therefore avoids the problem of simultaneity of firm decisions concerning innovation, investments, and organization, thus reducing the endogeneity risk. All performance data is deflated with the use of a 4-digit sectoral price index.

While the survey is conducted at the plant level, we do not distinguish between plants and firms in this study. To capture the specificity of the ownership pattern in the Russian manufacturing industry we control all estimations for the measurement that distinguishes between independent and dependent plants (Holding dummy).

The strength of this study lies in the combination of two independent data sources. This allows us to measure innovation directly, based on the self-perception of company managers, while accounting data for the post- and pre-survey period enable us to assess the impact of lagged measurements of firm organization and behaviour on later performance. In addition, combining survey and accounting data reduces common method bias, which is a usual occurrence for survey statistics.

4.3.2 Dependent variables

This paper seeks to explain three performance measurements that are expected to be impacted by innovation decisions. They are the productivity, the growth rate, and firm survival.

Productivity, generally understood as efficiency in production, is measured in two ways – either as total factor productivity (technical efficiency, TE) computed by means of stochastic frontier analysis, or as labour productivity (real operational turnover per worker). TE takes account of the firm's efficiency and shifts in the sectoral technological frontier. Because we lose a lot of observations with TE, additionally we use simple labour productivity as a measure of efficiency: this indicator is easy to understand and to measure, though it does not reflect the intensity of use of factors other than labour input factors. Our data shows a large within sector's gap in TE estimates among manufacturing plants in the year when the survey was conducted: the average firm in the 90th percentile of TE distribution is 1.6 times closer to the technological frontier than the average firm in the 10th percentile.

The second dependent variable is the growth rate measured as annual real growth of operational revenue, deflated with the use of 4-digit sectoral prices indexes (2010 being the base year).

As it relates to survival, our dependent variable is the number of years between 1991 (the year when the market reforms started) and the failure event by 2018. A plant is defined as exiting when it is not operational in year t as compared to the year t-1 and has either permanently closed, remains in the process of liquidation, or was acquired by another firm. In our data, the share of exits falls monotonically with the firm size: in the group of companies with 10-19 employees 42.7% of firms exited the market whereas the percentage stood at only 2.3% for plants with more than 500 workers. Companies face different operational risks depending on sector affiliation: the highest mortality rate is observed in the timber and food-processing sector (21.7% and 20.2% of firms exited respectively), the lowest being found among firms which belong to the transportation equipment industry (about 2%).

4.3.3 Independent variables

We do not observe the full history of surveyed firms before and after the survey was conducted and rely on several self-reported indicators of R&D, innovation, firm organization, and ownership. R&D as innovation input is measured by two indicators. First, by the dummy constructed by asking if the firm performed R&D three years prior to the survey. Second, R&D intensity is calculated from the answers to the question about the mean share of R&D expenditures in sales within the three years prior to the survey and is defined as the logged value of R&D expenditures per employee. The indicator of R&D intensity is used to explain innovation output in a knowledge production framework and to additionally test for H.4 when R&D - survival effects are studied. In our data, the mean value of R&D of a typical manufacturing firm accounts for about RuR 19 thousand per employee in 2014 –

TABLE 4.1: Group statistics of performance (2014-2016) of innovators and R&D spenders

	Product innovation within 3 years prior to the survey				Process innovators within 3 years prior to the survey				R&D within 3 years prior to the survey			
	yes		no		yes		no		yes		no	
	Mean	No. obs	Mean	No. obs	Mean	No. obs	Mean	No. obs	Mean	No. obs	Mean	No. obs
Employment, people	143.5	752	79.42	724	186.8	606	75.97	956	185.4	495	80.57	1,450
TE	0.703	563	0.680	450	0.695	480	0.691	593	0.688	387	0.685	922
Labour productivity, output in thousand RUB/person	1635	728	1111	678	2132	590	1080	899	1881	482	1175	1,372
Sales growth rate, %	-14.4	722	-20.5	654	-17.7	585	-19.2	875	-16.7	484	-18.0	1,327
Exit rate, %	7.6	159	9.4	197	4.7	98	12	251	2.3	50	19	398

Source: Survey data for innovations and Ruslana data derived from Bureau van Dijk for productivity, output growth, and exit. The monetary indicators are deflated at 2010 prices. Deflators were calculated with the use of annual 4-digit sectoral prices indexes, as reported by Rosstat.

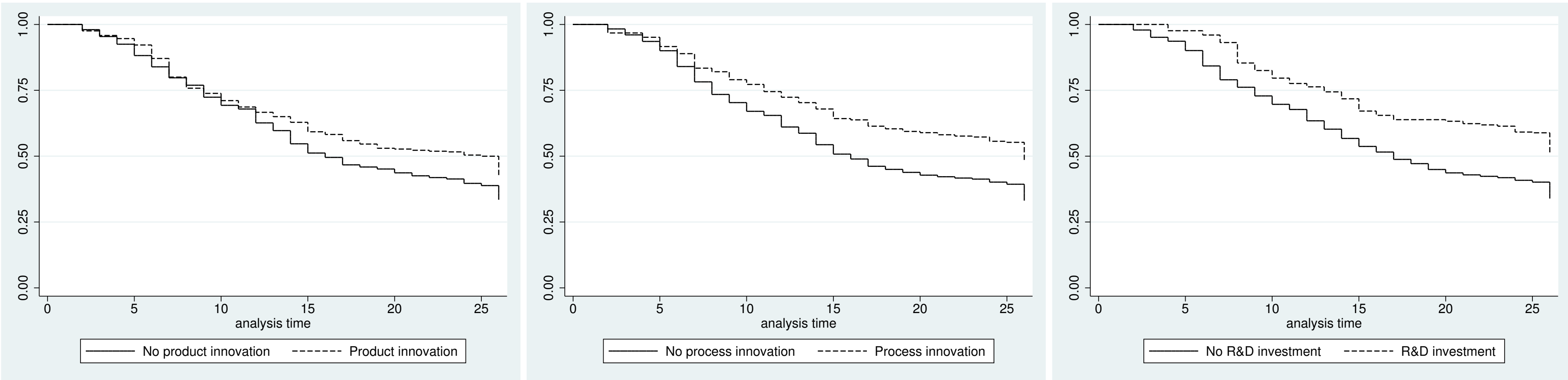

FIGURE 4.1: Kaplan-Meier survival by type of innovation

Note: The horizontal axis shows the number of survival years, starting from 1991 and the vertical axis displays the Kaplan-Meier survival estimates. Failure is defined as exit of the plant from the market. All of the data are weighted. Product innovations, process innovations, and R&D spenders in this figure are defined by the dummies.

approximately an average monthly wage in manufacturing.

Additionally, our econometric strategy takes into account the specificity of innovation processes in transition economies, seeing as relying on the R&D input into the knowledge function may underestimate the innovation effort especially in smaller firms in traditional sectors. We assume that the plant receives knowledge either through R&D or by learning from technologies embodied in imported machines and equipment. Import participation is measured as a logged value of imports per worker and is constructed from the questions about the share of imports of machinery and equipment in fixed assets.

In our data, some differences in R&D and import participation are observed: 16.9% of plants report R&D expenditures and 23.9% import hardware. Overall 32.5% of the sampled plants engage in at least one of the learning activities, which we expect to serve as an input into innovation.

We measure innovations following the procedure applied in most innovation surveys by asking if the plant introduced a new or significantly improved product or production technology during the past three years prior to the survey (that is between 2011 and 2014). Thus, we get the dummy for product innovators (48.2% of observations) and a dummy for process innovators (33.3% of observations).

This measurement is extensively used in survey-based empirical literature, albeit for some important drawbacks – for instance, its inability to fix the exact timing of innovation and to correct for size, seeing as larger firms obviously have more product lines and are thus more likely to be counted as product innovators (see the survey by Mairesse and Mohnen, 2010). Therefore, to measure product innovations, we use the responses to the question about the mean share of the plant's sales due to new products within the three years prior to the survey. From these responses we construct our measurement of innovation output for product innovations – the real sales of novel products per worker. This indicator is often regarded as a relatively accurate measure because it highlights the persistence of successful product innovations, thus profiting from the fact that most firms track their sales by type of product.

We use a comparable approach to capture process innovations because of the above-mentioned fuzziness of innovation dummies. In the survey, we have the question about the age structure of machines and equipment. We assume that the share of machines and equipment installed no later than 5 years ago quantifies the technological structure of the hardware stock and reflects recent investments into process innovations. To take account of other than equipment-related production technologies, we condition the measurement of the technological structure of equipment by the positive answer to the question about the introduction of new or significantly modernized technologies.

Table 4.1 shows how our main performance indicators of interest differ across innovating and non-innovating firms between 2014 and 2016. Additionally, Figure 4.1 presents a more detailed graphical analysis of our data for exits using the Kaplan-Meyer survival estimator across various groups of plants depending on their innovation status and R&D spending.

R&D spenders exhibit the most consistent advantages in all performance indicators: they beat non-spenders in technological efficiency, labour productivity, growth rate, and survival. The Kaplan-Meyer estimator (Figure 4.1) shows the same tendencies: starting from the central point in the survival time, the product innovators, process innovators, and R&D spenders are more likely to survive than are non-innovators.

The return to process innovation is the highest in labour productivity and survival, while the technical efficiency is only slightly higher for process innovators. And at last, all types of innovators have much larger plants than non-innovators, the gap being the highest for process innovators where firms which introduce new technologies employ nearly 2.5 times more people than inactive firms. These results illustrate patterns of performance by innovators in the Russian manufacturing industry and need to be tested by our further econometric analysis.

4.3.4 Controls

The literature recognizes various determinants of R&D and innovation which we include in the knowledge production function as controls and divide them into three groups: firm-level knowledge stock, ownership and organization, and the industry's technological and demand conditions.

With regard to knowledge stock, we include a variable which measures investments into human capital as a dummy for firms which invest into personnel training (24.7% of observations). Age may capture the accumulated knowledge through learning and lead to improvements in innovation, productivity, and growth (Coad, Segarra, and Teruel, 2013), though the under-performance of younger firms may be associated with their riskier R&D strategies when compared to mature firms rather than being derived from their low knowledge stock (Coad, Segarra, and Teruel, 2016). Our sample is dominated by mature firms: the mean age of the firm in the sample amounts to almost 18 years.

ICT capabilities measured as a dummy for firms which report ICT management system (14.6% of observations) may contribute to innovation decisions due to additional IT-based capabilities, lower operation time, and a higher efficacy of managers. The international quality management certificate (ISO) has an impact on product and process innovations through its incentives to update technologies and improve quality (Marette and Crespi, 2003).

We control for the size of the plant measured in terms of employment as a continuous and categorical variable or as logged operational turnover in the equation for growth effects. The firm's market power is measured as a share of firms' turnover in the total industry's turnover at the 4-digit sectoral level. As a rule, the empirical literature confirms the Schumpeter hypotheses of size and monopoly power and reports that large plants are more likely to innovate and to receive higher return from innovation to productivity, but their innovation output does not increase proportionally to their size (Griffith et al., 2006; Mairesse and Mohnen, 2010). The mean plant in the sample employs 99 people in the time covered by the survey (2014)[4]; between 2011 and 2016, the mean employment declined from 141 to 100 workers.

Several features, controlling for firm organization, are captured by the ownership structure. We expect that the foreign subsidiary has advantages in terms of productivity (Melitz, 2003), but is not necessarily a superior innovator if R&D and innovation decisions are taken at the level of the home multinational (Crespi, Tacsir, and Vargas, 2016). Government ownership has an inconclusive impact on innovation decisions. On the one hand, the management of a publicly owned organization

[4] According to the Ruslana data.

has weak incentives to take decisions that lead to cost reduction or innovation (Hart, Shleifer, and Vishny, 1997). On the other hand, the state sector is still an important actor in technological development, seeing as state-owned firms can more easily obtain financing support, innovation subsidies, and preferential access to the new markets than can private firms. Literature on emerging economies' data mostly shows that firms innovate less if the government keeps a stake (Cui, Jiao, and Jiao, 2016). In addition to providing us with an ownership dummy, our data allows to measure access to public support. Subsidies may stimulate innovation by yielding additional resources to the firm (Mairesse and Mohnen, 2010) or by creating rents and reducing the firm's incentive to improve efficiency (Cette, Lopez, and Mairesse, 2017). In our data, about 3.6% of firms receive subsidies, larger firms being much more effective at getting subsidies (59% subsidized firms in the group of large firms).

The dummy for the holding answers for the external economies of scale, which is usually an attribute of an integrated company and simultaneously measures the level of independence of firm behavior because the holding may delegate the R&D and innovation decisions to a specialized facility. The share of the main product in sales (specialization) takes account of the finding by (Bernard, Redding, and Schott, 2010) that a firm's productivity is positively linked to the variety of products it produces.

We control the estimations for financial constraints experienced by the firm (lagged negative profit dummy), taking into account the argument of Schumpeterian literature that profits play a role in innovation decisions of the entrepreneur as part of the "virtuous circle" when profit is the result of successful innovation and the source of financing of the innovation effort (Guarascio and Pianta, 2017). Financial frictions prevent firms from developing and adopting better technologies (Gorodnichenko and Schnitzer, 2013), though access to external financing (measured in our data as a dummy for firms which use external funds) may increase investing capabilities.

TABLE 4.2: Descriptive statistics of dependent and independent variables.

Variable	Definition and source of data	Mean	Standard Deviation	Minimum	Maximum
TE – technical efficiency	A ratio of observed TFP to the maximum TFP in the 4-digit sector. The higher the value, the closer the plant is to the production frontier. Own calculation through stochastic frontier analysis, Ruslana data for the full population of manufacturing firms	0.688	0.127	0.227	0.992
Labour productivity	Log of deflated output per worker. Own calculation on Ruslana data	6.703	1.139	-1.310	13.36
Output growth	Annual output growth. Own calculation on Ruslana data	-0.106	0.613	-6.779	3.238
Failure to survive	Dummy for firms which de-registered between the time of the survey 2014 and the last reporting date (2018), Ruslana	0.0729	0.260	0	1
Product innovation	Log of real new products' sales per worker. Calculated from the question about the mean share of new products' sales in total turnover during three years prior to the survey. Own calculation based on the survey data	0.366	4.340	-9.640	11.11

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Table 4.2 Descriptive statistics of dependent and independent variables (continued).

Variable	Definition and source of data	Mean	Standard Deviation	Minimum	Maximum
Process innovation	Share of recently installed machinery and equipment (< 5 years) if the firm positively responded to the question about the introduction of new production processes. Own calculation based on the survey data	0.116	0.248	0	1
R&D decision	Dummy for firms which performed R&D between 2011 and 2013, survey	0.171	0.377	0	1
R&D intensity	Log of real annual value of R&D expenditures per worker. Own calculation from the survey data	0.466	1.391	-0.728	8.968
ICT	Dummy for firms which have ICT management system, survey	0.161	0.367	0	1
Human capital	Dummy for firms, which trained personnel, survey	0.292	0.455	0	1
ISO	Dummy for firms which introduced ISO and other international quality certificates, survey	0.413	0.493	0	1
Exporting	Dummy for exporting activities, survey	0.154	0.361	0	1

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Table 4.2 Descriptive statistics of dependent and independent variables (continued).

Variable	Definition and source of data	Mean	Standard Deviation	Minimum	Maximum
Imports	Log of yearly real value of imports of machinery and equipment per worker. Own calculation based on the survey data	-2.352	3.047	-3.729	9.876
Age	Number of years on the market, survey	17.98	19.13	1	303
Specialization	% of main product line in sales, survey	79.74	21.68	3	100
Subsidized	Dummy for firms which received any kind of financial support from the government, survey	0.0367	0.188	0	1
Holding	Belongs to holding, dummy, survey	0.0897	0.286	0	1
Foreign	FDI among owners (any stock), dummy, survey	0.0234	0.151	0	1
State	Government among owners, any stock, dummy, survey	0.0254	0.158	0	1
Liquidity	Dummy on negative profit in the previous year, Ruslana	0.198	0.399	0	1
Market share	% of firms' sales in total sales of 4-digit sector. Own calculation on Ruslana data	0.0253	0.135	0	1
External financing	Dummy for firms which raised any external financing in 2011-2013, survey	0.375	0.484	0	1

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Table 4.2 Descriptive statistics of dependent and independent variables (continued).

Variable	Definition and source of data	Mean	Standard Deviation	Minimum	Maximum
Size group	Categorical variable for small (=3), medium (=2), and large (=1) subsidiaries, Ruslana	1.565	0.679	1	3
Size (alternative)	Log of employees, Ruslana	3.251	1.447	0	9.727
Foreign competition	Dummy for firms which experience any type of competitive pressure from foreign subsidiaries or imports, survey	0.395	0.489	0	1
Entry rate	Share of firms which entered the 4-digit sector in the total number of firms. Own calculation on Ruslana data	0.0731	0.0344	0	0.222
Industry growth	Yearly real output growth rate in 4-digit sector. Own calculation on Ruslana data	0.00695	0.174	-1.271	1.004
Size of the city	Categorical variable for cities with population less 250 thousand people (=3), 250 - 999 thousand people (=2), and above 1 million people (=1), survey	1.918	0.836	1	3

Note: Data are weighted and for 2014

Sector dummies are used to control for unobserved sectoral heterogeneity and to take account of various technological opportunities within sectors. The variety of technological opportunities, as evolutionary theory shows, may stem from the population ecology approach, obtaining when shared resource pools affect firms belonging to one niche, i.e. industry, in the same way (Geroski et al., 2003; Hannan and Freeman, 1977). In some specifications, we replace sector dummies by specific sectoral characteristics like the entry rate (the share of entries in the total number of active firms in 4-digit sector) or the deflated sector output growth rate. This allows us to control for external forces possibly acting on innovation decisions of the firm and the efficacy of these decisions, especially for demand-oriented innovation. The entry rate captures industry evolution when the incumbents may be challenged by start-ups which enter with new technologies and therefore the higher entry rate may be associated with an additional motivation for mature firms to innovate. The average output growth at the sectoral level helps to capture the stage of the business cycle and demand conditions in the sector.

The role of competition in innovation decisions is complex, being mostly positive for technologically advanced firms near the frontier and nil or negative for laggards (Aghion et al., 2006). We expect positive impulses from competition, for which we use a self-reported categorical variable showing the pressure of competition from foreign subsidiaries and imports on the markets where the firm is active. Exporting firms are more likely to innovate and report R&D expenditures due to the pressure of higher competition in international markets and the learning effects (Gorodnichenko, Svejnar, and Terrell, 2010).

The access to external knowledge is proxied by the strength of agglomeration forces, depending on the size of the host city. The city size may determine innovation and productivity because proximity contributes to a more effective generation and diffusion of knowledge (see Feldman, 1999 for literature survey). Table 4.2 summarizes definitions of dependent variables, main predictors of interest, and a set of controls at the firm and sector level.

4.4 Empirical model

4.4.1 Research design and identification strategy

We begin by constructing the measure of firm productivity with maximum-likelihood estimates of the stochastic frontier production function for panel data, as suggested in (Battese and Coelli, 1995). The advantage of this measurement is that it takes account both of technical progress and inefficiency of the plant relative to the best performing plant in the sector. Given that the registry data which we link to the survey data is extracted from the Ruslana database, we also followed the advice of the OECD, 2017 on how to approximate indicators not observed directly in this data base, but which are needed for a production function analysis. Thus, we proxy output, capital, material, and labour cost by turnover, fixed assets, cost of goods sold and the average wages at the sector/region level, because the plant level labour cost data is too scarce. Then we exclude the missing observations and trim the 1% worst and best plants at the TFP level to exclude the outliers. The final full unbalanced population panel includes 471,740 firms across 231 4-digit manufacturing sectors. For each of the surveyed plants we construct the indicator of the TFP distance to the technological frontier as a share of plant TFP relative to the best performing plant in the 4-digit sector.

In all further specifications except for the survival equation we use an extension of the three-stage structural model developed by Crépon, Duguet, and Mairesse, 1998 (CDM) and later modified by Lööf and Heshmati, 2006. We depart from this classical model with two important novelties: we add imports as an input into the knowledge production function and continue the CDM logic into the growth equation when growth is influenced by productivity gains achieved due to innovation. Figure 4.2 shows the research model we apply in this study when the system of four equations is estimated for several sequencing stages of the innovation cycle: the decision to undertake R&D, to introduce product or process innovation, the resulting outcome for productivity, growth, and survival.

The main starting point of CDM analysis comes from the assumption that R&D data systematically underestimate the amount of R&D efforts and innovation, especially within smaller firms, which often innovate on a more informal basis outside of

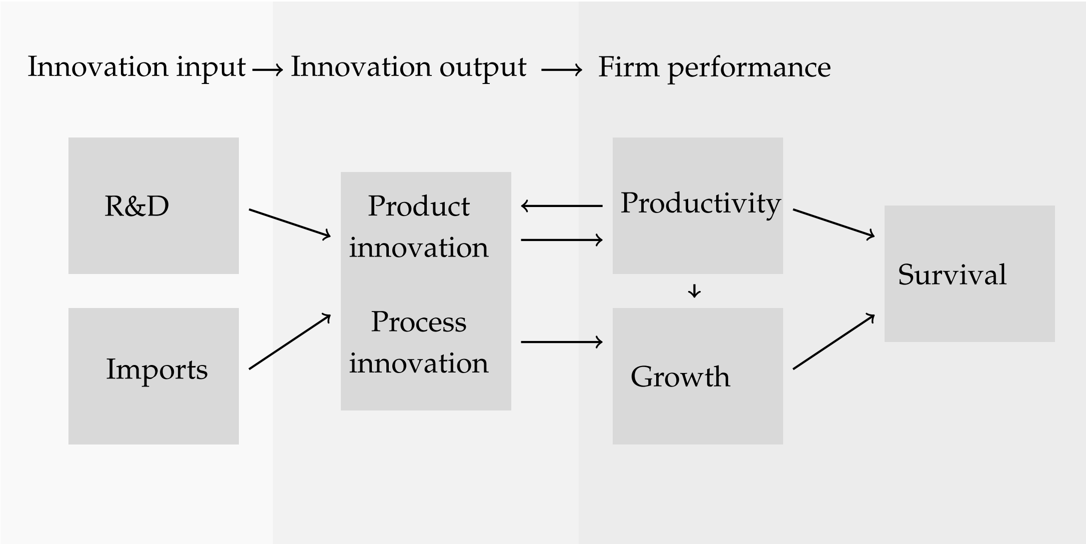

FIGURE 4.2: The research model applied in the study

the R&D lab (Dosi, 1988). If so, using predicted rather than observed values of R&D and innovation efforts helps to take account of formal and informal activities.

Additionally, several econometric problems, typical for the innovation-productivity analysis, are addressed by CDM approach. First, it deals with the selection bias occurring when R&D spenders and innovators are not randomly selected from the manufacturing firms' population and the decision to undertake R&D and R&D intensity are not fully independent. When modelling the selection of innovation input, we solve this issue by additionally considering a selection equation and therefore allowing for a possible dependence between the first two stages of the system of four equations.

Second, the studies of innovation-performance link on the survey data face difficulties in the interpretation of correlation and in defining the direction of causation because one cannot ignore that more productive firms are more likely to engage in R&D and be successful in the area of innovation output. Therefore, the real causation may go from productivity to R&D and innovation. When factors underlying selection into R&D spenders are accounted for, explaining R&D intensity on a reduced sample of firms which report R&D reduces concerns about endogeneity.

Thirdly, the strength of this study lies in the possibility of a chronological sequence of the analysis. Usually, innovation papers suffer from the simultaneity bias because of the cross-sectional nature of the survey data. Thus, innovation input in t is often used as an explanatory variable for the innovation output in t, and the innovation output, in turn, as a determinant of the productivity, also in t. However, previous productivity in t-1 probably determines innovation in t as well. In order to break this econometrically vicious circle, we combine cross sectional data for selection and outcome equations, and panel data from various sources for the innovation output-performance link. Lagged levels of TE among controls additionally lessen endogeneity issues and help to study how previous productivity supports further innovation.

To sum up, our research explains the decision to undertake R&D, the innovation output, and the resulting performance indicators: productivity, growth and survival. Each stage of the three-stage CDM model is explained in detail below.

4.4.2 R&D decision and R&D intensity

First, following Griffith et al., 2006 and Morris, 2018, we estimate the decision to undertake R&D and the R&D intensity within the two-step Heckman selection procedure for the cross-sectional data structure. Our aim is to obtain the latent measurement of R&D input into the knowledge production function, based on the assumption of the existing recording and/or reporting problems associated with the formal R&D expenditures in firms' books. The sample selection model can be specified as follows:

Let g_i^* be a latent (unobserved) firm's decision relating to whether or not to undertake an innovation effort and let r_i^* be its latent (unobserved) level of innovation investment, with g_i and r_i being their observable counterparts. Then,

$$g_i = \begin{cases} 1 & \text{if } g_i^* = \beta_0 x_{0i} + \mu_{0i} > 0 \\ 0 & \text{if } g_i^* \leq 0 \end{cases} \tag{4.1}$$

and

$$E[r_i | g_i = 1, x_{1i}] = E[r_i | r_i^* > 0, x_{1i}] = \beta_1 x_{1i} + E[\mu_{1i} | r_i^* > 0, x_{1i}] \tag{4.2}$$

where x_{0i} and x_{1i} are vectors of determinants. β_0 and β_1 are parameter vectors which measure the impact of various factors on the probability of undertaking an R&D investment in the first place and its level respectively. We assume that μ_{0i} and

μ_{1i} are normally distributed random error terms with mean of zero, that they have constant variances, and that they are uncorrelated with the explanatory variables and correlated with each other. Their joint distribution is bivariate normal.

In the first stage, a binary variable g determines whether or not r is observed. We estimate x_0 using Probit. In the second stage, we estimate β_1 of the second stage using OLS, but conditional on $g_i = 1$, i.e. $r_i > 0$. For observed values $g_i = 1$, we have an observed realization of the other latent variable r^*.

Both x_0 and x_1 include sector dummies, a training dummy as a proxy for human capital, an internationally recognized certificate (ISO), and the ownership structure as predictors of R&D decision and R&D intensity. If a firm undertakes R&D, the intensity of R&D expenditures is measured as a logarithm of R&D expenses in sales per worker (averaged for 2011-2013).

For a more robust specification, we impose exclusion restrictions, meaning that the selection equation includes exogenous variables that are excluded from the outcome equation (Cameron and Trivedi, 2010). In the absence of the exclusion restriction, a multicollinearity issue might potentially arise due to the almost linear form of the inverse Mill's ratio over the considerable portion of its range: in case of collinearity existing between the correction term and the included regressors, standard errors are heavily overestimated. The size of the plant is a state-of-the-art exclusion restriction in the selection equation and is measured as logged average employment between 2011 and 2013. It is not included in equation 4.1 because R&D intensity has already been explicitly scaled (Morris, 2018). The possible explanation is that smaller firms possess fewer financial resources and a stronger risk aversion towards innovation activities as compared to large firms (van de Vrande et al., 2009). Two other parameter shifters, exporting and foreign competition, are relevant for decision on R&D spending, but are excluded from the R&D intensity equation.

Thus, we predict the value of R&D expenditure per employee, save the predicted values of the R&D intensity and the inverse Mills ratio, and use it as an instrument in the next step when estimating the knowledge production function.

4.4.3 The knowledge production function

The third equation within the CDM framework is the knowledge production function that links innovation output to productivity. It can be formalized as follows:

$$K_{it} = \gamma_r \widehat{R_{it}} + \beta_2 Y_{it-1} + \beta_3 X_{2it} + \beta_4 MR + \mu_{3t} \tag{4.3}$$

where K is the innovation output, R is the latent innovation input, Y is the previous productivity, X is a vector of controls, MR is the inverse Mill's ratio from equations 4.1-4.2, and μ is the random error term with a zero mean and constant variance.

We include the inverse Mill's ratio to control for the selection bias. We also account for firms which might have attempted some innovations but don't report it explicitly in the survey by including the predicted values of R&D intensity.

To estimate an alternative specification of the knowledge production function, we also make use of importing intensity as a proxy for knowledge input. We assume that import is not a latent variable, therefore, we just employ observed values of import intensity and do not correct for the selection bias and therefore omit the inverse Mill's ratio

$$K_{it} = \gamma_r I + \beta_2 Y_{it-1} + \beta_3 X_{2it} + \mu_{3t} \tag{4.4}$$

where K is the innovation output, I is the observed innovation input, Y is the previous productivity, X is a vector of controls, and μ is the random error term with a zero mean and constant variance.

4.4.4 Performance equations

At the last stage of the CDM model we assess the impact of the innovation input on the performance:

$$Y_{it} = \gamma_k \widehat{K_{it-1}} + \beta_5 X_{3it} + \mu_{4t} \tag{4.5}$$

where Y is a firm's performance indicator, γ is the performance' effect[5] with respect to product or process innovation, K is the predicted innovation from the previous

[5] Only in case of labour productivity and product innovation can we speak of elasticity, whereas it is not possible to talk about elasticities when measuring a firm's performance by TE or the impact of process innovation on TE or labour productivity (see Table 4.2 for a construction of the variables).

step, X is a vector of controls, and μ is the random error with zero mean and constant variance.

In equation 4.5 three alternative measures indicating firm's performance are used: technical efficiency, labor productivity and output growth. To account for a plausible chronological sequence of the innovation process, allowing for a feedback effect between productivity and innovation, the dependent variable is modelled as a function of the lagged predicted innovation output (product and process innovation). We control equation 4.4 and 4.5 for a number of factors such as: size, age, ownership, specialization, liquidity, market share, location, and sectoral dummies.

In case of output growth, we use the sectoral growth rate on the NACE 4-digit level instead of sectoral dummies. In line with Gibrat's law (Gibrat, 1931), we proxy size by previous output. Further on, we exclude market share and limit the sample to surviving firms only.

Following (Lööf and Heshmati, 2006), we allow for a partial correlation of the error terms within the CDM model by assuming that the main predictor's (innovation output) error terms are correlated with the independent endogenous variable (TE, labor productivity, and output growth). Therefore, equations 4.3, 4.4, and 4.5 are modelled as a simultaneous system using instrumental variables two-stage least squares (IV 2SLS) in the panel data setting for the post-innovation period of 2014-2016. To sum up, we assume that productivity in 2014 was influenced by innovation output from 2013 and this output in turn was affected by the productivity level in 2012. Thus, we account for the endogeneity of innovation output and a firm's productivity.

4.4.5 Survival function

As a further performance indicator, we estimate a firm's survival as depending on productivity and growth advantages. For this purpose, we estimate proportional semi-parametric Cox proportional hazard regressions, which relates the survival time of the firm to other performance and innovation indicators: technical efficiency, labor productivity, product, process innovation, and R&D intensity. The model produces estimates of the hazard rate, i.e. the instantaneous rate of failure at which a subsidiary i will exit at time t on the condition that it survived at $t - 1$.

In order to obtain the hazard rate of firm i at time t, $h_i(t)$, the non-parametric baseline hazard function, $h_0(t)$, is multiplied by a parametric part capturing the impact of the vector of covariates $X_{ik}(t)$ by means of parameter estimates b_k.

$$h_i(t) = h_0(t)exp\{\sum_{j=1}^{n} b_j P_{ij}(t) + \sum_{k=2}^{m} b_k X_{ik}(t)\} \tag{4.6}$$

The vector of main predictors P, individually comprising innovation and performance indicators, is used in the equation together with the vector of covariates X: size, age, liquidity, specialization, market share, and organization on the firm-level and some further controls (size of the city and entry share in the 4-digit sector). In one specification, we interact innovation with the size dummy to study if innovation may help most vulnerable small firms to decrease their mortality rate.

4.5 Results and Discussion

4.5.1 Knowledge production function

Our first step is to estimate R&D knowledge input by means of the Heckman procedure. Table 4.3 presents results on the likelihood of the decision to undertake R&D (column 2) and the value of R&D expenditures per worker (column 1). As explained in our methodological section, the two-stage procedure to define the input into innovation output is essential because we imply selection and expect that some manufacturing firms underreport R&D expenditures. Our results confirm the selection bias: the coefficient on lambda (inverse Mill's ratio) is significant at the 5% level, which implies that error terms are correlated. Therefore, traditional methods with OLS estimation would be misleading in this research.

The propensity to undertake R&D increases with the size of the plant and is more typical for industries with the higher value added, firms in food-processing and timber industries being significantly less likely to take an R&D decision relative to chemicals (our reference category). In line with the Schumpeterian prediction concerning the role of firm size in concentrated markets, in our data a growth of the number of employees by 1% is associated with a 3.1% increase of the likelihood of an R&D decision. Thus, our finding confirms that the production of knowledge is a subject of scale economy. We therefore use size to explicitly control for selection bias and furthermore assume the linearity of the investment function with respect to size. Therefore, it is omitted from the second stage equation explaining R&D intensity.

A greater knowledge stock is associated with a higher likelihood of performing R&D: if the firm reports personnel training, the likelihood of an R&D decision increases by 13.5%. International quality certificate and the power of foreign competition strongly determine an R&D decision. Our result on exports compellingly confirms a positive relation between R&D and exports, where being an exporter correlates with a 12% higher probability to invest in R&D. This result stays in line with the CDM-based literature, which reports a higher probability of investing in innovation for exporting firms. Thus, (Crespi and Zuniga, 2012) report an 11% marginal effect of exports on R&D decision for Chile and 15% for Argentina. The economic significance of this effect for developed countries is somewhat higher: 65% for UK (Hall and Sena, 2017) and 64% for Belgium (Czarnitzki and Delanote, 2017).

The ownership structure and organization are weakly related to R&D. Comparable results on size, competition, and ISO as drivers of R&D decision in the Heckman equation can be found in (Morris, 2018) for a big group of transition and developing economies.

Next, we estimate the knowledge production function (equation 4.3) and use the predicted value of R&D expenditures per worker and observed imports per worker as indicators of knowledge input into innovation output. We consider two different outputs: product and process innovations. Additionally, we control the model for previous technical efficiency (columns 1-4 in Table 4.4) and previous labour productivity (columns 5-8) as drivers of innovation to test our hypothesis concerning incentives to innovate generated by economic return from previous innovation. As results from Table 4.4 indicate, our choice of two-stage models is fully justified: the significant Mill's ratio suggests selectivity across all specifications in equation 4.1.

The economic significance of the knowledge input is the highest for product innovation. When R&D expenditures per worker grow by 1%, new products' sales per worker increase by 1.95-1.11% (columns 1 and 5). The contribution of imports is somewhat lower when compared to R&D, though it remains positive and significant: if lagged imports, measured as the value of imported machines and equipment

TABLE 4.3: R&D decision and R&D intensity (average marginal effects)

	R&D per worker	R&D decision
Holding	0.623***	-0.004
	(2.81)	(-0.15)
Human capital	0.283	0.135***
	(0.97)	(6.20)
ISO	0.585***	0.060***
	(2.93)	(2.91)
FDI	0.119	-0.066
	(0.33)	(-1.46)
State	-0.523	0.004
	(-1.15)	(0.07)
Specialization	-0.004	-0.000
	(-0.77)	(-0.90)
Electro	-0.036	0.132*
	(-0.10)	(1.74)
Engineering	-0.085	-0.010
	(-0.27)	(-0.19)
Food	-0.137	-0.193***
	(-0.29)	(-4.39)
Other non-metallic	-0.664*	-0.061
	(-1.77)	(-1.04)
Steel	-0.480	-0.051
	(-1.46)	(-0.94)
Textile and garment	-0.960	-0.163***
	(-1.49)	(-3.17)
Timber	-0.091	-0.185***
	(-0.15)	(-3.88)
Transport	0.019	-0.071
	(0.05)	(-1.16)
Log of employees		0.031***
		(4.94)
Exports		0.120***
		(5.09)
Competition (FDI or import)		0.064***
		(3.12)
Lambda		0.638**
		(2.02)
Number of observations	1111	
Number of selected observation	217	
Rho	0.454***	
Sigma	1.404***	
p-value for comparison test	0.013***	

Notes: The results of the two-step Heckman procedure on cross-section average data for 2011-2013. The coefficients in the second column are for the likelihood of a firm to invest in R&D, in the first column those for the expected value of R&D intensity if the firm has reported R&D spending; Rho tests for the significance of the correlation term between the residuals of the selection and outcome equations; t statistics in parentheses. Significance levels: ***p<0.01, **p<0.05, *p<0.1

per worker, increase by 1%, sales of novel products per worker grow by 0.5%.

In the same way both R&D and imports translate into process innovations, though its effect is smaller when compared to product innovation and we do not observe a meaningful difference between the two knowledge inputs. The share of new equipment in the hardware stock conditional on a positive answer to the question about the introduction of new technologies (our definition of process innovation) increases by 0.8-0.6 percentage points with a 10% increase of R&D intensity and by 1-0.8 percentage points with a 10% increase of imports. The lower elasticity of process innovations to knowledge inputs may be caused by a low sensitivity of revenue-based indicators to efficiency improvements, associated with the modernization of hardware and production technologies (Hall, 2011).

It is also the case that innovation output is higher for the most productive firms, both for TE and labour productivity specifications. The shortening of the distance to the technological frontier by 1 percentage point, or 0.01 unit, (the TE ranges from 0 to 1, where the 1, or 100%, is the frontier), leads to a 2-35-3.65% growth of product innovations. Less powerful is the impact of achieved labour productivity on product innovations, where a 1% gain in labour productivity results in a 0.19-0.27% growth of product innovations. Effects of previous levels of productivity on process innovations are less consistent and somewhat "noisy". Summing up, the results confirm our H2 for product innovations and demonstrate the sequence of evolutionary knowledge creation, whereby efficient innovation, proxied by technological superiority and higher labour productivity, reinforce further innovation.

Some controls are also important determinants of innovation output outside their effect on R&D. Thus, smaller firms are not only less likely to perform R&D, but they are also less efficient in translating R&D into successful product or process innovations. Firms under foreign ownership, being neutral for R&D decisions, are significantly less innovative in the case of product innovations. This result could capture the specificity of the markets the foreign subsidiaries are targeting and the distribution of labour in the international value chain they belong to because subsidiaries may rely on the innovations carried out by the headquarters (Crespi, Tacsir, and Vargas, 2016). Market share (not included in R&D equation), as a rule, significantly increases innovation output in line with the Schumpeterian hypothesis on the advantages of dominating firms in innovation efforts.

A location in a large city significantly increases innovation output for product innovation irrespective of the source of the knowledge input and is not significant for process innovations. Thus, we confirm the power of agglomeration forces and the importance of the local market size for more demand-driven product innovations.

The firms which belong to the sectors characterized by higher entry rates do not innovate more intensively, contrary to our expectation based on evolutionary theory. Thus, we could not confirm that new entrants threaten the technological leadership of mature incumbents and thus incentivize their innovation behaviour.

Weak innovation efforts of entrants may be inferred from the results on how age determines innovation: younger firms in all specifications are significantly less innovative. This may partly explain our result on the neutrality of the industrial dynamism as measured by the entry rate as a determinant of innovation.

4.5.2 The effects of innovation on TE and labor productivity

Next, we study whether innovation leads to technological progress of the firm and productivity gains as described in equation 4.5. In this way we test our main hypothesis concerning the innovation-productivity link (H1). We take into account that the knowledge stock, a firm's organization, ownership, and other covariates included in the analysis affect both innovation and its efficacy in terms of productivity growth and estimate productivity equations as a system of two stage 2SLS, where all regressions are IV regressions. Table 4.5 reports the second stage results for two outcomes: TE and labour productivity[6]. As in previous specifications, we distinguish between two sources of knowledge input: predicted R&D intensity and imports, and two types of innovation.

The results show that product innovation has a strong effect on TE: if innovative sales per worker increase by 10%, the distance to the technological frontier shortens by 1-2 percentage points. Process innovations are somewhat less beneficial for TE and contribute to technological advances only when we measure knowledge input by imports.

[6]The first stage IV results are available from the authors upon request

TABLE 4.4: The determinants of innovation output: by type of innovation and source of knowledge

	Controlled for lagged TE				Controlled for lagged labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
Lagged TE	3.651***	2.348**	0.055	0.067**				
	(3.70)	(2.49)	(1.64)	(2.07)				
Lagged labor productivity					0. 186***	0.266***	0.003	-0.002
					(4.23)	(4.10)	(1.20)	(-0.42)
Latent R&D intensity	1.951***		0.082***		1.114***		0.058***	
	(5.67)		(5.23)		(3.99)		(4.55)	
Mill's inverse	-0.660**		-0.022*		-0. 612***		-0.025**	
	(-2.55)		(-1.86)		(-2.97)		(-2.65)	
Lagged imports		0.518***		0.013***		0.116***		0. 080***
		(10.62)		(7.24)		(5.57)		(6.43)

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Table 4.4 The determinants of innovation output: by type of innovation and source of knowledge (continued)

	Controlled for lagged TE				Controlled for lagged labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
ICT	0.990**	0.456	0.091***	0.057***	0. 759***	0.760**	0.071***	0.052***
	(3.23)	(1.56)	(6.50)	(4.36)	(2.75)	(2.96)	(5.72)	(4.33)
External financing	1.304***	0.783**	0.033***	0.018	1. 097***	1. 005**	0.033***	0.015
	(4.64)	(2.84)	(2.59)	(1.47)	(4.63)	(4.52)	(3.11)	(1.46)
Market share	2.217**	1.045	0.174***	0.127 ***	0.698	0.497	0.102***	0.100***
	(2.48)	(1.30)	(4.70)	(3.85)	(1.13)	(0.81)	(3.51)	(3.46)
Liquidity	0.331	-0.153	0.019**	0 014	-0.056	-0.088	0.002	0.003
	(1.00)	(-0.48)	(2.14)	(1.56)	(-1.06)	(-1.12)	(0.55)	(0.64)
Medium size	-1.297**	-0.969**	-0.036*	-0.055 ***	-0.247	-0.241	-0.010	-0.036**
	(-2.95)	(-2.31)	(-1.89)	(-3.11)	(-0.95)	(-0.90)	(-0.81)	(-2.76)
Small size	0.294	0.308	-0.004	-0.039	-0.306	-0.217	0.060**	0.005
	(0.30)	(0.32)	(-0.10)	(-1.04)	(-0.51)	(-0.40)	(2.23)	(0.18)

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Table 4.4 The determinants of innovation output: by type of innovation and source of knowledge (continued)

	Controlled for lagged TE				Controlled for lagged labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
Age	-0.012**	-0.009**	-0.001***	-0.001***	-0.013***	-0.006	-0.001***	-0.000**
	(-2.89)	(-2.32)	(-3.87)	(-3.11)	(-3.15)	(-1.56)	(-3.36)	(-2.50)
FDI	-2.654***	-0.797	-0.200	0.028	-2.314***	-0.714	0.003	0.048**
	(-5.03)	(-1.58)	(-0.84)	(1.20)	(-4.38)	(-1.45)	(0.12)	(-2.50)
State	1.008	0.180	0.069**	0. 011	0.141	-0.236	0.034	-0.001
	(1.44)	(0.29)	(2.19)	(0.41)	(0.21)	(-0.41)	(1.15)	(-0.06)
Subsidized	0.172	-0.391	-0.024	-0.037*	0.387	0.055	-0.013	-0.023
	(0.33)	(-0.78)	(-1.01)	(-1.67)	(0.77)	(0.12)	(-0.58)	(-1.09)
Holding	-1.204**	0.182	0.000	0.035**	-0.455	0.423	0.020	0.043***
	(-2.90)	(0.56)	(0.03)	(2.41)	(-1.22)	(1.41)	(1.18)	(3.09)
City size	0.280	-0.338	0.044***	0.012	-0.352	-0.519*	0.006	-0.001
250 - 999 th.p..	(0.81)	(-1.01)	(2.84)	(0.79)	(-1.24)	(-1.93)	(0.46)	(-0.05)

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Table 4.4 The determinants of innovation output: by type of innovation and source of knowledge (continued)

	Controlled for lagged TE				Controlled for lagged labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
City size less 250 th.p	-1.074**	-1.834***	0.014	-0.011	-0.768***	-0.944***	-0.011	-0.017
	(-3.18)	(-5.72)	(0.90)	(-0.74)	(-2.72)	(-3.61)	(-0.87)	(-1.43)
Specialization	-0.003	-0.009	0.000	-0.000	-0.009	-0.014***	0.001**	0.000
	(-0.44)	(-1.35)	(1.16)	(-0.73)	(-1.60)	(-2.79)	(1.96)	(0.09)
Entry rate	0.991	-0.144	0.015	-0.060	0.920**	-0.181	-0.008	-0.052
	(0.30)	(-0.04)	(0.22)	(-0.83)	(2.42)	(-0.31)	(-0.41)	(-1.35)
Constant	-7.113***	0.124	-0.229***	0. 086**	-2.294*	0.180	-0.115**	0.129***
	(-3.91)	(0.14)	(-2.90)	(2.57)	(-1.70)	(0.27)	(-1.86)	(3.71)
Number of observatiions	1427	1519	1458	1583	2069	2156	2124	2243

Note: The results stem from estimating the system of two -stage least-squares equations (2SLS on the panel data) for each year for the factors which affect product and process innovations depending on knowledge input through predicted R&D or imports. Only the second stage IV regressions are reported. TE refers to the TFP distance to the best performing plant in the sector and ranges from 0 to 1. t statistics in parentheses. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

TABLE 4.5: The impact of innovation on TE and labor productivity by type of innovation and source of input

	TE				Labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
Lagged product innovation	0.019***	0.011***			0.365***	0.548***		
	(6.15)	(5.08)			(4.75)	(7.77)		
Lagged process innovation			0.026	0.304**			6.631***	7.663***
			(0.29)	(3.13)			(4.27)	(5.90)
Medium size	0.038**	0.028**	-0.001	0.028	-0.668**	-0.678***	-0.769***	-0.744***
	(2.53)	(2.22)	(-0.06)	(1.49)	(-3.17)	(-3.44)	(-3.89)	(-4.80)
Small size	-0.041	-0.047*	-0.060	-0.035	-1.130**	-1.205**	-1.639***	-1.390***
	(-1.31)	(-1.71)	(-1.59)	(-0.97)	(-2.38)	(-3.05)	(-3.82)	(-4.80)
Age	-0.000**	-0.000**	-0.001**	-0.000*	-0.002	0.001	-0.001	0.001
	(-2.88)	(-3.07)	(-3.23)	(-1.83)	(-0.50)	(0.26)	(-0.43)	(0.61)

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Table 4.5 The impact of innovation on TE and labor productivity by type of innovation and source of input (continued)

	TE				Labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
FDI	0.060***	0.029**	0.034	0.013	1.018**	0.589*	0.077	-0.121
	(3.59)	(1.98)	(1.62)	(0.58)	(2.38)	(1.66)	(0.21)	(-0.44)
State	0.031	0.046**	0.039	0.048*	0.066	0.287	-0.173	0.187
	(1.42)	(2.56)	(1.40)	(1.90)	(0.12)	(0.68)	(-0.37)	(0.67)
Subsidized	-0.028*	-0.031**	-0.022	-0.028	-0.069	0.035	0.260	0.319
	(-1.72)	(-2.15)	(-1.06)	(-1.34)	(-0.17)	(0.10)	(0.72)	(1.33)
Liquidity	-0.007	0.002	0.001	-0.007	-0.200***	-0.181**	-0.245***	-0.290***
	(-0.69)	(0.25)	(0.15)	(-0.76)	(-4.69)	(-3.14)	(-5.57)	(-4.99)
Holding	0.011	0.018**	0.016	0.011	0.029	-0.012	-0.242	-0.038
	(1.04)	(1.98)	(1.03)	(0.76)	(0.11)	(-0.05)	(-0.93)	(-0.22)

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Table 4.5 The impact of innovation on TE and labor productivity by type of innovation and source of input (continued)

	TE				Labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
Market share	-0.081**	-0.035	-0.043	-0.065*	2.180***	1.290**	1.493**	0.355
	(-2.80)	(-1.51)	(-1.20)	(-1.89)	(4.41)	(2.87)	(3.07)	(1.02)
Specialization	0.001***	0.001**	0.000	0.000*	0.006	0.006	-0.002	-0.004*
	(3.33)	(2.86)	(1.39)	(1.72)	(1.18)	(1.54)	(-0.54)	(-1.67)
City size	-0.074***	-0.073***	-0.079***	-0.078***	0.166	0.414**	-0.003	0.049
250 - 999 th.p.	(-6.97)	(-7.75)	(-5.56)	(-5.52)	(0.73)	(2.08)	(-0.01)	(0.35)
less 250 th. people	-0.005	-0.026**	-0.035**	-0.037**	0.390*	0.556**	0.137	0.143
	(-0.42)	(-2.64)	(-2.57)	(-2.69)	(1.65)	(2.75)	(0.66)	(1.03)
Entry rate	-0.011	-0.068	0.023	-0.049	2.411***	1.925***	2.905***	2.307***
	(-0.10)	(-0.73)	(0.37)	(-0.72)	(7.71)	(4.62)	(9.35)	(5.43)
Constant	0.650***	0.677***	0.717***	0.658***	5.896***	5.469***	6.288***	6.185***
	(28.62)	(37.17)	(24.96)	(22.80)	(12.16)	(13.46)	(14.71)	(20.08)

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Table 4.5 The impact of innovation on TE and labor productivity by type of innovation and source of input (continued)

	TE				Labor productivity			
	Product innovation		Process innovation		Product innovation		Process innovation	
	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input	R&D as an input	Imports as an input
Number of observations	1427	1519	1458	1583	2069	2156	2124	2243
Number of groups	532	583	543	608	735	809	756	844
Chi-squared	132.308***	150.524***	64.885***	67.884***	211.532***	188.342***	209.823***	221.484***
Panel-level standard deviation	0.000***	0.000***	0.123***	0.120***	2.783***	1.995***	2.372***	1.209***
Standard deviation of epsilon	1.309***	0.470***	0.094***	0.101***	0.576***	0.634***	0.553***	0.559***
Rho	0.000***	0.000***	0.629***	0.588***	0.959***	0.908***	0.948***	0.824***

Note: The results stem from estimating the system of two-stage least-squares equations (2SLS for the panel data) for each year for the effects of innovation on TE and productivity. Only the second stage IV regressions are reported. TE refers to the TFP distance to the best performing plant in the sector and ranges from 0 to 1. t statistics in parentheses. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Referring to labour productivity, both types of innovation irrespective of knowledge source make firms more productive: the elasticity of labour productivity in relation to product innovation accounts for 0.37-0.55%. This result is consistent with the finding by (Roud, 2018) for Russian firms on CIS data (he reports a mean 0.3% elasticity ranging from 0.1% among so called national innovators to 0.4% among international innovators). Comparable estimations for 18 OECD countries produce an elasticity of 0.3-0.7% (Criscuolo, 2009).

The effect of process innovation on labour productivity is high: a radical improvement of the technological structure of the hardware stock, such as a doubling of the share of machines and equipment installed no later than 5 year ago conditional on a positive answer to the question about the introduction of new technologies, leads to a 7-8% increase of labor productivity. The established large coefficient (when compared to peers) for process innovation with respect to labour productivity compared to peers[7] is explained by our measurement strategy where we did not use a conventional process innovation dummy, typical for most studies, but instead quantified it by recent investments in machinery and equipment – the standard source for technologies among Russian manufacturing firms.

The implication of our results for productivity equations is that product innovation is most beneficial as a tool to increase TFP and shorten the distance to the frontier, while process innovation, which mostly rely on knowledge embodied in new hardware stock, critically increases labour productivity.

Regarding the remaining control variables, it is remarkable that subsidized firms are significantly behind other manufacturing firms in TE. This finding brings with it some implications concerning the focus of innovation policies. Foreign subsidiaries, which were not found to be superior innovators, nevertheless lead in technical efficiency and labour productivity, well in line with the theory by Melitz, 2003. Younger firms trail behind incumbents in TE.

[7] The finding that product innovation are more beneficial for labor productivity than process innovation are reported in (Crespi, Tacsir, and Vargas, 2016) (36 vs 19 %) and (Morris, 2018) (30 vs 13%) though in both papers process innovations were measured as dummies.

4.5.3 Growth equation

In this section, we estimate the growth effects of innovation and productivity gains on the short panel of post-innovation performance – the econometric method which is found most appropriate for high-frequency variations in a firm's growth rates (Geroski et al., 2003). We address the issue of the endogeneity of innovation and productivity by estimating the IV 2SLS model, thus expanding the logic of the structural multi-stage modelling to the growth equation[8] . In this part of the study, only firms that are in existence in the beginning and at the end of the observation period have been examined to avoid selection bias. The determinants of survival are studied separately in the next section 5.4. to check if the impact of innovation on growth is not biased by the higher mortality of risky innovating firms. The main variables of interest are product and process innovations in t-1 period and achieved technical efficiency. In this way, we aim at separately analysing the effects of innovation and technical efficiency, the last we believe to be a mechanism to transmit innovation impulse to growth (Nelson and Winter, 1982b). All regressions are controlled for the real mean growth rate at the 4-digit sectoral level to account for the business cycle, which could have driven the growth dynamics of firms in turbulent years (Table 4.6).

Both product and process innovations produce a significant improvement in the growth performance of manufacturing firms: a 1% increase in the share of novel products' sales per worker is associated with a 0.05% increase in the growth rate. Process innovations are somewhat less beneficial for growth with a 0.02% effect. Contrary to expectations, technological superiority, achieved as a result of product and process innovation, is not advantageous for growth (the coefficient on TE is positive, though insignificant). The lack of positive causation between TE and growth may reflect the general inefficiency of allocative mechanism in the Russian manufacturing industry, where firms that could exploit scarce resources in the most efficient way have limited access to resources and therefore are not able to unfold their full productive potential (Coad, 2009).

[8]We have also experimented with quantile regressions, which are extensively used in growth analyses on micro data based on the assumption about the conditional distribution of growth rates (Coad and Rao, 2008; Distante, Petrella, and Santoro, 2018). However, the coefficient estimates on our data remain more or less constant across various quantiles.

TABLE 4.6: Sales growth following innovation and productivity gains

	Product innovation output with R&D input	TE from product innovation output	Process innovation output with R&D input	TE from process innovation output
Lagged product innovation	0.053** (2.96)			
Lagged process innovation			1.619*** (3.47)	
Lagged TE		3.147 (1.55)		8.591 (1.00)
Lagged turnover	-0.026** (-2.50)	0.000 (0.02)	-0.045*** (-3.34)	-0.050 (-1.39)
Liquidity	0.025 (0.73)	0.001 (0.01)	0.029 (0.80)	0.128 (1.01)
Age	0.001** (2.17)	0.002* (1.67)	0.002** (2.81)	0.004 (1.23)
Industry growth rate	0.263*** (4.03)	0.393*** (3.86)	0.254*** (3.77)	0.658* (1.66)
Other controls		included		
Const	0.085 (0.74)	-2.322* (-1.68)	0.226 (1.64)	-5.566 (-0.96)
Number of observations	1961	1801	2022	1919
Number of groups	676	655	698	699
Chi-squared	32**	21**	37***	7
Panel-level standard deviation	0.270**	0.000**	0.344***	0.398
Standard deviation of epsilon	0.409**	1.880**	0.423***	0.425
Rho	0.304**		0.399***	0.467

Note: The sales growth following innovation and productivity gains are calculated conditional on firm survival. The results are from estimating the system of two -stage least-squares equations (2SLS on the panel data) for each year and relate to how innovation affects growth. Only the second stage IV regressions are reported. TE refers to the TFP distance to the best performing plant in the sector and ranges from 0 to 1. t statistics in parentheses. Significance levels: ***p<0.01, **p<0.05, *p<0.1.

Industry dynamics are the most influential factor which determines firm growth: an increase in the sectoral growth rate by 1% leads to an increase in the firm growth rate of about 0.25–0.66%, depending on the specification. Thus, our study confirms that the performance of firms is critically shaped by the conditions of technology and demand in underlying industries (Audretsch and Mahmood, 1995; Audretsch, 1991) and that innovation is an important, if only second-rate factor contributing to growth.

As far as the size-growth connection is concerned, when we measure the size by the real lagged sales, we find that smaller firms grow faster conditional on their survival. Age is beneficial for growth when size is controlled for: the finding is not supportive of the "bad controls" argument (Angrist and Pischke, 2009; Coad, 2018), whereby the advantages which come with age are controlled by the size. Our result also suggests that there is no clear evidence for the validity of the Gibrat's law (Gibrat, 1931) on the basis of our data. The change in firm size is not independent from its initial size.

4.5.4 Does innovation support survival?

Table 4.7 shows the regression results estimating the survival time of the surveyed manufacturing firms. The post-innovation survival was tracked three years after the survey was conducted. We use the Cox proportional hazard model and report hazard rates - the rate of failure at which a firm will exit at time t on the condition that it survived at $t-1$. The aim of this examination is to test the H4 which expects innovation and productivity gains to increase survival time. Moreover, we also seek to confirm the power of our previous results regarding the growth equation, which was estimated on the sub-sample of surviving firms in order to preclude the selection of non-innovating firms into survivors. First, we report the hazard rates of firms depending on their R&D intensity (column 1), product (3) and process innovations (5), technical efficiency (7), labour productivity (9), and growth rate (11). Additionally, building on the previous literature which establishes higher mortality rates among small firms and overall significant structural barriers to survival erected by low economies of scale (Audretsch, 1995), we seek to understand if innovation and productivity gains condition the survival of small firms. For this, we use the same proportional Cox-Hazard model and add interactions of our main predictors of interest with a dummy for the small size of the firm (columns 2, 4, 6, 8, 10). We use the universal set of controls, which capture the market share, location, and firm-specific characteristics such as ownership, economies of scale, and specialization. Industrial dynamics proxied by the entry rate at the 4-digit sectoral level suggests that the exposure of manufacturing firms to risk of failure are smaller in highly dynamic expanding sectors.

Our main finding from estimating equation 4.6 is that there is a significant survival premium conferred by product innovation: the survival time increases for firms which are persistent in the introduction of new products to the market and manage to build a new product market portfolio rather than make minor refreshments of the product line: if the firm increases the sales of novel products per employee by 1%, the survival time increases by 5.7%. The hazard rate of exit is negative for all our main predictors of interest, though it is not always statistically significant: neither for R&D expenditures, nor for process innovation.

However, labour productivity strongly determines firm demography. A 1% increase in labour productivity decreases the hazard rate by 30%. The productivity advantage, measured through TE, is also positively, though not significantly, related to survival time (while controlling for profitability). It means that exiting firms do not necessarily have a lower efficiency than surviving firms, as is the case if the selection mechanism functions well. Therefore, the argument of the evolutionary literature according to which innovators can improve their survival chances as a result of higher efficiency (Griliches, 1979) holds only partially — namely for labour productivity — in our data.

Table 4.7 also reports that the firm growth rate has a positive effect on survival (column 11). Comparable results are reported in the relevant literature (Cefis and Marsili, 2006; Ugur, Trushin, and Solomon, 2016).

TABLE 4.7: The impact of innovation, productivity and growth on survival

	R&D and survival		Product innovation and survival		Process innovation and survival		TE and survival		Labor productivity and survival		Sales growth and survival	
	R&D	Small size interaction	Product innovations	Small size interaction	Process innovation	Small size interaction	TE	Small size interaction	Labor productivity	Small size interaction	Sales growth	Small size interaction
R&D	0.973	0.966										
	(-0.43)	(-0.49)										
R&D x small size		0.372**										
		(-2.84)										
Product innovation			0.943*	0.953								
			(-1.83)	(-1.46)								
Product innovation x small size				0.664**								
				(-2.55)								
Process innovation					0.612	0.588						
					(-0.99)	(-0.93)						

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Table 4.7 The impact of innovation, productivity and growth on survival (continued)

	R&D and survival		Product innovation and survival		Process innovation and survival		TE and survival		Labor productivity and survival		Sales growth and survival	
	R&D	Small size interaction	Product innovations	Small size interaction	Process innovation	Small size interaction	TE	Small size interaction	Labor productivity	Small size interaction	Sales growth	Small size interaction
Process innovation x small size						0.433 (-0.46)						
TE							0.502 (-0.58)	0.964 (-0.03)				
TE x small size								17.215 (0.86)				
Labor productivity									0.694*** (-4.66)	0.843 (-1.38)		
Labor productivity x small size										0.661** (-2.42)		

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Table 4.7 The impact of innovation, productivity and growth on survival (continued)

	R&D and survival		Product innovation and survival		Process innovation and survival		TE and survival		Labor productivity and survival		Sales growth and survival	
	R&D	Small size interaction	Product innovations	Small size interaction	Process innovation	Small size interaction	TE	Small size interaction	Labor productivity	Small size interaction	Sales growth	Small size interaction
Sales growth											0.630***	0.592***
											(-4.91)	(-4.35)
Sales growth x small size dummy												1.032
												(0.17)
Small size dummy	3.351***	0.381	3.633***	1.741	3.455***	3.621**	2.565	0.388	1.549	11.149**	1.533	1.494
	(3.32)	(-1.26)	(3.54)	(1.18)	(3.34)	(3.18)	(0.90)	(-0.41)	(0.98)	(2.17)	(0.88)	(0.76)
Entry rate	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000**	0.000**	0.000***	0.000***	0.000***	0.000***
	(-4.94)	(-5.01)	(-4.47)	(-4.37)	(-4.78)	(-4.79)	(-2.18)	(-2.14)	(-4.07)	(-4.01)	(-4.46)	(-4.43)
Controls	Controls for firm liquidity, ownership, age, specialization, market share and host city size are included											

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Table 4.7 The impact of innovation, productivity and growth on survival (continued)

	R&D and survival		Product innovation and survival		Process innovation and survival		TE and survival		Labor productivity and survival		Sales growth and survival	
	R&D	Small size interaction	Product innovations	Small size interaction	Process innovation	Small size interaction	TE	Small size interaction	Labor productivity	Small size interaction	Sales growth	Small size interaction
Number of observations	6192	6192	5606	5606	5904	5904	5018	5018	6664	6664	5699	5699
Number of subjects	6170	6170	5584	5584	5882	5882	4996	4996	6642	6642	5677	5677

Note: All estimations use the Cox proportional hazard model. Regression coefficients are the hazard ratio (exponentiated coefficients). Z statistics are reported in parentheses beneath the coefficients. Robust standard errors are used. Significance levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$.

The estimated hazard rates for industry dynamics, measured by the entry rate at the 4-digit sectoral level, are negative and highly significant, indicating that firms grouped in dynamic sectors with increasing demand tend to have a low hazard of exit. This result is consistent with (Foster, Haltiwanger, and Syverson, 2008) and finds that demand variations across producers are the dominant factor in determining survival.

The controls have the expected signs: the survival time increases for profitable firms and for firms which report larger market share, while specialization and ownership do not matter.

Next, we study whether the gap between the firm size and the minimal efficient scale, which is found to be critical for survival in the literature (Audretsch, 1995), shrinks when the firm innovates and achieves productivity advantages. Table 4.7 shows that our measurement of R&D intensity interacting with the dummy for the small size of the firm is negative and significant (column 2), meaning that a growth of R&D intensity by 1% increases the survival time of the small firm by 62.8%. Similar effects are observed for product innovation and labor productivity. Neither process innovation, nor TE and growth improve the demography of small firms. These results demonstrate that small firms, being most vulnerable to disinvestment risks, live longer when they undertake R&D investments and sell new products. The finding that innovation is most beneficial for the survival of small firms may also be found in (Cefis and Marsili, 2006) in the case of Dutch firms, who also report that small firms are the most exposed to the risk of exit and that they benefit most from innovation as it relates to surviving in the market.

To sum up, we find that innovation is efficient in reducing firms' exit probability, though the effect is weaker than the economic return from innovation in terms of productivity and growth and is mostly important for small firms.

4.6 Concluding remarks

Raising productivity and changing the production structure remain the main challenges transition economies are facing. This paper aims to find new evidence concerning the effects of innovation on the performance of the Russian manufacturing firms and presents an empirical comparison of economic payoffs from various sources of knowledge input and for different types of performance. The available support of the predictions of the evolutionary literature on the Russian data is minimal and non-conclusive. Manufacturing firms are regarded as weak innovators focused on technology adoption and positioned far from the technological frontier, operating in a fragile economic and institutional setting. All this may suggest a low significance of innovation in catching up and growth, as is often the case in other transition and developing countries (Hall and Mairesse, 2006). On the other hand, imitation and low risk strategies may have some rationale, since technological progress foreshadows a different use of inputs at different levels of development (Vandenbussche, Aghion, and Meghir, 2006).

The findings in this paper provide new arguments regarding the process of knowledge evolution in the context of an emerging economy. The innovation-performance link in Russia does not differ much from the regularities established in the literature for other countries: firms that invest in R&D or learn from knowledge embodied in imported hardware are superior innovators; innovating firms are furthermore superior in labour productivity and technological efficiency. Innovative and productive firms are more likely to survive and grow conditional on their survival. However, weak market selection mechanisms and an inefficiency of resource allocation has some consequences: greater technical efficiency is not rewarded by growth and survival.

There are several remaining problems concerning Russia's technological development. The government still controls a large share of research resources and this hardly helps the technical upgrading of manufacturing firms. Our data confirm that neither subsidized nor government firms stay at the forefront of innovation. In general, firms respond weakly to government initiatives and the policies involve private firms incompletely. This may be partly explained by the obvious mismatch between the government tools to stimulate technological progress and the actual tools which the firms use for technological upgrade and growth. Thus, the government mostly seeks to support large and high-tech projects in the inward-looking policy environment and largely overlooks mid-tech innovation and technology adoption. Our research shows that firms' behaviour conforms to more fundamental economic incentives than the ones considered by government policy and that knowledge is generated through in-house R&D and imports in the presence of stronger foreign competition and trade integration.

Next, this paper confirms that economies of scale, both internal (size of the firm) and external (size of the host city) decide the successful conversion of knowledge input into innovation and innovation into productivity. Only a handful of advanced locations which generate agglomeration forces (large cities at most) host efficient innovators. Therefore, the policy of mushrooming technoparks in distant locations seems to disregard this reality.

We consider there to be some limitations of the data and research. First, our dataset is biased towards larger firms. Our econometric approach addresses the problem of underreporting of R&D expenditures by smaller firms in the survey but is not able to cope with underreporting of SME accounting data, while the estimations of performance are conditional on data availability. Weighting is only partly helpful because the actual full population of small firms is simply not known. Next, some inconsistency in the data may be caused by the absence of a full set of disaggregated deflators (firm level prices are always unobserved). This is an issue which could result in the mis-measurement of growth indicators during periods of high economic turbulence. Therefore, we urge caution in the interpretation of growth results because the variation of growth rates may be partly caused by a variation in input price dynamics. A short panel for productivity and growth equations may also underestimate the notion that firms have natural life cycles (Binder, Hsiao, and Pesaran, 2005).

There are various extensions to the line of research suggested in this paper. A longer time period of analysis may bring additional insight and allow the use of a more nuanced econometric methodology because firms in our dataset were severely hit by exogenous destructive shocks which obviously interfered in the innovation-performance link. It would be interesting to find out whether the obtained results hold for a growing rather than for a stagnating industry when the growth is balanced by commodities' prices and more favourable terms of trade. The duration of the performance effects of innovations is also an interesting topic for analysis, especially in a comparative perspective.

Appendix A

Appendix to Chapter 1

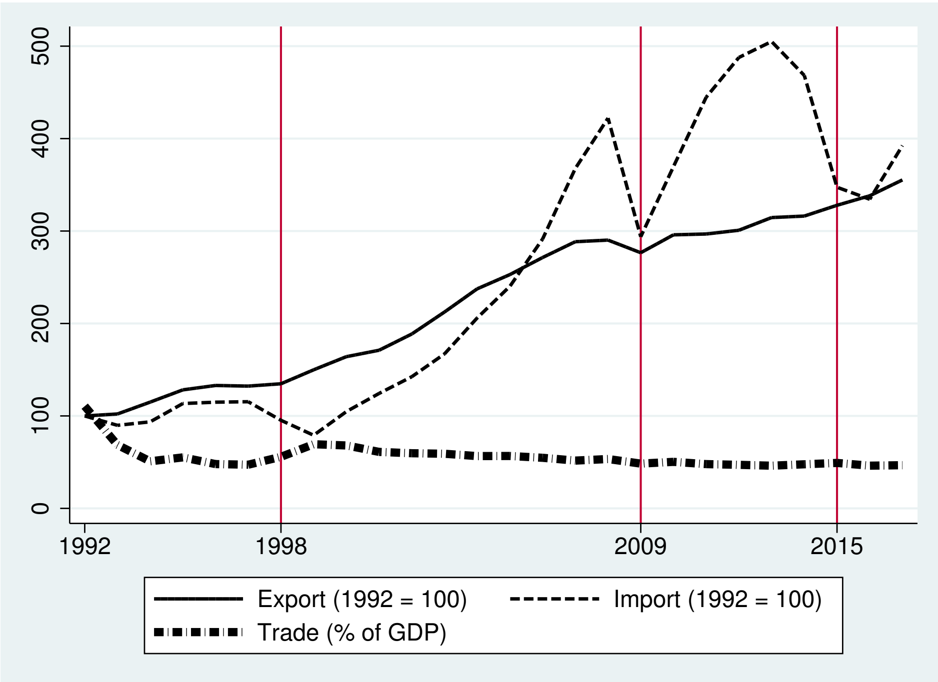

FIGURE A.1: Globalisation trends in Russia

Note: Trade openness is calculated as the share of the sum of exports and imports of goods and services in the GDP in 2017.
Source: World Bank

TABLE A.1: Transition outcomes

Country Name	GDP 1992, in billion US$	GDP 2000 / GDP 1992	GDP 2017 / GDP 1992	Type of transition	Part of the world	Group average in 2000	Group average in 2017	EBRD indicator in 2000	EBRD indicator in 2014
Albania	4037.34	1.72	3.46	Aborted big bang	FSU	0.97	2.43	3.17	3.50
Armenia	3267.34	1.32	3.78	Gradual	FSU	0.97	2.43	2.94	3.44
Azerbaijan	17159.11	0.77	3.34	Gradual	FSU	0.97	2.43	2.67	2.89
Belarus	28943.97	0.99	2.14	No Reform	FSU	0.97	2.43	1.67	2.17
Bulgaria	30811.15	1.05	1.91	Aborted big bang	FSU	0.97	2.43	3.39	3.72
Croatia*	39547.13	1.18	1.60	Gradual	CEEC	1.29	2.18	3.44	3.83
Czech Republic	127113.23	1.19	1.90	Big bang	CEEC	1.29	2.18	3.83	
Estonia*	10507.17	1.34	2.38	Big bang	CEEC	1.29	2.18	3.78	4.05
Georgia	7338.08	0.86	2.17	Gradual	FSU	0.97	2.43	3.33	3.50
Hungary	89012.80	1.20	1.72	Gradual	CEEC	1.29	2.18	3.89	3.89
Kazakhstan	81159.67	0.82	2.42	Gradual	FSU	0.97	2.43	3.06	3.06
Kyrgyz Republic	3818.72	0.84	1.74	Gradual	FSU	0.97	2.43	3.28	3.39
Latvia*	12774.50	1.29	2.36	Big bang	CEEC	1.29	2.18	3.50	3.94
Lithuania*	19315.60	1.26	2.46	Big bang	CEEC	1.29	2.18	3.44	3.94
Macedonia, FYR	6744.62	1.04	1.62	Aborted big bang	FSU	0.97	2.43		
Poland	216032.59	1.51	2.78	Big bang	CEEC	1.29	2.18	3.66	4.00
Romania	98478.43	1.12	2.20	Gradual	FSU	0.97	2.43	3.28	3.67
Russian Federation	1147448.09	0.83	1.46	Aborted big bang	FSU	0.97	2.43	3.00	3.28
Slovak Republic	40719.12	1.36	2.66	Big bang	CEEC	1.29	2.18	3.78	3.94
Slovenia*	29973.08	1.23	1.77	Gradual	CEEC	1.29	2.18	3.50	3.56
Tajikistan	4472.98	0.58	2.03	Gradual	FSU	0.97	2.43	2.72	2.95
Turkmenistan	11096.84	0.97	3.80	No Reform	FSU	0.97	2.43	1.56	1.78
Ukraine	170185.71	0.53	0.75	Gradual	FSU	0.97	2.43	2.89	3.28
Uzbekistan	18077.74	1.11	3.64	No Reform	FSU	0.97	2.43	2.17	2.28

Notes: Since the transition encompasses a lot of various reforms, it is often difficult to clearly define which group the country belongs to. The classification adopted here is based on Lenger, 2008. Other sources include: World Bank for the data on real GDP and EBRD for the transition indicator.

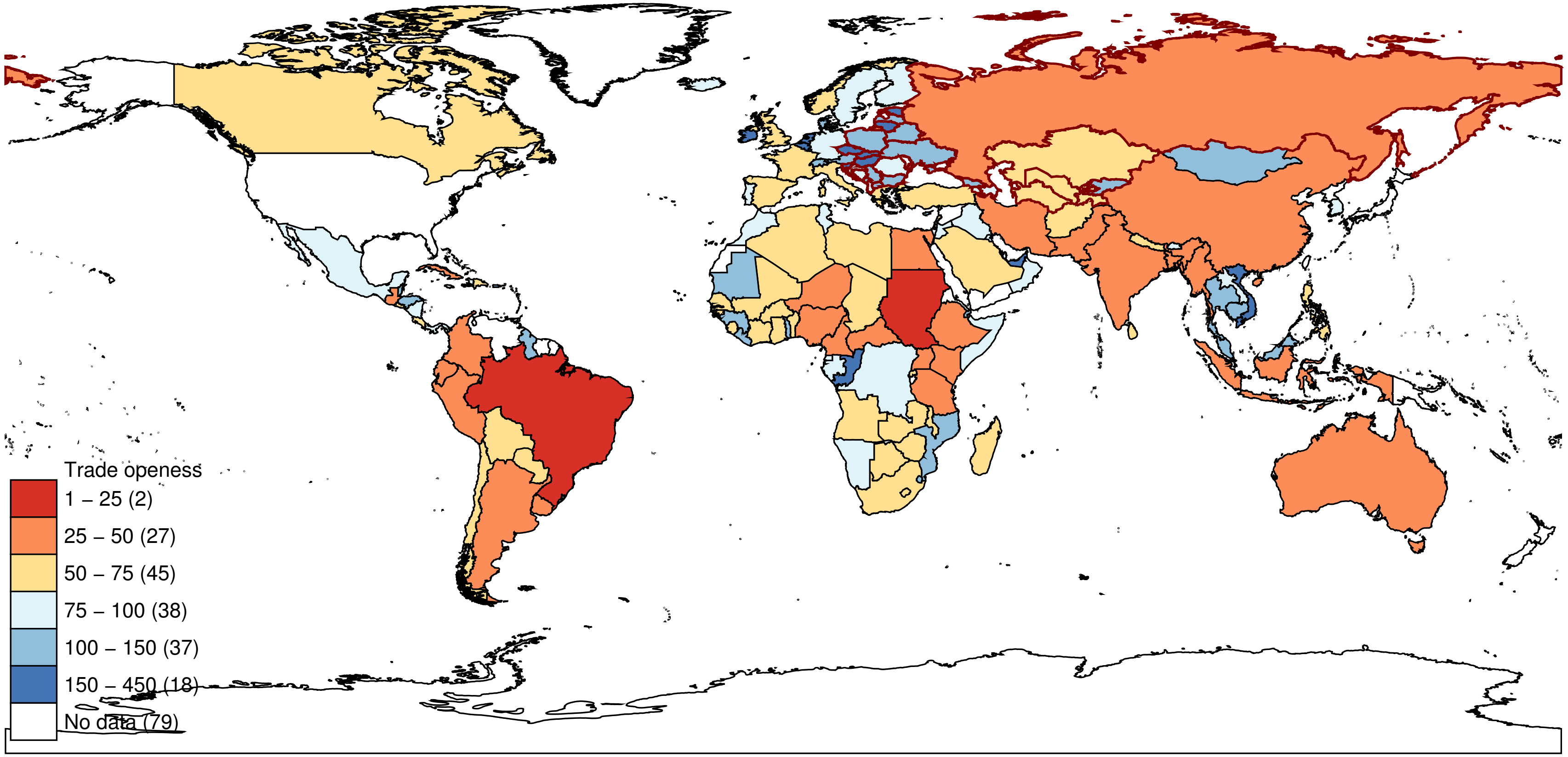

FIGURE A.2: Trade openness by country in 2017

Note: Trade openness is calculated as the share of the sum of exports and imports of goods and services in the GDP in 2017. The number of countries in each category is shown in parenthesis in the legend. Transition countries are marked by red boarders.
Source: World Bank

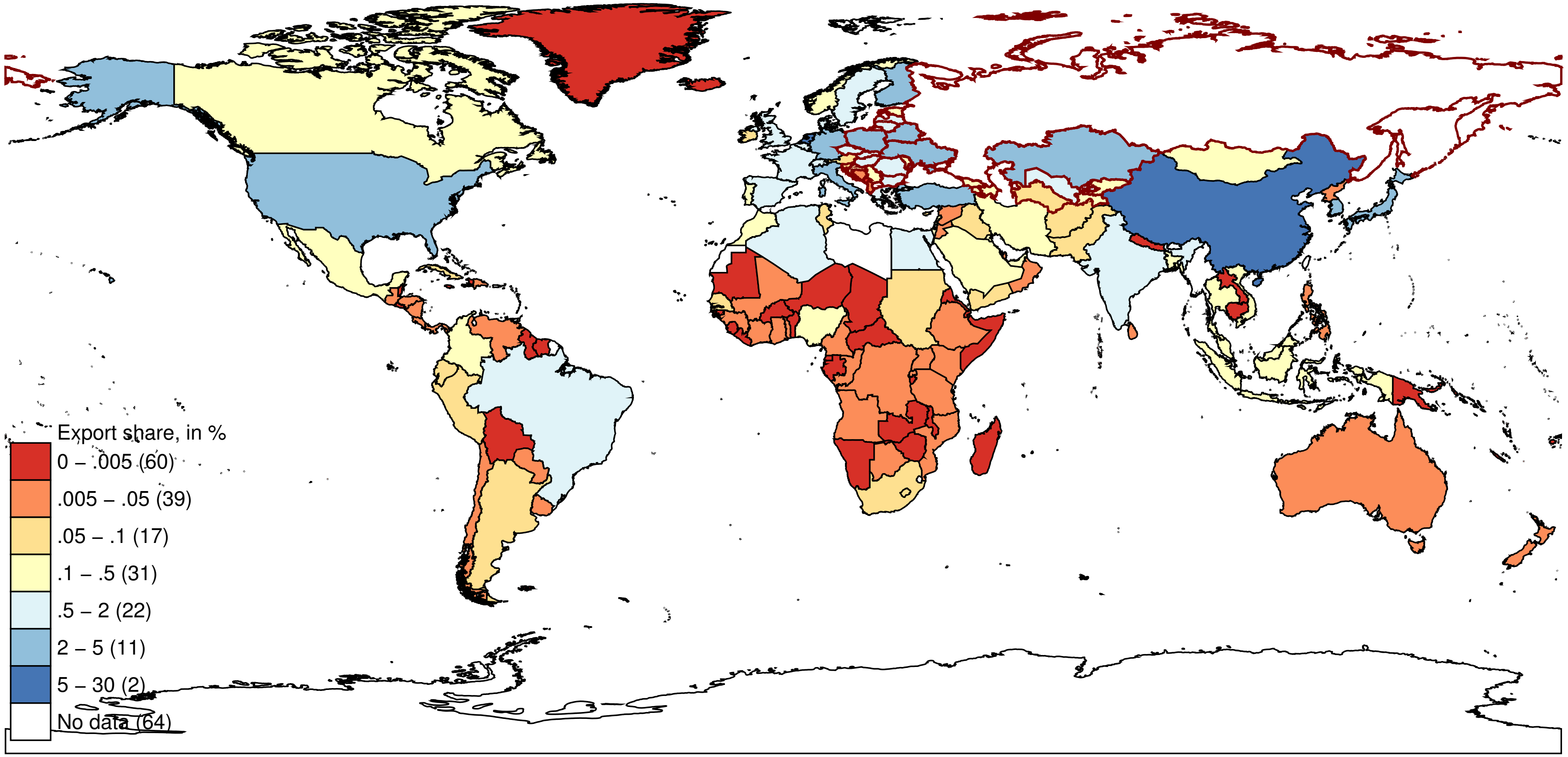

FIGURE A.3: Russia's export share by trade partner in 2017

Note: The number of countries in each category is shown in parenthesis in the legend. Transition countries are marked by red boarders.
Source: World Bank

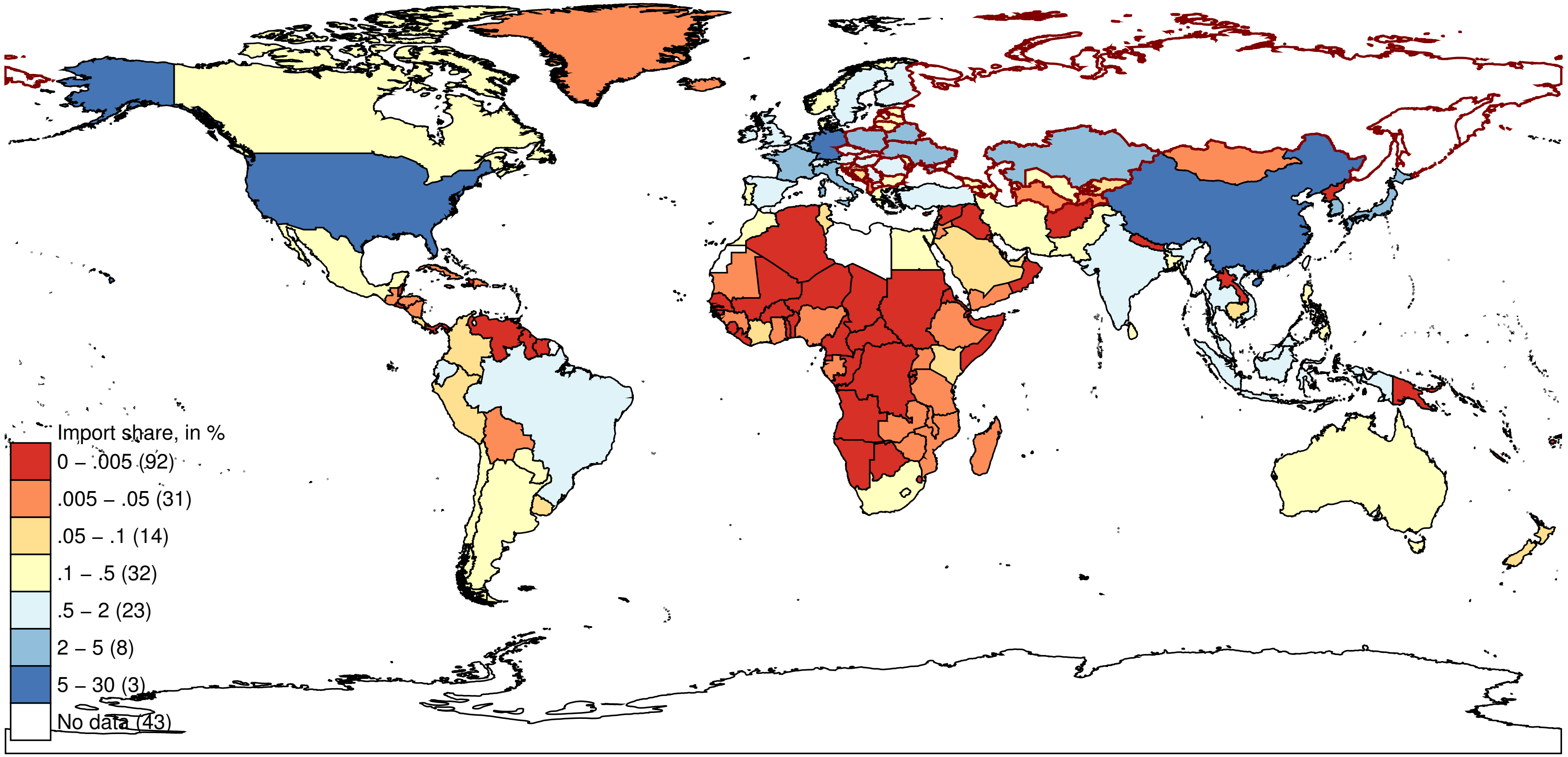

FIGURE A.4: Russia's import share by trade partner in 2017

Note: The number of countries in each category is shown in parenthesis in the legend. Transition countries are marked by red boarders.
Source: World Bank

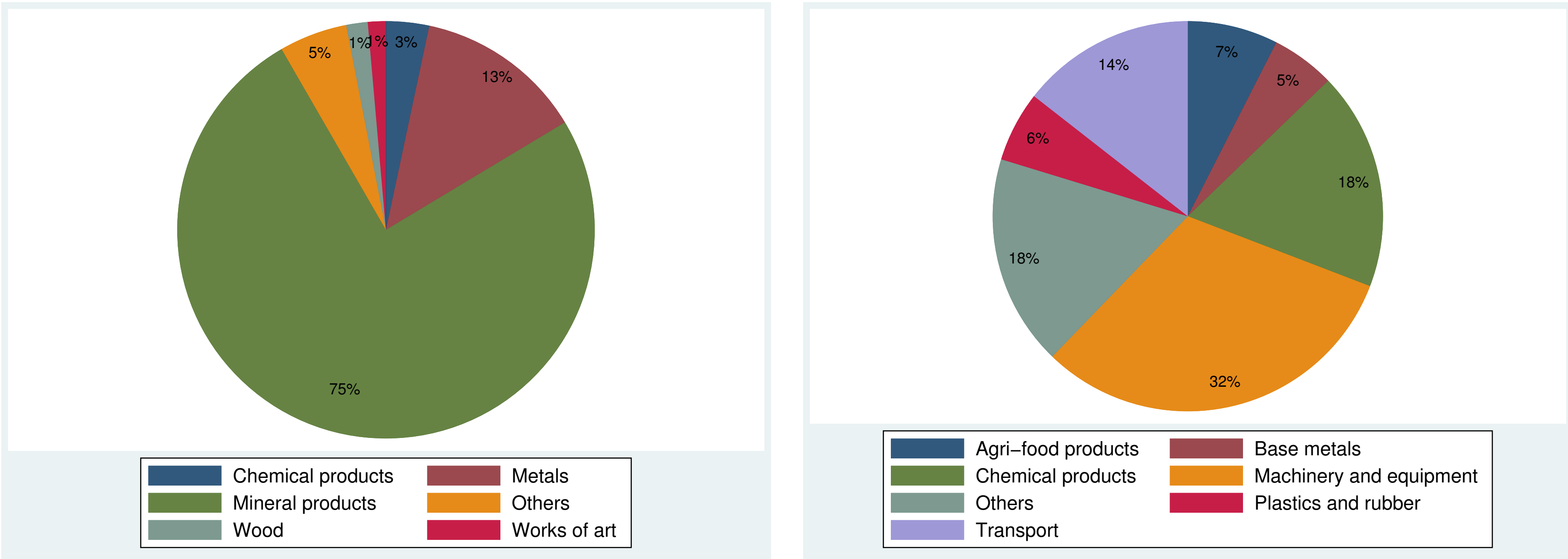

FIGURE A.5: Russia's exports to the EU (left) and imports from the EU (right)

Note: The data shows the trade structure with the EU-28 in 2017. The trade structure before the crisis differs insignificantly.
Source: Own calculations

TABLE A.2: Aggregated FDI data for Russia

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Russia's political risk	34	34.3	36.8	36.1	38	40.5	42	43.8	44.2	43.5	.
Inward FDI											
FDI inflow, EUR bln	40.2	51.7	19.9	23.9	26.5	23.5	40.2	22	10.7	33.6	23.1
FDI inflow, in % of GDP	4.2	4.6	2.3	2.1	1.9	1.4	2.3	1.4	0.9	2.9	1.7
FDI inward stock, EUR bln	335.5	150.9	256	350.8	316	330.8	343.1	238.8	240.3	374.5	368.9
Number of FDI affiliates	14783	16396	17372	.	24080	21417	24025	23520	17565	.	.
Number of people employed by foreign subsidiaries, thosand	3166	3282	3179	3215	3402	3321	3468	3445	3255	.	.
Structure of FDI inflows, in EUR mn											
A Agriculture, forestry and fishing	.	.	.	239.4	169.5	179.6	466.1	-22.7	243.3	-126.9	-242.4
B Mining and quarrying	.	.	.	2833.8	3266.6	3739.9	5345.8	3436.0	10331.9	20139.2	7377.8
C Manufacturing	.	.	.	7420.8	5995.0	4966.9	12416.3	886.8	6150.5	4410.4	2539.6
D-E Electricity, gas, water supply	.	.	.	1075.5	1595.7	1466.9	1350.5	1281.5	-1763.2	-96.7	1007.1
F Construction	.	.	.	297.0	2708.2	3055.4	2179.2	2054.7	-945.2	-309.0	1835.8
Services (G-S)	.	.	.	20677.4	25822.2	25944.3	30348.9	9018.2	-7854.3	5364.1	12890.3
Outward FDI											
FDI outflow, EUR bln	33.5	38.7	24.7	31	34.9	22.1	53.2	48.5	24.4	24.3	32.3
FDI outflow, in % of GDP	3.5	3.4	2.8	2.7	2.6	1.3	3.1	3.1	2	2.1	2.3
FDI outward stock, EUR bln	252.9	139.9	200.9	254.2	244	251.3	280.4	271.5	258.5	317.8	317.9

Notes: Political risk is calculated as a sum of 12 political and social attributes of the business environment in the home country (higher score indicates higher risk), based on the data provided by PRS group. The inward FDI stock is the value of foreign investors' equity in and net loans to enterprises resident in Russia. Values are indicated in current prices. Structure of FDI inflows is presented in accordance with the NACE Rev. 2 classification. Sources: FDI data are from wiiw FDI Database (2019). Number of affiliates and number of employees is reported by the Russian statistical agency.

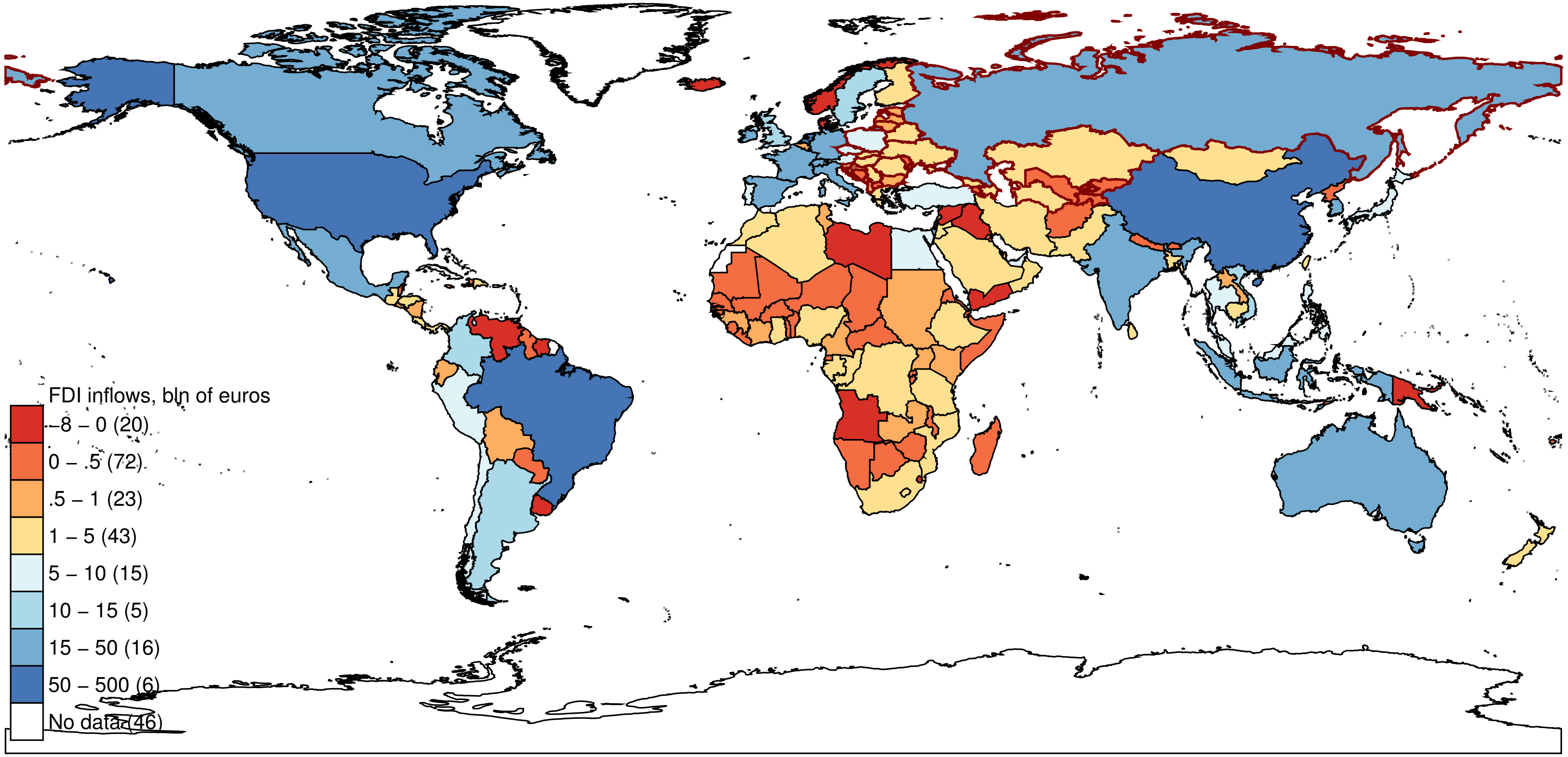

FIGURE A.6: FDI inflows by economy in 2017

Note: FDI inflows are measured in billion Euro. The number of countries in each category is shown in parenthesis in the legend. Transition countries are marked by red boarders.
Source: World Bank

TABLE A.3: Biggest FDI hosts in 2013 and 2017

Country name	Inflow Rank in 2017	Inflow Rank in 2013	Inflow Rank in 2017 among transition countries	Inflow Rank in 2013 among transition countries	FDI inflow in 2013, in bln Euro	FDI inflow in 2017, in bln Euro
United States	1	1			243.70	151.42
China	2	2			120.64	93.17
Hong Kong	3	4			92.33	55.86
Brazil	4	8			55.50	40.27
Singapore	5	6			54.87	43.20
Netherlands	6	11			51.29	38.43
France	7	16			44.07	25.77
Australia	8	7			41.03	42.68
Switzerland	9	87			36.27	0.87
India	10	17			35.32	21.20
British Virgin Islands	11	3			33.95	82.39
Cayman Islands	12	12			33.13	38.38
Germany	13	24			30.73	11.71
Mexico	14	13			26.28	36.46
Ireland	15	14			25.64	35.06
Russia	**16**	**9**	**1**	**1**	22.38	40.15
Canada	17	5			21.45	52.17
Indonesia	18	22			20.41	14.15
Spain	19	15			16.89	28.15
Israel	20	30			16.77	8.90
Czech Republic	35	46	2	4	6.56	2.74
Poland	41	58	3	8	5.69	2.06
Romania	44	47	4	5	4.57	2.71
Kazakhstan	46	31	5	2	4.10	7.76
Azerbaijan	56	62	6	9	2.54	1.98
Serbia	57	72	7	11	2.54	1.54
Hungary	62	51	8	6	2.20	2.56
Turkmenistan	63	55	9	7	2.05	2.15
Slovakia	65	194	10	28	2.01	-0.45
Ukraine	66	42	11	3	1.95	3.38
Croatia	68	96	12	15	1.86	0.72
Georgia	70	95	13	14	1.65	0.77
Belarus	80	65	14	10	1.13	1.68
Albania	86	86	15	13	0.99	0.95

Source: UNCDAT. Data are converted to EUR using official exchange rates by ECB.

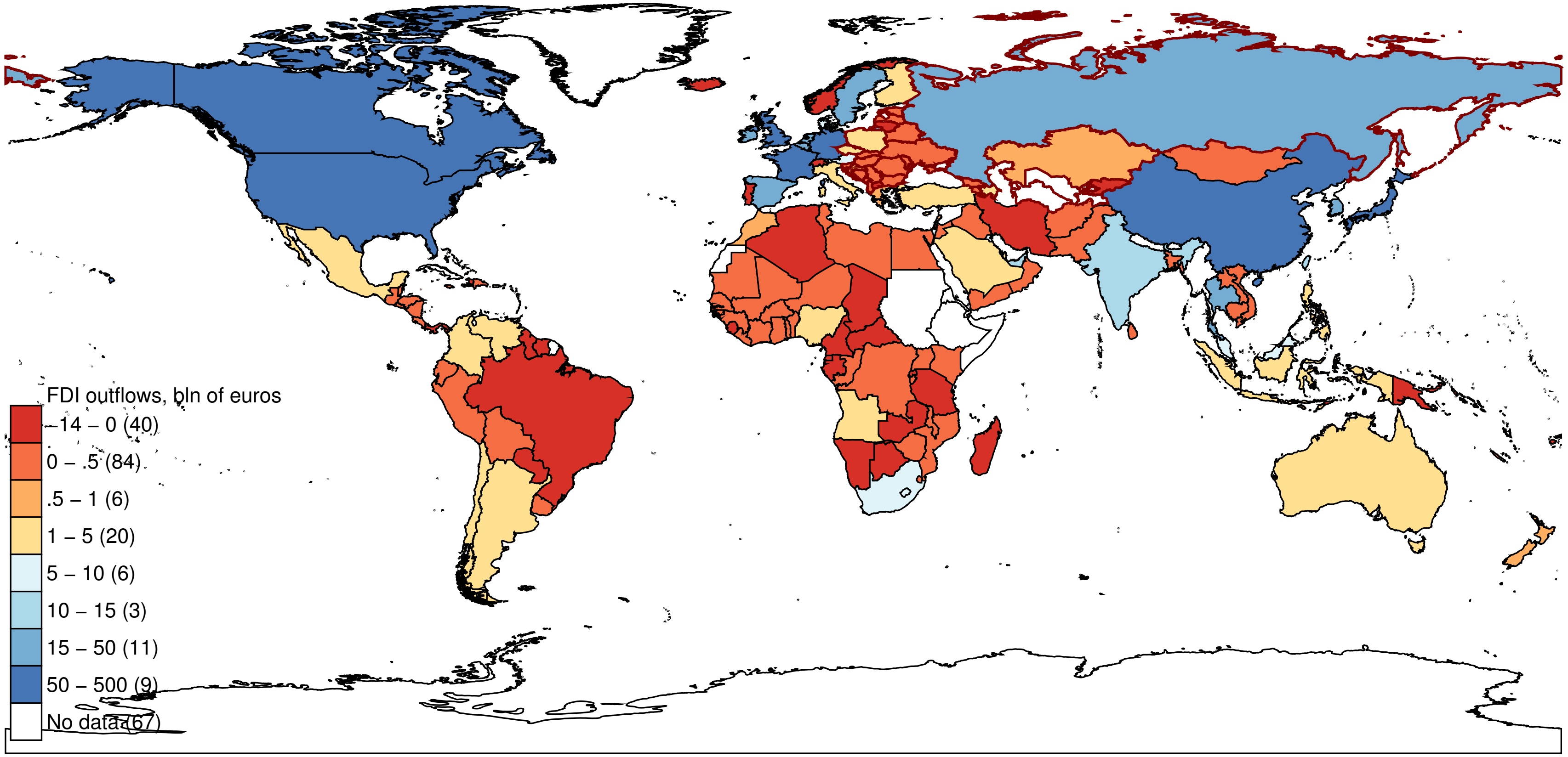

FIGURE A.7: FDI outflows by economy in 2017

Note: FDI outflows are measured in billions of euros. The number of countries in each category is shown in parenthesis in the legend. Transition countries are marked by red boarders.
Source: World Bank

TABLE A.4: Biggest FDI suppliers in 2013 and 2017

Country name	Outflow Rank in 2017	Outflow Rank in 2013	Outflow Rank in 2017 among transition countries	Outflow Rank in 2013 among transition countries	FDI outflow in 2013, in bln Euro	FDI outflow in 2017, in bln Euro
United States	1	1			302.89	228.14
Japan	2	2			141.99	102.07
China	3	4			110.29	81.09
United Kingdom	4	11			88.15	30.44
Hong Kong	5	5			73.31	60.73
Germany	6	10			72.86	31.78
Canada	7	8			68.13	43.14
British Virgin Islands	8	3			62.64	82.97
France	9	19			51.43	15.31
Luxembourg	10	18			36.42	16.61
Spain	11	25			36.09	9.64
Russia	**12**	**6**	**1**	**1**	31.89	53.15
Korea, Republic of	13	16			28.03	21.32
Cayman Islands	14	26			26.88	8.92
Singapore	15	9			21.84	33.41
Sweden	16	13			21.51	22.77
Netherlands	17	7			20.64	52.41
Belgium	18	14			18.52	22.17
Thailand	19	27			17.06	8.78
Ireland	20	15			16.47	22.08
Poland	36	177	2	25	3.18	-1.01
Azerbaijan	39	49	3	5	2.27	1.12
Czech Republic	44	38	4	2	1.44	3.02
Kazakhstan	51	42	5	3	0.70	1.72
Croatia	53	167	6	21	0.57	-0.13
Slovakia	58	172	7	24	0.31	-0.24
Hungary	59	47	8	4	0.28	1.42
Bulgaria	61	78	9	12	0.26	0.14
Georgia	64	84	10	13	0.24	0.09
Serbia	73	68	11	9	0.13	0.25
Slovenia	78	168	12	22	0.09	-0.16
Latvia	79	62	13	8	0.08	0.31
Bosnia and Herzegovina	93	96	14	14	0.04	0.03
Belarus	97	73	15	10	0.03	0.18
Albania	102	98	16	15	0.02	0.03
Armenia	106	105	17	17	0.02	0.02
Estonia	108	59	18	6	0.02	0.39
Montenegro	110	109	19	18	0.01	0.01
Romania	111	171	20	23	0.01	-0.21
Republic of Moldova	114	113	21	19	0.01	0.01
Ukraine	115	61	22	7	0.01	0.32
Kyrgyzstan	158	156	23	20	0.00	0.00
Macedonia	160	103	24	16	0.00	0.02
Lithuania	166	76	25	11	-0.03	0.14

Source: UNCDAT. Data are converted to EUR using official exchange rates by ECB.

Appendix B

Appendix to Chapter 2

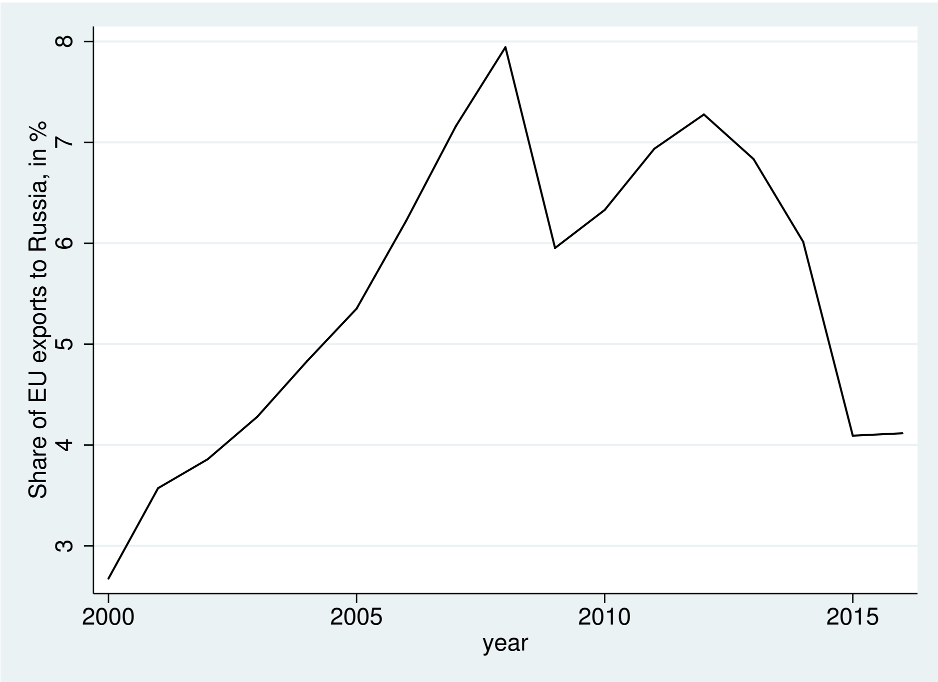

FIGURE B.1: EU-exports to Russia over total European exports between 2000 and 2016, in %

Source: Eurostat

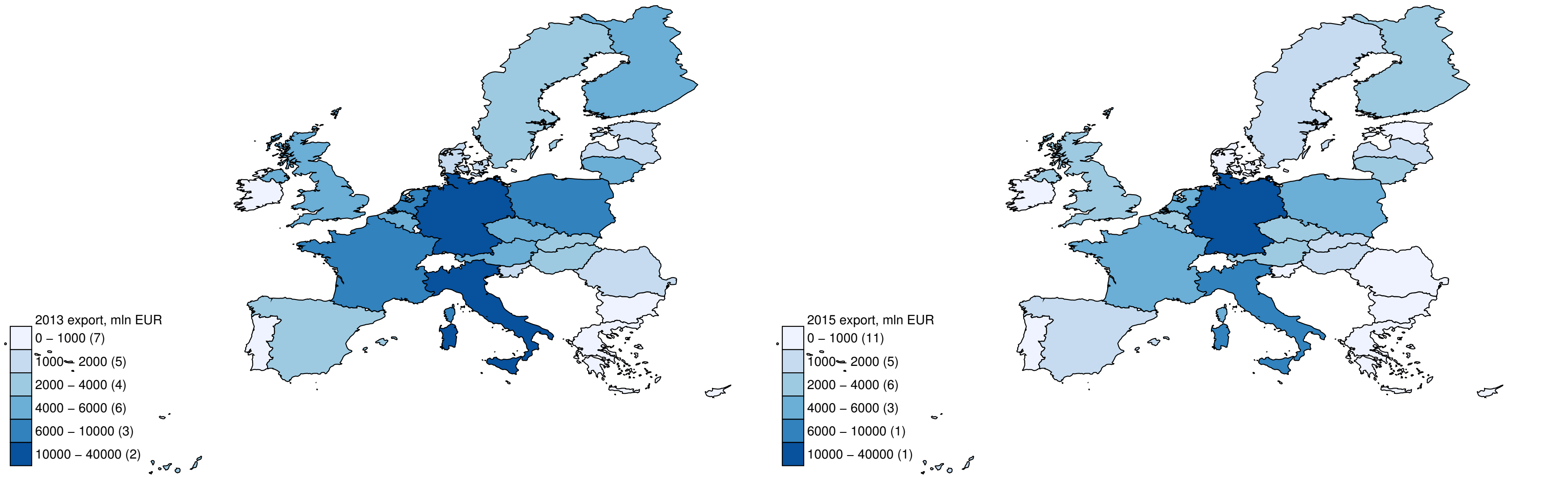

FIGURE B.2: EU-27 exports to Russia, in million Euro

Note: EU-27 exports to Russia in absolute values before the Ukraine conflict in 2013 (left) and in the second sanctions year, 2015 (right). The number of countries in each category is shown in parenthesis in the legend.
Source: Eurostat

TABLE B.1: VAR lag selection

	all exports	AtB	C	15t16	17t18	19	20	21t22	24	25	26	27t28	29	30t33	34t35	36t37
Austria	6	12	6	2	6	6	3	6	6	2	2	6	2	6	6	6
Belgium	6	6	6	2	6	6	4	6	6	6	6	6	6	2	6	7
Bulgaria	6	2		6	7			2	6	3	11	2	6	8	7	7
Czech Republic	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	6
Germany	6	6	3	3	6	6	6	6	6	8	6	6	6	6	6	6
Denmark	2	6		2	2	6	2	6	6	6	6	6	6	6	6	2
Spain	6	6	6	2	6	6	2	7	6	2	6	6	3	2	6	6
Estonia	6	2	6	6	2	6	7	2	8	6	6	6	6	6	6	2
Finalnd	6	2	2	6	6	2	6	2	6	6	3	6	2	2	6	3
France	6	6	2	6	9	6	2	2	6	6	2	2	6	2	6	6
Great Britain	2	4	6	4	4	4	5	4	4	4	4	2	7	4	6	4
Greece	6	11	12	6	2			6	11	6	6	12	11	6	2	3
Hungary	2	1		2	1	6	1	6	1	2	1	7	2	1	6	2
Ireland	2															
Italy	7	2	6	6	6	11	6	6	2	6	6	3	6	7	6	7
Lithuania	6	2	6	2	11	10	2	6	2	6	6	6	6	2	3	7
Luxembourg	6															
Latvia	2	2	12	2	3	11	7	6	2	6	2	6	2	6	2	6
The Netherlands	6	6	2	6	6	6	2	6	2	6	6	6	6	2	6	6
Poland	2	2	1	2	2	7	2	2	2	2	2	2	2	2	2	2
Portugal	6															
Romania	2															
Slovakia	2															
Slovenia	6															
Sweden	2	2	2	2	2	2	2	2	2	12	2	2	2	2	2	2

Notes: ISIC Sectors are abbreviated as follows: AtB - Agriculture, Hunting, Forestry and Fishing; C - Mining and Quarrying; 15t16 - Food, Beverages and Tobacco; 17t18 - Textiles and Textile Products; 19 - Leather, Leather and Footwear; 20 - Wood and Products of Wood and Cork; 21t22 - Pulp, Paper, Paper , Printing and Publishing; 24 - Chemicals and Chemical Products; 25 - Rubber and Plastics; 26 - Other Non-Metallic Mineral; 27t28 - Basic Metals and Fabricated Metal; 29 - Machinery; 30t33 - Electrical and Optical Equipment; 34t35 - Transport Equipment; and 36t37 - Manufacturing, Recycling

TABLE B.2: AIC criterion for each chosen lag. Part 1

	Sector	AUT	BEL	BGR	CZE	DEU	DNK	ESP	EST	FIN	FRA	GBR	GRC	HUN
	all exports	-10.834	-10.712	-10.087	-10.424	-11.492	-10.579	-10.594	-10.358	-11.338	-10.119	-10.077	-10.303	-9.577
AtB	Agriculture, Hunting, Forestry and Fishing	-7.822	-10.016	-7.362	-7.75	-9.31	-7.791	-8.666	-6.862	-8.321	-8.798	-7.052	-8.405	-7.222
C	Mining and Quarrying	-7.599	-5.68		-7.499	-8.459		-7.504	-7.917	-7.608	-7.823	-6.188	-6.116	
15t16	Food, Beverages and Tobacco	-10.328	-10.11	-9.248	-9.369	-10.458	-9.606	-9.889	-8.852	-10.9	-10.277	-8.84	-8.492	-8.963
17t18	Textiles and Textile Products	-9.515	-10.001	-8.321	-9.152	-10.771	-9.296	-9.839	-8.867	-10.323	-10.665	-9.72	-9.452	-7.973
19	Leather, Leather and Footwear	-8.862	-8.591		-7.021	-9.894	-6.669	-8.861	-6.395	-8.272	-9.129	-8.435		-5.157
20	Wood and Products of Wood and Cork	-9.343	-8.235		-8.041	-10.231	-6.436	-8.813	-8.647	-9.676	-8.295	-6.323		-6.719
21t22	Pulp, Paper, Paper , Printing and Publishing	-9.535	-8.952	-6.746	-9.35	-10.983	-8.351	-9.239	-8.572	-11.08	-9.725	-8.625	-5.419	-8.103
24	Chemicals and Chemical Products	-9.151	-9.64	-8.551	-9.168	-11.174	-9.295	-9.796	-8.73	-10.13	-10.719	-9.523	-9.128	-8.586
25	Rubber and Plastics	-10.27	-10.086	-8.451	-9.258	-10.963	-8.923	-9.696	-8.596	-9.929	-10.111	-9.864	-8.455	-9.175
26	Other Non-Metallic Mineral	-9.773	-8.465	-8.25	-9.889	-10.749	-7.27	-10.731	-8.885	-10.696	-9.988	-9.103	-7.632	-7.103
27t28	Basic Metals and Fabricated Metal	-9.399	-9.246	-7.105	-8.74	-9.831	-8.297	-9.268	-8.592	-9.727	-8.738	-8.514	-8.083	-7.656
29	Machinery, Nec	-9.535	-9.223	-9.556	-9.385	-10.947	-9.099	-9.369	-8.582	-10.167	-9.84	-9.44	-7.563	-7.601
30t33	Electrical and Optical Equipment	-9.263	-9.268	-8.662	-8.702	-10.804	-9.756	-9.034	-8.456	-9.735	-9.844	-9.595	-6.415	-7.713
34t35	Transport Equipment	-8.044	-8.791	-7.096	-8.5	-10.147	-8.584	-8.092	-8.839	-8.675	-7.339	-8.72	-5.887	-6.945
36t37	Manufacturing, Nec; Recycling	-8.931	-9.312	-7.568	-9.134	-10.56	-8.429	-9.299	-8.347	-10.009	-9.458	-7.413	-6.919	-7.14

Notes: Country codes are abbreviated as follows: AUT - Austria, BEL - Belgium, BGR - Bulgaria, CZE - Czech Republic, DEU - Germany, DNK - Denmark, ESP - Spain, EST - Estonia, FIN - Finalnd, FRA - France, GBR - Great Britain, GRC - Greece, HUN - Hungary. Due to infinitesimal exports with numerous monthly breaks from Cyrus and Malta, VAR models were not calculated for these countries. Only spillover effects could be calculated for these countries.

TABLE B.3: AIC criterion for each chosen lag. Part 2

	Sector	IRL	ITA	LTU	LUX	LVA	NLD	POL	PRT	ROU	SVK	SVN	SWE
	all exports	-9.488	-11.109	-11.15	-8.368	-10.803	-11.259	-10.871	-9.117	-9.272	-9.944	-10.211	-10.024
AtB	Agriculture, Hunting, Forestry and Fishing		-8.845	-9.418		-7.654	-10.138	-8.84					-4.895
C	Mining and Quarrying		-7.801	-7.65		-6.68	-7.928	-6.455					-6.066
15t16	Food, Beverages and Tobacco		-10.054	-10.189		-9.74	-10.194	-10.153					-8.846
17t18	Textiles and Textile Products		-10.753	-9.246		-9.487	-9.518	-9.816					-8.71
19	Leather, Leather and Footwear		-10.034	-6.414		-6.849	-8.537	-7.667					-7.159
20	Wood and Products of Wood and Cork		-10.121	-9.42		-8.378	-7.6	-10.28					-7.483
21t22	Pulp, Paper, Paper , Printing and Publishing		-10.138	-10.51		-9.233	-9.958	-10.605					-9.697
24	Chemicals and Chemical Products		-10.264	-9.813		-9.375	-10.361	-10.545					-9.816
25	Rubber and Plastics		-10.593	-10.036		-9.645	-10.168	-10.603					-9.479
26	Other Non-Metallic Mineral		-10.418	-9.766		-8.827	-8.729	-10.504					-8.565
27t28	Basic Metals and Fabricated Metal		-9.939	-9.821		-8.65	-9.8	-9.718					-8.929
29	Machinery, Nec		-10.305	-9.628		-9.186	-9.682	-9.58					-9.507
30t33	Electrical and Optical Equipment		-10.142	-9.514		-9.168	-9.92	-9.431					-7.963
34t35	Transport Equipment		-8.828	-9.118		-8.595	-8.671	-7.717					-8.135
36t37	Manufacturing, Nec; Recycling		-10.601	-9.824		-8.298	-9.412	-10.687					-8.433

Notes: Country codes are abbreviated as follows: IRL - Ireland, ITA - Italy, LTU - Lithuania, LUX - Luxembourg, LVA - Latvia, NLD - The Netherlands, POL - Poland, PRT - Portugal, ROU - Romania, SVK - Slovakia, SVN - Slovenia, SWE - Sweden. For several countries (IRL, LUX, PRT, ROU, SVK, and SVN) only total export forecasts could be calculated. Due to infinitesimal exports with numerous monthly breaks from Cyrus and Malta, VAR models were not calculated for these countries. Only spillover effects could be calculated for these countries.

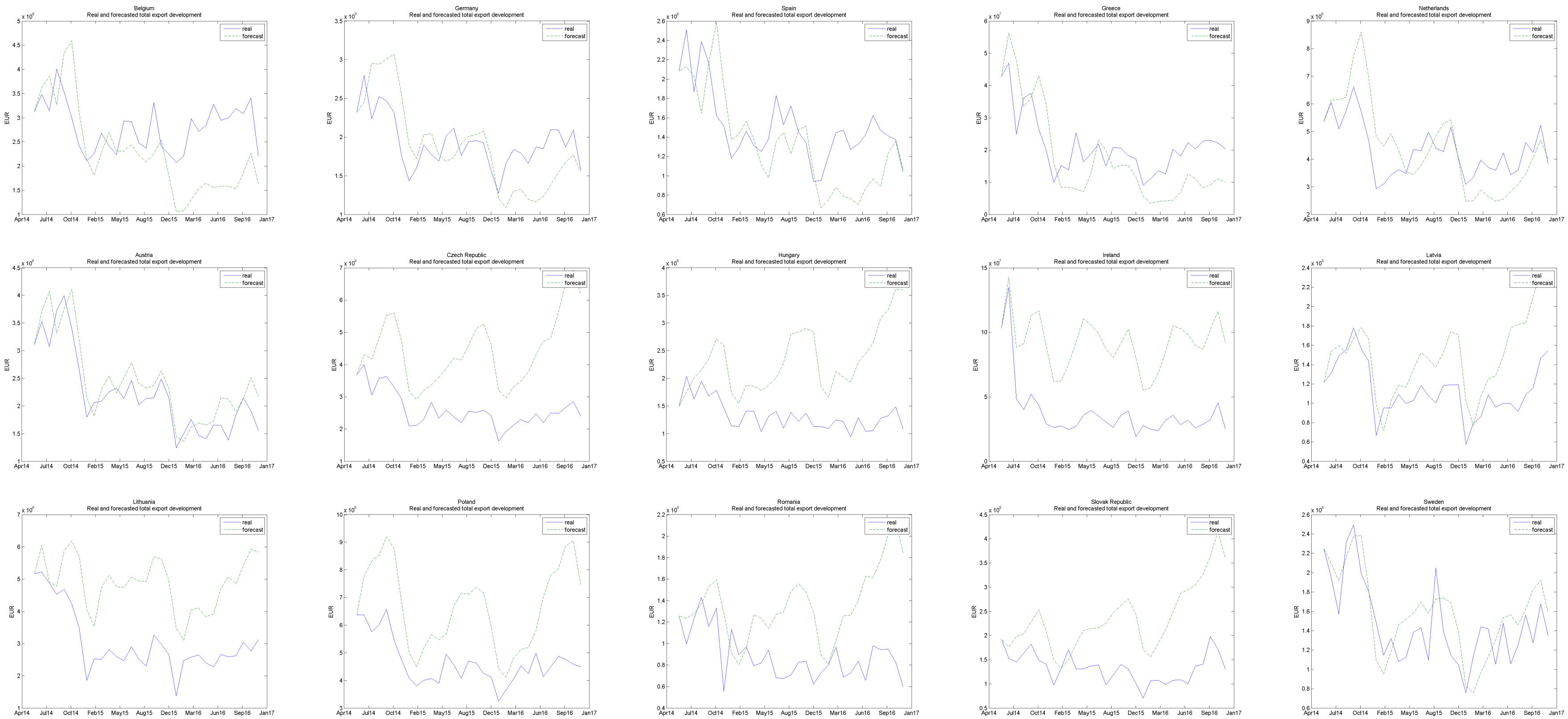

FIGURE B.3: Forecasted exports in levels for selected countries

Note: The countries are depicted as follows. First row (from left to right): Belgium, Germany, Spain, Greece, the Netherlands. Second row (from left to right): Austria, Czech Republic, Hungary, Ireland, Latvia. Third row (from left to right): Lithuania, Poland, Romania, Slovak Republic, Sweden

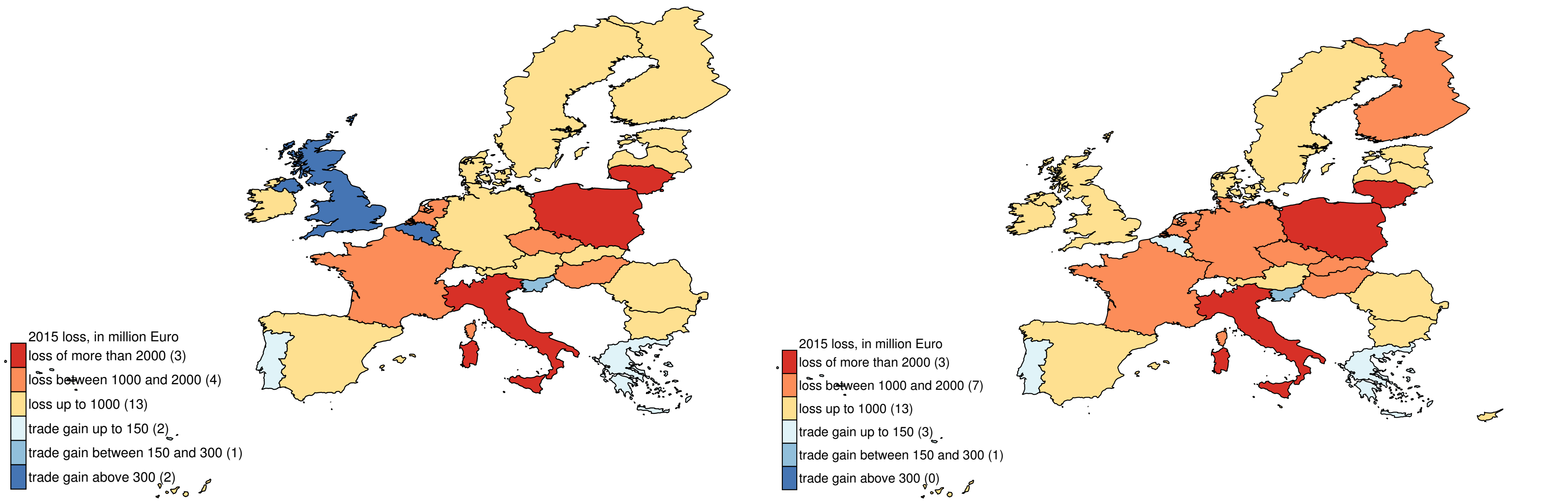

FIGURE B.4: EU-27 export losses due to sanctions in 2015, in million Euro

Note: EU-27 export losses: direct + indirect impact (left) and direct + indirect + spillover (due to intra-EU trade connectedness) impact, 2015 (right). The number of countries in each category is shown in parenthesis in the legend.
Source: own calculations

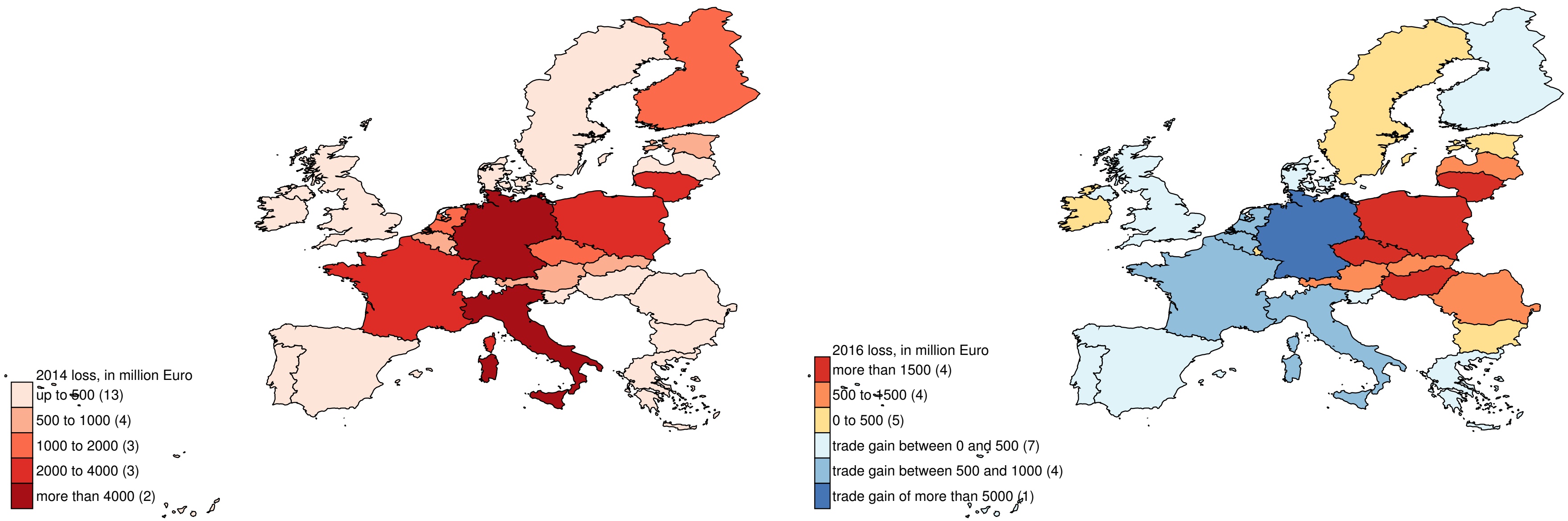

FIGURE B.5: Export losses due to sanctions in 2014 (left) and 2016 (right), in million Euro

Note: EU-27 export losses without considering for the intra-EU trade connectedness. The number of countries in each category is shown in parenthesis in the legend. The scale shows the biggest losses on the top, countries recovered from losses to a different extent are depicted in blue.
Source: own calculations

TABLE B.4: Summary of direct, indirect and spillover losses by country, in million Euro, per year and cumulative

	2014		2015		2016		2 Years		3 Years	
	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover
Austria	-508	-782	-711	-852	-613	-556	-1,218	-1,634	-1,831	-2,190
Belgium	-558	-956	392	125	1,313	1,410	-166	-831	1,147	579
Bulgaria	-173	-199	-107	-125	-19	-19	-280	-324	-299	-343
Cyrus		-3		-2		-1		-5		-6
Czech Republic	-1,792	-2,053	-1,724	-1,891	-1,707	-1,704	-3,515	-3,944	-5,222	-5,647
Germany	-5,648	-7,514	-292	-1,674	8,486	7,951	-5,940	-9,188	2,546	-1,237
Denmark	-262	-374	-165	-269	239	214	-426	-643	-188	-429
Spain	-476	-870	-420	-610	261	412	-896	-1,480	-634	-1,068
Estonia	-984	-1,027	-469	-540	-328	-380	-1,453	-1,567	-1,781	-1,947
Finalnd	-1,311	-1,484	-930	-1,073	346	286	-2,241	-2,557	-1,896	-2,271
France	-3,014	-3,654	-1,044	-1,404	3,003	3,179	-4,058	-5,057	-1,055	-1,879
Great Britain	-121	-685	351	-20	125	299	230	-705	355	-406
Greece	-136	-151	112	100	103	104	-24	-51	79	53
Hungary	-408	-566	-1,315	-1,410	-1,531	-1,532	-1,723	-1,976	-3,254	-3,508

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Table B.4 Summary of direct, indirect and spillover losses by country, in million Euro, per year and cumulative (continued)

	2014		2015		2016		2 Years		3 Years	
	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover	Direct + indirect	Direct + indirect + spillover
Ireland	-412	-490	-546	-593	-25	-3	-959	-1,083	-984	-1,087
Italy	-4,116	-4,834	-4,618	-4,927	693	856	-8,734	-9,762	-8,042	-8,905
Lithuania	-2,608	-2,641	-5,627	-5,663	-4,657	-4,685	-8,235	-8,304	-12,892	-12,989
Luxembourg	-51	-89	-50	-70	-5	9	-102	-159	-106	-150
Latvia	-300	-377	-620	-741	-766	-863	-919	-1,118	-1,685	-1,981
Malta		-4		-4		-2		-8		-10
The Netherlands	-1,331	-1,828	-1,050	-1,367	797	914	-2,381	-3,194	-1,584	-2,280
Poland	-3,099	-3,577	-2,021	-2,497	-1,760	-1,945	-5,120	-6,074	-6,880	-8,019
Portugal	-162	-215	74	46	36	59	-88	-169	-52	-110
Romania	-263	-331	-531	-581	-525	-533	-794	-912	-1,319	-1,445
Slovakia	-508	-646	-991	-1,105	-1,305	-1,356	-1,499	-1,751	-2,803	-3,107
Slovenia	-353	-387	219	193	265	263	-134	-193	132	70
Sweden	-172	-464	-496	-696	-393	-396	-668	-1,160	-1,061	-1,556
TOTAL	-28,768	-36,199	-22,577	-27,650	2,033	1,981	-51,345	-63,850	-49,313	-61,869

TABLE B.5: List of EU-27 countries, grouped by their overcoming of the crisis

Group 1. "less dependent" countries: Countries, recovered from the crisis until 2016	Group 2. "more dependent" countries Countries with sustainable losses until 2016
Belgium *	Austria
Germany	Bulgaria
Denmark	Czech Republic
Spain	Estonia
Finland	Hungary
France	Ireland
Great Britain *	Lithuania
Greece *	Latvia
Italy	Poland
Luxembourg	Romania
The Netherlands	Slovak Republic
Portugal *	Sweden
Slovenia *	Cyprus **
	Malta **

Notes: * denotes countries that recovered already in 2015, ** denotes two countries, for which only losses due to the EU-interconnectedness could be considered

Appendix C

Personal contributions to the papers of the cumulative thesis

EU and Russian sanctions: how big is the economic impact within the European Union?

This paper was designed solely by myself, including data collection, analysis and writing. The work has benefited from valuable advise and comments from the colleagues and participants of the numerous conferences where I had a chance to present this paper.

Impact of political risk on FDI exit decisions: the case of Russia

This paper is a joint work with Dr. Ksenia Gonchar, Leading Research Fellow at the Institute for Industrial and Market Studies at the Higher School of Economics in Moscow, and Dr. Philipp Marek, Economist at the Research Centre of the Deutsche Bundesbank. This study develops further the series of analyses, that were performed in the working group of Prof. Jutta Günther, on the decisions of foreign investors in transition economies, including the work by Gonchar and Marek 2014. The new paper addresses the issue that is not sufficiently researched in the existing empirical literature. In particular, the impact of political risks on the disinvestment decision has been rather generally scarcely studied in economics and international business. Therefore, we decided to contribute to closing this research gap.

The research was conducted jointly by Ksenia and myself. Specifically I have contributed to the construction of the microeconomic database, the development of hypotheses, the development of the econometric strategy, as well as by running the regressions and further description of findings. Ksenia contributed specifically with the initial design, and most of the writing. Whereas Philipp contributed to the compilation of the dataset.

How innovation affects performance

This is the latest paper, elaborated together by Ksenia Gonchar and myself. It was designed, and conducted jointly from scratch. The distribution of labour was minimal and fully balanced. Thus, Ksenia contributed by providing the survey and registry data, deriving hypotheses and writing, while I carried out the literature review and worked on the empirical design, applying the three-stage CDM model to the cross-section and panel data, as well as other models employed in the study. Also, I put together the strategy and the results discussion in the light of the existing empirical literature.

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