

Faculty of Business Studies and Economics

University of Bremen

Doctoral Thesis

Transition economies and the impact of crises

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.

Date of submission:

17.12.2021

Date of colloquium

22.04.2022

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Bremen, 2021

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List of Abbreviations

CIS	Commonwealth of Independent States
CEEC	Central and Eastern European Countries
CEECCA	Central and Eastern Europe, the Caucasus and Central Asia
EBRD	European Bank for Reconstruction and Development
EI	Environmental Innovation
EU	European Union
FDI	Foreign Direct Investment
FSU	Former Soviet Union
GDP	Gross Domestic Product
GFC	Global Financial Crisis
IMF	International Monetary Fund
OECD	Organisation for Economic Co-operation and Development
R&D	Research and Development
USA	United States of America

1 Chapter

Introduction: Crises, transition economies and innovation

Katharina Friz

Abstract:

This chapter provides the framework for the underlying dissertation. The focus of this dissertation is on the innovation behaviour of companies from transition countries in the context of crises as well as political support in the context of geopolitical and economic tensions. First, an overview of the three selected crises is given, as well as a review of the transformation history of the countries under consideration. This is followed by a comprehensive overview of the theoretical framework. In order to provide a holistic perspective, an outline of the other chapters of the dissertation is also given. Finally, the summary formulates some important conclusions and implications.

Key words: transition economies, crisis, innovation, environmental innovation

JEL classification: O12, O31, O57, F51, D72

1.1 Introduction

The term 'crisis' is a catchword suggesting dramatic culmination and developments, but it is not specifically defined. The word is used frequently in many contexts, such as in literature or mass media, and therefore varies in its description of magnitude and drama. The term defies clear definition or delimitation and is only as precise as the context of use (Starn, 1971). The word itself comes from the Greek word '*krisis*', which means distinction or decision (Schubert & Klein, 2018). It was first used in the context of diseases and war, but analogies developed over time, and by the 19th century the term "crisis" was quickly extended to describe basically any time of turmoil or tension (Starn, 1971).

Crises serve researchers as a starting point to determine the facts of an event and to classify them in development patterns. They occur at unequal intervals and differ in value and impact. Importantly, they often flank transitions from one phase to another and provide the impetus for major periodic changes throughout history. Crises thus mark key points in change processes, so-called moments of truth (Starn, 1971). They shape the course of events and force responses with uncertain outcomes from elites, mass public, or institutions (Starn, 1971; Widmaier et al., 2007).

In economic theory, a crisis is often described as the result of a malfunctioning market mechanism (Burnham, 2011). A crisis is seen as a severe and sudden disruption of the complex equilibrium between supply and demand of goods, services and capital (Starn, 1971). Thus, crises separate a growth phase from a contraction phase in the business cycle (Starn, 1971) and raise uncertainty about the future (Bloom, 2007). In political theory, too, a crisis is seen as an event that throws the processes of a system out of balance. It often leads to the functionality and structures of the political system being called into question. These moments of disruption lead to uncertainty and institutional instability until the system adjusts to the new circumstances (Offe, 1976). The economic and political systems are not separate from each other and phases of uncertainty or instability are transferred to each other. Crises and the resulting uncertainties also affect economic actors like companies and influence their behaviour in terms of, for example, hiring, investment and innovation (Bloom, 2007, 2009).

In today's world, marked by simultaneous crises such as a global pandemic, a global economic shock and global climate change, politics, business and science are called upon to push for

appropriate solutions (Porfiriev, 2016). In the face of these crises, it is of great relevance to examine how countries deal with crises and how crises affect them.

The group of countries studied in this dissertation is unique in that all countries have experienced a system break and restructured their economic systems in the course of transition from a planned to a market economy. Although these transition economies differ in size, geopolitical location and economic development, they all carry the same recent socialist past. Hence, they share inherited similarities in governance structure, public institutions and infrastructure (OECD & IEA, 2015). Against this background, it is therefore of great relevance to examine whether this past has left these countries more vulnerable in the context of the recent crises, especially with regard to the innovation behaviour of companies. This is because the market-based economic system, and in particular market-based innovation systems, are still relatively young and in the process of developing a technological profile and networks between actors and institutions. This makes these countries more vulnerable to external shocks compared to older market-based countries and puts the achievements of transformation at considerable risk.

This thesis comprises this introductory chapter and three scientific articles (Chapters 2-4). The first two scientific articles contribute to the understanding of the determinants of innovation and environmental innovation in the context of crisis. Due to the special features of innovation during crises, and in particular the special features of environmental innovations, these papers are of great relevance. The third research paper investigates the so-called 'rally around the flag effect' in the context of the Crimean crisis and the economic downturn in Russia. Thus, it enriches the understanding of the nature of the rally effect in an authoritarian environment. In today's world, where authoritarian populism is on the rise, it is of great importance to understand the mechanisms that can trigger changes in public opinion.

The introductory chapter of this dissertation is structured as follows. Section 1.2 gives an overview of the crises addressed in this dissertation. In the following Section 1.3, the historical background of the selected countries will be discussed in more detail and their distinctive features will be highlighted. Section 1.4 gives a theoretical framework and describes the Schumpeterian theoretical considerations of this dissertation. Section 1.5 provides an overview of the three remaining chapters of the thesis. Finally, Section 1.6 draws conclusions and provides an outlook on future research.

1.2 The crises under study

This dissertation deals with three crises, which are presented in more detail in this section.

The first two crises, the global financial crisis of 2008/2009 and the international Crimean crisis of 2014/2015, despite having different causes and characteristics, have the commonality that both have peaked already and forced a decision on how to deal with them. The other crisis, namely the current global climate crisis, is different both in respect to its longer emerging aspect and the fact that it has not yet reached its peak. Another difference is that when this peak is reached, the tipping points of current ecosystems may be irreversibly damaged (Moore, 2018). It is therefore necessary to act in advance.

1.2.1 The financial crisis of 2008/2009

The International Monetary Fund (IMF) described the global financial crisis (GFC) of 2008/2009 as 'the deepest global recession since the Great Depression' (IMF, 2009). It was long considered the most severe economic crisis of the post-war era and was only eclipsed last year by the economic consequences of the global COVID-19 pandemic (Blankenburg & Palma, 2009; Burnham, 2011; IMF, 2020; Nicola et al., 2020). The economic crisis began in 2007, initially as a real estate crisis in the United States of America (USA). It then quickly turned into an international financial crisis¹ that culminated in the bankruptcy of Lehman Brothers in September 2008, sending shockwaves around the world (Adu-Gyamfi, 2016; Azadinamin, 2012). This triggered a total loss of confidence worldwide and in order to save the banking system, many state governments around the world had to intervene. Thus, the initially local US real estate disaster soon became a crisis of public finances for many countries (Burnham, 2011).

This global crisis hit the region of Central and Eastern Europe, the Caucasus and Central Asia (CEECCA) in October 2008. Ukraine's banks were the first to falter. Due to the market plunge,

¹ The detailed cause of the crisis was a series of decades of misguided developments such as complexly structured financial products, combined with a lack of transparency within this financial structure, inadequate control and regulation and poor risk management. The vulnerability of the financial system became evident in 2007 when the real estate market in the USA collapsed. This housing crisis is also known as the subprime crisis because when the prime market dried up, US banks extended mortgage loans to people with poor credit ratings. These mortgages were bundled and sold to other banks or investors around the world, with the only collateral in case of default being the property itself (Azadinamin (2012); Burnham (2011); Reinhart and Rogoff (2008).

the National Bank of Ukraine was compelled to bail Prominvestbank, the sixth largest bank of the country (Smith & Swain, 2010). Shortly afterwards, short selling forced Hungarian bank OTP, one of Central Europe's biggest independent commercial banks, into financial distress (Andor, 2009; Smith & Swain, 2010). Subsequently, the crisis spread to the surrounding economies and has caused severe recessions in many countries (Fagerberg & Srholec, 2016; IMF, 2009). For many transition countries, the GFC was the first profound economic crisis since the transition from a planned to a market economy, ending a sustained period of economic growth in many of them (Connolly, 2012; EBRD, 2009; Smith & Swain, 2010).

In the following, I will describe how this economic downturn has affected the group of countries under study. Table 1.1 shows the annual growth in GDP for 29 transition economies between 2005 and 2011.

As Table 1.1 shows, all countries experienced a sharp contraction in growth. The Baltic states of Estonia, Lithuania and Latvia and the Eastern European and Caucasian countries of Armenia and Ukraine were the countries with the sharpest decline in GDP growth in 2009. The Baltic states in particular had built up high imbalances in their economies in the 2000s and had some of the highest current account deficits in the years leading up to the crisis (Andor, 2009; Kattel, 2010). The Baltic countries, being small and highly liberalised economies, were very dependent on capital flows and energy imports. In addition, they were also highly affected by a large credit-financed bubble in the real estate sector (Kattel & Raudla, 2013; OECD, 2009a; Smith & Swain, 2010). This made them highly vulnerable to the effects of the financial crisis. What the Baltic states had in common with Ukraine and Armenia was the prevalence of foreign currency lending (Åslund, 2009; Drahekoupil & Myant, 2010; Smith & Swain, 2010). The balance of payments deficit hit Ukraine particularly hard due to its dependence on commodity exports, especially steel (Smith & Swain, 2010). The worldwide decline in demand for metal products in the real economy triggered a crisis in the Ukrainian banking sector, as the private sector was no longer capable of financing its foreign debt (Smith & Swain, 2010). Foreign investors and rating agencies put further pressure on the state, leading Ukraine to require financial support from the IMF (Andor, 2009; Åslund, 2009).

Table 1.1: Annual GDP growth (in %) by Country

Country	2005	2007	2008	2009	2011
Central Europe and the Baltic states					
Croatia	4,17	5,09	1,91	-7,23	0,15
Czech Republic	6,45	4,96	1,84	-5,20	1,55
Estonia	10,12	8,07	-4,83	-14,27	7,75
Hungary	4,45	0,40	1,24	-6,55	2,23
Latvia	11,93	10,93	-2,31	-12,83	8,43
Lithuania	9,50	12,44	3,68	-13,89	8,46
Poland	3,55	7,12	4,19	2,76	4,70
Slovak Republic	6,61	10,80	5,48	-5,58	2,71
Slovenia	3,62	6,38	3,35	-8,38	0,65
South Eastern Europe					
Albania	6,07	6,78	8,33	4,05	2,82
Bosnia and Herzegovina	8,73	5,93	5,68	-2,53	2,18
Bulgaria	7,96	7,34	6,83	-2,75	3,01
Montenegro	4,03	6,66	7,03	-6,00	3,12
North Macedonia	4,56	6,36	5,38	-0,44	2,25
Romania	5,32	8,83	11,14	-4,73	2,41
Serbia	5,85	6,87	6,11	-2,34	2,85
Eastern Europe and the Caucasus					
Armenia	6,07	6,78	8,33	4,05	2,82
Azerbaijan	26,66	24,05	8,29	7,12	-2,85
Belarus	10,15	9,10	10,58	0,42	5,57
Georgia	10,29	13,17	2,73	-2,79	8,26
Moldova	7,76	3,24	8,01	-5,88	5,88
Ukraine	3,75	8,24	2,86	-14,38	5,85
Russia	6,81	8,69	5,25	-7,83	4,22
Central Asia					
Kazakhstan	8,73	7,66	1,38	-0,79	5,87
Kyrgyz Republic	-1,30	7,51	7,38	1,65	4,67
Mongolia	5,98	8,76	7,32	-2,82	15,15
Tajikistan	4,71	5,66	5,70	1,72	5,03
Turkmenistan	11,82	9,69	13,18	4,57	12,77
Uzbekistan	5,71	7,93	7,29	6,24	4,93

Source: World Bank Indicators

In addition to the Baltic states, the other EU member states were also hit hard by the crisis. Again, the countries suffered from the collapse of the foreign market as well as the weakening of the domestic market due to rising unemployment, budget constraints and tight credit conditions (OECD, 2009a). In particular, Croatia, Hungary, and Slovenia were hit the hardest. Despite its comparatively strong market institutions, Hungary particularly struggled due to its financial vulnerabilities. The country had relatively high public debt to GDP ratios as well as external debt to GDP ratios (Andor, 2009). Poland, on the contrary, was able to avoid a

recession because, among other factors, trade dependence was relatively low and private sector indebtedness was moderate (Kattel, 2010; OECD, 2009a).

Some former Soviet Union (FSU) countries in Central Asia and the Caucasus also managed to avoid a severe recession despite the crisis (see Table 1.1). This was the case for Azerbaijan, Turkmenistan and Uzbekistan. These countries are mainly energy exporters and benefited from the energy price bubble of 2007 to 2008, which boosted their current account balance (Smith & Swain, 2010).

Russia had also benefited from strong oil revenues in previous years and therefore did not fall into a debt crisis, even though the country fell into a severe recession (OECD, 2009a). The high reserves also enabled the Russian state to pursue a counter-cyclical policy and save its private sector companies from insolvency (Drahokoupil & Myant, 2010; Smith & Swain, 2010).

The crisis unfolded differently in the Central and Eastern European Countries (CEEC) and FSU countries also due to the different degree of integration into the international financial markets and dependence on the European export market (Smith & Swain, 2010). The fact that some transition countries were hit so hard by the crisis, especially many countries that were highly developed in terms of market institutions, divided opinions in the scientific community. On the one hand, it was argued that the crisis was an external shock and that integration into the European financial system was instrumental in mitigating it (Drahokoupil & Myant, 2010; EBRD, 2009). On the other hand, this vulnerability to the crisis was attributed to the structural developments during the transformation phase and was not considered surprising (Kattel, 2010; Kattel & Raudla, 2013). In particular, it was argued that the credit- and consumption-fuelled growth in previous years had overshadowed many structural problems in these countries (Kattel, 2010; Smith & Swain, 2010; Tiits et al., 2008). According to Kattel (2010) and Tiits et al. (2008), the crisis reflected the weak linkages in domestic production and limited increases in knowledge intensity. Myant et al. (2013) also critically pointed out that in many transition countries the crisis was not used to address long-term economic weaknesses in innovation, technology, and research in order to build a knowledge-based economy. In contrast, the focus of the political debate often shifted to deficit reduction in the state budget. The GFC was the first “post-transition” recession for many transition economies (Connolly, 2012; Smith & Swain, 2010). Negative shocks on this scale can be one of the major constraints

on the achievements of transition countries since the 1990s (Berglof et al., 2015), putting at risk their efforts to restructure their innovation systems. The fact that such achievements were relatively recent at the time of the crisis put even more pressure on understanding how this crisis impacted the development of these countries. How the GFC affected the innovation behaviour on the firm-level in these countries is discussed in Chapter 2 in more detail.

1.2.2 The Crimean crisis

This section provides an overview of the events that led to the annexation² of the Crimean peninsula and beyond.

The Euromaidan protests in Ukraine in 2013-2014, triggered by Ukrainian President Viktor Yanukovich's decision to not sign the EU Association Agreement in November 2013, was the beginning of a dramatic sequence of political events (Onuch & Sasse, 2016). The ongoing and escalating protests led President Yanukovich to flee to Russia on the night of 21 February 2014 (Frye, 2021; Katchanovski, 2016). On the 27th of February, troops without insignia (or Russian 'green men') seized administrative buildings in Crimea, blockaded Ukrainian military posts therein, and raised the Russian flag. On March 6, 2014, a newly established Crimean parliament issued a decree "on the holding of a referendum throughout Crimea", scheduled for March 16, 2014 (Katchanovski, 2016; Podolian, 2015). The day after the referendum, Russian President Vladimir Putin signed a decree recognising Crimea's independence from Ukraine. One day later, on March 18, 2014, Russia and the Crimean institutions signed an agreement on the incorporation of the Republic of Crimea³ into the Russian Federation (Grant, 2015).

² or according to the official Russian narrative: the reintegration of Crimea into the Russian Federation

³ In order to understand why the Crimea is of such importance to the Russian Federation, it is important to take a look at the Crimean history, which is deeply interwoven with Russian history. The peninsula came into the possession of the Russian Empire in 1783, when it was obtained from the disintegrating Ottoman Empire. Crimea was then visited by many Russian writers (e.g. Alexander Pushkin in the 1820s), which anchored the peninsula in the Russian collective memory as an integral place of Russian culture. Later on, it was integrated into the Soviet Union, in 1922, becoming a popular resort destination among the working population. In 1954, Crimea was transferred from the then Russian Federation to the then Ukrainian Soviet Socialist Republic. This was more of a symbolic gesture at the time, since Ukraine was still part of the USSR. However, as a direct successor state, the peninsula became part of Ukraine after the collapse of the Soviet Union (Jobst (2020); Plokhy (2000); Podolian (2015)). In addition to its historical significance, Crimea is also of military importance. The main base of the Russian Black Sea Fleet is stationed in the Crimean port of Sevastopol, and since Ukraine's independence, the port has been leased to Russia (Alexseev and Hale, 2016; Plokhy, 2000).

The referendum held in Crimea violated the Ukrainian constitution (and its territorial integrity), and Western states also recognize a violation of international law – even if Russia interprets it differently (Burke-White, 2014; Grant, 2015; Podolian, 2015; Tierney, 2015). Accordingly, the Western international community reacted with harsh criticism of Russia⁴. The USA and the European Union (EU), implemented sanctions against Russia, supported by Albania, Australia, Canada, Iceland, Japan, Liechtenstein, Moldova, Montenegro, Norway, Switzerland, and Ukraine (Dreyer & Popescu, 2014). The severity of sanctions was gradually increased, using targeted (or smart) sanctions, which have been common since 2001⁵. Initially, diplomatic and individual sanctions were imposed by the EU. These included the suspension of a visa facilitation agreement and a new bilateral agreement between the EU and Russia, exclusion from the G8 summit, and the freezing of assets and visa bans on key individuals and companies in Russia and Ukraine. A further level of escalation was reached after the shooting down of the commercial flight MH17 on 17 July 2014. Sectoral economic sanctions were then imposed. These included a ban on loans to five major Russian state banks (e.g. Sberbank) and to six energy and defence companies (e.g. Rosneft), as well as a ban on financial transactions with a maturity of more than 30 days and a ban on the export of energy equipment for technology-intensive Russian energy projects. An embargo was also imposed on trade in military and dual-use goods, i.e. civilian goods that could be used for military purposes (Dreyer & Popescu, 2014; European Council, 2021a; Frye, 2018).

The durability of the sanctions was initially in doubt, as economic sanctions have never before been imposed on an economy of this size (Korhonen, 2019). Nevertheless, the sanctions have lasted for over six years at the time of this dissertation's writing and, according to the latest decision of the Council of the European Union, will remain in force until 2022 (European Council, 2021b). The Russian government responded with counter-sanctions in August 2014 and imposed an import ban on agricultural products against Western countries (EU, USA and

⁴ Alongside this, a military conflict between a pro-Russian separatist movement and Ukraine's troops has been ongoing in the Eastern regions of Ukraine since March 2014. The Russian government is accused of supporting the separatist mobilisation by sending troops and military resources to these local militias, with the aim of further destabilising the region (Frye (2021); Malyarenko and Wolff (2018).

⁵ After the humanitarian tragedy in Iraq triggered by comprehensive sanctions, targeted sanctions are now being used to affect those responsible and targeted sectors of the economy, sparing the general population (Rudolf (2007).

others) (Crozet & Hinz, 2020). According to the current situation, the Russian measures will remain in force until the end of 2021.

The economic sanctions overlapped with two other negative economic developments in Russia: a sharp fall in oil prices and a sharp decline in Russian currency (rouble) (Dreger et al., 2016). Between June 2014 and January 2015, the world oil price fell dramatically from 111 dollars per barrel to 48 dollars per barrel, losing more than half of its value (Tuzova & Qayum, 2016). Since oil revenues account for about half of government revenues, the sharp drop in oil prices led to fiscal difficulties. Moreover, lower oil revenues mean lower demand for the Russian currency, which caused a massive devaluation of the rouble. Between June and December 2014, the Russian rouble depreciated by 59% against the US dollar (Aganin & Peresetsky, 2018; Tuzova & Qayum, 2016; World Bank, 2015). The currency depreciation was exacerbated by capital flight. The fall in oil prices weakened confidence in the state of the economy, which, combined with sanctions against Russia and political uncertainty, led Russian citizens and foreign investors to withdraw their assets from the country. The central bank intervened and raised the interest rate to 17% in December 2014 to stabilise the currency and stem capital flight (Dreger et al., 2016; OECD, 2015; Tuzova & Qayum, 2016). As a result of these events, the country's GDP contracted by almost 3% from the moderate growth of 0.7% in 2014 to the negative growth of -2% in 2015 (see Figure 1.1).

The question of how much the sanctions have influenced the economic downturn in Russia has been investigated in various analyses. Results so far suggest that the economic downturn was largely caused by the oil price shock, although economic sanctions also had a negative effect (Aganin & Peresetsky, 2018; Crozet & Hinz, 2020; Dreger et al., 2016; Hoffmann & Neuenkirch, 2017; Kholodilin & Netšunajev, 2019; Pestova & Mamonov, 2019). According to this, the sanctions have fulfilled their purpose, which was not to defeat the Russian economy, but rather impose a "clear economic price for Russia's undesirable actions" (Korhonen, 2019).

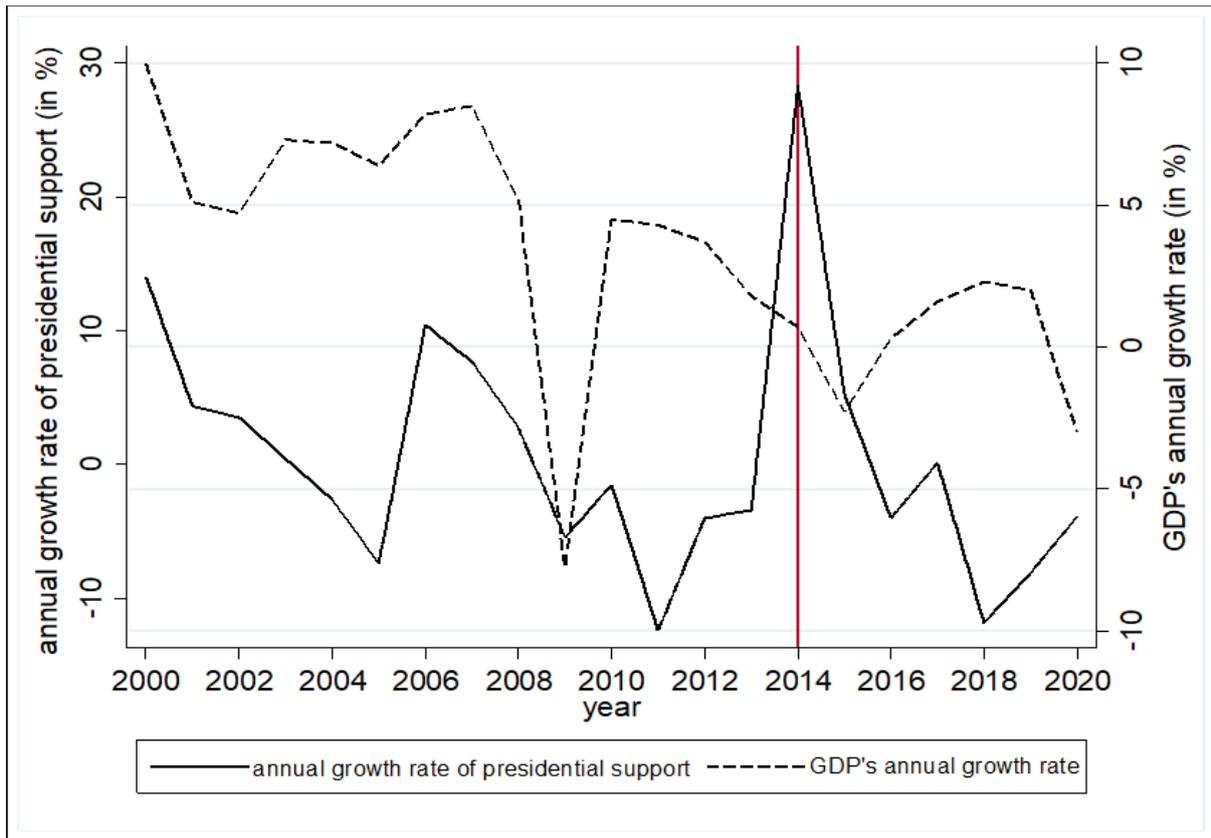


Figure 1.1: Putin's growth rate of annual approval and Russia's annual growth rate of GDP (2000-2020).

Note: The red vertical line marks the year 2014 during which geopolitical tensions arose.

Source: Levada data and World Bank data

The Crimean crisis and its related effects are currently the severest political stalemate between Russia and Western states since the end of the Cold War (Podolian, 2015). It is remarkable from different perspectives: legal, political and, of course, economic. A look at public opinion also raises relevant questions. In general, the assessment of a president's job performance depends very much on a country's economic state: the approval rate rises and falls with an economic recovery or recession, respectively (Ostrom & Simon, 1985; Tir & Singh, 2013). This is true for both democracies and autocracies (Guriev & Treisman, 2020). Therefore, despite a sharp economic contraction, the increase in public support is surprising at first glance. Although Russia has struggled with both economic and geopolitical tensions, average support for President Putin grew by 28% from 2013 to 2014 — the highest growth rate during his entire time in office — and by as much as 5% in 2015, when the economic crisis was at its peak (see Figure 1.1). This phenomenon is explored in more detail in Chapter 4.

1.2.3 The climate crisis

After reviewing the global financial crisis and the political crisis in Crimea, we now turn to the global climate crisis or anthropogenic climate change. As already mentioned in Section 1, economic and political crises are similar in that both disrupt and distress an existing system, but there are also similarities to the climate crisis. Very simply and briefly put, changes in the atmospheric amount of greenhouse gases and aerosols, particularly due to human activities, and natural variations in external forcings, cause the energy balance of the climate system to become unbalanced and realigned (IPCC, 2007). This, in turn, affects the Earth's ecosystems (IPCC, 2007). The magnitude of these changes in the system processes is, of course, much greater and more complicated.

Changing geographical conditions, combined with the numerous political, economic and institutional changes that occurred since 1991 (see next Chapter), make transition countries more vulnerable to the environmental variations caused by climate change (Lioubimtseva & Henebry, 2009). Many of the transition countries, such as Russia, the countries of Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) and Eastern Europe, are projected to face warming (2.5 to 6.5 degrees warmer, depending on the estimated model scenario, season, and local climate zone) above the global mean (Anders et al., 2014; Doose, 2020; Maselli, 2019; Zhupankhan et al., 2017). This warming leads to critical changes in these and the rest of the transition countries. According to climate modelling, climate change will (and already does) profoundly impact water resources and natural hazards⁶ in Central and Eastern Europe, Central Asia and the Caucasus (Fay et al., 2010; Maselli, 2019; Sillmann et al., 2017). In terms of heat extremes (defined as 3 or 5 standard deviations from the mean temperature), this means that air temperatures in the warmest 10% of summer nights from 1961 to 1990 will account for about 30% (in a 2 degree warmer world) to about 90% (in a 4 degree warmer world) of summer nights by the end of the century (Maselli, 2019; Sillmann et al., 2013).

⁶ Some of the recent extreme weather events include heatwaves in 2010 and 2021 in Russia, in 2015 in Poland and Ukraine, 2019 in Kyrgyzstan and Tajikistan, extreme forest fires in Siberia in 2019 and 2021, droughts in 2020 in Romania, Bulgaria and Ukraine, as well as floods in Kazakhstan and Kyrgyzstan in 2017, in Caucasus 2018, and in southern Russia and Crimea in 2021.

Warmer temperatures also cause glaciers to recede, reducing the amount of winter precipitation that falls and is stored as snow. Although the melting of glaciers means that more water is available in the valley basins in the short term (especially in summer), the long-term effects on the availability of water in summer are a cause for concern - especially in Central Asia, which depends on the inflow of water from the mountains for irrigation (Fay et al., 2010; Maselli, 2019). Besides the effects caused by the reduction of glaciers, other precipitation patterns are also affected by global climate warming. The changes in precipitation are more difficult to predict, partly because the formation processes are more complex and also because of the high spatial and temporal variability (Anders et al., 2014; Xenarios et al., 2019). In very general terms, it is assumed that wet regions become wetter and dry regions drier, making the occurrence of droughts or floods more frequent and severe (Fay et al., 2010; Maselli, 2019). A negative trend in precipitation is clearly discernible for the transition countries in South Eastern Europe and Central Asia (Anders et al., 2014; Fay et al., 2010). Water availability can also lead to political tensions. This is particularly critical in Central Asia, where competing claims for water resources have caused tensions and conflicts since the collapse of the Soviet Union and the associated independence of the individual states in this region (Zhupankhan et al., 2017).

In addition, warming and the associated weather extremes threaten housing, infrastructure, road maintenance, and waterworks (Fay et al., 2010). This is particularly true for ageing and poorly-maintained assets. The thawing processes in the permafrost caused by warming already has a negative impact on the structural integrity of buildings, major infrastructure (access roads, power stations and mines), and pipelines in Russian Siberia. These include failure of piers, subsidence of structures or erosion of shorelines, and riverbanks (Doloisio & Vanderlinden, 2020; Fay et al., 2010). The predicted intense heat periods and extreme precipitation also pose a threat to the flow within the entire energy chain, from initial generation to transmission, distribution, and final consumption. The ability of energy grids to function properly is also at risk (Fay et al., 2010).

The threats outlined here have the potential to be exacerbated by parallel emerging crises, such as civil unrest, collapse of the health system or collapse of institutions (Fay et al., 2010). Hence, climate change has significant implications for national security in the energy,

economic, social, and environmental fields (Fay et al., 2010; Lioubimtseva & Henebry, 2009; Zhupankhan et al., 2017).

Adapting to these challenges is therefore essential to be prepared for the future (Fay et al., 2010; Pietrapertosa et al., 2018). This also urges businesses located in risky regions to strengthen both their adaptive capacity and resilience (Linnenluecke & Griffiths, 2010). Decoupling economic growth from pollution is therefore an urgent step to enable efficient resource use and build a climate-resilient economy (Shi et al., 2021; Stern, 2017). As the post-communist states have historically inherited very energy-intensive economies, both in terms of consumption and production of energy (see Section 1.3.3), decarbonisation and greening of the economies is one of the most pressing issues (Fay et al., 2010; Li et al., 2020; Shi et al., 2021). As fossil fuels are the basic energy resources in many post-socialist countries, their use in producing various types of goods and services results in an increase in carbon dioxide emissions (Li et al., 2020). Thus, promoting less energy-intensive industries is important as achieving climate policy goals requires that large quantities of fossil fuels are replaced by alternative, carbon-free energy sources (Popp, 2019). One way to achieve this is through environmental innovations that aim to reduce environmental pressure such as cleaner production technologies (Horbach, 2016; Li et al., 2020; Sineviciene et al., 2017).

However, high pressure for adaptation to climate change does not necessarily lead to action. In part, there is also uncertainty about "what to adapt to" (Fay et al., 2010). Although such uncertainty may be paralysing, environmental innovations can be a way to counter inaction by favouring the decoupling of economic growth from pollution. In this way, the discussed endangered economies may overcome inertia and become more adaptive to climate change (Popp et al., 2010). Considering this, Chapter 3 analyses the determinants of the current environmental innovation behaviour of companies in transition countries, revealing potentials and weaknesses.

1.3 Overview of the historical background

As Frye (2021) has aptly said: "The past and present are entwined in intricate ways in every country". In this following chapter, the historical legacy of Soviet central planning is examined in more detail in order to understand structural commonalities in the transition countries and how these path dependencies continue to reverberate today.

1.3.1 The transition from planned to market economy

The collapse of the Soviet Union, and hence, the transition from a planned to a market economy, is historically unique (Sachs & Lipton, 1990). The Soviet Union's command and control system operated on the basis that many of the decisions for individual firms were made by central ministries (Arrow, 2000). Thus, production quotas and available input resources were set, without reference to monetary criteria (Bitzer & Hirschhausen, 1998). The transition to a market-based system meant that individual firms could then make their own decisions about outputs and inputs based on a market determined price (Arrow, 2000). In order to establish an efficient market economy, two basic prerequisites are needed: private property and competitive markets. The socialist countries did not have either of these (Stiglitz, 2005).

The type and extent of restructuring required for corporate and market reforms was unprecedented, and thus, no set process to aid this change existed (Gabrisch & Hölscher, 2006). Consequently, the transformation was a learning experience that was accompanied by a high degree of uncertainty for the outcome (Berglof et al., 2015; Roland, 2000). The pace of transformation became a central point of contention in theoretical approaches to the transformation from a planned to a market economy. Some argued that the transformation should take place 'in one big leap' as a big bang (Aslund, 1991; Berg et al., 1992; Frydman & Rapaczynski, 1994; Murphy et al., 1992; Sachs & Lipton, 1990; Woo, 1994), while others were in favour of a gradual approach (Aghion & Blanchard, 1994; Dewatripont & Roland, 1996; McKinnon, 1991; McMillan & Naughton, 1992; Portes, 1991; Roland, 1994).

At the beginning of the 1990s⁷, there was still a great deal of uncertainty as to whether the communist chapter was completely closed. Against the background of this fear, much was to be said for an abrupt change of system in order to lend credibility to the transformation process and to avoid the impression of reversibility (Arrow, 2000; Gabrisch & Hölscher, 2006; Roland, 2000). Therefore, the radical approach advocating a simultaneous introduction of several reforms focusing on (1) quick liberalisation (2) stabilisation of the macroeconomy, and (3) rapid privatisation of state-owned enterprises, prevailed at the beginning of transition

⁷ This short time directly after the Soviet breakdown was also seen as the 'window of opportunity' (Roland, 1994).

(Williamson, 1990). This approach, rooted in mainstream economic thinking, was based on the Washington Consensus⁸.

As many of the socialist economies struggled with severe macroeconomic imbalances such as discrepancy between supply and demand, trade deficits, and high foreign debt, macroeconomic stabilisation was seen as particularly important (Gabrisch & Hölscher, 2006). The Washington Consensus placed great emphasis on fiscal discipline. A tight monetary policy consisting of a high interest rate, a fixed exchange rate, and expenditure cuts, aimed to achieve a balanced budget and minimise inflation (Williamson, 2004). Concurrently, it was assumed that rapid privatisation of property (and the accompanying dismantling of the role of the state) would provide incentives for efficient and profit-maximising behaviour, which, together with a quick liberalisation of trade and prices, would lead to the creation of a competitive, market-oriented economy (Gabrisch & Hölscher, 2006; Stiglitz, 2005).

However, events such as the unexpectedly deep and prolonged production slump in the transition countries⁹, the financial crisis in Latin America and East Asia, and China's success with a gradual reform process, raised doubts about the radical approach and whether the Washington Consensus could deliver the desired results (Murrell, 1992; Rodrik, 2006; Roland, 2000; Serra & Stiglitz, 2012). Therefore, the gradualist or evolutionary-institutional approach, which advocated for a step-by-step approach (building a bridge from one form of economy to another), gained more momentum. While the Washington Consensus opposed partial reform, the gradualist approach saw the advantage of flexibility in an adequate sequencing of reforms, arguing that the results of the transformation are unpredictable and uncertain (Roland, 2000, 2001). Another advantage of a sequence of reform steps is that it gives the opportunity to individuals and organisations to adapt to the new environment (Gabrisch & Hölscher, 2006).

A restructuring of the economic system is designed to change everything about it. This raises uncertainty and affects expectations about the future (Arrow, 2000; Rodrik, 1991). Institutions are instrumental in providing an environment of stable expectations, which are a set of rules designed to reduce uncertainties in human interactions (North, 1990). Human interactions are

⁸ The Washington Consensus is a set of economic policies for underdeveloped and emerging countries promoted by Washington-based institutions such as the IMF and the World Bank (Stiglitz (2005); Williamson (1990)).

⁹ The slump in output was due, among other things, to the disruptions in supply chains and access to financial markets that resulted from the dismantling of the former planning system (Tiits et al. (2008)).

central to a market economy, which operates by individual firms entering into contractual relationships with each other (Arrow, 2000). Hence, institutions play a crucial role, as their rules and regulations create a framework within which markets function (Dewatripont & Roland, 1996; Stiglitz, 2005). Therefore, the institutional framework had to be adapted to the new conditions of a market economy. Institutional underpinning is fundamental from an evolutionary-institutional perspective, as it is not only necessary for the legal and contractual framework and law enforcement, but also for political stability and market growth (Roland, 2000). The reforms of the Washington Consensus did not completely neglect the adaptation of the institutional framework, but were more concerned with the legal and financial structures (Roland, 2000). This refers to the formal rules, i.e. laws and regulations such as the regulation of private property (Burki & Perry, 1999). The evolutionary-institutionalist perspective, on the other hand, broadened the perspective and also focused on informal rules, norms, conventions and communally shared values (Roland, 2000). These rules set the conditions for the enforcement of law, which must be supported by society. An important determinant of success in the transition to a market economy is that the existing social norms and attitudes and the newly introduced formal institutions should complement each other (Pejovich, 2003; Tarabar, 2017). The interplay between informal and formal rules is achieved rather gradually, as informal institutions such as cultural norms only change slowly (Berglof et al., 2015; Dimitrova-Grajzl & Simon, 2010). However, despite their different views and approaches, it is important to remember that both reform theories, radical and gradual, had the same goal: a successful transition to a market economy (Rodrik, 2006).

In order to measure the progress and success of transition, the European Bank for Reconstruction and Development (EBRD) developed indicators that attempt to measure a country's transition success. Table 1.2 shows for each country the chosen reform path and the average outcome for the years 1990, 2000 and 2014. In 2014, the countries with the highest average EBRD indicators were Estonia, Poland, Latvia, Lithuania and the Slovak Republic. These countries have all adopted the big bang approach and are located in Central Europe or the Baltics. This is closely followed by Hungary and Croatia, both of which have undergone a gradual reform process, while countries that did not apply a reform have the lowest scores.

Table 1.2: Transition performance

Country	EU Membership	EBRD Indicator 1990	EBRD Indicator 2000	EBRD Indicator 2014	Transition reform path
Central Europe and the Baltic states					
Croatia	Yes	1,95	2,67	3,83	Gradual
Czech Republic	Yes	1,00	3,83	3,83	Big Bang
Estonia	Yes	1,22	3,78	4,06	Big Bang
Hungary	Yes	2,00	3,89	3,89	Gradual
Latvia	Yes	1,00	3,50	3,94	Big Bang
Lithuania	Yes	1,22	3,45	3,94	Big Bang
Poland	Yes	2,61	3,67	4,00	Big Bang
Slovak Republic	Yes	1,00	3,78	3,94	Big Bang
Slovenia	Yes	1,95	3,50	3,56	Gradual
South Eastern Europe					
Albania	Candidate	1,00	3,17	3,50	Aborted Big Bang
Bosnia and Herzegovina	Candidate	1,95	2,33	3,06	Aborted Big Bang
Bulgaria	Yes	1,17	3,39	3,72	Aborted Big Bang
Kosovo	Candidate			2,89	
Montenegro	Candidate	1,95	1,95	3,33	Aborted Big Bang
North Macedonia	Candidate	2,13	3,22	3,56	Aborted Big Bang
Romania	Yes	1,00	3,28	3,67	Gradual
Serbia	Candidate	1,95	1,56	3,17	Aborted Big Bang
Eastern Europe and the Caucasus					
Armenia	No	1,00	2,94	3,44	Gradual
Azerbaijan	No	1,00	2,67	2,89	Gradual
Belarus	No	1,00	1,67	2,17	Weak Reform
Georgia	No	1,00	3,33	3,50	Gradual
Moldova	No	1,00	3,06	3,28	Gradual
Ukraine	No	1,00	2,89	3,28	Gradual
Russia	No	1,00	3,00	3,28	Aborted Big Bang
Central Asia					
Kazakhstan	No	1,00	3,06	3,06	Gradual
Kyrgyz Republic	No	1,00	3,28	3,39	Aborted Big Bang
Mongolia	No	1,00	3,00	3,44	Gradual
Tajikistan	No	1,00	2,72	2,95	Gradual
Turkmenistan	No	1,00	1,56	1,78	Weak Reform
Uzbekistan	No	1,00	2,07	2,28	Weak Reform

Note: The EBRD indicators measure the degree of market orientation of a country on a scale of 1 to 4+, where 1 indicates a centrally planned economy and 4+ an advanced market economy. The mean scores calculated here consider the following categories: price and trade liberalisation, competition policy, governance and enterprise restructuring, small and, large scale privatisation, and banking and financial sector liberalisation. The reform classification follows the approach of Havrylyshyn (2007). Source: EBRD Transition Indicators (1989-2014)

At the first sight, it seems that, overall, the radical approach was more successful (Havrylyshyn, 2007). However, it is difficult to conclude the success or failure of the transformation process from a country's chosen reform path. Other important determinants also need to be

considered. These include a country's initial economic situation, its geographic location and economic structure, its stock of physical and human capital, its size of the economy, and a country's historical background and culture (Alesina & Giuliano, 2015; Aristei & Perugini, 2012; Balcerowicz, 2002; Dimitrova-Grajzl & Simon, 2010; Pejovich, 2003; Tarabar, 2017). This wide range of influencing factors makes it clear that there is no one-size-fits-all solution and that each country must adapt its transformation path individually.

From a historical-cultural perspective, the transition countries in Central Europe and the Baltic states had a special role. These countries had memories of Western philosophical traditions and the rule of law due to their historical development (Pejovich, 2003, 2006). Many countries in Central Europe (such as Hungary and Slovakia) were under the influence of the Habsburg Empire¹⁰ (Dimitrova-Grajzl, 2007; Pejovich, 2003) whilst some customs and traditions of the Baltic States were influenced by Germany, Sweden, and Finland. Parts of Poland were formerly part of the Prussian Empire, and during the communist era, the Catholic Church as an informal institution reinforced Western traditions (Pejovich, 2003). Hence, in these countries, there was more affinity with Western attitudes, resulting in a comparatively greater proximity between existing informal rules and newly emerging formal rules (Tarabar, 2017). The stronger affinity to the West was further strengthened by the accession to the European Union (EU) in 2004 and 2007 (Berglof et al., 2015; Gros & Steinherr, 2004).

Historically, the countries of South Eastern Europe were also shaped by the times under Ottoman Empire¹¹ rule, which, for example, did not allow private property until the beginning of the 19th century, in comparison to the Habsburg Empire where it was already possible in the 1780s (Dimitrova-Grajzl, 2007). Contrastingly, many countries in Central Asia and the Caucasus were more connected to Russian history as part of the Russian Empire, and in some cases (e.g. Uzbekistan) had never been a separate nationality (Brubaker, 1994). These historical and cultural differences have also affected the transformation process (Dimitrova-Grajzl, 2007; Dimitrova-Grajzl & Simon, 2010; Pejovich, 2003).

¹⁰ The Habsburg Empire is the informal name for the Central European monarchy that ruled over a series of countries from the 13th century to 1918, including Austria, Bohemia, Croatia and parts of Hungary and Upper Germany (Wank (2018).

¹¹ The Ottoman Empire was a state that controlled large parts of Southeast Europe, West Asia and North Africa from the 14th century until its dissolution in 1922 (Mardin (2018).

1.3.2 The impact of transition on innovation systems

The changes and adaptations in institutions were also a core task in relation to the institutions of science, as the entire system of innovation had to be restructured in each country. Freeman (1987) referred to the national system of innovation (NSI) as “the network of institutions in the public and private sectors whose activities and interactions initiate, import, and diffuse new technologies”. According to Freeman (1995), the NSI has an important impact on the behaviour of economic agents and on firms’ performance. Therefore, the catching-up process and growth of the transition countries is closely linked to the emergence of market-based innovation systems (Radošević, 1999; Radošević & Walter, 2002).

The science and technology (S&T) systems in socialist countries consisted of three elements: (1) the academy of sciences for basic research, which brought together the leading researchers and often received high priority for public funding, (2) the industrial or branch research institutions for applied research, which provided the technology base for industry, and (3) the universities for educational purposes (Bitzer & Hirschhausen, 1998; Walter, 2002). The S&T systems were administered by sectoral or science ministries and were characterised by strict hierarchical structures (Radošević, 1999). These strict structures did not allow for cooperative interactions between the S&T institutions and thus spill-over effects did not occur (Bitzer & Hirschhausen, 1998). Furthermore, due to the isolation of the socialist countries, research focused on independent problem-solving strategies and on imitating Western technology (Pavitt, 1997; Radošević, 1999). This led to a technological backlog in many areas of research, as technological developments were not able to keep up with the pace of the capitalist countries (Bitzer & Hirschhausen, 1998).

With the collapse of the socialist bloc, the hierarchical management of institutions in science ceased to exist (Bitzer & Hirschhausen, 1998; Meske, 2000). Consequently, the core institutional structure of these systems dissolved and fragmented, and needed to be restructured and transformed (Meske, 1999, 2000). The transformation of these institutions was carried out in different ways, the first of which was a rapid dissolution and transfer of the institutes to universities. Concurrently, many institutes were largely retained in a reduced and reorganised form (Dyker & Radošević, 2000; Meske, 2000).

The introduction of capitalist market economies also resulted in the monetisation of the S&T systems and the removal of previously secure state funding (Bitzer & Hirschhausen, 1998). The sudden financial shortages led to a contraction of research activities and layoffs of specialised staff, entailing a severe loss of research potential in former Soviet countries¹² (Walter, 2002). This also led to an exodus and mobility of scientists, facilitated by a complete restructuring of the scientific and economic environment (Bitzer & Hirschhausen, 1998; Freeman & Soete, 2009; Ganguli, 2015).

Previously, research institutions had clear guidelines regarding the orientation of research as well as the implementation of findings (Bitzer & Hirschhausen, 1998), since they were not independent entities and were controlled by respective ministries. Thus, the autonomy and competence structures of the universities and other public R&D institutions had to be restructured (Meske, 2000; Walter, 2002). Moreover, the transformation to a market economy meant that innovation activities were shifted from the state to the companies (Bitzer & Hirschhausen, 1998). Therefore, the transformation of the state-funded branch institutes posed another challenge, as they had to be integrated into the private sector as industrial R&D (e.g. in the form of in-house R&D within a company) (Meske, 2000; Radošević, 1999).

In a capitalistic economy, it is a company's core task to make use of new knowledge and to develop products and their manufacture (Bitzer & Hirschhausen, 1998). In Soviet times, enterprises only acted as production units and were organised in a very uniform way (Dyker & Radošević, 2000). Other business activities such as R&D or finance were often outsourced (Pavitt, 1997; Radošević, 1999). R&D activities, for example, occurred externally within branch institutes and were done 'for industry', not 'in industry' (Radošević, 1999). Only the implementation took place in enterprises. Therefore, technological knowledge and innovation was integrated only in one direction towards production (a linear innovation model). Other knowledge sources, such as feedback from producers and users were not considered (Acha & Balazs, 1999; Bell & Pavitt, 1993; Dyker & Radošević, 2000; Radošević, 1999). Due to these hierarchical structures and the weak exchange, knowledge was not accumulated within a

¹²However, it can also be argued that the bloated labour force has been reduced to a normal level again (Pavitt (1997)).

company, as is usual in a market economy¹³, but rather accumulated in external institutions. This resulted in a weak technology formation capacity of enterprises (Bell & Pavitt, 1993; Radosevic, 1999). The lack of R&D development at the firm level was thus a crucial weakness of the NSI under socialism (Freeman, 2006).

The system transformation in socialist countries can therefore also be seen as a process of creative destruction (Schumpeter, 1942), in which something existing gives way in favour of something improved. In the course of liberalisation, destruction was not problematic but the simultaneous creation of something new was a challenge (Günther, 2015; Tiits et al., 2008). The emergence of NSI in post-socialist countries was shaped by the reconstruction of enterprises as main actors, the rebuilding and the extent of their links with other enterprises and organisations, and their corporate competencies (Radosevic, 1999). These different forms of interaction with other companies and institutions are important for knowledge diffusion and therefore for innovation (Dyker & Radosevic, 2000; Günther, 2015; Varblane et al., 2007).

The collapse of socialism not only led to a fragmentation of the S&T systems, but also broke down the socialist production structures and the established links between production and the socialist S&T system (Bitzer & Hirschhausen, 1998; Meske, 2000). These links now had to be rebuilt and managed by the companies themselves, which had previously been done by state authorities (Radosevic, 1999). This also meant that companies could choose their own innovation partners (Bitzer & Hirschhausen, 1998). The weakness of industrial R&D and the broken links between companies and the remaining industrial research were expressed in low demand from companies for local R&D (Acha & Balazs, 1999; Dyker & Radosevic, 2000; Meske, 2000). As a result, these companies¹⁴ had a high demand for new machinery, organisational forms, and logistics that met international standards, and local R&D was often unable to meet these demands (Bitzer & Hirschhausen, 1998). Consequently, innovation has mainly taken place through product adoption and technology transfer from Western to Eastern countries, mostly in combination with privatisation and/or foreign direct investments (FDI) (Meske,

¹³ In a market economy company, technological knowledge is firm-specific. This means that knowledge accumulates through learning-by-doing within a specific organisational context and is then transformed into new products or processes (Radosevic (1999).

¹⁴ Companies that had already gained experience in Western markets or were already integrated to some extent in Western production networks had better starting conditions for restructuring and survival (Radosevic and Yoruk (2001); Tiits et al. (2008).

2000; Radosevic, 1999). Therefore, the technological catching-up process was largely driven by the absorption and diffusion of (existing) technology (Günther, 2015; Varblane et al., 2007). The economic catching-up process in transition economies came from FDI, efficiency gains, and resource reallocation, all of which provided short-term growth (Radosevic, 2006; Varblane et al., 2007). As FDI do not automatically link foreign and domestic companies, the latter is more attractive if the companies can provide a strong local knowledge base (Varblane et al., 2007). To sustain future growth, it is important for the NIS to evolve beyond the linear innovation model and to foster knowledge diffusion and interactive learning processes. Next to R&D, this must also include non-R&D aspects, for instance, companies need to strengthen their absorptive capabilities and engage in active accumulative learning processes (Radosevic, 2006; Varblane et al., 2007). This not only applies to technological accumulation, but also for management and organisational capabilities (Bruno et al., 2021; Pavitt, 1997; Varblane et al., 2007).

Due to the importance of innovation for long-term growth, these transition countries have been striving since the 1990s to build and modernise their innovation systems in order to re-establish original technological activities in networks of innovators (Dyker, 2010; Günther, 2015; Varblane et al., 2007).

1.3.3 Environmental legacy of the socialist era

The transition to a market economy also entailed further changes in institutions and company structures in relation to environmental organisation.

Under both socialism and capitalism, economic growth comes with an undesirable side effect: the degradation of the environment (Baker & Jehlička, 1998; Khabibullov, 1991). However, the extent was higher in a planned economy. The Marxist industrial ideology, that the communist rule was based on, placed great emphasis on economic growth, industrialisation and technological progress (Baker & Jehlička, 1998). Nature was regarded as an obstacle to scientific and technical progress that had to be conquered¹⁵ (Baker & Jehlička, 1998; Tellegen,

¹⁵ Large projects were launched with the aim of transforming or correcting "nature's mistakes". For example, attempts were made to change the flow direction of certain river sections in Siberia and the European part of Russia from north to south in order to facilitate large-scale irrigation and hydropower projects. In 1986, this project was discontinued (Tellegen, 1996).

1996). Thus, the Soviet system strived for economic growth, blatantly disregarding natural conditions¹⁶ (Fay et al., 2010).

Moreover, both systems tend to underestimate the value of natural resources (Tellegen, 1996). In a planned economy, natural resources have a use value, whereas in a market economy they have an exchange value. The exchange value is expressed in prices, which is determined by the human labour that goes into the production of a resource (Tellegen, 1996). Along with this, the scarcity of a resource is expressed in its price and transport costs (Hirschhausen & Waelde, 2001; Tellegen, 1996), while the extraction costs (in the sense of environmental degradation) are seen as negative externalities. Contrastingly, in a socialist economy, the availability of natural resources is considered free and without price, as they have only use value (Tellegen, 1996). Thus, no economic criteria were applied in the extraction of resources and only technical feasibility mattered (Hirschhausen & Waelde, 2001). This contributed to the waste of resources in the Soviet Union. This waste of resources was also facilitated by the top-down financing (funding from ministry officials to companies) typical for a planned economy (Khabibullov, 1991). This led to inefficient use of natural resources¹⁷, as the amount of funding provided did not depend on the profitability of the enterprise (Khabibullov, 1991). Hence, there were also no incentives to develop new technologies that conserved resources or had less impact on the environment¹⁸ (Khabibullov, 1991). Planned targets, regarding the amount of materials to be used, also contributed to this inefficiency. These output quotas had to be met by companies and involved a greater amount of energy and material compared to Western countries (Baker & Jehlička, 1998; Tellegen, 1996).

The dramatic state of the environment in the Soviet Union was also seen as symptomatic of the economic crisis of state socialism (Pavlínek & Pickles, 2004). The communist regime was not oblivious to these environmental problems (Baker & Jehlička, 1998; Khabibullov, 1991;

¹⁶ However, it is important to note that economic development before the period of Soviet rule also had a negative impact on the environment (Baker and Jehlička (1998).

¹⁷ For instance, the Aral Sea was once the fourth largest lake in the world. Due to water use for large-scale and excessive irrigation of agricultural land, which was highly inadequate, the average water level of the Aral Sea dropped from 53 to 38 meter above sea level in the short period between 1960 and 1991. The total surface area of the lake decreased to half its initial size. The average volume of the lake also decreased drastically from 1090 km³ to 290 km³ (Tellegen (1996).

¹⁸ At this point, we can also recall the deficits of the innovation system in the Soviet era, which also hindered the development of more efficient technologies.

Tellegen, 1996). However, environmental regulation and reforms were weakly implemented. The slow administrative system of a planned economy was too cumbersome to deal with complex environmental conservation problems (Baker & Jehlička, 1998; Khabibullov, 1991; Pavlínek & Pickles, 2004). Often, the same authority was both responsible for the pollution and for its prevention (Baker & Jehlička, 1998; Tellegen, 1996). Furthermore, the lack of financial independence of companies also meant that environmental regulation in the form of fines and penalties was ineffective (Khabibullov, 1991). A fine was not a viable means of enforcement because it was paid from one government pocket to another. Companies could write off the fine as a production expense and subsequently get an increased budget for the next fiscal year as compensation (Khabibullov, 1991). In other cases, it was more profitable for a company manager to pay a small fine for not respecting environmental standards than to take the risk of not meeting production quotas (Baker & Jehlička, 1998).

As a result, after the collapse of the Soviet Union, these countries have been burdened with a legacy of environmental degradation. The most serious problems were air¹⁹ and water²⁰ pollution. Other environmental challenges were: insufficiently disposed hazardous (including radioactive waste), contaminated agricultural soils, deforestation, and soil erosion (Baker & Jehlička, 1998; Fay et al., 2010; Pavlínek & Pickles, 2004; Spoor, 1998; Tellegen, 1996). Other legacy problems, including administrative structures and political culture contributed to the difficulties in environmental management (Baker & Jehlička, 1998).

Although the Soviet regime avoided informing the population about the extent of environmental degradation, it was not possible to conceal it entirely (especially in industrial regions). The resulting political movement for environmental protection was also driven by dissatisfaction with the political regime (Baker & Jehlička, 1998; Baumgartl, 1993; Khabibullov, 1991; Tickle & Welsh, 2001). After the collapse of communist rule, this movement lost momentum, as the Soviet system no longer existed. In addition, the environmental protection

¹⁹ For example, the area within the Czech-German-Polish border, also referred to as the "black triangle", repeatedly recorded peak levels of sulphur dioxide air pollution. This also led to health problems in the local population and lower life expectancy (Pavlínek and Pickles (2004); Tellegen (1996).

²⁰ Heavily polluted rivers, which then contributed significantly to the increased pollution of the Baltic, Black and Adriatic Seas. The pollution was caused, among other things, by heavy industry discharging heavy metals and toxic chemicals into the rivers. Agricultural practices also caused high levels of nitrogen and phosphorus in the waters (Pavlínek and Pickles (2004); Tellegen (1996).

issue was overshadowed by the negative consequences of the economic reforms in the transformation process (Baker & Jehlička, 1998; Pavlínek & Pickles, 2004; Tickle & Welsh, 2001). The transition period was therefore marked by a loss of popularity towards the importance of environmental issues in society (Baker & Jehlička, 1998).

Economic and structural change in the early 1990s favoured lower pollutant emissions (Pavlínek & Pickles, 2004). The sharp decline in industrial production and the gradual industrial restructuring away from heavy industry towards services resulted in a "clean-up by default" (Pavlínek & Pickles, 2004; Tellegen, 1996). Furthermore, the privatisation of enterprises and monetization of the economy led to a more economic use of resources and modernisation of production processes (Cornillie & Fankhauser, 2004). In addition, progress has also been made through improved legislation and renewed enforcement efforts (Baker & Jehlička, 1998; Pavlínek & Pickles, 2004; Tellegen, 1996). Particularly in the countries that aspired to EU membership, great attention was paid to improving environmental policy reforms. This was an important threshold as the EU was eager to introduce uniform environmental standards and health regulations to facilitate trade and fair competition (Baker & Jehlička, 1998; Pavlínek & Pickles, 2004).

All of these factors led to environmental improvements and a reduction in pollution, but environmental problems did not disappear completely (Pavlínek & Pickles, 2004). This can be demonstrated in an exemplary case by the emitted carbon dioxide (CO₂) emissions, which is a good indicator because, as explained, historically transition countries have inherited very energy-intensive economies resulting in higher levels of CO₂ emission (Li et al., 2020; Shi et al., 2021). Since the baseline year 1990²¹, transition economies in Europe and Central Asia reduced their CO₂ emissions due to the collapse in output at the beginning of the transition from central planning to market economies (see Figure 2) (Vukina et al., 1999). CO₂ emissions remained at lower levels thereafter due to a decline in energy intensity achieved through market reforms (market liberalisation, reforms in infrastructure sectors as well as in the financial sector) that enabled efficiency improvements (Baker & Jehlička, 1998; Cornillie & Fankhauser, 2004; Nepal et al., 2014). But here, too, developments in individual countries

²¹ In the Paris Agreement, many transition countries still mention this year as the baseline when it comes to CO₂ reduction targets which makes the ambition of the goals set debatable.

have varied (Li et al., 2020; Nepal et al., 2014; Sineviciene et al., 2017). The transition countries in Central and Eastern Europe have achieved a higher level of energy efficiency and hence the reduction in CO2 emissions than the transition countries in Central Asia and the Caucasus, especially due to their proximity to the EU and the associated institutional changes (Li et al., 2020; Nepal et al., 2014). However, transition countries are still less energy efficient compared to Western countries (Cornillie & Fankhauser, 2004; OECD & IEA, 2015).

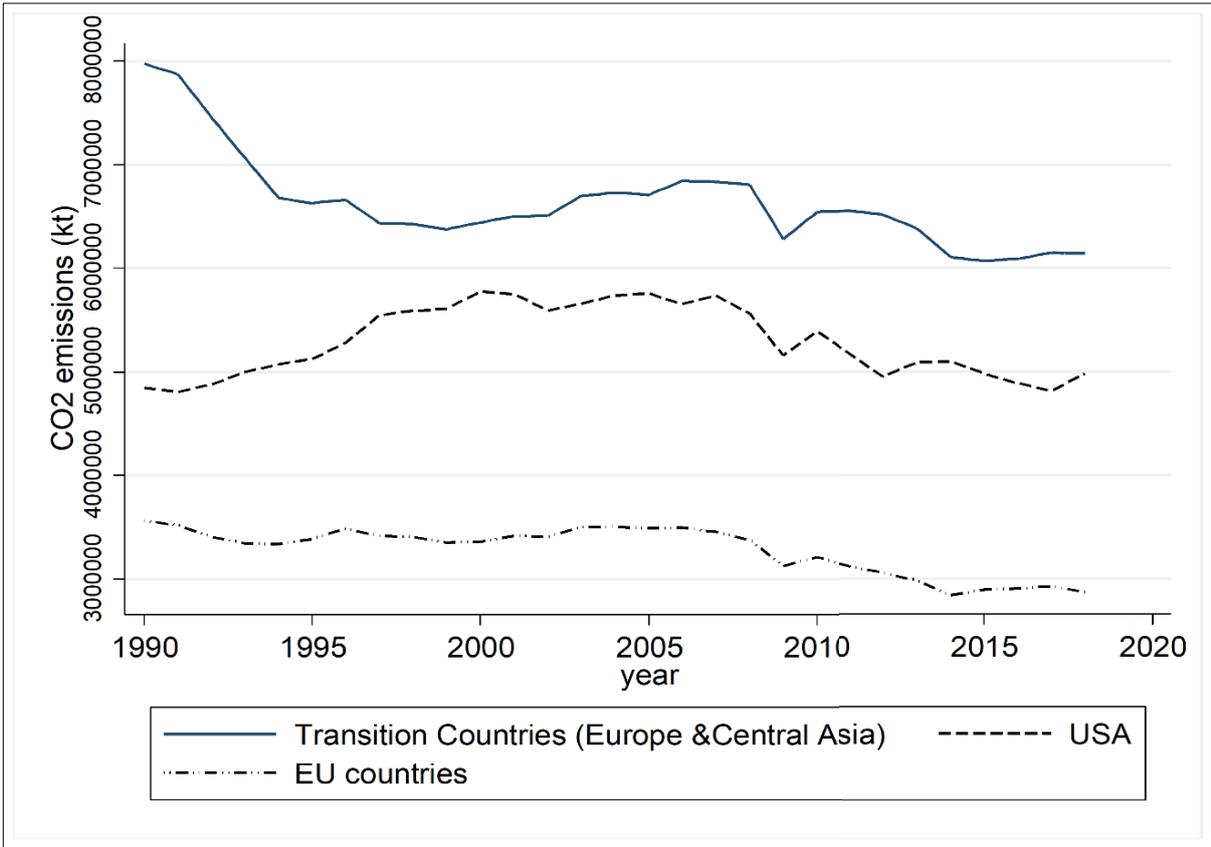


Figure 1.2: “CO2 Emissions for Transition Countries in Europe and Central Asia, USA and EU- 1990-2018”
 Note: The carbon dioxide emissions measured here are emissions arising from the combustion of fossil fuels and the production of cement, including the carbon dioxide that results from the consumption of solid and liquid fuels and the flaring of gas.
 Source: World Bank: World Development Indicators

In conclusion, however, it is important to remark that the capitalist economic system is not free of environmental issues. With the introduction of market economy, Western habits were also introduced in the transition countries, such as the increasing use of disposable products and private cars, which brought about new burdens on the environment. Mass consumption leads to waste problems and untouched nature is often converted into motorways for the increasing number of cars (Baker & Jehlička, 1998; Pavlínek & Pickles, 2004; Tellegen, 1996).

Hence, the transition from a planned to a market economy had both positive and negative effects on the environment (Baker & Jehlička, 1998; Pavlínek & Pickles, 2004).

1.4 Innovation in light of crisis and uncertainty

Joseph Schumpeter (Schumpeter, 1939) described the term innovation as simply coming up with ideas to do and see “things” differently. With the help of this innovative nature, existing structures are simultaneously destructed and created, which fuels continuous economic and social progress (Jalonen, 2011). This process was called "creative destruction" (Schumpeter, 1911). Therefore, innovation goes hand-in-hand with a process of change, because innovation also means discontinuity or a break with old structures, including previous technological, organisational, regulatory, or economic paradigms (Jalonen, 2011; Tülüce & Yurtkur, 2015).

Accordingly, innovation is a process that inherently involves uncertainty (Jalonen, 2011). For instance, there is the technical uncertainty of whether or not a company will indeed succeed in making an invention (Goel & Nelson, 2021). Moreover, if the innovation is not accepted by the market, the high costs of the development of new processes or products are not covered, and the innovation does not bring the hoped-for competitive advantage. If the innovation is accepted, it is possible that competitors will quickly copy or replace the innovation and that the innovative advantage cannot be maintained for long (Fernandes & Paunov, 2012). Besides the innovation itself, other uncertainties can influence the decision to innovate. External uncertainties such as regulatory/institutional uncertainty, or economic and political uncertainty can influence innovation as well (Jalonen, 2011). Economic and political uncertainties affect the costs of innovation introduction and diffusion and/or the demand for innovation (Goel & Nelson, 2021). How these external uncertainties can affect innovation activities is discussed below.

1.4.1 Innovation and business cycle

There is ongoing discourse as to whether economic growth drives innovation or innovation drives economic growth (Perez, 2003). Decisions to invest in innovation are influenced by economic fluctuations in the business cycle (Binding & Dibiasi, 2017). These economic shocks increase uncertainty and affect the planning and budgeting of organisations (Bloom et al., 2018; Hingley & Park, 2017). In the literature, opinions are divided on whether innovation occurrences are cyclical (Aghion et al., 2012; Arvanitis & Woerter, 2014; Barlevy, 2007; Hingley

& Park, 2017). On the one hand, there is the resource effect which is in favour of pro-cyclical innovations (Hingley & Park, 2017). During an economic upswing, access to innovation resources is easier. High demand provides favourable conditions for the development of new products and processes (Filippetti & Archibugi, 2011). The high costs of research and development are financed from companies' internal financial resources. These resources consist mainly of retained earnings and cash flows and shrink during recessions. Additionally, it is easier to access external finance, such as loans or public sector grants and subsidies during economic upturns, as banks, markets and investors become more risk averse during recessions (Cruz-Castro & Sanz-Menéndez, 2016; OECD, 2009b; Paunov, 2012). Since both internal and external resources are more readily available when the economy is in an expansionary phase, innovation is thought to be more pro-cyclical (Hingley & Park, 2017).

On the other hand, the opportunity cost effect argues for counter-cyclical innovations (Hingley & Park, 2017). During a downturn, input costs for innovation, such as material and labour costs, reduce (Hingley & Park, 2017). Furthermore, it is argued that the opportunity costs, and hence trade-off of foregoing productivity growth, are lower in a recession (Arvanitis & Woerter, 2014; Barlevy, 2007). During a recession, firms have the opportunity to shift resources from production and marketing activities to their innovation activities without losing a significant amount of revenue (Arvanitis & Woerter, 2014; Hingley & Park, 2017). This would be beneficial for companies, as they could innovate at lower costs and bring their novelties to the market when the economy picks up (Arvanitis & Woerter, 2014). In addition, it is not profitable for companies to postpone innovation projects or abandon innovation projects that have reached the initial stage due to an economic shock because it is costly for them to forego the benefits of these projects (Paunov, 2012; Pinto et al., 2019) Therefore, it is important for companies to invest counter-cyclically.

During the GFC 2008/2009, innovation activity declined significantly, primarily due to low demand expectations and increased uncertainty, which supports the argument for the resource effect (Kanerva & Hollanders, 2009; OECD, 2009b, 2012; Paunov, 2012). However, continuous innovation efforts are still important in order to keep pace with future high rates of innovation. Innovations are crucial for a country's knowledge base and long-term growth (Paunov, 2012). Creative destruction in Schumpeter's sense can be a crucial engine that is assumed to intensify during downturns, so that "less efficient firms fail while more dynamic

firms emerge or expand" (OECD, 2009b). While Schumpeter's concept of creative destruction originally described an entrepreneurial individual, today the main actors in his sense are new entrants and small firms that challenge established firms (Archibugi et al., 2013; Archibugi, 2017; Breschi et al., 2000). By contrast, established companies have the advantage of creative accumulation, i.e. that they continuously innovate and have built up a strong knowledge base (Schumpeter, 1942). This can also prove its worth in an economic downturn, as established resources help to maintain innovation capacity (Archibugi et al., 2013). These two Schumpeterian theoretical considerations of creative destruction and accumulation are further explored in Chapter 2, where the innovation behaviour of companies during the severe economic crisis of 2008/2009 is analysed. In particular, the research question of how the GFC has shifted innovation activities across companies in terms of creative destruction and accumulation will be explored.

1.4.2 Environmental innovation

Environmental innovation focuses not only on 'doing things differently' in the Schumpeterian sense, but also on reducing environmental harm. A commonly used definition of environmental innovation (EI) generally includes any product, process, or organisational, social or institutional method that is novel to the company and additionally contributes to reducing environmental damage and resource consumption (Kemp, 2010; Kemp & Pearson, 2007; OECD, 2009c; Rennings, 2000). In particular, more resource efficiency in economic processes can be achieved by reducing resource consumption along the production chain, and in the original extraction and disposal²² (Barbieri et al., 2016). In this transition, the economic composition and innovation intensity of a country's economy and its environmental and industrial policy framework conditions are of great relevance (Barbieri et al., 2016). Environmental innovations can enable companies not only to change the way they produce,

²² There are different typologies of EI: Environmental process measures e.g. can be further differentiated into cleaner production and end-of-pipe technologies (Fronzel et al. (2007). Cleaner production refers to the reduction of resource consumption and/or pollution directly at the source by introducing cleaner production methods and products. End-of-pipe implies the reduction of emissions by additional measures that prevent the direct release of pollutants into the environment (e.g. filters). The different types of EI are influenced by different factors. Since end-of-pipe technologies have fewer economic benefits but increase costs, they are more subject to regulation (see Fronzel et al. (2007); Horbach et al. (2012).

but also to effectively regulate pollution and resources (Costantini et al., 2017). In turn, these innovations help companies to fulfil their social responsibility (Liao, 2018).

Due to the focus on environmental improvement, two special features go hand-in-hand with EI. Environmental innovations have the peculiarity that they additionally produce environmental externalities in the adoption and diffusion phase²³ (Jaffe et al., 2005; Rennings, 2000) which benefit society by reducing environmental damage. Externalities can result in companies having less incentive to engage in environmental information policy because the benefits to companies are less than the benefits to society. This is referred to as the "double externalities problem" of EI (Rennings, 2000). Furthermore, EI activities require knowledge and skills that are not necessarily part of the traditional core competencies of the company or industry (Arranz et al., 2019; Horbach et al., 2013; Marchi, 2012), which may lead them to require more external sources of knowledge.

Due to the multifaceted nature of EI, it is important to understand whether companies are driven by business opportunities or public policy (Barbieri et al., 2016). There are four groups of determinants that, together, promote the adoption of EI in companies: market pull²⁴, technology push²⁵, company-specific factors (e.g. age, size etc.) and regulatory political push/pull factors (Barbieri et al., 2016; Ghisetti & Pontoni, 2015; Horbach et al., 2012; Rennings, 2000). As environmental innovations are featured by double externalities (Rennings, 2000), it is necessary to create an institutional environment that encourages companies to innovate in an environmentally friendly way. Regulation can have a bilateral effect on both the supply side (push) and the demand side (pull) (Rennings, 2000). In the following, particular attention is paid to environmental regulations and awareness of future institutional developments, as these provide important impulses for companies to find answers to environmental challenges (Kolk & Pinkse, 2004; Okereke & Russel, 2010; Rodriguez Lopez et al., 2017). By adjusting relative prices of production factors or setting new

²³ An invention describes an idea or model for a new, improved product or process. Through the first market introduction, the invention becomes an innovation in the economic sense. The use and adoption of the innovation over time represents the diffusion phase (Rennings (2000)).

²⁴ Market conditions consist of expectations of future sales, past economic performance, demand and consumer preferences (Barbieri et al. (2016)).

²⁵ Technological conditions depend on the firm's knowledge capital, which can be enhanced by R&D investments or activities, and organisational capabilities and innovations (Barbieri et al. (2016)).

environmental standards, existing and future policies stimulate the environmental innovation process within the Schumpeterian innovation phases from invention to adoption and diffusion (Barbieri et al., 2016; Popp, 2005). Incentives should be created by environmental policies such as CO2 standards, EU emission standards, or post-tax fuel prices (Barbieri, 2015). However, uncertainty can arise in the face of a change in environmental regulations because it affects the predictability of a firm's environment (Hoffmann et al., 2008; Rodriguez Lopez et al., 2017; Tseng et al., 2013). This uncertainty can result from a political debate of the final specification or enforcement of a policy (Rodriguez Lopez et al., 2017). It can also lead to regulation-induced uncertainty, which is more complex than regulatory uncertainty because it is influenced by the interaction of companies from the regulatory environment and companies from the non-regulatory environment (Rodriguez Lopez et al., 2017). Regulatory uncertainty may also prompt companies to act proactively to secure important competitive resources, leverage complementary resources or mitigate institutional pressures (Hoffmann et al., 2009; Rodriguez Lopez et al., 2017). Participation in the policy debate can be an effective response for companies to react to the uncertainty surrounding upcoming regulatory changes (Rodriguez Lopez et al., 2017). In the next section, the effect of policy uncertainty on innovation will be discussed in more detail.

Chapter 3 readdresses the double externalities problem. The neoclassical view can contribute to a better understanding of EI by describing the "double externalities" of EI and therefore the need for an appropriate incentive system consisting of regulatory push and pull incentives. In addition, the evolutionary view is better suited to capture the context in which EI emerges and develops and thus to understand the knowledge trajectories of EI and its diffusion (Barbieri et al., 2016; Ghisetti et al., 2015; Rennings, 2000). Chapter 3 examines EI on the firm-level using the neoclassical and evolutionary approaches. The combination of these two approaches provides a holistic view into the EI behaviour of companies in transition countries.

1.4.3 Innovation and political uncertainty

Policy and political developments are of central importance for innovation (Bhattacharya et al., 2017; Goel & Nelson, 2021; Julio & Yook, 2012). Political and regulatory decisions made by politicians can change the economic environment and, therefore, the environment in which

innovative companies operate, which has a subsequent impact on a nation's innovation progress (Bhattacharya et al., 2017).

Political uncertainty arises from internal (or external) political changes such as conflicts and violence, but also from policy inconsistency, upcoming government or presidential elections (Bhattacharya et al., 2017; Goel & Nelson, 2021; Julio & Yook, 2012). A change in the political climate can affect industry regulation, subsidy policy for private R&D, changes in intellectual property rights, or monetary, trade and/or taxation policies. In very extreme cases it can even mean expropriation or nationalisation of private companies (Díaz-Díaz et al., 2021; Julio & Yook, 2012). For these reasons, political events such as the outcome of a presidential vote is vitally important for business decisions (Goel & Nelson, 2021; Julio & Yook, 2012).

There are different views on how political uncertainty affects innovation. On the one hand, it is argued that companies choose to wait out these political uncertainties (Bhattacharya et al., 2017; Dixit & Pindyck, 2012). Therefore, political uncertainty can decrease investments in innovation until a politically uncertain situation is resolved (Díaz-Díaz et al., 2021; Gulen & Ion, 2015). Moreover, market launches of innovations can be delayed or abandoned altogether. This is because this uncertainty can have a negative impact on potential profits as well as expected costs (Goel & Nelson, 2021; Julio & Yook, 2012; Xu, 2020).

On the other hand, it is argued that innovations can also act as a hedge against political uncertainty (Goel & Nelson, 2021). Goel and Nelson (2021) further argue that process innovations in particular are less susceptible to uncertainties, as they reduce production costs but do not involve greater market uncertainties (unlike product innovations) and can therefore provide more certainty.

Empirical findings are in favour of both arguments. In times of political uncertainty, firms reduce their investments in R&D, which is an important input for innovation, and also sharply decrease their innovation activities (Bhattacharya et al., 2017; Díaz-Díaz et al., 2021; Goel & Nelson, 2021; Julio & Yook, 2012; Xu, 2020). In particular, countries with fewer control mechanisms or stable governments show a greater decline in investment in innovation, as

companies²⁶ located there are more sensitive to political events (Julio & Yook, 2012). Moreover, innovation-intensive industries also experience a severe decline in innovations in politically uncertain times (Bhattacharya et al., 2017). However, Goel and Nelson (2021) observe in their analysis that process innovation increases in times of political uncertainty, which is consistent with their argument that innovation can be a hedge against uncertainty.

Innovation is important for the long-term growth of a country. As political events influence innovation activities, it is relevant to better understand both.

1.4.3.1 Excuse: rally around the flag event and effect

As previously explained, political uncertainties can have a negative impact on the innovation behaviour of companies affected by them. Therefore, it is relevant to better understand both. An international conflict can also create a situation of political uncertainty. The tensions between two or more states can have an impact on their economic relations and, hence, on companies. Additionally, tension can have an influence on domestic politics, because the popularity of a state leader in society is decisively influenced by domestic and foreign policy events (Baker & Oneal, 2001). Such a situation can trigger a “rally around the flag event” in the affected country. The earliest and most influential definition of a rally event comes from Mueller (1973), who states that it must be international, directly involve the country and its leader, and should be “specific, dramatic, and sharply focused.” Mueller (1973) argues that by “[confronting] the nation as a whole” and “assur[ing] public attention and interest,” the event will trigger a spike in presidential job approval (e.g. (Baum, 2002; Brody, 1991; Chatagnier, 2012; Mueller, 1970). Mueller (1973) lists six different possible international events that can meet these criteria: a sudden military intervention in another country, significant military developments in an existing conflict, significant diplomatic events, dramatic technological developments (e.g. the atomic bomb), international summits and the beginning of a new presidency. It can be seen that the range of possible rally events is quite wide.

When applying these three criteria to Russia in the context of the Crimean crisis (as described in Section 1.2.2), the following can be concluded. Firstly, the conflict between Russia and

²⁶ Companies with political connections have more insights into legislative and bureaucratic procedures, which can reduce uncertainty and in turn lead to more innovation (see e.g. Díaz-Díaz et al. (2021); Kim (2017); Ovtchinnikov et al. (2020).

Ukraine is international. Secondly, it personally involves the national leader. Thirdly, the issue in question, the repatriation of Crimea to Russia, is specific, dramatic, and sharply focused. Therefore, this conflict fulfils all the criteria of a rally event.

Typically, a rally event causes a striking increase in the approval rate for the president (the rally around the flag effect) (Mueller, 1970, 1973). However, Lian and O Neal (1993) argue that rally around the flag effects are by no means automatic or long-lasting, and therefore presidents cannot simply expect them to occur when an international crisis arises. This is because rally effects vary greatly in scope and magnitude (Chowanietz, 2011). Using survey data from Levada, a rally effect can be demonstrated in the case of Russia. Figure 1.3 describes how Russian citizens answered between 2000 and 2020 to the following question: “Do you approve of the activities of V. Putin as the President (Prime Minister) of Russia?”. In the second half of 2013, President Putin’s approval rates were ca. 64% on average. However, in March 2014, the approval rate showed a remarkable increase to 80%. This strong rise in public opinion can be associated with the annexation of Crimea, which occurred on March 18th, 2014. For the following four years the approval rate would remain above 80%.

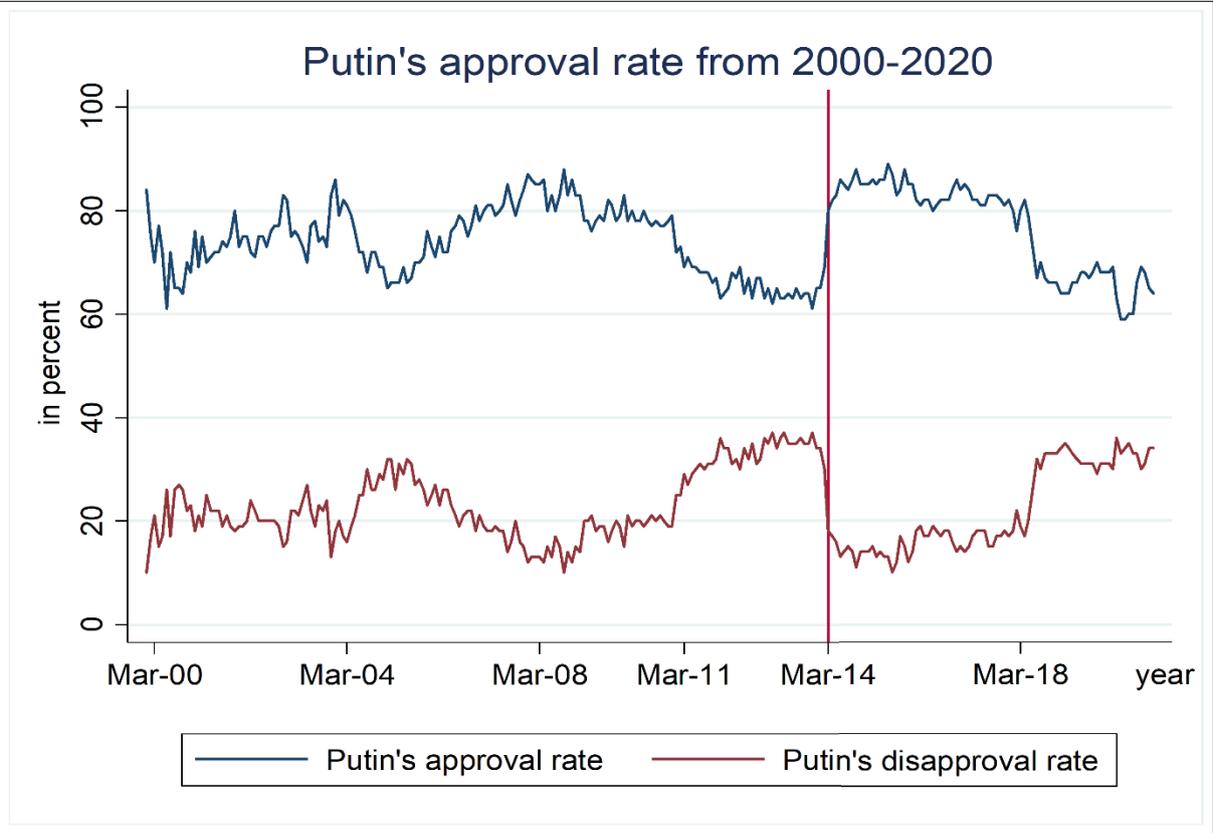


Figure 1.3: Presidential approval from 2000 to 2020
Source: Levada data

Therefore, a rally effect could dampen the political uncertainty that accompanies a rally event, as political leadership is strengthened, at least domestically. This could subsequently have an impact on the innovation activities of companies in Russia. Empirical studies focusing on the innovation behaviour of Russian companies during 2014, 2015, and 2016 find that although the overall level of innovation activity decreased due to lower investments, key indicators of innovation have remained substantially unchanged (Grasmik, 2018; Shirokova et al., 2019). Chapter 4 analyses the described rally effect in Russia in the course of the Crimea crisis in more detail.

1.5 Dissertation milestones

1.5.1 An overview of the dissertation papers

This dissertation comprises three research articles linked by the general focus on transition economies in the context of crises. Table 1.3 provides an overview of all contributions, including the research questions, the object of analysis, the data, and the time frame. The order of the papers in the table reflects the order of the dissertation chapters. The first two papers focus both on innovation, however, they address two distinct literature streams. The first paper (Chapter 2) contributes to the Schumpeterian literature of creative destruction and accumulation in the context of an economic downturn with a focus on transition economies. The second paper (Chapter 3) is concerned with the determinants of the adoption of environmental innovation in these countries against the backdrop of the threats of the climate crisis. Finally, the third paper (Chapter 4) contributes to the rally literature in an authoritarian setting by examining approval ratings of President Putin in the light of geopolitical tensions in the wake of the Crimean crisis and the concurrent economic crisis in Russia.

Table 1.3: Overview of the dissertation papers

Chapter	Title	Literature stream	Research question	Subject of analysis	Data	Time scope
2	Innovation and Economic Crisis in Transition Economies	Determinants of innovation in times of crisis	What are the determinants of firms' innovation and research activities in times of a deep economic crisis?	Firms	BEEPS firm-level survey data provided by ERBD & WB	2009 and 2012
3	A question of regulation? Environmental innovation activities in transition economies	Determinants of environmental innovation	What are the determinants of environment-related innovation activities of firms in transition economies?	Firms	ES firm-level survey data provided by EBRD, WB & EIB	2020
4	Through thick and thin with the national leader: the rally around the flag effect in Russia	Determinants of presidential approval in times of crisis	Which (sub-) population groups contributed to the rally effect? How long-lasting was the support in this group? Which mechanisms (media or patriotism) were most pronounced over time?	Public opinion	Survey data provided by Levada Center	2008 to 2016

Before presenting the individual chapters, details of the data used are given. In Chapter 2, the EBRD-World Bank Business Environment and Enterprise Performance Survey (BEEPS) is used. This survey data allows the analysis of innovation activities on the firm level, particularly product or process innovation which is novel to the firm. Consequently, innovations that are new to the company but not to the market are presented in the BEEPS under "Innovation". A commonly-used alternative is to combine firm and patent data in innovation research. This approach is not chosen here because the analysis of patent activity in transition countries is less suitable. Firms in transition economies tend to innovate by imitation or adaptation, rather than creating entirely new, patentable inventions using existing state-of-the-art technologies (Acemoglu et al., 2006; Aghion et al., 2002; Gorodnichenko et al., 2009; Gorodnichenko & Schnitzer, 2013). Therefore, the use of firm-level survey data can better reflect firms' innovation behaviour in these countries.

In Chapter 3, firm-level survey data is also analysed. The EBRD-EIB-WBG Enterprise Surveys conducted in 2018-2020 is applied. As this survey round includes a Green Economy module for the first time, it is possible to identify environmental innovation activities for 29 transition economies. The ES survey includes both original development of environmental innovation and adoption of EI to reduce a firm's environmental impact or to enhance energy efficiency. EI is not differentiated according to the type of innovation, e.g. technological or organisational, but solely according to the type of environmental impact the innovation has, regardless of whether it is the main objective or a side effect. Focusing on EI adoption instead of EI invention provides an advantage for two reasons. Firstly, not all invented green technologies (e.g. patents) are launched to the market and thus have an influence on the company's environmental performance (Albrizio et al., 2017). Secondly, for an invention to be patentable, it must be genuinely new, so that the mere adaptation of an innovation is not considered a patentable innovation. However, as explained above, imitation or adaptation is the common innovation among companies in transition countries.

In Chapter 4, survey data conducted by the independent research institute Levada Analytical Center in Moscow is applied. The advantage of using representative surveys from the Levada Center is that a high frequency of data is available, as a large sociological survey is conducted every two months and thus always reflects current public opinion in Russia. These surveys therefore allow us to analyse the change in public opinion. In the following sections, each dissertation paper is presented in more detail.

1.5.2 Innovation and Crisis in Transition Economies

This paper studies the relevance of the Schumpeterian theoretical considerations in the context of the global financial crisis of 2008/2009. The focus is on 29 transition countries of Central and Eastern Europe and Central Asia. In these countries, the market-based innovation systems are relatively young compared to established market economies, which may make them more vulnerable to the effects of this economic downturn. As a result of the crisis, we observe a sharp decline in innovation activity in all transition countries. This motivates the research question of how the economic crisis has shifted innovation activities across firms in the sense of creative destruction or accumulation.

Since the focus is on firms' innovation decisions, this paper uses BEEPS survey data. Two independent survey waves are selected as they provide information on firms' innovation activities. The 2009 BEEPS wave was conducted between 2005 and 2007 and the 2012 BEEPS wave between 2009 and 2011. These two waves were selected to compare firms' innovation behaviour before and during the aftermath of the financial crisis of 2008/2009. The study comprises two different samples of several thousand companies from 29 transition countries. There are two important consequences for the analysis based on this data structure. Firstly, the cross-sectional nature of the data imposes difficulties in determining the direction of causality. Secondly, we are only able to observe the aggregated shifts in firms' innovation behaviour.

The analysis shows some interesting results, using logit models of the pooled waves and a direct comparison of the two waves from the pre- and post-crisis observation period. We observe a shift of innovation from small to incumbent and large companies, indicating a process of creative accumulation. However, young companies also increase their likelihood of innovation after the crisis, which suggests, albeit weakly, creative destruction. Moreover, firms that engage in R&D are found to innovate more consistently and are thus less affected by the financial crisis. Access to financial resources such as loans and subsidies increases the probability of innovating after the crisis. In addition, access to finance in the form of subsidies combined with R&D increases the likelihood that a firm will innovate before and after the financial crisis.

Overall, the analysis shows that the external shock of the 2008/2009 global financial crisis has hit the innovation activity of these countries quite hard. Against this background, it is instructive to observe that an important theoretical prediction of Schumpeter, creative accumulation, is generally valid and durable. Moreover, our results argue in favour of counter-cyclical innovation policies, and in particular, financial support for business R&D.

1.5.3 A question of regulation or motivation? Environmental innovation activities in transition economies

Chapter 3 is motivated by the relevance of environmental innovations that contribute to decoupling economic growth and environmental impacts (Horbach, 2016; Shi et al., 2021; Stern, 2017). This is becoming an urgent task given that transition countries face more severe

warming and increasing occurrence of weather extremes in the wake of climate change. This paper focuses on the environmental innovation behaviour of companies in transition countries of Eastern Europe and Central Asia, which have received less consideration up to now. These transition countries are burdened with the Soviet legacy of environmental mismanagement. To some extent, this past is still embedded in lower environmental priorities and vague institutional commitments as compared to Western countries (Biscione et al., 2020; Crotty & Rodgers, 2012; Horbach, 2016; OECD, 2020). Therefore, the aim of this paper is to empirically investigate the main determinants affecting the environmental innovation behaviour of firms in transition economies.

This paper makes two main contributions. The data underlying this analysis provides a large number of observations (17,191 companies) across different countries and allows us to gain insights into the current (2018-2020) environmental innovation behaviour of companies. This provides an update to the existing literature which is mostly based on firm-level survey data from CIS 2014. In addition, there is an overrepresentation of studies focusing on environmental innovation in Western countries, while there are only few studies on less developed countries. As less developed countries are relatively more affected by the impacts of climate change (Chinowsky et al., 2011), it is therefore relevant to obtain a deeper understanding of their environmental innovation behaviour.

The analysis employs a logit model that investigates three kinds of environmental innovation and contrasts it to general innovations. The main limitation is again the nature of cross-sectional data, as the direction of causality cannot be clearly determined from these data. Nevertheless, this paper provides several important findings. Firstly, regulation in the form of energy taxes is positively associated with EI. The weaker results for regulation as an obstacle to doing business compared to other EIs may indicate that environmental regulation in transition countries is subject to less stringent regulation policies (OECD, 2020). This indication is further strengthened by the finding that the relationship between regulation and EI is stronger for transition countries that are part of the EU than for non-EU transition countries. This could be related to the EU's stricter environmental policy targets or their more stringent enforcement. Secondly, demand push factors are relevant. Customer demand for environmental protection stimulates EI but also general product and process innovations. These results are in contrast to previous studies on the eastern EU countries, which indicate

that consumer awareness of sustainability has increased over the years or that companies are now more responsive to it. Thirdly, the findings show that companies that suffer losses due to extreme weather events are more likely to engage in environmental initiatives. The strongest relationship here is found with environmental adaptation. This might suggest that companies use EI as a coping strategy. Finally, both internal R&D and collaborative R&D are positively associated with the adoption of EI. However, the results do not suggest that external R&D collaboration plays a more important role for EI than for general innovation. The results could be related to the fact that the network structures are relatively young and the networks between actors and institutions are less established, as the transition process was characterised by fragmentation and dissolution of scientific institutions.

These findings have some important policy implications. Firstly, policymakers should be encouraged to continue and strengthen their environmental regulations. Secondly, awareness of sustainability should be further raised among the population. Finally, external R&D linkages should be more strongly promoted.

1.5.4 Through thick and thin with the national leader: the rally around the flag effect in Russia

This study was prompted by the spike in President Putin's approval ratings in Russia during March 2014. In general, a presidential approval rate rises and falls with an economic recovery or recession (Ostrom & Simon, 1985; Tir & Singh, 2013). However, despite increasing international geopolitical tensions and a deteriorating economic situation, the president achieved the highest approval ratings among the Russian population. This circumstance led to a number of relevant research questions: Which (sub-) population groups contributed to this boost in approval? How long-lasting was the support in this group? Which mechanisms (opinion leadership or patriotism) were most pronounced over time?

In order to answer these questions, information from surveys conducted by the Levada Center in different months between 2008 and 2016 is used. Due to the cross-sectional structure of the data, it is possible that there is a reciprocal relationship between support for the president and feelings of national pride or state news consumption. To some extent, this is compensated for by explicitly examining support for the president by people who do not agree with Russia's development path in the robustness check.

Nevertheless, this large data set allows us to compare the waves before and after March 2014 and to capture the aggregate change in opinion. With the help of a nearest neighbour matching procedure, we are also able to directly capture the shift of opinion from people who have switched from opposing the president to supporting him. This way a number of important results are collected. First, although general support for the president is strongly associated with national pride, the geopolitical crisis in 2014 persuaded unpatriotic Russians to rally. However, the effect appears to be less long-lasting. The mechanism of patriotic feeling is more pronounced in terms of its stabilisation of the overall presidential support. Furthermore, following the state news is in general linked to a higher likelihood of supporting the president. However, again, Russians who followed the TV news were less likely to rally for the president. Finally, it is shown that people with low incomes are more likely to rally. However, we also illustrate that people with higher incomes are generally more supportive of President Putin. This casts doubt on the longevity of the lower-income approval.

This paper makes three main contributions. Firstly, we can track the change of opinion of former non-supporters and thus capture the nature of rally behaviour in Russia. Secondly, our large pooled data set allows a direct comparison of support mechanisms over a long period of time, which to the best of our knowledge, has not been done before in this form. Lastly, we separate the mechanisms behind the rally effect from the mechanisms behind general support sentiment.

1.6 Conclusion

This dissertation condenses three crises and illustrates that the past of transition countries is still relevant today, as they reflect weaknesses from their socialist and transformation pasts.

The global financial crisis of 2008/2009 reflected the weak linkages in domestic production and limited increases in knowledge intensity (Kattel, 2010; Tiits et al., 2008). This aligns with the sharp decline in R&D or innovation activities we observed in Chapter 2 as a result of the crisis. We assumed that an external shock like this hit the innovation activity of these countries harder compared to established market economies. In light of these considerations, it is insightful to observe that an important theoretical prediction of Schumpeter, creative accumulation, holds true. Our analysis showed weaker indications for creative destruction, which is probably an indication of the still weak or nascent start-up milieus in transition

economies. This argues for a counter-cyclical policy. Our results mostly align with what is found in the empirical literature (Correa & Ito, 2010; Paunov, 2012; Teplykh, 2018). This alignment could be initially surprising, as we assumed a much higher vulnerability of transition countries due to their relatively young innovation systems. However, it is an indication that policymakers from Western Europe are still taken as role models for policy-making in transition countries (Tiits et al., 2008).

The similarities in innovation policies are also reflected in the company behaviour regarding environmental innovations (see Chapter 3). Analysing the EI determinants of firms in transition economies show parallels in many parts to the findings of the non-transition countries. It is plausible to assume that the transition countries still take their cue from the non-transition countries and draw lessons from the successes and failures of their environmental and energy policies. The transition to a greener economic system requires, among other things, structural and technological changes, as well as institutional reforms (Li et al., 2020; Sineviciene et al., 2017). The transition economies have already experienced a system break and had to adapt their structures in the process. It is therefore conceivable that these historical experiences could also be beneficial for future challenges in order to counteract massive environmental problems. However, the weaknesses resulting from the transformation must be addressed. Addressing current vulnerabilities is not only important to ensure long-term economic growth, but also to ensure the well-being of the population in the face of environmental challenges. The results of Chapter 3 indicate that R&D cooperation is still quite weak in these countries which need to be strengthened as they positively correlate with EI. Policymakers should be encouraged by this to better promote external R&D linkages. Furthermore, in Chapter 4, this thesis contributes to the literature of presidential support in an authoritarian context. This chapter explores determinants of presidential support during the latest rally event in Russia accompanied by an economic crisis. We find that even though patriotic citizens are more likely to support the president, their non-patriotic counterparts are more likely to rally. Following state broadcasters is positively associated with presidential support but not with rallying. Moreover, this thesis found that as one's personal financial situation improves, the odds for presidential approval increase, however, it was the low-income class that was more likely to rally. Overall, the chapter contributes to a better understanding of the peculiarities of public opinion and its role in the rally effect in an

authoritarian context. We show that there are numerous overlaps between rally effects in both non-democratic and democratic countries, but also point to some significant differences. This thesis also provides policy-relevant insights by helping to shed light upon mechanisms that can trigger changes in public support. This is particularly important at a time when authoritarian populism is on the rise worldwide. Additionally, understanding mechanisms that can trigger changes in public opinion is of great importance, especially for transition countries, where authoritarian governance is relatively more common (Frye, 2021).

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2 Chapter

Innovation and Economic Crisis in Transition Economies

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Abstract:

Based on Schumpeterian theoretical considerations, this paper investigates the innovation behaviour of firms during the severe economic crisis of the year 2008/2009. It focuses on transition countries of Central and Eastern Europe and Central Asia, which have completely restructured their innovation systems through the course of transition from planned to market economies a relatively short time ago. As a result of the crisis, we observe a strong decline of innovation activity in all transition economies. In line with the literature, there is, however, empirical evidence for both creative destruction as well as creative accumulation. This underlines two key findings: firstly, the universality and durability of Schumpeterian assumptions, and secondly, a call for anti-cyclical innovation policy.

Keywords: Innovation behaviour, economic downturn, transition countries

JEL Classification: O12, O14, O30, O31, O57

Publication:

This article has been published as an original research article in *Eurasia Business Review*: Friz, K., Günther, J. (2021) Innovation and economic crisis in transition economies. *Eurasian Bus Rev* **11**, 537–563. <https://doi.org/10.1007/s40821-021-00192-y>

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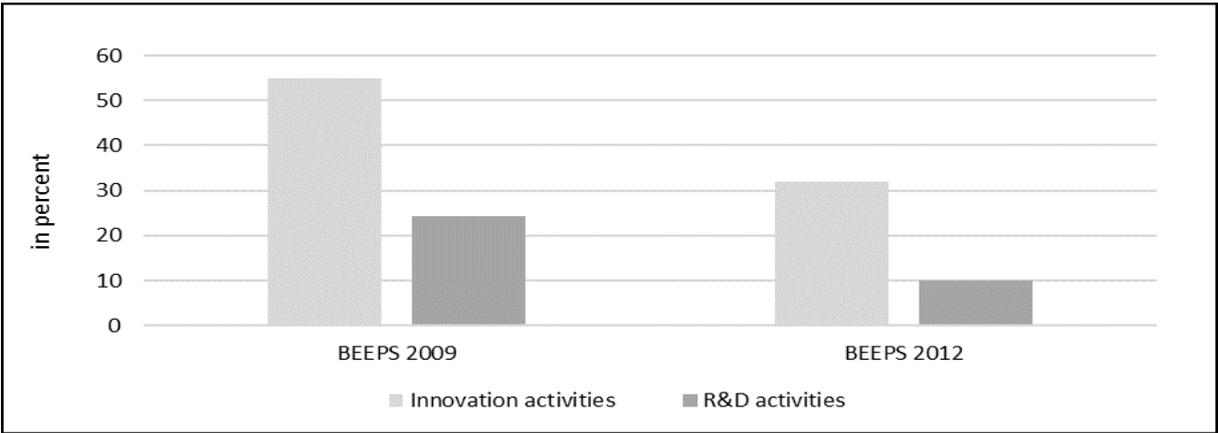
Acknowledgements

We are indebted to Ksenia Gonchar, Maciej Grodzicki, Maria Kristalova, Michael Rochlitz, and Tomasz Geodecki for their valuable comments and feedback on earlier versions of the paper. Furthermore, the work has benefited from helpful suggestions and comments of Christian Cordes and other participants of the IERP seminar in May 2020 at the University of Bremen as well as participants of the Research Colloquium in May 2019 at the Institute of Economics, Finance and Management at the Jagiellonian University (Kraków, Poland), and participants of the XX International April Conference at the HSE Moscow (Russia) in April 2019. In addition, we are very grateful to Chetna Chawla for valuable assistance in language editing. Finally, we would like to thank the anonymous reviewers and the journal editor for helpful comments and recommendations which improved the quality of the paper.

2.1 Introduction

The global financial crisis (GFC) of 2008/2009 had catastrophic repercussions on individual countries as well as on the international economy (Crotty, 2009; Obstfeld & Rogoff, 2009). Like many developed and emerging economies, Central and Eastern Europe (CEE) were hit hard by the GFC (Fagerberg & Srholec, 2016). Using firm level data of the Business Environment and Enterprise Performance Surveys (BEEPS), we can see that the economic crisis in CEE was also accompanied by a strong reduction of research and innovation activities. Considering 29 economies in CEE and the Commonwealth of Independent States (CIS) and comparing 2005-2007 and 2009-2011, we observe a significant drop in research and innovation activities (see Figure 2.1).

Figure 2.1: Share of firms (in % of all firms) involved in innovation or research & development (R&D) activities



Note: Data includes 29 transition economies. The BEEP survey 2009 and 2012 refer in each case to innovation / R&D activities in the period 2005-2007 and 2009-2011, respectively.
Source: European Bank for Reconstruction and Development

Descriptive statistics give a first impression about innovation and research activities before and after the economic crisis. Overall, it seems that innovation appears more cyclical rather than anti-cyclical in these countries. However, the reaction of individual firms may be different depending on their economic and financial situation as well as business strategy and other firm specific circumstances. Therefore, this paper will empirically investigate the determinants of firms' innovation and research activities in times of a deep economic crisis. In this context, we also scrutinise how the GFC of 2008/2009 shifted the innovation behaviour of companies in the sense of creative destruction or accumulation. The subject of the paper is of great importance, given the fact that the world economy is again experiencing an economic crisis triggered by the COVID-19 pandemic. Continuous innovation efforts are not only crucial for a

company's long-term economic performance but also for a country's knowledge base and its long-term growth (Grossman & Helpman, 2001; Romer, 1986, 1990). Schumpeterian literature suggests that innovative activities and innovative organisations can be revamped by economic crises through the effects of creative accumulation and destruction (Schumpeter, 1934, 1939). Moreover, creative destruction can be an opportunity for more economic diversification that benefits social welfare. Previous evidence indicates that diversification is particularly important for social welfare in transition economies (Ali & Cantner, 2020).

Whilst there exist several studies for European Union and Latin American economies on innovation behaviour during the GFC, no empirical insights are available for transition economies so far. We use the term "transition economies", referring to the formerly planned economies in CEE and the CIS. We acknowledge that transition in the sense of institutional change from a planned to a market economy has formally been completed in many of these countries, and that the group of all 29 transition economies today is quite heterogeneous. Conversely, these countries share the common experience of system break and complete restructuring of their economic and technological system. Moreover, these relatively young market-based innovation systems may be more vulnerable compared to established market economies. It is therefore very likely that the GFC of 2008/2009 had a stronger impact on innovation activity in these countries. Harmonised company survey allows a comprehensive analysis in which heterogeneity will be taken into consideration. Our paper is not focusing on a specific industry sector or technology, but how an economic crisis affects firms' innovation performance in general.

According to our findings, the crisis leads to an overall decline in innovation activities. Moreover, a shift of innovation activities from small to large firms occurs which indicates creative accumulation. However, we also observe that young firms increase their likelihood to innovate after the crisis which gives some weak indication for creative destruction as well. Further, our results show firms engaged in R&D activities innovate more persistently and thus are less affected by the GFC. Additionally, firms with access to financial resources such as loans and subsidies have a higher likelihood to innovate after the crisis.

The paper is organised as follows: Section two provides the literature review as well as the hypotheses. Section three describes the data samples and the econometric model. The

empirical results are presented in Section four. Finally, Section five provides a brief summary, dealing with study's limitations and a conclusion.

2.2 Theoretical considerations, literature review and hypotheses

In the 2008/2009 crisis, innovation activities overall declined significantly because of low demand expectations and increased uncertainty (Archibugi et al., 2013a, 2013b; Kanerva & Hollanders, 2009; OECD, 2009, 2012). Schumpeter argued that an economic turmoil could provide the chance for firms to become more efficient and innovative through creative destruction, allowing them to even gain competitive advantage (Schumpeter, 1911, 1934). Creative destruction is characterised by low learning cumulateness, high technological opportunities, and a dynamic environment with higher entry and exit rates (Archibugi et al., 2013a; Francois & Lloyd-Ellis, 2003; Malerba & Orsenigo, 1995). These more agile and flexible structures within new entrants and small companies allow them to better adapt to an economic downturn, challenging incumbent firms. Incumbent firms, though, perform research and development (R&D) and innovation as routine activities because they build on their previous knowledge in specific (technological) areas (Schumpeter, 1942). This innovation process is called creative accumulation and is characterised by path-dependent patterns, high knowledge accumulation, low opportunities, and high entry barriers which lead to a more stable environment (Archibugi et al., 2013a; Archibugi, 2017; Breschi et al., 2000; Nelson & Winter, 1982; Schumpeter, 1942). Hence, established companies benefit from their path-dependent patterns and cumulative learning processes and innovate continuously unaffected by economic fluctuations.

The most recent literature investigated firms' innovation behaviour during the GFC of 2008/2009 (Antonioli & Montresor, 2021; Archibugi et al., 2013a, 2013b; Filippetti & Archibugi, 2011; Paunov, 2012). Archibugi et al. (2013a) examining panel data from 2,500 British firms, found that firms classified as great innovators are more likely to increase innovation during the crisis (but not before), and thus supporting the case of creative accumulation. They also find evidence that new fast-growing firms are as well more likely to expand their innovation investment, indicating a process of creative destruction. However, the empirical evidence is not yet conclusive. Archibugi et al. (2013b) analysing survey data of 5,238 European companies from 2009, find that small or new firms are more likely to increase

their investment in innovation during the GFC, while before the crisis larger firms are more likely to increase their investment in innovation. Thus, they conclude that even though before the crisis creative accumulation prevailed, during the recession firms' innovation behaviour converged towards creative destruction. Findings from other studies, however, display the opposite. Teplykh (2018) using panel data from 420 Western European firms, found that larger firms innovated more during the crisis, while small firms struggled the most, indicating a stronger tendency towards creative accumulation. This is in line with Correa and Iooty (2010), who show for 1,686 Eastern European firms that young and innovative firms are more affected by GFC. Paunov (2012) confirms this for 1,548 Latin American firms, which are also an example of how young firms are less likely to innovate in times of crisis. In these studies, liquidity constraints are a listed reason for the innovation weakness of small firms during an economic slump because smaller or younger companies have more difficulties to access external finance due to small credit history (Correa & Iooty, 2010; Paunov, 2012; Teplykh, 2018). In fact, getting access to external finance during an economic downswing becomes difficult for firms because banks, markets, and investors are more risk averse in recessions (OECD, 2009, 2012; Paunov, 2012). These financial constraints detain innovation during recessions (Aghion et al., 2012; Hyytinen & Toivanen, 2005; Stiglitz, 1993).

The most recent empirical literature based on studies of European and Latin American countries indicates that there is no pure cyclical or anticyclical innovation behaviour (Archibugi et al., 2013a, 2013b; Filippetti & Archibugi, 2011; Paunov, 2012). It further demonstrates that creative destruction and creative accumulation co-exists. However, it should be noted that the countries studied so far are at different stages of development, which could explain the discrepancies in the results. In transition countries, not much is yet known about the impact of the GFC on innovation behaviour. All transition economies experienced a system break with heavy losses of their scientific and industrial research and development (Meske, 2000). Since the 1990s, they have tried to build-up and modernise their innovation systems and to re-engage in original technological activities (Dyker, 2010; Günther, 2015; Varblane et al., 2007). The economic crisis of 2008/2009 puts these achievements at risk. Using firm-level data for a large number of transition economies and drawing on Schumpeterian theoretical considerations, we will test the following hypotheses about firm behaviour in transition economies for the pre- and post-crisis periods.

According to the literature, incumbent firms in general profit from their established resources and are more robust in innovating during an economic crisis (Archibugi et al., 2013a; Paunov, 2012; Teplykh, 2018). In transition economies, it must also be accounted for that the institutional environment often fosters the success of large firms, while the opportunities for small and medium companies are restricted (Golikova & Kuznetsov, 2017). Furthermore, incumbent firms are former organisations of the planned economy. They survived by adapting to market conditions and a changing institutional environment which completely disrupted their innovation routines (Maksimov et al., 2017; Radosevic & Auriol, 1999). This profound experience may have given these companies a greater resilience to other crises. Therefore, the first hypothesis is:

H1: The crisis leads to a shift of innovation activities across firms towards larger or older firms (in the sense of creative accumulation).

However, a crisis can provide chances for small and new firms to emerge and gain market power through creative destruction (Archibugi et al., 2013a; Francois & Lloyd-Ellis, 2003; Malerba & Orsenigo, 1995). In transition economies, these young firms have no predecessor in the pre-reform economy and emerged in an already competitive environment, which is expected to make them more responsive to changing market conditions (Carlin et al., 2004). Thus, the second hypothesis is formulated as follows:

H2: The crisis leads to a shift of innovation activities across firms towards small or younger firms (in the sense of creative destruction).

Financial constraints are one of the main reasons to cut back innovation during an economic downturn (Hyytinen & Toivanen, 2005; Spatareanu et al., 2019; Stiglitz, 1993). The results of Gorodnichenko and Schnitzer (2013) and Mateut (2018) show that this also applies for transition countries in Eastern Europe and Central Asia. Furthermore, during a crisis banks, markets, and investors become more risk averse and it is more difficult to get access to external finance (OECD, 2009, 2012; Paunov, 2012). Hence, the third hypothesis to be tested is:

H3: Firms with better access to finance are less likely to cut back their innovation activities during the crisis.

H3a: Companies with better access to finance are more likely to spend money on R&D and are therefore more likely to innovate during the crisis.

2.3 Data and Econometric Specification

2.3.1 Description of the data

The analysis makes use of the Business Environment and Enterprise Performance Survey (BEEPS), which is implemented by the EBRD (European Bank for Reconstruction and Development) in partnership with the World Bank. The BEEPS data is a firm-level survey based on face-to-face interviews with managers containing information on a wide range of standard firm characteristics. BEEPS also covers a wide range of business environment topics. Furthermore, it provides the advantage that firms self-report various types of their innovation activity such as: if the company introduced new products or services or did a major upgrade of existing ones or acquired a new production technology over the last three years. ‚New’ in this case means new to the firm, not necessarily new to the market. A frequently used alternative in innovation research is a combination of firm and patent data. We have not taken this approach because analysing patent activity in transition countries is less suitable since firms are more likely to innovate through imitation or adaptation instead of inventing completely new (patentable) things of the existing state-of-the-art technologies (Acemoglu et al., 2006; Aghion et al., 2002; Gorodnichenko et al., 2009; Gorodnichenko & Schnitzer, 2013). Using publication data is another alternative. However, this leads to the problem of language bias, as publication databases typically only include English-language publications.

We analyse the fourth and fifth wave of the BEEPS that were conducted in 30 countries²⁷ during 2009 and 32 countries²⁸ during 2012. The surveys contain answers from almost 12,000 enterprises in 2009 and 15,600 in 2012. Since our research concentrates only on transition countries, we have omitted data from Turkey, Greece, and Cyprus. Our final sample comprises 10,846 observations in 2009 and 14,539 in 2012 for 29 transition countries. Both surveys have

²⁷ Both surveys contain 17 countries from CEE: Albania, Bosnia and Herzegovina, Kosovo, FYR Macedonia, Montenegro, Serbia, and the EU member states Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia, another 11 countries from the former Soviet Union: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine, and Uzbekistan, as well as Mongolia and Turkey.

²⁸ The countries Cyprus and Greece were only surveyed in BEEPS 2012.

a similar sampling frame and contain a wide range of identical questions. Each sample includes very small firms with a minimum of two employees as well as large firms with up to 10,000 employees. The sample excludes companies that are ruled by government price regulations such as electric power, gas, and water supply and companies that are 100% state-owned. Overall, the sample frames have been designed by a stratified random sampling to assure a representative structure of the firms' population in each country. In each country, the sectoral composition concerning the share of manufacturing firms versus firms in services has been set by their contribution to country's GDP²⁹. Furthermore, the data includes companies from both rural areas and large cities. Moreover, each questionnaire includes a question regarding the firms' innovation activities over the last three years³⁰. This enables us to compare innovation behaviour before and during the aftermath of the crisis.

We rely on pooled data for data-related reasons. Due to missing information about panel firm identification numbers, a unique firm identification in both waves is not possible. Moreover, the small panel data set of heterogeneous firms makes it difficult to determine robust relationships (Gorodnichenko & Schnitzer, 2013).

2.3.2 Operationalization of key variables

To investigate our first two hypotheses, we use the following firm characteristics: firm size measures the number of full-time employees (at the end of the fiscal year) and ranges from micro, small, middle to large firms. The size categories are in accordance with the OECD's criteria.³¹ Further, age is measured as the number of years since the firm is operating and coded as a categorical variable (from 1= start-up (1-5 years) to 4=incumbent (over 21 years)). We included the sub-categories start-up to control for newly created businesses as the first five years are the most challenging years for a company (Fort et al., 2013). Alternatively to firm age, we include categories of manager experience measured in years. With respect to the

²⁹ The manufacturing sector includes manufacturing and agro-processing, but not primary industries such as mining or agriculture. The service sector includes retail, wholesale, IT and repair services, hotel and restaurants as well as transportation and communication services.

³⁰ This three-year period covers 2005-2007 in BEEPS 2009 and 2009-2011 in BEEPS 2012, but it should be noted that Russian companies were surveyed one year earlier in the 2012 survey. Thus, in this case, the innovation period covers 2008-2010.

³¹According to OECD (2017) firm sizes can be subdivided into micro (fewer than 10 employees), small (10 to 49 employees), and medium-sized enterprises (50 to 249 employees). Large enterprises employ 250 or more people.

third hypothesis, the firm's financial situation is described through the dummy loan (if the firm currently has a loan from a financial institution or not). In addition, we include a subsidies dummy (if the firm received governmental subsidies over the last three years or not), as subsidies can help stimulate firm's innovation activities in times of crisis (Brautzsch et al., 2015; Mateut, 2018; Paunov, 2012). As a measure of firm financial constraints, we use the following two variables: (1) the dummy variable overdue, which indicates if the firm has overdue payments by more than 90 days or not. (2) Self-reported problematic to get access to finance, which includes availability and cost, interest rates, fees and collateral requirements. Access to finance is coded ,1' if it is none to minor obstacle, ,2' if it is a moderate obstacle and ,3' if it is a very severe to major obstacle.

Furthermore, we include R&D as a measure of innovation input, even though not all R&D activities generate innovations necessarily. The dummy R&D (inhouse or outsourced) measures whether a company spends money on R&D or not³². The variable employee growth is included as firms' employment decisions can reflect the effects of an economic plunge. Moreover, a firm is foreign owned if the foreign shareholder holds more than 50%. Gorodnichenko and Schnitzer (2013) and Karymshakov et al. (2019) found that foreign-owned companies innovate more in transition countries than local firms. As foreign competition and exporting status can have an impact on firm behaviour (Beneito et al., 2015; Gorodnichenko et al., 2009; Mateut, 2018; Molodchik et al., 2021) we include export defined as 1/0 if the company is doing export business. Background measures the firms' origin: 1= private from the start, 2=privatised, and 3=other (e.g. private subsidiary of a formerly state-owned firm, joint venture with foreign partner). The ordinal variable education describes the share of employees with a university degree and captures the human capital within a firm.

2.3.3 Summary statistics

Table 2.1 reports the summary statistics of all variables for each survey wave.

³² Archibugi et al (2013a, 2013b) are using R&D expenditures in their analysis. Due to a large amount of missing data for R&D expenditures, we decided against using this indicator. We are aware that the binary R&D variable has its limitations.

Table 2.1: Summary statistics

Variable	N	Mean	Std. Dev.	Min	Max
BEEPS survey 2009					
Dependent variable					
Product or Process Innovation	10828	.637	.481	0	1
Central explanatory variables					
Firm size	10729	2.24	.902	1	4
Firm age	10839	2.671	.864	1	4
Manager experience	10839	2.775	.987	1	4
R&D activities	10717	.243	.429	0	1
General economic & financial situation					
Current loan	10703	.464	.499	0	1
Subsidies	10678	.086	.281	0	1
Employee growth	10079	1.68	.829	1	3
Sales growth	7321	1.403	.574	1	3
Financial constraints					
Overdue payment	10731	.642	.48	0	1
Access finance	10396	1.817	.849	1	3
Control variables					
Foreign owned	10839	.073	.26	0	1
Background	10823	1.347	.598	1	3
Human capital (HC)	10336	2.388	.855	1	4
Export	10806	.233	.423	0	1
EU transition	10839	.316	.465	0	1
BEEPS survey 2012					
Dependent variable					
Product or Process Innovation	14536	.433	.495	0	1
Central explanatory variables					
Firm size	14449	1.937	.809	1	4
Firm age	14537	2.656	.912	1	4
Manager experience	14538	2.792	.955	1	4
R&D activities	14443	.102	.302	0	1
General economic & financial situation					
Current loan	14331	.34	.474	0	1
Subsidies	14409	.081	.273	0	1
Employee growth	13519	1.78	.794	1	3
Sales growth	8555	1.518	.5	1	2
Financial constraints					
Overdue payment	14538	.633	.482	0	1
Access finance	14250	1.567	.793	1	3
Control variables					
Foreign owned	14538	.046	.21	0	1
Background	14523	1.207	.514	1	3
Human capital (HC)	13858	2.68	.96	1	4
Export	14403	.191	.393	0	1
EU transition	14538	.256	.436	0	1

Source: European Bank for Reconstruction and Development

Among the central explanatory variables, the share of firms classified as micro and small increase in Beeps 2012 compared to 2009, while the share of medium and large firms slightly declines. A possible explanation is that firms were forced to dismiss employees due to the

GFC. The share of firms involved in R&D sinks by almost 15 percentage points in BEEPS 2012 compared to 2009. Other financial indicators also decreased in the 2012 survey, as expected. The percentage of firms with a current credit line drops by about 10 percentage points. It is surprising that the share of firms ranking access to finance as a great obstacle decreased from BEEPS 2009 to 2012. The share of firms with overdue payments stays stable in both waves.

Table A1 presents the correlation coefficients. The coefficient suggests that larger firms are more engaged in R&D. Similarly, there is a positive correlation between firms involved in R&D and receiving subsidies. Human capital (HC) measured in form of employees with a university degree and R&D spending are only weakly positively correlated. There is no indication of multicollinearity problems.

2.3.4 Econometric Specification

The dependent variable in our analysis is binary and stands for product or service innovation or process innovation, with an either “yes, innovated over the last three years” or “no, did not” option. Innovation in this context is defined as the introduction of new products/services or process technologies³³. The query of firms’ innovation activities is in accordance with the Oslo Manual established by OECD and Eurostat. Due to the binary dependent variable, a logit model is employed for the estimation. We have chosen the logit approach as it facilitates the interpretation of the coefficients (Archibugi et al., 2013b). The vector of explanatory and control variables encompasses firm characteristics such as size, age, employee growth over the last three years, manager experience, R&D, education, subsidies over the last three years, and foreign ownership.

We are aware of a possible reverse causality that has to be considered. Therefore, the estimated correlation between the various firm characteristics and innovation activities cannot be considered causal. Nevertheless, this paper attempts to determine as best as possible how size, age, R&D activities, and financial measures affect innovation through a variety of controls. To control for unobserved heterogeneity across countries and industry sectors, we include country as well as industry dummies based on four-digit industry codes

³³ Since the Beeps 2009 definition of product innovation explicitly refers to changes in the process, we combined it with the queries of process or product innovation in Beeps 2012 on the independent variable (product or process innovation).

according to ISIC Revision 3.1 classification. An overview of the industry labels is provided in Table A2.

2.4 Empirical results

2.4.1 Baseline results

The main findings of the study are presented in Table 2.2. Column 1 shows the main variables of interest (firm age, firm size, and financial measures) whilst in column 2, the age variable is expressed as the manager's experience. All specifications control for industry and country fixed effects and cluster standard errors at industry and year level. In addition, a likelihood ratio test was applied to ensure that the models explain more than an empty base model. Models with a significant p-value (less than 0.01) are included.

Table 2.2: Logit estimation results of pooled BEEPS waves

	(1)	(2)
Size: small firm	1.152*** (0.0471)	1.165*** (0.0482)
Size: medium firm	1.214*** (0.0667)	1.242*** (0.0675)
Size: large firm	1.265** (0.0956)	1.317*** (0.103)
Age: young firm (6-10 years)	1.162** (0.0591)	
Age: middle aged (11-20 years)	1.296*** (0.0579)	
Age: incumbent (>20 years)	1.341*** (0.0885)	
Manager exp. (6-10 years)		1.079 (0.0610)
Manager exp. (11-20 years)		1.320*** (0.0740)
Manager exp. (>20 years)		1.271*** (0.0889)
RD activities	5.266*** (0.314)	5.273*** (0.311)
Subsidies	1.351*** (0.0750)	1.362*** (0.0760)
Current loan	1.289*** (0.0431)	1.290*** (0.0426)
Overdue	1.250*** (0.0493)	1.252*** (0.0494)
Employee growth increased	1.292*** (0.0546)	1.265*** (0.0558)
Employee growth decreased	1.002 (0.0372)	1.006 (0.0363)
Access finance: no/minor obstacle	0.984 (0.0430)	0.983 (0.0427)
Access finance: great obstacle	1.257***	1.253***

	(0.0523)	(0.0519)
Foreign owned	1.301***	1.293***
	(0.0823)	(0.0811)
Export	1.392***	1.389***
	(0.0975)	(0.0981)
HC: up to 25% have university degree	1.199**	1.203**
	(0.0884)	(0.0873)
HC: 25-50% have university degree	1.354***	1.361***
	(0.102)	(0.101)
HC: more than 50% have university degree	1.531***	1.543***
	(0.113)	(0.113)
Private from start	1.060	1.036
	(0.0740)	(0.0695)
Privatization	0.840**	0.847**
	(0.0699)	(0.0683)
N	21395	21395
PseudoR	0.178	0.179
Log Likelihood	-12030.574	-12023.846
LR Chi ²	5221.32	5234.77
Prob > chi ²	0.000	0.000

Note: The dependent variable is binary standing for process or product/service innovation activities. Reference groups: for firm size: micro firms; manager experience/age: 1-5 years; employee growth: unchanged; access finance: moderate obstacle; HC: no workers with university degrees. Time controls as well as country and industry fixed-effects are included. Exponentiated coefficients: to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at sector*wave level, * p < 0.10, ** p < 0.05, *** p < 0.001. Source: European Bank for Reconstruction and Development

The estimates suggest a positive and significant relationship between firm size and firm innovation: the odds to innovate increase with size. Large firms have 27% higher odds to innovate compared to micro firms, whereas the odds to innovate decrease around 11 percentage points for small firms. Looking at the marginal effects of firm size on firm's predicted innovation activities and comparing the two survey (see Figure 2.2³⁴), we can see that before the GFC small firms are more likely to innovate compared to micro firms, but there are no substantial differences to medium and large companies. However, after the GFC large firms have a higher predicted likelihood to innovate. Although it appears that small firms were innovating before the GFC, our overall results suggest a shift of innovation activities from small to large firms, indicating a process towards creative accumulation during and after the crisis. This is plausible as larger firms have more resources and are thus more resistant to a crisis and continue to innovate. Thus, we can confirm our first hypothesis.

³⁴ The corresponding regression tables of the marginal effects are available upon request.

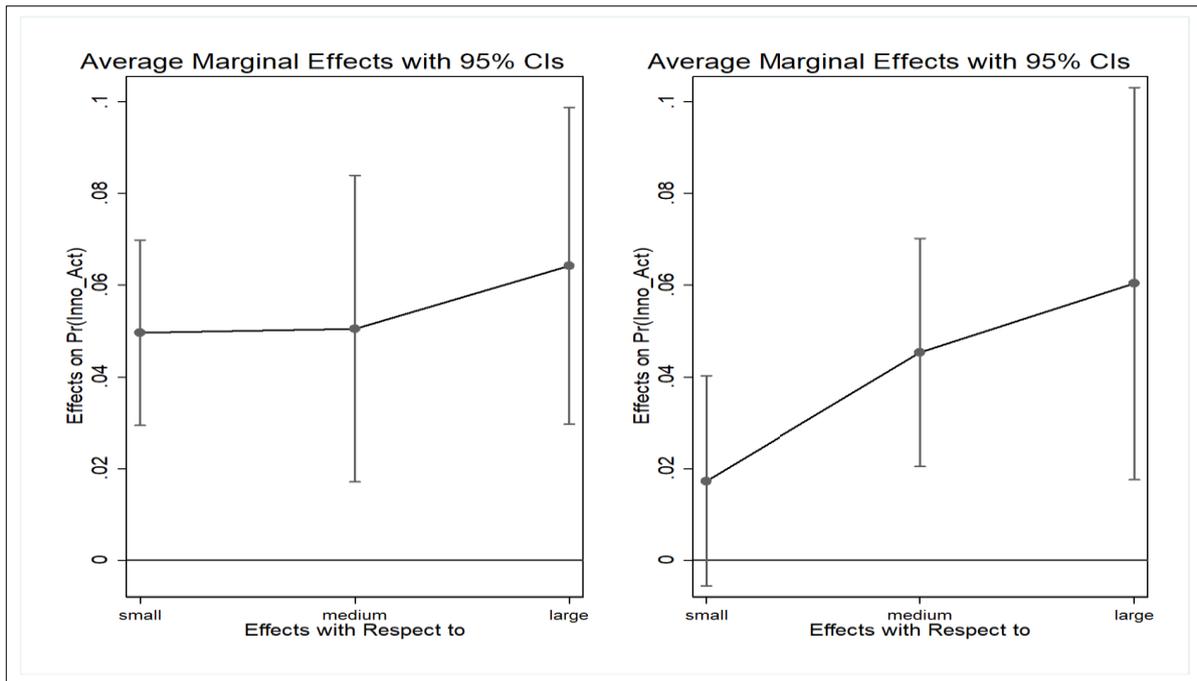


Figure 2.2: Marginal effects on predicted probability of firm’s innovation activities with respect to firm size before (left) and after (right) the crisis. Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Here, the reference group is “micro firms”. Source: European Bank for Reconstruction and Development

Turning to firm age, the results similarly suggest a positive and significant relationship between firm age and innovative activities. Again, the odds to innovate increased with age. Incumbent firms have 34% higher odds and middle-aged firms have 29% higher odds to innovate compared to start-up firms, while young firms have 16% higher odds to innovate. Figure 2.3 shows the marginal effects of firm age on firm’s predicted innovation activities for both surveys. According to Figure 2.3, before the GFC middle aged firms are more likely to innovate compared to start-up firms, while after the GFC also young firms and incumbent firms have a higher probability to innovate. These findings indicate that incumbent firms which in general perform innovation activities more routinely, innovate less affected by the crisis. Once again, this confirms our hypothesis. However, we also see a rise in the likelihood to innovate among young firms. This could indicate a behaviour of creative destruction. Hence, we cannot fully rule out our second hypothesis.

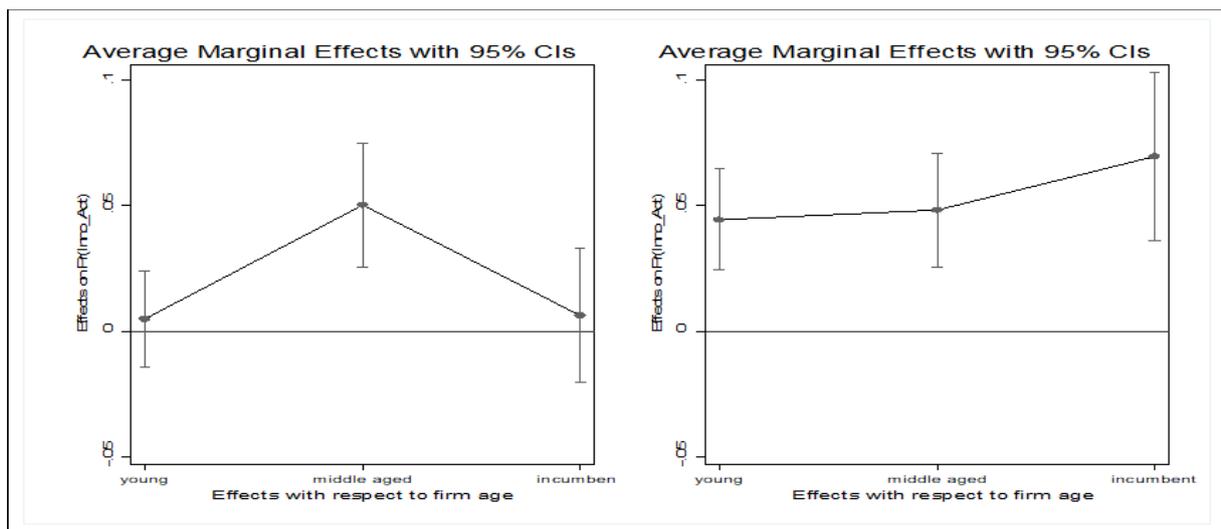


Figure 2.3: Marginal effects on predicted probability of firm’s innovation activities with respect to firm age before (left) and after (right) the crisis. Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Here, the reference group is “start-up firms” Source: European Bank for Reconstruction and Development

Concerning our third hypothesis, our results indicate that firms with access to finance such as a current loan or receiving subsidies have indeed higher odds to innovate compared to firms that do not have access to these financial resources. Firms that receive governmental subsidies over the last three years have 35% higher odds to innovate than those that do not. As in transition economies the institutional environment often fosters the success of incumbent firms (Golikova & Kuznetsov, 2017), we compare in Figure 2.4 the probability to innovate of firms that are receiving government subsidies across firm age before and after the GFC. Before the GFC, firms had (disregarding age) about the same level of likelihood to innovate. After the crisis, older subsidised companies are more likely to innovate. This result indicates that older companies may receive more government support. A possible reason might be that older firms are receiving more publicly funded support because they have a stronger political network or on the basis of the concept ‘too big to fail’ incumbent firms get more public support.

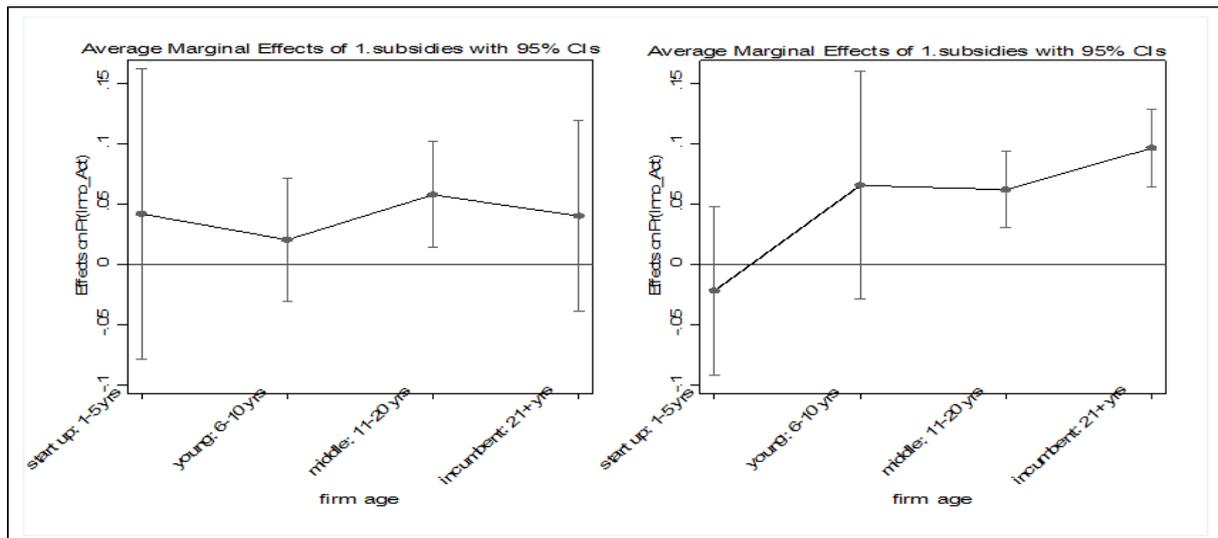


Figure 2.4: Marginal effects on predicted probability of firm's innovation activities with respect to receiving subsidies across firm size before (left) and after (right) the crisis. Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Here, the reference group is "firm with no loan" Source: European Bank for Reconstruction and Development

Firms with a current loan have 29% higher odds than those that do not. Thus, it appears that firms with access to finance are more likely to innovate, which confirms our third hypothesis.

Furthermore, firms that are doing well and increase their number of employees have 29% higher odds to innovate compared to those who maintain their employee number³⁵. However, decreasing the number of employees is not significant. Interestingly, those firms with issues to access finance and firms with financial constraint in form of overdue payments have as well higher odds to innovate. How can this be? Companies that state accessing finance is a great obstacle have 26% higher odds to innovate than those with moderate difficulties. In addition, firms with overdue payments have 25% higher odds compared to firms that do not. What seems counterintuitive at first sight, becomes clearer on closer examination. Comparing the marginal effects of having overdue payments across firm size (see Figure 2.5), it becomes visible that after the crisis the likelihood of firms (disregarding size) with overdue payments to innovate decreases. These results suggest that innovating firms are more likely to face

³⁵ As an alternative to employee growth, we used sales growth in our analysis. The findings are similar. Companies that report an increase in turnover are more likely to be innovative. Due to the high numbers of missing that occurred when creating this measure, we decided not to include sales growth in our main analysis.

financial constraints than firms that do not pursue innovation activities. These findings are consistent with Mateut (2018) and Gorodnichenko and Schnitzer (2013).

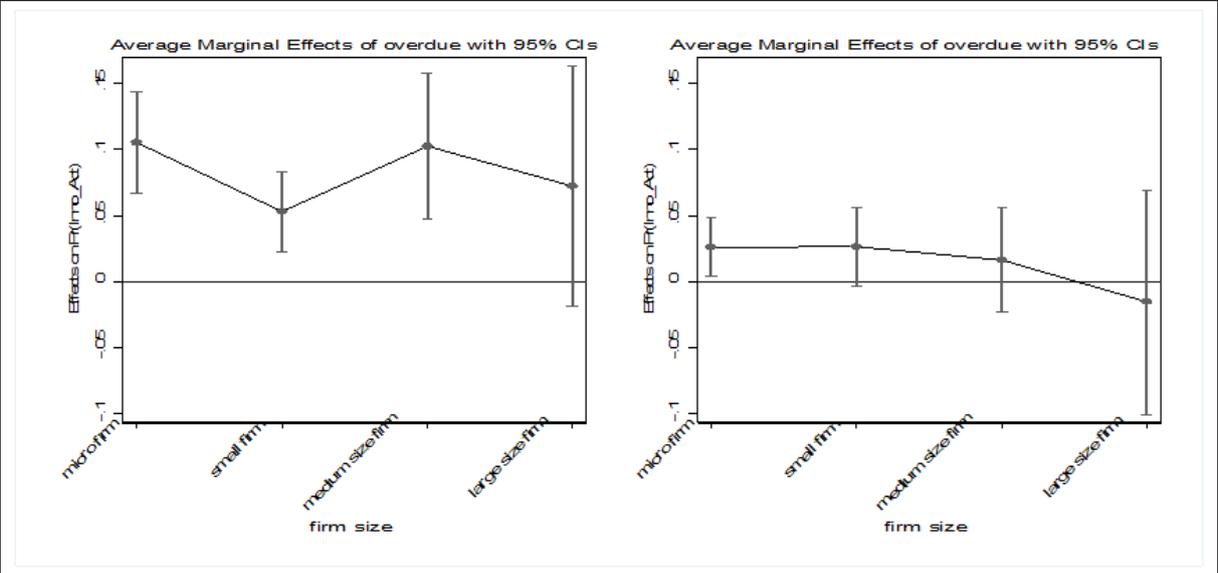


Figure 2.5: Marginal effects on predicted probability of firm’s innovation activities with respect to overdue payments across firm size before (left) and after (right) the crisis. Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Here, the reference group is “no overdue payments” Source: European Bank for Reconstruction and Development

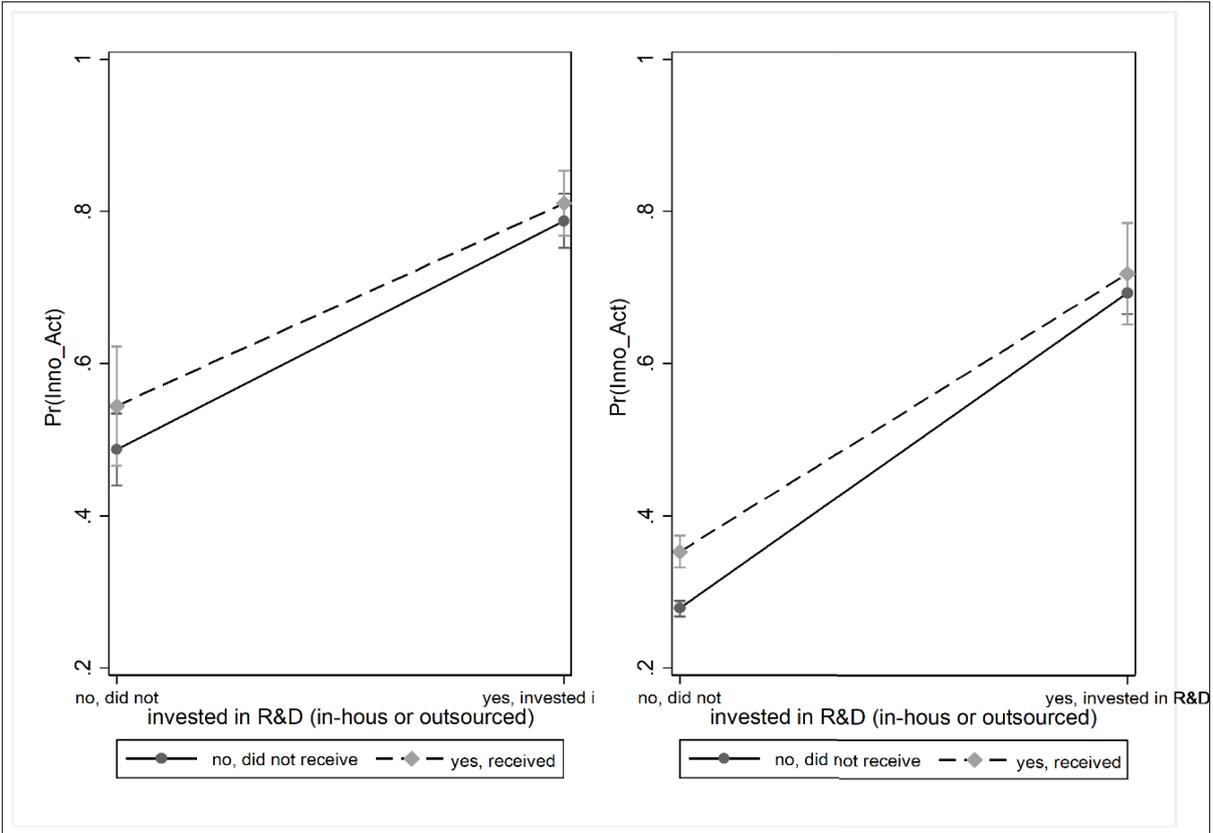


Figure 2.6: Marginal effects on predicted probability of firm’s innovation activities with respect to receiving subsidies and spending on R&D before (left) and after (right) the crisis. Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Source: European Bank for Reconstruction and Development

With respect to hypothesis 3a, we find that access to finance in the form of subsidies in combination with R&D leads to a higher predicted innovation probability before and after the financial crisis (see Figure 2.6). However, the innovation probability of firms that do not receive subsidies drops by half after the crisis. A similar picture emerges when looking at access to credit and R&D. Due to the high degree of similarity, only one figure is presented here. It seems that access to financial sources supports companies' innovation activities. Although firms that invest in R&D without financial support from subsidies also have a higher predicted probability of innovating.

Moving to our control variables, our findings show that R&D activities are an important input-factor for innovation. This is in line with the results of Gogokhia and Berulava (2021). The odds to innovate are over five times higher for companies involving themselves in R&D than those that do not. These results are in line with Archibugi et al. (2013a, 2013b.) Comparing firms' R&D activities across firm size before and after the GFC shows that R&D stabilises innovation across firm sizes (see Figure 2.7). We see that (disregarding firm size), firms which didn't invest into R&D have a lower level of probability to engage in innovation activity. Whereas the probability of R&D investors only decreases by 5 percentage points. A similar picture appears comparing firms' R&D activities across firm age before and after the GFC³⁶. These results suggest that companies that invest in R&D innovate more continuously throughout a crisis.

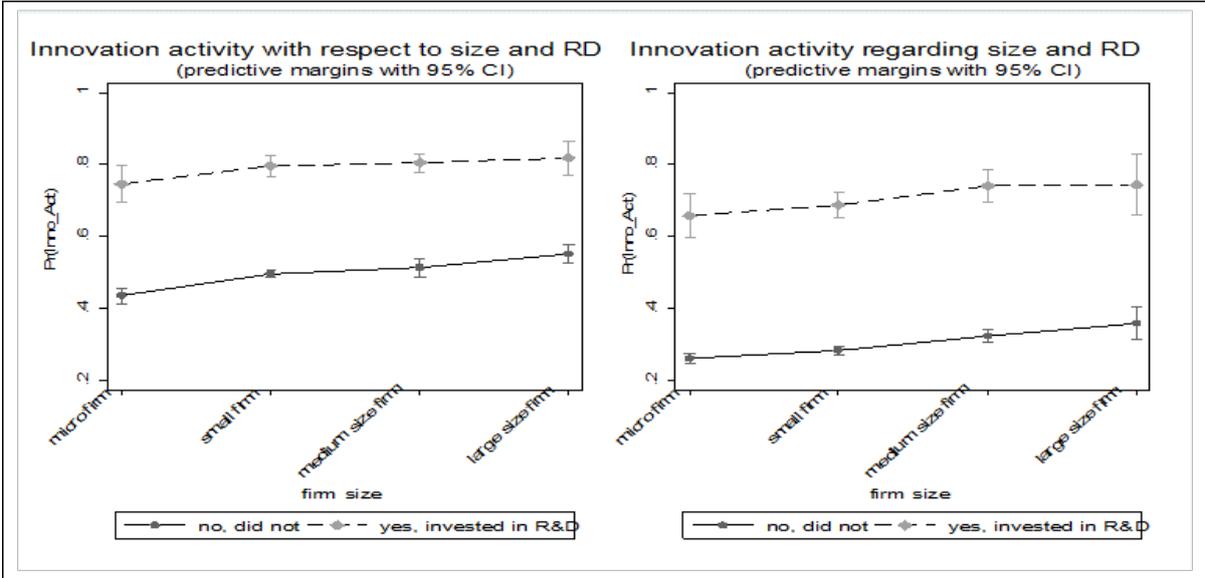


Figure 2.7: Predicted probability of firms' innovation activity depending on R&D activities across firm size before (left) and after (right) the crisis. Source: European Bank for Reconstruction and Development

³⁶ Due to the strong similarity, we have only included one figure. The other illustration is available upon request.

Regarding internationalisation, our findings show that foreign firms have 30% higher odds to innovate compared to domestically owned ones. Furthermore, companies involved in the export business have almost 40% higher odds to innovate than those that are not. These findings are in line with Paunov (2012) and show that internationalisation helps to stimulate innovation in transition economies. Human capital measured as the share of employees with a university degree makes innovation activities within firms more likely. Firms where a majority of employees hold a university degree have 53% higher odds to innovate than firms with no university-trained employees. These results support the premise that innovation knowledge is impersonated in skilled workers and should not be dismissed due to a crisis (Hall & Lerner, 2010; Paunov, 2012). Besides, we control the firm's background whether the firm was privatised or run privately from the start. Our results suggest that privatised firms have around 20% fewer odds to engage in innovative activities compared to firms created by a joint venture etc., while the difference between joint ventures and private firms since their start is not significant. This could imply that privatised firms may offer a less creative environment and, thus, have less odds to innovate.

2.4.2 Robustness checks

Although firm age is a good measure for a firm's experience and knowledge base, it does not necessarily mean that the firm's manager is as experienced as firm age implies. Furthermore, Amore (2015) demonstrated that past experience shapes firms' innovation decisions during crises. Therefore, we additionally use an alternative measure of manager experience.

We present the robustness checks in column 2 of Table 5. Overall, our findings still hold. The odds to innovate increase by 3 percentage points for medium sized firms and by 5 percentage points for large firms compared to the baseline estimations. Firms run by managers with eleven to twenty years of experience have 32% higher odds compared to firms with inexperienced managers. Though, the odds to innovate decrease by 5 percentage points for firms that employ managers with over twenty years of experience. This indicates that with higher age managers are getting less eager to innovate. Nevertheless, it supports our findings above, during and after the crisis innovation activities across firms shifted and became more concentrated in experienced firms.

So far, we have focused on product or process innovation as well as on pooled waves. Table 2.3 shows the results in column (1) of product/process innovations, as the 2009 BEEPS survey does not allow a delimitation of process innovations. Column (2) analyses the 2012 wave separately with reference to product/service innovation or, in the case of column (3), to process innovation. Overall, our findings remain similar. Slight differences appear when analysing Beeps 2009 individually. Differences within the categories firm age are less significant. However, this confirms the results of the marginal plots presented above. Before the crisis, small firms as well as middle aged firms were more likely to innovate. However, after the crisis a shift of innovation activities happens towards large and incumbent firms having the highest odds to innovate which can be seen in the results of column (2). This is indicating a process towards creative accumulation. When only focusing on process innovation, we can see that the odds to innovate increase even more with age and size. This makes sense as process innovation conducted to reduce costs, to increase output or quality is more common among larger firms. This is in line with the results of Paunov (2012).

Table 2.3: Logit estimation results of BEEPS waves separately by innovation type

	(1) Product/process 2009	(2) Product 2012	(3) Process 2012
Size: small firm	1.280*** (0.0650)	1.027 (0.0623)	1.231** (0.0858)
Size: medium firm	1.286** (0.109)	1.205** (0.0844)	1.417*** (0.110)
Size: large firm	1.378*** (0.122)	1.297* (0.178)	1.690*** (0.194)
Age: young firm (6-10 years)	0.997 (0.0492)	1.311*** (0.0897)	1.383*** (0.132)
Age: middle aged (11-20 years)	1.257*** (0.0747)	1.317*** (0.0713)	1.428*** (0.136)
Age: incumbent (>20 years)	1.035 (0.0724)	1.545*** (0.132)	1.534*** (0.196)
RD activities	4.557*** (0.266)	5.128*** (0.296)	5.493*** (0.350)
Subsidies	1.222** (0.117)	1.378*** (0.0751)	1.384*** (0.125)
Current loan	1.248*** (0.0583)	1.288*** (0.0910)	1.351*** (0.0688)
Overdue	1.437*** (0.0763)	1.170** (0.0758)	1.215*** (0.0691)
Access finance: no/minor obstacle	1.007 (0.0806)	0.924 (0.0618)	1.082 (0.0758)
Access finance: great obstacle	1.239*** (0.0752)	1.161** (0.0735)	1.442*** (0.103)
N	9015	12418	12497
PseudoR ²	0.153	0.159	0.172

Log Likelihood	-5235.0208	-5987.5693	-5304.9642
LR Chi ²	1891.62	2262.15	2200.39
Prob > chi ²	0.000	0.000	0.000

Note: Reference groups are as follows: for firm size: micro firms; age: 1-5 years; employee growth: unchanged; access finance: moderate obstacle. All controls included like in Table 2. Time controls, sector, and country fixed-effects included. Exponentiated coefficients: to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at the sector*wave level, * p < 0.10, ** p < 0.05, *** p < 0.001. Source: European Bank for Reconstruction and Development

To account for the complementary nature of product and process innovations (Mantovani, 2006), we also apply a bivariate probit estimation. Table A3 presents the marginal effects at the means. Overall, our results are comparable. For both, product and process innovation, the probability that a firm will innovate increases with size and age. The estimated effect of large firms is higher for process innovation with 27% compared to 15% for product innovation. R&D activities positively affect the probability that firms innovate either in products or processes. Furthermore, firms with access to finance in form of subsidies and a loan have a higher probability to innovate. The wald test shows a significant correlation between the error terms, but the estimation yields very similar results. The magnitude of the marginal effects was compared with a probit estimate (see Table A4). Here, too, there are no overly large differences.

2.4.3 Further analysis: subsamples

To account for the different levels of development of the countries considered here, we use the possibility that BEEPS allows for the comparison of cross-country variations. Thus, we estimate two subsamples with respect to EU-membership (see Table 2.4, Column 1 and 2). Among EU countries, young firms have with 33% the highest odds to innovate compared to start-up firms. While in non-EU countries middle-aged firms have the highest odds to innovate. Once again, the difference in odds regarding firm size is noticeable. In transition countries without an EU membership, odds increase much more with firm size compared to EU transition countries. This could be related to the institutional environment in these countries which often fosters the success of larger firms. Moreover, we find that being involved in R&D activities increases the likelihood in both country groups. Although, the relation is stronger in non-EU countries. In both country groups, having a current loan increases the likelihood to innovate. However, the odds to innovate are 20 percentage points higher among non-EU members. Hence, it appears that in these countries access to finance has a higher importance to innovating firms.

Table 2.4: Logit estimations of pooled subsamples with respect to EU-membership and sectors

	(1) EU transition countries	(2) None-EU countries	(3) Manufacturing	(4) Service
Size: small firm	1.066 (0.0643)	1.195*** (0.0544)	1.076 (0.0863)	1.197*** (0.0516)
Size: medium firm	1.104* (0.0983)	1.288*** (0.0833)	1.099 (0.102)	1.315*** (0.0855)
Size: large firm	1.072 (0.123)	1.361** (0.133)	1.300* (0.196)	1.178** (0.0830)
Age: young firm (6-10 years)	1.329** (0.141)	1.131** (0.0609)	1.183** (0.0882)	1.134** (0.0703)
Age: middle aged (11-20 years)	1.218** (0.113)	1.340*** (0.0614)	1.388*** (0.105)	1.219*** (0.0454)
Age: incumbent (>20 years)	1.292** (0.166)	1.290*** (0.0852)	1.360** (0.134)	1.314** (0.116)
RD activities	4.588*** (0.343)	5.704*** (0.486)	5.924*** (0.454)	4.774*** (0.433)
Subsidies	1.436*** (0.115)	1.298** (0.132)	1.321** (0.116)	1.393*** (0.0931)
Current loan	1.118* (0.0674)	1.386*** (0.0578)	1.353*** (0.0650)	1.245*** (0.0590)
Overdue	1.290** (0.103)	1.247*** (0.0568)	1.275*** (0.0821)	1.246*** (0.0571)
Access finance: no/minor obstacle	1.029 (0.0937)	0.974 (0.0450)	1.089 (0.0695)	0.911* (0.0444)
Access finance: great obstacle	1.203* (0.121)	1.250*** (0.0648)	1.413*** (0.0838)	1.149** (0.0654)
N	5969	15496	8665	13120
PseudoR ²	0.148	0.193	0.172	0.172
Log Likelihood	-3517.3949	-8450.2012	-4790.0005	-7174.0415
LR Chi ²	1224.61	4042.48	1985.20	2973.09
Prob > chi ²	0.000	0.000	0.000	0.000

Note: The dependent variable is binary standing for process or product/service innovation activities. Reference groups are as follows: for firm size: micro firms; age: 1-5 years; employee growth: unchanged; access finance: moderate obstacle. All controls included like in Table 2. Time controls, sector, and country fixed-effects included. Exponentiated coefficients: to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at the sector*wave level, * p < 0.10, ** p < 0.05, *** p < 0.001. Source: European Bank for Reconstruction and Development

To see if industry specialisation plays a role, we further divide the sample into manufacturing and service sectors. Since the nature of innovation in the service sector can be different from manufacturing (Pellegrino & Piva, 2020). Column 3 and 4 of Table 7 provide the estimation results. The results remain similar. In both sectors, older and larger firms are more likely to innovate compared to smaller and younger companies. Firms with access to finance in form of subsidies and loans have as well a higher likelihood to innovate. This applies for manufacturing and service firms.

2.5 Conclusion

This study has investigated the innovation behaviour of companies in 29 transition economies within CEE and the CIS and compares their innovation activities before and after the GFC of 2008/2009. Using BEEPS data, we investigated over 25,000 firms in two pooled surveys conducted in the years 2009 and 2012. Overall, we find strong empirical support for a shift of innovation activities from small to incumbent and large companies, indicating the Schumpeterian phenomenon of creative accumulation after the crisis. However, young firms also have a higher likelihood to innovate after the crisis, whereas we cannot say the same regarding small firms. Regarding financial measures, we find that firms that have access to finances in form of a loan or subsidies are more likely to innovate. Furthermore, our findings highlight the importance of R&D activities within companies as these have a significant stabilisation effect on firms' innovation behaviour in times of crisis.

The studied countries have gone through a radical transition process from a planned to a market economy and have reached different degrees of modernization and technological capability. The market-based innovation systems, even in EU transition economies, are relatively young and still developing a technological profile, networks between actors, and institutions. It is plausible to assume that an external shock hits these countries' innovation activity quite hard. In the light of these considerations, it is insightful to observe that a major Schumpeterian theoretical prediction, creative accumulation, holds true. Creative destruction is not fully confirmed, which is likely an indication for the still weak or emerging start-up milieus in transition economies. Policymakers should be encouraged by our findings to support research and development activities in firms, which is a basis for innovative activities and helps firms to weather the crisis.

Our findings mostly align with what is found in the empirical literature. Creative destruction and creative accumulation are two co-existing scenarios and a clear distinction between those two is not possible. This is also reflected in the findings of the empirical literature. While some studies show a stronger tendency to creative destruction during the GFC of 2008/2009 in Europe (Archibugi et al., 2013a, 2013b), most findings suggest that established companies are more likely to innovate during this economic downturn which points to creative accumulation

(Correa & Ito, 2010; Paunov, 2012; Teplykh, 2018). In this respect, our paper supports these findings.

As every empirical analysis, our investigation is not without limitations. Firstly, companies that did not survive the crisis are not in the data set. However, we are mainly interested in the innovation behaviour of companies that survived the crisis or were created during the crisis. Thus, this limitation does not undermine our results; it is just that we cannot say anything about the firms that dropped out of the market. Hence, we cannot answer the question whether non-surviving firms left the market because they were less innovative and thus less successful or they might have exited because innovation activities depleted their financial resources. Secondly, due to data restrictions, we cannot control for the differences of maintaining, increasing or decreasing innovation activities only for the type of firms that do innovate in times of crisis. Therefore, we are only able to observe the aggregated shifts in firms' innovation behaviour. This limitation stresses the need for further research on this matter. Given the overall decline in innovation activities during the GFC, the question remains whether this decline in innovation and R&D is less pronounced for larger firms or whether larger firms are using innovation as a coping strategy to get through the crisis. Finally, even though self-reported measurements provide in our case earlier mentioned advantages, we are aware that self-reported data are more vulnerable to measurement error and cultural bias.

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Appendix

Table A1: Correlation matrix (pooled sample)

	firm size	firm age	manager experience	R&D activities	current loan	subsidies	employee growth	overdue	access finance	foreign owned	back-ground	human capital	export
firm size	1												
firm age	0,244	1											
manager experience	0,078	0,419	1										
R&D activities	0,318	0,112	0,074	1									
current loan	0,304	0,123	0,066	0,275	1								
subsidies	0,251	0,173	0,077	0,288	0,336	1							
employee growth	-0,067	0,301	0,132	-0,102	-0,082	-0,018	1						
overdue	0,158	0,074	0,029	0,193	0,339	0,187	-0,050	1					
access finance	0,035	0,007	0,003	0,119	0,196	-0,012	0,048	0,122	1				
foreign owned	0,337	-0,048	-0,065	0,176	0,026	0,086	-0,051	0,082	-0,109	1			
background	0,417	0,348	0,090	0,108	0,023	0,154	0,242	-0,040	0,038	0,223	1		
human capital	-0,008	-0,139	-0,127	0,019	-0,142	-0,108	-0,072	-0,037	0,023	0,040	-0,056	1	
export	0,368	0,186	0,104	0,397	0,313	0,379	-0,006	0,203	0,017	0,400	0,165	-0,100	1

Source: European Bank for Reconstruction and Development

Table A2: Overview of firms' number (and share) by industry in pooled sample

Variables	Industry Label	Freq.	Percent
sec15-16	Food and tobacco	1,971	7.82
sec17-19	Textiles, clothing, leather	1,399	5.55
sec20-22	Wood, paper, printing	1,198	4.75
sec23-26	Coke, chemicals, rubber, plastic	1,787	7.09
sec27-28	Metals	1,122	4.45
sec29_34-35	Machinery	1,061	4.21
sec30-33	Electronics, instruments	596	2.36
sec36-37	Other manufacturing	531	2.11
sec45	Construction	2,380	9.44
sec50-52	Retail, wholesale	10,112	40.11
sec55	Transport	1,134	4.50
sec60-64	Hotel, Restaurant	1,379	5.47
sec72	IT	419	1.66
Total		25,089	100

Source: European Bank for Reconstruction and Development

Table A3. Bivariate probit estimation results

	(1a) Product innovation	(1b) Process innovation
small firm	0.0120 (0.0325)	0.113** (0.0345)
medium firm	0.105** (0.0447)	0.179*** (0.0473)
large firm	0.151** (0.0754)	0.277*** (0.0784)
Age: young firm (6-10 years)	0.152** (0.0487)	0.229*** (0.0579)
Age: middle aged (11-20 years)	0.154** (0.0475)	0.113** (0.0345)
Age: incumbent (>20 years)	0.242*** (0.0550)	0.179*** (0.0473)
RD activities	0.984*** (0.0410)	1.003*** (0.0405)
subsidies	0.182*** (0.0487)	0.166*** (0.0497)
current loan	0.152*** (0.0298)	0.170*** (0.0313)
overdue	0.0899** (0.0299)	0.100** (0.0314)
Access finance: no/minor obstacle	-0.0473 (0.0346)	0.0464 (0.0372)
Access finance: great obstacle	0.0907** (0.0416)	0.211*** (0.0437)
N	12396	12396
Wald chi ²	2979.56	2979.56
Prob > chi ²	0.0000	0.0000
Wald test of rho=0:	chi ² (1) =1200.93 Prob > chi ² = 0.0000	

Note: Marginal effects at the means are reported. Reference groups: for firm size: micro firms; age: 1-5 years; access finance: moderate obstacle. All controls included like in Table 2. Country and industry fixed-effects are included. Standard errors in parentheses are clustered at sector*wave level. Robust standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$. Source: European Bank for Reconstruction and Development

Table A4. Probit estimation results

	(1) Product innovation	(2) Process innovation
small firm	0.0142 (0.0325)	0.113** (0.0348)
medium firm	0.106** (0.0448)	0.180*** (0.0475)
large firm	0.149** (0.0752)	0.275*** (0.0785)
Age: young firm (6-10 years)	0.153** (0.0487)	0.181*** (0.0515)
Age: middle aged (11-20 years)	0.155** (0.0475)	0.199*** (0.0504)
Age: incumbent (>20 years)	0.247*** (0.0550)	0.239*** (0.0586)
RD activities	0.989*** (0.0416)	1.006*** (0.0412)
subsidies	0.186*** (0.0487)	0.173*** (0.0501)
current loan	0.149*** (0.0299)	0.169*** (0.0314)
overdue	0.0882** (0.0299)	0.105*** (0.0317)
Access finance: no/minor obstacle	-0.0464 (0.0348)	0.0406 (0.0374)
Access finance: great obstacle	0.0862** (0.0418)	0.202*** (0.0440)
N	12418	12420
Pseudo R ²	0.159	0.172

Note: Marginal effects at the means are reported. Reference groups: for firm size: micro firms; age: 1-5 years; access finance: moderate obstacle. All controls included like in Table 2. Country and industry fixed-effects are included. Standard errors in parentheses are clustered at sector*wave level. Robust standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$. Source: European Bank for Reconstruction and Development

3 Chapter

A question of regulation or motivation? Environmental innovation activities in transition economies

Author: Katharina Friz

Abstract:

Environmental innovation (EI) plays an important role in decoupling economic growth and environmental harm. This paper focuses on the environmental innovation behaviour of companies in transition countries of Eastern Europe and Central Asia, which have been little studied so far. These countries share the Soviet legacy of environmental mismanagement, and have restructured their innovation systems relatively recently in the course of transition. The EBRD-EIB-WB Enterprise Survey (2018-2020) allows us to examine the determinants of environmental innovation in 29 transition countries. Although the theory places a greater emphasis on external sources of knowledge in EI, the results indicate that collaborative R&D is still quite weak in these countries. Moreover, environmental regulation increases the likelihood of adopting energy efficiency measures, while customers demanding environmental standards increases the likelihood across all innovation activities, indicating an increasing sustainability awareness among consumers.

Keywords: Environmental innovation, transition economies, firm-level data, logit model

JEL Classification: O12, O31, O32, O5, Q55

Publication:

This article has been published as a working paper:

Friz, K., (2021) A question of regulation or motivation? Environmental innovation activities in transition economies, No. 2107. University of Bremen, Bremen.

Formal changes, compared to the published version, have been made.

Acknowledgements:

I am deeply grateful to Jessica Birkholz, Maria Greve, Ann Hipp, Judyta Lubacha and Tobias Wendler for their valuable comments and feedback on earlier versions of the paper. In addition, I wish to thank for the comments I received at various seminars and conferences, in particular from Christian Cordes and other participants at the IERP seminar in January 2021 at the University of Bremen, as well as from participants at the 18th International Schumpeter Society Conference, the 60th ERSA Congress, and the 33rd EAEPE Conference.

3.1 Introduction

Many countries of the Central and Eastern Europe, the Caucasus and Central Asia (CEECCA) region are particularly vulnerable to the impacts of climate change (Fay et al., 2010; Peng et al., 2020; Xenarios et al., 2019) and are facing increasing extremes such as droughts, floods, heat waves, and forest fires (Fay et al., 2010; Gozlan et al., 2019; Kharuk et al., 2021). In addition, these countries are burdened with the Soviet legacy of environmental mismanagement, which has reduced natural resilience in many areas (e.g. the disappearing of the Aral Sea) (Fay et al., 2010). Regarding environmental conservation, transition economies can be described relatively to Western countries by lower environmental priorities and vague institutional commitments, as well as less environmental awareness among the general public³⁷ (Biscione et al., 2020; Crotty & Rodgers, 2012; Horbach, 2016; OECD, 2020). Furthermore, they are marked by an energy and resource intensive economy³⁸, inefficient energy systems (Cornillie & Fankhauser, 2004; OECD, 2019a, 2019b; OECD & IEA, 2015), and a lower level of research and development (R&D) activities (Kammerer, 2009; Kleibrink et al., 2017; Veugelers & Schweiger, 2016).

Environmental problems on this scale often cannot be addressed with existing technologies and business as usual (Popp et al., 2010). Therefore, the transition to a low-carbon, climate-resilient economy is important. Greening the economy enables new opportunities for economic diversification, access to new markets and increases competitiveness (OECD, 2019a). A way to achieve this is by environmental innovation that combines business objectives and environmental pollution reduction (Porter & van der Linde, 1995). They are therefore an important component of climate protection, as environmental innovations

³⁷ According to results from the EU barometer 2017 and 2019 environmental awareness among the population in EU transition countries increased in the last three years. However, besides Bulgaria and Hungary, it is still below the EU average. Moreover, the Levada Center 2019 survey results show that in Russia, pollution (48%) is considered the biggest threat worldwide, while climate change (34%) ranks fourth. The most serious environmental problem for Russian citizens seems to be air pollution and waste. This can be explained by the fact that climate change is still abstract, while environmental problems such as pollution are more tangible and often associated with direct negative consequences. Nevertheless, 67% see man-made pollution as the main cause of global warming.

³⁸ In the CEECCA region, for example, natural resource extraction contributes significantly to export earnings, employment, and public revenues. Moreover, the mining sector is closely intertwined with other parts of the economy OECD (2019a).

contribute to the decoupling of economic growth and environmental impacts (Horbach, 2016; Shi et al., 2021; Stern, 2017).

The aim of this paper is to empirically investigate the main determinants affecting the environmental innovation behaviour of firms in transition economies. I recognise that the transition from a planned to a market economy in terms of institutional change has been formally completed in many of these economies. Hence, the term ‘transition economies’ covers a rather heterogeneous group of countries.

Several studies already exist on environmental innovation (see e.g. Cainelli et al., 2020; Ghisetti et al., 2017; Lubacha & Wendler, 2021). Though, results differ depending on the characteristics of the nationality under study (del Río et al., 2015). The recent environmental literature mostly focuses on Western countries in Europe (see e.g. Arranz et al., 2019; Kesidou & Demirel, 2012; Marchi & Grandinetti, 2013). Furthermore, cross-country studies are rare (Ghisetti et al., 2015; Horbach et al., 2013) and there are only a few studies looking at Eastern European countries, but only within the EU context (e.g. Biscione et al., 2020; Hojnik & Ruzzier, 2016; Horbach, 2016). Therefore, my study is broadening the scope by including all 29 transition countries of the CEECCA region³⁹. In addition, previous studies use survey data conducted between the years 2004 and 2014 (see e.g. Arfaoui 2018, Arranz et al. 2019). However, climate change is a dynamic issue that due to increasing weather extremes, is progressively getting more societal and political recognition and action (Bell & Masys, 2020; Hulme, 2014; Petrova, 2020; Ummenhofer & Meehl, 2017). Thus, it is relevant to analyse more recent data on innovation activities.

Using the most recent firm-level EBRD-EIB-WB Enterprise Surveys (ES) from 2018-2020, the results show that environmental regulation increases the likelihood to introduce energy efficiency measures in firms. Companies that indicate that environmental regulation is an obstacle for their current business are positively associated with developing environmental innovations (EI) within the company. Moreover, customers requiring environmental standards increase the probability across all environmental and general innovation activities. These

³⁹ Countries included: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, FYR Macedonia, Georgia, Hungary, Kazakhstan, Kosovo, Kyrgyzstan, Latvia, Lithuania, Moldova, Montenegro, Mongolia, Poland, Russia, Romania, Serbia, Slovak Republic, Slovenia, Tajikistan, Ukraine, and Uzbekistan.

findings are in contrast to Horbach (2016) and Biscione et al. (2020). In addition, companies that suffer losses due to extreme weather events are more likely to adapt environmental measures. Furthermore, the results do not suggest that outsource R&D collaborations (or the purchase of external knowledge) play a more important role for EI than for general innovation which aligns with Marchi and Grandinetti (2013) and Ghisetti et al. (2015), but not with da Silva Rabêlo and Azevedo Melo (2019). This indicates that R&D cooperation is still quite weak in these countries. Nonetheless, external knowledge transfer stimulates EI, albeit to a lesser extent than inhouse R&D.

The contribution of this paper is multifold. First, many studies are limited to less recent data and sometimes to smaller samples (Arfaoui, 2018; Demirel & Kesidou, 2011). The data used here provides a large number of observations (17,191 companies) across different countries and allows us to gain insights into the current (2018-2020) environmental innovation behaviour of companies. Second, this study offers a comparative analysis of different environmental innovation activities such as adapting energy efficiency measures, adapting general environmental measures to reduce environmental harm, and introducing EI developed within the company as well as general innovation activities. Finally, there is an overrepresentation of studies that focus on environmental innovation in Western countries, while few analyses are available for less developed countries. Furthermore, as less developed countries are relatively more affected by the consequences of climate change (Chinowsky et al., 2011), it is therefore important to obtain a deeper understanding of their environmental innovation behaviour.

The paper is structured as follows: Section Two provides the theoretical and empirical literature review as well as the hypotheses. Section Three lays a descriptive foundation for the following empirical analysis by presenting the data sample and introducing the econometric model. The empirical results are presented in Section Four. Finally, in Section Five, a brief summary is given, the limitations of the study are addressed and a conclusion is drawn.

3.2 Literature review: Theoretical background

Containing the global rise in temperature and achieving sustainability without a significant deviation from 'business as usual' is not possible. A deviation from business as usual can be innovation as defined by Schumpeter: a combination of factors in a new way (Schumpeter,

1939), however, processes toward sustainability are essential. Environmental Innovations (EI) are thereby broadly defined as product, process, organisational, social or institutional methods that are novel to the firm and contribute to reducing environmental harms and resource use (Kemp, 2010; Kemp & Pearson, 2007; OECD, 2009; Rennings, 2000). However, not all invented green technologies (e.g. patents) have an influence on the company's environmental performance (Albrizio et al., 2017). Therefore, focusing on EI adoption provides an advantage as not all inventions are launched (Cainelli et al., 2020). Furthermore, referring to EI-adoption allows a better understanding of a firm's green capabilities (Ghisetti et al., 2015).

It is common to distinguish environmental process measures further into cleaner production and end-of-pipe technologies (Demirel & Kesidou, 2011; Frondel et al., 2007; Horbach et al., 2012). The term cleaner production describes the reduction of resource use and/or pollution directly at the source by introducing cleaner production methods and products. End-of-pipe means that emissions are reduced by implementing add-on-measures that hinder the direct release of pollutants into the environment (e.g. filters) (Frondel et al., 2007; Rennings & Rammer, 2009; Rennings & Zwick, 2003).

Environmental innovation not only differs in its environmental focus from other innovations, differences can also be found in the neoclassical and evolutionary theoretical perspective.

General innovation as well as environmental innovations create knowledge externalities in research and innovation phases. Environmental innovation have the peculiarity that they additionally produce environmental externalities in the adoption and diffusion phase⁴⁰ (Jaffe et al., 2005; Rennings, 2000). These externalities benefit society by reducing environmental damage. This can lead to lower incentives for firms to engage in EI as the firms' return is lower than the social return. This is called the "double externality problem" of EI (Rennings, 2000). As long as markets do not penalise environmentally damaging effects, there is a distortion of competition between eco- and non-ecological innovations (Rennings, 2000). This leads to another peculiarity of environmental innovation. While technology push factors and market

⁴⁰ An invention describes an idea or model for a new, improved product or process. Through the first market introduction, the invention becomes an innovation in the economic sense. The use and adoption of the innovation over time represents the diffusion phase (Rennings (2000)).

pull factors drive general innovation (Hemmelskamp, 1997; Pavitt, 1984), environmental innovation behaviour can be in need of additional support of a regulatory and institutional framework (regulatory push/pull effect) (Rennings, 2000). Thus, policy intervention tools such as subsidies or implementation of environmental taxes can mitigate these negative externalities (Acemoglu et al., 2016) .

From an evolutionary perspective, the learning processes of innovation are more in focus. For a firm's knowledge base and technological capabilities, R&D cooperation with other firms can be an important input source of innovation (Veugelers, 1997), as long as a firm invest in its own R&D, building up its "absorptive capacity" which allows to understand and apply knowledge generated outside the company (Cohen & Levinthal, 1989, 1990). EI activities require knowledge and skills that are not necessarily part of the traditional core competencies of the company or industry (Arranz et al., 2019; Horbach et al., 2013; Marchi, 2012). In addition to this inexperience, there is uncertainty about differences in standards, specific technological solutions, and measures to assess the environmental performance of products and processes (Marchi, 2012). Therefore, external knowledge sources are even more important compared to other innovation activities (Cainelli et al., 2012; Ghisetti et al., 2015; Horbach et al., 2013; Marchi & Grandinetti, 2013).

3.3 Empirical research and hypotheses

Based on the theoretical assumptions about the particularities of EI described above, I now present empirical literature findings and derive hypotheses on the environmental innovation behaviour of companies in transition countries.

As explained above, the neoclassical perspective assumes that regulation, along with other market pull and push factors, plays an important role in the introduction of EI. Regulations can have both a direct impact on the innovation behaviour of companies, by imposing technological standards and emission limits, and an indirect impact, by granting tax incentives and public subsidies (Arfaoui, 2018; Cainelli et al., 2020; Ghisetti et al., 2017; Horbach, 2016; Kesidou & Demirel, 2012; Lubacha & Wendler, 2021).

While Cleff and Rennings (1999) results indicate that civil law enforcement is rather unimportant with regard to EI, Cai et al. (2020) find for Chinese firms that direct environmental regulation in form of law enforcement is positively associated with EI adoption. Furthermore,

del Río et al. (2015) investigated environmental innovation of Spanish firms in 2009 and argues that regulatory instruments such as environmental, health, and safety regulation positively influences EI. This suggests that companies in countries where they face stricter environmental regulations are more likely to innovate in an environmentally friendly way. Based on these findings, I assume:

H1: Environmental regulations that restrict a firm's current business provide incentives to introduce EI.

Some studies focus mainly on subsidies (Aldieri et al., 2019; Horbach, 2016), however, taxes can also be an efficient environmental policy instrument (Cleff & Rennings, 1999; Rennings & Rammer, 2011). Veugelers (2012) shows for Flemish firms that environmental taxes provide incentives to EI. This aligns with Cainelli et al. (2020). In addition, Biscione et al. (2020) show for EU transition countries that taxes have a stimulating effect on EI, but only if the tax rate is particularly high for the company. Hence, the next hypothesis is:

H2: Environmental taxes increase the likelihood of firms to engage in EI.

While some findings suggest that regulation prevails when it comes to incentives for EI, other studies find that at least in some countries demand pull and technology push factors such as customer requirements are also driving determinants for EI (Cainelli et al., 2020; Kesidou & Demirel, 2012; Veugelers, 2012). For instance, Kesidou and Demirel (2012) show for UK firms that next to regulation also customer environmental requirements are positively associated with EI. However, this is in contrast to del Río et al. (2015) who do not find significant effects of other market determinants on EI. This is in line with results from studies on companies in Eastern EU countries (Biscione et al., 2020; Horbach, 2016). Here, too, the findings indicate that regulation triggers environmental innovation to a greater extent than demand-promoting factors. These findings suggest that environmental awareness differs among countries and I therefore assume:

H3: Customer environmental preferences provide incentive to introduce EI.

Another external factor besides regulatory and market push factors can be the environment itself. As weather extremes become more and more frequent, the changes in the environment affect companies and push them to adapt (Linnenluecke & Griffiths, 2010; Nelson et al., 2007). This especially applies for the countries under study. Hence, I expect that:

H4: Firms which suffer from losses due to weather extremes are more likely to introduce EI.

The evolutionary perspective presented above argues that external sources of knowledge are a key factor in the adoption of EI as environmental innovations are generally more complex.

Renning and Rammer (2009) find that German companies explore information sources more broadly in innovation related to energy and resource efficiency compared to other innovations. In the case of Brazilian firms, external cooperation facilitates the adoption of EI and with increasing complexity firms strive to cooperate (da Silva Rabêlo & Azevedo Melo, 2019). In the same vein, Frigon et al. (2020) argues that for the Canadian wine sector, eco-innovation is more closely linked to external information sources relative to conventional innovation. Furthermore, Marchi (2012) and Marchi and Grandinetti (2013) findings show that Spanish and Italian companies cooperate to a greater extent with partners outside the company in environmental innovations compared to other innovations. However, they also find indications that internal R&D can substitute external cooperation. This result aligns with Ghisetti et al. (2015). Similarly, they find that for eleven European countries, external knowledge sourcing positively affects EI performance. However, they further show that these effects fade when firms possess internal innovation capabilities and knowledge.

According to the empirical literature, external R&D cooperation is relevant to introduce EI, whereas internal R&D can be equally important. Although, in Central and Eastern (CEE) transition countries have a lower level of cooperation and opportunities for knowledge spillovers are limited (Hájek & Stejskal, 2018; Poghosyan, 2017). Horbach et al. (2016) finds that Eastern EU countries are more reliant on information sources like competitors and external R&D for EI. Therefore, my hypothesis is:

H5: Firms engaged in collaborative R&D activities are more likely to introduce EI.

Nonetheless, external R&D cooperation may also involve more effort and expense to gain access to additional or complementary knowledge. Search, coordination, and transaction costs may exceed the corresponding benefits (Gkypali et al., 2017). This could be particularly crucial in transition economies, as their market-based innovation systems are relatively young, as are their innovation networks between actors and institutions. Hence, I assume:

H6: Firms engaged in in-house R&D activities more likely to introduce EI.

3.4 Data

The analysis uses the latest EBRD-EIB-WB Enterprise Surveys (ES) which was conducted in 2018 until 2020. The ES is the successor to the Business Environment and Enterprise Performance Surveys (BEEPS) and combines the BEEPS and the Middle East, and North Africa Enterprise Surveys (MENA ES). As a result, the ES covers responses from nearly 28,000 enterprises in 41 economies. As this study focuses only on transition countries, data from Middle East countries, North African countries, South European countries, and Turkey have been omitted. The final sample comprises 17,191 observations for 29 transition economies⁴¹.

The ES aims to provide a representative sample of each country's private sector in respect of industry sectors⁴², company size⁴³ and regional allocation. In addition, the ES data is a firm-level survey based on face-to-face interviews with managers and covers a wide range of standard company characteristics as well as topics related to the business environment. It also has the benefit that enterprises self-report different types of their innovation activity, e.g. whether the enterprise has introduced new or significantly improved products or services in the last three years, or acquired a new or improved production technology. 'New' in this case refers to new to the company, not being necessarily new to the market. This is because firms from transition economies tend to innovate by imitating or adapting rather than inventing entirely new things from the existing state of the art (Acemoglu et al., 2006; Aghion et al., 2002; Gorodnichenko et al., 2009; Gorodnichenko & Schnitzer, 2013).

Finally, it includes a Green Economy module, covering green management practices and green investments. This green economy module also offers the opportunity to identify environmental innovation behaviour such as: whether the establishment adopted any

⁴¹ The ES covers 17 countries from Central and Eastern Europe including Albania, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro, Serbia, and the EU member states Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia, as well as 11 countries from the former Soviet Union among including Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine, and Uzbekistan. The country of Mongolia is also listed.

⁴² The manufacturing sector describes companies with ISIC rev. 3.1 industry classification codes 15-37. Basic industries such as mining or agriculture are not included. The services sector includes enterprises classified with codes 45, 50-52, 55, 60-64, and 72. Not part of the sample are companies that are subject to state price regulation, such as electricity, gas and water supply, as well as companies that are 100 percent state-owned.

⁴³ While there is a wide range in terms of number of employees (from 1 to over 100,000), the majority (44.09%) of the sample firms are classified as small and 92.49% of the firms are SMEs.

measures to reduce its environmental impact over the last three years; whether it adopted any measures to enhance energy efficiency over the last three years; and whether any of these measures were developed by the establishment over the last three years⁴⁴. R&D and innovative activities cover a 3-year period from 2016 until 2018.

3.4.1 Descriptive Data

This section presents the data sample with Table 3.1, reporting summary statistics by country. It shows the proportions of enterprises in relation to firms' different (environmental) innovation and R&D activities in 2016 until 2018 across countries. Looking at the shares of companies included in the sample, 64.3% of Latvia-based companies implement energy efficiency measures and 93.9% have adapted environmental measures. At the other end, companies located in Azerbaijan and Romania have the lowest shares of environmental innovation with 12.2% or 17.9% of firms implementing energy efficiency measures and 59.5% or 44.7% environmental measures. Comparing this to general innovation in form of services or process innovation, the highest share with 51.7% of companies involved in process and 66.8% in product innovation are from Slovenia. This is closely followed by companies from Latvia. Both Slovenian and Latvian firms exhibited above average spending on R&D (inhouse or in cooperation). Polish and Russian firms have the lowest share of innovation and firms' spending on R&D are below average.

Grouping the responses of the sample with respect to EU membership, Table 3.2 shows additional statistical measures. Companies from EU member countries are on average more environmentally active as well as involved in process innovation compared to companies from non-EU members. In addition, a regulation measure is included in this table showing that on average more firms located in EU member states are subject to energy taxes. This could be explained by the EU's environmental policy objectives (European Commission, 2019; Kelemen, 2010). However, the opposite applies for product innovation and R&D activities carried out within the company or in cooperation with other companies. Here companies from non-EU members lead the average. From the wide standard deviations, it can be seen that a general

⁴⁴ However, the last question should be treated with caution, as a total of only 5707 companies answered this question (see also Table A1). This indicates that EIs that are new to the firm are more common than EIs that are new to the market.

classification is not possible and that companies from some EU countries (e.g. Romania) are also less innovative than companies from non-EU countries (e.g. Ukraine).

Table 3.1: Indicators of companies' different innovation activities by country

	Eco innovation developed by firm	Adapt energy efficiency measures	Adapt environmental measure	Process innovation	Product innovation	R&D (inhouse)	R&D (out-house)
Albania	.713	.236	.84	.246	.393	.189	.056
Armenia	.684	.331	.799	.13	.408	.375	.143
Azerbaijan	.583	.122	.595	.1	.286	.446	.111
Belarus	.417	.535	.786	.239	.408	.214	.099
Bosnia and Herz.	.592	.235	.817	.303	.515	.36	.228
Bulgaria	.612	.398	.688	.127	.201	.148	.04
Croatia	.656	.182	.864	.156	.349	.119	.059
Czech Rep.	.144	.331	.894	.291	.395	.369	.153
Estonia	.432	.481	.898	.236	.406	.272	.133
Georgia	.388	.178	.774	.168	.427	.238	.14
Hungary	.235	.437	.852	.129	.182	.133	.046
Kazakhstan	.234	.323	.664	.137	.253	.209	.084
Kosovo	.753	.364	.886	.13	.313	.231	.076
Kyrgyz Rep.	.376	.361	.701	.265	.429	.265	.133
Latvia	.589	.643	.939	.483	.508	.221	.153
Lithuania	.664	.423	.763	.223	.328	.078	.067
Moldova	.556	.365	.801	.213	.322	.204	.129
Mongolia	.686	.24	.934	.412	.506	.44	.2
Montenegro	.429	.188	.572	.127	.3	.18	.081
North Macedonia	.629	.405	.688	.274	.507	.267	.131
Poland	.816	.32	.715	.082	.206	.084	.04
Romania	.723	.179	.447	.202	.268	.162	.106
Russia	.228	.297	.642	.115	.151	.18	.074
Serbia	.736	.398	.782	.287	.423	.219	.12
Slovak Rep.	.621	.348	.865	.084	.166	.128	.091
Slovenia	.261	.459	.887	.517	.668	.4	.2
Tajikistan	.578	.368	.663	.099	.219	.211	.073
Ukraine	.471	.531	.804	.212	.371	.306	.111
Uzbekistan	.443	.439	.882	.175	.296	.136	.07
Total	.481	.361	.763	.191	.318	.214	.098

Source: EBRD-EIB-WB Enterprise Surveys 2018-2020

Table 3.2: Indicators of companies' different innovation activities by EU membership

		Eco innovation developed by firm	Adapt energy efficiency measures	Adapt environmental measures	Process innovation	Product innovation	R&D in-house	R&D out-house	Energy tax
EU member	mean	.52	.363	.772	.193	.293	.171	.085	.201
	sd	.5	.481	.42	.395	.455	.377	.279	.401
	N	2192	6253	5132	6524	6550	6533	6539	6096
Non-EU member	mean	.457	.359	.758	.189	.334	.241	.106	.185
	sd	.498	.48	.428	.391	.472	.428	.307	.389
	N	3515	10093	8892	10451	10527	10515	1050	10241

Source: EBRD-EIB-WB Enterprise Surveys 2018-2020

3.4.2 Operationalization of key variables

To capture the determinants of the different EI, the following variables are considered. A detailed description of the variables is provided in Table A1, while their correlations are presented in Table A2. To determine the influence of regulation measures on environmental innovation in relation to Hypotheses 1 and 2, I rely on information provided by the ES. The two dummies 'energy tax' and 'obstacle of environmental regulation' are used. These describe whether the company is subject to energy taxes and whether it views environmental regulation as a constraining factor on its business activities. To investigate the third hypothesis, customer preferences are described through the dummy 'customer push' (if customers required environmental certifications or standards as a condition to do business or not⁴⁵). To analyse hypothesis four, I include the dummy whether the company experienced monetary losses due to extreme weather/ pollution or not. With respect to hypothesis five and six, the firm's R&D activities are described through the dummies 'inhouse R&D spending' and 'R&D spending contracted with other companies'. Alternatively, to collaborative R&D, I include the dummy whether the company purchased or licensed external knowledge in form of patents and non-patented inventions, know-how, and other types of knowledge from other businesses or organisations.

Furthermore, several controls are included. As incumbent firms can benefit from accumulated internal capabilities and more long-standing knowledge network relationships, age can have an impact on EI (del Río et al., 2017). Moreover, firm size can be an important factor as small firms have generally less resources in the areas of human labour, technology, and finances compared to large companies (del Río González, 2009; Ghisetti et al., 2017). Additionally, Garrone et al. (2018) finds that larger firms are relatively more responsive to high regulatory pressure. Therefore, in accordance with the OECD definition, company size measures the number of full-time employees (at the end of the fiscal year) and ranges from micro, small,

⁴⁵ It is not clear from the questionnaire whether customer means business-to-consumer (B2C) or business-to-business (B2B). I therefore assume that both are meant, since the environmental certifications mentioned as examples are relevant for B2B transactions as well as for certified end products.

middle to large firms.⁴⁶ Besides, age is measured as the number of years the business has been operating.

In addition, competitive pressure can create incentives for companies to introduce eco-innovations (Cai & Li, 2018; Hojnik & Ruzzier, 2016; Horbach, 2016). Hence, the variable 'main market' is included and coded '1' regional, '2' nation, and '3' international. Moreover, voluntary internal measures such as environmental management and auditing can have a stimulating impact on environmental innovation (Frondel et al., 2007; Rennings et al., 2006; van den Bergh, 2013; Wagner, 2008). Hence, the following dummies are also considered: whether a manager for environmental matters is employed and whether a company pursues self-set environmental targets regarding energy, CO2 emissions or other pollution, as well as whether external audits are performed. Furthermore, sales expectations for the next year and employee growth over the last three years are included.

3.4.3 Model Specification

Five dependent variables are analysed: three related to environmental innovations and two related to general innovations. For each innovation type, a company must decide whether it wants an (environmental) innovation or not. Due to the binary nature of each dependent variable, a logit model is employed for each environmental and general innovation activity to enable a comparison.

$$(1) \text{ Innovation_activity} = \beta_0 + \beta_1 * \text{obstacle_of_regulation}_i + \beta_2 * \text{energy_tax}_i + \beta_3 * \text{customer_push}_i + \beta_4 * \text{collaborative_R\&D}_i + \beta_5 * \text{inhouse_R\&D}_i + \beta_6 * \text{losses}_i + \beta_7 * \text{Controls}_i + \mu_i$$

Equation (1) comprehends the main variables used in the regression models. The vector of controls encompasses variables such as firm size and age, main market, as well as voluntary internal measures. The vectors β capture the coefficient⁴⁷, and i index firms. To facilitate

⁴⁶ In accordance with the OECD criteria, enterprise size is divided into micro enterprises (5 to 10 employees), small enterprises (10 to 49 employees), and medium-sized enterprises (50 to 249 employees), as well as large enterprises with 250 or more employees.

⁴⁷ The possibility of reverse causality must be considered and the results of the models should be interpreted with caution. There could be endogeneity issues, especially with regard to the choice of different innovation inputs. Following Horbach's (2016) procedure, I conducted endogeneity tests for these variables. In each case where the Smith-Blundell test suggested the presence of endogeneity, I estimated the respective models without the suspected variables to check robustness. In all verified cases, the results remained similar.

interpretation, the coefficients in Section 4 are exponentiated and expressed in odds ratios. Standard errors are clustered on the sector level. Finally, country and industry dummies capture other country- or industry-specific fixed effects such as differences in the institutional environment across countries and differences in industry characteristics. The industry dummies are based on a four-digit industry classification code, for more details see Table A3.

3.5 Empirical Results

3.5.1 Main Results

We start with the results of the baseline models which are presented in Table 3.3. Each column (1-5) shows the result for a specific (environmental) innovation activity. The results show that environmental regulation plays an important role in EI, while it is not significant for general innovation. Being a subject to energy tax increases the odds for firms to develop environmental innovation within the firm by about 33% (see column 3). The odds of engaging in EI enhancing energy efficiency increases 29% for energy taxed companies compared to those that are not being taxed (see column 4). Companies stating that environmental regulation is a moderate-to-great obstacle only show for EI developed within the company a statistically significant positive relation. Here, the odds increase about 25%. Although I do not find a significant relationship between all EI forms, overall, I confirm the first two hypotheses.

Concerning the influence of customer preferences, we see that the odds of adopting energy efficiency measures increase about 24%, when the companies' customers require environmental standards, while the odds of adopting general environmental measures increase about 55% (column 5). Only for EI developed within the company, customer environmental requirements does not have a significant influence. Thus, I confirm hypothesis three. Interestingly, dealing with customers who require environmental standards also increases the chances for companies to engage in general innovation. The odds for product increase about 28% and the odds for process innovation even about 44% (see column 1 and 2). Hence, it seems that customer environmental requirements provide innovation incentives that go beyond environmental activities. Furthermore, there is an overall significant and positive link between EI and suffering from losses due to weather or pollution extremes. The highest odds occur for adopting environmental measures. Companies that experienced losses have almost 80% higher odds to introduce environmental measures compared to companies

that did not suffer from losses. The odds for process innovation or adopting energy efficiency measures are both around 39% when the companies suffered from losses. It seems that exposure to environmental extremes encourages companies to find innovative solutions to their process behaviour in order to be better prepared for extreme weather events. Hence, I accept hypothesis four.

Table 3.3. Logit estimation results

	(1)	(2)	(3)	(4)	(5)
	Process innovation	Product Innovation	EI developed within firm	Energy efficiency	Environmental measures
Energy tax	1.013 (0.0694)	0.872* (0.0694)	1.326*** (0.111)	1.292*** (0.0905)	1.141 (0.143)
Obstacle regulation	0.935 (0.0571)	1.032 (0.0584)	1.253** (0.0980)	0.951 (0.0635)	0.945 (0.0944)
Customer push	1.436*** (0.0891)	1.279*** (0.0903)	1.064 (0.0980)	1.239** (0.0912)	1.553** (0.218)
Losses weather	1.386*** (0.102)	1.205** (0.0886)	1.230* (0.133)	1.390*** (0.118)	1.791*** (0.248)
RD inhouse	2.243*** (0.160)	2.788*** (0.206)	1.315*** (0.109)	1.622*** (0.104)	2.103*** (0.230)
RD outhouse	1.424*** (0.122)	1.409*** (0.133)	1.265** (0.148)	1.408*** (0.132)	1.288 (0.261)
Green targets	1.261*** (0.0747)	1.240*** (0.0613)	1.800*** (0.142)	3.375*** (0.171)	3.435*** (0.353)
Green manager	1.077 (0.0871)	1.010 (0.0776)	1.413*** (0.145)	1.565*** (0.134)	1.648** (0.305)
Ext audit	1.127* (0.0772)	1.067 (0.0602)	1.395*** (0.116)	1.470*** (0.0915)	1.810*** (0.174)
Employee growth	1.001 (0.000614)	1.000 (0.000344)	1.000 (0.000539)	1.001 (0.000587)	1.003** (0.00126)
small firm	1.294** (0.112)	1.272** (0.0998)	1.284** (0.161)	1.077 (0.0779)	1.119 (0.119)
medium firm	1.751*** (0.172)	1.331*** (0.113)	1.106 (0.149)	1.451*** (0.112)	1.561*** (0.190)
large firm	1.674*** (0.204)	1.361** (0.160)	1.523** (0.270)	1.724*** (0.237)	2.249*** (0.489)
Age	1.000 (0.00194)	1.000 (0.00184)	1.001 (0.00256)	1.002 (0.00193)	0.998 (0.00371)
sales will increase	1.502*** (0.100)	1.507*** (0.0859)	0.984 (0.0850)	1.207** (0.0769)	1.316** (0.112)
sales will decrease	1.176 (0.143)	1.177* (0.0985)	0.985 (0.120)	1.014 (0.0965)	1.175 (0.157)
national market	1.257** (0.0982)	1.266*** (0.0696)	1.074 (0.106)	1.260*** (0.0726)	1.112 (0.0857)
international	1.266**	1.162	1.118	1.234**	1.357

market	(0.125)	(0.110)	(0.168)	(0.107)	(0.267)
Country FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
N	8067	8091	3759	7995	7064

Note: The dependent variable is binary. Reference groups: for firm size: micro firms; employee growth: unchanged; main market: local. Exponentiated coefficients: to better interpret the results, I transform the coefficients into odds ratio; standard errors in parentheses are clustered at sector level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Looking at the R&D, companies engaged in internal R&D have about 31% higher odds to EI within the company and 62% higher odds to adopt energy efficiency measures compared to companies that are not involved in internal R&D. The odds for product or process innovation, however, are even higher and raise by a factor of over 2.2, if the companies are involved in internal R&D. Comparing this to collaborative R&D, while the overall relationship is positive and significant the odds are lower compared to companies engaged in internal R&D. Being engaged in R&D in cooperation with others increases the odds for EI within the company by 26% and for energy efficiency by 40%, while it is not significant for adapting environmental measures. Overall, I confirm my last two hypotheses.

Moving to the control variables, the results show the odds to innovate increase with firm size. This corresponds to the results of del Río et al. (2015). Age is not statistically significant, indicating that there are no significant differences between new entrants and incumbents in terms of participation in EI. This is in line with del Río et al. (2015) and Horbach et al. (2012). Employee growth over the last three years is also not significant. Companies that expect an increase in sales for the next year have 50% higher odds to innovate in process or products. The odds for adapting environmental measures and energy efficiency are lower with 32% or 20% respectively. Having a manager for environmental issues increases the odds for EI, while it does not have an impact on general innovation. The highest odds (65%) occur here for adopting environmental measures. If the company sets itself green targets, it also increases the odds to EI (EI within the firm about 41%, enhancing energy measures and adapting environmental measures by a factor over three). It even shows a positive relationship between general innovation and having green targets. Companies that are doing external audits have higher odds to innovate. This applies for all innovation activities except product innovation. This can be explained by the fact that auditing reflects the processes within a company rather than the company's products. The highest odds (81%) occur for environmental measures,

while the smallest with 12% are for product innovation. Compared to local markets, having the national or the international market as its main operation area is positively associated with measures enhancing energy efficiency and general innovation.

3.5.2 Robustness Check

As the acquisition of e.g. patents is another form of access to externally generated knowledge, I consider alternatively to ‘collaborative R&D’ ‘acquiring external knowledge’. The findings are presented in Table 3.4.

Table 3.4: Logit estimation results with acquiring external knowledge

	(1)	(2)	(3)	(4)	(5)
	Process innovation	Product Innovation	EI developed within firm	Energy efficiency	Environmental measures
Energy tax	1.014 (0.0697)	0.861* (0.0726)	1.335*** (0.110)	1.309*** (0.0918)	1.181 (0.151)
Obstacle regulation	0.930 (0.0563)	1.023 (0.0580)	1.242** (0.0978)	0.973 (0.0649)	0.964 (0.102)
Losses weather	1.351*** (0.104)	1.171** (0.0858)	1.228* (0.130)	1.404*** (0.120)	1.686*** (0.216)
RD inhouse	2.055*** (0.166)	2.660*** (0.184)	1.345*** (0.117)	1.709*** (0.100)	1.905*** (0.209)
Ext knowledge	2.225*** (0.129)	1.961*** (0.134)	1.291** (0.125)	1.222** (0.104)	2.108*** (0.346)
Green targets	1.251*** (0.0746)	1.230*** (0.0631)	1.813*** (0.142)	3.407*** (0.169)	3.503*** (0.382)
Green manager	1.063 (0.0833)	1.008 (0.0757)	1.391** (0.144)	1.573*** (0.132)	1.672** (0.304)
Ext audit	1.098 (0.0765)	1.059 (0.0588)	1.408*** (0.116)	1.460*** (0.0913)	1.750*** (0.169)
Country FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
N	7992	8018	3740	7920	6995

Note: The dependent variable is binary. Controls included. Exponentiated coefficients: to better interpret the results, I transform the coefficients into odds ratio; standard errors in parentheses are clustered at sector level, * p < 0.10, ** p < 0.05, *** p < 0.01

Overall, the results hold. The results show that the acquisition of external knowledge in companies has higher odds to EI than collaborative R&D in the previous estimates. The odds of companies that acquire external knowledge increase by 2.1 to introduce general environmental measures compared to the companies that do not acquire knowledge. Only for adapting energy efficiency measures the odds are 20 percentage points lower than using

collaborative R&D. This could again suggest that there is a lower level of cooperation in transition economies, while external sources of knowledge are nevertheless important. These results indicate a high importance of knowledge transfer from external sources. Compared to general innovation, it does not look like external knowledge plays a more important role for EI, even though odds for adapting environmental measures are slightly higher than internal R&D but this is also the case for process innovation.

Since the findings of the different environmental innovation types may be correlated, resulting in inconsistent estimates of the simple logit models, a multinomial logit model is estimated in Table 3.5 as a further robustness check.

Table 3.5: Multinomial logit estimation results

	(1)	(2)	(3)	(4)
	General innovation (product or process)	Energy efficiency	EI developed within firm	Environmental measures
Energy tax	0.881 (0.109)	1.086 (0.132)	1.492** (0.190)	1.173 (0.153)
Obstacle regulation	0.788** (0.0786)	0.701*** (0.0653)	0.849* (0.0842)	0.701** (0.0803)
Customer push	1.588** (0.241)	1.548** (0.235)	1.539** (0.240)	1.113 (0.199)
Losses weather	1.349* (0.219)	1.760*** (0.255)	1.970*** (0.287)	1.503** (0.224)
RD inhouse	3.811*** (0.680)	3.209*** (0.517)	4.407*** (0.717)	1.591** (0.260)
RD outhouse	1.773** (0.448)	1.925** (0.492)	2.324*** (0.575)	1.014 (0.282)
Green targets	1.855*** (0.201)	4.057*** (0.461)	7.132*** (0.786)	1.654*** (0.175)
Green manager	1.157 (0.172)	1.526** (0.270)	2.154*** (0.341)	1.272 (0.212)
Ext audit	1.637*** (0.174)	1.937*** (0.202)	2.689*** (0.282)	1.707*** (0.204)
Country FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
N	8128	8128	8128	8128

Note: The base category is “no innovation activity”; Controls included; Exponentiated coefficients: to better interpret the results, I transform the coefficients into Relative Risk Ratio; Standard errors in parentheses are clustered at sector level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Overall, the results remain similar. The findings indicate a significant, positive correlation of customer requirements and experience losses (due to weather extremes) with the introduction of all environmental innovation measures. Differences occur when looking at

regulation. Here, we can see that energy tax only shows significant results for EI developed within the company. Being energy taxed increases the relative risk to EI within the company about 50% compared to companies not involved in innovation. Furthermore, if companies state that regulation is a moderate to great obstacle, the relative risk of introducing EI to no innovation decreases by a factor of 0.7 for adopting energy efficiency measures and environmental measures.

3.5.3 Further Analysis of Subsamples

The post-socialist economies of CEECCA are far from being a homogeneous group. To investigate possible heterogeneity in environmental innovation across country groups, I estimate two subsamples in terms of EU membership and non-membership.

Starting with adopting environmental measures (see Table 3.6), energy tax only shows for EU members a significant positive correlation. This again indicates that the EU has stronger environmental policy objectives compared to countries outside the EU. Furthermore, companies whose customers demand environmental standards have higher odds of introducing environmental measures in both groups of countries. However, it is about 7 percentage points higher in the EU member countries, which could be explained by possibly higher environmental awareness within the EU. Companies that experienced losses due to weather extremes are positively associated with the adoption of environmental measures in both country groups. This is also the case for internal R&D, while the odds are about 30 percentage points higher among EU member states. Collaborative R&D is not significant for adapting environmental measures, which is in line with my baseline results above. Estimating it in column 3 and 4 alternatively with acquiring external knowledge, we see a strong significant positive correlation only for non-EU states. This is again indicating a high relevance of external knowledge transfer.

Table 3.6: Logit estimation results: adopting environmental measures in EU and non-EU members

	(1)	(2)	(3)	(4)
	environmental measures		environmental measures	
	EU members	Non -EU members	EU members (a)	Non -EU members (a)
adopt env. measure				
Energy tax	1.612** (0.367)	1.062 (0.134)	1.648** (0.395)	1.105 (0.145)
Customer push	1.704** (0.460)	1.638** (0.265)	1.764** (0.474)	1.626** (0.254)
Losses weather	1.977** (0.438)	1.878*** (0.334)	1.888** (0.431)	1.761*** (0.278)
RD inhouse	2.136** (0.572)	1.863*** (0.227)	2.285** (0.614)	1.591*** (0.193)
RD outhouse	1.774 (0.655)	1.249 (0.269)		
Ext knowledge			1.591 (0.450)	2.729*** (0.536)
Green targets	4.156*** (0.742)	2.984*** (0.333)	4.380*** (0.790)	2.997*** (0.346)
Green manager	1.417 (0.330)	1.723** (0.401)	1.433 (0.347)	1.671** (0.408)
Ext audit	0.933 (0.201)	2.326*** (0.248)	0.925 (0.204)	2.215*** (0.228)
Obstacle regulation	0.760* (0.122)	0.971 (0.110)	0.745* (0.123)	0.988 (0.115)
FE	YES	YES	YES	YES
N	2644	5034	2608	4977

Note: The dependent variable is binary. Controls included. Exponentiated coefficients: to better interpret the results, I transform the coefficients into odds ratio; standard errors in parentheses are clustered at sector level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Looking at energy efficiency measures (see Table 3.7), companies being energy taxed are positively associated with EI in both country groups, while in EU members the odds to adapt energy efficiency measures are 10 percentage points higher. This is consistent with above results. Customer requirements only increase the likelihood to introduce energy efficiency in non-EU states. This could be related to backward technologies that are still often used in these countries and that might not meet customer standards. Internal R&D increases the likelihood for companies to adapt energy efficiency measures in both country groups, while the odds are about 15 percentage points higher among non-EU member states. The opposite is the case for collaborative R&D, where the odds are 25 percentage points higher among EU members. This suggests that firms from EU transition countries are on average more involved in collaborative R&D than those from non-EU transition countries (see Table 3.2). Estimating it with acquiring external knowledge (see column 3 and 4) shows only significant and positive results for EU

member states. The EU actively promotes cleaner energy technologies and updates its regulations, this could pressure companies from EU transition countries and make them more reliant on external knowledge sources.

Table 3.7: Logit estimation results: adopting energy efficiency measures in EU and non-EU members

	(1)	(2)	(3)	(4)
	energy efficiency measures		energy efficiency measures	
	EU members	Non -EU members	EU members (a)	Non -EU members (a)
energy efficiency				
Energy tax	1.384** (0.155)	1.273** (0.107)	1.397** (0.159)	1.290** (0.111)
Customer push	1.129 (0.128)	1.369*** (0.128)	1.174 (0.140)	1.362*** (0.128)
Losses weather	1.287* (0.187)	1.475*** (0.163)	1.291* (0.192)	1.521*** (0.166)
RD inhouse	1.459** (0.181)	1.669*** (0.121)	1.582*** (0.174)	1.774*** (0.120)
RD outhouse	1.759*** (0.280)	1.390** (0.157)		
Ext knowledge			1.420** (0.157)	1.159 (0.126)
Green targets	3.997*** (0.354)	3.114*** (0.211)	3.960*** (0.358)	3.175*** (0.212)
Green manager	1.428** (0.191)	1.598*** (0.164)	1.457** (0.194)	1.588*** (0.166)
Ext audit	1.620*** (0.163)	1.494*** (0.102)	1.612*** (0.168)	1.486*** (0.0987)
Obstacle regulation	1.024 (0.106)	0.921 (0.0750)	1.042 (0.107)	0.955 (0.0759)
FE	YES	YES	YES	YES
N	3103	5582	3064	5518

Note: The dependent variable is binary. Controls included. Exponentiated coefficients: to better interpret the results, I transform the coefficients into odds ratio; standard errors in parentheses are clustered at sector level, * p < 0.10, ** p < 0.05, *** p < 0.01

Finally, in Table 3.8, we look at EI developed with the company. Companies show again higher likelihood to EI when faced with energy taxes, while here companies from non-EU members have 15 percentage points higher odds to EI. Customer requirements are as in the baseline results not significant. Furthermore, experiencing losses due to weather events does not show a significant result. Companies engaged in internal R&D have in both country groups a higher likelihood to EI, while collaborative R&D (and acquiring external knowledge) only show for EU member states a significant, positive relation. This is similar to the results before.

Table 3.8: Logit estimation results: EI within firm in EU and non-EU members

	(1)	(2)	(3)	(4)
	Eco Innovation		Eco Innovation	
	EU members	Non -EU members	EU members (a)	Non-EU members (a)
EI within firm				
Energy tax	1.293* (0.174)	1.447*** (0.151)	1.286* (0.175)	1.419*** (0.144)
Customer push	0.873 (0.133)	1.144 (0.127)	0.867 (0.131)	1.127 (0.128)
Losses weather	1.288 (0.230)	1.200 (0.145)	1.271 (0.225)	1.181 (0.140)
RD inhouse	1.434** (0.246)	1.248** (0.120)	1.477** (0.268)	1.297** (0.127)
RD outhouse	1.462* (0.306)	1.146 (0.153)		
Ext knowledge			1.537** (0.220)	1.116 (0.134)
Green targets	1.521** (0.198)	1.759*** (0.169)	1.519** (0.194)	1.756*** (0.170)
Green manager	1.379** (0.205)	1.461** (0.194)	1.342** (0.199)	1.420** (0.192)
Ext audit	1.298 (0.218)	1.558*** (0.131)	1.315* (0.214)	1.536*** (0.130)
Obstacle regulation	1.044 (0.126)	1.316** (0.119)	1.022 (0.130)	1.294** (0.120)
FE	YES	YES	YES	YES
N	1501	2539	1482	2492

Note: The dependent variable is binary. Controls included. Exponentiated coefficients: to better interpret the results, I transform the coefficients into odds ratio; standard errors in parentheses are clustered at sector level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Empirical studies show that determinants of EI can vary depending on the type of eco-innovation (Biscione et al., 2020; del Río et al., 2017; Demirel & Kesidou, 2011; Frondel et al., 2007; Horbach et al., 2012). Since the ES questionnaire allows further differentiation of firms' environmental measures, the variables End-of-Pipe (EOP) and Cleaner Productions (CP) were created whose estimation results are presented in Table 3.9.

The findings suggest that environmental regulation that is an obstacle to companies and energy tax increase the odds over 20% to introduce EOP measures in companies, while there is no significant relation to CP. This is in line with Frondel et al. (2007). Regulatory pressure seems to play a significant role in the application of EOP measures. Environmental customer requirements and experience of losses due to weather extremes increase the likelihood to introduce both EOP and CP. Regarding R&D, companies involved in internal R&D have 34

percentage points higher odds to introduce CP than EOP. These findings indicate that CP are more knowledge intense than EOP. This is also reflected in the results for collaborative R&D. While there is no significant relationship for EOP, the odds of engaging in CP increases by more than 50% when firms are involved in collaborative R&D.

Table 3.9: Logit estimation: Cleaner production and end of pipe

	(1) EOP	(2) CP
Energy tax	1.247** (0.0987)	1.113 (0.100)
Obstacle regulation	1.237** (0.0857)	1.071 (0.0836)
Customer push	1.501*** (0.109)	1.469*** (0.146)
Losses weather	1.436*** (0.128)	1.694*** (0.217)
RD inhouse	1.457*** (0.113)	1.797*** (0.156)
RD outhouse	1.106 (0.103)	1.555** (0.241)
Green targets	2.400*** (0.138)	3.003*** (0.236)
Green manager	2.519*** (0.219)	1.667*** (0.235)
Ext audit	1.559*** (0.110)	1.586*** (0.128)
Country FE	YES	YES
Industry FE	YES	YES
N	8120	8631

Note: The dependent variable is binary. Controls included. Exponentiated coefficients: to better interpret the results, I transform the coefficients into odds ratio; standard errors in parentheses are clustered at sector level, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.6 Discussion and Conclusion

This study examined the environmental innovation behaviour of companies in 29 transition economies within the CEECCA region and compared it to their general innovation. Using the most recent ES survey data conducted between 2018 and 2020, I analysed over 17,000 companies.

The results of this study confirm a positive role of regulation on EI development, thus supporting hypothesis 1 and 2. Companies stating environmental regulation is an obstacle for their current business are more likely to EI within the companies. The weaker results for

regulation as an obstacle to do business across other EI may indicate that environmental regulation is subject to less stringent policies in transition economies (OECD, 2020). In addition, the findings indicate that environmental regulation in the form of energy taxes is positively associated with the adoption of energy efficiency measures. These results align with the findings of Biscione et al. (2020). The importance of government tax regulation for energy efficiency measures is noteworthy given that transition countries are partly still entrenched in energy-intensive technologies or industries (OECD, 2019a, 2019b), indicating a more important role of the state. Moreover, I found that this link is stronger for transition countries that are part of the EU compared to non-EU transition economies. This could be related to the EU's higher environmental policy targets or more stringent enforcement.

Hypothesis 3 is confirmed as well. Customer demand for environmental protection stimulates innovation in all areas of environmental innovation as well as general product and process innovation. This is indicating that market pull factors create incentives that go beyond environmental activities. These findings are in contrast to Horbach (2016) and Biscione et al. (2020) who found the demand push factor is less relevant than environmental regulation in Eastern EU states. My results, however, indicate the opposite. This might be an indication of increasing sustainability awareness on the part of consumers over the years or that companies are now more responsive to it. Furthermore, I confirm hypothesis 4. Companies experiencing losses due to extreme weather events are more likely to engage in EI. The strongest link is here found with adapting environmental measures. This suggests that these losses stimulate companies to find innovative solutions and might raise environmental awareness. As many countries of the CEECCA region are vulnerable to consequences of climate change and are confronted with increasing weather extremes, it is important that companies prepare for these environmental challenges. My results indicate that firms use EI as a coping strategy.

Finally, internal R&D is an important input factor for all firms' innovation activities (general and environmental). This supports hypothesis 5. Also, collaborative R&D is positively associated with the introduction of EI. Thus, confirming hypothesis 6. However, the results do not indicate that external R&D cooperation (or buying access to external knowledge) have a more important role for EI than for general innovation. The results could be an indication that the absorptive capabilities within companies are not advanced enough to implement the knowledge gained from cooperation. However, it seems more likely that R&D collaborations

are less common in transition economies (Hájek & Stejskal, 2018). Therefore, internal R&D compensates for these which is in line with the findings of Ghisetti et al. (2015) and Marchi and Grandinetti (2013) but in contrast to the findings of da Silva Rabêlo and Azevedo Melo (2019) and Rennings and Rammer (2009). Here, however, it should be accounted for by the special background of the countries under study. The transformation from a planned to a market economy was accompanied by heavy losses in scientific and industrial R&D (Meske, 2000). Existing structures in and between science institutes dissolved and fragmented (Radosevic, 1998; Radosevic, 2002). This means that the market-based innovation systems, even in the transition countries of the EU, are relatively young and networks between actors and institutions are less established. Nevertheless, knowledge transfer from external sources is conducive to companies' EI in these countries, as the findings of the alternative measure 'acquiring external knowledge' show.

The countries studied have undergone a massive transformation process and have achieved varying degrees of modernisation and technological performance. Overall, the results show parallels in many parts to the findings of the non-transition countries. It is plausible to assume that the transition countries still take their cue from the non-transition countries and draw lessons from the successes and failures of their environmental and energy policies. However, since the transition countries have the distinction of having already transformed their economic system once in the 1990s, this experience could also prepare them for the renewed challenge of transforming the economic system to a low-carbon economy.

Analysis of ES data is useful for gaining insights into firms' environmental innovation behaviour over a large number of observations, but has several limitations. First, because I am limited to cross-sectional data, the direction of causality is difficult to determine. Second, since only one wave of the survey is available, it is not possible to include a time dimension in this analysis. This limitation underscores the need for further research on this topic, as the availability of more survey waves or a panel data set would provide deeper insights. In addition, the firms studied are affected by regulations that may vary at the industry and country level. These variations cannot be captured in this empirical analysis. Furthermore, the data do not allow further differentiation of the types of external R&D partners. Hence, I cannot show whether the links are national or international and whether they are collaborations between companies or with universities or research institutions, leaving room for further research on

this topic. Finally, I acknowledge that there is a vulnerability to measurement error and cultural bias in self-reported data.

This topic of environmental innovation is of great importance as countries face and will continue to face major challenges caused by global climate change. Therefore, it is important to grasp the features of environmental innovation in order to take appropriate measures to better address the pressing task of policymakers, business, and society to create green industries. Overall, policymakers should be encouraged by my findings to continue and strengthen their environmental regulations. Furthermore, the results suggest that there is still room for more cooperation in the area of R&D. Decision-makers should see this as an opportunity to promote more external R&D linkages and facilitate the possible costs of cooperation. Finally, these results have shown the positive stimulation of environmental demands of customers on environmental innovations. This should reinforce policy makers to further raise sustainability awareness among the population.

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Appendix

Table A1: Summary statistics

	Description	N	Mean	Std. Dev.	Min	Max
process innovation	Takes value 1 if any new or improved process were introduced during last 3 years, 0 otherwise	16975	.19	.393	0	1
product innovation	Takes value 1 if any new or improved products/services were introduced during last 3 years, 0 otherwise	17077	.318	.466	0	1
Environ. innovation within firm	Takes value 1 if any environmental measures were developed within company over last 3 years, 0 otherwise	5707	.481	.5	0	1
Adopt energy efficiency measures	Takes value 1 if any energy efficiency measures were adapted over last 3 years, 0 otherwise	16346	.361	.48	0	1
Adopt environ. measures	Takes value 1 if any environmental measures were adapted over last 3 years, 0 otherwise	14024	.763	.425	0	1
end of pipe	Takes value 1 if any end of pipe measures were adapted over last 3 years, 0 otherwise	14939	.243	.429	0	1
cleaner production	Takes value 1 if any cleaner production measures were adapted over last 3 years, 0 otherwise	15975	.73	.444	0	1
RD inhouse	Takes value 1 if R&D were spent on within company during last 3 years, 0 otherwise	17048	.214	.41	0	1
RD outhouse	Takes value 1 if R&D were spent on contracted with other companies during last 3 years, 0 otherwise	17048	.098	.297	0	1
Ext. knowledge	Takes value 1 if external knowledge was purchased over last 3 years, 0 otherwise	17029	.142	.349	0	1
Green targets	Takes value 1 if environmental targets (energy, CO2 or pollution) were defined over last 3 years, 0 otherwise	16249	.307	.461	0	1
Green manager	Takes value 1 if environmental manager was employed last year, 0 otherwise	16847	.12	.325	0	1
Ext. audit	Takes value 1 if external audits are performed over last 3 years, 0 otherwise	10432	.294	.455	0	1
Customer push	Takes value 1 if customers required environmental certifications or standards as a condition to do business last year, 0 otherwise	16756	.147	.354	0	1
Losses weather	Takes value 1 if experienced monetary losses due to extreme weather/ pollution over last 3 years, 0 otherwise	16939	.099	.299	0	1
obstacle regulation	Takes value 1 if environmental regulation is a moderate to great obstacle to the current operations of this establishment, 0 otherwise	16431	.270	.444	0	1
Energy tax	Takes value 1 if establishment is subject to an energy tax or levy, 0 otherwise	16337	.191	.393	0	1
Firm size	Firm size bases on employee figures ((1) micro, (2) small, (3) middle or (4) large)	16997	2.133	.878	1	4
Firm age	Firm age in years	17032	18.049	13.752	0	205
Employee growth	Employee growth over last 3 years	15132	4.513	55.314	-1750	2215
Sales expectation	Sales expectation for next year	16421	1.548	.699	1	3
Main market	Establishment's main market ((1) local, (2) national or (3) international)	17070	1.712	.684	1	3

Source: EBRD-EIB-WB Enterprise Surveys 2018-2020

Table A2: Correlation matrix

	RD inhouse	RD outhouse	Ext. know	Customer push	Energy tax	Losses weather	Obstacle regulation	Ext. audit	Green targets	Green manager	Firm size	Sales exp.	Main market
RD inhouse	1												
RD outhouse	0,469	1											
Ext. knowledge	0,342	0,299	1										
Customer push	0,180	0,172	0,137	1									
Energy tax	0,079	0,092	0,104	0,067	1								
losses weather	0,093	0,088	0,104	0,149	0,072	1							
obstacle regulation	0,043	0,053	0,030	0,124	0,019	0,094	1						
Ext. audit	0,140	0,120	0,103	0,190	0,040	0,087	0,051	1					
Green targets	0,110	0,098	0,087	0,194	0,085	0,091	-0,015	0,231	1				
Green manager	0,159	0,152	0,131	0,351	0,051	0,095	0,083	0,213	0,211	1			
Firm size	0,205	0,193	0,165	0,205	0,039	0,063	0,071	0,185	0,177	0,314	1		
Sales expectation	-0,099	-0,088	-0,073	-0,038	-0,022	0,002	0,053	-0,043	-0,045	-0,040	-0,058	1	
Main market	0,194	0,151	0,118	0,184	0,038	0,048	0,079	0,099	0,104	0,203	0,327	-0,018	1

Source: European Bank for Reconstruction and Development

Table A3: Distribution of firm by industries

Variable	Industry labels	Numbers of firms	Percent
sec15-16	Food, Tobacco	2,206	12.84
sec17-19	Textile, clothing, leather	1,413	8.22
sec20-22	Wood, paper, printing	745	4.34
sec23-25	Coke, Chemical, rubber and plastics	886	5.16
sec26	Non-metallic mineral products	864	5.03
sec27-28	Metals	1,252	7.29
sec29_34-35	Machinery	1,103	6.42
sec30-33	Electronics, instruments	367	2.14
sec36-37	Other manufacturing	579	3.36
sec45	Construction	1,273	7.41
sec50-52	Retail and wholesale	4,694	27.31
sec55	Hotel, restaurants	779	4.53
sec60-64	Transport	784	4.56
sec72	IT	240	1.40
Total		17,185	100

Source: EBRD-EIB-WB Enterprise Surveys 2018-2020

4 Chapter

Through thick and thin with the national leader: the rally around the flag effect in Russia

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Abstract:

In 2014, during the aftermath of the Crimea referendum, a substantial increase in the approval ratings for President Putin was observed whilst Russia was dealing with a serious economic crisis. One possible explanation for this phenomenon is the so-called ‘rally around the flag’ effect, whereby domestic leaders are benefiting from a boost in public opinion during international conflicts. This paper explores determinants of presidential support during the latest rally event in Russia accompanied by an economic crisis, and compares it to a previous five-year period. Using large pooled Levada survey data between 2008-2016, we find that even though patriotic citizens are more likely to support the president, their non-patriotic counterparts are more likely to rally. Following state broadcasters is positively associated with presidential support but not with rallying. Moreover, as one’s personal financial situation improves, the odds for presidential approval increase, however it was the low-income class that was more likely to rally. Overall, our paper contributes to a better understanding of peculiarities of public opinion and its role for the rally effect in an authoritarian context.

Keywords: international conflict, economic crisis, presidential approval, rally effect

JEL code(s): F51, G01, D72

Publication

This is an unpublished manuscript. It is awaiting further refinement and publication in a peer-reviewed scientific journal.

Acknowledgements

We are indebted to Heiko Pleines, Michael Rochlitz and Julian Waller for their valuable comments and feedback on earlier versions of the paper. Furthermore, we are very grateful to the Levada Center in Moscow for sharing the data with us. The work has benefited from helpful suggestions and comments of Jutta Günther and other participants of the IERP seminar in April 2018 at the University of Bremen as well as participants of the Research Colloquium in Politics and Economics in May 2018 at the Research Centre for East European Studies in Bremen. We also want to thank Timothy Frye and other participants of the EACES-HSE Workshop within the 9th Annual ICSID Online-Conference 2020 in Moscow for their notes and useful remarks.

4.1 Introduction

It is commonly agreed that there is an association between the economic performance of a country and public support for its political leader (Curry & Morris, 2010; Ostrom & Simon, 1985; Tir & Singh, 2013). Thus, it is not surprising that Vladimir Putin's political success went along with Russia's strong economic performance during his tenure in the 2000s (Colton & Hale, 2009; Treisman, 2014). However, it is surprising that despite an economic decline in 2014, President Putin's approval rates rose by approximately 20 percentage points, reaching over 80% support rates. Hereafter, the public approval rates peaked in 2015, while the Russian economy reached rock bottom. There are several possible explanations to this phenomenon.

The approval rating of a country's president is usually influenced by internal and external political events (Baker & Oneal, 2001). An enormous increase in the president's approval during the aftermath of an international crisis is associated with the so-called "rally around the flag effect", or short: rally effect (Baum, 2002; Chatagnier, 2012; Edwards & Swenson, 1997; Mueller, 1970, 1973). It is mainly driven by people who were either in opposition or unaligned voters before the international crisis. With the rally effect in place, the public is willing to lay aside its economic problems; however, it remains debated whether a rally effect can completely offset a poor economic situation (Tir & Singh, 2013).

A rally effect usually requires a rally event to be triggered. A prominent rally event occurred in Russia on March 18, 2014, when the Ukrainian peninsula Crimea became a part of the Russian Federation, leading to a rise of geopolitical tensions evolving around Russia. A number of Western countries exerted harsh critique, accusing Russia of violating international law, and introduced various sanctions towards Russia (Wang, 2015). The imposed sanctions involved, among others, economic restrictions that placed an additional burden to the battered Russian economy, plunging it into a severe crisis (Gurvich & Prilepskiy, 2015; Hinz, 2017). However, despite the difficult economic situation against the backdrop of the foreign policy crisis, approval rates for the Russian president increased drastically. This dramatic increase of presidential approval in 2014 corresponds timely to the Crimea event.

The existing literature mostly examines the rally effect in the United States due to the hypothesised greater accountability of the government towards the population in democratic states rather than in authoritarian regimes (Rudolf, 2007). However, modern authoritarian

regimes, or "informational autocracies", also rely heavily on public support - which is assured through a working propaganda machine (Guriev & Treisman, 2019; Levy & Vakili, 1992). Simultaneously, in a century of increasing economic interdependence and a global communication network, authoritarian leaders need to adapt in order to stabilise their power. Therefore, authoritarian regimes make a great effort to maintain a positive image of their government and popularity in society (Frye et al., 2016; Guriev & Treisman, 2015; Guriev & Treisman, 2019, 2020b)⁴⁸. Hence, Russia provides a unique setting to observe the changes in sources of presidential support during a rally event and beyond in a country that is widely considered as authoritarian (Hale, 2018).

In this study, we empirically examine the determinants of the presidential support with respect to the latest rally event that co-occurred with an economic crisis in Russia and make a comparison of the approval determinants with the time prior to it. Moreover, we are interested in identifying which (sub-) population groups contributed to the rally effect that boosted presidential support: in particular, how long-lasting the support in this group was and which mechanisms (media or patriotism) were most pronounced over time. Another subject of our interest comprises uncovering the channels through which the rally effect took place. We use rich survey data between the years 2008 and 2016 provided by the Levada Analytical Center (Levada Center), an independent research organisation in Moscow that regularly carries out sociological polls.

According to our findings, there was a drastic rise of approval rankings in times of geopolitical escalations with Russia's involvement starting March 2014. This increase was driven by persons who did not think that Russia was moving in the right direction. The greatest boost occurred in October 2014. This evidence serves as a proof for the "rally" nature of the latest approval development. Furthermore, the citizens being more likely to rally did not approve of the Russians politics in Ukraine, but considered the annexation just. Individuals who follow the news broadcasters do not have higher odds to rally. Comparing the time before and after

⁴⁸ One significant difference between authoritarian and democratic regimes is the durability of the rally effect. In electoral authoritarian regimes like the Russian one, the rally effect happens to be more long lasting compared to democratic ones (Kazun, 2016). The principal reason being that authoritarian regimes are more able to influence the public image through state media control and repression of opponents (Alexseev & Hale, 2016; Hale, 2018). In non-democratic regimes, several tactics of weakening or marginalising political opponents are used, varying from governmental harassment to outright bans on anti-regime parties (Hale, 2018).

the rally, our results show that Russian citizens who get information through state media are generally more likely to support the president. In addition, the president can count on the support of people who have a strong sense of national pride at any time within our observation period, not depending on whether the rally event is in place or not. However, when provided by people without deep patriotic feelings, the presidential support becomes more sluggish as rally events get less pronounced. An important finding relates to the nature of the rally effect: obviously, it occurs on the wave of justice sentiments. One possible explanation that we find in the data is that rallying people consider the Crimea being a Russian territory. Caught in financial troubles, people are less likely to support the president, but are more likely to contribute to the rally effect. Our results survive several robustness checks.

There are several papers closely related to our topic. Greene and Robertson's (2020) results show a correlation between an increase in citizens' emotional arousal in the summer of 2014 and an increase in presidential approval ratings. Alexseev and Hale (2016) illustrate the strong relationship between patriotism and support for the president after Crimea in their descriptive analysis of polling data from May 2013 and November 2014. Hale (2016), using a survey experiment in 2015, shows that Russians who consume state media the least, have the strongest Crimea effect in form of increased trust in President Putin.

Our paper contributes to the existing literature in several ways. First, we are able to trace the changes in opinion of previous non-supporters, thus, capturing the nature of rallying behaviour in Russia. We can complete the picture of the rally candidates before the rally event by identifying those who rallied. Second, our data allows us to draw a direct comparison of the support mechanisms throughout a long period of time, in both pre- and post-Crimean times. So far, the existing studies specifically focused on a single month before and after March 2014. To the best of our knowledge, we are the only ones to enlarge the scope of observation and include the development over time.(e.g. Alexseev & Hale, 2016; Frye et al., 2016; Greene & Robertson, 2020; Hale, 2018; Kazun, 2016). Finally, our study enhances the understanding of the nature of the rally effect in an authoritarian setting. By doing so, we disentangle the mechanisms behind the rally effect from the mechanisms behind the overall support sentiments. It appears that the mechanism of patriotic feelings is more persistent behind overall presidential support, however, patriotic feelings seem to be more nuanced depending on the kind of support.

The remainder of this paper is organised as follows: Section two provides the theory review with respect to the main mechanisms behind the presidential support as well as the rally effect, followed by a brief literature review on the rally effect in Russia. In Section three, a descriptive foundation of the following empirical analysis is laid. The main results are discussed in Section four. Section five provides a summary, deals with the study limitations and concludes.

4.2 Mechanisms behind the rally effect in democratic and authoritarian countries

The literature highlights that people who have always supported the president are the ones who do not participate in rallies (Brewer et al., 2003; Edwards & Swenson, 1997; Groeling & Baum, 2008; Kernell & Hibbs, 1981) because party followers already approve of the president even before the rally event. Furthermore, people who are closest to the threshold between approval and disapproval, are most likely to change their mind in view of external circumstances (Baum, 2002).

There are two possible theoretical approaches to explain the rally effect. The first one refers to a *patriotism* approach. During major international events, the public approval for the president increases, at least in the short term. Reason being, that the president is the symbol of the nation and consequently becomes, in such times, a dominant focus of public attention (Edwards & Swenson, 1997; Kam & Ramos, 2008). Furthermore, in times of crisis when the country itself is being threatened, there is a tendency for individuals to prioritise their overriding sense of national identity over their political grievances. This gives the president a chance to trigger and, thus, utilise patriotic sentiments to serve their political cause (Mueller, 1973). Insofar as the threat is maintained, people overlook disagreements and reorient towards patriotism that is inevitably associated with the president (Baker & Oneal, 2001).

Another possible reason for the rally effect is a so-called *opinion leadership* approach (Brody, 1991). During international crises, it is more difficult for the public to access information and to make an adequate political assessment as opposition voices are usually less discernible in the mass media. Political opponents sometimes restrain their criticism for fear of appearing foolish or unpatriotic in the face of a rapidly developing crisis. In a democratic regime, the non-government-controlled media, whose function is to provide a balanced perspective, run

then into danger of presenting a rather one-sided view. In view of that, the public may wrongly assume that there is consensus about the political leaders and their policy. Thus, the absence of criticism can also instigate the rally phenomenon⁴⁹.

The approach of the opinion leadership emphasises the significance of the role of media. The mass media is considered as a strategic actor⁵⁰ and has a huge effect on the relationship between public opinion and foreign policy, as well as shaping the perceptions of the public about the characteristics of the conflict (Baum & Potter, 2008; Baum & Potter, 2019). Hence, not only do pre-existing attitudes influence the public opinion, but a close attention to the media can also lead to a change of opinion about the president, causing people to shift from non-supporters to approvals.

The pre-existing opinion of a president is also influenced by personal experience, and thus dependent on the social and economic status of individuals in a society (Zaller, 1992). Brody (1991) argues, the more individuals are in an economically weak position, the more critically they assess the previous job performance of their president because they are more affected by economic downturns. Hence, it is possible that individuals with small incomes are less supportive of the president.

As long as economic downturns do not severely impact the general public, the president's competent image lasts. However, the use of repressions against citizens rises with an increasing poor economic performance (Guriev & Treisman, 2015). This development can be observed recently in countries such as Turkey, China and Russia (Petrov & Rochlitz, 2019). In the following section, the rally effect applied to the Russian context is described.

4.3 The rally around the flag effect in Russia

The literature shows a correlation between patriotism and presidential support (Brewer et al., 2003). According to Hale (2018), the rally effect in authoritarian regimes resembles the one in democratic regimes regarding the stimulation of patriotic sentiment. In Russia's case,

⁴⁹ For instance, even Alexey Navalny, the main and loudest regime detractor, on numerous occasions never openly opposed the Crimea annexation or even expressed a clear-cut opinion on this subject (Faraponov 2021).

⁵⁰ However, it has to be kept in mind that nowadays through diverse media channels (social media etc.) media coverage becomes highly competitive, hyper-fragmented and more polarised (at least to some degree in non-democratic countries). This development challenges the traditional media environment and hampers information convergence (Baum and Potter, 2019).

nationalism had already been quite strong before the Crimea events (Alexseev & Hale, 2016). However, in 2014, the Kremlin started to actively use symbolic patriotism and directed it towards the government in order to gain and sustain public support (Alexseev & Hale, 2016; Bækken, 2021; Hale, 2016).

However, when we take Brody's approach of opinion leadership and the associated role of the media into consideration, such that an absence of criticisms in the media can also cause a rally effect (Brody, 1991). As a strong opposition is missing in Russia, Russian media has no great access to a critical perspective of the government's policy⁵¹. Consequently, an elite consensus is presented to the public. Thus, a rally effect is more likely to occur.

With the worsened economic performance the use of censorship and propaganda intensifies and limits opposition media (Guriev & Treisman, 2015). In Russia, the mass media is controlled by the state in order to avoid critical media coverage of the government. The five leading broadcasters (Perviy Kanal, Rossiya 1, NTV, TNT and Pyatiy Kanal) are owned by the state or have strong affiliations with the Kremlin (Becker, 2014; Gehlbach, 2010). These Russian television broadcasters employ propaganda, using methods such as excluding political opponents from public political debates (Kazun, 2016). Consequently, strong criticism of the government disappears from the media. Moreover, the Russian ruling elites use state media to shape collective memories for political purposes and to gain public support (Belmonte & Rochlitz, 2019; Malinova, 2020). By only placing importance on the negative facets of the transition process in the 1990s, such as economic hardships and chaotic political circumstances, Putin's tenure is systematically linked with the status quo, whose attributes are economic and political stability (Belmonte & Rochlitz, 2019). Thus, television broadcasters greatly contribute to the stabilisation of presidential support in Russia (Kazun, 2016; Kazun & Semykina, 2020; Treisman, 2011). Furthermore, due to the control by the Kremlin, self-censorship prevails among the Russian journalists (Becker, 2014; Fredheim, 2017). Nevertheless, the vast majority of the Russian public favours television to inform themselves about current affairs, and 50% also trust television the most (Becker, 2014).

⁵¹ Another reason for a substantial underrepresentation of critical opinion in the Russian mainstream media is its lack of independence. State media sources are notorious for being a propaganda voice (Paskhalis et al. 2022). The only publicly broadcasted independent TV channel, Dozd, was cut off free broadcast in early 2014.

Thus, it is possible that media coverage has an even stronger influence in Russia than in democratic states, as the information deficit mentioned by Baum and Potter (2008) never decreases due to the state control. Rozenas and Stukal (2019) analysed the state media reporting of economic news in Russia. Their results show that bad economic news is not censored but systematically related to foreign factors. Contrastingly, good economic developments are systematically associated with the Russian government or President Putin. Moreover, a pre-existing opinion of a president is also influenced by personal experience and is dependent on the social and economic status of individuals (Brody, 1991; Zaller, 1992). The state of the economy and public support are highly interdependent (Curry & Morris, 2010; Ostrom & Simon, 1985; Tir & Singh, 2013). This applies to democracies as well as autocracies (Guriev & Treisman, 2020a). Since the Russian economy experienced a severe recession in 2015, the economic situation of individuals is also addressed in the current research. In line with Brody (1991), individuals who are more affected by economic downturns, are generally more critical of the president's job performance. This is supported by the findings of Treisman (2011) who, in his investigations of the approval rates of Putin and Yeltsin during 1991 and 2008, discovered that the Russian society reacts to economic developments similarly like Western societies. Thus, President Putin's political success and his popularity are heavily connected to Russia's strong economic performance during Putin's tenure in the 2000s (Colton & Hale, 2009; Treisman, 2014). Furthermore, Russian citizens who believe the media to be biased attach greater weight to their personal economic observation (Rosenfeld, 2018). The Russian economic crisis in 2015 is characterised by an enormous decline in the price of oil, a high deficit in the Russian state budget, a massive devaluation of the Russian currency, capital flight, as well as a rise in interest and inflation rate (see e.g. Aganin & Peresetsky, 2018; Dreger et al., 2016; Hoffmann & Neuenkirch, 2017; Kholodilin & Netšunajev, 2019; etc.). Economic sanctions imposed by Western countries aggravated the crisis (Gurvich & Prilepskiy, 2015; Hinz, 2017)⁵². Although we do not place economic sanctions as such in the focus of this

⁵² For the particular link between sanctions and presidential support in the aftermath of the Crimea crisis see Alexseev and Hale (2020), Frye (2018), and Kazun (2016). For instance, Frye (2018) finds that economic sanctions do not directly affect presidential support. Instead, the popularity of the Russian leadership increased due to the incorporation of Crimea into Russia.

study, we do consider the individual economic situation of Russians and how it affects the presidential support in general as well as opinion change during the crisis.

4.4 Method and Data

4.4.1 Structure of the Levada data

To answer the research questions, we employ information extracted from surveys conducted by the Levada Center in the different months between 2008 and 2016. The broad time coverage of the surveys allows us to divide the data in a pre-rally-period (2008-2013) and a post-rally-period (2014-2016)⁵³. We use the pre-rally-period as a benchmark.

Using the survey data often raises the question, how trustworthy the answers towards incumbent politicians are. According to Frye et al. (2016), the opinion polls carried out in Russia within our defined post-rally-period can be considered credible and reflect true views of the respondents. Treisman (2014) also makes use of the Levada data and argues that the presidential rankings remain meaningful even in case of an upwards bias of the average presidential rating due to concerns about criticising incumbents, as long as this distortion is continuous in the course of time. Finally, we are interested in the publicly stated views on President Putin. If the surveyed public state their opinion to Levada, these answers are then seen to indeed represent their public opinion.

The advantage of the data provided by the Levada Center lies in the high frequency of available data since a vast sociological survey is carried out bimonthly and thus always reflects attitudes that are relevant for a specific moment. This section will present our data, with Table A1 reporting the pooled summary statistics and Tables A2 to A15 for each wave individually.

For the analysis of the post-rally-period⁵⁴ six survey waves are utilised: March 2014, October 2014, March 2015, November 2015, March 2016, and May 2016⁵⁵. In this way, we can analyse

⁵³ The division into two groups is necessary for data-related reasons, as national pride and media use were not surveyed simultaneously in the pre-rally period.

⁵⁴ The March wave of 2014 used here was carried out after the new regional parliament decided to annex Crimea to Russia and set the date for the referendum, therefore while the annexation was still underway. This event-chain obviously was very present in the news as we also see in the sample descriptive for following state news (92%). For the sake of simplicity, the term post-rally period will be continued in the following.

⁵⁵ The selection of the waves was made on the basis of the available data.

the impact of the March 2014 rally on support for the president over time. In addition, we use eight available survey waves from 2008 to 2013⁵⁶ to compare our results with the pre-rally time period.

Each survey wave contains representative responses of ca. 1600 Russian citizens⁵⁷ from rural and urban areas in all federal districts of Russia. The age of the survey participants ranges between 18 and over 80 years old in each wave. The participants from three different income groups (poor, middle-class, and rich) are distributed in the original survey throughout seven federal districts in Russia: Central, Northwest, South, Volga, Ural, Siberia, and Far East. Additionally, we define Moscow as a separate region by using the question on the city size, which includes Moscow as a separate category⁵⁸. Regarding the division of income groups after 2014, approximately 17% of respondents are allocated to the low-income group, 54% have middle income, and 30% can be considered relatively wealthy⁵⁹. The comparison of the pre-and post-rally-period shows that over the years the share of the lowest income groups decreases and of the highest income group increases. This is in line with the average income increase in Russia since 1998.

4.4.2 Description of key variables

Given the non-panel structure of the survey waves, we pool them. We also combine analogous questions from different waves to create the main variables of interest, related to patriotism and media use⁶⁰ as well as income level. Table A16 shows the operationalization of the key

⁵⁶ The second half of 2008 and the year 2009 is excluded. Thus, the financial crisis 2008/9 is not considered.

⁵⁷ The following population groups are not included in the sample: persons in military service, in pre-trial detention, persons living in remote or inaccessible regions of Siberia and the Far North, homeless persons, persons living in rural settlements with no more than 50 inhabitants, see Levada Center (2021).

⁵⁸ We treat Moscow as a special case as the city features the highest share of economic activities in Russia. Further, Moscow offers the rich cultural life of a metropolitan city, attracting a particular sort of people from the whole Russia. Since 2010, the Russian opposition has reinvigorated, especially in Moscow. Incidents like the 'Bolotnaya case' in 2011/2012 or the candidacy of Aleksei Naval'nyi for Moscow's mayoral elections in September 2013 strengthened the opposition movement and mobilised citizens in Moscow (Sakwa, 2015, Gel'man, 2015).

⁵⁹ Prior to the rally chain of events, the income group allocation across low, middle, and high income was 28%, 52% and 20% respectively.

⁶⁰ To measure patriotism, we combine questions about being proud to be a Russian citizen, being proud of today's Russia, and being a patriot. The media variable, in its turn, harmonises the questions on usage of state TV and state newspapers across several dimensions.

variables. Individuals are selected into the income category based on what they could afford to purchase (low income: food, clothes; middle income: additionally, some small goods, wealthy: everything). This measurement rules out subjective perception of economic conditions as more favourable if the party they support is in power (van der Brug et al., 2007; Wlezien et al., 1997).

In the pre-rally-period, pride is measured by whether a person states that they are proud to be a Russian citizen. In March 2008 and July 2010 pride share was about 80%, while in July 2008 it was 6 percentage points higher. This could be related to the Caucasian war. However, in September 2012, even though the question wording did not change, pride declined to 38%. In the post-rally-period, the question wording is more irregular due to data availability. In March 2014, pride measured to feel proud as a Russian citizen or as a patriot and amounted to 45%. In October 2014 and in March 2015, pride, due to the wording 'proud of Russia's position on the world political stage', amounted to 29% or 26% respectively. In November 2015, pride captured citizens who think that Russia is better than most countries and amounts to 64%. In March and May 2016, pride is expressed as pride in today's Russia, and amounted to 69% and 77% respectively.

In the pre-rally-period, news is measured whether citizens main news source is state TV channels or state newspapers, with the exception of September 2010, in which trust in state channels and newspapers is measured. Despite the different wording, no conspicuous differences are recognizable. It ranges from 74% to 82%. In the post-rally-period, following state news is measured similarly. Only in October 2014 and March 2015 a significantly different wording appears: following Ukraine news in main broadcasters in October and whether central television is an important source for political information. However, the answers remain within the usual range (from 73 to 87%). Notable, however, despite suitable questioning, are the months of March 2014 and March 2016. In March 2014, following state news amounted to 92%, suggesting that the Crimea event attracted a lot of attention, while in March 2016 it decreased to 64%.

4.4.3 Statistical matching: Who rallied?

To identify rallying individuals and gain an insight into the specific reasons behind the opinion change resulting in presidential support after the annexation, we employ two survey waves

from March 2014⁶¹. By statistically matching these two surveys, we can identify the individuals who rallied in March 2014 (see Table A17). This is done by applying a nearest-neighbour matching technique. The criteria for ‘closeness’ or ‘pairing’ are: sex, age, education, occupation, size of the locality and federal district.

The results show that on average, men and women around 45 years from middle-income groups and a medium level of education rallied. Occupationally, they were mainly workers, pensioners and skilled workers who lived in villages or smaller towns. With respect to the allocation across federal districts, these were mainly people from the Central, Volga, and Siberian regions who rallied. Furthermore, the descriptive statistics suggest that people who think that Russia is not developing in the right direction are a dominant group among those who rallied. The same applies to people who are not proud. Individuals who rally have a lower proportion consuming state media than the group that does not rally. Nevertheless, the consumption of state media also makes up the largest share in the rally group.

4.4.4 Model specification

The dependent variable is binary and stands for the support of the president, with an either “support” or “no support” option. The vector of controls encompasses socio-demographics such as sex, age, and education as well as federal districts’ and waves’ dummies. We employ a logit model for the estimation and cluster standard errors on the federal region and wave level.

Considering the cross-section structure of our data, the issue of potential reverse causality has to be mentioned. It is possible that a two-way nature of presidential support and feeling national pride exists. We try to capture this by explicitly looking at presidential support among individuals who are not agreeing with Russia’s direction (see Section 5.3). However, a causal relationship between both national pride and presidential support is not clearly determinable. Also, it is not quite clear whether state news can trigger presidential support or people who clearly support the ruling elites tend to rather follow news which reflect their political preferences. Therefore, the estimated correlation between following state media (or being

⁶¹ The first survey in March was conducted between 7th and 10th March, while the later one was conducted between 21th and 24th March 2014.

proud) and support for the president has to be interpreted cautiously and cannot be considered causal.

In the next chapter main results are presented and discussed.

4.5 Results and discussion

4.5.1 Pre- and post-rally comparison: who supports the president?

We first compare the impact of sensing national pride, following state news, and income levels on presidential support in the course of pre- and post-rally survey waves (see Figure 4.1 to 4.4).

We begin with respect to national pride. Figure 4.1 shows the predicted presidential support among individuals with and without a sense of pride across all survey waves (see Table A18 and A19)⁶². According to Figure 4.1, not only are patriotic citizens always more likely to support the president, but also the support of unpatriotic citizens peaks in October 2014. Overall, we can see that in both groups the likelihood to support the President increased after March 2014. Even though people feeling national pride have ca. 10% higher predicted likelihood to support the president than unpatriotic individuals, it seems that also unpatriotic feeling individuals contributed to the peak in presidential support and thus to the rally effect. This is an interesting finding as the patriotism approach suggests that a peak in presidential support is driven by mainly patriotic feeling citizens (Baker & Oneal, 2001; Mueller, 1973). However, there is an important difference between these two groups. As shown in Figure 4.1, when conflict is initiated, people who do not feel patriotic are more likely to lose their supportive spirits over time. After two years, unpatriotic people have the same odds as prior to Crimea⁶³. Until then, the gap between groups is more or less constant.

⁶² For the post-rally period, we also provide individual regressions for each wave in Table A26 to better reflect the differences in the questions. Overall, the results remain very similar. Only in October 2014 following state news is not significant. Reason for that might be that the survey wave of October 2014 did not contain a suitable question regarding media.

⁶³ It should be noted here that in the March 2016 and May 2016 waves, pride is measured as pride to live in today's Russia and as shame about today's Russia. Therefore, unpatriotic has more negative connotations here than in the previous waves. This could also explain the kink. These concerns are addressed in Section 5.3 in the robustness check part.

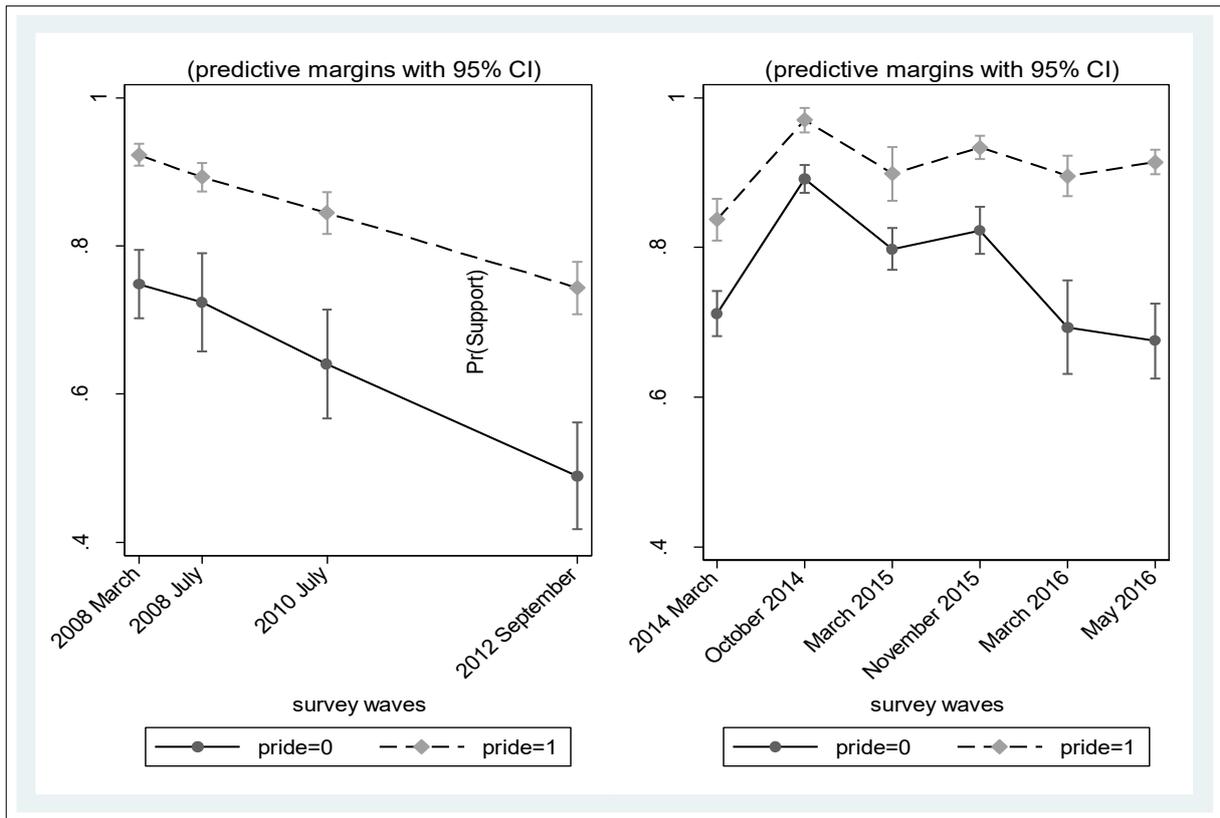


Figure 4.1: Predicted presidential support depending on national pride in the pre- (left) and post-rally (right) period

The overall continuity of the high approval rates over time is remarkable in Russia, as this is contrary to rally effects in democratic countries that are characterised by its short-term nature (see e.g. Kam & Ramos, 2008; Kernell, 1978; Mueller, 1970). Alexseev and Hale (2016) and Hale (2016) have shown a strong relationship between patriotism and support for the president after the Crimea rally for individual waves in 2014 and 2015. Our result further illustrates how enduring the mechanism of patriotism is among proud citizens. However, looking at unpatriotic individuals, this effect appears to be less long lasting, whereas patriotic individuals continue contributing throughout the observed time period. The predicted presidential support peaks for both groups in October 2014 and may be related to Russian counter-sanctions against Western economies imposed in August 2014. This geopolitical event demonstrated Putin and Russia's political strength. This peak could also correspond to Greene and Robertson's research (2020) linking an increase in emotional excitement of citizens in the summer of 2014 to the rise in approval ratings. However, it seems that the sense

of excitement was not persistent across all subpopulations. For more details on the link between patriotism and rallying behaviour see Section 5.2.

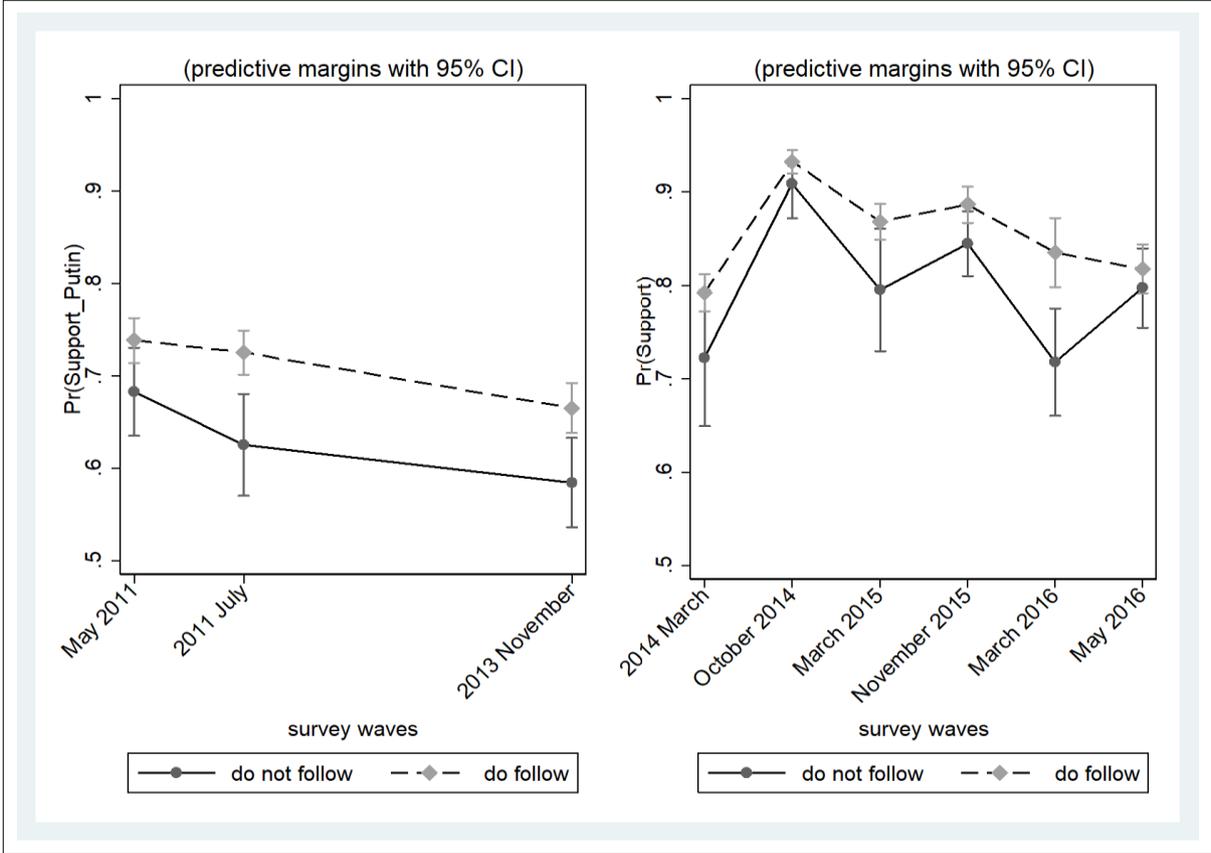


Figure 4.2: Predicted presidential support depending on state news in the pre- (left) and post-rally (right) period

However, regarding state news the pattern is less clear. We see in Figure 4.2 showing the predicted presidential support depending on state news across all survey waves⁶⁴ that the predicted odds of presidential support among individuals following the state news increased compared to the pre-rally-period. Yet, we also observe an increase in predicted likelihood of support among non-followers. The difference between these two groups is clearly significant in March 2016. Additionally, the predicted odds of both groups do not return to the pre-rally-level. Hence, with respect to following state media in Russia, no clear picture emerges concerning the source of information as a decisive factor for causing a rally effect.

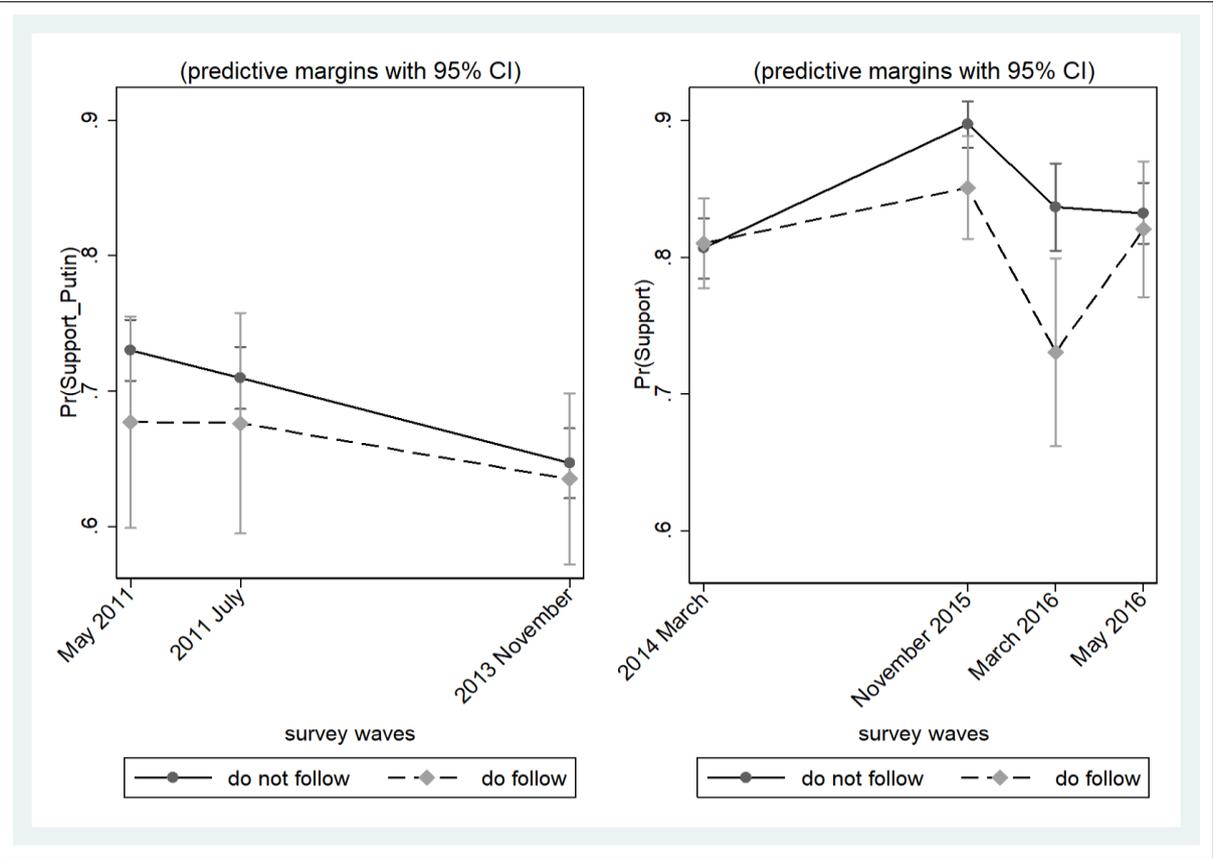


Figure 4.3: Marginal effects on predicted presidential support depending on non-state media in pre- and post-rally period.

Additionally, we test whether there was an opinion shift among (non-)followers of the non-state broadcasters⁶⁵ (Figure 4.3). By doing so, in line with the opinion leadership approach, we take into consideration non-monolithic opinion/representation in media sources. We still find

⁶⁴ Corresponding regressions are in Tables A18 and A19.

⁶⁵ Not following the state media here means that respondents stated that their main source of information is e.g. internet, social media, or foreign news channels, while if they do not follow these, then their main sources are state media sources. More details are provided in Table A16.

a pronounced switch in opinion in both groups, but again no clear pattern in differences across groups. This is consistent with the findings of Hale (2018) to some extent. Hale (2018) shows that individuals who consume state media the least are more likely to rally. However, Hale (2018) finds no significant results for news provided online, whereas Russians who do not use social media trust Putin more after the Crimea event.

What is striking in both analyses is that in March 2016, we see a significant difference between (non-)state media followers and non-followers. At this point we can only speculate. The case of Nadija Sawtschenko⁶⁶, which was heard in court in March 2016, is possibly related to this but it could have other reasons as well.

In addition, we examined whether the sources of the information differ in their influence on presidential support, in the individual waves in which the question of the sources of news is posed. Some previous studies already showed that the source of information matters (Enikolopov et al., 2011). With small exceptions in the consumption of non-state newspapers and foreign news, the overall impression is that the sources of information do not differ greatly in their influence (see Figures A1-A6).

Regarding income groups, we observe that there is a significant difference among higher income groups in respect to presidential support after March 2014 (see Figure 4.4). This difference only disappears in March 2015 and corresponds to the huge surge in the inflation rate (CPI) of over 15% (compared to March 2014) shocking the Russian population as a whole. This result implies that low income citizens are less likely to support the president after March 2014, compared to those with higher income. It demonstrates that foreign policy and state propaganda can lessen economic discontent but cannot fully outweigh it. This is consistent with Frye's (2018) findings that people whose economic situation worsened between 2014 and 2016 were less likely to support the president.

⁶⁶ Ukrainian military officer Nadezhda Savchenko was accused of coordinating an artillery attack in the Luhansk region that killed two Russian journalists (Oxford Analytica , 2016).

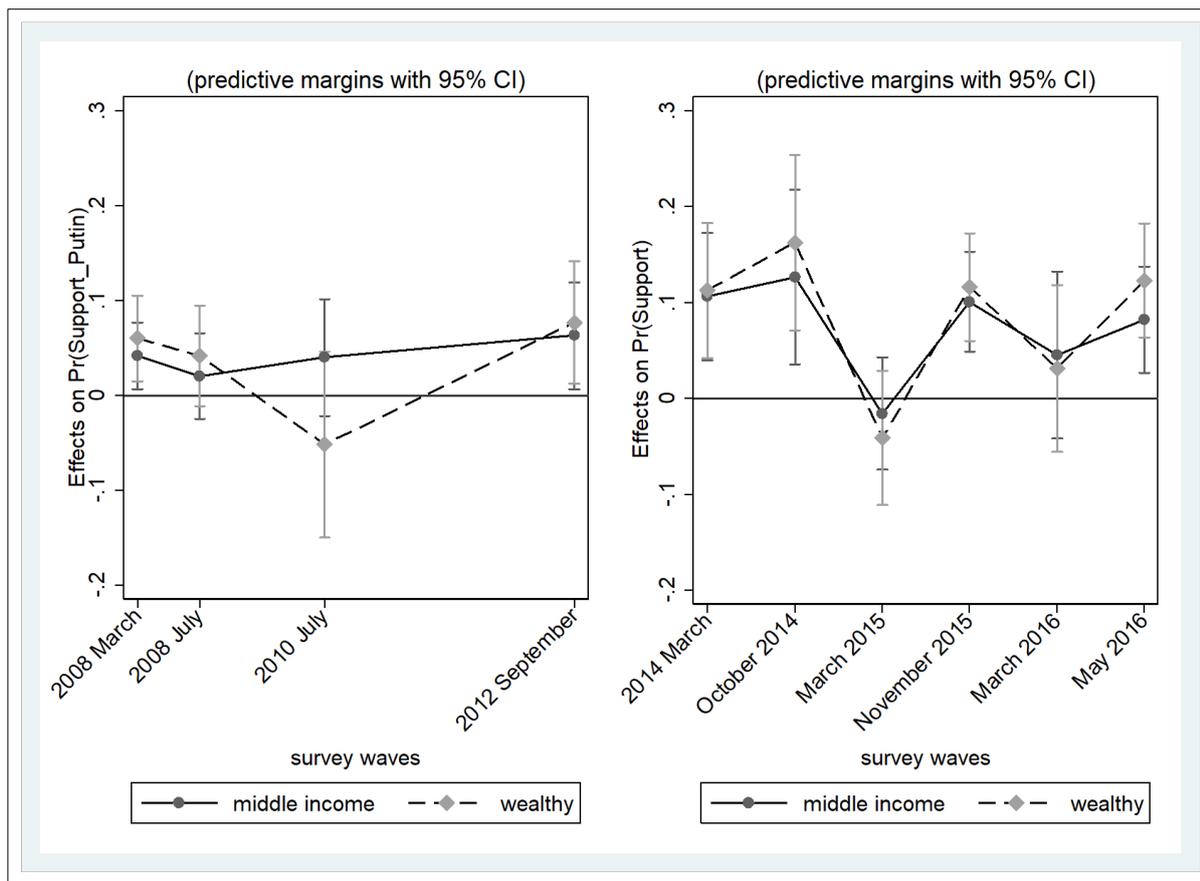


Figure 4.4: Marginal effects on predicted presidential support depending on income groups across survey waves. Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Reference group is low income group

4.5.2 Statistical matching results: who stands behind the rally event?

In the next step, we look at the results of our matched regression analysis in an attempt to explain what motivated individuals to rally in March 2014⁶⁷. Table 4.1 shows the different feelings associated with the Crimea annexation and Russian politics in Ukraine, and how these feelings are related to rally⁶⁸ (see columns 1 and 3) and presidential support (columns 4 and 6). Individuals who feel that the annexation of the Crimea was just, have 45% higher odds to rally than those who do not. Other feelings are not significantly associated with rallying. The Russian government invoked the Russian population's geopolitical and historical perception of Crimea, and Putin in particular repeatedly paraphrased the cession of Crimea to Ukraine in

⁶⁷ The data set underlying these regressions was created from the two March waves using the nearest neighbour matching method. In addition, we also tried the propensity score method. The results we obtained were similar.

⁶⁸ The rally variable is binary and measures the change of opinion: whether a person has changed from non-support to support of President Putin.

the 1950s as incomprehensible (Biersack & O’Lear, 2014). Our findings show that this narrative seems to have convinced Russians to rally. Interestingly, individuals who approve of the Russian politics in Ukraine are less likely to rally. It can be explained by the fact that these individuals belonged to presidential supporters before the rally event anyway. Comparing this result to presidential support, we find that individuals who feel that the annexation was just are more than twice as likely to support the president than those who do not. We observe similar results for feeling pride or personal approval of annexation or Russian politics in Ukraine.

Table 4.1: Regression results for matching March2014 waves

VARIABLES	(1) rally	(2) rally	(3) rally	(4) support	(5) support	(6) support
Crimea's annexation evokes a sense of justice	1.45*			2.17***		
	(0.306)			(0.557)		
The accession of Crimea brings about - pride for the country	1.19			2.33***		
	(0.249)			(0.602)		
accession of Crimea brings joy	1.28			1.26		
	(0.305)			(0.357)		
The accession of Crimea evokes approval	0.71			0.84		
	(0.148)			(0.188)		
The annexation of Crimea evokes disapproval	0.82			0.10***		
	(0.553)			(0.059)		
Crimea accession causes - protest, indignation	1.65			0.47		
	(1.980)			(0.581)		
Crimea accession causes shame and despair	0.51			0.55		
	(0.351)			(0.341)		
Crimea's annexation causes anxiety, fear	0.62			0.60		
	(0.292)			(0.233)		
personal approval of Crimea's annexation		1.09			3.55***	
		(0.427)			(1.179)	
Approval of Russian politics in Ukraine			0.23***			4.72***
			(0.041)			(0.825)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	780	764	1,404	780	751	1,404

Note: The dependent variable is binary standing for rally (columns 1 to3) or presidential support (columns 4 to6). The Crimean attributes were each estimated in a single regression and summarised in one column for ease of presentation. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratios; standard errors in parentheses eform *** p<0.01, ** p<0.05, * p<0.1

The same analysis was done for the matched data of March 2014 and October 2014 (see Table A20 and A21). In this analysis, we find that individuals who perceive Russian politics towards Ukraine as just, are more likely to rally. In addition, individuals who approve the annexation

because they feel that Crimea is Russian land have 65% higher odds to rally than those who do not. Other reasons such as the protection of Russian citizens are not significantly associated with rallying. Strycharz (2020) argues that the narrative of the "threat to compatriots" became prevalent among Russian elites and influenced the decision to annex Crimea. However, our results show that this narrative did not convince Russians to turn into presidential supporters. For presidential support, our findings are similar as compared to the March matching. However, there is an even stronger association with Crimea approval and presidential support. Russian citizens who support the annexation of Crimea are more than eight times more likely to support the president. This could be because more time has passed since the Crimea events and therefore these feelings could be more associated with President Putin.

Furthermore, in Table 4.2 we take a look at individuals' characteristics that are associated with rallying behaviour. Individuals feeling proud to be a Russian citizen are less likely to rally which confirms our previous results. However, individuals who proudly identify themselves with the Soviet past have higher odds to rally. Individuals being proud to be a Soviet citizen or communist have almost 70% (or four times respectively) higher odds to rally than those who do not. However, citizens being proud of the economic stabilisation during Putin's tenure are less likely to rally, indicating that these people were already Putin supporters. Furthermore, individuals getting their information via TV and newspapers are less likely to rally⁶⁹. This aligns with Hale's (2018) finding that individuals who consume state media least frequently are more likely to rally. Moreover, citizens with a poor income have over 70% higher odds to rally than individuals from the middle class. The results of O'Loughlin and Toal (2019) show that Crimean residents believed that the annexation would improve their economic situation. Our findings suggest that this sense of optimism may also have been present in the lower income class within Russia. This would be in line with Parker (1995), who argues that a rally event can influence not only the perception of the president, but also that of economic development.

⁶⁹ Other media sources do not show significant results. In order to keep the table clear, these are not presented here. However, the results are available on request.

Table 4.2: Regression results for matching March 2014 waves

VARIABLES	(1) rally	(2) rally	(3) rally
pride: Russian citizen or patriot	0.40*** (0.060)		0.42*** (0.069)
news source: TV or newspapers	0.70 (0.159)	0.64* (0.146)	0.96 (0.255)
income: poor	1.76*** (0.347)	1.58** (0.304)	1.42 (0.319)
income: rich	0.88 (0.149)	0.83 (0.137)	0.95 (0.176)
proud being a Soviet citizen		1.69** (0.412)	
proud to be a democrat		1.63 (0.736)	
proud to be a communist		4.75*** (1.934)	
proud being a Putin follower		0.22*** (0.114)	
pride to see country transformed in Soviet times into one of the world's leading industrial powers		1.02 (0.150)	
pride - victory in the Great Patriotic War 1941-45		0.77 (0.128)	
pride - the glory of Russian arms		0.79 (0.129)	
Pride in Perestroika, the beginning of market reforms		0.88 (0.500)	
Proud of the stabilisation of the country under Putin, growth of economy		0.19*** (0.068)	
approval of Russian politics in Ukraine			0.27*** (0.051)
other Controls	Yes	Yes	Yes
Observations	1,576	1,576	1,404

Note: The dependent variable is binary standing for rally. The proud attributes were each estimated in a single regression and summarised in one column for ease of presentation. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratios; standard errors in parentheses eform *** p<0.01, ** p<0.05, * p<0.1

4.5.3 Further analysis: the rallying nature

Although we assume that the respondents answer trustworthy questions towards incumbent politicians, we cannot fully rule out the possibility that they do not. Therefore, we additionally use an alternative measure of the respondents' opinion about the political direction Russia is heading to as a dependent variable.

Overall, our findings still hold (see Tables A22 and A23). Of note is the difference in the odds of national pride within our two observation periods. In the post-rally-period the odds to agree with Russia's development path are ca. 40 percentage points higher among individuals with strong national pride compared to the pre-rally-period. Although national pride is positively correlated with agreeing of the direction of development in both periods, our results indicate that feelings of national pride could be activated to a greater extent within the Russian population in the post-rally-period. Regarding the state media use, the odds are 20 percentage points higher in the post-rally period compared to the period before. This is not surprising, as the censorship in the media coverage was existing in both observation periods, but to a much greater extent in the period following the rally⁷⁰. Comparing the influence of income groups on agreeing with Russia's development path, our results show that personal socio-economic background matters in both pre- and post-rally-periods.

So far, all figures (Figure 4.1, 4.2 and 4.4) demonstrate that the aggregated shifts in public opinion between pre- and post-rally-period contributed to the rally effect. However, among holding national pride sentiments and following state news, so far, no group is a clear driver behind the rally effect in the pooled analysis, while in the statistical matching analysis the results indicate that people who do not feel proud of being a Russian citizen and do not follow the state broadcasters are likely to rally. Additionally, we are therefore looking at respondents' opinion on the political direction Russia is heading towards and presidential support (see Figure 4.5 comparing both periods, for respective tables see Table A24 and A25).

⁷⁰ In the years 2008, 2010 and 2011/12 World Press Freedom Index ranked Russia between 140th and 142th out of 179 countries. This means Russia, placed 148th in 2014, decreased its position by about six in the post-rally period.

In particular, we only observe an aggregated shift in public opinion among citizens who disagree with Russia’s direction. In the post-rally period, the predicted presidential support increases over ten percentage points among non-supporter of Russia’s direction, while the predicted presidential support among people who agree with Russia’s direction does not change much pre- to post-rally. Thus, there was a clear opinion shift only in one group, namely among less supportive-individuals being dissatisfied with the direction Russia is heading. This underlines a clear rally nature of the presidential support after March 2014 and aligns with our results from the matching analyses.

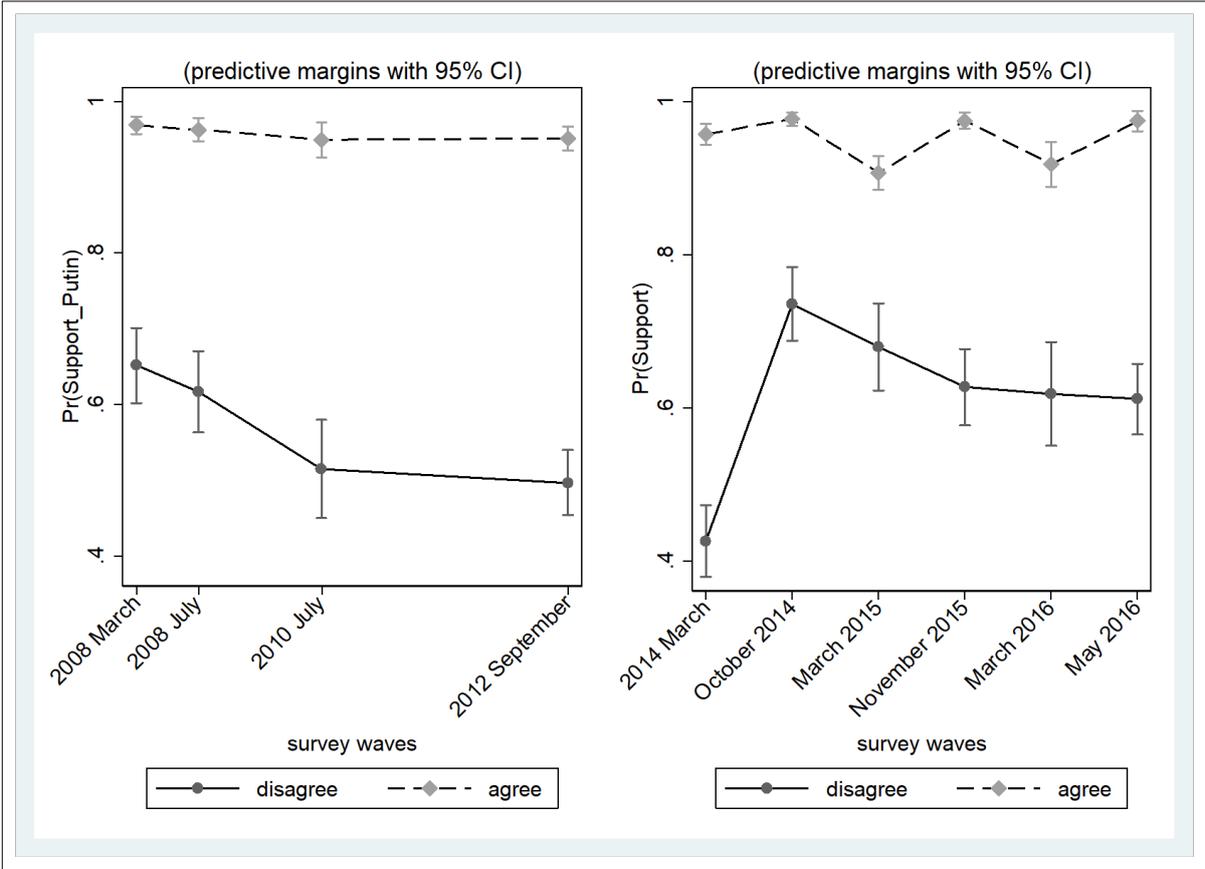


Figure 4.5: Predicted presidential support depending on direction Russia is heading towards in the pre- (left) and post-rally (right) period

To zoom into this group composition among people disagreeing with Russia’s direction, we now take a closer look at the differences in predicted presidential support with respect to national pride and state news across survey waves. Figure 4.6 shows the marginal effects for predicted presidential support for the sub-sample of citizens who disagree with a general direction Russia is moving to depending on national pride. We can see that compared to the pre-rally-waves the difference in predicted presidential support between supporters and non-supporters did not widen in the post-rally period. The difference between being patriotic and

unpatriotic groups remains extremely stable prior to Crimea events. It amounts to approximately 15%. In the post-rally period, the difference is similar, highly stable in terms of 15 percent-level, throughout the whole period except for October 2014. This indicates that unpatriotic citizens within the group who does not support Russia’s direction did contribute to the rally effect only in October 2014. Afterwards the effect disappears. This is in line with our previous results. It is also consistent with the findings of Greene and Robertson (2020), who found an increase in emotion and linked it to support for the president in summer 2014. Hence, in this particular group of citizens the support only increased in the short term, whereas the overall support in Russia of less patriotic people stayed on a high level for a long time. As we have already noted before, in March 2016 and May 2016 pride is measured as being proud of today’s Russia versus being ashamed of today’s Russia. However, we can see here as well that the significant difference between being proud and not proud becomes more distinct towards May 2016 (recognizable from the shorter confidence intervals). This serves as further robustness-check for our results in Section 5.1

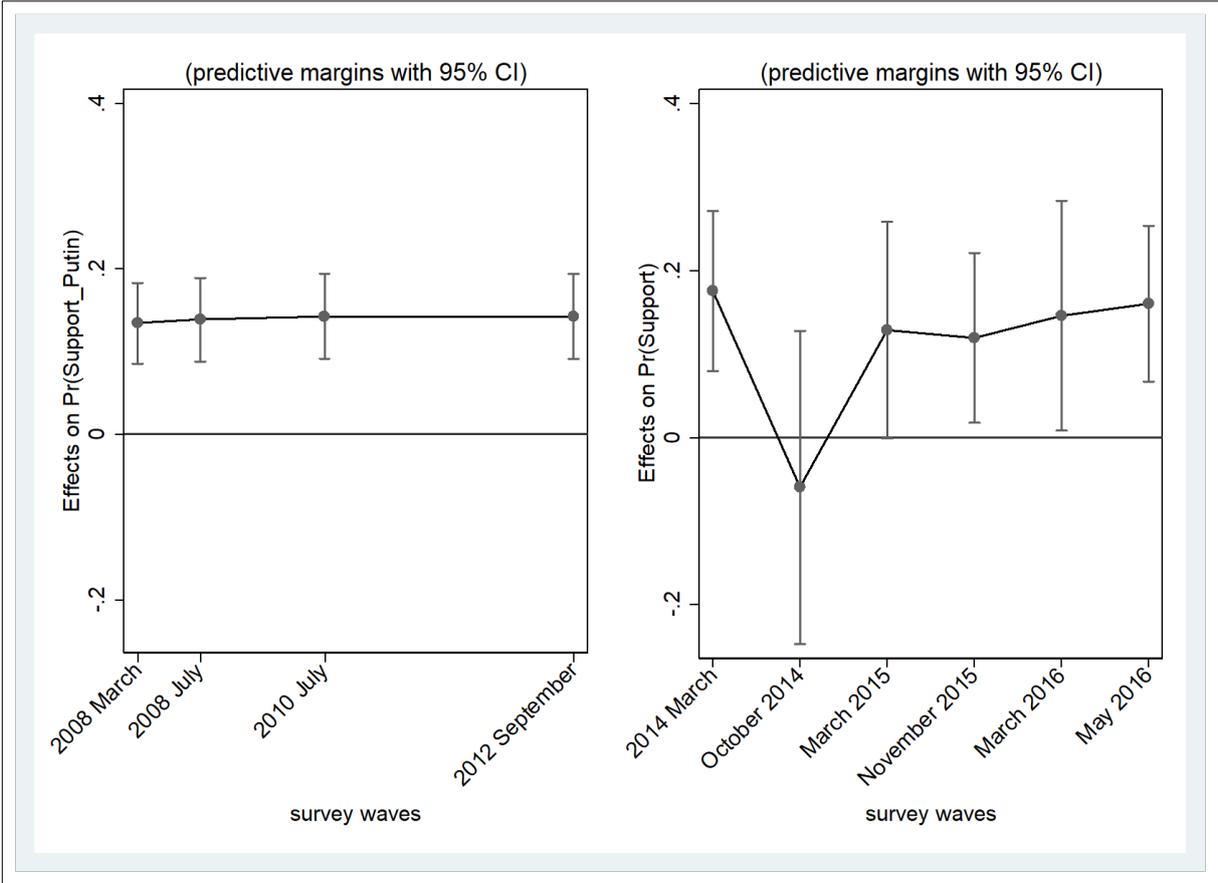


Figure 4.6: Marginal effects on predicted presidential support depending on national pride across survey waves among citizens who disagree with Russia’s direction.

Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Reference group is non-pride.

Turning now to presidential support depending on state news across survey waves (see Figure 4.7), we observe that the marginal effects on the predicted presidential support with respect to state news followers does rise in some post-rally-waves. However, we can also see that in some waves there is no significant difference between following and not-following state news. Hence, even among individuals who do not agree with Russia’s direction of development following the state news does not clearly show to be a decisive factor for causing a rally effect. This result is in line with our previous finding based on the unrestricted sample.

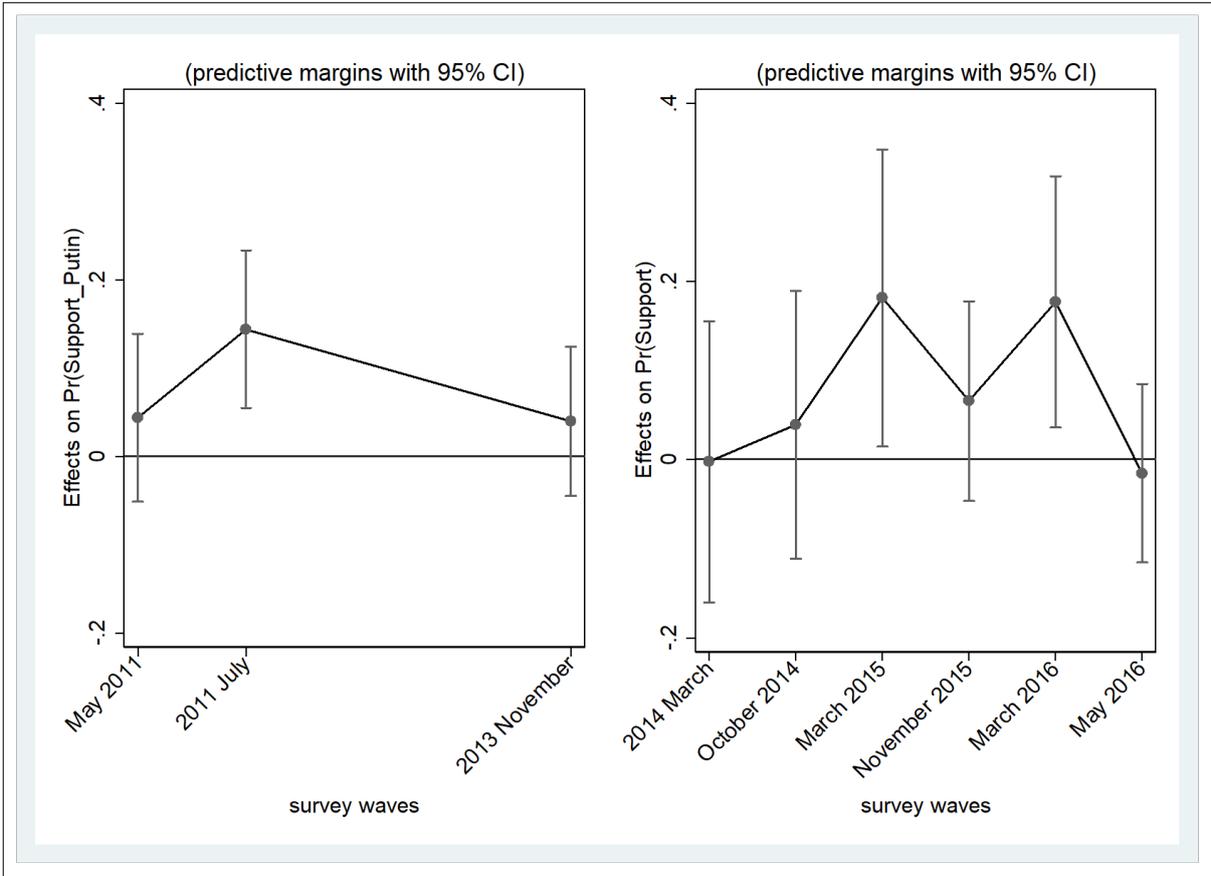


Figure 4.7: Marginal effects on predicted presidential support depending on following state news across survey waves among citizens who disagree with Russia’s direction. Note: Marginal effects show if the difference between subgroups of a categorical variable are significant. Reference group is non-followers of the state media.

4.6 Conclusion

This paper explains the determining factors of the high presidential support in Russia in the aftermath of the geopolitical conflict despite an economic crisis. Moreover, the analysis was not only conducted for presidential support but also for rallying. More precisely, it examines the population groups and mechanisms standing behind the rally effect in Russia.

Firstly, the geopolitical crisis in 2014 did not trigger a boost of patriotic feelings toward the president. It was the unpatriotic Russians that rallied. In this regard, the rally effect in Russia does not resemble the one in democratic countries as it correlates with not feeling national pride. However, the empirical analysis for Russia reveals that sensing of national pride is significantly associated with the overall support for the president. A closer look at both pre- and post-rally-periods shows that national pride's effect is more pronounced after the Crimea event. Furthermore, the mechanism of patriotic feeling is more pronounced with regard to its lasting. Interestingly, the duration depends on the group of citizens. For those feeling national pride the presidential support remains on a high level several years after the rally event took place. Moreover, the rally effect is obviously riding the wave of justice sentiments regarding Crimea. One possible explanation is that the people rallying see Crimea as Russian territory. Over time, these feelings may have turned into patriotic feelings and thus into support for president Putin. Nevertheless, unpatriotic citizens contribute to the rally effect, although in their case the effect appears to be less long lasting. This indicates that even though national pride regime narrative helped to stabilise approval among patriotic supporters, it did not have the same effect for unpatriotic supporters. This demonstrates the limits of this mechanism. During the rally event, however, various nuances of pride were also activated, such as pride in Soviet history, which inclined people to rally. These nuances can vary in longevity.

Secondly, during an international crisis, an elite consensus presented in the media coverage can lead to a rise in public support. Although following the state news leads in general to a higher likelihood to support the president, no clear pattern arises if it is also a decisive factor for causing a peak in presidential support after March 2014 as Russian that followed the TV broadcasters were less likely to rally. Our results open up questions such as whether the source of the news is more important than the frequency of media consumption itself in an authoritarian context. It also suggests that censorship in the Russian media may distort the validity of the opinion leadership approach to a rally effect in an authoritarian setting.

In addition, we consider the impact of individuals' economic situation on presidential support. People tend to disregard personal financial troubles in times of a rally effect. However, it remains unclear to what extent the rally effect cancels out economic worries (Tir & Singh, 2013). Our results provide an insight for this debate, indicating that poor people in Russia tend to be generally more critical about the president rather than wealthier fellow-countrymen in

the post-rally period. However, we also observed that individuals with a poor income were closer to the threshold to presidential approval and with that more likely to rally in 2014. Thus, our results indicate that the rally event caused an economic confidence that has driven people from the lower income class to rally. But we have also shown that people with higher incomes are generally more supportive of President Putin, which casts doubt on the longevity of this optimism. Considering the important influence of national pride on presidential support in Russia, the question arises whether economic success and national pride can be seen as substitutes at least to some extent. This issue should be investigated empirically in more detail.

In sight of the remarkable continuity of the rally effect in Russia throughout the entire post-rally-period, we could show that this continuity is at least partially driven by individuals who hold national pride sentiments. The Kremlin also seems to be deliberately holding on to what is expressed in Putin's repeated declaration of patriotism as Russia's only "national idea" (Bækken, 2021). However, our findings raise the question, if the chosen political strategy in the aftermath of the Crimea crisis which in a nutshell encompasses distracting the Russian public from domestic problems by foreign events is a reasonable one in terms of a long-term orientation. After a four-year high, President Putin's approval rates decreased significantly. This points to the need for a new strategy. Dismissing Prime Minister Medvedev and forming a new government might have been the first steps of a new approach to stabilise Putin's approval rates. However, public sentiment surrounding the new constitution, as well as other domestic and foreign policy events, negated the desired positive effect before it translated into higher approval rates. This is because Putin's approval rates in 2020 fell to the lowest level during his entire presidency.

We acknowledge a number of limitations the current empirical investigation suffers from. First, due to the lack of a panel structure, we are only able to observe the aggregated shifts in public opinion, but it is impossible to capture the shift in public opinion among those citizens who had not supported the current president in the past at an individual level. We try to compensate for this to a certain extent with the help of the matching analysis. Second, despite the best possible attempt to harmonise the data, the same questions were not asked in every survey wave, which can affect the comparability. As far as possible, the differences in the questions are considered in the assessment of the results. Finally, starting 2015, further

numerous foreign policy events – for example, the Russian military intervention in Syria (September 2015) or shooting down of Russian aircraft by Turkey (November 2015) – could also have had an influence on presidential approval. Partially, we capture this impact in the models starting from November 2015 by controlling for further foreign policy events, such as the Syrian War. The remaining variables still deliver robust results.

Overall, our paper contributes to the strands of literature dealing with presidential support and rally effects in authoritarian regimes. We show that there are numerous overlaps between rally effects between both non-democratic and democratic countries, but also highlight some significant differences. Our paper also delivers policy-relevant insights by helping to understand mechanisms that can trigger changes in public support. This is especially important in times of a rise of authoritarian populism worldwide.

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Appendix

Table A1: Summary statistics of the pooled sample

Variable	Pooled survey waves <u>before</u> Crimea events 2014		Pooled survey waves <u>after</u> Crimea events 2014	
	Percent	No. obs.	Percent	No. obs.
Proud - yes	80.54	3,550	50.57	4,253
Proud - no	19.46	858	49.43	4,351
State news - yes	77.41	3,718	76.55	6,088
State news - no	22.59	1,085	23.45	1,865
Sex - male	45.32	5,627	45.34	4,369
Sex - female	54.68	6,790	54.66	5,267
Age group - 18-30 years	26.87	3,337	26.16	2,521
Age group – 31-54 years	44.35	5,508	43.05	4,148
Age group - retired	28.68	3,573	30.79	2,967
Education level - low	11.34	1,408	6.55	630
Education level - middle	35.64	4,425	31.13	2,993
Education level - high	53.02	6,584	62.31	5,990
income level - low	28.89	3,578	16.50	1,587
Income level - middle	52.10	6,453	53.98	5,192
Income level - high	19.01	2,355	29.52	2,840
Region – Far East	4.54	564	4.27	410
Region - Moscow	7.63	948	8.49	816
Region - Siberia	13.47	1,706	13.11	1,260
Region - Urals	8.49	1,054	8.30	798
Region - Volga	21.49	2,669	20.61	1,981
Region - North West	9.66	1,200	9.71	933
Region - South	14.62	1,815	16.40	1,576
Region - Central	19.82	2,461	19.11	1,836
Russia’s direction - alright	59.39	6,057	69.06	5,460
Russia direction – not alright	40.61	4,142	30,94	2,446

Note: Reference categories in bold print.

Source: Levada Center

Table A2: Summary statistics: Wave March 2008

Variable	Description	N	Mean	Std. Dev.	min	max
support (Putin)	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	1575	.885	.319	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1363	.733	.443	0	1
pride	Takes value 1 if proud of being a Russian citizen, 0 otherwise	1603	.79	.407	0	1
sex	Takes value 1 if male, 0 otherwise	1603	.452	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1603	2.026	.741	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1603	2.364	.728	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1601	1.792	.708	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural, 5 Volga, 6 Northwest, 7 South, 8 Central	1603	5.185	2.114	1	8

Source: Levada Center

Table A3: Summary statistics: Wave July 2008

Variable	Description	N	Mean	Std. Dev.	min	max
support (Medvedev)	Takes value 1 if overall supportive of Dimitry Medvedev's actions as President of Russia, 0 otherwise	1209	.748	.434	0	1
support (Putin)	Takes value 1 if overall supportive of Vladimir Putin's actions as Prime Minister of Russia, 0 otherwise	1174	.868	.339	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1034	.696	.46	0	1
pride	Takes value 1 if proud of being a Russian citizen, 0 otherwise	1209	.859	.348	0	1
sex	Takes value 1 if male, 0 otherwise	1209	.455	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1209	2.026	.739	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1209	2.364	.723	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1209	1.901	.719	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1209	5.188	2.133	1	8

Source: Levada Center

Table A4: Summary statistics: Wave July 2010

Variable	Description	N	Mean	Std. Dev.	min	max
support (Medvedev)	Takes value 1 if overall supportive of Dimitry Medvedev's actions as President of Russia, 0 otherwise	1562	.771	.42	0	1
support (Putin)	Takes value 1 if overall supportive of Vladimir Putin's actions as Prime Minister of Russia, 0 otherwise	1569	.812	.391	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1262	.651	.477	0	1
pride	Takes value 1 if proud of being a Russian citizen, 0 otherwise	801	.795	.404	0	1
sex	Takes value 1 if male, 0 otherwise	1600	.452	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1600	2.002	.752	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1600	2.366	.671	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1591	1.869	.647	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1600	5.225	2.109	1	8

Source: Levada Center

Table A5 Summary statistics: Wave September 2010

Variable	Description	N	Mean	Std. Dev.	min	max
support Medvedev	Takes value 1 if overall supportive of Dimitry Medvedev's actions as President of Russia, 0 otherwise	1573	.766	.423	0	1
support Putin	Takes value 1 if overall supportive of Vladimir Putin's actions as Prime Minister of Russia, 0 otherwise	1578	.802	.398	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1301	.635	.482	0	1
trustnews	Takes value 1 if trust: Central television (First Channel, RTR, TVC, NTV, etc.) or Central newspapers (MK, Komsomolskaya Pravda, Rossiyskaya, 0 otherwise	800	.782	.413	0	1
trustnews other	Takes value 1 if trust in Internet publications (news sites Lenta.ru, Ytro.ru, Gazeta.ru), 0 otherwise	800	.08	.271	0	1
sex	Takes value 1 if male, 0 otherwise	1601	.452	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1601	2.013	.741	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1601	2.375	.701	1	3
income groups	Takes value 1 -poor, 2 -middle income, 3 - rich	1598	1.815	.646	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1601	5.222	2.109	1	8

Source: Levada Center

Table A6 Summary statistics: Wave May 2011

Variable	Description	N	Mean	Std. Dev.	min	max
support Medvedev	Takes value 1 if overall supportive of Dimitry Medvedev's actions as President of Russia, 0 otherwise	1574	.722	.448	0	1
support Putin	Takes value 1 if overall supportive of Vladimir Putin's actions as Prime Minister of Russia, 0 otherwise	1577	.722	.448	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1321	.549	.498	0	1
News	Takes value 1 if main source Russian state channel, state newspaper, 0 otherwise	1600	.77	.421	0	1
other news	Takes value 1 if main source non-state newspapers, foreign news services, internet, 0 otherwise	1600	.09	.286	0	1
sex	Takes value 1 if male, 0 otherwise	1600	.454	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1600	2.016	.739	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1600	2.373	.693	1	3
income groups	Takes value 1 -poor, 2 -middle income, 3 - rich	1597	1.813	.659	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1600	5.225	2.109	1	8

Source: Levada Center

Table A7 Summary statistics: Wave July 2011

Variable	Description	N	Mean	Std. Dev.	min	max
support Medvedev	Takes value 1 if overall supportive of Dimitry Medvedev's actions as President of Russia, 0 otherwise	1572	.689	.463	0	1
support Putin	Takes value 1 if overall supportive of Vladimir Putin's actions as Prime Minister of Russia, 0 otherwise	1579	.706	.456	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1343	.492	.5	0	1
News	Takes value 1 if main source Russian state channel, state newspaper, 0 otherwise	1600	.818	.386	0	1
other news	Takes value 1 if main source non-state newspapers, foreign news services, internet, 0 otherwise	1600	.081	.273	0	1
sex	Takes value 1 if male, 0 otherwise	1600	.451	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1600	2.019	.737	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1600	2.388	.683	1	3
income groups	Takes value 1 -poor, 2 -middle income, 3 - rich	1595	1.863	.669	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1600	5.225	2.109	1	8

Source: Levada Center

Table A8 Summary statistics: Wave September 2012

Variable	Description	N	Mean	Std. Dev.	min	max
support Putin	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	1573	.708	.455	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1289	.501	.5	0	1
pride	Takes value 1 if proud of being a Russian citizen, 0 otherwise	795	.764	.425	0	1
sex	Takes value 1 if male, 0 otherwise	1601	.455	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1601	2.022	.759	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1601	2.539	.634	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1593	2.035	.704	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1601	5.213	2.118	1	8

Source: Levada Center

Table A9 Summary statistics: Wave November 2013

Variable	Description	N	Mean	Std. Dev.	min	max
support Putin	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	1566	.652	.476	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1286	.512	.5	0	1
News	Takes value 1 if main source Russian state channel, state newspaper, 0 otherwise	1603	.735	.442	0	1
other news	Takes value 1 if main source non-state newspapers, foreign news services, internet, 0 otherwise	1603	.15	.358	0	1
sex	Takes value 1 if male, 0 otherwise	1603	.456	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1603	2.03	.756	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1603	2.552	.621	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1602	2.121	.665	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1603	5.216	2.119	1	8

Source: Levada Center

Table A10 Summary Statistics: Wave March 2014 - 01

Variable	Description	N	Mean	Std. Dev.	min	max
support	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	1559	.778	.416	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1312	.667	.471	0	1
pride	Takes value 1 if I proud to feel as - patriot of my country - or as - Russian citizen, 0 otherwise	1603	.452	.498	0	1
state news	Take value 1 if news source television or newspaper, 0 otherwise	1603	.915	.28	0	1
other news	Take value 1 if news source internet or social media, 0 otherwise	1603	.318	.466	0	1
sex	Takes value 1 if male, 0 otherwise	1603	.459	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1603	2.026	.757	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1603	2.538	.629	1	3
income groups	Takes value 1 -poor, 2 -middle income, 3 - rich	1602	2.191	.657	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1603	5.216	2.119	1	8

Source: Levada Center

Table A11 Summary statistics: Wave October 2014

Variable	Description	N	Mean	Std. Dev.	min	max
support	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	1587	.916	.278	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1334	.773	.419	0	1
pride	Takes value 1 if proud of - Russia's position on the world political stage, 0 otherwise	1600	.291	.454	0	1
State news	Takes value 0 if read/ watch/ listen to) information that contains viewpoints that differ drastically from the official version of Russia's main broadcasters and other federal news services, 1 otherwise	1502	.874	.332	0	1
sex	Takes value 1 if male, 0 otherwise	1600	.45	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1600	2.063	.743	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1600	2.559	.616	1	3
income groups	Takes value 1 -poor, 2 -middle income, 3 - rich	1595	2.216	.662	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1600	5.216	2.12	1	8

Source: Levada Center

Table A12 Summary statistics: Wave March 2015

Variable	Description	N	Mean	Std. Dev.	min	max
support	Takes value 1 if would vote for Putin if there was a presidential election on 4 March, 0 otherwise	1056	.825	.38	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1319	.71	.454	0	1
pride	Takes value 1 if proud of - Russia's position on the world political stage, 0 otherwise	1626	.259	.438	0	1
state news	Takes value 1 if consider central television to be an important source of political information, 0 otherwise	1615	.827	.378	0	1
sex	Takes value 1 if male, 0 otherwise	1626	.451	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1626	2.036	.764	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1626	2.556	.618	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1624	2.066	.659	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1600	5.216	2.12	1	8

Source: Levada Center

Table A13 Summary statistics: Wave November 2015

Variable	Description	N	Mean	Std. Dev.	min	max
support	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	1589	.886	.318	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1320	.717	.451	0	1
pride	Takes value 1 if Russia is better than most other countries 0 otherwise	1537	.635	.482	0	1
state news	Takes value 1 if main source Russian state channel, state newspaper, 0 otherwise	1589	.718	.45	0	1
other news	Takes value 1 if main source non-state newspapers, foreign news services, internet, 0 otherwise	1601	.214	.41	0	1
sex	Takes value 1 if male, 0 otherwise	1603	.453	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1603	2.048	.756	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1590	2.545	.617	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1601	2.07	.641	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1603	5.24	2.112	1	8

Source: Levada Center

Table A14 Summary statistics: Wave March 2016

Variable	Description	N	Mean	Std. Dev.	min	max
support	Takes value 1 if would vote for Putin if there was a presidential election on 4 March, 0 otherwise	1401	.829	.376	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1314	.641	.48	0	1
pride	Takes value 1 if proud of today's Russia, 0 otherwise	781	.693	.462	0	1
state news	Takes value 1 if main source Russian state channel, state newspaper, 0 otherwise	1586	.638	.481	0	1
other news	Takes value 1 if main source non-state newspapers, foreign news services, internet, 0 otherwise	1586	.233	.423	0	1
sex	Takes value 1 if male, 0 otherwise	1602	.453	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1602	2.055	.749	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1602	2.579	.597	1	3
income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	1599	2.194	.706	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1602	5.239	2.113	1	8

Source: Levada Center

Table A15 Summary statistics: Wave May 2016

Variable	Description	N	Mean	Std. Dev.	min	max
support	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	1588	.848	.359	0	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	1307	.635	.482	0	1
pride	Takes value 1 if proud of today's Russia, 0 otherwise	1457	.772	.42	0	1
state news	Takes value 1 if main source Russian state channel, state newspaper, 0 otherwise	1560	.726	.446	0	1
other news	Takes value 1 if main source non-state newspapers, foreign news services, internet, 0 otherwise	1560	.174	.38	0	1
sex	Takes value 1 if male, 0 otherwise	1602	.454	.498	0	1
age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	1602	2.051	.751	1	3
education	Takes value 1 - low, 2 - middle, 3 - high	1592	2.568	.61	1	3
income groups	Takes value 1 -poor, 2 -middle income, 3 - rich	1598	2.046	.647	1	3
federal districts	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	1602	5.239	2.113	1	8

Source: Levada Center

Table A16: Operationalization of key variables

Name of Variable	Description	Values	Wave
Support	Overall, do you or do you not support Vladimir Putin's actions as President of Russia?	0: no 1: yes	March 2014, October 2014, November 2015, May 2016, all pre-rally waves
	Who would you vote for on 4 March if there was a presidential election?	0: others 1: Putin	March 2015, March 2016
Pride	How proud are you of being a Russian citizen? 1 very proud 2 rather proud 3 not too proud 4 not at all proud	0: no 1: yes (very or rather proud)	March 2008, July 2008, July 2010, September 2012
	With pride I perceive myself as - patriot of my country, or With pride perceive myself as - Russian citizen	0: no 1: yes	March 2014

	Filling me with pride - Russia's position on the world political stage	0: no 1: yes	October 2014, March 2015
	To what extent do you agree with the statement "Overall, it can be argued that Russia is better than most other countries"?	0: neither, rather disagree, do not agree at all 1: completely agree, rather agree	November 2015
	Are you proud or ashamed of today's Russia?	0: neutral, not really proud, not proud at all 1: very proud rather proud	March 2016, May 2016
Following state news	Which news source do you use to inform yourself? 1. News source - Television 2. News source - Radio 3. News source - Newspapers 4. News source - Magazines 5. News source - Friends, family, neighbours 6. News source - Internet publications (newspapers, magazines, news portals) 7. News source - Internet social networks 8. News source - Other	0: others 1: TV, newspaper	March 2014
	Do you read (/ watch/ listen to) the information that contains viewpoints that differ drastically from the official version of Russia's main channels and other federal news services? (About events in Ukraine)	0: often, seldom 1: never	October 2014
	To what extent do you consider central television to be an important source of political information?	0: not really an important source; I don't get any info from the source 1: important source	March 2015
	Where do you mainly find out what is happening in our country? 1 Russian state channel ("First Channel" e.g.) 2 Russian private channels ("Ren-TV", STS, TNT, "Dozdd", 3 internet 4 foreign news services (foreign television, radio etc.) 5 state newspapers ("Rossiyskaya gazeta" etc.) 6 non-state/private newspapers 7 radio 8 Family, friends, neighbours	0: others 1: Russian state channel, state newspaper	November 2015, March 2016, May 2016, May 2011, July 2011, November 2013
Trust state news	Which news source do you trust? 1. News source - Television	0: others 1: TV, newspaper	March 2014

	<p>2. News source - Radio</p> <p>3 News source - Newspapers</p> <p>4. News source - Magazines</p> <p>5. News source - Friends, family, neighbours</p> <p>6. News source - Internet publications (newspapers, magazines, news portals)</p> <p>7. News source - Internet social networks</p> <p>8. News source - Other</p>		
	<p>Which news sources do you trust most?</p> <p>1 Russian state channel ("First Channel" e.g.)</p> <p>2 Russian private channels ("Ren-TV", STS, TNT, "Dozdd",</p> <p>3 internet</p> <p>4 foreign news services (foreign television, radio etc.)</p> <p>5 state newspapers ("Rossiyskaya gazeta" etc.)</p> <p>6 non-state/private newspapers</p> <p>7 radio</p> <p>8 Family, friends, neighbours</p>	<p>0: others</p> <p>1: Russian state channel, state newspaper</p>	<p>November 2015, March 2016, May 2016, May 2011, July 2011, November 2013</p>
	<p>Do you trust: centralised television (first channel, TVTS, NTV etc.)?</p> <p>Do you trust central newspapers (MK, Komsomolskja Pravda, Rossijskaya Gazeta, AiF, Izvestija, Kommersant etc.)?</p>	<p>0: others</p> <p>1: TV, newspaper</p>	<p>September 2010</p>
<p>Following no state news</p>	<p>Which news source do you use to inform yourself?</p> <p>1. News source - Television</p> <p>2. News source - Radio</p> <p>3 News source - Newspapers</p> <p>4. News source - Magazines</p> <p>5. News source - Friends, family, neighbours</p> <p>6. News source - Internet publications (newspapers, magazines, news portals)</p> <p>7. News source - Internet social networks</p> <p>8. News source - Other</p>	<p>0: others</p> <p>1: internet, social media</p>	<p>March 2014,</p>
	<p>Where do you mainly find out what is happening in our country?</p> <p>1 Russian state channel ("First Channel" e.g.)</p> <p>2 Russian private channels ("Ren-TV", STS, TNT, "Dozdd",</p> <p>3 internet</p> <p>4 foreign news services (foreign television, radio etc.)</p>	<p>0: others</p> <p>1: non-state newspapers, foreign news services, internet</p>	<p>November 2015, March 2016, May 2016, May 2011, July 2011, November 2013</p>

	<p>5 state newspapers ("Rossiyskaya gazeta" etc.)</p> <p>6 non-state/private newspapers</p> <p>7 radio</p> <p>8 Family, friends, neighbours</p>		
Income groups	<p>Which income group do you belong to?</p> <p>1 The money is not always enough even for the food.</p> <p>2 We can afford food, but have difficulties with clothes.</p> <p>3 We can afford the clothes and food, but have difficulties with consumer goods</p> <p>4 We can buy some expensive durables (e.g. fridge) without difficulty.</p> <p>5 We can afford a car, but not all expensive goods</p> <p>6 We cannot afford to miss out on anything</p>	<p>1 (low):</p> <p>The money is not always enough even for the food.</p> <p>We can afford food, but have difficulties with clothes.</p> <p>2 (middle):</p> <p>We can afford the clothes and food, but have difficulties with consumer goods.</p> <p>3 (high):</p> <p>We can buy some expensive durables (e.g. fridge) without difficulty.</p> <p>We can afford a car, but not all expensive goods.</p> <p>We can afford everything.</p>	All waves
Education	<p>1 primary school or less</p> <p>2 unfinished middle school (7-8, today 9 years)</p> <p>3 Education based on primary school-leaving certificate or unfinished middle school-leaving certificate</p> <p>4 Secondary school (10, today 11 years)</p> <p>5 Post-secondary education</p> <p>6 technical education technical school/engineering school</p> <p>7 unfinished higher education (at least 6 semesters)</p> <p>8 university degree</p>	<p>1 (low):</p> <p>primary school or less unfinished middle school (7-8, today 9 years)</p> <p>2 (middle):</p> <p>Education based on primary school-leaving certificate or unfinished middle school-leaving certificate</p> <p>Secondary school (10, today 11 years)</p> <p>Post-secondary education</p> <p>3 (high):</p> <p>technical education technical school/engineering school unfinished higher education (at least 6 semesters)</p> <p>university degree</p>	All waves

Source: Levada Center

Table A17: Summary statistics of matched sample in March 2014

Variable	Description	N	Mean	Std. Dev.	min	max
Putin support	Takes value 1 if overall supportive of Vladimir Putin's actions as President of Russia, 0 otherwise	281	1	0	1	1
direction	Takes value 1 if things in the country are now generally moving in the right direction, 0 otherwise	241	.863	.344	0	1
Following state news	Take value 1 if news source television or newspaper, 0 otherwise	281	.879	.327	0	1
Proud to be						
a Russian citizen or patriot	Takes value 1 if I proud to feel as - patriot of my country - or as - Russian citizen, 0 otherwise	281	.278	.449	0	1
part of my nation	Takes value 1 if yes, 0 otherwise	281	.135	.343	0	1
soviet citizen	Takes value 1 if yes, 0 otherwise	281	.1	.3	0	1
Putin supporter	Takes value 1 if yes, 0 otherwise	281	.014	.119	0	1
Communist	Takes value 1 if yes, 0 otherwise	281	.043	.203	0	1
Democrat	Takes value 1 if yes, 0 otherwise	281	.025	.156	0	1
Fills me with pride -						
transformation of the country in Soviet times into one of the world's leading industrial powers	Takes value 1 if yes, 0 otherwise	281	.324	.469	0	1
Victory in the Great Patriotic War 1941-45	Takes value 1 if yes, 0 otherwise	281	.758	.429	0	1
glory of Russian military skill	Takes value 1 if yes, 0 otherwise	281	.217	.413	0	1
perestroika, the beginning of market reforms "	Takes value 1 if yes, 0 otherwise	281	.014	.119	0	1
stabilization of the situation/economic growth during the Putin period	Takes value 1 if yes, 0 otherwise	281	.032	.176	0	1
Crimea's annexation evokes:						
a sense of justice	Takes value 1 if yes, 0 otherwise	132	.402	.492	0	1
pride in the country	Takes value 1 if yes, 0 otherwise	132	.394	.49	0	1
joy	Takes value 1 if yes, 0 otherwise	132	.242	.43	0	1
approval	Takes value 1 if yes, 0 otherwise	132	.394	.49	0	1
disapproval	Takes value 1 if yes, 0 otherwise	132	.023	.15	0	1

Crimea accession causes										
protest, indignation	Takes value 1 if yes, 0 otherwise	132	.008	.087	0	1				
shame and despair	Takes value 1 if yes, 0 otherwise	132	0	0	0	0				
anxiety, fear	Takes value 1 if yes, 0 otherwise	132	.023	.15	0	1				
no special feeling	Takes value 1 if yes, 0 otherwise	132	.045	.209	0	1				
Crimea personal approval	Takes value 1 if yes, 0 otherwise	141	.936	.245	0	1				
Russian politics in Ukraine	Takes value 1 if yes, 0 otherwise	236	.669	.471	0	1				
sex	Takes value 1 if male, 0 otherwise	281	.445	.498	0	1				
Age groups	Takes value 1 - 18-30 years, 2 - 31-54 years, 3 - retired	281	2.018	.786	1	3				
education	Takes value 1 - low, 2 - middle, 3 - high	281	2.555	.614	1	3				
Income groups	Takes value 1 -poor, 2 - middle income, 3 - rich	281	2.11	.701	1	3				
Federal Districts + Moscow	Takes value 1 if Far East, 2 Moscow, 3 Siberia, 4 Ural. 5 Volga, 6 Northwest, 7 South, 8 Central	281	5.011	2.205	1	8				

Source: Levada Center

Table A18. Regression results of post-rally period: Interaction *wave

	(1) wave*pride	(2) wave*News	(3) wave*income
pride	2.127*** (0.363)	3.148*** (0.319)	3.175*** (0.315)
News	1.490*** (0.129)	1.152 (0.120)	1.518*** (0.125)
Middle income	0.751*** (0.0482)	0.743*** (0.0459)	0.744*** (0.0462)
wealthy	1.619*** (0.151)	1.655*** (0.162)	1.834*** (0.300)
2.wave#1.pride	2.127*** (0.363)		
3.wave#1.pride	1.842 (0.692)		
4.wave#1.pride	1.072 (0.257)		
5.wave#1.pride	1.451* (0.277)		
6.wave#1.pride	1.845** (0.559)		
2.wave#1.News		1.222 (0.342)	
3.wave#1.News		1.528 (0.495)	
4.wave#1.News		1.273 (0.305)	
5.wave#1.News		1.837** (0.460)	
6.wave#1.News		1 (.)	
2.wave#middle class			0.937 (0.369)
2.wave#wealthy			1.158 (0.476)
3.wave#middle class			0.484** (0.117)
3.wave#wealthy			0.388** (0.149)
4.wave#middle class			1.303 (0.312)
4.wave#wealthy			1.501 (0.505)
5.wave#middle class			0.756 (0.292)
5.wave#wealthy			0.649 (0.275)
6.wave#middle class			0.986 (0.183)
6.wave#wealthy			1.398 (0.642)
N	7721	7721	7721

Note: The dependent variable is binary standing for presidential support. Reference group for income is a poor group. Controls include following variables: sex, age, education, time dummies and regional-fixed-effects. Wave: 2.wave "October 2014" 3.wave "March 2015" 4.wave "November 2015" 5.wave "March 2016" 6.wave "May 2016". Controls of time-fixed-effects and regional-fixed-effects included. Exponentiated coefficients; to better interpret our results, we

transform the coefficients into odds ratio; standard errors in parentheses are clustered at federal region*wave level, * p < 0.10, ** p < 0.05, *** p < 0.01

Table A19. Regression results of pre-rally-period: Interactions *wave

	(1) Wave*pride	(2) Wave*news	(3) Wave*income
pride	4.131*** (0.698)		2.319*** (0.195)
Following state news		1.325** (0.178)	
income group: middle class	1.354*** (0.105)	1.456*** (0.114)	1.501** (0.260)
income groups: wealthy	1.387*** (0.130)	1.759*** (0.185)	1.885** (0.522)
2.wave#1.pride	0.794 (0.164)		
4.wave#1.pride	0.763 (0.302)		
8.wave#1.pride	0.332*** (0.0513)		
7.wave#1.News1		1.216 (0.235)	
10.wave#1.News1		1.081 (0.196)	
2.wave#2.incomegroups2			0.792 (0.206)
2.wave#3.incomegroups2			0.778 (0.291)
4.wave#2.incomegroups2			0.874 (0.237)
4.wave#3.incomegroups2			0.391** (0.154)
8.wave#2.incomegroups2			0.912 (0.203)
8.wave#3.incomegroups2			0.783 (0.250)
Controls	YES	YES	YES
Federals districts FE	YES	YES	YES
N	5092	4713	5092

Note: The dependent variable is binary standing for presidential support. Reference group for income is a poor group. Controls include following variables: sex, age, education, time dummies and regional-fixed-effects. Wave: 1.wave "March 2008" 2.wave "July 2008" 4.wave "July 2010" 8.wave "September 2012" 10.wave "November 2013". Controls of time-fixed-effects and regional-fixed-effects included. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at federal region*wave level, * p < 0.10, ** p < 0.05, *** p < 0.01

Table 20: Regression results for matching March & October 2014 waves

VARIABLES	(1) rally	(2) rally	(3) rally	(4) rally
proud of todays' Russia	0.92 (0.230)			
news source: TV or newspapers	0.59 (0.208)	0.63* (0.155)	0.63* (0.154)	0.64* (0.157)
income: poor	1.00 (0.309)	0.98 (0.200)	0.99 (0.202)	0.99 (0.202)
income: rich	0.89 (0.205)	0.80 (0.123)	0.81 (0.125)	0.80 (0.124)
A sense of pride - Russia's position on the international stage arena		1.18 (0.167)		
Makes you proud - Economic success			1.50* (0.359)	
Makes you feel proud - Russian history				0.97 (0.132)
Instills a feeling of pride - The Armed Forces				0.93 (0.143)
Makes you feel proud - Citizens				1.05 (0.246)
other Controls	Yes	Yes	Yes	Yes
Observations	723	1,582	1,582	1,582

Note: The dependent variable is binary standing for rally. The Crimean attributes were each estimated in a single regression and summarised in one column for ease of presentation. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratios; standard errors in parentheses eform *** p<0.01, ** p<0.05, * p<0.1

Table 21: Regression results for matching March & October 2014 waves

VARIABLES	(1) rally	(2) rally	(3) rally	(4) support	(5) support	(6) support
Support the annexation of Crimea to Russia						
to protect Crimean residents		1.08 (0.158)			1.44 (0.367)	
- because Crimea is Russian land	1.34* (0.220)				2.02*** (0.483)	
Crimea would have been forcibly Ukrainized		0.95 (0.190)			0.90 (0.283)	
other reasons		0.77 (0.600)			0.69 (0.738)	
Russian policy towards Ukraine fills me with						
- justice and joy			1.65*** (0.311)	3.61*** (1.692)		
pride in the country			0.91 (0.153)	4.57*** (1.815)		
joy			1.98** (0.567)	0.66 (0.279)		
approval			1.00 (0.132)	3.81*** (0.876)		
disapproval			1.07 (0.293)	0.30*** (0.086)		
protest, indignation			0.49 (0.265)	0.36** (0.152)		
shame, bewilderment			1.09 (0.480)	0.09*** (0.034)		
fear, concern			0.93 (0.201)	0.39*** (0.093)		
nothing			0.85 (0.161)	0.92 (0.232)		
approval of Crimea's annexation						8.33*** (2.251)
other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,410	1,408	1,582	1,582	1,405	1,509

Note: The dependent variable is binary standing for rally (Columns 1-3) or presidential support (Columns 4-6). The Crimean attributes were each estimated in a single regression and summarised in one column for ease of presentation. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratios; standard errors in parentheses eform *** p<0.01, ** p<0.05, * p<0.1

Table A22. Regression results of pre-rally-period: direction of Russia's development

	(1)	(2)
pride	2.180*** (0.267)	
state news		1.236* (0.136)
income group: middle class	1.826*** (0.186)	1.905*** (0.269)
income groups: wealthy	1.962*** (0.257)	2.603*** (0.490)
Controls	YES	YES
Federal districts FE	YES	YES
N	4295	3943

Note: The dependent variable is binary standing for opinion about the political direction Russia is heading. Reference group for income is a poor group. Controls include following variables: sex, age, education, time dummies and regional-fixed-effects. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at federal region*wave level, * p < 0.10, ** p < 0.05, *** p < 0.01

Table A23. Regression results of post-rally period: direction of Russia's development

	(1)	(2)
pride	2.541*** (0.341)	2.827*** (0.428)
Trust news		1.310** (0.116)
News	1.404*** (0.130)	
income group: middle class	1.768*** (0.141)	1.891*** (0.184)
income groups: wealthy	2.188*** (0.266)	2.386*** (0.334)
Controls	YES	YES
Federal districts FE	YES	YES
N	6159	4261

Note: The dependent variable is binary standing for opinion about the political direction Russia is heading. Reference group for income is a poor group. Controls include following variables: sex, age, education, time dummies and regional-fixed-effects. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at federal region*wave level, * p < 0.10, ** p < 0.05, *** p < 0.01

Table A24. Regression results of pre-rally-period: Interactions direction*wave

	(1)
pride	1.852*** (0.194)
1.direction	17.77*** (4.053)
2.wave#1.direction	0.985 (0.331)
4.wave#1.direction	1.108 (0.404)
8.wave#1.direction	1.244 (0.373)
Controls	YES
Federal districts	YES
N	4233

Note: The dependent variable is binary standing for presidential support. Reference group for income is a poor group. Controls include following variables: sex, age, education, time dummies and regional-fixed-effects.. Wave: 2.wave "October 2014" 3.wave "March 2015" 4.wave "November 2015" 5.wave "March 2016" 6.wave "May 2016". Controls of time-fixed-effects and regional-fixed-effects included. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at federal region*wave level, * p < 0.10, ** p < 0.05, *** p < 0.01

Table A25. Regression results of post-rally period: Interaction direction*wave

	(1)
pride	2.143*** (0.195)
News	1.335** (0.141)
1.direction: agree	0.810** (0.0676)
2.wave#1.direction	1.381** (0.155)
3.wave#1.direction	1.320** (0.173)
4.wave#1.direction	35.40*** (7.171)
5.wave#1.direction	0.475** (0.151)
6.wave#1.direction	0.139*** (0.271)
Controls	YES
Federal districts FE	YES
N	6415

Note: The dependent variable is binary standing for presidential support. Reference group for income is a poor group. Controls include following variables: sex, age, education, time dummies and regional-fixed-effects. Wave: 2.wave "October 2014" 3.wave "March 2015" 4.wave "November 2015" 5.wave "March 2016" 6.wave "May 2016". Controls of time-fixed-effects and regional-fixed-effects included. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at federal region*wave level, * p < 0.10, ** p < 0.05, *** p < 0.01

Table A26. Regression results of single waves in post rally period

	(1) march14	(2) oct14	(3) march15	(4) nov15	(5) march16	(6) may16
support						
pride	2.193*** (0.396)	3.955*** (1.377)	2.339*** (0.510)	3.169*** (0.329)	3.960*** (0.896)	5.772*** (1.411)
News	1.476** (0.220)	1.379 (0.409)	1.777* (0.526)	1.737** (0.337)	1.813** (0.512)	1.075 (0.116)
sex	0.839** (0.0604)	0.779 (0.172)	0.613** (0.116)	0.793 (0.136)	0.607** (0.132)	0.766 (0.130)
age group: 31-54	0.849 (0.0914)	0.948 (0.221)	0.877 (0.315)	0.662 (0.192)	0.943 (0.256)	0.877 (0.243)
age group: retired	0.757* (0.110)	0.685 (0.274)	0.440** (0.179)	0.556* (0.170)	1.183 (0.443)	1.001 (0.316)
education: low	0.730 (0.191)	1.629 (0.635)	1.561 (0.745)	1.072 (0.796)	0.524 (0.339)	1.507 (0.716)
education: high	0.930 (0.142)	0.913 (0.306)	1.511* (0.323)	1.176 (0.209)	0.878 (0.368)	1.097 (0.218)
income group: middle class	1.708*** (0.205)	1.812* (0.640)	0.767 (0.184)	2.362*** (0.492)	1.464 (0.589)	1.656*** (0.137)
income groups: wealthy	1.662** (0.344)	2.337** (0.754)	0.665 (0.252)	2.964*** (0.753)	1.331 (0.534)	2.412** (0.966)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1558	1519	1051	1502	685	1406

Note: The dependent variable is binary standing for presidential support. Reference group for income is a poor group. Controls include following variables: sex, age, education, time dummies and regional-fixed-effects. Wave: 2.wave "October 2014" 3.wave "March 2015" 4.wave "November 2015" 5.wave "March 2016" 6.wave "May 2016". Controls of time-fixed-effects and regional-fixed-effects included. Exponentiated coefficients; to better interpret our results, we transform the coefficients into odds ratio; standard errors in parentheses are clustered at federal region*wave level, * p < 0.10, ** p < 0.05, *** p < 0.01

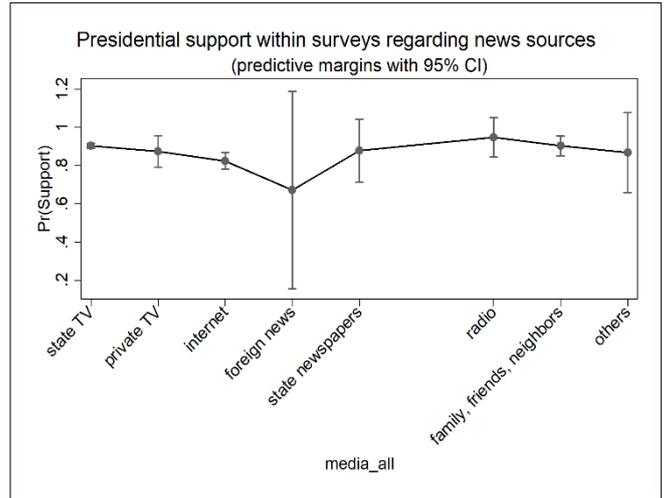
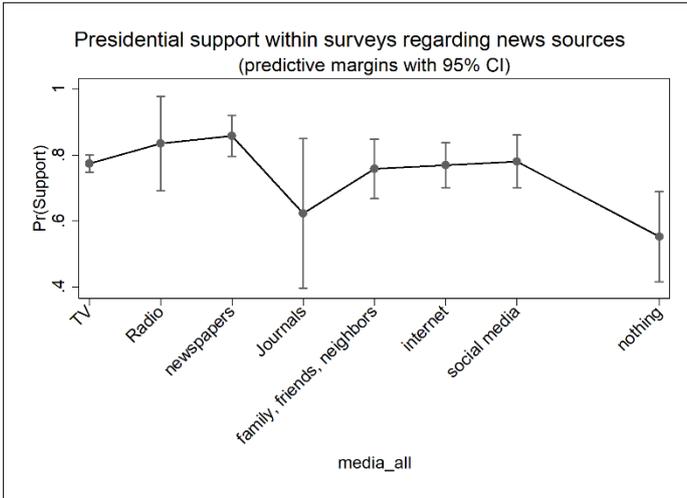


Fig. A1: Marginal effects on predicted presidential support depending on news source in March 2014 (left)
 Fig. A2: Marginal effects on predicted presidential support depending on news source in November 2015

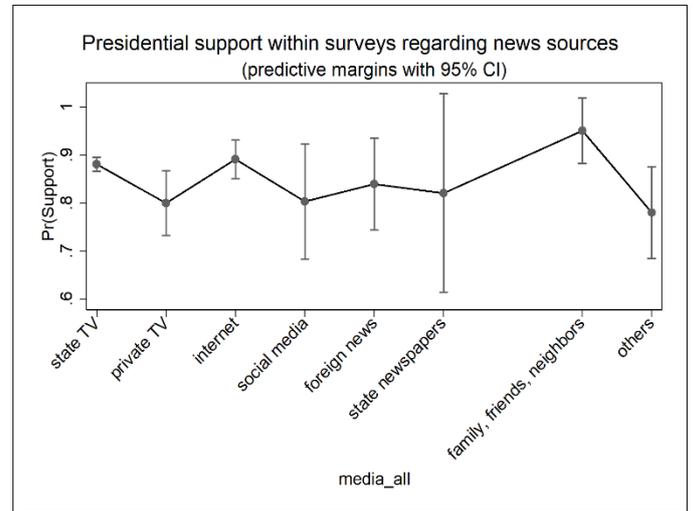
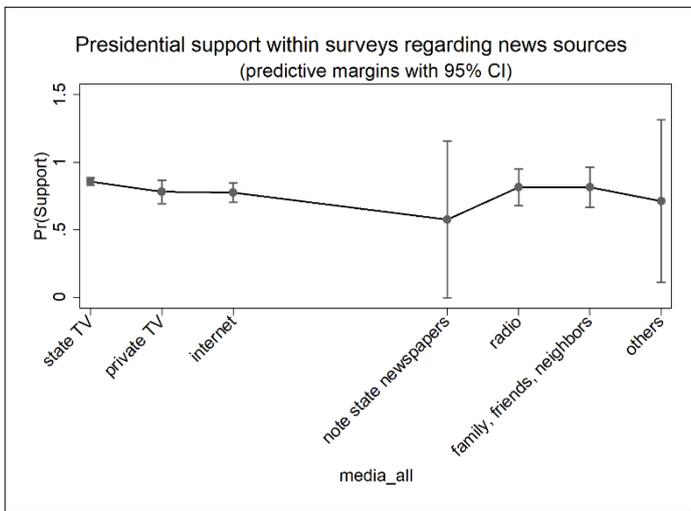


Fig. A3: Marginal effects on predicted presidential support depending on news source in March 2016 (left)
 Fig. A4: Marginal effects on predicted presidential support depending on news source in May 2016 (right)

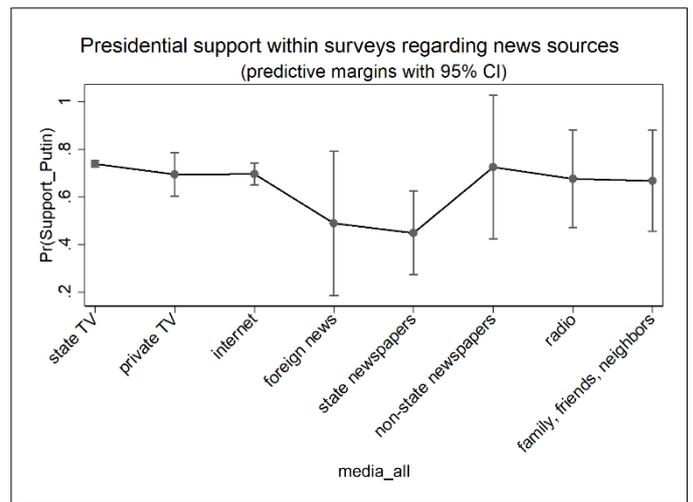
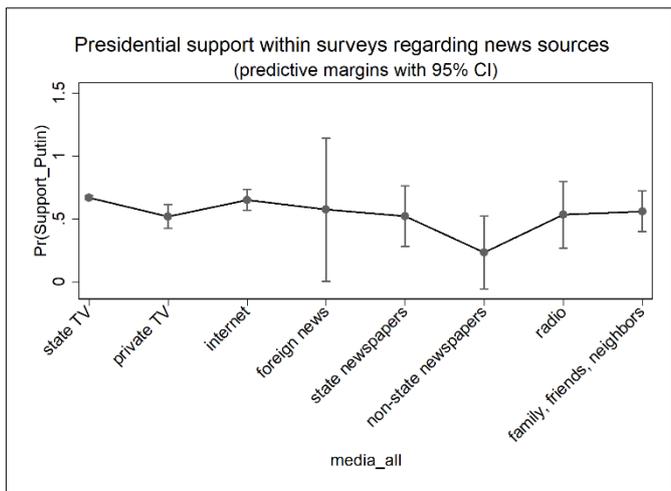


Fig. A5: Marginal effects on predicted presidential support depending on news source in November 2013 (left)
 Fig. A6: Marginal effects on predicted presidential support depending on news source in May 2011 (right)

Appendix A:

PERSONAL CONTRIBUTIONS TO THE PAPERS OF THE CUMULATIVE THESIS

CHAPTER 1: INTRODUCTION

This chapter is an introductory part of the dissertation and was written by me as sole author. It benefited from comments of colleagues.

CHAPTER 2: Crisis and Innovation in Transition Economies

This paper is a joint work with Prof. Dr. Jutta Günther. The original idea was mainly provided by Jutta Günther. The data collection and descriptive statistics as well as the implementation of the analysis were mainly done by me. The introduction and conclusion of the paper were written jointly by the two of us. The paper benefited from advice and comments from colleagues as well as from participants at the conferences and workshops where it was presented. It also profited from reviewer comments during the review process.

CHAPTER 3: A question of motivation or regulation? Environmental innovation activities in transition countries

This paper was written by me as the sole author. The paper benefited from advices and comments from colleagues as well as from participants at the conferences and workshops where it was presented.

CHAPTER 4: Through thick and thin with the national leader: the rally around the flag effect in Russia

This paper is a joint work with Dr. Maria Greve. The idea was developed together. I provided the theoretical framework and carried out the data preparation and econometric analysis (with valuable comments and help from Dr. Greve throughout the process). The paper was mostly written jointly by the two of us. The paper benefited from advice and comments from colleagues as well as from participants at the conferences and workshops where it was presented. It also profited from reviewer comments during the review process.

Appendix B: Erklärung

ERKLÄRUNG ÜBER DIE ANFERTIGUNG DER DISSERTATION OHNE UNERLAUBTE HILFSMITTEL

Ich erkläre hiermit, dass diese Arbeit ohne unerlaubte Hilfe angefertigt worden ist und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt wurden.

Ich erkläre ferner, dass die den benutzten Werken wörtlich und inhaltlich entnommenen Stellen als solche kenntlich gemacht wurden.

Eine Überprüfung der Dissertation mit qualifizierter Software im Rahmen der Untersuchung von Plagiatsvorwürfen ist gestattet.

Bremen, 17 December 2021

Katharina Friz

Acknowledgements

Path dependencies are not only happening in economic theory and in technology developments, they also happen during your personal lifetime. Sometimes you look down a path and wonder what would have happened if you would have turned left or right. Where would you be? Has every decision in your life been the right one? I am sure there will come up several situations in life where you stop, look back and wonder what could have been. However, it also makes you grateful for what actually is.

Looking back at the time leading to and during this dissertation, I realise that a certain path was already founded when I took the course about transition economies in my fifth semester of my Bachelor in 2015/16. Maybe it even started one semester earlier when taking the course "History of Economic Thought". There I met for the first time Prof. Dr. Jutta Günther. Then sitting in the course about transition economies one semester later, she knew exactly who I was. That surprised me actually at that time and it should not be the last time she surprised me. From the topic I chose for my project module it developed into my bachelor thesis. That's where I thought it would end, however, it turned out to be just a stepping stone into my doctoral thesis. The fact that this rather steep turn in life was made possible for me, I owe to Jutta Günther. I am very grateful that she believed in me, supported me and opened the door into the scientific world for me. With her started a new path in my life, allowing me to meet wonderful and intelligent persons, making new experiences, travelling and learning so much that goes beyond just the doctoral thesis.

Another important path-dependency that was created during my project module in the fifth semester was when I got to know Maria Greve (née Kristalova). The first time I met her was, when I was knocking on her office door to ask about my term paper. She greeted me with a cup of tea and we sat down to talk about my work. Who would have thought at that time that this setting would not change for the next five years ...? She was together with Jutta my supervisor for my bachelor thesis and with her my very first scientific paper developed. I am not only thankful for all her guidance, she also encouraged and challenged me when I needed it. And over all that she became a dear friend of mine.

In addition, I am grateful to Prof. Dr. Michael Rochlitz, who agreed to be my second supervisor, for many stimulating and charming conversations as well as his valuable feedback on my work.

Furthermore, I would also like to thank my occasionally changing office mates (in chronological order) Phillip, Nerina, Jarina, Matheus, and finally Susanna. It was always a pleasure to share the office with you guys! Especially Nerina, who helped me decorate the office after moving into the new building, and Matheus for the nice messages (written in perfect German!) on my desk during the corona-separation. Also, I would like to thank Jessica, Mariia and Phillip for sharing ideas, worries, hopes and thoughts during lunches, (unplanned) coffee breaks (where coffees turn cold) or even during walks through the park or city. Moreover, I want to thank all my colleagues Ann, Björn, Daniel, David, Hilal, Joshua, Julian, Marcel, Michel, Olga, Lydia, Tobias, and Toby and Tophy for all the nice talks and lunch breaks, help and advises over the years! Together, you all created this great and warm working atmosphere, without which my time as a doctoral student would only have been half as enriching. How important and valuable this is, became particularly noticeable during the Corona Lockdown, when one was suddenly isolated and at home.

Furthermore, I would like to thank Prof. Dr. Christian Cordes for organising the ierp seminar, as well as Prof. Dr. Dirk Fornahl, Prof. Dr. André W. Heinemann, Prof. Dr. Thorben Klarl, and all other participants for the opportunity to present my research and to receive helpful comments. Apart from that, I want to thank the project partners of Neo-Indikatorik Andreas Kladroba, Muhamed Kudick, Tobias Buchmann and Patrick Wolf for the fruitful collaboration over the last three years. To Patrick, in particular, I say thanks for the pleasant company during our conference travels together. I also want to thank my colleagues abroad Judyta, Jurand and Maciej for not just enabling my research stay at the Jagiellonian University in Kraków but also making it such a wonderful and memorable stay.

I would also like to thank those who have accompanied me over the last three years, and often many years before that, who have distracted me from my academic worries and always provided an open ear: Aristide, Henning, Irina and Wiebke.

Another important path which was founded with me staying in Bremen for my dissertation is, that I met the love of my life Amit Chawla. I am incredibly thankful to Amit for loving me, supporting me and encouraging me, and for introducing me to your sister Chetna who proof-read almost every word I wrote in here. Chetna, you did a fantastic job! Thanks also to Brittney who had so much fun reading and correcting that she read more than she had to!

However, path dependencies not only start with university. They start at the very moment of birth. So last but not least, I want to thank my family: my siblings Fabian, Jenny as well as Christine and of course our Harriet. I am especially grateful to Christine for her great support in the family emergencies we have had over the last few years. And of course, I wish to give a heartfelt thank you to my parents Vera and Eberhard! You brought me up, always supported me and enabled me everything you could. With your guidance and love I became this very person I am today and hopefully not too many people disagree when I say you did a very fine job! In the end I dedicate this work to you because no path or path dependency would have been possible if it weren't for you!