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Abstract

This dissertation deals with topics related to innovation, management quality, political economy and corruption. In Chapter 1 (which is co-authored by Martin Srholec), we econometrically test the hypothesis that pre-crisis innovation affected firms' survival odds and performance thereafter using a unique micro dataset of shareholding companies from emerging countries in Eastern and Southern Europe derived from the World Bank's Enterprise Surveys. Overall, the results indicate that the innovation-survival connection holds. Nevertheless, firms identified as those that innovated excessively before the crisis turned out to be far more likely to die, whereas cautious innovators came out better off. Firms that stretched their resources too much, or that were too bold, faced dire consequences. If an appetite for risky innovation is sociably desirable and the crisis weeds out viable businesses, including those that may drive the recovery, there is a role for public policy to mitigate the short-lived selection inefficiencies that proliferate during severe recessions.

In Chapter 2 we study the impact of management quality on the innovation input and output of firms in ten emerging countries using data from the Management, Organization and Innovation (MOI) Survey. We find the effects of management quality on the decisions of firms to invest in R&D hold for both EU and non-EU emerging countries. An improvement in management quality from the 25th percentile to the median is associated with a 3.3 percentage point increase in the propensity to invest in R&D. Furthermore, there are positive but weak effects of management quality on product innovation. The empirical results for individual management practices show that the quality of incentive management is intimately connected with innovation performance. The quality of monitoring management is related to higher inputs into innovation, but not to innovation output. The quality of incentive management is related to higher input into innovation, but not to innovation output. All results hold after controlling for differences in management quality by industries. Additional analysis of management quality asymmetry shows that the results are driven mainly by firms with low quality management.

In Chapter 3 (which is co-authored by Dmitriy Vorobyev) we study the topic of political budget cycles in which opportunistic politicians systematically adjust public policies prior to elections in order to attract a higher number of votes. We show that the corrupt behavior of politicians also follows certain patterns which are driven by electoral cycles. Based on Business Environment and Enterprise Performance Survey data, exploiting variation in the dates of surveys and in the length and starting date of Russian

regional governors' terms, we find that corruption levels, as perceived by firms operating in different regions of Russia, increase closer to the expected expiration date of a regional governor's term. We argue that the Russian political system allows governors to accumulate private information about their likelihood of remaining in office for another term. Therefore, they know well in advance of elections if they will continue in office for the next term. We suggest that the accumulation of such information may serve as an explanation for the observed pattern of perceived corruption: if a governor gradually learns that he will not be re-elected once the current term has expired he has increasing incentives to engage in corrupt activities in order to accumulate wealth before he leaves office. We formalize this idea with a simple empirical model and test it. We find that in regions where incumbent governors are less likely to remain in office for the next term, corruption increases over their terms, while in regions where governors are more likely to remain in office, perceived corruption follows a decreasing trend.

Abstrakt

V této disertační práci jsou zkoumány různé aspekty inovací, kvality managementu, politické ekonomie a korupce. V první kapitole, společně s Martinem Srholcem, ekonometricky testujeme hypotézu, že inovace zavedené před finanční krizí ovlivnily pravděpodobnost přežití firem a jejich následnou výkonnost. Pro tyto účely byly použity unikátní údaje o podnicích v rozvíjejících se zemích východní a jižní Evropy, získané z průzkumu Světové banky. Výsledky obecně potvrzují vazbu mezi inovacemi a přežitím finanční krize. Nicméně firmy, které byly identifikovány jako nadměrní inovátoři, měly během krize mnohem větší pravděpodobnost úmrtí, zatímco opatrní inovátoři na tom byli lépe. Firmy, které se přepjaly, které byly před krizí ohledně inovací příliš smělé, dosáhly horších výsledků. Pokud jsou inovace zdrojem ekonomického blahobytu a pokud krize ničí jinak životaschopné inovační projekty, včetně těch, které mohou táhnout následnou hospodářskou obnovu, otevírá se prostor pro veřejné politiky v podobě snahy zmírnit dopady těchto tržních nedokonalostí, které se projevují během hlubokých recesí.

Ve druhé kapitole je empiricky zkoumán vliv kvality managementu na vstupy a výsledky inovací. Použita jsou firemních data z deseti rozvíjejících se zemí, která byla získána z Šetření o řízení, organizaci a inovacích (MOI). Výsledky potvrzují propojení kvality managementu a rozhodnutí firem investovat do výzkumu a vývoje (VaV) jak v zemích EU tak i v rozvíjejících se zemích mimo EU. Zlepšení kvality managementu od 25. percentilu k mediánu je spojeno s nárůstem pravděpodobností investovat do VaV o 3,3 procentních bodů. Navíc existují pozitivní, i když slabé, účinky kvality managementu na sklon k zavedení produktové inovace. Empirické výsledky pro jednotlivé manažerské praktiky ukazují, že kvalita motivačního managementu je úzce spojena s inovační výkonností. Kvalita monitorovacího managementu sice nesouvisí s inovacemi produktů, ale vede k vyššímu objemem VaV investic.

Ve třetí kapitole spolu s Dmitrijem Vorobyevem zkoumáme vztah mezi korupci a délkou trvání vládního období politiků. Tady ukazujeme, že zkorumpované chování politiků sleduje určité modely, dané volebními cykly. Na základě mezinárodního průzkumu podnikatelského prostředí a podnikové výkonnosti (BEEPS), s využitím časové variace dat v průzkumech a variace v délce a termínu zahájení vládního období ruských gubernátorů, zjišťujeme, že se úroveň korupce, tak jak je vnímána firmami, které působí v různých oblastech Ruska, zvyšuje blíže k předpokládanému datu ukončení funkčního období gubernátora. Tvrdíme, že ruský politický systém umožňuje gubernátorům shromažďovat soukromé informace o pravděpodobnosti jejich setrvání v úřadu na další období, a to

v dostatečném předstihu před volbami. Ukazujeme, že akumulace takových informací může sloužit jako vysvětlení pro pozorované jevy vnímané korupce: jestliže gubernátor postupně zjistí, že po vypršení aktuálního volebního období opustí úřad, jeho motivace zapojit se do korupčních aktivit se zvyšuje kvůli shromažďování bohatství předtím, než bude mimo hru. Tuto myšlenku formalizujeme pomocí jednoduchého empirického modelu a testujeme ho. Zjistili jsme, že v oblastech, kde je méně pravděpodobné, že úřadující gubernátoři zůstanou ve funkci na další období, se korupce v jejích funkčním období zvyšuje, zatímco v regionech, kde je větší pravděpodobnost, že gubernátoři zůstanou ve funkci, vnímaná korupce vykazuje klesající trend.

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Chapter 1

Surviving the times of crisis: does innovation make a difference?

[1] Co-authored with Martin Srholec.

1.1 Introduction

Much has been written about the economic crisis that shook the foundations of the global economy in 2008. Although its massive impact on employment, productivity, the growth of firms, and the economy as a whole has been well documented by national statistics, only recently detailed micro datasets have started to surface indicating how exactly the crisis affected the operation of companies and what the main factors were that helped them to weather the downturn. This provides new opportunities for investigating, with the benefit of hindsight the consequences of the crisis on selection dynamics, including the innovation-survival relationthip. The sheer scale of the crisis caught most economists, including managers of prominent companies, caught the sheer scale of the crisis by surprise. Companies were not prepared to face this slump. Managers quickly found themselves struggling for the survival of their establishments. Yet fortune favors the prepared mind.

[1] A previous version of this paper was published in International Journal of Technological Learning, Innovation and Development, 7, 124-146. Source of the microdata is Enterprise Surveys, The World Bank Group. Financial support from the Czech Science Foundation (GAČR) project P402/10/2310 on 'Innovation, productivity and policy: What can we learn from micro data?' and institutional support RVO 67985998 from the Academy of Sciences of the Czech Republic is gratefully acknowledged. We thank Patrick Gaulé, Robert van der Have, Štěpán Jurajda, Caroline Paunov for fruitful comments. All errors remaining in this text are the responsibility of the authors.

Some companies no doubt were in a better position to cope with the crisis than others. Was innovation a relevant part of this equation and in which direction? Could it be that while innovation generally boosts survival odds, too much exposure turns toxic in hard times like these? What lessons in terms of the importance of innovation should we learn from the recent crisis?

Filippetti and Archibugi (2011) is an early example of a study based on micro data that addressed the impact of the crisis and found that human resources, specialization patterns and the quality of the financial system were the main national factors offsetting the impact on the innovation investments of firms. Likewise, Cincera et al. (2010) examined the impact of the crisis on the R&D budgets of large European firms and found a general pro-cyclical tendency. Paunov (2012) confirmed that the crisis led many firms to stop innovation projects in Latin America. Papers by Archibugi, Filippetti, and Frenz (2013a), and Archibugi, Filippetti, and Frenz (2013b) concluded that with some notable exceptions the crisis generally undermined the willingness of firms to invest in innovation. However, much less is known about the impact of innovation on the way firms fared in terms of their survival and general economic performance during the crisis. The aim of this paper is to help fill the gap. The main interest is not in what happened to innovation activity during the crisis, but rather whether pre-crisis innovation efforts made a difference thereafter, and whether the otherwise positive innovation-survival relationship continued to hold during the crisis. Using a unique micro dataset of shareholding companies from Eastern and Southern Europe derived from the World Bank's Enterprise Surveys, we econometrically test the hypothesis that the lagged innovativeness of firms affected their performance during the crisis.

More specifically, we estimate an empirical model which revolves around the connection between pre-crisis innovation output, given by sales of new products and services, and the odds of surviving the crisis. At the center is the distinction between what we call 'excessive' and 'cautious' innovation, which is derived from the (mis)balance between the observed innovation output on one hand and structural features, technological capabilities, market, industry and country conditions under which firms operate on the other. In the main equation of interest, therefore, we estimate the impact of actual innovativeness and the tendency to excessive versus cautious innovation on firms' survival. In addition, we also test for the impact on the sales growth of the survivors.

The structure of the paper is as follows. Section 2 considers theoretical arguments and reviews existing evidence on the innovation-survival connection during recessions.

Section 3 presents the micro dataset, explains the variables and provides a brief descriptive overview of the sample. Section 4 outlines the model and debates methodological issues. Section 5 provides results of the econometric estimates. Section 6 concludes with policy implications.

1.2 The innovation-survival connection: What should we expect?

According to the conventional Schumpeterian view following the seminal contribution of Schumpeter (2013), the survival of innovators improves economic performance by 'creative destruction' processes, including what has been dubbed the 'cleansing effect' of recession, as innovators drive out from the market less dynamic competitors. Empirical evidence on this topic seems to strongly confirm the notion that innovativeness provides advantage. Peltoniemi (2011), for example, found in an extensive survey of the industry life-cycle literature that there is plentiful support for the positive innovation-survival relationship.

During severe recessions, however, the selection dynamics favoring innovators could be broken by the disruptive forces of the crisis. For it is not necessarily the strongest, largest, most sophisticated, or most innovative, but plainly the fittest that prevails in the evolutionary struggle for survival and definition of the fittest can be fundamentally twisted during cataclysmic events. During a crisis, there are at least five forces pulling selection against innovators, most of which unfortunately for them tend to amplify each other.

The first and most obvious mechanism is that a sharp downturn in aggregate demand is accompanied with compositional shifts in favor of cheaper, simpler and possibly technologically less advanced solutions. In other words, in line with the well-known Engel's law, demand for new products and services that tend to have high income elasticity of demand contracts even more than for others, rendering innovators less competitive. Moreover, this is further reinforced by the so-called 'sullying' effect described by Barlevy (2002) that works through the labor market, according to which recession favors low-paid and temporary jobs.

Second, and symptomatic of the recent crisis, is that liquidity in financial markets becomes constrained, which can trigger negative selection of innovators due to possible financial market failures. Barlevy (2003) argues that in the presence of credit market fric-

tions, during recession resources might be reallocated from more efficient to less efficient uses if more efficient production arrangements are more vulnerable to credit constraints. If firms that are more innovative tend to borrow more and innovation incurs heavy investments financed by borrowings, then firms are also more severely affected by a credit crunch. Easy access to credit for innovative firms when business goes well, when creditors recognize their superior long-term growth prospects, can turn from sweet to sour when credit dries out.

Third, and an intimately related reason, is that as Sutton (1991) reminds us investment in innovation is generally a sunk cost, an idiosyncratic asset, which is difficult to convert into cash arises in a liquidity-constrained economy.

Fourth, recessions bring a 'scarring' effect (Ouyang 2009), according to which idiosyncratic productivity is not directly observable and can only be learned over time. Thus, potentially superior but inherently uncertain innovative ventures might be terminated during hard times because their owners (or financiers) cannot support them long enough to learn that they are viable. Finally, Paunov (2012) warns that governments tend to withdraw support for innovative firms due to budget cuts during a crisis, making investors more likely to abandon the innovation projects.

Generally, therefore, over the long term innovative firms are more likely to survive, but there are also credible reasons to expect that over the short term selection can produce remarkably inefficient outcomes Advantages over the long term can suddenly turn lethal dragging innovative firms into an abyss. Hence, the central hypothesis of this paper is that the positive selection of innovators breaks down, or even reverses to negative, during a particularly severe recession that goes far beyond the usual ups and downs of the business cycle. According to this thesis, innovation can turn into a fatal burden if the timing is unfortunate, the firm becomes too exposed to the associated risks and the firm innovates excessively just before the crisis hits.

Analysis of the relationship between innovation and performance has a long history. Traditionally, this has been studied at the macro level, but more recent studies have emerged that attempt to disentangle this relationship at the micro level. Crepon, Duguet, and Mairesse (1998) proposed a model, inspired by the earlier literature on technical change, knowledge production function and R&D spillovers (Griliches 1990), which considers in a sequential way links between inputs to the innovation process, innovation outputs and labour productivity. Adaptations of this so-called CDM model have been estimated on micro data from a number of countries (for surveys see OECD 2009; Mairesse

and Mohnen 2010). Overall, the results seem to confirm the assumed relationships.

As far the specific innovation-survival connection is concerned, there is a large number of survival studies that take into account the technological intensity of industry. However, because there is substantial industry heterogeneity in innovation (Srholec and Verspagen 2012), industry is quite unsatisfactory for determining on what happens at the firm-level. Econometric evidence on the survival of innovators based directly on micro data is less extensive, and does not contain evidence on whether this connection continues to hold during major crises.

Four studies deserve to be mentioned in particular. Cefis and Marsili (2006) used evidence from a large sample of manufacturing firms in the Netherlands, for which evidence on innovation was obtained from the second Community Innovation Survey (CIS) over 1996–1998. The main finding is that firms benefit from an innovation premium for survival, regardless of whether the innovation indicator is a dummy, innovation expenditure or R&D expenditure and regardless of the size or age category of firms. Hence, there seems to be overwhelming support for the positive innovation-survival connection, but unfortunately the study is silent on the underlying macroeconomic conditions.

Nishimura, Nakajima, and Kiyota (2005), however, used a comprehensive firm-level panel dataset from Japan to focus directly on determining the extent to which selection mechanisms worked properly during the banking-crisis of 1996–1997. The results showed that efficient firms in terms of total factor productivity died while inefficient ones survived. Based on the evidence in hand, they concluded that selection tends to malfunction in severe recessions. Although they did not measure technology (or innovation) directly, the paper needs to be acknowledged for providing rare insights on the disruptive impacts of a major crisis.

Likewise, using micro data from Indonesian manufacturing over 1991–2001, Hallward-Driemeier and Rijkers (2013) rejected the thesis that the East Asian crisis improved the allocative process. The study shows that the crisis destroyed relatively productive firms and thus the cleansing effect did not prevail. Firms more vulnerable to credit market conditions were found to be more likely to exit. After the crisis, however, the positive relationship between productivity and survival was restored and new entrants became much more productive on average. Hence, the attenuation of the protective power of productivity against exit was limited to the crisis period.

Finally, Fernandes and Paunov (2014) examined the connection between innovation and survival based on micro evidence from Chilean manufacturing plants over 1996–

2006. The results confirm that innovating plants generally have a lower hazard of death, but only innovators that retain diversified sources of revenue survive significantly longer, while risky innovators - in the sense of innovating a single product - are actually more likely to exit. Hence, cautious innovators are better off. Although, the approach used by Fernandes and Paunov (2014) is close to that used in this paper, the identification of cautious versus excessive innovators differs fundamentally.

1.3 Data

We use micro data derived from merging the third round of Business Environment and Enterprise Performance Survey (BEEPS) conducted jointly by the European Bank for Reconstruction and Development and The World Bank in 2008 and the Financial Crisis Survey (FCS) organized by The World Bank in 2009 and 2010. BEEPS asked firms about a comprehensive set of questions on their business activities, including information on innovation and financial variables in the pre-crisis period of 2005-2007. FCS gathered information on how the firms performed during the crisis and organized the survey in three rounds, of which the first took place in June/July 2009, the second in February/March 2010 and the third in June/July 2010. Hence this survey covers the main period of the economic downturn that began following the crisis of 2008. For more details see The World World Bank (2003, Correa et al. (2010).

BEEPS covered a large number of countries in Central, Southern and Eastern Europe. However, the follow-up FCS was conducted only in six countries (Bulgaria, Hungary, Latvia, Lithuania, Romania and Turkey), which limits the country coverage of this study. After initial screening of the data, we decided to limit the sample to shareholding companies because firms with other legal status, i.e., partnerships, limited partnerships and sole proprietors, accounted for only about 20% of the observations, and therefore were significantly underrepresented. Moreover, we excluded from the sample observations that were part of a larger firm - about 10% of the effective sample - because some of the questions referred to the whole firm, while others to the establishment only, which disturbed the interpretation of the results. Thus, we use a coherent sample of shareholding companies with data measured at the firm level; however it is important to note that the estimated inferences hold only for these kinds of firms.

Above all, we are interested in the variables that measure the engagement of the firm in R&D activity as the major input in the innovation process and the $INNOV$ measure of

innovation output given by the share of sales accounted for by new products and services. $SURVIVE$ is the crucial dummy variable for the survival of the firm, which has value 1 if the firm was found to remain active during the crisis.[2] Finally, $SALE$ stands for the estimated year-on-year percentage change of the survivor's sales that represents their performance during the peak time of the crisis.

In addition to a battery of industry and country dummies to control for the respective contextual dependencies, the dataset allows us to derive a rich set of firm-specific variables that include not only general structural features of the firms such as size, age, location and ownership, but also direct evidence on their technological capabilities, market conditions and financial situation - conditions that are essential to control for in order to determine the impact of the main variables of interest.

EMP accounts for the size, given by the total number of employees, i.e., permanent and temporary full-time employees, which is essential to control for scale economies. AGE refers to the number of years since the establishment began operations in the country. Older firms can capitalize on resources accumulated over time, including learning-by-doing, while younger firms can ultimately become more agile, flexible and indeed innovative. $CITY$ controls for location in the capital city, and hence for advantages thanks to urbanization economies. $FOROWN$ refers to the share of foreign ownership, which is important to account for as foreign owned firms can benefit from privileged access to technology (and finance) from abroad.

An essential part of the picture is the market condition. BEEPS included unique questions providing direct evidence on the perceived degree of pressure from customers, which allows us to distinguish between their pressure to cut the costs of the existing output on one hand, and to develop new products, services and markets on the other. From this follow the $COSTPRESS$ and $INNOVPRESS$ variables for the respective kind of pressure. Hence, we have proxy variables for the market pull effects on the innovativeness of firms and for demand price elasticity of the existing output, which are useful for our purpose. Another relevant variable in this domain is the information as to

[2]It should be emphasized that the $SURVIVAL$ variable strictly refers to exit in terms of going out of business, not through M&A, i.e., the establishment is confirmed to be or not to be active regardless of whether it remains standalone or possibly becomes a part of larger entity. For more details on the underlying definition see Appendix Table 1.7. The firm is considered active ($SURVIVE$=1), if it is mentioned in the last wave of the survey. It is considered inactive ($SURVIVE$=0), if it is mentioned as inactive, or filing for bankruptcy in any of three waves. If a firm was active in any of the first two waves, but was not surveyed in the third wave, it is not included into our analysis ($SURVIVE$ is missing). Survival status would be considered missing in this case: the way the firm was contacted does not allow us to determine whether the firm was active or not.

whether the firm serves foreign markets, represented by the $EXPORT$ intensity.

Structural patterns like these are relevant to control for, but equally important is to include variables for the capabilities of firms. $R\&D$ has traditionally been the only seriously considered indicator. As forcefully argued by Bell and Pavitt (1993), however, innovation is about more than just $R\&D$ spending. For this purpose the dataset provides information on the adherence to an internationally recognized quality certification, the use of the internet in the business and the structure of employment by education. ISO is a dummy for ISO (e.g., 9000, 9002 or 14000) certification, which captures the capability to conform to international standards of production and, thus, represents the production facet of technological capability in terms of Kim (1997). WEB is a dummy for using the firm's own website to communicate with clients or suppliers, which captures the capability of external interactions mediated by the internet, and hence feeds to the idea of Lundvall (1988) that decreasing the information asymmetry between users and producers is essential for innovation. Finally, $UNIEMP$ refers to the share of labor force with a university degree, which is a general proxy for the quality of human capital.

A major advantage of BEEPS over data from the CIS is that all of the information, including the $R\&D$, ISO and WEB variables, is available for the whole sample, whereas only firms engaged in innovation activity answer most of the CIS questionnaire. As a result, papers based on the latter data actually do not have much information about those firms that do not innovate and therefore inferences that can be made about factors behind success in the innovation process are limited. If the more detailed information from CIS data is used, the estimates suffer from a potential sample selection bias, which is difficult to identify precisely due to the lack of information.

Next, $MNGEXP$ refers to the top manager's years of experience working in the sector, which captures the aspect of her expertise that is the function of time, including possible experience with steering a company during crises of various sorts in the past. $FINREF$ is a dummy indicating whether the firm had been denied a loan even before the crisis, which identifies firms entering the contest for survival with already weak financial records, and thereby signals the likely candidates for trouble. Similarly, the $OVERDUE$ variable reveals whether the firm had delayed payments of taxes before the crisis occured, and hence whether the firm had been in serious financial distress, on the brink of exiting the market, regardless of the downswing. These variables are also highly useful in the survival equation.

Finally, sectoral differences are accounted for by a set of $INDUSTRY$ dummies clas-

sifying firms on the base of their principal activity into fifteen broad categories. Several categories in the survey had to be combined for the purpose of the estimation because of the low number of observations belonging to the respective industry: basic metals with fabricated metal products, retail trade with hotels and restaurants, and information technology services with the services of motor vehicles. National differences are controlled for by a set of *COUNTRY* dummies delineating the location of the firm within borders of the respective country. Food and beverages and Turkey are used as the base categories. More detailed definitions of the variables are presented in Table 1.8 in the Appendix.

Table 1.1: Descriptive statistics

	mean	*sd*	*min*	*max*	*N*
R&D	0.246	0.431	0	1	1,489
INNOV	13.271	22.935	0	100	1,489
SURVIVE	0.938	0.241	0	1	1,247
SALE	−22.488	39.007	−100	300	582
EMP	3.711	1.392	0	9.150	1,489
AGE	2.503	0.688	0	4.727	1,489
CITY	0.682	0.466	0	1	1,489
FOROWN	6.350	22.626	0	100	1,489
COSTPRESS	2.876	0.972	1	4	1,489
INNOVPRESS	2.914	0.968	1	4	1,489
EXPORT	18.171	31.728	0	100	1,489
ISO	0.413	0.493	0	1	1,489
WEB	0.717	0.450	0	1	1,489
UNIEMP	17.026	21.275	0	100	1,489
MNGEXP	2.791	0.679	0	4.317	1,489
FINREF	0.063	0.243	0	1	1,489
OVERDUE	0.060	0.238	0	1	1,489

Table 1.1 above provides descriptive statistics. After merging the BEEPS and FCS surveys and omitting observations with missing data, the dataset provides information on a sample of (1) 1,489; (2) 1,247 and (3) 582 shareholding companies, depending on the equation to be estimated. Sample (1) is the richest, which we use to estimate innovation production function described in the next section. Further, the data on firms' survival is limited, which leads us to a reduced sample (2). Finally, as an extension of the analysis we would use the data on sales, which has a substantial number of missing observations. This leads us to sample (3).

About 25% of the firms engaged in R&D, and on average about 13% of their sales resulted from new products or services. Subsequently during the economic crisis, roughly 6% of the firms exited the market. Not surprisingly, the survivors recorded a drop in sales on average of about 22% during the crisis. Statistics of the other variables are

self-explanatory and will be examined in more detail later in relation to the dependent variables in the econometric framework.

It is fruitful to compare the survivors and those exiting the market during the crisis, which gives us an initial indication of the factors driving the difference. Table 1.2 presents the two-way comparisons and results of (paired) t-test on the equality of the group means, indicating whether the difference is statistically significant. A brief glance at the pairs with highly significant differences confirms the intuition that the firms who survived tend to be older, have a better educated workforce, appear to be more export intensive, adhere to internationally recognized standards, use the internet to communicate along the value chain, and have lower probability of having to struggle with rejected loans and overdue taxes. Furthermore, the comparison indicates that on one hand the survivors have a higher probability of engaging in R&D, but on the other they have a lower level of innovative sales both within the whole sample and particularly in the sub-sample of innovating firms.

Nevertheless, in this preliminary 'unconditional' comparison these differences are not statistically significant at the conventional thresholds, albeit the latter is close to being at least weakly significant at the 10% level. This points to an intriguing contrast in the impact of innovation that requires closer scrutiny.

Table 1.2: Two-way comparison of group means

	SURVIVE				
	Yes	*No*	*Difference*	*St.dev.*	*N*
R&D	0.238	0.182	0.057	(0.050)	1,247
INNOV	13.074	13.584	−0.511	(2.662)	1,247
INNOV | INNOV > 0	27.025	34.867	−7.842	(4.873)	596
EMP	3.736	3.581	0.155	(0.163)	1,247
AGE	2.536	2.334	0.202	(0.077)***	1,247
CITY	0.637	0.649	−0.013	(0.057)	1,247
FOROWN	6.982	5.792	1.190	(2.775)	1,247
COSTPRESS	2.887	2.857	0.030	(0.115)	1,247
INNOVPRESS	2.922	2.844	0.078	(0.114)	1,247
EXPORT	18.044	8.429	9.616	(3.643)***	1,247
ISO	0.434	0.260	0.174	(0.058)***	1,247
WEB	0.733	0.532	0.201	(0.053)***	1,247
UNIEMP	17.803	9.714	8.088	(2.530)***	1,247
MNGEXP	2.803	2.688	0.114	(0.078)	1,247
FINREF	0.055	0.130	−0.075	(0.028)***	1,247
OVERDUE	0.034	0.195	−0.161	(0.024)***	1,247

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

An important issue that needs to be acknowledged is the overall representativeness of the dataset, which could be seen as relatively low by some observers, in particular by

those who have the fortune to work with extensive CIS micro datasets. Nevertheless, we should not necessarily judge the data by these standards because the BEEPS and FCS datasets bring extremely rare but much needed micro evidence on the connection between the innovation and performance of firms during the crisis that, to the best of our knowledge, has not been presented in the literature so far, at least not in the context of less advanced countries. Another issue is the somewhat disproportional composition of the sample by country: Bulgaria (10%), Hungary (12%), Latvia (10%), Lithuania (10%), Romania (17%) and Turkey (41%), with shares in the largest version of the sample in brackets. Turkey and Romania are by far the largest countries, and hence their shares are reasonable. However, Latvia and Lithuania are probably over-represented, although specifically in terms of the number of shareholding companies in the economy this might not necessarily be the case.

1.4 Model

Building on the CDM framework pioneered by Crepon, Duguet, and Mairesse (1998) and further developed in a variety of models, e.g. by Loof and Heshmati (2002), Griffith et al. (2006), Parisi, Schiantarelli, and Sembenelli (2006), Roper, Du, and Love (2008) and OECD (2009), we use the innovation production function to derive the predicted level of innovation output and then use this information to explain the subsequent performance of firms. Nevertheless, we depart from the CDM template in three major ways. First, we integrate the survival equation into the model, which is particularly relevant in studying how firms coped with the crisis, and which, to the best of our knowledge, has not been used in this framework so far.

Second, because we use data derived from BEEPS, and not from CIS as do most papers on this topic, we adjust the model specification to the available data. Finally, and perhaps most importantly, we test for the possibility that excessive innovation harms firms during a recession. Let i index firms and t denote time. All of the equations include X_{it} - a set of control variables:

$X_{it} \in (EMP_{it}, AGE_{it}, FOROWN_{it}, CITY_{it}, COSTPRESS_{it}, INNOVPRESS_{it}, EXPORT_{it}, ISO_{it}, WEB_{it}, UNIEMP_{it}, MNGEXP_{it}, FINREF_{it}, OVERDUE_{it}, INDUSTRY_{it}, COUNTRY_{it})$.

These control variables consist of covariates that account for structural characteristics, capabilities and resources of firms, market conditions, technological differences across industries and spatial differences, which are deemed to be relevant across the board, and therefore allowed to affect the survival odds and performance of firms both directly and indirectly through innovation.

To obtain the predicted innovation output, we estimate the innovation production function by means of zero-inflated negative binomial model (ZINB) for count data with robust standard errors [Greene (2007, pp.922-924); Hilbe (2011, pp.370-386)]. A count data model serves our purpose as the $INNOV_{it}$ variable is coded in discrete shares from 0% to 100%, and thus can be represented by counts [0, 100]. ZINB is suitable if the outcome variable contains excessive zeroes and at the same time when the outcome is overdispersed; both of which fit with our data rather well.[3] Hence, given these data properties, the model assumes two different data generating processes for excessive zero and positive count outcomes.

In our case, more specifically, this means that zero shares of innovative sales can be observed if:

1. a firm did not innovate, the firm did not introduce new products or services

2. a firm has innovated, but these innovation activities have not resulted in sales of new products and services.

Hence, the empirical representation of the innovation production function, as modelled by these two data generating processes, is as follows:

$$\widehat{INNOV}_{it} = \begin{cases} 0 & \text{if } INNOV_{it} \leq 0 \\ 1, 2, 3, ..., 100 & \text{if } INNOV_{it} > 0 \end{cases} \tag{1.1}$$

where $\widehat{INNOV}_{it}$ refers to the predicted share of innovation sales and $INNOV_{it}$ is the actual observed share of innovation sales.

[3]First, we ran a score test, which rejected the hypothesis of no Poisson overdispersion and then we consulted the boundary likelihood ratio test, which showed that the negative binominal model is preferable over Poisson in addressing the overdispersion (Hilbe 2011).

Cameron and Trivedi (2005) point out that in practice covariates of the two data generating processes for this model are the same, although they do not need to be. Therefore, as covariates we include the whole set, including the $R\&D$ dummy, of firm-specific variables at our disposal. Unfortunately, the likely lag between investment in R&D, the other controls X_{it}, and the output of the innovation process have to be ignored because of data limitations.

For more technical details on the ZINB estimator, see Stata (2013, p.6).[4]

As a robustness check we treat $INNOV_{it}$ as a continuous variable and estimate a two-part model, which combines Logit with Generalized Linear Model (see Table 1.9). The main results of all subsequent analyses hold both quantitavely and qualitatively.

Subsequently, we calculate a difference ($DIFF_{it}$) between the actual share of innovation sales ($INNOV_{it}$) and the share predicted by the innovation production function ($\widehat{INNOV}_{it}$) and use this insight to determine what we henceforth call excessively and cautiously innovating firms. The kernel densities of $INNOV_{it}$ and $INNOV_{it}$ are depicted in Figure 1.1 in the Appendix. If the difference falls into the top decile, i.e., the top tenth of the $DIFF_{it}$ distribution, the firm is considered to be on excessive innovator ($INNOVexcess_{it}$).

Conversely, if the difference falls into the bottom decile, i.e., the bottom tenth of the $DIFF_{it}$ distribution, the firm is labeled as a cautious innovator ($INNOVcautious_{it}$). In other words, these are dummy variables with value 1 if the firm falls into the respective part of the $DIFF_{it}$ distribution and zero otherwise. The kernel density of $DIFF_{it}$ withthe top ten and bottom ten deciles is depicted in Figure 1.2 in the Appendix. The idea is to identify which of the firms exhibit higher versus lower innovation intensity than what can be reasonably expected given the underlying conditions in which the firm operates; which of the firms stretch their resources too far with regard to innovation, thus displaying particularly risky behaviour and vice-a-versa.[5]

In the equation of prime interest, we estimate the probability of a firm's survival as

[4]We further performed formal tests to compare ZINB model against the main alternatives, namely zero-inflated Poisson and standard negative binomial models. A ZIP likelihood-ratio test that compares the ZINB model and zero-inflated Poisson model comes out with statistically significant alpha, which indicates that some heterogeneity is a source of overdispersion in the innovation output, thus ZINB is more appropriate. Statistically significant Vuong test confirms that ZINB model is preferable over a standard negative binomial model, which also allows for overdispersion (Vuong 1989).

[5]Kernel densities of $INNOV_{it}$ and $\widehat{INNOV}_{it}$ distributions are presented Figure 1.1 in the Appendix. Kernel density of the resulting distribution of $DIFF_{it}$ as well as the top/bottom deciles are presented Figure 1.2 in the Appendix. Sensitivity tests of the results to the cut-off point are presented in the next section.

the function of the actual past innovation output and the dummies for excessive and cautious innovation. The aim is to determine whether innovation strategies made firms more likely to overcome the economic downturn. Hence, there is a latent survival variable $\widehat{SURVIVE}_{it+1}$, which refers to some threshold for survival executed by stakeholders but unobserved in the data, such as the expected net gains from continuing the business by the owners or the probability of default perceived by the creditors:

$$\begin{cases} SURVIVE_{it+1} = 0 & \text{if } \widehat{SURVIVE}_{it+1} = \beta_0 + \beta_1 INNOV_{it} + \\ & +\beta_2 INNOVexcess_{it} + \beta_3 INNOVcautious_{it} + \\ & +\beta_4 X_{it} + u_{2it} \leq 0 \\ SURVIVE_{it+1} = 1 & \text{if } \widehat{SURVIVE}_{it+1} = \beta_0 + \beta_1 INNOV_{it} + \\ & +\beta_2 INNOVexcess_{it} + \beta_3 INNOVcautious_{it} + \\ & +\beta_4 X_{it} + u_{2it} > 0 \end{cases} \tag{1.2}$$

where u_{2it} is the standard normally distributed error term and the covariates are lagged. Since the dependent variable is binary, probit (or logit) estimator seems suitable for estimating the latent survival variable equation. Nevertheless, Johnston and Dinardo (1996) emphasize that any misspecification of the likelihood in probit (or logit) will lead to inconsistent estimates. Unfortunately, this can be the case here, because among the covariates are included the lagged $INNOVexcess_{it}$ and $INNOVcautious_{it}$ that have been estimated using a similar set of variables in the previous step. As a result, distributional assumptions in the error term of probit (or logit) are likely to be violated.

Another possibility is to use a linear probability model. Ordinary least square (OLS) estimates, for instance, are known to be more robust to specification errors and, as Rawlings, Pantula, and Dickey (1998) point out, the assumption that residuals are normally distributed is not necessary for the estimation of regression parameters, but only for significance tests and the construction of confidence intervals, though the latter weakness can be overcome by re-sampling methods. Furthermore, according to Cameron and Trivedi (2005), OLS provides reasonable direct estimates for sample-average marginal effects on probabilities that approach 1 due to changes in explanatory variables. They also suggest that maximum likelihood estimation can be more efficient than OLS, but numerically unstable, as high weights are placed on observations with probability close to

0 or 1, and the efficiency gains are often small. Hence, we estimate the survival equation with OLS. Limitations of OLS estimates are well studied (see, e.g. Greene 2007).

Estimated probabilities are not bounded to [0, 1] interval. Horrace and Oaxaca (2006) suggest that a high share of estimates, the predicted probabilities of which lie outside a unit interval, lead to bias and inconsistency. Wooldridge (2010) points out that if the main purpose is the estimation of partial effects on response probability, averaged across the distribution of the independent variable, the fact that some predicted probabilities are outside the unit interval is not very important. OLS estimation also leads to heteroskedastic standard errors, but this can be tackled by estimating robust standard errors.

Both of these concerns are addressed in this paper. First, we estimate the survival equation with OLS adjusted for heteroscedasticity with robust (Eicker-Huber-White) standard errors (we also report Logit estimates for comparison) and then make an additional robustness check by estimating bootstrapped standard errors. Second, following Horrace and Oaxaca's (2006) suggestion, we perform a robustness check by excluding observations with predicted probabilities outside the unit interval from our dataset and estimate the model based on the trimmed sample. This procedure may reduce the OLS bias.

Finally, we estimate the impact of past innovativeness on the growth of sales of the survivors ($SALE_{it+1}$) by OLS:

$$\begin{aligned} SALE_{it+1} = \delta_0 + \delta_1 INNOV_{it} + \delta_2 INNOVaccess_{it} \\ + \delta_3 INNOVcautious_{it} + \delta_4 X_{it} + u_{3it} \end{aligned} \tag{1.3}$$

where u_{3it} is the standard normally distributed error term, the covariates are lagged and $SALE_{it+1}$, is observed only when $SURVIVE_{it+1}$ is equal to one. Admittedly, the latter restriction for observing the sales growth entails a potential selection bias. Nevertheless, there is a lack of instrumental variables that could properly identify the selection; therefore, we restrict the sample to the survivors only, noting that this limitation is well acknowledged.

1.5 Results

Table 1.4 reports the main results. Column 1 presents the ZINB estimate of the innovation production equation. Marginal effects at the mean of the covariates are reported[6]. As a robustness check, Table 1.9 in the Appendix presents the main results for the TPM estimate of the innovation production function.

Columns 2 and 3 of Table 1.4 give results of the OLS estimate of the survival equation, where the first specification takes into account only the actual innovation output and the second estimate also includes the dummies for excessive and cautious innovation. In Table 1.10 in the Appendix we also present results for an alternative (Logit model) for comparison. The main results are similar both quantitavely and qualitatively, but marginally less statistically significant.

Table 1.3: Observations with different predicted probability of survival after OLS

Interval	<0	[0;1]	>1	
Obs.	0	1233	256	1,489
Share	0%	82.8%	17.2%	100%

As a sizable share of predicted probabilities is above 1, we estimate the equation again using a trimmed sample. Columns 4 and 5 present robustness tests of the OLS estimator with regard to bootstrapping standard errors and using the trimmed sample. Hereafter, the subscripts i and t are not indicated for the simplicity of presentation. $INDUSTRY$ and $COUNTRY$ dummies are accounted for across the board, but the estimated coefficients not presented in order to save space.

First, we check whether the results of the first equation for $INNOV$ are in line with the existing literature. The main outcome is that the impact of $R\&D$ is positive and highly statistically significant, thus not surprisingly confirming the assumed input-output relationship (OECD 2009). Moreover, the proportion of innovative sales decreases with the firm size, which is also reassuring as previous evidence such as Brouwer and Kleinknecht (1996) and a long line of subsequent studies have shown that the propensity to innovate increases less than proportionately with size. $FOROWN$ is positive, because foreign affiliates benefit from technology transfer from their parent group.

[6]We also estimate this equation using the reduced sample (1,247 obs.). Qualitatively and quantitatively the results are similar to those reported in Table 1.4, but marginally less statistically significant.

Table 1.4: Results of the innovation output and survival equations

	(1) *ZINB INNOV* *robust*		(2) *OLS SURVIVE* *robust*		(3) *OLS SURVIVE* *robust*		(4) *OLS SURVIVE* *bootstr.*		(5) *OLS SURVIVE* *bootstr.trim.*	
EMP	−0.8409	(0.5039)*	−0.0042	(0.0054)	−0.0042	(0.0054)	−0.0042	(0.0053)	−0.0052	(0.0064)
AGE	−1.4605	(0.9115)	0.0247	(0.0150)*	0.0269	(0.0151)*	0.0269	(0.0155)*	0.0419	(0.0168)**
CITY	0.1040	(3.9140)	−0.0087	(0.0219)	−0.0081	(0.0219)	−0.0081	(0.0219)	−0.0018	(0.0339)
FOROWN	0.0522	(0.0280)*	−0.0002	(0.0003)	−0.0003	(0.0003)	−0.0003	(0.0003)	−0.0005	(0.0003)
COSTPRESS	−0.1852	(0.7520)	−0.0010	(0.0099)	−0.0008	(0.0099)	−0.0008	(0.0096)	0.0015	(0.0127)
INNPRESS	1.1534	(0.7903)	0.0060	(0.0098)	0.0048	(0.0098)	0.0048	(0.0097)	0.0040	(0.0123)
EXPORT	−0.0047	(0.0219)	0.0007	(0.0002)***	0.0008	(0.0002)***	0.0008	(0.0002)***	0.0011	(0.0004)***
ISO	0.5150	(1.2817)	0.0197	(0.0147)	0.0180	(0.0148)	0.0180	(0.0147)	0.0287	(0.0172)*
WEB	5.9340	(1.4363)***	0.0449	(0.0188)**	0.0349	(0.0189)*	0.0349	(0.0188)*	0.0394	(0.0198)**
UNIEMP	−0.0107	(0.0274)	0.0007	(0.0002)***	0.0007	(0.0002)***	0.0007	(0.0002)***	0.0012	(0.0003)***
MNGEXP	0.8211	(0.8845)	0.0012	(0.0132)	−0.0003	(0.0132)	−0.0003	(0.0134)	−0.0011	(0.0145)
FINREF	0.1151	(2.2584)	−0.0492	(0.0368)	−0.0478	(0.0363)	−0.0478	(0.0362)	−0.0616	(0.0382)
OVERDUE	−0.6847	(2.3223)	−0.1996	(0.0587)***	−0.1994	(0.0584)***	−0.1994	(0.0577)***	−0.2116	(0.0579)***
R&D	8.5514	(1.2000)***								
INNOVexcess					−0.0959	(0.0484)**	−0.0959	(0.0482)**	−0.1423	(0.0583)**
INNOV			−0.0001	(0.0003)	0.0011	(0.0006)*	0.0011	(0.0006)*	0.0017	(0.0009)**
INNOVcautious					0.0477	(0.0192)**	0.0477	(0.0187)**	0.0743	(0.0279)***
Intercept			0.8222	(0.0574)***	0.8116	(0.0576)***	0.8116	(0.0574)***	0.8093	(0.9175)
INDUSTRY	Yes		Yes		Yes		Yes		Yes	
COUNTRY	Yes		Yes		Yes		Yes		Yes	
F			2.05***		2.02***					
Wald χ^2 (35)	91.56***						68.24***		66.44***	
R^2			0.0865		0.0919		0.0919		0.0988	
N	1,489		1,247		1,247		1,247		1,026	

Marginal effects at mean are reported for ZINB. Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

WEB comes out with a highly significantly positive coefficient, which highlights the importance of user-producer interactions mediated by the internet. Other coefficients are not statistically significant at the conventional levels.

However, the prime interest is in the survival equation with the SURVIVE dummy as the dependent variable. The first estimate, presented in column 2 of Table 1.4 in the Appendix, allows only for the straightforward impact of innovation output and control variables.

Results of the latter are in line with expectations. AGE, $EXPORT$, WEB and $UNIEMP$, i.e. the firm's age, educated workforce, website, and export intensity, are estimated to significantly boost the survival odds, while the financial distress 'pre-determined' condition given by $OVERDUE$ has rather negative consequences.

Surprisingly, however, the estimated coefficient of $INNOV$ does not come out to be significantly different from zero. Thus, according to this specification, innovation does not make a significant difference.

However, the impact of innovation is more complex. In the second specification, presented in column 3 of Table 1.4 in the Appendix, we disentangle the impact of innovation by adding the dummy variables that identify the excessively versus cautiously innovating firms. The survival probability is estimated to significantly increase with the lagged innovation output, though only conditional on not being classified in the two extreme categories. All else equal, a 10 percentage point increase in the share of sales accounted for by products or services introduced over three years before the crisis occurred is associated with an estimated 1.1 percentage point increase in the odds of survival thereafter. It needs to be pointed out, however, that the coefficient continues to be estimated relatively imprecisely.

Most interestingly, there is a stark contrast in the estimated survival odds between the excessively and cautiously innovating firms. Indeed, the excessive innovators turn out far less likely to survive; they are severely punished for following the exceedingly bullish strategy. If firms excessively innovated before the crisis started, their survival probability is estimated to drop by about 9.6 percentage points during the downturn. In other words, firms that found themselves too dependent on new output at the outbreak of the crisis ended up in trouble. Conversely, the cautious innovators are estimated to be by 4.8 percentage points less likely to die. Firms benefited from pursuing a rather low-profile innovation strategy. Both of the coefficients are statistically significant at the 5% level.

If we use bootstrapping (with 2,500 replications) to estimate standard errors nonparametrically, see column 4 of Table 1.4 in the Appendix, the standard errors come out very similar and the estimated coefficients remain significant at the same levels. Hence, the violation of distributional assumptions is not a serious problem. The initial OLS model with robust standard errors is reasonable. Furthermore, following Horrace and Oaxaca's (2006) suggestion, we estimate the survival equation using the trimmed sample to reduce finite sample bias. The results are presented in the last column of Table 1.4 in the Appendix. The trimmed estimate reconfirms the main conclusions, although the magnitude of the coefficients increases noticeably, so the true effects in fact might be even stronger.

Finally, Table 1.5 presents variations in the threshold of *INNOVexcess* and *INNOVcautious* as robustness checks. First, we use the same definition derived from quantiles of $DIFF$ distribution but extend the threshold below and above the baseline cutoff point. Second, we switch to using symmetric thresholds based on standard deviations from the mean of $DIFF$. Third, we use absolute thresholds asymmetric to the $DIFF$ distribution, in which the cut-off point is given by the value of $DIFF$ in percentage points. OLS with robust standard errors estimated on the full sample is used for this purpose. To save space, only the results of the innovation covariates are reported here.

Table 1.5: Robustness of the results to the threshold

	INNOVexcess		*INNOV*		*INNOVcautious*	
	Coef.	*St.dev.*	*Coef.*	*St.dev.*	*Coef.*	*St.dev.*
5% and 95%	0.0105	(0.0543)	−0.0001	(0.0006)	0.0365	(0.0264)
10% and 90%	−0.0959	(0.0484)**	0.0011	(0.0006)*	0.0477	(0.0192)**
15% and 85%	−0.0241	(0.0345)	0.0003	(0.0006)	0.0250	(0.0214)
+/- 0.75 sd	−0.0355	(0.0387)	0.0005	(0.0006)	0.0498	(0.0189)***
+/- 1.00 sd	−0.0799	(0.0456)**	0.0009	(0.0006)	0.0657	(0.0195)***
+/- 1.25 sd	−0.0529	(0.0488)	0.0005	(0.0006)	0.0791	(0.0278)***
+/- 15 ppt	−0.0338	(0.0364)	0.0005	(0.0006)	0.0245	(0.0213)
+/- 25 ppt	−0.0895	(0.0479)*	0.0010	(0.0006)	0.0753	(0.0236)***
+/- 35 ppt	−0.0377	(0.0503)	0.0003	(0.0006)	0.0728	(0.0338)**

Robust standard errors in parentheses. % - distribution quantiles;
sd - standard deviations from the mean of DIFF;
ppt - absolute value of DIFF in percentage points
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results confirm that innovativeness boosts the survival prospects of firms, but only up to a certain point, beyond which the positive effect starts to diminish and eventually reverses into negative. Regardless of the threshold definition, there is always a top and bottom cut-off point that is statistically significant at the conventional levels. If the difference between actual and predicted innovation output is excessive, the survival prob-

ability is estimated to decrease as much as about 8 to 10 percentage points. Conversely, if the innovator is cautious, the likelihood of survival increases by about 5 to 8 percentage points.

Finally, Table 1.6 provides results of the final equation on the sales growth of the survivors. Column 1 gives results of the conventional OLS estimator. Column 2 presents the OLS results excluding major outliers based on Cook's distance. Column 3 shows coefficients derived from OLS robust to outliers following the procedure by Li (2011). About 20% to 30% of the variability in sales growth is explained. The pivotal finding is that if the influence of outliers is treated, the impact of innovativeness is qualitatively similar to the previous equation, i.e. that excessive innovation backfires with a significantly negative impact, while modest innovation seems to be rewarded. During a rapid slump in demand, excessive innovation not only threatens the very foundations of firms, but also leads to a disproportionate loss of the market if the firm happens to withstand the turmoil.

Table 1.6: Results of the sales growth equations

	(1) *OLS*		(2) *OLS excl.*		(3) *OLS robust*	
EMP	4.80	(1.27)***	4.39	(0.94)***	5.01	(1.10)***
AGE	2.25	(2.72)	1.87	(1.96)	1.82	(2.14)
CITY	0.85	(5.90)	−2.70	(5.36)	−1.10	(8.39)
FOROWN	0.09	(0.08)	0.12	(0.04)***	0.10	(0.06)*
COSTPRESS	0.57	(2.45)	1.45	(1.80)	2.34	(1.99)
INNOVPRESS	−1.86	(2.40)	−1.20	(1.77)	−1.32	(2.00)
EXPORT	0.04	(0.08)	0.01	(0.05)	−0.05	(0.05)
ISO	−1.85	(3.95)	−0.74	(2.85)	0.64	(3.03)
WEB	4.12	(3.62)	2.72	(2.95)	2.79	(3.30)
UNIEMP	0.09	(0.07)	0.06	(0.05)	0.04	(0.06)
MNGEXP	0.70	(2.25)	0.35	(1.80)	−0.18	(1.99)
FINREF	−1.49	(6.31)	−2.77	(4.44)	−1.08	(5.68)
OVERDUE	−11.58	(8.99)	−9.55	(5.79)*	−10.69	(7.19)
INNOVexcess	−15.54	(11.24)	−14.64	(6.88)**	−16.93	(8.15)**
INNOV	0.20	(0.13)	0.20	(0.10)**	0.23	(0.11)**
INNOVcautious	3.88	(7.15)	0.04	(4.91)	0.74	(4.75)
Constant	−52.24	(14.89)***	−57.93	(9.06)***	−59.93	(9.68)***
INDUSTRY	Yes		Yes		Yes	
COUNTRY	Yes		Yes		Yes	
F	5.45***		7.24***		5.18***	
R^2	0.18		0.30		0.20	
AIC					820.31	
BIC					977.09	
Deviance					493,777	
N	582		548		582	

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Overall, the central hypothesis of this paper that during a major crisis the positive innovation-survival connection breaks down if the firm becomes excessively exposed is strongly supported by the data. Firms that pursued a low-profile innovation strategy before the crisis occurred found themselves in a much better position to absorb the hit. However, if the firm stretched its resources with regard to innovation too far, if the firm bitted more before the crisis than it can chew during the downturn, the consequences were detrimental to the firm. In this respect the results broadly concord with the findings of Fernandes and Paunov (2014) that cautious innovators are better off than others.

1.6 Conclusion

Schumpeter (2013, p.84) argued long ago that competing through innovation "strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives". However, during turbulent times like these, the innovation-survival connection may become somehow more complicated than usual. Using a unique micro dataset that provides information on the pre-crisis innovativeness of firms and their survival as well as performance during the crisis gave us a rare opportunity to econometrically test this proposition. The results confirmed that innovation generally boosts survival odds during severe crises but with a major clarification.

Innovation can turn toxic if overdone just before the crisis occurs if the firm becomes too exposed. Firms identified as excessive innovators before the crisis – those that ceteris paribus innovated significantly more than can be reasonably expected given what we know about them – turned out to be far more likely to die thereafter. If firms excessively innovated, their survival probability is estimated to drop by about 8 to 10 percentage points during the peak period of the downturn. In addition, the surviving excessive innovators experienced a significantly deeper reduction in sales. Firms that were too bold at the outbreak of the crisis faced serious consequences.

Arguably, the results challenge the widespread consensus that is strongly proliferated in the literature that more innovation is always better, that if anything innovation has a positive impact on the performance and ultimate survival of firms. In fact, at a theoretical level, this consensus is strikingly out of sync with evolutionary thinking, as what matters for survival is to be the fittest, and the selection environment is anything but static. Over the long term the selection surely favors the innovative, but there are periods - cataclysmic events - such as deep, prolonged recessions, when the selection criteria is

profoundly different. Thus the sentiment that innovation is a panacea that always needs to be promoted to its maximum no matter what must be critically questioned.

Nevertheless, no crisis lasts forever. If an appetite for risky innovation is sociably desirable and the crisis selects out viable business - and thus innovators that would thrive otherwise, including those that may drive the recovery - there is a role for public policy to mitigate the possibly short-lived selection bias. To the extent that efforts devoted to innovation bring large economic benefits over the long term and the most bullish innovators are destroyed by recessions, there could be a failure in dynamic terms that needs to be corrected by policy interventions. These could include, e.g. support of jobs for highly-skilled (or R&D) workers, loan guaranties for bold innovation projects, public procurement for innovation to alleviate demand drop, etc.

Finally, managers should be aware that excessive innovation can undermine the survival prospects of their firm in times of economic crisis. An innovation project that is financially viable of the assumption on growing demand can easily sink the company if a crisis arrives unexpectedly. The results clearly confirm that maintaining a balanced portfolio of innovative and other sources of revenue is as important for a firm's survival as the capability to generate new products and services. Although not always possible, it is advisable to conduct a diligent risk-assessment of a firm's innovation strategies.

1.A Appendix

1.A.1 Definitions

Table 1.7: Definition of the SURVIVE variable

	FCS Wave 1 (2009)	FCS Wave 2 (2010)	FCS Wave 3 (2010)
SURVIVE = 1			
Complete effective interview	838	819	768
Incomplete effective interview	3	3	33
Firm exists but not interviewed	60	4	70
SURVIVE = 0			
The firm is inactive	26	12	25
The firm discontinued business	4	5	8
The firm discontinued business and filed for bankruptcy	7	4	15
The firm discontinues business and is filing for bankruptcy	6	8	9
SURVIVE = missing (not considered)			
ID not in response reports	86	0	0
Refusal	143	252	260
Answering machine	0	3	0
Fax line - data line	7	2	0
Wrong contact details	1	0	0
No reply after several calls	50	80	6
Line out of order	3	8	1
No tone	2	5	0
Not available at time of interviewing	0	4	6
Wrong number	1	27	11
Busy	1	1	0
Appointment	6	8	44
Total number of observations	1,244	1,245	1,247

N = 1,247 obs.
Source: Authors' calculations based on the EBRD and World Bank FCS survey

Table 1.8: Definition of the variables

Variables	Description
R&D	Dummy variable with value 1 if the firm spent on research and development activities either in-house or contracted with other companies in 2007
INNOV	% of sales in 2007 accounted for by products or services introduced over 2005–2007
SURVIVE	Dummy variable with value 1 if the firm conducted effective interview or was found to continue business and could be reached by the surveyors (but was not interviewed as sample target was already achieved) in the FCS in mid-2010 and with value 0 if the firm has been found to become inactive, discontinued business or reported in the FCS to file for bankruptcy/insolvency from mid-2008 to mid-2010

Table 1.8: Definition of the variables (continued)

Variables	Description
SALE	% change of firm's sales between the last completed month in 2010 (third wave, June-July) and the same month in 2009 (first wave, June-July)
EMP	Logarithm of the number of full-time employees at the end of 2007
AGE	Logarithm of the number of years until 2008 since the firm began operations in the country
CITY	Dummy variable with value 1 if the firm was located in the capital city in 2007
FOROWN	% of the firm owned by private foreign individuals, companies or organizations in 2007
COSTPRESS	Likert scale variable indicating by integers from zero to four whether the pressure from customers in affecting decisions with respect to reducing the production costs of existing products or services was 1 not at all important 2 slightly important 3 fairly important 4 very important in 2007
INNOVPRESS	Likert scale variable indicating by integers from zero to four whether the pressure from customers in affecting decisions to develop new products or services and markets was 1 not at all important 2 slightly important 3 fairly important 4 very important in 2007
EXPORT	% of sales exported directly or indirectly (sold domestically to third party that exports) in 2007
ISO	Dummy variable with value 1 if the firm had an internationally recognised quality certification, for example ISO 9000, 9002 or 14000, in 2007
WEB	Dummy variable with value 1 if the firm used its own website to communicate with clients or suppliers in 2007
UNIEMP	% of labour force with a university degree at the end of 2007
MNGEXP	Logarithm of top manager's years of experience working in this sector until 2008
FINREF	Dummy variable with value 1 if the firm applied for new loans or new lines of credit that were rejected in 2007
OVERDUE	Dummy variable with value 1 if the firm had delayed payments of taxes for more than 90 days in 2007
INDUSTRY	Dummy variables with value 1 if the principal activity of the firm is classified in a food and beverages b textiles c garments d chemicals e plastics and rubber f non-metallic mineral products g basic metals and fabricated metal products h machinery and equipment i electronics j other manufacturing k construction l retail, hotel and restaurants n transport m wholesale o other services
COUNTRY	Dummy variables with value 1 if the firm is located in Bulgaria, Hungary, Latvia, Lithuania, Romania and Turkey

Table 1.9: Results of the innovation output and survival equations after Two-Part Model

	(1) *TPM INNOV* *robust*		(2) *OLS SURVIVE* *robust*		(3) *OLS SURVIVE* *robust*		(4) *OLS SURVIVE* *bootstr.*		(5) *OLS SURVIVE* *bootstr.trim.*	
EMP	−0.8358	(0.4967)*	−0.0042	(0.0054)	−0.0044	(0.0054)	−0.0044	(0.0054)	−0.0058	(0.0066)
AGE	−1.4838	(0.9989)	0.0247	(0.0150)*	0.0269	(0.0151)*	0.0269	(0.0155)*	0.0418	(0.0174)**
CITY	0.3913	(2.9487)	−0.0087	(0.0219)	−0.0090	(0.0220)	−0.0090	(0.0225)	−0.0033	(0.0341)
FOROWN	0.0489	(0.0278)*	−0.0002	(0.0003)	−0.0003	(0.0003)	−0.0003	(0.0003)	−0.0005	(0.0003)
COSTPRESS	−0.2224	(0.7719)	−0.0010	(0.0099)	−0.0010	(0.0099)	−0.0010	(0.0098)	0.0011	(0.0123)
INNPRESS	1.4570*	(0.7750)	0.0060	(0.0098)	0.0045	(0.0099)	0.0045	(0.0098)	0.0036	(0.0123)
EXPORT	−0.0061	(0.0231)	0.0007	(0.0002)***	0.0008	(0.0002)***	0.0008	(0.0002)***	0.0011	(0.0004)***
ISO	0.8099	(1.3308)	0.0197	(0.0147)	0.0176	(0.0148)	0.0176	(0.0150)	0.0277	(0.0179)
WEB	5.4379	(1.4060)***	0.0449	(0.0188)**	0.0354	(0.0185)*	0.0354	(0.0185)*	0.0403	(0.0201)**
UNIEMP	0.0007	(0.0274)	0.0007	(0.0002)***	0.0007	(0.0002)***	0.0007	(0.0002)***	0.0012	(0.0004)***
MNGEXP	0.5922	(0.8817)	0.0012	(0.0132)	−0.0003	(0.0132)	−0.0003	(0.0136)	−0.0004	(0.0143)
FINREF	0..2423	(2.3872)	−0.0492	(0.0368)	−0.0481	(0.0365)	−0.0481	(0.0370)	−0.0619	(0.0369)*
OVERDUE	−0.7634	(2.4715)	−0.1996	(0.0587)***	−0.2001	(0.0581)***	−0.2001	(0.0587)***	−0.2124	(0.0573)***
R&D	8.7764	(1.2498)***								
INNOVexcess					−0.0988	(0.0484)**	−0.0988	(0.0495)**	−0.1449	(0.0569)**
INNOV			−0.0001	(0.0003)	0.0012	(0.0006)*	0.0012	(0.0006)*	0.0017	(0.0008)**
INNOVcautious					0.0484	(0.0202)**	0.0484	(0.0205)**	0.0752	(0.0292)***
Intercept			0.8222	(0.0574)***	0.8109	(0.0575)***	0.8109	(0.0573)***	0.7566	(0.0679)
INDUSTRY	Yes		Yes		Yes		Yes		Yes	
COUNTRY	Yes		Yes		Yes		Yes		Yes	
F			2.05***		2.04***					
Wald χ^2 (35)							70.48***		64.65***	
Pseudo R^2	0.1143									
R^2			0.0865		0.0922		0.0922		0.0992	
N	1,489		1,247		1,247		1,247		1,026	

Marginal effects at mean are reported for TPM. Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1.10: Results of the survival equations after Logit

	(1)		(2)		(3)	
St. errors	*robust*		*robust*			
EMP	−0.0815	(0.0989)	−0.0707	(0.1008)	−0.0707	(0.1086)
AGE	0.4085	(0.2211)*	0.4246	(0.2187)*	0.4246	(0.2274)*
CITY	0.2884	(1.0795)	0.3082	(1.1036)	0.3082	(6.3930)
FOROWN	−0.0052	(0.0056)	−0.0065	(0.0061)	−0.0065	(0.0068)
COSTPRESS	0.0091	(0.1992)	0.0252	(0.2039)	0.0252	(0.2128)
INNPRESS	0.0653	(0.1822)	0.0377	(0.1891)	0.0377	(0.1992)
EXPORT	0.0161	(0.0064)**	0.0165	(0.0065)**	0.0165	(0.0077)**
ISO	0.5301	(0.3172)*	0.4627	(0.3205)	0.4627	(0.3318)
WEB	0.6882	(0.2797)**	0.5002	(0.2865)*	0.5002	(0.3155)
UNIEMP	0.0257	(0.0092)***	0.0252	(0.0094)***	0.0252	(0.0104)**
MNGEXP	0.0176	(0.2125)	−0.0104	(0.2116)	−0.0104	(0.2294)
FINREF	−0.6292	(0.4052)	−0.6659	(0.3932)*	−0.6659	(0.4225)
OVERDUE	−1.7728	(0.3802)***	−1.7785	(0.3743)***	−1.7785	(0.4453)***
INNOVexcess			−1.5404	(0.7839)**	−1.5404	(0.8200)*
INNOV	−0.0008	(0.0059)	0.0203	(0.0120)*	0.0203	(0.0129)
INNOVcautious			1.4606	(0.8391)*	1.4606	(0.7435)**
Intercept	1.0400	(0.9129)	0.8093	(0.9176)	0.8093	(0.9982)
INDUSTRY	Yes		Yes		Yes	
COUNTRY	Yes		Yes		Yes	
Wald χ^2	χ^2 (33) = 108.67***		χ^2 (35) = 113.22***		χ^2 (35) = 78.22***	
Pseudo R^2	0.1660		0.1790		0.1790	
N	1,247		1,247		1,247	

Raw log-odds are reported. Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1.A.2 BEEPS dataset methodology

In all countries where a reliable sample frame was available (except Albania), the sample was selected using stratified random sampling, following the methodology explained in the Sampling Manual (available at http://www.enterprisesurveys.org/Methodology/). Three levels of stratification were used in all countries: industry, establishment size and region. There were no additional requirements on the ownership, exporter status, location or years in operation of the establishment as was the case in the previous rounds of BEEPS. Along the defined stratification guidelines, priority was given to completing interviews with establishments that participated in BEEPS 2005.

Details on the regional stratification are country-specific. In all countries, the sample was stratified along Manufacturing, Retail trade (sector 52) and Other services. In some of the countries, there were specific target numbers of interviews for more detailed sectors within these three groups. Size stratification was defined following the standardized definition for the rollout: small (5 to 19 employees), medium (20 to 99 employees), and

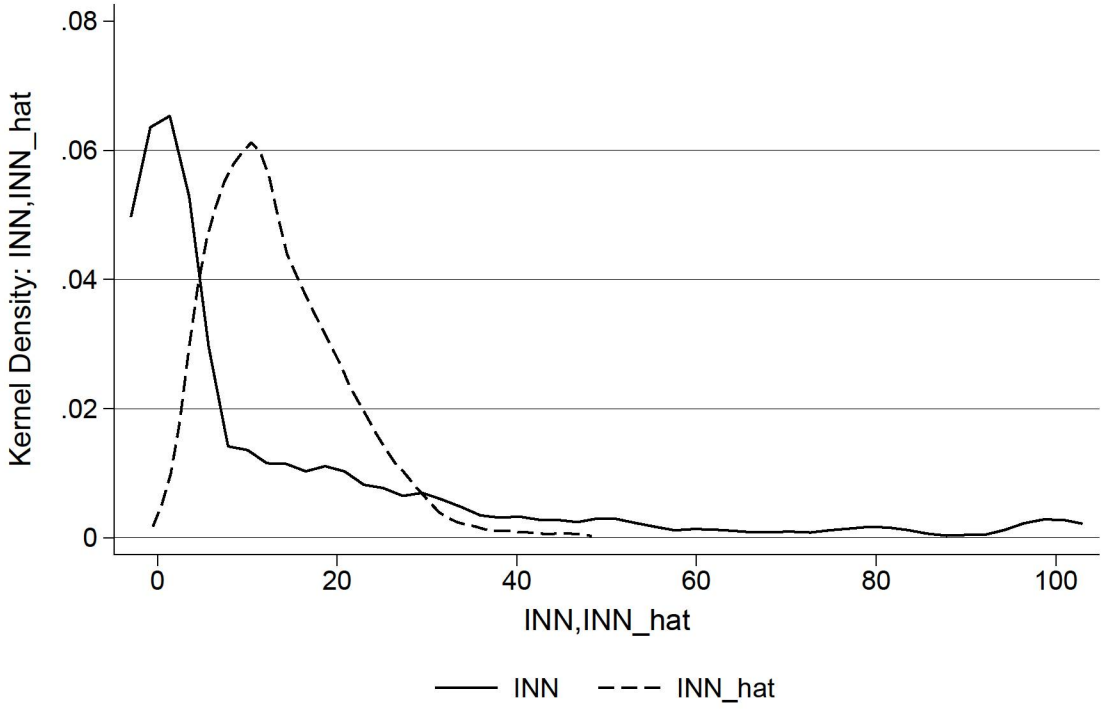

Figure 1.1: Kernel densities of actual ($INNOV_{it}$) and predicted ($\widehat{INNOV}_{it}$) shares of innovation sales

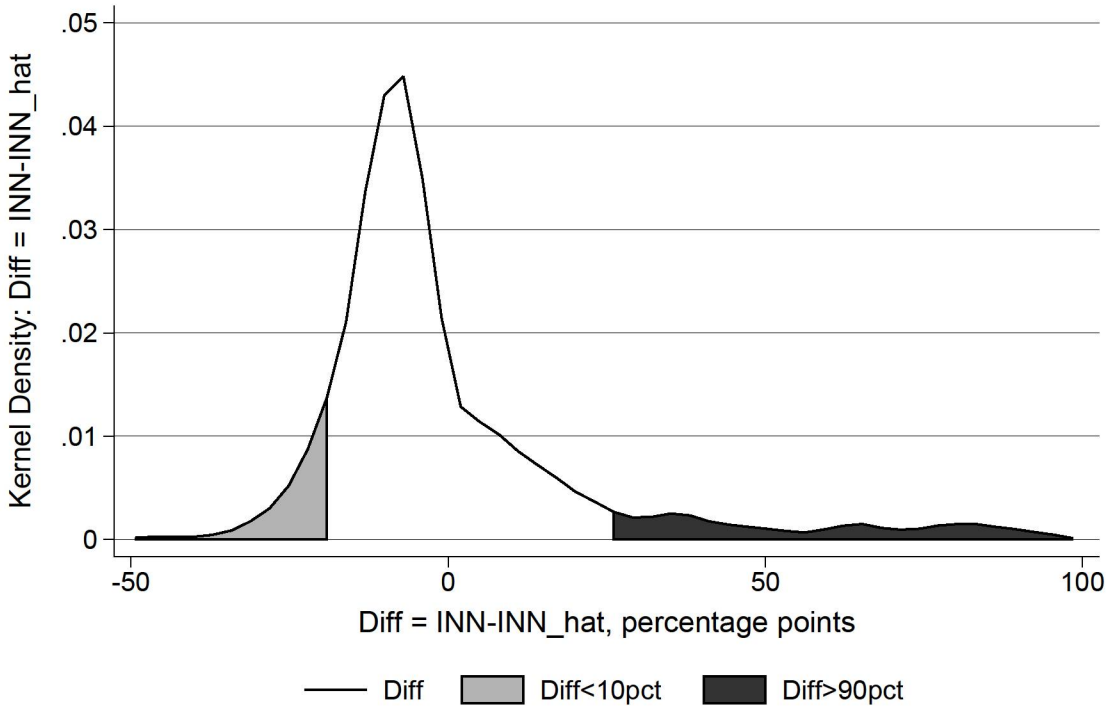

Figure 1.2: Kernel density of the $DIFF_{it}$ distribution and the top/bottom deciles

O.2	In fiscal year **2007,** what percent of this establishment's annual sales was accounted for by products or services that were introduced in the last three years?

	Percent
Percent of annual sales accounted for by new products or services	ECAo2 %
Don't know (spontaneous)	-9

Figure 1.3: BEEPS questionnaire: $INNOV_{it}$ variable

large (more than 99 employees). For stratification purposes, the number of employees was defined on the basis of reported permanent full-time workers. This seems to be an appropriate definition of the labor force, since seasonal/casual/part-time employment is not a common practice, except in the sectors of construction.

Survey non-response was addressed by maximizing efforts to contact establishments that were initially selected for interviews. Up to 4 attempts were made to contact an establishment for interview at different times/days of the week before a replacement establishment (with similar strata characteristics) was suggested for interview. Survey non-response did occur, but substitutions were made in order to potentially achieve strata-specific goals.

The surveys were implemented following a two-stage procedure. In the first stage, a screener questionnaire was applied over the phone to determine eligibility and to make appointments; in the second stage, a face-to-face interview took place with the Manager/Owner/Director of each establishment.

1.A.3 FCS dataset methodology

The Financial Crisis Survey (FCS), an initiative of the Private Sector Development Vice-Presidency of the World Bank Group, provides a quick, short, and cost-efficient evaluation of the impact of the 2008 global financial crisis on private companies in European and Central Asian countries.

For this study, researchers contacted the same companies interviewed in 2008-2009 Business Environment and Enterprise Performance Surveys (BEEPS), also referred to as 2008-2009 Enterprise Surveys (ES). Manufacturing and services private sector establishments were surveyed for 2008-2009 BEEPS. The original data also served as a baseline for comparisons because it referred mostly to fiscal year 2007, thus measuring the pre-crisis scenario.

The Financial Crisis Survey was designed to follow up the same firms every six months

during the financial crisis. The first round of FCS took place in June-July 2009, the second wave in February-March 2010, and the third round was implemented in June-July 2010. Six countries - Bulgaria, Hungary, Latvia, Lithuania, Romania, and Turkey - participated in all three waves. Companies from Kazakhstan were surveyed only in the second round.

Universe: The manufacturing sector was the primary business sector of interest [ISIC Rev.3.1: 15-37]. Formal (registered) companies were targeted for interviews. Firms with 100% government ownership were excluded.

Units of Analysis: The primary sampling unit of the study was the establishment. An establishment is a physical location where business is carried out and where industrial operations take place or services are provided. A firm may be composed of one or more establishments. For example, a brewery may have several bottling plants and several establishments for distribution. For the purposes of this survey an establishment must make its own financial decisions and have its own financial statements separate from those of the firm. An establishment must also have its own management and control over its payroll.

Data collection mode: Computer Assisted Telephone Interview.

1. *Bulgaria:* For the Bulgaria Enterprise Survey 2009, the sample was selected using stratified random sampling. Three levels of stratification were used in this country: industry, establishment size, and region. Industry stratification was designed as follows: the universe was stratified into 23 manufacturing industries, 2 services industries (retail and IT), and one residual sector. Each sector had a target of 90 interviews. Regional stratification was defined in six regions. These regions are Severozapaden, Severen Tsentralen, Severoiztochen, Yugozapaden, Yuzhen Tsentralen and Yugoiztochen.

   (a) I, II, III wave: 288 establishments that participated in the Bulgaria Enterprise Survey 2009 were contacted for The Financial Crisis Survey. The implementing contractor received directions that the final achieved sample should include at least 150 establishments.

2. *Hungary:* For the Hungary Enterprise Survey 2009, the sample was selected using stratified random sampling. Three levels of stratification were used in this country: industry, establishment size, and region. Industry stratification was designed as follows: the universe was stratified into 23 manufacturing industries, 2 services

industries (retail and IT), and one residual sector. Each sector had a target of 90 interviews. Regional stratification was defined in three regions. These regions are Central Hungary, West Hungary and East Hungary.

(a) I, II, III wave: 291 establishments that participated in the Hungary Enterprise Survey 2009 were contacted for The Financial Crisis Survey. The implementing contractor received directions that the final achieved sample should include at least 150 establishments.

3. *Kazakhstan:* The sample for the Kazakhstan Enterprise Survey 2009 was selected using stratified random sampling. Three levels of stratification were used: industry, establishment size, and oblast (region). Industry stratification was designed as follows: the universe was stratified into 23 manufacturing industries, 2 services industries (retail and IT), and one residual sector. Each sector had a target of 177 interviews. Regional stratification was defined in five regions. These regions are North, West, East, South, and Central.

(a) I, II, III wave: 544 establishments that participated in the Kazakhstan Enterprise Survey 2009 were contacted for The Financial Crisis Survey.

4. *Latvia:* For the Latvia Enterprise Survey 2009, the sample was selected using stratified random sampling. Three levels of stratification were used in this country: industry, establishment size, and region. Industry stratification was designed as follows: the universe was stratified into manufacturing industries, services industries, and one residual (core) sector. Each industry had a target of 90 interviews. For the core industries sample sizes were inflated by about 2% to account for potential non-response cases when requesting sensitive financial data and also because of likely attrition in future surveys that would affect the construction of a panel. Regional stratification was defined in 6 regions. These regions are Riga, Pieriga, Vidzeme, Kurzeme, Zemgale, and Latgale.

(a) I, II, III wave: 271 establishments that participated in the Latvia Enterprise Survey 2009 were contacted for The Financial Crisis Survey. The implementing contractor received directions that the final achieved sample should include at least 120 establishments.

5. *Lithuania:* For the Lithuania Enterprise Survey 2009, the sample was selected using stratified random sampling. Three levels of stratification were used in this country: industry, establishment size, and region. Industry stratification was designed as follows: the universe was stratified into manufacturing industries, services industries, and one residual (core) sector. Each industry had a target of 90 interviews. Regional stratification was defined in 4 regions. These regions are Coast and West, North East, South West and Vilniaus.

   (a) I, II, III wave: 276 establishments that participated in the Lithuania Enterprise Survey 2009 were contacted for The Financial Crisis Survey. The implementing contractor received directions that the final achieved sample should include at least 120 establishments

6. *Romania:* For the Romania Enterprise Survey 2009, the sample was selected using stratified random sampling. Three levels of stratification were used in this country: industry, establishment size, and region. Industry stratification was as follows: the universe was stratified into 23 manufacturing industries, 2 services industries (retail and IT), and one residual sector. Each group of sectors had a target of 180 interviews. Regional stratification was defined in eight regions. These regions are Nord-Est, Sud-Est, Sud, Vest, Nord-Vest, Bucuresti, Sud-Vest, and Centru.

   (a) I wave: 541 establishments that participated in the Romania Enterprise Survey 2009 were contacted for The Financial Crisis Survey. The implementing contractor received directions that the final achieved sample should include at least 360 establishments.

   (b) II and III wave: 536 establishments that participated in the Romania Enterprise Survey 2009 were contacted for The Financial Crisis Survey. The implementing contractor received directions that the final achieved sample should include at least 360 establishments.

7. *Turkey:* Stratified random sampling was used in the Turkey Enterprise Survey 2008. Three levels of stratification were implemented: industry, establishment size, and oblast (region). For industry stratification, the universe was divided into 5 manufacturing industries, 1 services industry (retail), and two residual sectors. Each manufacturing industry had a target of 160 interviews. The services industry and the two residual sectors had a target of 120 interviews. For the manufacturing

industries sample sizes were inflated by about 33% to account for potential non-response cases when requesting sensitive financial data and also because of likely attrition in future surveys that would affect the construction of a panel. Regional stratification was defined in 5 regions. These regions are Marmara, Aegean, South, Central Anatolia and Black Sea-Eastern.

(a) I wave: Researchers contacted 860 manufacturing companies interviewed in the Turkey Enterprise Survey 2008. 514 establishments completed the questionnaire.

(b) II and III wave: 1152 establishments that participated in the Turkey Enterprise Survey 2008 were contacted for The Financial Crisis Survey. The implementing contractor received directions that the final achieved sample should include at least 650 establishments.

Chapter 2

The impact of management quality on the innovation performance of firms in emerging countries

[1]

2.1 Introduction

Recent empirical studies have revealed a positive connection between management quality and innovation in a number of developed countries (Kremp and Mairesse 2004; Bloom et al. 2014a). However, the question of what types of individual management practices are especially important for innovation input and which types impact innovation output is still open. It is also not clear whether the effects of management quality hold for emerging countries. This paper helps to close this gap. We study how differences in overall management quality and the quality of management practices affect the decisions of firms to invest in innovation input, i.e. to start searching for new solutions (R&D propensity), to accelerate their efforts (R&D intensity) and, eventually, to generate innovation output, i.e. introduce innovative products.

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There are two main mechanisms that connect management quality and innovation output on one hand and management quality and innovation input, on the other. First, there is a direct influence of management on innovation output through the individual components of organizational and management processes. These processes support new technologies, new ideas, learning, solving problems, achieving results, aligning corporate goals and others. We can proxy a number of these individual components with relevant management practices that provide incentives, monitor performance, support long-term goals through targeting and help to improve production with operation management.

Second, there is an indirect connection between management and innovation input, such as R&D propensity and efforts. In other words, firms with better management practices, which help them to produce and commercialize products, are more likely to start and boost innovation in the first place.

We confirm that in the Eastern European (EE) and Commonwealth of Independent States (CIS) countries, management quality is positively connected to both innovation input and output. We also find that the quality of incentives and monitoring practices plays an important role in starting innovations and boosting innovation efforts, while only the quality of incentive practices is associated with better product innovations.

2.2 Literature review

Management literature has established a connection between management and firms' innovation. Scholars consider management one of the components of organizational capabilities that allow firms to achieve innovation successes. Teece (1986) points out the importance of complementary assets and capabilities as pre-requisites for successful product innovation and subsequent new product commercialization. The author highlights the role of capabilities in the production of new products and in the extraction of rents from innovation. Teece also suggests that the availability of these complementary assets and capabilities is crucial for promoting innovation efforts. Hayes, Wheelwright, and Clark (1988) argue that innovation depends on understanding production and management processes specifically, as better understanding these processes is associated with innovation success. Teece and Pisano (1994) point out that if firms aim to support innovations, they need to re-structure their organizational and managerial processes to promote new technologies.

Researchers point out that individual management practices, such as inputs manage-

ment, knowledge management, strategic management, organizational culture, and others are essential for innovative firms (see Adams, Bessant, and Phelps 2006 for an in-depth review of different management measures). Teece and Pisano (1994) suggest several components of organizational and managerial processes which are important for our analysis. The authors point out that learning helps firms to achieve tasks related to innovation.[2] Learning practices can facilitate problem solving in product production and operations. These practices can be influential, supporting the introduction and production of new products, especially in cases of radical innovations. Teece and Pisano (1994) also argue that organizational processes provide incentives, connecting individual or team behavior to innovation and rewarding high performance. As a result, we should expect a strong empirical connection between incentive management and innovations.

In cases where a performance reward system is established, we should also find a connection between management practices that monitor individual and team performance and innovation output. Griffin and Hauser (1996) point out that innovation processes (R&D efforts) are optimal when focused on long-term goals and that different functional departments work well if they have similar objectives. As a result, management practices supporting long-term goals could be beneficial to a firm's innovation success.

Empirical research on individual innovation management practices is a challenging task and scholars often focus on their presence (adoption) and quantifiable outcomes. Studying the quality and connections between different practices is important, but particularly difficult because of their complex qualitative nature: improvement of individual management practices is itself an exploratory development which influences firms' innovation performance (Birkinshaw, Hamel, and Mol 2008). Scholars analyze organizational and managerial factors that influence new product development both from a theoretical perspective (see Montoya-Weiss and Calantone 1994 and Van der Panne, van Beers, and Kleinknecht 2003 for relevant reviews) and in relation to individual firms (see Helper and Henderson 2014 for a discussion of management practices in General Motors and Liker 2004 in Toyota). These factors usually include management characteristics, such as management style, workforce management, performance management and others.

New management practices can be developed by innovating firms or adopted from a large pool of existing innovations (Mol and Birkinshaw 2009; Walker, Damanpour, and

[2]Continuous improvement, as well as Just-in-Time and Total Quality Control systems are examples of learning practices which have helped Japanese carmakers to achieve advantages in product development over their American and European competitors (Clark and Fujimoto 1989; Liker 2004)

Devece 2010). For example, (Hamel 2006) and his colleagues identified 175 innovative management practices in the 20th century, such as scientific management (time and motion studies), cost accounting and variance analysis and many others. Firms can also improve the quality of existing management practices to achieve higher performance results (Schweiger and Friebel 2013).

There is a set of management practices that have been shown to be beneficial for a firm's performance, such as quality and environmental certification (Bloom and Reenen 2006). Kim, Kumar, and Kumar (2012) show that quality management has both direct and indirect positive effects on different types of innovations. Bloom et al. (2014a) and Bloom et al. (2014b) found a positive connection between management quality, based on individual practices, and innovation input (R&D) and output (patenting) using two different large-scale management surveys. Makri, Lane, and Gomez-Mejia (2006) find that CEO incentives are tightly linked to desirable innovation outputs (both in quantitative and qualitative terms) for firms that are actively innovating. Moreover, they find that incentives that explicitly rely on the desired innovation outcomes help firms to achieve better market performance. Lerner and Wulf (2007), who confirm a positive relationship between long-term compensation plans for R&D managers and innovation output, also support this result. They also find no relationship between long-term incentives for other executives who are not directly involved in innovation and innovation output.

The effects of different management practices may vary in firm, industry and country characteristics. For example, innovative industries focus more on people management, motivation and incentives, while capital-intensive industries pay attention to monitoring and targeting (Bloom et al. 2014b). Bloom, Schweiger, and Van Reenen (2012) found that the positive effects of management quality on firms' performance hold for emerging countries.

Further studies are necessary to confirm whether the quality of individual management practices have sizable effects on innovation input and product innovation in emerging countries, once we control for other conditions traditionally considered in the empirical literature on this topic, such as technological capabilities, opportunities, trajectories and others (Trott 2008).

The structure of the paper is as follows. Section 3 outlines the empirical model. Section 4 describes the dataset, key management measures and data patterns. Section 5 presents empirical results and prospects for future research. Section 6 provides concluding remarks.

2.3 Model

The empirical model to be estimated is as follows:

$$R\&D_{ic} = \alpha_1 l_{ic} + \beta_1 k_{ic} + \gamma_1 M_i + \delta_1 Z_{ic} + u_{1ic} \quad (2.1)$$

$$y_{ic} = \alpha_2 l_{ic} + \beta_2 k_{ic} + \gamma_2 M_i + \delta_3 Z_{ic} + \theta_2 R\&D_{ic} + u_{2ic} \quad (2.2)$$

where $R\&D_{ic}$ – is a measure of innovation input (R&D spending per employee) and y_{ic} output (new products introduced) of firm i in country c, l_{ic} – the logarithm of labor, k_{ic} – the logarithm of capital; M_i – the measure of management quality (aggregate quality of management and four different management practices); Z_{ic} - other control variables which affect innovation, such as workforce characteristics (share of employees with university degrees and the average weekly hours worked), firm characteristics (firm age and whether it is listed on a national or international market), a set of two-digit industry, country and year dummies in which interviews were conducted (2008, 2009, 2010). See Table 2.6 - Table 2.10 of the Appendix for a complete set of variables with summary statistics. u_{1ic}, u_{2ic} - error terms.

We use two model specifications:

1. We include only an aggregate measure of the management quality to test whether this variable is connected to different measures of innovation input and output.

2. We include quality measures for four individual management practices (operations, monitoring, targeting, incentives) to test their effects on innovation measures.

According to the design, model (1) is nested in model (2). We also provide formal tests, which compare different model specifications.

It is important to note that the analysis can reveal only conditional correlations. Although a causal relationship between management quality and innovation indicators is likely to exist, it is not possible to control for possible endogeneity and to measure precise causal effects. In the empirical specification, we use control variables presented in Table 2.3. We use a dummy variable for the EU to separate the fixed effects of European countries on innovation input and output variables (see Table 2.4 for a complete list of the Eastern European and CIS countries).

2.4 Data

An empirical study of the relationship between management and innovations is a challenging task because large cross-country surveys covering both topics in detail are scarce. Recently, there have been a number of attempts to improve data collection on innovation (Mairesse and Mohnen 2010). Community Innovation Surveys (CIS) have helped researchers to study the innovation activity of European firms and some non-member nations (Canada, USA, and others). Although CIS does not include questions related to management quality, they cover a number of questions about the introduction of new business practices (organizational innovation). There are a number of empirical studies based on CIS data (see, for example, Mol and Birkinshaw (2009) who analyzed drivers of management changes based on the UK Innovation Survey). In this study, we will focus on a unique survey which contains data on management quality and innovation (input and output) in the context of emerging countries.

In October 2008 – November 2009, the European Bank for Reconstruction and Development (EBRD) and the World Bank conducted a Management, Organization and Innovation (MOI) Survey[3], based on recommendations from works by Bloom and Reenen (2006), and Bloom and Reenen (2010). Details on sampling methodology are presented in Appendix 2.A.3. The managers of about 1,400 firms from 10 emerging countries in the Eastern Europe and CIS countries (Belarus, Bulgaria, Kazakhstan, Lithuania, Poland, Romania, Russia, Serbia, Ukraine and Uzbekistan) were interviewed face-to-face. The organizers conducted the survey in the Russian Far East between February and April 2010. The survey focused mainly on production and operation activities, which include four groups of management practices: operations, monitoring, targeting and incentives. Up to now, MOI has remained one of the few datasets that allow researchers to study the relationships between management quality and innovation in emerging countries.

The data consists of information from manufacturing firms with between 10 and 5,500 employees. All monetary values have been converted to constant 2005 international US dollars. Original MOI data do not include financial information, however EBRD provided us with an additional dataset, in which completed MOI survey interviews are matched to balance sheets and income and loss statements from the Bureau Van Dijk's Orbis database (see Appendix 2.A.4 for details on merging). Based on the merged data, we

[3]EBRD-World Bank Management, Organization and Innovation (MOI) Survey dataset is available at http://www.ebrd.com/what-we-do/economic-research-and-data/data/moi.html

use the measure of physical capital (fixed assets per employee) and the firm's efficiency (return on total assets, ROTA), which are the factors influencing a firm's performance. As a result, they could be an important factor affecting innovation decisions (Crepon, Duguet, and Mairesse 1998; Mohnen and Hall 2014). Unfortunately, financial data are missing for some Orbis data, which leads to a sample reduction in the merged dataset by about 36%[4]. As a result, we will use financial variables for robustness checks and focus mainly on the full merged dataset.

An average firm in our sample has about 216 permanent full-time and part-time employees. Firm size is an essential parameter to control, as firms may benefit from economies of scale (Earl and Gault 2004; Huergo and Jaumandreu 2004). The average share of employees with higher education is 27.5%, which is a measure of human capital quality. Employees serve as an internal source of knowledge, which has a positive impact on innovation outcomes (Dakhli and Clercq 2004; Elche-Hotelano 2011). Further, we control for the firm's age (an average firm in the dataset is 32 years old), as newer firms tend to be more innovative (Huergo and Jaumandreu 2004). Further, we control for the firm's legal status, as successful innovation may benefit from stable share-holding arrangements, which can provide incentives for top management and effectively delegate monitoring (Soskice 1997). About 26% of the firms in our sample are share-holding companies with shares traded on the national or international stock markets. About 8% have foreign firms or individuals as their largest owners.

Foreign-owned firms can often have lower innovation costs and higher R&D efforts due to better access to new technologies, lower costs of financing and better organizational practices (Guadalupe, Kuzmina, and Thomas 2012). In addition, we control whether firms have a high-speed internet connection at their premises, as one of the measures of technological capability (Kim 1997). Other variables include weekly working hours of permanent full-time employees to control for effectiveness of human resource management (Laursen and Foss 2003). We also control for firm location (whether a firm is located in a capital city) as geographical concentration is linked to knowledge externalities and availability of skilled labor, and therefore to innovation propensity (Audretsch and Feldman 1996). As market environment can be an important innovation driver, therefore we account for market competition with imports from abroad.

[4]As described in the Appendix 2.A.4, Orbis database was used as a sample frame, but if the source was not available or of poor quality, official sample frames were used without financial performance information.

We examine innovation input and output in terms of:

1. Decisions of firms to engage in R&D (i.e. whether a firm has invested in R&D). In our sample about 38% of firms invested in R&D in the last complete fiscal year of the study.

2. Decisions of firms to accelerate research efforts - R&D intensity (R&D spending per employee). Among the firms that engaged in R&D, the average amount invested was about USD 400 of constant USD 2005 per employee) in the last complete fiscal year of the study.

3. Innovation output as new products introduced over the last three years of the study (a binary variable). In our sample, on average about 70.8% of firms introduced new products over last 3 years. This share is higher for firms that invested in R&D research (92.0%), than those which did not (57.9%). The difference in the means of these groups is significantly different from zero according to the two-sample t-test with equal variances (t = -11.3, 830 d.o.f.).

Following Bloom and Reenen (2006) and Bloom, Schweiger, and Van Reenen (2012) we group questions into four main categories: operations (one question), monitoring (seven questions), targets (one question) and incentives (three questions). The operations question aims to answer how firms deal with process problems. Monitoring questions reveal the use of production performance indicators. The target questions cover the setting of time targets. Incentives questions are related to employee reward, promotion and dealing with poor performance.

The survey includes mainly closed questions. With regard to monitoring, we drop one question, as it has a substantial share of missing values. The questionnaire was tested in two pilot surveys in the USA and Ukraine, and in the UK before implementation in the MOI survey. The questions included in the analysis are presented in Appendix 1. Although in general the definition of "good" and "bad" practice can be subjective and may differ by countries, Nicholas Bloom and John Van Reenen, the organizers of the MOI survey, focus on practices which have a straightforward meaning, so that the quality of each practice can be revealed based on responses to the survey.[5] Following

[5]For example, for *Incentives* question R.7 "How do you reward this establishment's production target achievement?", management score and the quality of practice increases from "There are no rewards" (score = 1), to "Only top and middle management is rewarded" (score = 2) and finally "All staff is rewarded" (score = 0). Other questions follow a similar logic; nevertheless, one might possibly think of other score combinations for quality increase.

the suggestions of Bloom, Schweiger, and Van Reenen (2012) for the MOI survey, we assign scores to responses for each management question such that a higher score means higher quality of the management practice analyzed. Although this assignment might look somewhat subjective, survey organizers tried to formulate the questions so that the answers could be ranked, and we follow their recommendations. Further, we calculate z-scores by normalizing scores for each question to mean zero and standard deviation one[6]. Normalization is a necessary step, because each question could have a different number of answers, and thus, we would need to normalize answers in order to make them comparable:

$$z_{m_i} = \frac{m_i - \bar{m}_i}{\sigma_{m_i}} \tag{2.3}$$

where z_{m_i} is the z-score of a question m_i in firm i, $\bar{m}_i$ is an unweighted average of a respective question across all countries; σ_{m_i} is a standard deviation of a question across all countries.

Second, the z-scores were combined into management practices as a non-weighted average, thus we want to aggregate relevant questions into four distinctive groups:

$$\bar{m}_{i,P} = \frac{1}{n_{m_{i,P}}} \sum_{m \in P} z_{m_i} \tag{2.4}$$

where $\bar{m}_{i,P}$ is the unweighted average of questions, belonging to one of four management practices P (operations, monitoring, targets or incentives) in firm i; $n_{m_{i,P}}$ denotes number of observations.

Further, we construct an aggregate measure of the management quality as a non-weighted average of all four practices as our aim is to have one measure of management quality instead of four. In this case, all management practices have an equal contribution to this final measure.

$$\tilde{M}_i = \frac{1}{4}(\bar{m}_{i,operations} + \bar{m}_{i,monitoring} + \bar{m}_{i,targets} + \bar{m}_{i,incentives}) \tag{2.5}$$

Finally, we calculate the z-scores for $\tilde{M}_i$ to compare management practices across firms. If the value of the z-score is positive, it indicates management practice above average

[6]This is a standard way to calculate aggregate measures of management quality, widely used in other surveys, such as Management and Organizational Practices Survey (MOPS) and World Management Survey (WMS). There could be other approaches.

("good" practice); the opposite is true for negative values ("bad" practice).

$$z_{\tilde{M}_i} = M_i = \frac{\tilde{M}_i - \bar{\tilde{M}}_i}{\sigma_{\tilde{M}_i}} \tag{2.6}$$

Essential summary statistics for the z-scores (aggregate and by different practices), country dummies, year dummies, two-digit industries dummies as well as other variables in the dataset, which we describe further on, are presented in Tables 2.6–2.10 of the appendix. Comparison of the aggregate management z-scores across the surveyed countries is presented in Figure 2.1.

As expected, most EU countries take higher values of the aggregate management z-scores than CIS countries. Surprisingly, Ukraine shows above average management quality and Lithuania is below average. Uzbekistan and Kazakhstan have the worst management score of all surveyed countries. For example, in EU countries the mean z-score is 0.168 (median = 0.270), while for CIS countries the average z-score is -0.113 (median = -0.001). The difference in means is different from zero at a 1% level (t=-3.71). Therefore, in EU countries variations in management quality might have different effects than in CIS countries, which have relatively poorer management. We would like to study these differences in our analysis.

The diffusion of four management practices by firm size (small, medium, large, extra-large business) is depicted in Figure 2.2. We see that, in general, management practices are positively connected to firm size. For very small firms, formal management practices are of lesser importance. As the size increases, it becomes more difficult for managers to have direct influence on day-to-day production processes, communication with external sources, innovation activities and other tasks. As a result, managers must rely on formal practices to manage the growing firm. This finding is in line with existing literature (Bloom et al. 2014a; Kremp and Mairesse 2004; Earl and Gault 2004).

The diffusion of four management practices by R&D propensity (No – do not invest in R&D; Yes – invest in R&D) and by the introduction of new products (No – no new products are introduced, Yes – new products are introduced) are presented in Figure 2.3. The chart suggests a positive connection between the quality of individual management practices and the decision of firms to invest in R&D as well as innovation output in terms of new products introduced, across all management practices. We see that firms which invest in R&D and introduce product innovations have higher quality management practices. This observation is in line with Kremp and Mairesse's (2004) findings for

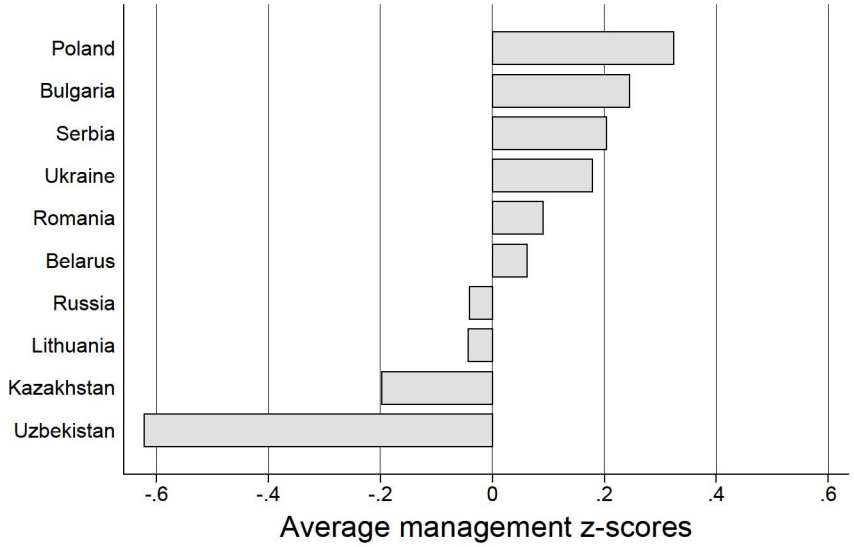


Figure 2.1: Management scores across countries by average management z-score

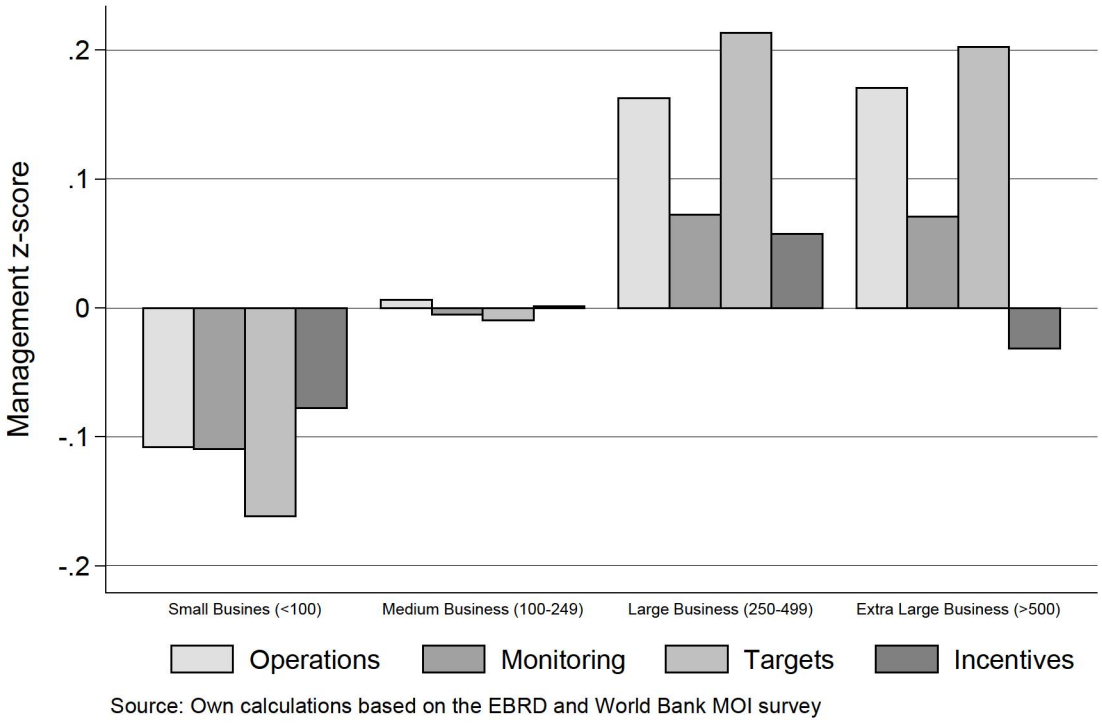


Figure 2.2: Diffusion of management practices by firm size

French manufacturing firms. As a result, our data contains explicit patterns connecting management quality and innovation, which we would like to study in detail using an empirical model, described in the previous section.

2.5 Results

In this section, we present our findings of how management quality affects innovation for two basic specifications: aggregate management quality (models 1.1, 1.2, 3) and quality of individual management practices (models 2.1, 2.2, 4) in Table 2.1.[7] Table 2.1 presents raw effects for R&D propensity, R&D intensity, combined in a two-part model, and the introduction of new products. The two-part model estimates the effects on R&D propensity and intensity using different underlying processes – logit for propensity equation, for the intensity equation – a generalized linear model (GLM) with logarithm of dependent variable for values greater than zero.

We find that R&D propensity strongly increases with the aggregate measure of management quality (model 1.1), although the effect of R&D intensity is not statistically significant. That is, if the management z-score grows from the 25 percentile to the median value (which is equivalent to an increase in z-score from -0.67 to 0.12), the probability of positive R&D spending increases by 3.3 percentage points (see Table 2.2, Model 1.1). At the same time, the combined expected value of positive R&D spending increases by 2.3 percentage points A pairwise comparison of the estimated marginal z-scores at 25 percentile and the median is statistically significant at a 1% significance level. If we keep in mind that the normalized z-scores of aggregate management quality range from roughly -4.0 to 2.0 for all firms in the data sample, the result is quite strong.

It is worth noting that EE countries have on average a higher level of both R&D propensity and intensity. Figure 2.4 (left chart) demonstrates the changes in the predicted probability of R&D with different levels of management quality for the EE and CIS countries. We have also tried specifications with an interaction term between region and management quality to determine whether the change in management is associated with

[7] After initial evaluation of statistical significance for *fixed assets per employee* and *ROTA*, we find that these variables are insignificant in innovation propensity and intensity equations, which is in line with the findings of Kremp and Mairesse (2004). As in their case, coefficients are similar when we both include and exclude these variables; at the same time, the effects of management are less significant and lower. In the final estimation, we exclude *fixed assets per employee* and *ROTA* variables relying on a more parsimonious model and a larger sample. The estimates with *fixed assets per employee* and *ROTA* variables are available from the author upon request.

Table 2.1: Regression: R&D, R&D Intensity, New products introduced

	TPM (R&D spen.)		TPM (R&D spen.)		Logit (New prod.)	
	(1.1)	(1.2)	(2.1)	(2.2)	(3)	(4)
Management z-score	0.249**	0.075			0.203	
	(0.097)	(0.058)			(0.128)	
Operations z-score			−0.033	−0.001		0.110
			(0.111)	(0.076)		(0.140)
Incentives z-score			0.376**	−0.059		0.029
			(0.159)	(0.089)		(0.213)
Targeting z-score			−0.019	0.122**		−0.043
			(0.097)	(0.061)		(0.142)
Monitoring z-score			0.464***	0.036		0.453**
			(0.171)	(0.113)		(0.209)
EU	0.905**	0.363	0.944**	0.289	0.652	0.785
	(0.442)	(0.258)	(0.447)	(0.256)	(0.966)	(0.990)
Ln(Labour)	0.268**	−0.082	0.289**	−0.091*	0.312*	0.318*
	(0.129)	(0.057)	(0.132)	(0.055)	(0.173)	(0.175)
ln(R&D spen.)					5.987	5.905
					(3.880)	(3.844)
Country and Industry FE	Yes		Yes		Yes	Yes
Pseudo R^2	0.113		0.126		0.165	0.173
Prob> Chi^2	<0.001		<0.001		0.036	0.052
Observations	699	177	699	177	387	387

Standard errors in parentheses
Source: Author's calculations based on the EBRD and World Bank MOI survey
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2.2: Parewise comparison at 25th percentile (mgmz) and median(mgmz)

	b	se	z	p
Model (1.1). R&D propensity				
1. Management z-score (25th percentile)	0.195	0.019	10.24	< 0.001
2. Management z-score (median)	0.2278	0.018	12.84	< 0.001
Pairwise comparison 1. & 2.	0.033	0.012	2.65	0.008
Model (1.1-1.2 combined). R&D spending				
1. Management z-score (25th percentile)	0.057	0.013	4.32	0.000
2. Management z-score (median)	0.061	0.014	5.65	0.000
Pairwise comparison 1. & 2.	0.023	0.011	2.21	0.027
Model (3). New product				
1. Management z-score (25th percentile)	0.728	0.057	12.87	< 0.001
2. Management z-score (median)	0.759	0.051	14.94	< 0.001
Pairwise comparison 1. & 2.	0.031	0.020	1.53	0.126

different R&D probability for the two regions. The results indicate that this term was not statistically significant in any specification, therefore we do not include it in the final models.

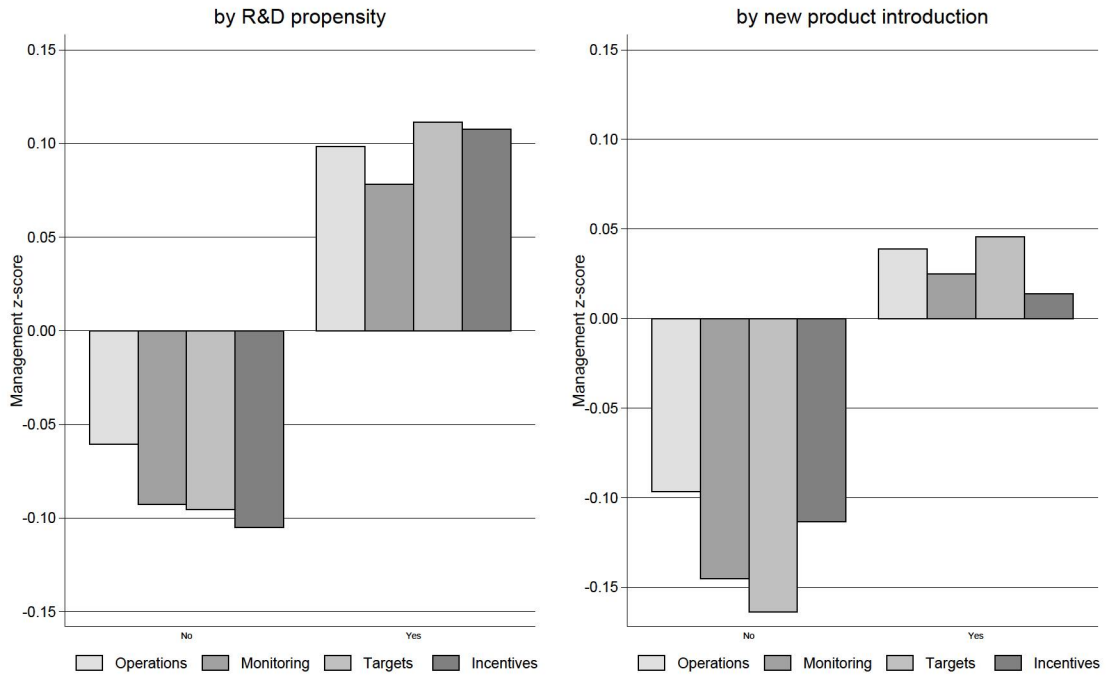
Among individual practices (model 2 of Table 2.1) the quality of monitoring and incentives have strong positive effects, as expected. At the same time, the quality of operations and targeting practices have no statistically significant effects on R&D propensity. In our dataset, operations and targeting have the least variation among all management practices, as each of them has only one underlying question, and, as a result, they depend heavily on exact wording. As discussed above, we expect that firms which effectively work on solutions to production problems are more likely to become innovators. The operation question in the MOI survey focuses on the general handling of a wide range of problems in production processes (i.e. machinery breakdown, human error, etc.; see Appendix 2.A.2 for further details). Although responses to this question could provide a good approximation of how firms solve operational problems, in fact 97.1% of answers (810 of 834) concentrate in two scores with the highest quality out of four. In both cases firms "fix it [problem] and take measures to ensure that it does not happen again". The difference in answers for these two scores comes from the "availability of a continuous improvement process to anticipate problems". As a result, the actual variation in answers might not be sufficient to reveal the quality of operation practices and their connection to innovation processes.

As in the case of operations management practices, the model shows that target practices have no statistically significant effects on R&D propensity, but it is the only group of practices, which matters for R&D intensity. Although the survey question relates to the "production targets for its main product", it could be a good approximation of a corporate goal-setting strategy. Further studies are necessary to confirm whether this result persists.

For both model specifications, we find that firm size, quality of human capital, the quality of information technology and business practices (measured by the availability of high-speed internet connection on a firm's premises) and market pressure from imports are positively associated with R&D propensity.

A formal Likelihood Ratio specification test suggests that we can reject this hypothesis at a 5% significance level, and thus, model (2) is preferred (see Table 2.3).

The combined expected value of R&D spending for different values of management quality is depicted in Figure 3 (middle chart). The overall result is consistent with a recent



Source: Own calculations based on the EBRD and World Bank MOI survey

Figure 2.3: Diffusion of management practices by R&D propensity and new product introduction

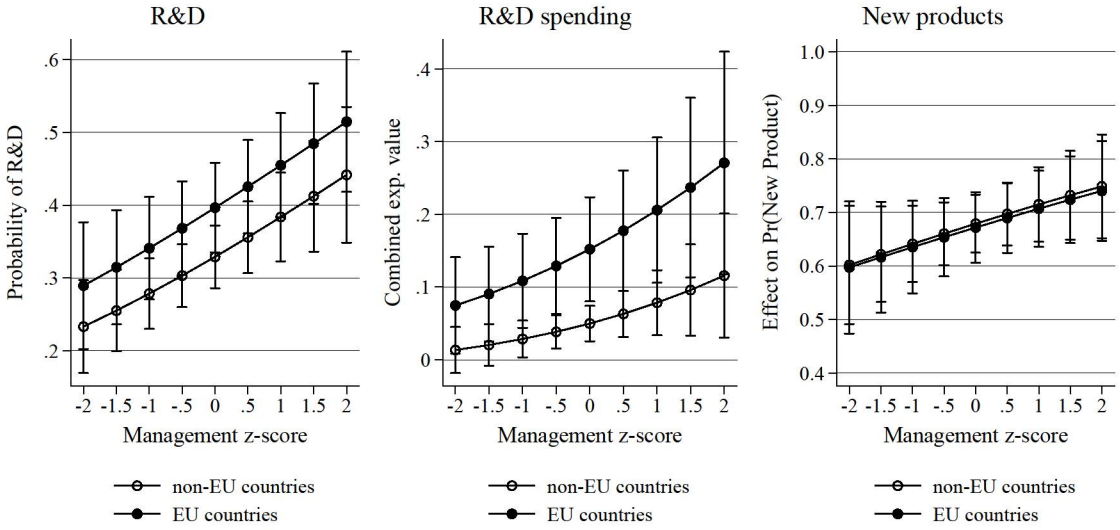


Figure 2.4: Predicted values of R&D propensity and R&D intensity for different management z-score values

study by Bloom et al. (2014a) based on a survey of about 30,000 US plants, in which the authors suggest that establishments with higher management scores show significantly higher innovation activity measured by R&D spending per employee.

Among individual practices (model 2.1 of Tables 2.1) the quality of monitoring and incentives have strong positive effects in the R&D propensity model, as expected. At the same time, the quality of targeting practices is statistically significant in the model for R&D intensity (model 2.2 of Tables 2.1). It is likely that the incentive component

Table 2.3: Specification tests for exclusion of four individual management practices

	N	*LRtest*	*AIC*	*BIC*
Model (1.1–1.2) R&D (constrained)	699			1486.68
Model (2.1–2.2) R&D (unconstrained)	699	14.22*		1512.75
Model (3) New product (constrained)	387		466.52	585.27
Model (4) New product (unconstrained)	387	3.60	468.93	599.55

plays an important role, as the complexity of innovation process requires a different set of incentives than in the production process. In the MOI survey, incentives management has a wide definition and can be applied to business processes in general. Kremp and Mairesse (2004), for example, use a different set of questions to define knowledge management practices. One of these practices (incentive policy to retain employees), can be, in a wide sense, considered incentives management. The authors find that incentives have significant positive effects on both innovation propensity and intensity. Other management practices are not statistically significant from zero, indicating that they may play a more limited role in decisions about the amounts firms are willing to spend on R&D.

A formal Likelihood Ratio specification test suggests that we can reject this hypothesis at a 5% significance level, and thus, model (2) is weakly preferred (see Table 2.3). In the next step, we consider whether management quality is associated with better innovation output: whether new products are introduced. We estimate the models by logit regression and present the results in Table 2.1 (models 3 and 4). The effect of the aggregate management quality (model 3) is statistically insignificant at a 5% level. If we look at Figure 2.4 (right chart), which depicts the predictive margin of innovation output for different values of management quality, it suggests that although management quality positively affects the probability of new product introduction, increasing management quality is marginal and there is no difference between the EE and CIS countries.

If we look at individual management practices (model 6), we find that only monitoring management quality has a statistically significant effect (at a 5% significance level), while

the coefficients of other management practices are not significant.

A Likelihood Ratio specification test (see Table 2.3) cannot reject the hypothesis that model (4) is nested in model (3). Therefore, adding the quality of individual management practices as predictor variables does not lead to an improvement in the model fit. We find that in all specifications, R&D spending and market pressure from imports play a sizable positive role, and the coefficient is statistically significant at the 10% and 5% levels, respectively. This result confirms earlier findings of the importance of R&D and perceived market competition for innovation output (Kremp and Mairesse 2004; Mohnen, P. and Dagenais, M. 2002; Mohnen, Mairesse, and Dagenais 2006).

Although we expected that the quality of all management practices would play an important role for new product introduction in emerging countries, we did not find support for this hypothesis in the empirical results. This result calls for further empirical research:

1. Can this result be confirmed for emerging countries if a stricter definition of management quality practices is applied?

2. Does this result hold for developed countries? A comparative study would allow us to find out of whether business environment factors intensify or weaken the positive effects of management quality.

3. Can the effects of individual management practice quality on innovation output be indirect – through the innovation input? This hypothesis would be consistent with the findings of Cantner and Joel (2007) that the direct effects of knowledge management on innovation success are not significant, while the indirect impact through innovation input and cooperation is sizable.

4. Is it possible to confirm a causal relationship between the improvement of management quality and innovation?

2.5.1 Industry z-score normalization

It is possible to argue that measures of management quality might differ across manufacturing sectors. For example, the management quality achieved by top firms in certain sectors might be considered mediocre in others. The differences in management z-scores by industries on average are not substantial at maximum values (i.e. 'best' management

quality), but are striking in terms of minimum values (i.e. 'worst' management quality). Some sectors, such as electronics, have relatively higher values. We would like to account for these differences and normalize scores by firms in each sector (2-digit code) separately. Estimation results in Table 2.4 show that the main conclusions, described

Table 2.4: Regression: Management quality, normalized by industries

	TPM (R&D spen.		TPM (R&D spen.)		Logit (New prod.)	
	(5.1)	(5.2)	(6.1)	(6.2)	(7)	(8)
Management z-score	0.252***	0.067			0.215*	
	(0.097)	(0.059)			(0.127)	
Operations z-score			−0.031	−0.006		0.113
			(0.110)	(0.076)		(0.141)
Incentives z-score			0.401**	−0.065		0.036
			(0.157)	(0.088)		(0.212)
Targeting z-score			−0.019	0.121**		−0.041
			(0.097)	(0.061)		(0.140)
Monitoring z-score			0.445***	0.035		0.438**
			(0.171)	(0.113)		(0.205)
EU	0.908**	0.365	0.945**	0.292	0.653	0.776
	(0.442)	(0.258)	(0.447)	(0.256)	(0.961)	(0.987)
Ln(Labour)	0.267**	−0.081	0.289**	−0.090*	0.310*	0.317*
	(0.129)	(0.056)	(0.132)	(0.055)	(0.173)	(0.175)
ln(R&D spenind)					5.986	5.910
					(3.874)	(3.852)
Country and Industry FE	Yes		Yes		Yes	Yes
Pseudo R^2	0.113		0.127		0.166	0.172
Prob> Chi^2	<0.001		<0.001		0.035	0.052
Observations	699	177	699	177	387	387

Standard errors in parentheses
Source: Author's calculations based on the EBRD and World Bank MOI survey
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

in detail in the previous section, hold both numerically and qualitatively when we take sector-specific characteristics of management quality into account. A possible advantage of accounting for industry differences is in the model (7), which studies the relationship between aggregate management quality and new product introduction. In this model the effect of management quality becomes significant at a 10% level and higher in size, as compared to the results in Table 2.1.

2.5.2 Quality asymmetry analysis

In this section we study asymmetries in the relationship between management quality, R&D and innovation output. For this purpose, we use a piecewise regression to determine whether low or high aggregate relative quality of management has a stronger connection

to innovation. As management quality M is the main variable of interest, we use splines to distinguish between below (low) and above (high) mean management quality. Results are presented in Table 2.5.

Table 2.5: Regression: Quality asymmetries

	TPM (R&D spen.)		TPM (R&D spen.)		Logit (New prod.)	
	(9.1)	(9.2)	(10.1)	(10.2)	(11)	(12)
Management z-score <0	0.513***	0.147			0.132	
	(0.178)	(0.110)			(0.233)	
Management z-score >0	−0.059	−0.003			0.338	
	(0.222)	(0.140)			(0.316)	
Operations z-score <0			0.335	−0.155		0.045
			(0.368)	(0.176)		(0.403)
Operations z-score >0			−0.575	0.181		0.232
			(0.551)	(0.279)		(0.620)
Incentives z-score <0			0.879***	0.413***		0.024
			(0.326)	(0.151)		(0.349)
Incentives z-score >0			−0.326	−0.699***		0.069
			(0.401)	(0.247)		(0.495)
Targeting z-score <0			0.295	0.173		0.145
			(0.241)	(0.134)		(0.349)
Targeting z-score >0			−0.290	0.071		−0.210
			(0.214)	(0.134)		(0.304)
Monitoring z-score <0			0.306	−0.051		0.411
			(0.236)	(0.162)		(0.289)
Monitoring z-score >0			0.648*	0.170		0.394
			(0.373)	(0.244)		(0.527)
EU	0.925**	0.376	0.982**	0.320	0.629	0.737
	(0.438)	(0.256)	(0.450)	(0.252)	(0.955)	(0.998)
Ln(Labour)	0.270**	−0.080	0.285**	−0.085	0.302*	0.309*
	(0.129)	(0.056)	(0.132)	(0.056)	(0.175)	(0.175)
ln(R&D spening)					6.019	5.794
					(3.863)	(3.785)
Country and Industry FE	Yes		Yes		Yes	Yes
Pseudo R^2	0.117		0.136		0.166	0.173
Prob> χ^2	<0.001		<0.001		0.040	0.100
Observations	699	177	699	177	387	387

Standard errors in parentheses
Source: Author's calculations based on the EBRD and World Bank MOI survey
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In most cases, a positive relationship between management quality and R&D holds only for firms with low quality management, and for this group the size of the effect is greater. At the same time, for firms with high management quality, the relationship is mixed and, in the case of incentives management, even negative (see models 9.1 - 10.2). If we look at the relationship between management quality and innovation output (models 11-12), the effect of management quality is statistically insignificant.

This result suggests that this relationship might be weak and could be sensitive to the

model specification and quality (z-score) interval under consideration. In general, asymmetry analysis shows that the relationship between management quality and innovation input is of high importance for firms with below average management quality, while firms with higher quality management might not enjoy innovation acceleration associated with better management.

2.6 Conclusion

This paper explicitly focuses on connections between the quality of aggregate management, individual management practices and innovation (input and output) in the Eastern European and CIS countries. The empirical analysis presented in the paper helps to explain whether management quality, associated with firms' operations, affects R&D propensity, R&D intensity and the introduction of new products. This study provides evidence that better aggregate management quality is associated with a higher propensity of firms to invest in R&D and while the effect on intensity of their R&D spending is not statistically significant. The effects of management quality on the introduction of new products are positive, this relationship is weak and the improvement of management quality is not directly related to a significant increase in the probability of new product introduction. As a result, although management quality does not guarantee the successful introduction of new products, it may have an indirect positive result through higher R&D propensity and intensity. The results hold after controlling for differences in management quality by industries. Quality asymmetry analysis strongly suggests that the relationship between management quality and innovation input is sizable for firms with low management quality, while for firms with high management quality it becomes statistically insignificant. The MOI survey has certain limitations, as it includes a limited set of questions for each management practice and does not provide a large coverage of developed economies for comparative analysis. Therefore, further studies analyzing quality management practices using wider definitions of management are needed. These would help to establish the direct and indirect links between management practices and the innovation output of different firms. For example, in the case of small firms, innovation in management can serve as a substitute for investments in R&D (Rammer, Czarnitzki, and Spielkamp 2009).

2.A Appendix

2.A.1 Summary Statistics

Table 2.6: Summary Statistics: Main Variables

	(1) count	min	max	mean	sd
Management z-score	834	-4.008	1.841	-0.023	1.032
Operations z-score	834	-4.497	0.814	-0.001	0.995
Monitoring z-score	834	-2.433	1.142	-0.028	0.676
Targeting z-score	834	-1.972	1.332	-0.018	1.005
Incentives z-score	834	-2.448	0.723	-0.025	0.680
ln(R&D spending+1)	699	0	1.795	0.065	0.214
R&D	834	0	1	0.376	0.485
New Products introduced	832	0	1	0.708	0.455

Table 2.7: Summary Statistics: Controls

	(1) count	min	max	mean	sd
Ln(Labour)	834	3.401	7.937	4.944	0.844
Higher education (share)	834	0	1	0.275	0.223
Ln(Firm's Age)	834	0	5.342	3.048	0.948
Shareholding company (traded)	834	0	1	0.259	0.438
Ln(Perm. FT emp. weekly hours)	834	3.178	4.094	3.715	0.088
Capital city	834	0	1	0.291	0.455
Foreign (largest owner)	834	0	1	0.082	0.274
High-speed Internet	834	0	1	0.829	0.377
Pressure from imports	834	0	1	0.683	0.465
Ln(Fixed Assets, 2008)	504	-9.390	5.522	1.536	1.768
ROTA (2008)	503	-79.48	75.91	3.614	16.519

Table 2.8: Summary Statistics: Countries

EU status	Country	frequency	percent
Non-EU countries	Belarus	46	5.52
	Kazakhstan	97	11.63
	Russia	242	29.02
	Ukraine	93	11.15
	Uzbekistan	88	10.55
EU countries	Bulgaria	53	6.35
	Lithuania	41	4.92
	Poland	39	4.68
	Romania	55	6.59
	Serbia	80	9.59
Total	834	100.00	

Table 2.9: Summary Statistics: Years

	(1) frequency	percent
2008	474	56.83
2009-2010	360	43.17
Total	834	100.00

Table 2.10: Summary Statistics: Industries

	(1) frequency	percent
Other Manufacturing	237	28.42
Food	179	21.46
Textiles	28	3.36
Garments	43	5.16
Chemicals	33	3.96
Plastics and Rubber	34	4.08
Non Metallic Mineral Products	63	7.55
Basic Metals	7	0.84
Fabricate Metal Products	107	12.83
Machinery and Equipment	68	8.15
Electronics	35	4.20
Total	834	100.00

2.A.2 Management Practices: Core Questions

Table 2.11: Operations R.1. What normally happens when a process problem arises, for example, machinery break-down human errors or failures in communication?

	Score in questionnaire	Management score
Nothing is done about it.	1	1
We fix it but do not take further measures.	2	2
We fix it and we take measures to make sure that it does not happen again.	3	3
We fix it and we take measures to make sure that it does not happen again and we also have a continuous improvement process to anticipate problems.	4	4
Don't know	-9	.
Refusal	-8	.

Table 2.12: Targets R.4. What is the timescale of this establishment's production targets for the main product?

	Score in questionnaire	Management score
The main focus is on short-term (less than one year) production targets for the main product.	1	2
There are short- and long-term (more than three years) production targets for the main product, but they are set independently.	2	3
There are integrated short- and long-term production targets for the main product.	3	4
There are no production targets set for the main product.	4	1
Don't know	-9	1
Refusal	-8	.

Table 2.13: Incentives R.7. How do you reward this establishment's production target achievement?

	Score in questionnaire	Management score
There are no rewards.	1	1
Only top and middle management is rewarded.	2	2
All staff is rewarded.	3	3
Don't know	-9	.
Refusal	-8	.

Table 2.14: Incentives O.14. Which of the following best corresponds to the main way employees are promoted in this establishment?

	Score in questionnaire	Management score
Promotions are based solely on individual's effort and ability.	1	3
Promotions are based partly on individual's efforts and ability, and partly on other factors such as tenure (how long they have worked at the firm.	2	2
Promotions are based mainly on factors other than on individual's effort and ability, such as tenure.	3	1
Other.	4	.
Does not apply	-7	.
Don't know	-9	.

Table 2.15: Incentives O.15. Which of the following best corresponds to this establishment's main policy when dealing with employees who do not meet expectations in their position?

	Score in questionnaire	Management score
They are rarely or never moved from their position.	1	1
They usually stay in their positions for at least a year before action is taken.	2	2
They are rapidly helped and re-trained, and then dismissed if their performance does not improve.	3	3
Other.	4	.
Does not apply	-7	.
Don't know	-9	.

Table 2.16: Monitoring R.2a. How many production performance indicators are monitored in this establishment?

	Score in questionnaire	Management score
None.	1	1
One or two production performance indicators (for example, volume and quality).	2	2
More than two production performance indicators.	3	3
Don't know	-9	1
Refusal	-8	.

Table 2.17: Monitoring R.2b. How frequently are these production performance indicators collected in this establishment?

	Score in questionnaire	Management score
Yearly	1	1
Quarterly	2	2
Monthly	3	3
Weekly	4	4
Daily	5	5
Hourly	6	6
Don't know	-9	1
Never	.	0

Table 2.18: Monitoring R.2c. How frequently are production performance indicators shown to factory managers?

	Score in questionnaire	Management score
Annually	2	2
Semi-annually	3	3
Quarterly	4	4
Monthly	5	5
Weekly	6	6
Daily	7	7
Hourly	8	8
Never	1	1
Other	10	depends on answer
Don't know	-9	.

Table 2.19: Monitoring R.2d. How frequently are production performance indicators shown to workers?

	Score in questionnaire	Management score
Annually	2	2
Semi-annually	3	3
Quarterly	4	4
Monthly	5	5
Weekly	6	6
Daily	7	7
Hourly	8	8
Never	1	1
Other	10	depends on answer
Don't know	-9	1

Table 2.20: Monitoring R.3. How often are production performance indicators reviewed by top or middle managers?

	Score in questionnaire	Management score
They are continually reviewed.	1	3
They are periodically reviewed.	2	2
They are rarely reviewed.	3	1
Don't know	-9	1
Refusal	-8	.

Table 2.21: Monitoring R.6. Does this establishment use any production performance indicators to compare different teams of employees in the production line, in different shifts, or similar?

	Score in questionnaire	Management score
Yes	1	2
No	2	1
Don't know	-9	.

2.A.3 MOI sampling methodology

MOI sampling methodology[8] uses a random sample representative of the manufacturing sector and ensures large enough sample sizes for the manufacturing sector to condusct statistically robust analyses with levels of precision at a minimum 7.5% precision for 90% confidence intervals about the differences in management practices across countries.

The Management, Organisation and Innovation (MOI) survey includes (according to ISIC, revision 3.1) all manufacturing sectors (group D). The sample frame for each country should include only establishments with at least fifty (50) but less than 5000 employees. The survey was administered face-to-face, with generally the same person – the factory, production or operation manager - responding to all sections.

If available and of sufficient quality in terms of representativeness of the manufacturing sector, the preferred sample frame was Bureau van Dijk's Orbis database, which contained published balance sheet and profit and loss statements. When this source is not available or is of poor quality, the official sample frames (Business Environment and Enterprise Performance Survey, see https://ebrd-beeps.com/ for details) without financial performance information can be used. The sample frame downloaded from Orbis was cleaned by the EBRD through the addition of regional variables, updating addresses and phone numbers of companies. MOI (ORBIS) sample frame was not available for Kazakhstan and Uzbekistan, so BEEPS sample frame was used there. No stratification was used in the majority of the countries, but the sample was selected randomly, and covered all regions and at least a 25 per cent response rate was a requirement.

MOI survey also added location as another dimension to the sampling strategy, ensuring that the sample frame was stratified by region, where the laws and regulations that might have an impact on management practices vary across regions. Stratification along industries (two-digit codes) within manufacturing and establishment size were not required for MOI sampling design.

Item non-response was addressed by two strategies:

- For sensitive questions that may generate negative reactions from the respondent, such as ownership information, enumerators were instructed to collect the refusal to respond as (-8).

- Establishments with incomplete information were re-contacted in order to com-

[8]These are adapted excerpts from the official MOI survey sampling methodology, available at http://www.ebrd.com/downloads/research/economics/moimethodology.pdf.

plete this information, whenever necessary. However, there were clear cases of low response.

Survey non-response was addressed by maximizing efforts to contact establishments that were initially selected for interviews. Up to 15 attempts (but at least 4 attempts) were made to contact an establishment for interview at different times/days of the week before a replacement establishment (with similar characteristics) was suggested for interview. Survey non-response did occur, but substitutions were made in order to potentially achieve the goals.

2.A.4 Merging MOI and ORBIS datasets

The merged MOI-ORBIS dataset comes from EBRD and was also used in the paper by Schweiger and Friebel (2013). The authors write "We were able to perfectly match the survey data back to the Bureau van Dijk's Orbis database on the basis of the Bureau van Dijk's firm identification number, which was included in the survey data. The latter also included the name, address and phone number of the firm, and we cross-checked the firm names and addresses manually after the matching. In some of the countries that did not use Bureau van Dijk's Orbis database as a sample frame, we were able to find some of the firms in the Orbis database on the basis of their name, industry and address at a later date when the coverage in Orbis improved" (Schweiger and Friebel 2013, p.23).

Chapter 3

Political Risk, Information and Corruption Cycles: Evidence from Russian Regions

[1] Co-authored with Dmitriy Vorobyev

3.1 Introduction

There is plentiful evidence showing that politicians change their behavior during terms of office in systematic ways. This is particularly true for elected politicians: in pre-election periods, elected incumbents tend to increase public expenditures, shift the composition of expenditures towards more publicly visible projects, stimulate job creation, release overly optimistic economic forecasts, and increase overt anti-corruption activities. However, evidence of clear patterns in the behavior of appointed politicians is scarce. In this paper, using Russian regional data, we demonstrate that political cycles substantially affect the incentives of appointed officials to engage in corrupt activities in completely different ways than they affect elected officials.

Opportunistic behavior by elected politicians is empirically well documented in both developed and developing countries. A large body of research focuses on the patterns

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of fiscal behavior of incumbent politicians[2]. Though there is some degree of controversy, the literature on political budget cycles is generally consistent in its major findings. In developing countries, cycles in fiscal policies and public expenditures are usually of higher magnitude and often rewarded by voters (Akhmedov and Zhuravskaya 2004; Guo 2009; Ehrhart 2011). In developed countries, cycles appear less often, are of a smaller magnitude, and may even be punished by voters (Shi and Svensson 2006; Brender and Drazen 2008; Streb, Lema, and Torrens 2009; Klomp and Haan 2013). Often, in developed countries, politicians prefer to stabilize fiscal policies (Andrikopoulos, Loizides, and Prodromidis 2004) or to temporarily change the focus of public expenditures towards more visible projects in pre-election years (Brender 2003; Schneider 2009; Aidt, Veiga, and Veiga 2011). Examples of manipulation of the composition of expenditures rather than levels are also found for developing countries (Drazen and Eslava 2010).

In this paper, we focus on corruption as a phenomenon that can be affected by the timing of political cycles. There is no need to emphasize that corruption is undesirable. Its effects on various social, economic and political aspects have been well studied in academic literature - theoretically, empirically and experimentally, and on both macro and micro levels. Corruption has been found to misallocate resources and human capital, distort income and wealth distribution, decrease levels and quality of investments, shift government expenditures towards less transparent directions, increase transaction costs, generate wasteful resource expenditures, slow down economic growth, etc. (see, for example, Jain (2001) and Rose-Ackerman and Soreide (2011) for comprehensive reviews).

While it is well established that corruption in particular, and the quality and transparency of governance in general, are important determinants of political fiscal cycles (Shi and Svensson 2006; Alt and Lassen 2006; Klomp and De Haan 2013; Vergne 2009), corruption appears to be subject to cycles itself. Intuitively, the proximity of elections may have effects on corrupt behavior similar to its effects on fiscal behavior: if voters appreciate a politician's integrity or his ability to fight corruption, the incumbent may want to commit less corruption himself or to stimulate anti-corruption activities prior to elections in order to attract extra votes, for the same reasons he adjusts fiscal policies. Evidence of such behavior by elected politicians has been found by, for example, Khemani (2004) and Vadlamannati (2015) in Indian states, and by Chen (2015) in Chinese municipalities. Mironov and Zhuravskaya (2016) highlight another mechanism behind the

[2]For a comprehensive review of the literature on political budgets cycles see, e.g. De Haan and Klomp (2013).

relationship between political cycles and corruption, providing evidence that politicians may engage in more corruption closer to elections to raise funds for their campaigns.

In this paper, we further study the link between political cycles and the corrupt behavior of politicians, focusing on the incentives and actions of appointed officials rather than of elected officials. Although there are several works on the behavior of appointed politicians, the literature on the topic remains scarce. Several recent studies demonstrate that appointed politicians behave quite differently than elected officials, being, in general, relatively less likely to be involved in opportunistic behavior. For example, Enikolopov (2014) shows that appointed politicians are less likely to engage in targeted redistribution than their elected counterparts. Specifically, appointed chief executives in US local governments are less likely to use excessive public employment as a targeted redistribution tool than elected executives. Hessami (2014) demonstrates that elected German mayors attract more state grants for highly visible municipal investment projects in pre-election years, while in cities with appointed mayors, investment grants do not exhibit any cycle. With this paper, we contribute to the discussion on the behavior of appointed politicians by studying their corrupt behavior over political cycles.

We investigate the example of Russian regional governors who were appointed by the president in the 2005–2012 period. We use a dataset on Russian regions based on the Business Environment and Enterprise Performance Survey (BEEPS) to estimate the effect of the approaching expiration dates of regional governors' terms on the level of corruption anticipated by local firms. To do this, we exploit the variation in the dates of surveys and in the length and starting dates of governors' terms. First, we establish that pressure on business for corruption tends to increase toward the end of the incumbent's term[3].

We then argue that this pattern could arise due to changes in governors' private information about their career perspectives. Specifically, if a governor becomes more certain that he is leaving office once the current term ends, he may have increased incentives to engage in corrupt activities in order to accumulate wealth before his departure. Conversely, when a governor becomes more certain that he will remain in office for another term, he may have incentives to accumulate wealth through corruption more smoothly and thus not to increase, or even decrease, his corrupt intensity. As a result, the pattern

[3]Since our data do not allow us to distinguish between true corruption and reported corruption, which may not be identical, the expressions "corruption increases", "firms report higher corruption", "firms perceive higher corruption", and "governors put more pressure on business" should be understood as equivalent throughout the paper.

we observe may be generated mostly by the governors who become more certain that they will leave office when their current term expires. Although the data we use do not allow us to directly verify the existence of the relationship between governors' beliefs and their corrupt behavior, we are able to conduct several exercises to indirectly test the validity of this explanation. We show that all of our results are consistent with this explanation, while they are not fully consistent with a number of plausible alternatives.

3.2 Corruption Cycles in Russia

There are several theoretical explanations for the existence of politicians' opportunistic behavior driven by political cycles. Early works simply assume that voters are naive: they interpret the pre-election performance of an incumbent as a result of his competency and reward him with votes (Nordhaus 1975). Rogoff and Sibert (1988) and Rogoff (1990) suggest a signaling approach to explain fiscal cycles. Their logic is that when an incumbent's competency is not observable by voters, budget cycles could be used by politicians to signal their competency. Specifically, a highly competent incumbent increases public expenditures before elections to a higher than optimal level to signal his competence, at the expense of debt to be paid after elections. Since such a deviation from optimal fiscal strategy is too costly for an incumbent with low competence, voters infer high competence from high public expenditures in the pre-election period and thus vote for the incumbent. Shi and Svensson (2006) and Martinez (2009) show that asymmetric information about an incumbent's competency may generate incentives to finance extra government expenditures through excessive borrowing in pre-election periods, even if voters do not electorally reward such behavior. In their models, voters cannot infer an incumbent's competency (in fact, productivity) from the amount of public good provided (which is determined by both competency and available financial resources: a more competent incumbent could provide more public good given the level of expenditures), and thus can only form rational expectations about this. Because of the increasing marginal costs of borrowing, an incumbent is likely to have an incentive to excessively borrow prior to elections, even though voters would rationally anticipate this.

When politicians are appointed, similar logic can be applied if integrity is valued by the society, and if the preferences of the society and of the appointing authority are aligned with respect to corruption. If the society and the appointing authority are naive, then corruption should decrease prior to re-appointment decisions. The signaling logic

leads to the same outcome: if the marginal cost of fighting corruption is increasing and negatively depends on the incumbent's competency, a more competent incumbent can reduce corruption through an above-optimal level of anti-corruption measures to credibly signal his competence because, for a low competent incumbent, such a deviation from optimality would be too costly.

In the first part of the paper, we test the hypothesis that corruption decreases close to a re-appointment decision using a dataset on Russian regions based on the Business Environment and Enterprise Performance Survey (BEEPS). Our results show that pressure on business for corruption seems to demonstrate the opposite trend, increasing closer to the term expiry date. Specifically, we find that levels of corruption perceived by Russian firms are relatively stable over the first 75–80% of governors' terms but then rapidly increase in the last 12–18 months.

One might be concerned that this result arises from the nature of the corruption measure we use rather than from the corrupt behavior of politicians, since the perception of corruption may generally fluctuate over a governor's term for reasons other than actual changes in his corrupt behavior. For instance, the perception of corruption may increase around the term expiry date as a result of more intense news coverage, media campaigns and input from political rivals. Although we cannot completely eliminate these possibilities, we believe that they are unlikely to drive our results. First, the survey question we use to construct our main dependent variable is designed to reflect not just managers' perceptions of overall corruption, but their perceptions of obstacles to their present business activities as a consequence of corruption, which is less likely to be easily influenced by, e.g., the media, without the presence of an actual effect on business, though some measurement error is indeed possible. Second, we find the same pattern using an alternative corruption measure, the share of annual sales paid by firms as bribes, which is much less sensitive to information flows that may be generated by the media and political rivals around the expiration of a governor's term. Hence, we believe that the established pattern is likely to reflect the pattern in actual corrupt behavior rather than just perceptions.

The established result is consistent with a recent and, to our knowledge, the sole existing study on the relationship between corruption and political cycles in Russia, by Mironov and Zhuravskaya (2016). Using banking transaction data, they show that the amount of illegal cash outflow (measured as transfers to fly-by-night firms) of Russian firms that obtain public procurement contracts strongly increases around regional elections (they consider the 1999–2004 period). This can be explained only by corruption,

since firms that do not obtain public procurement contracts do not exhibit a similar cycle. Neither is such a cycle found in the legal activities of the firms.

Despite being consistent with studies on corruption in Russia, the pattern we find does not accord with patterns predicted by standard theories of political budget cycles. In the second part of the paper, we try to understand the source of the trend. We discuss a number of potential explanations and test their validity in several ways. We show that our results are fully consistent with one of our explanations only.

The first step to understanding the pattern is to realize that the Russian political system is quite tolerant of corruption in particular and poor performance in publicly valued sectors in general. Several studies show that while loyalty is essential for the career success of Russian governors, the economic performance of the governed regions and governors' engagement in corruption activities have a weak effect at most. Reuter and Robertson (2012), studying an extensive dataset on Russian governors, find that while governors' loyalty to the president and, more specifically, their ability to mobilize votes for the ruling party, have a strong impact on appointment decisions, good governance, measured as regional economic development, plays a limited role in appointments. This finding is confirmed by Reisinger and Moraski (2003), and by Rochlitz (2016). In his earlier work, Rochlitz (2014) finds a strong positive relationship between the winning margins of the president and the ruling party in a region and the scale of the involvement of government officials in illegal corporate raiding (asset-grabbing) in the region, arguing that regional officials are allowed to participate in illegal financially rewarding activities in exchange for their ability to deliver satisfactory electoral results.

Though it may seem that avoiding corruption closer to re-appointment decisions could give a governor stronger support among citizens and thus push the president towards a decision in favor of the governor, this does not appear to be an effective strategy in Russia. This therefore raises questions as to why governors change their corrupt behavior prior to the expiration of their terms and why they engage in increased corruption.

Poor overall governance around re-appointment may serve as a potential explanation. Recent research shows that politicians tend to substantially decrease the quality of governance close to the end of their terms. If corruption may be thought of as a form of misgovernance, this could explain the pattern. Skouras and Christodoulakis (2014) show that there is a significant increase in tax evasion and losses from wildfires around elections in Greece, arguing that this is likely to be a result of increased misgovernance. They suggest that officials focus on their campaigns and thus devote less time and resources to

governance. Secondly, temporal misgovernance, while observed by the majority of voters with a lag, may immediately benefit certain interest groups and thus public officials. The latter explanation is also supported by Holland (2015), who establishes that in Latin American countries with a substantial poor population, politicians strategically tolerate violations of the law prior to elections, since law enforcement may negatively affect the support of poor voters. Nevertheless, the first explanation cannot be applied in the case we study in a straightforward manner. The need to devote time and resources to the campaign, whatever that means under the appointment system, should more likely result in a decrease in corruption since corrupt activities also require time and resources. The second argument could lead to the observed outcome only if corruption rents are partially transferred to the president or higher level government officials who can influence the president's decision to re-appoint a governor; increased corruption around the end of a term may arise as a result of the governor's attempt to increase his chances to remain in office. However, the exercises we conduct below show that this is unlikely to be the case.

Instead, we suggest that the pattern we observe may be a result of the different behavior of two different types of governors whose incentives are shaped by the risk of not being re-appointed, together with private information about their likelihood of remaining in office. Our hypothesis is that at the beginning of their terms, governors may not be certain about whether they will remain in office, but throughout the term, they accumulate some information that changes their beliefs. These changes may be a result of, for example, information that comes directly from the president and the president's circle, or may be driven by news media and rumors, etc. Alternatively, beliefs may change as a result of changes in the governor's intention to continue in the position. It is possible that the accumulation of information forces governors to adjust their corrupt behavior: if a governor becomes more certain that he will leave office once the current term has expired, he may have incentives to increase corruption in order to extract rents which will not be available once he departs. When a governor becomes more certain that he will keep his office for the next term, he may have higher incentives to smooth rent extraction over time and thus not increase or may even decrease corruption[4]. Under the

[4]Throughout the paper, we mainly discuss corrupt behavior and the incentives of governors, though obviously the governor is not the only person in a region who applies corruption pressure on local business. In each region there are numerous other local officials who are able to extract rents. Nevertheless, for the purpose of our analysis we only need a governor to have a certain amount of control over the actions of some other officials and their careers. Given, for example, the usual practice that a governor's resignation results in the consecutive resignation of his core team and affiliated state officials, it is likely that the

assumption of increasing marginal cost of corrupt activities, such an outcome would be the result of a simple inter temporal choice problem where the trade-off is to commit more corruption today at a higher marginal cost, or to postpone it for the next term, where the cost is lower but where there is also a risk not being re-appointed, and thus unable to extract any rent at all. The higher the likelihood of not being re-appointed, the more incentives to commit corruption today.

We test this explanation in several ways. Although each of the tests we implement has certain shortcomings due to the nature of the data, and hence may be questioned, they are all consistent with the explanation but not the other plausible alternatives. First, a crucial point about our data is that we observe whether the governors in our study remained in office for the next term[5]. Assuming that governors possessed correct information, on average, we perform our analysis separately for firms in regions where governors left office and for those in regions where governors stayed for another term. If our theory is valid, we should observe increasing corruption over terms in the first case, while we should not in the second case. This is exactly the outcome we obtain: those governors who are more likely to believe that they are leaving office engage in increasing corruption, while those who are more likely to believe that they will remain in office do not show an increasing trend.

This result also provides evidence against the alternative potential explanation for the established pattern, according to which governors may have incentives to increase corruption prior to the end of their term in order to influence the re-appointment decision through increased rents transferred to higher level politicians. If this were the case, we would obtain the reverse result: the increase in corruption closer to the end of the term is observed for those governors who then remained in office, not for those who left.

One may argue that the result, where leaving governors commit increasing corruption while staying governors do not, may be driven by an endogeneity problem: if a governor engages extensively in corrupt activities, he is more likely not to be re-appointed. However, we believe this is unlikely to be a driving force of the patterns found. First, as discussed above, corrupt behavior is unlikely to have a substantial effect on the likelihood of being re-appointed under the Russian political system. Second, when the corruption of a regional politician becomes an issue for the president, there are relatively simple

approach of expiration of a governor's term generates incentives for corruption for some local officials similar to those of the governor himself.

[5]One of the governors considered in our study has not yet finished his term.

tools for removing him before his term ends. There have been several historical cases when a governor was dismissed and then arrested following accusations of corruption[6]. Third, while the explanation that the president is reluctant to re-appoint governors who increasingly engage in corruption is plausible, the behavior of governors who were not re-appointed can hardly be rationalized: they must anticipate the president's reaction to their actions, and thus increasing corruption cannot be an equilibrium behavior under reasonable assumptions. Fourth, we conduct a set of additional tests and obtain results which, while consistent with our primary explanation, are not consistent with the story that the president punishes corrupt governors.

We use information on personal meetings between regional governors and the Russian president in the last year or two of their terms as a proxy for a change in governors' beliefs. The president occasionally meets governors in different formats: during his visits to regions, at various summits, conferences and other events, and in one-on-one meetings in the Kremlin, his residence and workplace. We assume that if a one-on-one meeting takes place some time close to the expiration of the governor's term, it substantially changes or even resolves the governor's uncertainty about his likelihood of remaining in office for another term. During such a meeting, the president is likely to fully disclose, or strongly signal, his intentions regarding re-appointment of the governor. Likewise, if the governor decides to retire at the end of his term or to continue to govern, he is likely to let the president know this during the meeting and is unlikely to reverse the decision after the meeting[7]. If this is the case, and if our theory is valid, one should observe that a) those governors who left office at the end of their term put more pressure on business after a meeting with the president than before, and b) those governors who stayed for another term should decrease corruption or, at least, not increase it after a meeting. In the final section of this paper we demonstrate that this is precisely the case.

[6]For example, the governor of the Tula region, Vyacheslav Dudka, was removed from office by the president in July 2011, just 15 months after his re-appointment, arrested and then convicted of and jailed for corruption. In 2015 the governor of the Sakhalin region, Alexander Khoroshavin, and the governor of the Komi region, Vyacheslav Gayzer, were arrested and removed from office following accusations of severe corruption. In June 2016, the same happened to the governor of the Kirov region, Nikita Belykh.

[7]An example of a meeting in which a governor asked the president not to consider him for re-appointment: http://en.kremlin.ru/events/president/news/6697. An example of a meeting in which the president suggested a governor should leave office and take another position: http://en.kremlin.ru/catalog/persons/215/events/11769. An example of a meeting in which the president informed a governor that he had decided to re-appoint him: http://kremlin.ru/catalog/persons/214/events/6172 (in Russian).

3.3 Empirical Analysis

3.3.1 Background

In 1993, when the current Constitution of Russia was adopted, there were 89 constituent entities ("federal subjects") in the country "which shall have equal rights" according to Article 5 of the Constitution. Between 2003 and 2007, several mergers took place, and since then there have been 83 federal subjects in Russia, including 21 "republics", 9 "krays", 46 "oblasts", 2 "cities of federal significance", 1 "autonomous oblast" and 4 "autonomous okrugs". For simplicity, we refer to all of these as "regions". Since Russia became an independent state following the collapse of the Soviet Union, mechanisms for selecting regional governors ("gubernators") have been very mixed across regions: in some regions governors were elected directly by the population, in others they were appointed by regional parliaments or by the Russian president. Since 1996, following the decision of the Constitutional Court of Russia, governors of all the federal subjects had to be directly elected by the regional population.

At the end of 2004, the Russian president, Vladimir Putin, proposed a reform that abolished direct gubernatorial elections in order to consolidate the federal state: from that time until 2012 regional governors were appointed by the president. Although formally the new procedure assumed that the president would only nominate a candidate for governor, and the regional parliament would then approve or reject the candidate, there was no single case when the parliament of a region did not approve a presidential nominee. The reform was approved by the Parliament of Russia ("State Duma") in December 2004. Because the reform assumed the replacement of elected governors after the expiration of their terms, and the date of expiration varied significantly across the regions, the full replacement of elected governors took about five years. The first appointed governor took office in February 2005, while the term of the last elected governor expired in December 2009, and from then all the governors were appointed until October 2012. The variation in the dates of gubernatorial appointments across the regions can be mostly explained by differences in local legislation that allowed for different term lengths (usually four or five years) as well as a high degree of freedom for regions in setting the dates of gubernatorial elections in the past. Because of this, we believe that the variation in the dates of governors' appointments, and thus in the dates of the expiration of their terms across regions, can be considered exogenous.

3.3.2 Data

We use data on Russian firms from two waves of the EBRD/World Bank Business Environment and Enterprise Performance Survey (BEEPS) conducted in 2008–2009 (wave IV) and 2011–2012 (wave V)[8]. Together the waves provide data on about 5,000 firms in 37 Russian regions (about 1,100 firms from 20 regions in the first wave and over 3,800 firms from 37 regions in the second wave). According to the description of the BEEPS dataset, the authors of the survey did their best to ensure that the sample of firms is representative, with a stratified survey design of three levels: industries, firm size, and (most importantly for our analysis) regions.

Our main variable comes from the Likert scale question "Is corruption an obstacle to the current operations?", the answers to which range from "no obstacle" (0) to "very severe obstacle" (4). We label the main variable *Corrupt*. We also use an alternative indicator of corruption which BEEPS offers: answers to the questions "On average, what percent of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials to "get things done" (see Figure 3.7 in the Appendix for the precise survey form). We label this variable as *CorSale*. Although this variable may seem to better reflect actual corruption and be more appropriate for the purposes of our analysis due to its continuous nature, we should treat answers to this question with care. In our dataset, only 67.0% of respondents (3319 observations) answered the question at all, and only 15.1% of those (501 observations) reported having made such payments. One reason may be that they are reluctant to discuss their involvement in corrupt activity. In contrast, 61.4% of respondents (3041 observations) reported that corruption is an obstacle to current operations (from minor to very severe). Another possible problem with *CorSale* is that answers to this question depend heavily on the knowledge of the individuals surveyed, and thus may be subject to severe measurement error. Moreover, this measure does not account for any form of corruption not directly related to informal payments, while our main corruption measure does. Thus, throughout our analysis, we use the categorical variable *Corrupt* as the main measure of perceived corruption, and as a robustness check, present some results using *CorSale* as an alternative measure, showing that our main findings are quite similar for both measures.

From BEEPS, we take various firms' characteristics such as industry, owner's origin,

[8]Three earlier waves of the survey do not contain information on regions where the surveyed firms operate, and thus cannot be used for our analysis.

number of employees, age, manager's gender, etc. We also collect data on the characteristics of governors of the regions such as origin and length of tenure in office. Given some evidence that the perception of corruption in Russian regions may depend on regional economic development and bureaucratization (Dininio and Orttung 2005; Sharafutdinova 2010), we complete our dataset with the political and economic characteristics of the regions where the firms operate, including gross regional product per capita, population, unemployment rate, number of state officials, etc. Please see Tables 3.6–3.10 for the complete list of variables used in our analysis.

Wave IV of the BEEPS survey design uses three aggregate industry categories for stratification, which consist of the highest aggregation-level groups (one-digit codes) of ISIC[9]. In wave V, a more detailed industry classification (two-digit codes) is used for stratification. To avoid potential issues due to the difference in the levels of aggregation, we use the highest level of ISIC classification. Our final dataset contains data on 4953 firms operated between 2008 and 2012 in 37 Russian regions across 7 industry groups.

3.3.3 Baseline Model: Identification

We want to test the hypothesis that the approach of the expected expiration date of the term of office influences the corrupt behavior of governors. For this purpose, we estimate the following model:

$$Corrupt_{ir} = \alpha_0 + \alpha_1 Time_{ir} + \alpha_2 Time_{ir}^2 + \alpha_z Controls_{ir} + u_{ir} \tag{3.1}$$

where $Time_{ir}$ is the share of the current term of a governor of region r where firm i operates, completed by the date when the firm was surveyed. For instance, if firm i from region r was surveyed on the day when the regional governor began serving his current term, $Time_{ir} = 0$; if the firm was surveyed on the last day of the governor's term, $Time_{ir} = 1$; if at the moment of the survey the governor had served 3 years of his 5 year term, $Time_{ir} = 0.6$. We use percentages to measure time passed from the beginning of the current governor's term until the time of the survey instead of days, weeks or months because of the variation in term length across Russian regions; in some regions term length is 4 years, while in others it is 5[10]. Using percentages allows us to make our

[9]International Standard Industrial Classification of All Economic Activities, Revision 3.1 (http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=17)

[10]We also performed our analysis for the case when $Time$ is measured as the raw number of months remaining in a governor's term, as well as separately for regions with 4-year terms and 5-year terms.

variable of interest comparable across regions. $Time_{ir}^2$ is a quadratic term for $Time_{ir}$; $Controls_{ir}$ are other control variables for a region's, governor's and firm's characteristics and year dummies; u_{ir} is the error term.

We try to determine whether corruption levels follow any pattern over governors' terms. Our main variable of interest is $Time_{ir}$. Variation in $Time_{ir}$ comes from several sources. First, as discussed above, the dates of governors' term expirations across Russian regions vary for historical reasons and due to differences in regional electoral legislation. Second, dates of the survey in each wave vary substantially both across regions and, within a region, across firms[11]. For example, for 16 of 37 regions in our dataset there are observations for each of the 4 survey years (2008, 2009, 2011 and 2012). The dates on which firms within regions and waves were surveyed vary on average by 7 months. The kernel density of $Time_{ir}$ is presented in the Appendix, Figure 3.6. Given the sources, the variation in $Time_{ir}$ can be considered exogenous to the dependent variable, allowing for identification of the effect of interest. Since we expect that the effect may be non-linear, we include a quadratic term for $Time_{ir}$. Further, to verify the robustness of the timing effect, we split governors' terms into 10 equally spaced time periods and directly control for them with dummy variables instead of using $Time_{ir}$.

Unfortunately, BEEPS data for Russia contains only 128 firms that are present in both wave IV and wave V. This does not allow us to construct true panel data, so we are limited to cross-section estimation methods with regional fixed effects and dummy variables for the years the survey was conducted, and a mean-based pseudo-panel where we can group data by regions, since we observe firms from the same regions in different years. First, we estimate the model (3.1) on pooled cross-sectional data, with *Corrupt* as the dependent variable, using several methods. We run an ordinary least squares regression and a logistic regression with a binary variable which takes 0 value in the case of no or minor corruption perceived by firms and 1 otherwise. Since the Logit equation ignores additional information on the intensity of corruption, we use an ordered logistic regression. Because this assumes that coefficients are the same for different categories and error variances are homoskedastic, while we suspect that these assumptions may be violated, we also estimate a generalized ordered logit (GOLogit) model, which relaxes

The results are very similar to those presented in this paper. These results, as well as all the results mentioned but not presented throughout this paper, are available from the authors upon request.

[11] We are indeed not the first to exploit the variation in the timing of a survey for identification. See Eifert, Miguel, and Posner (2010) for an example of the use of such a variation to study political processes.

the proportional odds assumption. Since error terms for firms are likely to be correlated within regions, in all the estimations we use the corresponding clustering.

Next, we try to partially overcome the identification problems implied by the cross-sectional nature of the data, by constructing a group-mean pseudo-panel for our dataset. The idea of group-mean pseudo-panels, originally suggested by Deaton (1985), is to identify groups in the data and then to follow group means over time. As the BEEPS survey follows a stratified design with respect to regions, we can use regions as such groups to construct a group-mean pseudo-panel. Although there are certain issues with using pseudo-panels, such as biased estimates and measurement errors under certain circumstances, they generally make it possible to obtain consistent estimates when individual effects are correlated with explanatory variables, as with genuine panel data (see Collado 1997; McKenzie 2004, and Verbeek 2008 for a discussion on the consistency of pseudo-panel estimates).

Following (Verbeek 2008), the basic pseudo-panel model with repeated observations over T periods and R groups (regions) in our case is as follows:

$$\overline{Corrupt}_{r,t} = \overline{Time}_{r,t}\beta_1 + \overline{Time}^2_{r,t}\beta_2 + \overline{Controls}'_{r,t}\beta_3 + \overline{\alpha}_{r,t} + \overline{u}_{r,t}, \tag{3.2}$$

where $r = 1, ..., R$; $t = 1, ..., T$; $\overline{Corrupt}_{rt}$ - is the average value of all observed $Corrupt_{it}$'s in group r in period t, and similarly for other variables.

If we treat the group-specific effects $\overline{\alpha}_{r,t}$ as fixed unknown parameters and assume that there is no variation over time, that is $\overline{\alpha}_{r,t} = \alpha_r$ ($\overline{\alpha}_{r,t} \to \alpha_r$ if $n_r \to \infty$), we can estimate the above model by fixed effect estimator. We construct two panels, using survey waves (2 periods) and survey years (4 periods) as the time units. Since in both panels we have fewer than 100 observations per group on average, we may encounter a small-sample bias problem. Though there is no general rule to judge whether n_r is large enough to use asymptotics, and researchers often work with 100–200 observations per group, some works (e.g. Devereux (2007)) suggest that a group size of this magnitude might not be sufficient to achieve unbiased estimates. Furthermore, identification in the pseudo-panels comes from variation across 107 region-years and 57 region-waves, a relatively small number of groups, which might also result in biased estimates. As a result, we treat the pseudo-panel approach as an additional robustness check rather than as the main test of our hypothesis.

To further explore the effect of timing on corruption, we use *CorSale* as a dependent

variable and estimate a two-part model (a generalized version of a Tobit model), which assumes that zero and positive outcomes are generated by different underlying decisions, since this is likely to be the case with the *CorSale* corruption measure. In the two part model, a decision to participate in corruption activities is modeled by Logit, while the intensity of corruption is modeled by a generalized linear model. We estimate the model for *CorSale* using both a continuous variable $Time$ and time dummies.

3.4 Baseline Model: Results

The main results for *Corrupt* are presented in Table 3.1 in the Appendix, columns 1–4. The regressions for Table 3.1 provide similar results in terms of the significance and the direction of the effect, although the interpretation is somewhat different. Standard errors are clustered on regions. We use an OLS estimation (column 1, Table 3.1) for illustrative purposes only, since there are obviously several difficulties with the OLS estimation in our case. First, errors are likely to be heteroskedastic and not normally distributed. Second, the results of the OLS estimation would correspond to ordered models when the thresholds are about the same distance apart, while this may not be true in our case, and thus OLS can give misleading results (Long 1997).

Logit (we combining categories "no obstacles" and "minor obstacle" into value 0, and the other categories into 1) and an ordered logistic regression provide similar results for $Time_{ir}$ and $Time_{ir}^2$ in terms of log odds (columns 2–3 of Table 3.1). We test the parallel odds assumption for ordered logistic regression using a Wald test. The statistics for $Time_{ir}$ and $Time_{ir}^2$ are not significant at the 5% level (see Table 3.11, column 1), implying that we do not find strong evidence that the parallel odds assumption is violated for these variables. However, the overall Wald test statistic is significant, suggesting that this assumption may be violated for the model in general. To account for this problem, we use a generalized ordered Logit model (GOLogit)[12] which relaxes the parallel odds assumption for variables for which it is violated. The main results of the GOLogit (column 4 of Table 3.1) do not substantially differ from the results for the ordered logistic regression in terms of direction, magnitude and significance of the effects[13].

[12]We use an add-on module in Stata, `gologit2`, written by Richard, W. (2006) Generalized Ordered Logit/ Partial Proportional Odds Models for Ordinal Dependent Variables. *The Stata Journal* 6(1): 58-82.

[13]If the Wald test statistic is significant at the 10% level for an explanatory variable, the GOLogit model generates more than one distinct coefficient for the variable. For a more efficient presentation, we do not report the coefficient for such variables, labeling them "vary".

Table 3.1: Regression dependent variable: *Corrupt*

	(1) OLS		(2) Logit		(3) OLogit		(4) GOLogit	
Time (term completion share)	−1.560**	(0.712)	−1.775*	(1.034)	−2.026**	(0.958)	−2.010**	(0.916)
Time (term completion share)^2	1.827***	(0.671)	1.912**	(0.910)	2.409***	(0.917)	2.372***	(0.861)
Foreign ownership	−0.002	(0.002)	−0.003	(0.003)	−0.002	(0.002)	−0.002	(0.002)
Female manager	−0.149**	(0.064)	−0.231***	(0.084)	−0.204**	(0.090)	−0.206**	(0.091)
ln(Employment)	0.012	(0.018)	0.034	(0.028)	0.023	(0.023)	vary	
ln(Firm's age)	0.085**	(0.035)	0.117**	(0.053)	0.104**	(0.044)	0.105**	(0.044)
Private	0.227***	(0.077)	0.400***	(0.106)	0.281***	(0.103)	vary	
Permit	0.286***	(0.054)	0.392***	(0.072)	0.348***	(0.070)	vary	
1st term	0.418**	(0.189)	0.650**	(0.263)	0.556**	(0.258)	0.570**	(0.248)
Governor's origin (local)	0.307**	(0.151)	0.592**	(0.232)	0.365*	(0.198)	0.456**	(0.191)
Unemployment	−0.125	(0.081)	−0.129	(0.118)	−0.161	(0.103)	vary	
ln(State officials per 1000)	−3.282***	(1.168)	−5.391**	(2.339)	−4.046***	(1.508)	−4.726***	(1.558)
ln(Real GRP per capita)	0.033	(0.598)	−0.281	(1.135)	0.027	(0.733)	vary	
Last elections (UR's share)	−0.022	(0.017)	−0.035	(0.026)	−0.026	(0.022)	−0.031	(0.021)
Last elections (Turnout)	0.033*	(0.018)	0.053**	(0.025)	0.043*	(0.023)	0.047**	(0.022)
City size	−0.067	(0.055)	−0.111	(0.087)	−0.098	(0.072)	−0.096	(0.074)
Year 2009	0.456*	(0.264)	0.409	(0.373)	0.623*	(0.332)	vary	
Year 2011	−0.953**	(0.461)	−1.182*	(0.710)	−1.157*	(0.607)	vary	
Year 2012	−1.200**	(0.539)	−1.355*	(0.808)	−1.462**	(0.723)	vary	
Region fixed effects	Yes		Yes		Yes		Yes	
Industry fixed effects	Yes		Yes		Yes		Yes	
Clusters (Regions)	37		37		37		37	
Pseudo R^2			0.0728		0.043		0.060	
McFadden adj. R^2	0.033		0.066		0.039		0.055	
AIC	17333		6410		14383		14144	
BIC	17496		6573		14578		14391	
Observations	4953		4953		4953		4953	

Standard errors clustered on Regions are reported in parentheses
Source: Authors' calculations based on the EBRD and World Bank BEEPS survey
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

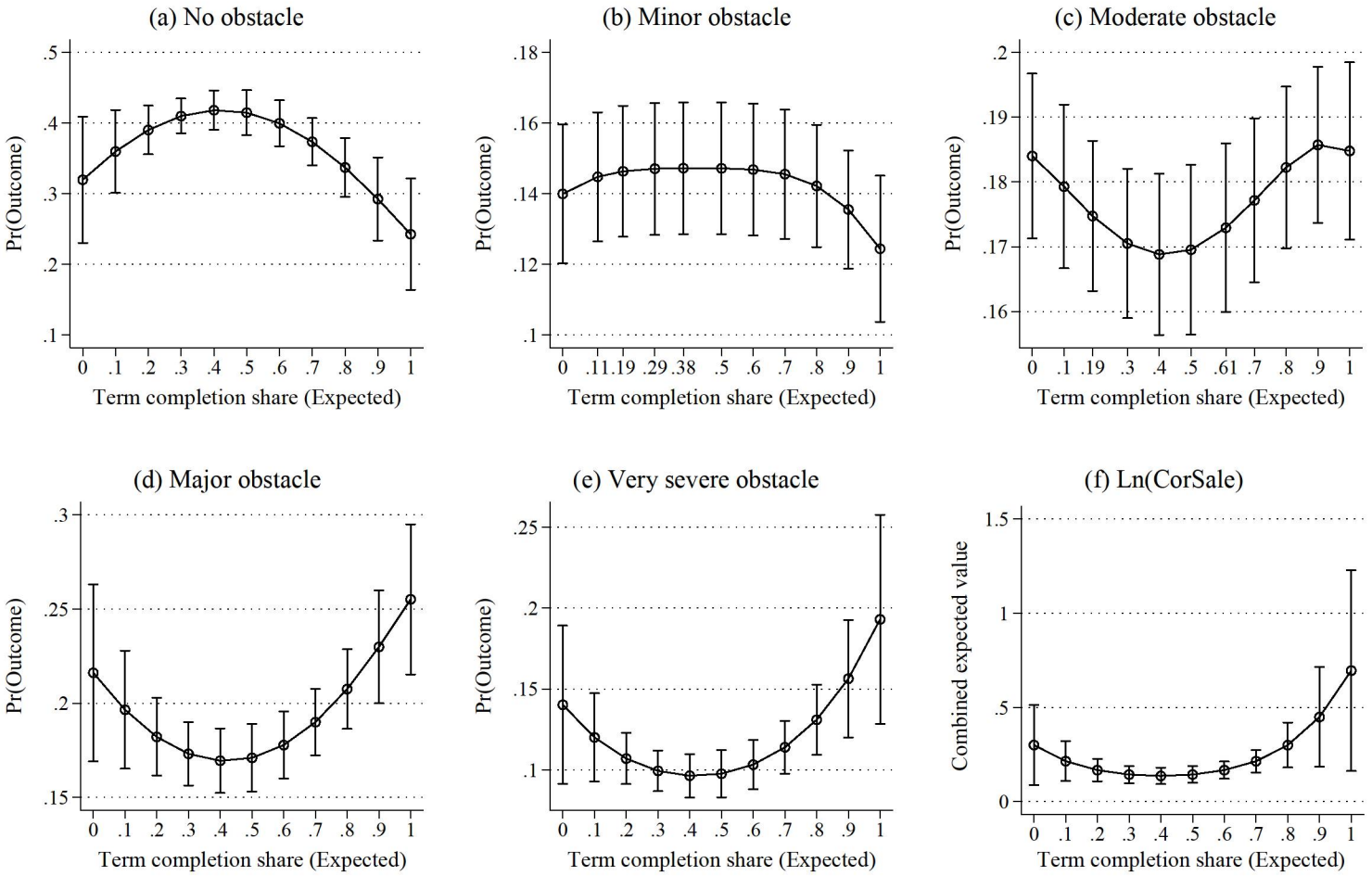

Figure 3.1: Predicted probabilities of *Corrupt* outcomes after OLogit (charts a–e) and combined expected value of *CorSale* after TPM (chart f) by *Time*.

Overall, our results show that the stage of the governor's term and perception of corruption by local business are strongly related in a non-linear way. The effect of the term completion share ($Time_{ir}$) and its quadratic term $Time_{ir}^2$ are statistically significant at the 5% and the 1% level, respectively. To illustrate the dynamics of corruption perception over a governor's term, we construct, based on our estimates from the OLogit model, predicted probabilities to observe each value of the variable $Corrupt$ as a function of $Time$. The probabilities are presented in Figure 3.1.

Further, we use jackknife re-sampling to estimate standard errors for our ordered logistic regression non-parametrically. It is an important exercise in our case: if the results from asymptotic and non-parametric methods differ, this might indicate serious data problems such as the presence of outliers and extremely skewed data distribution. We find that our jackknife standard errors are in line with those produced by the ordered Logit, which implies no evidence of severe issues with data. We also estimate our model using two-way cluster-robust standard errors on regions and years, regions and industries, and year and industries, suspecting that error terms for firms may be correlated within a year, a region and an industry. The results of such analysis do not significantly differ from the previous results.

The predicted probability of perception of the low corruption levels ("no obstacle" and "minor obstacle" to current operations) demonstrates an inverse U-shaped profile, while the pattern for perception of higher levels of corruption ("major" and "very severe" obstacle to current operations) is exactly the opposite. The graphs suggest that firms on average perceive higher pressure for corruption at the beginning and at the end of the political cycle. In quantitative terms, the predicted probability of perception of zero-corruption ("no obstacle") increases, on average, from approximately 0.3 to 0.42 during the first half of the term and then decreases below the initial value during the second half of the term, while the probability of high corruption ("very severe") falls, on average, from approximately 0.15 to 0.1 and then rises to 0.2 closer to the end of the term. That is, corruption moderately decreases during the first half of the term and then increases during the second half relatively quickly.

To check the robustness of the timing effect, we combine the values of $Time$ into 10 equally spaced groups and create 10 corresponding dummy variables. A dummy *Time-i* ($i \in [0, 9]$) equals 1 for an observation if the term completion share for the observation is between $i/10$ and $(i + 1)/10$. The results of the estimation with time dummies instead of continuous variables $Time$ and $Time^2$ are illustrated in Figure 3.2.

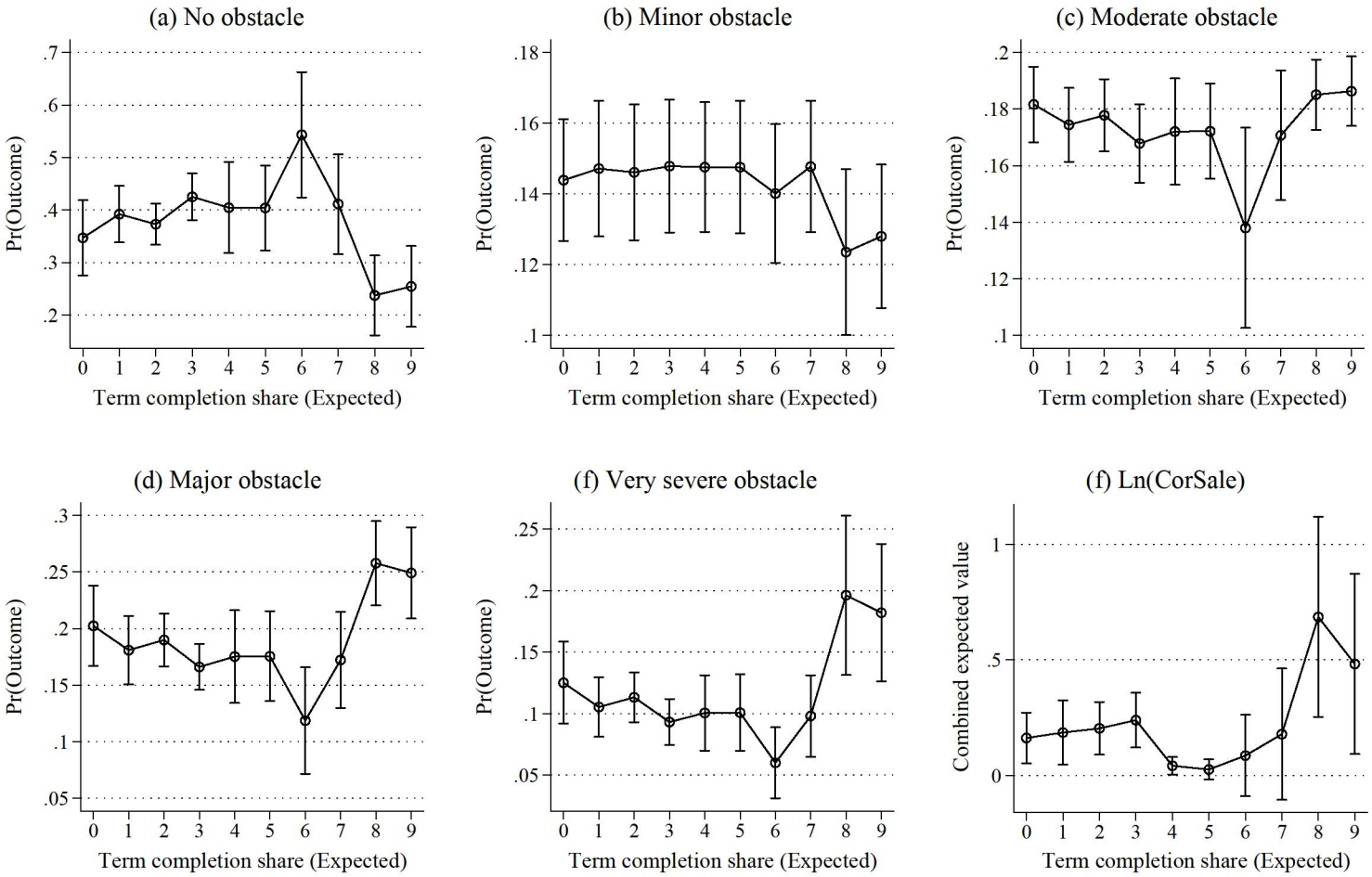

Figure 3.2: Predicted probabilities of *Corrupt* outcomes after OLogit (charts a–e) and combined expected value of *CorSale* after TPM (chart f) by *Time* dummies.

The graphs show that corruption slowly decreases from the beginning towards the middle of the term with an accelerated drop around 50%-60% of the term, followed by a rapid increase in the last 20%-30% of the term. Indeed, the fast decrease during the period around the middle of the term could be a result of certain features of the data rather than a systematic pattern in the behavior of governors. If this is the case, then the established U-shaped pattern can to some extent come from this data anomaly. Nevertheless, the severe increase in corruption in the last quarter of a term is observed in both the continuous and the dummy specifications.

As a further robustness check, we estimate the effect of term completion on corruption based on pseudo-panel data. As we discussed above, our data do not allow us to perform the usual panel data analysis, since there are very few firms that we observe in more than one wave of the survey. However, since we observe firms operating in the same regions in two waves of the survey, we can construct group-mean pseudo-panels, using regions as groups, and analyze the resulting data set with the usual panel data techniques. The results of fixed-effects are presented in Table 3.2. Although they are consistent with previous results, one needs to keep in mind that, as discussed in the previous section, the estimates could be biased due to the relatively small data sample. The linear prediction of corruption by different values of *Time* after fixed effects regression for 2 (waves) and 4 time periods (years) are presented in Figure 3.3. The dynamics are fully in line with our previous results for continuous variable *Time*: pressure for corruption follows a U-shaped trend.

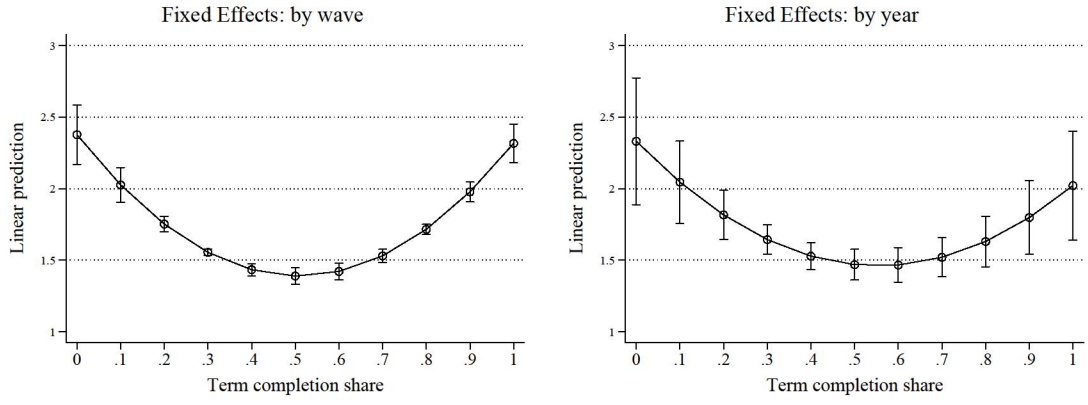

Figure 3.3: Linear predictions of region-average corruption levels after FE regressions.

For the alternative measure of corruption, the share of sales a firm pays as bribes, labeled $CorSale$, we identify a similar pattern. The results of the estimations are presented in Table 3.1, columns 5–7. It is important to point out that the distribution of $CorSale$ is far from normal because of the presence of excessive zeroes. This skewness can possibly cause severe problems with the OLS estimation (column 5 of Table 3.1), thus we prefer to focus on a two-part model (TPM) (columns 6–7). TPM combines logistic regression (Logit, column 6), where all the values of the dependent variable are grouped into zeros and positive values, and a generalized linear model(GLM, column 7), which deals with positive values. The Logit results for $Time_{ir}$ are in line with the main results for the dependent variable $Corrupt$ in terms of the direction of effects, although the magnitudes differ slightly. The two-part model estimates demonstrate that the results for the $CorSale$ come mainly from participation in corruption (Logit), but not from corruption intensity (GLM).

This may be because $CorSale$ variable is noisy, and its true value heavily depends on the truthfulness of respondents, among other concerns. To illustrate the dynamics of corruption, measured as the share of sales firms pay as bribes, we construct a graph of the combined expected value of the corruption measure as a function of term completion share ($Time$). The corresponding chart is presented in Figure 3.1. Finally, as in the case of $Corrupt$, we use time dummies to further explore the timing effect on $CorSale$. The results of the estimation are illustrated in Figure 3.2. Overall, all the findings are consistent: perceived corruption substantially grows towards the end of governors' terms.

There are several other variables, in addition to the variable of interest, which also have a significant effect on corruption perception. First, firms that were originally established as private (dummy variable $Private$), and older firms tend to report higher corruption than those established as state-owned firms, joint ventures with foreign partners and firms established after privatization of state-owned companies. Perceived corruption is also substantially higher for firms with recent experience of dealing with a permit-issuing state bureau (specifically, dummy variable $Permit$ equals 1 if a firm submitted an application to obtain a construction-related permit over the two years prior to the interview). Coefficients on the dummy for a top manager being a woman ($Female$) are mostly significantly negative across specifications, suggesting that firms under female management tend to either perceive or report lower corruption.

Table 3.2: Regression dependent variable: *Corrupt* and *CorSale*

	(1)		(2)		(3)		(4)		(5)	
	PP FE: waves		PP FE: years		OLS		TPM: Logit		TPM: GLM	
	Corrupt		Corrupt		Ln(CorSale)		Ln(CorSale)			
Time (term completion share)	−4.116***	(0.615)	−3.139***	(0.930)	−0.682	(0.530)	−4.263**	(2.014)	−0.306	(0.739)
Time (term completion share)^2	4.037***	(0.570)	2.829***	(0.833)	1.145**	(0.563)	5.316**	(2.086)	0.398	(0.833)
Foreign ownership	−0.083***	(0.019)	−0.023	(0.016)	−0.001	(0.001)	0.002	(0.005)	−0.006***	(0.001)
Female manager	−1.176***	(0.310)	−0.796	(0.800)	−0.049*	(0.028)	−0.283	(0.176)	−0.098	(0.105)
ln(Employment)	0.145**	(0.055)	0.124	(0.091)	−0.006	(0.011)	0.052	(0.057)	−0.112***	(0.036)
ln(Firm's age)	0.759***	(0.175)	0.110	(0.282)	0.015	(0.019)	0.063	(0.103)	0.055	(0.055)
Private	0.941***	(0.281)	0.440	(0.627)	0.035	(0.043)	0.252	(0.224)	−0.047	(0.124)
Permit	−0.154	(0.269)	−0.095	(0.578)	0.098**	(0.047)	0.426**	(0.174)	0.075	(0.086)
1st term	−0.091	(0.062)	0.258	(0.235)	0.545***	(0.157)	1.601***	(0.592)	0.049	(0.173)
Governor's origin (local)	−0.150	(0.118)	0.357	(0.226)	0.339**	(0.131)	1.766***	(0.473)	−0.001	(0.214)
Unemployment	0.003	(0.040)	−0.081	(0.119)	−0.087	(0.085)	−0.623*	(0.334)	−0.085	(0.128)
ln(State officials per 1000)	−0.016	(0.416)	−1.947	(1.658)	−2.624**	(1.250)	−14.459**	(5.695)	−0.738	(1.196)
ln(Real GRP per capita)	−1.381***	(0.375)	−0.141	(0.616)	−0.027	(0.670)	1.811	(3.062)	−0.338	(1.039)
Last elections (UR's share)	−0.007	(0.013)	−0.037*	(0.018)	−0.011	(0.021)	−0.031	(0.071)	0.024	(0.015)
Last elections (Turnout)	0.025**	(0.010)	0.045**	(0.022)	0.028	(0.020)	0.142**	(0.068)	−0.016	(0.021)
City size	−0.327***	(0.089)	−0.210	(0.229)	−0.054	(0.033)	−0.219	(0.176)	−0.117	(0.130)
Year 2009	–		0.428	(0.384)	−0.540	(0.338)	−3.912***	(1.438)	0.329	(0.348)
Year 2011	–		−1.105**	(0.526)	−1.559***	(0.507)	−8.826***	(2.308)	0.980	(0.670)
Year 2012	0.070	(0.273)	−1.218*	(0.606)	−1.722***	(0.528)	−10.106***	(2.592)	0.993	(0.807)
Region fixed effects	–		–		Yes			Yes		
Industry fixed effects	–		–		Yes			Yes		
Clusters	37		37		37			37		
Overall R^2	0.1334		0.2978							
Pseudo R^2								0.264		
McFadden adj. R^2					0.086					
AIC	-209		88		6723			3295		
BIC	-172		139		6875			3600		
Observations	57		107		3319			3319		
Standard errors	Robust		Robust		Clustered: Region			Clustered: Region		

Standard errors in parentheses
Source: Authors' calculations based on the EBRD and World Bank BEEPS survey
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.3: Wald test for the parallel odds assumption (p-values associated with the statistic).

	(1) Full sample	(2) Retired	(3) Re-appointed	(4) M:Leningrad obl.	(5) M:Moscow city	(6) M:Retired 1y 1 year	(7) M:Retired 2y 2 years	(8) M:Re-appointed 2y 2 years
Overall Wald χ^2	$\chi^2(36) = 458.29^{***}$	$\chi^2(14) = 10.17$	$\chi^2(22) = 11.68$	$\chi^2(11) = 6.78$	$\chi^2(9) = 6.67$	$\chi^2(13) = 6.69$	$\chi^2(13) = 10.35$	$\chi^2(16) = 12.68$
Time (term completion share)	0.1667	0.2990	0.9988	–	–	–	–	–
Time (term completion share)2	0.1414	0.9594	0.5304	–	–	–	–	–
Meeting president	–	–	–	0.0727	0.0065	0.8390	0.0008	0.0853
Foreign ownership	0.5124	0.3231	0.5408	0.8319	0.2662	0.7897	0.3704	0.2598
Female manager	0.3488	0.6974	0.5168	0.7585	0.1626	0.8001	0.5311	0.8897
ln(Employment)	0.0011	0.1006	0.4354	0.1233	0.1906	0.0236	0.0077	0.0899
ln(Firm's age)	0.1290	0.0877	0.4160	0.0980	0.9403	0.8229	0.6883	0.9529
Private	0.0001	0.0252	0.8018	0.3373	0.1493	0.0827	0.0060	0.1546
Permit	0.0063	0.0096	0.4903	0.7021	0.9333	0.5361	0.2020	0.1348
Non-1st term	0.0839	0.0026	0.9482	–	–	0.0039	0.0059	0.0042
Governor's origin (local)	0.2058	0.0011	0.0008	–	–	–	0.0028	0.0002
Unemployment	>0.0001	0.8196	0.9887	–	–	0.8533	0.0810	0.4033
ln(State officials per 1000)	0.4004	0.0016	0.0237	–	–	0.0072	0.0009	0.0024
ln(Real GRP per capita)	>0.0001	0.5381	0.3148	–	–	0.0115	0.0028	0.8905
City size	0.8013	0.0984	0.7194	–	–	0.0062	0.3578	0.9058
Last elections (UR's share)	0.9440	0.0017	0.0246	–	–	0.0054	0.6817	0.0301
Last electinos (turnout)	0.8740	0.0007	0.0209	–	–	0.0051	0.0013	0.0052
Year = 2009	>0.0001	0.0173	0.3244	0.3078	0.0046	0.9760	0.5502	0.1075
Year = 2011	0.0001	0.0010	0.0297	0.9 901	–	0.0050	0.6333	0.0292
Year = 2012	0.0010	0.0011	0.0200	0.8843	–	0.0051	0.0124	0.0320
Region fixed effects	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Further, firms tend to experience higher corruption in regions where governors have had a career associated with the region, in contrast to those who came from other regions, and where governors serve their first terms, as well as in regions with a lower relative number of state officials. The last finding could be a result of either lower rents due to higher competition among officials or the fact that the regions with high numbers of state officials are typically remote regions with low population density located in the north and far east of Russia, where business activity is generally low and, as a consequence, corruption is relatively moderate.

Finally, in the majority of the specifications, the dummies for 2011 and 2012 have a strong negative impact on dependent variables. This may indicate either a general trend of decreasing corruption in Russia between 2009 and 2012 or a growing tolerance for corruption over time. We tend to believe the former, since there was a notable liberalization of the business environment in Russia following the 2008–2009 crisis (Yakovlev 2014) that might have affected corruption.

3.4.1 Retired vs. Re-Appointed Governors

Having estimated the baseline model, we observe that firms tend to experience more obstacles to their operations closer to the end of terms of local governors. As we argue above, this pattern cannot be explained by the reasoning behind the standard political budget cycles theories. Instead, we suggest not focusing on the established pattern, but decomposing it, since it is based on an aggregation of the behavior of two very different groups of governors whose incentives for corruption may be completely different. Our theory is that governors accumulate some information regarding their future over terms: early in his term, a governor may be unsure whether he will stay in office for another term; he becomes more certain towards the end of the term. This changing uncertainty shapes governors' corruption incentives: the more a governor is certain that he is leaving, the higher his incentives to commit corruption. Our data allow us to test this theory in several ways. In this and the next section, we present the results of these tests.

First, since we know what eventually happened to the majority of governors in our sample, we perform our analysis separately for firms in regions where governors left once their current term had expired, and for firms in regions where governors stayed for another term. Our theory suggests that in regions where governors left, firms should experience increasing corruption over the term, while in regions where governors stayed, corruption

should follow a decreasing, or at least a non-increasing trend.

We divide governors from our data sample into two groups. We label a governor *Retired* if he is not re-appointed once his current term is over. We label a governor *Re-appointed* if he is re-appointed for another term once the current term is over, or if he requested the president's approval before his term is expired and was then re-appointed. [14]

Table 3.4: Effect of governor's retirement. Ordered Logit. Regression dependent variable: *Corrupt 3*.

	(1) Retired		(2) Re-appointed	
Time (term completion share)	9.294**	(3.890)	7.499	(5.271)
Time (term completion share)^2	−5.131	(3.268)	−9.711**	(3.868)
Foreign ownership	−0.006**	(0.003)	−0.005	(0.003)
Female manager	−0.257*	(0.133)	−0.022	(0.136)
ln(Employment)	0.029	(0.051)	0.013	(0.048)
ln(Firm's age)	0.024	(0.089)	0.104	(0.086)
Private	0.335*	(0.176)	0.277	(0.178)
Permit	0.536***	(0.174)	0.459***	(0.167)
1st term	4.940***	(1.862)	3.630	(3.258)
Governor's origin (local)	2.163	(2.660)	−0.187	(1.523)
Unemployment	0.345	(0.379)	0.754**	(0.369)
ln(State officials per 1000)	0.539	(6.687)	−11.308*	(6.574)
ln(Real GRP per capita)	1.231	(2.070)	−3.110	(2.351)
Last elections (UR's share)	−0.288***	(0.106)	−0.477*	(0.263)
Last elections (Turnout)	0.212**	(0.097)	0.595**	(0.295)
City size	0.057	(0.124)	−0.162	(0.133)
Year 2009	−1.272	(0.992)	0.038	(0.837)
Year 2011	−9.234***	(2.889)	−2.226	(4.039)
Year 2012	−9.160***	(2.879)	−1.487	(4.364)
Region fixed effects	Yes		Yes	
Industry fixed effects	Yes		Yes	
McFadden's adj. R^2	0.039		0.035	
Pseudo R^2	0.063		0.062	
AIC	2887		2720	
BIC	3076		2911	
Observations	1386		1304	

Robust standard errors in parentheses.
Authors' calculations based on the EBRD and World Bank BEEPS survey.
Baseline: Year - 2008
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We have to exclude observations for a number of governors, including several who voluntarily resigned, since we do not know how far in advance the resignation decisions were made, and governors requested the president's approval far in advance of their term expiry dates. We also removed several governors who were promoted once their terms expired to positions such as ministers, since their incentives for corruption while serving as governors may have been mixed. On the one hand, if a governor expects to be promoted, he knows that he will still be in the system in the future and will have

[14] After the abolition of direct gubernatorial elections, governors of several regions asked for the "president's trust": effectively they voluntarily resigned long before the expiration of their current terms, immediately asked for re-appointment for another term, received it, and thus received another four or five years in office.

continuing opportunities to extract rents, so there is no need for him to increase pressure for corruption to "smooth consumption". On the other hand, knowing that he will not be in the region for the next term may give a governor incentives to extract as much as possible from the region before relocating. We do not have sufficient observations to create a separate group for the promoted governors. Overall, our dataset includes 1386 observations for 12 *Retired* and 1304 observations for 14 *Re-appointed* governors. As we now deal with a smaller sample size, we group the five *Corrupt* categories into the following three: "no obstacle", "minor and moderate obstacle", "major and very severe obstacle". Moreover, as we now know the actual expiry dates of the governors' terms, we can compute *Time* as an actual term completion share. Kernel densities of *Time* for *Retired* and *Re-appointed* governors, available in the data, are presented in Figure 3.6 in the Appendix.

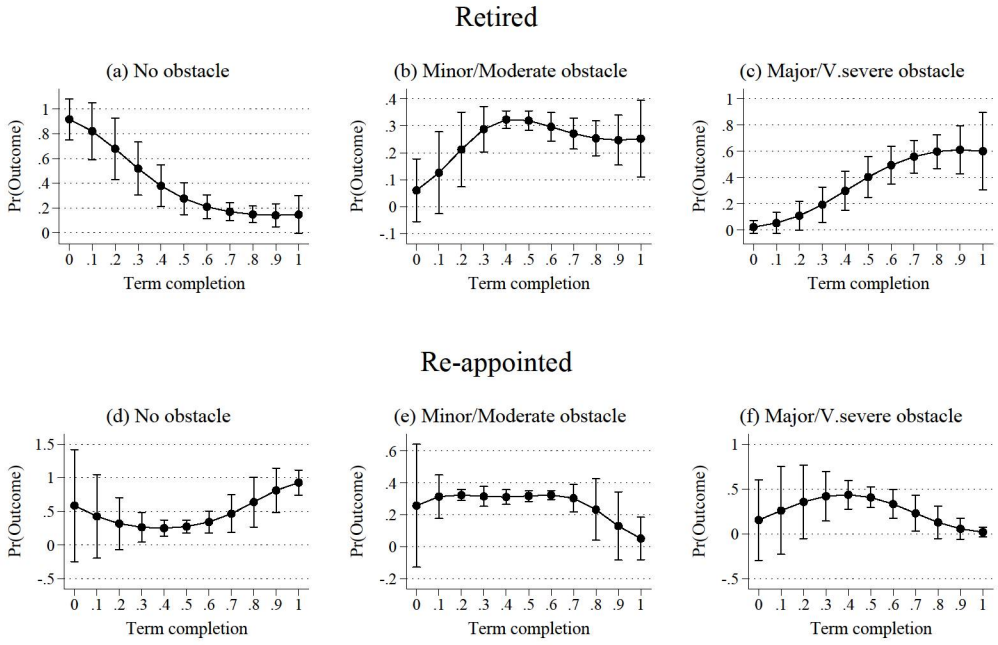

Figure 3.4: Predicted probabilities of corruption levels by *Time* for *Retired* and *Re-appointed* governors.

Since, according to the Wald test, there is no evidence that the parallel odds assumption is violated either for retired or re-appointed governors (See Table 3.11, columns 2–3), we use ordered logit for the estimation. The results of the estimation for the *Corrupt* dependent variable are presented in Table 3.4. From the graphs of predicted probabilities for the values of *Corrupt* (Figure 3.4), it is clear that for the retired governors, pressure

for corruption increases over time, while for the re-appointed it is relatively stable for the first half of the term, but then notably falls towards the end. These results fully meet our expectations: if a governor is likely to leave office once his current term is expired he has increasing incentives to engage in corrupt activities, while when he expects to remain in office for another term the incentives decrease.

As in the case of the baseline model, we check the robustness of the timing effect using dummies for the groups of time periods instead of the continuous variable *Time*. The results of the estimation are in line with those for the case of continuous variable: corruption increases for the *Retired* group of governors and decreases for the *Re-appointed* group. The corresponding marginal effects are depicted in Figure 3.5. To ensure that the established results for retired and re-assigned governors are not driven by certain features of data distribution across the two groups, we additionally include the full set of interactions between dummies for years and for quarters and reach qualitatively similar results.

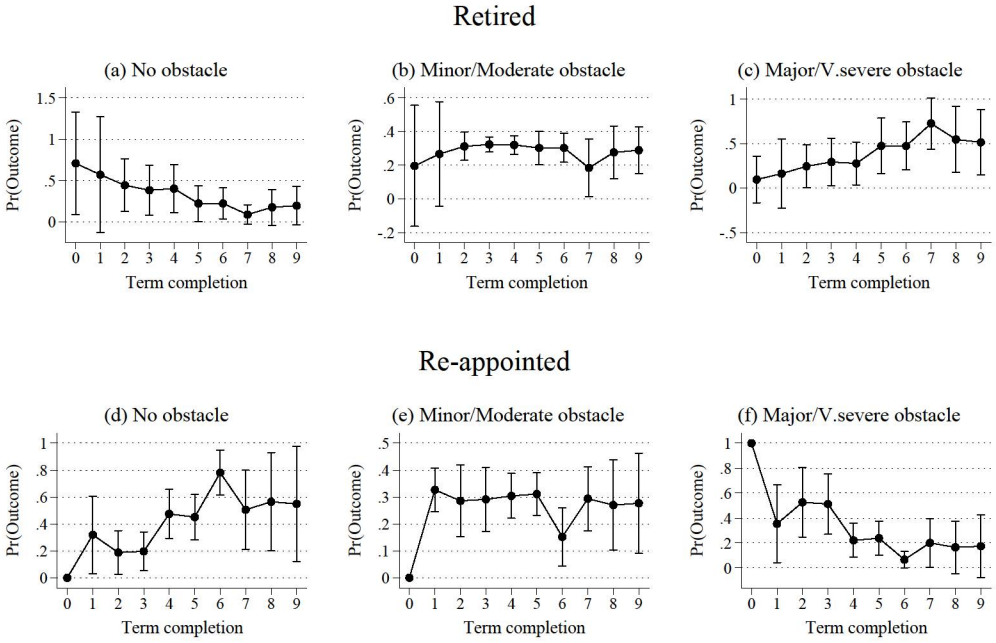

Figure 3.5: Predicted probabilities of corruption levels by time dummies for *Retired* and *Re-appointed* governors.

3.4.2 Meetings with the President

For further tests of our theory, we use information on personal meetings between regional governors and the president of Russia before the end of governors' terms. As we argue above, according to our theory, governors should change their corrupt behavior after these meetings. Our data allows us to verify this hypothesis indirectly.

We focus on meetings that took place during the last year or two before a governor's actual end of term, since these meetings are more likely to be informative for governors regarding their future than meetings at earlier stages of the term. Ideally, we would like to have in our data 1) a set of firms which operated in regions with a governor who then retired, 2) firms which operated in regions with a governor who then stayed for another term, 3) firms that were surveyed before a meeting of the corresponding governor with the president close to the expiration of his term, and 4) those that were surveyed after such a meeting. Unfortunately, we do not have sufficient observations of all of these four types, and thus we are limited to indirect and not fully precise, yet informative approaches.

First, there are two regions, Leningrad under governor Valeriy Serdyukov, and the city of Moscow under Yuriy Luzhkov. In our dataset, these governors were not reappointed, they met with the president within the last two years of the term, and firms operating in the regions were surveyed before and after the meeting (84 and 82 observations respectively for the first region, and 173 and 61 observations for the second)[15]. According to our theory, firms surveyed after the meeting should perceive higher corruption than those surveyed before.

Since the Wald test indicates that the parallel odds assumption is likely to be violated for the dummy for a firm surveyed after a meeting (columns 4 and 5 of Table 3.11), we estimate the effect of the interest using GOLogit. The results of the estimations are presented in columns 1 and 2 of Table 3.5. Estimates for which the parallel odds assumption is violated are reported separately. For both regions, although the coefficients on the meeting dummy are insignificant on the intensive margin, i.e. between the states when corruption is "not an obstacle, minor or moderate obstacle" and when it is "a major or very severe obstacle", they are strongly significant and positive on the extensive margin, i.e. between the states when corruption is "not an obstacle" and when it is "an

[15]In fact, we have two more regions, the city of Saint-Petersburg and Nizhny Novgorod region, where firms were surveyed before and after the meeting. However, since there are only 3 firms surveyed after the meeting in the first case, and 4 firms surveyed before the meeting in the second case, we cannot perform a reliable analysis.

obstacle" to current operations, in line with our expectations.

Second, there are several regions in the dataset whose governors had a meeting with the president in the last year or two (we do the analysis for both cases) of their terms and then retired when the term expired. In some of these regions firms were surveyed before a meeting (480 firms in 6 regions for the last year, and 801 firms in 8 regions for the last two years), while in others they were surveyed after the meeting took place (201 firms in 2 regions for the last year, and 497 firms in 5 regions for the last two years). As we do not have a reason to believe that there is a correlation between corruption in a region, the timing of the meetings and the survey dates, the latter firms should report higher corruption on average. Thus, positive significant coefficients on the dummy for a firm surveyed after a meeting support our theory. The estimation results are presented in columns 3 and 4 of Table 3.5.

Finally, there are also several regions whose governors had a meeting with the president in the last two years of their terms and then were re-appointed for another term. Again, in some of these regions firms were surveyed before a meeting (1442 firms in 15 regions), while in others they were surveyed after the meeting (149 firms in 2 regions). Our theory suggests that those governors who were then re-appointed should decrease corrupt pressure after the meeting. A negative, although weakly significant, coefficient on the dummy for a firm being surveyed after a meeting is fully in line with this prediction (see column 5 of Table 3.5).

The Wald test results for the parallel odds assumption for the last set of tests are presented in Table 3.11, columns 4–8. Since they indicate that the assumption may be violated, we use GOLogit for the estimation.

Indeed, given the relatively small number of regions we use for these exercises, we cannot rule out a possibility that the observed effects are driven by differences in corruption levels, which are uncorrelated with our measures. However, the consistency of the predictions for different subsets of regions suggests that it is likely we captured the true effects. Overall, although each of the tests of our theory we implement in this section has obvious shortcomings arising from the nature of the data, their results are all consistent with each other and with our hypothesis: higher confidence in not remaining in office for another term forces incumbents to extract more rent and to put more pressure on local firms for corruption. This is the main finding of the paper.

Table 3.5: Regression: effect of meeting with the president

		GOLogit(Corrupt 3)									
		(1)		(2)		(3)		(4)		(5)	
		Leningrad region		Moscow city		Retired		Retired		Re-appointed	
		1 year		2 years		1 year		2 years		2 years	
Surveyed after meeting	N vs M,S	1.927**	(0.805)	1.644***	(0.592)	0.764	(0.565)	1.684***	(0.434)	-1.186	(0.908)
	N,M vs S	0.686	(0.612)	0.175	(0.381)	0.764	(0.565)	0.317	(0.291)	-2.455***	(0.869)
Foreign ownership		-0.001	(0.008)	-0.006	(0.006)	>-0.001	(0.006)	-0.003	(0.004)	-0.006*	(0.003)
Female manager		-1.012**	(0.465)	0.298	(0.333)	-0.611***	(0.227)	-0.365***	(0.140)	-0.099	(0.126)
ln(Employment)		vary		0.049	(0.126)	vary		vary		vary	
ln(Firm's age)		vary		-0.194	(0.231)	-0.091	(0.126)	-0.005	(0.091)	0.151*	(0.080)
Private		0.672	(0.464)	0.217	(0.378)	vary		vary		vary	
Permit		-0.648	(0.497)	0.362	(0.409)	-0.130	(0.224)	0.031	(0.174)	0.466***	(0.168)
1st term						vary		vary		vary	
Governor's origin (local)						–		vary		vary	
Unemployment						-0.690	(0.823)	vary		-0.224	(0.326)
ln(State officials per 1000)						vary		vary		vary	
ln(Real GRP per capita)						vary		vary		-1.005	(1.668)
Last elections (UR's share)						vary		-0.058	(0.084)	vary	
Last elections (Turnout)						vary		vary		vary	
City size						vary		0.120	(0.117)	-0.092	(0.114)
Region fixed effects		No		No		Yes		Yes		Yes	
Industry fixed effects		Yes		Yes		Yes		Yes		Yes	
Year fixed effects		Yes		Yes		Yes		Yes		Yes	
Model		$\chi^2(21)$=1503***		$\chi^2(17)$=901.43***		$\chi^2(39)$=122***		$\chi^2(49)$=201***		$\chi^2(54)$=212***	
Pseudo R^2		0.1178		0.083		0.0996		0.0879		0.0682	
AIC		342		464		1427		2693		3309	
BIC		414		529		1613		2956		3510	
Observations		166		234		681		1295		1591	

Robust standard errors in parentheses. Significance level for Wald tests (α)=0.1.
Source: Authors' calculations based on the EBRD and World Bank BEEPS survey
Corrupt 3: N - no obstacle; M - minor/medium obstacle; S - severe/very severe obstacle
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.5 Conclusion

In this paper we present evidence that the corrupt behavior of appointed politicians follows certain patterns that can be explained by political cycles. Specifically, we find that the corruption level perceived by firms operating in various regions of Russia is higher closer to the end of a regional governor's term in office. This pattern persists after controlling for firm-level, regional and governors' characteristics as well as regional, industry, and year fixed effects both in cross-sectional and pseudo-panel frameworks. We also perform several robustness checks, using different estimation approaches, model specifications and an alternative corruption measure, and identify a similar trend. Arguing that the established pattern cannot be explained by the reasoning typically used to explain political budget cycles, we suggest that it can be decomposed into two trends in the behavior of two different groups of governors: those who expect to leave office once their current term expires and those who expect to remain in office for another term. The different trends are driven by different governors' beliefs.

Our theory is that the governors from the first group should have increasing incentives to commit corruption over their terms, while the governors from the second group should have decreasing incentives. The trends come from the intertemporal choice where the incumbent faces the trade-off between postponing rent extraction which has increasing marginal cost for the next term and risking loss of office and thus being unable to extract rents at all: the more certain the incumbent is that he will (will not) be re-appointed, the stronger (weaker) are the incentives to decrease corruption now and to postpone it to the next term. We test this explanation using several approaches. Although, due to the nature of the data, the approaches we use have certain limitations, we consistently find evidence to support our explanation. First, we assume that those governors who were eventually re-appointed were more likely to expect that they would be re-appointed, while those who eventually retired were more likely to expect they would not be re-appointed. in analyzing the effect of timing on corruption for these two groups of governors separately, we find that corruption decreases for the first group of governors and increases for the second group. Second, we use meeting with the president as a proxy for the moment of change in governors' beliefs regarding their likelihood of re-appointment. We find that governors who were eventually re-appointed commit less corruption after a meeting, while the effect of a meeting is the opposite for governors who were not re-appointed.

Based on our findings, we believe that there may be a need to strengthen anti-

corruption control and accountability prior to the expiration of officials' terms, particularly for those officials who are less likely to remain in office. Furthermore, our findings may serve as an indirect argument against appointment systems. A system that assumes the direct election of regional governors by the population may create incentives for incumbent candidates to decrease corruption in order to boost support from voters, which in turn may reduce the increased corruption when governors fear they will lose office.

3.A Appendix

Table 3.6: Summary statistics: *Time* by oblasts.

	Count	Min.	Max.	Median	Mean	St.Dev.	Wave
Belgorod Oblast	117	0.833	0.900	0.883	0.871	0.017	V
Chelyabinsk Oblast	90	0.267	0.750	0.333	0.392	0.164	IV,V
Irkutsk Oblast	118	0.469	0.531	0.516	0.507	0.016	V
Kaliningrad Oblast	117	0.183	0.283	0.217	0.229	0.033	V
Kaluga Oblast	128	0.233	0.847	0.367	0.451	0.206	IV,V
Kemerovo Oblast	115	0.267	0.433	0.367	0.362	0.044	V
Khabarosvk Kray	114	0.583	0.708	0.646	0.645	0.038	V
Kirov Oblast	94	0.517	0.633	0.617	0.599	0.036	V
Krasnodarsk Kray	96	0.267	0.983	0.900	0.765	0.274	IV,V
Krasnoyarsk Kray	119	0.197	0.443	0.361	0.347	0.056	IV,V
Kursk Oblast	101	0.295	0.800	0.361	0.443	0.178	IV,V
Leningrad Oblast	166	0.250	0.950	0.842	0.677	0.277	IV,V
Lipetsk Oblast	106	0.267	0.400	0.367	0.342	0.040	V
Moscow City	351	0.180	0.542	0.375	0.358	0.110	IV,V
Moscow Oblast	251	0.133	0.983	0.367	0.594	0.302	IV,V
Murmansk Oblast	106	0	0.617	0.517	0.439	0.217	V
Nizhni Novgorod Oblast	105	0.200	0.817	0.267	0.395	0.218	IV,V
Novosibirsk Oblast	159	0.183	0.333	0.250	0.243	0.038	IV,V
Omsk Oblast	116	0.850	0.967	0.917	0.908	0.035	V
Perm Kray	154	0.133	0.750	0.167	0.261	0.190	IV,V
Primorsky Kray	195	0.317	0.833	0.383	0.555	0.209	IV,V
Republic of Bashkortostan	157	0.217	0.583	0.300	0.331	0.114	IV,V
Republic of Mordovia	119	0.167	0.267	0.233	0.223	0.034	V
Republic of Sakha (Yakutia)	89	0.267	0.383	0.283	0.294	0.029	V
Republic of Tatarstan	115	0.283	0.367	0.317	0.317	0.020	V
Rostov Oblast	166	0.233	0.733	0.300	0.394	0.188	IV,V
St. Petersburg city	183	0	0.533	0.125	0.237	0.184	IV,V
Samara Oblast	151	0.233	0.867	0.800	0.703	0.220	IV,V
Smolensk Oblast	56	0.167	0.850	0.767	0.728	0.172	IV,V
Stavropol Kray	116	0.650	0.717	0.683	0.687	0.021	V
Sverdlovsk Oblast	143	0.367	0.792	0.450	0.484	0.135	IV,V
Tomsk Oblast	121	0	1	0.933	0.855	0.287	V
Tver Oblast	142	0.0328	0.433	0.131	0.140	0.092	IV,V
Ulyanovsk Oblast	111	0.100	0.217	0.167	0.162	0.041	V
Volgograd Oblast	106	0	0.393	0.0500	0.152	0.159	V
Voronezh Oblast	148	0.0167	0.983	0.533	0.601	0.190	IV,V
Yaroslavl Oblast	115	0.846	0.981	0.904	0.910	0.038	V
Total	4953	0	1	0.375	0.467	0.266	

Table 3.7: Summary statistics: *Corrupt*, *CorSale*, *Time*.

	Count	Min.	Max.	Median	Mean	St.Dev.
Corrupt (obstacle to current operations)	4953	0	4	1	1.546	1.477
CorSale (share of annual sales paid)	3319	0	0.600	0	0.012	0.0450
Time (term completion share)	4953	0	1	0.375	0.467	0.266

Table 3.8: Summary statistics: control variables.

	Count	Min.	Max.	Median	Mean	St.Dev.
Foreign ownership	4953	0	100	0	2.449	14.310
Female manager	4953	0	1	0	0.205	0.404
ln(Employment)	4953	1.609	11.51	2.996	3.233	1.338
ln(Firm's age)	4953	0	5.165	2.303	2.319	0.696
Private	4953	0	1	1	0.850	0.358
Permit	4953	0	1	0	0.131	0.337
1st term	4953	0	1	0	0.485	0.500
Governor's origin (local)	4953	0	1	1	0.788	0.409
Unemployment	4953	0.800	10	6	5.897	2.081
ln(State officials per 1000)	4953	2.398	3.524	3.105	3.105	0.246
ln(Real GRP per capita)	4953	30.58	32.81	31.49	31.518	0.422
City size	4953	1	5	3	2.850	0.833
Last elections (UR's share)	4953	29	91.60	45	47.463	14.082
Last elections (Turnout)	4953	47.20	94.20	55.70	58.592	10.050

Table 3.9: Summary statistics: *Year*.

	Wave	Frequency	Percentage	Cum. Percentage
2008	IV	594	11.99	11.99
2009	IV	502	10.14	22.13
2011	V	2682	54.15	76.28
2012	V	1175	23.72	100.00
Total		4953	100.00	

Table 3.10: Summary statistics: *Industry*.

	Frequency	Percentage	Cum. Percentage
D: Manufacturing	1918	38.72	38.72
G: Wholesale and retail trade	1911	38.58	77.31
F: Construction	462	9.33	86.63
I: Transport	267	5.39	92.03
K: IT	153	3.09	95.11
H: Hotels and Restaurants	146	2.95	98.06
Other manufacturing	96	1.94	100.00
Total	4953	100.00	

Table 3.11: Wald test for the parallel odds assumption (p-values associated with the statistic).

	(1) Full sample	(2) Retired	(3) Re-appointed	(4) M:Leningrad obl.	(5) M:Moscow city	(6) M:Retired 1y 1 year	(7) M:Retired 2y 2 years	(8) M:Re-appointed 2y 2 years
Overall Wald χ^2	$\chi^2(36) = 458.29^{***}$	$\chi^2(14) = 10.17$	$\chi^2(22) = 11.68$	$\chi^2(11) = 6.78$	$\chi^2(9) = 6.67$	$\chi^2(13) = 6.69$	$\chi^2(13) = 10.35$	$\chi^2(16) = 12.68$
Time (term completion share)	0.1667	0.2990	0.9988	–	–	–	–	–
Time (term completion share)2	0.1414	0.9594	0.5304	–	–	–	–	–
Meeting president	–	–	–	0.0727	0.0065	0.8390	0.0008	0.0853
Foreign ownership	0.5124	0.3231	0.5408	0.8319	0.2662	0.7897	0.3704	0.2598
Female manager	0.3488	0.6974	0.5168	0.7585	0.1626	0.8001	0.5311	0.8897
ln(Employment)	0.0011	0.1006	0.4354	0.1233	0.1906	0.0236	0.0077	0.0899
ln(Firm's age)	0.1290	0.0877	0.4160	0.0980	0.9403	0.8229	0.6883	0.9529
Private	0.0001	0.0252	0.8018	0.3373	0.1493	0.0827	0.0060	0.1546
Permit	0.0063	0.0096	0.4903	0.7021	0.9333	0.5361	0.2020	0.1348
Non-1st term	0.0839	0.0026	0.9482	–	–	0.0039	0.0059	0.0042
Governor's origin (local)	0.2058	0.0011	0.0008	–	–	–	0.0028	0.0002
Unemployment	>0.0001	0.8196	0.9887	–	–	0.8533	0.0810	0.4033
ln(State officials per 1000)	0.4004	0.0016	0.0237	–	–	0.0072	0.0009	0.0024
ln(Real GRP per capita)	>0.0001	0.5381	0.3148	–	–	0.0115	0.0028	0.8905
City size	0.8013	0.0984	0.7194	–	–	0.0062	0.3578	0.9058
Last elections (UR's share)	0.9440	0.0017	0.0246	–	–	0.0054	0.6817	0.0301
Last electinos (turnout)	0.8740	0.0007	0.0209	–	–	0.0051	0.0013	0.0052
Year = 2009	>0.0001	0.0173	0.3244	0.3078	0.0046	0.9760	0.5502	0.1075
Year = 2011	0.0001	0.0010	0.0297	0.9 901	–	0.0050	0.6333	0.0292
Year = 2012	0.0010	0.0011	0.0200	0.8843	–	0.0051	0.0124	0.0320
Region fixed effects	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

3.A.1 BEEPS dataset methodology

According to the survey description, the sample is representative at the regional level for the 2012 survey wave. For the wave of 2009, the sample is representative for seven federal districts, which are the groups of neighboring regions. More information can be obtained from the "BEEPS – Sampling structure, Russia 2009, 2012 surveys": http://www.enterprisesurveys.org/M The sample for Russia was selected using stratified random sampling with three levels of stratification used in Russia: industry, establishment size, and region.

Regional stratification

1. IV (2009) wave - Regional stratification was defined in seven regions. These regions are North West, Central, South, Ural, Siberia, Volgo-Viatsky, and Far East (federal districts).

2. V (2012) wave - Regional stratification was defined in 37 regions (city and the surrounding business area) throughout Russia.

Industry stratification was designed as follows:

1. IV (2009) wave - the whole population, or the universe of the study, is the non-agricultural economy. It comprises all manufacturing sectors according to the group classification of ISIC Revision 3.1 (group D), construction sector (group F), services sector (groups G and H), and transport, storage and communications sector (group I). Note that this definition excludes the following sectors: financial intermediation (group J), real estate and renting activities (group K, except sub sector 72, IT, which was added to the population under study), and all public and utilities sectors. In all countries, the sample was stratified along Manufacturing, Retail trade (sector 52) and Other services. In some of the countries, there were specific target numbers of interviews for more detailed sectors within these three groups.

2. V (2012) wave - the universe was stratified into eight manufacturing industries (food, wood and furniture, chemicals and plastics and rubber, non-metallic mineral products, fabricated metal products, machinery and equipment, electronics and precision instruments, and other manufacturing), and seven service industries (construction, wholesale, retail, hotels and restaurants, supporting transport activities, IT, and other services).

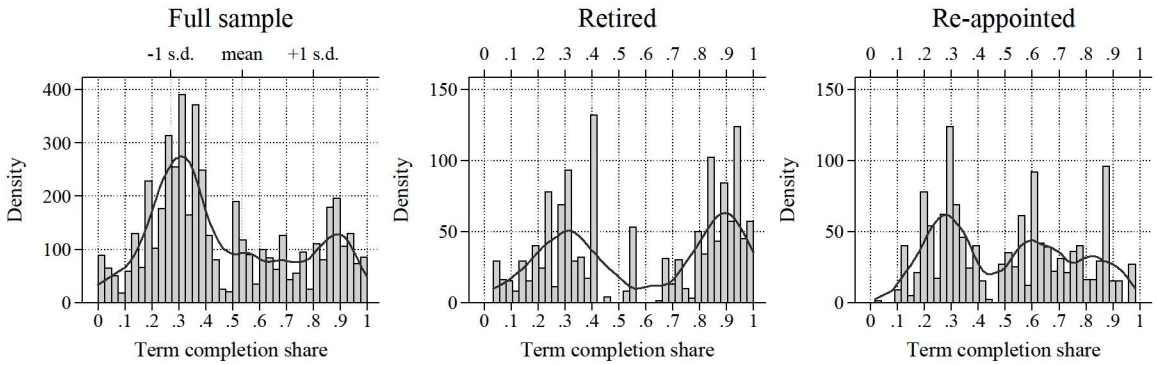

Figure 3.6: Kernel densities of term completion share; overall and by *Retired* and *Re-appointed* statuses.

J.30	As I list some factors that can affect the current operations of a business, please look at this card and tell me if you think that each factor is No Obstacle, a Minor Obstacle, a Moderate Obstacle, a Major Obstacle, or a Very Severe Obstacle to the current operations of this establishment. **SHOW CARD 21**

ROTATE OPTIONS	No obstacle	Minor obstacle	Moderate obstacle	Major obstacle	Very Severe Obstacle	Do Not Know (spontaneous)	Does Not Apply (spontaneous)
Tax rates j30a	0	1	2	3	4	-9	-7
Tax administration j30b	0	1	2	3	4	-9	-7
Business licensing and permits j30c	0	1	2	3	4	-9	-7
Political instability j30e	0	1	2	3	4	-9	-7
Corruption j30f	0	1	2	3	4	-9	-7
Courts h30	0	1	2	3	4	-9	-7

J.7	It is said that establishments are sometimes required to make gifts or informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services etc. On average, what percent of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose?

	Percent
Percent of total annual sales paid as informal payment	j7a %
No payments/gifts are paid	**0**
Don't know (spontaneous)	**-9**
Refusal (spontaneous)	**-8**

Figure 3.7: Questionnaire for dependent variables *Corrupt*(j30f) and *CorSale*(j7a).

Size stratification was defined following the standardized definition for the rollout (both for IV and V waves): small (5 to 19 employees), medium (20 to 99 employees), and large (more than 99 employees). For stratification purposes, the number of employees was defined on the basis of reported permanent full-time workers. This seems to be an appropriate definition of the labor force since seasonal/casual/part-time employment is not a common practice, except in the sectors of construction and agriculture.

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