GREASING THE WHEELS OF INNOVATION: HOW CORRUPTION AND INFORMAL PRACTICES OF FIRMS IMPACT THE LEVEL OF INNOVATION IN BULGARIA?

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ABSTRACT

The 2013 Union Innovation Scoreboard ranked Bulgaria as the least innovative country in the European Union. This ranking is worrisome since innovation is recognized as one of the main drivers of economic growth. Moreover, the World Bank Enterprise Survey shows that firms consider practices of informal competitors and corruption among the biggest obstacles for their operations. Therefore, in this paper I examine the impact of firm informality (corruption, informal competition, and informal practices of the firms themselves) on innovation in Bulgaria. To analyze this relation, I used an unbalanced panel dataset for 2009 and 2013 from the Business Environment and Enterprise Performance Survey. I instrumented for the primary explanatory variables of interest using sector-region averages to address the issues of endogeneity and measurement errors and then I ran a number of probit regressions. The results of the conducted econometric estimations indicate that the bribes that firms pay to government officials are positively and significantly correlated to their radical innovation activities. Moreover, the ability to corrupt a government official facilitates not only the introduction of new products or services by reducing the bureaucratic burden for the innovating firm, but it also eases the processes of incremental innovation. However, my analysis did not find any statistically significant impact of the practices of informal competitors and the informal practices of the firms themselves on firms' innovativeness. My findings suggest that when it comes to firms' inclination to engage in innovations, corruption is not the biggest obstacle that needs to be tackled. Reducing the red tape, defining an innovation policy, and improving the monitoring should come first in the government agenda, if Bulgaria wants to improve its ranking in the Union Innovation Scoreboard.

Keywords: firm innovation, corruption, firm informality

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Chapter 1: Introduction

The long term economic growth of every nation is defined by its ability to innovate, i.e. to transform knowledge into economic value (Chobanova 2007). As stated by Tom Peters (1997) "Innovate or Die" – these are the two main options for organizations if they want to stay competitive in the uncertain and ever changing business environment. This statement can be backed up by the fact that since the Industrial Revolution a substantial part of the GDP growth and improvement in living standards in countries around the world are a result of innovation activities and the importance of innovations for GDP growth has a tendency to increase in the future (OECD 2007). In "The Competitive Advantage of Nations" Michael Porter clearly states that "a nation's competitiveness depends on the capacity of its industry to innovate and upgrade" (1990, p.73).

The literature covering the importance of innovations in different areas of the economic life is quite extensive. Grossman and Helpman (1993) consider innovation as a product of high-cost investments in industrial research and development (R&D) and show a positive link between economic growth and innovations brought about by technological competition on the international market. Romer (1994), Aghion and Howitt (1998), and Lederman (2010) also find evidence for a positive impact of innovations on economic development. In the same line of research, Cameron (1996) concludes that growth is enhanced by innovation and knowledge spillovers between firms, industrial sectors, and across countries, albeit these spillovers are bounded to certain locations where domestic firms are the ones that gain the most from innovations. Rosenberg (2004) finds evidence for a strong positive impact of technological innovation on economic growth. Aghion and Howitt (1992) infer that competition between firms lead to innovation and this technological progress

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translates into economic development. Moreover, Aghion et al. (2002) find evidence for an inverted U-shape relationship between innovation and product market competition: competition can either increase the revenues from innovation or decrease the incentives for laggard firms to engage in innovation. Mohnen and Hall (2013) find that innovation activities result in improved firm productivity and "better revenue per employee performance" (2013, p. 61). Moreover, after analyzing the food-processing, textiles, and garments industries in five developing countries, Goedhuys, Janz, and Mohnen (2008) conclude that sources of knowledge, such as R&D activities, licensed technologies from abroad, and good management practices can be major drivers of firm productivity across different industrial sectors.

Acknowledging its importance, innovation has been considered as one of the most important factors for enduring economic development in the European Union since the introduction of the Lisbon Strategy in 2000. The current Europe 2020 strategy also targets R&D and innovations as key policy components for sustainable economic growth. These components are viewed as crucial for smart growth, job creation, improved labor productivity and industrial competitiveness, and the development of more efficient resources.

An innovative performance of firms is an essential factor for enhancing national progress and competitiveness. However, small countries that do not have a leading role in the global economy and are resource constrained face significant difficulties in being innovative and keeping up with the pace of the developed world. Bulgaria can serve as a good example for such a country since its innovative performance measured by different indicators is rather poor. It is worth looking in more details at how the country performs compared to the other Member states and regarding the Europe 2020 strategy, what are its innovation strengths and weaknesses, and what obstacles firms face in their operations, because such a thorough

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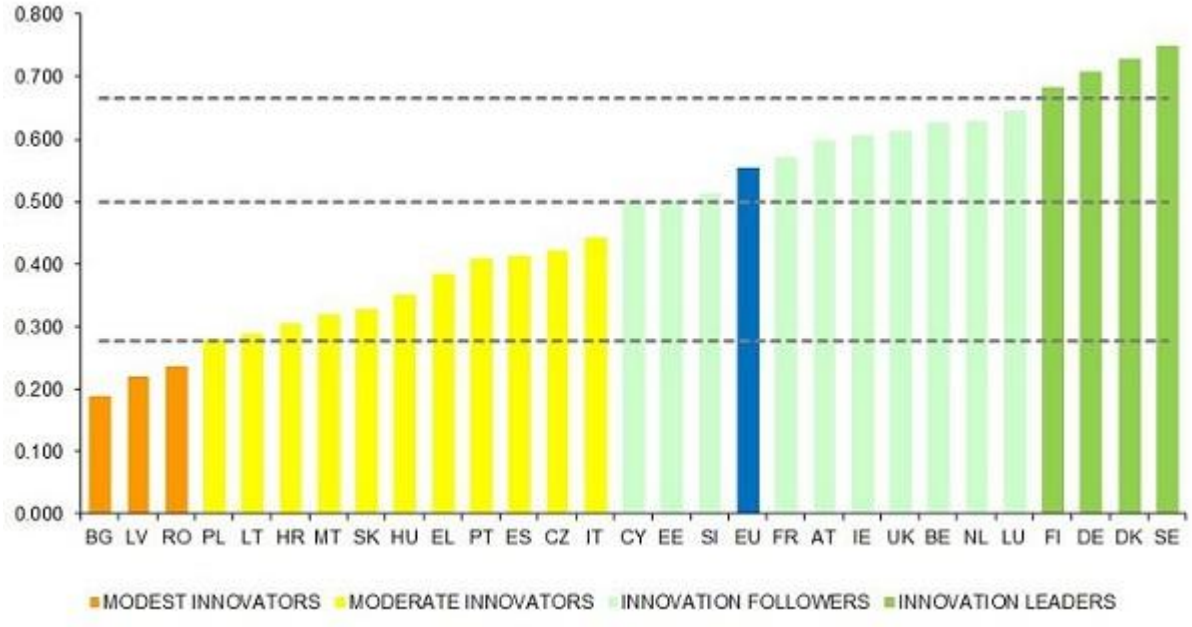
analysis would help to identify the areas that need the attention of the Bulgarian government and allow for policy recommendations.

The Union Innovation Scoreboard (UIS), an instrument of the European Commission to address the issue of countries' innovativeness and stimulate increases in their innovation rates, provides a comparative assessment of the innovation performance of the countries in the European Union (EU), looking at their research and innovation strengths and weaknesses by 25 indicators. With an innovative performance significantly below the average for the Union, Bulgaria ranks last in the 2014 Union Innovation Scoreboard and together with Latvia and Romania falls in the group of "Modest Innovators" (Figure 1). In fact, Bulgaria has been at the bottom of the ranking almost every year since its accession to the EU in 2008. The country reported the highest decline in its innovation rate for the European Union between 2010 and 2012 – a drop of 18.7%. This decline was related to a large extent to the financial difficulties of firms caused by the global recession that hit the economy in 2009.

Figure 1: Innovation performance of the EU Member states. Source: EU 2014



In 2013 Bulgaria showed some signs of recovery – its innovation rate amounted to 0.6%, a number that is still low compared to the EU average but at least positive in sign. The UIS report for 2014 shows that the situation in the country has improved further and now the

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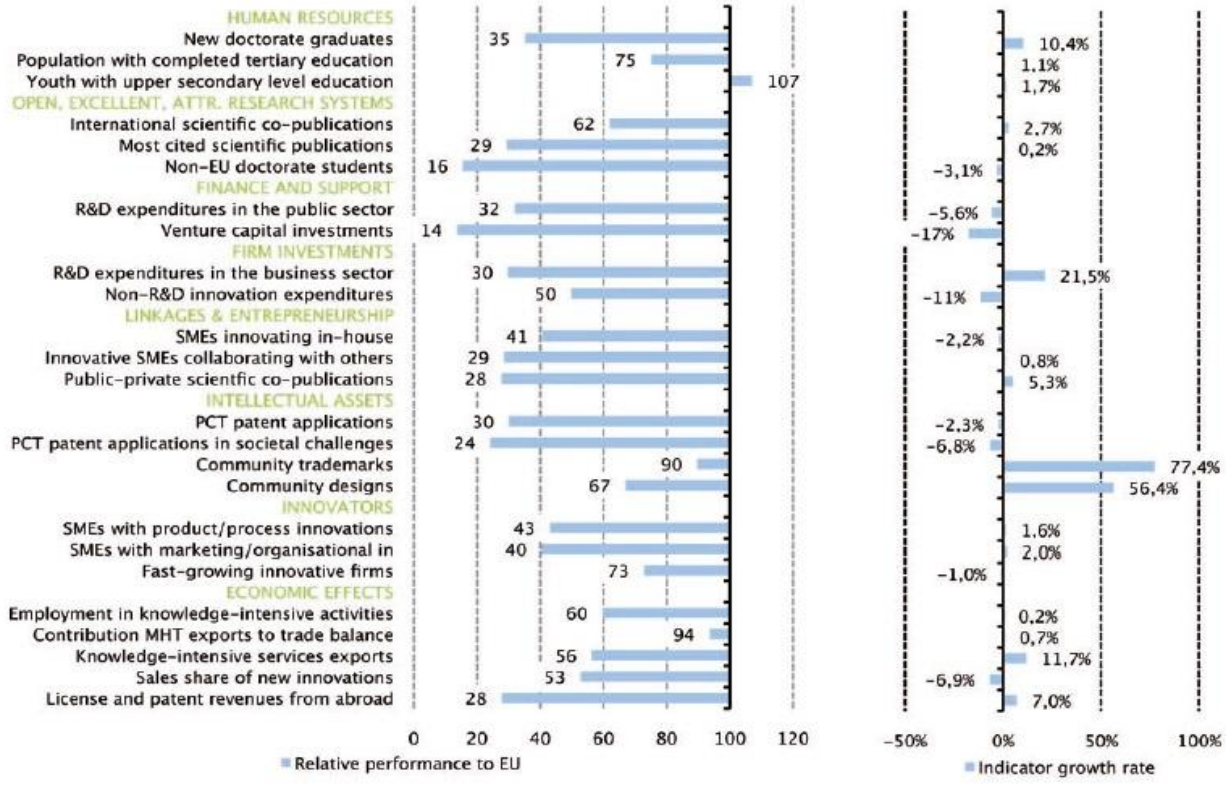
innovation rate of Bulgaria is among the highest in the Union – 2.5%, given that the average for the EU is 1.7%.

Figure 2 below presents 25 indicators measuring different aspects of the innovative performance of Bulgaria in 2014. For all indicators except for Youth with upper secondary level education, the country reports much lower level than the EU average. Bulgaria's relative strengths are in Human Resources, Intellectual Assets, and Economic Effects. Its relative weaknesses are in Finance and Support, especially in relation to venture capital investments, Open, Excellent, Attractive Research Systems, Firm Investments, and Linkages and Entrepreneurship. Bulgaria ranks at the bottom among all Member states when it comes to the innovation dimensions of Finance and Support and Innovators.

Figure 2: Innovative performance of Bulgaria relative to the EU. Source: EU 2014.



Note: Performance relative to the EU where the EU = 100.

R&D intensity measured as the R&D expenditures as a percentage of GDP is another main indicator measuring innovative performance. It reflects the resource input of a given country for research and innovation activities. The 2020 target set for R&D intensity of the

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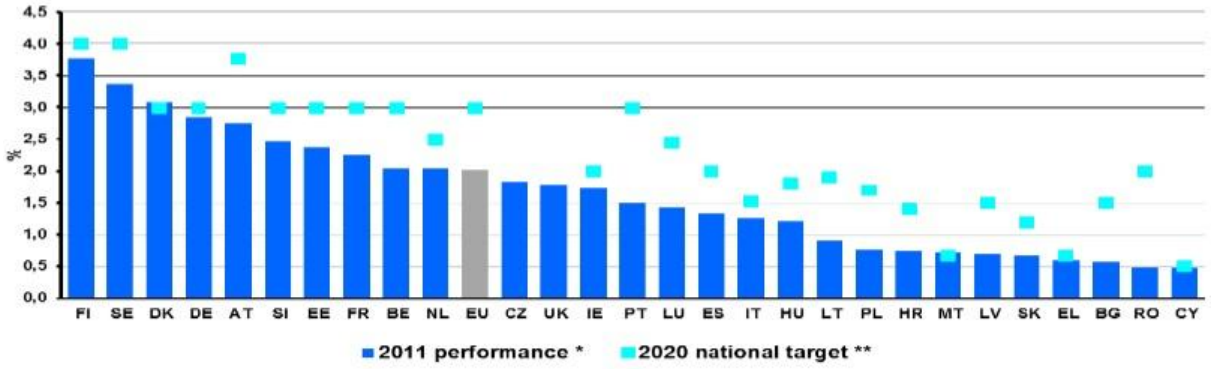
Member states is 3%, but each country can set its own target. In the case of Bulgaria the R&D spending in 2011 was 0.57% of GDP and the country has set for itself the ambitious goal to reach 1.5% expenditures on R&D by 2020 (Figure 3). This means that Bulgaria needs to make a progress of 163% of the current R&D intensity to meet its goal, given that the average rate of increase in R&D intensity for the EU is 48%.

Figure 3: R&D intensity of Member states in 2011 and their targets for 2020.
Source: DG Research and Innovation – Economic analysis Unit



Furthermore, the total expenditures for R&D are usually split between public and private sectors. In Bulgaria firms are cautious when investing in innovations and the contribution of the private sector is relatively small compared to other countries in the EU. The public sector accounts for the bigger amount of R&D spending and since the accession of Bulgaria to the EU, the Structural Funds have become the most significant source of public funding for R&D.

Despite the improvement that Bulgaria showed in the last few years with respect to innovative performance, the country is well behind all other Member states. Lack of financing is surely among the biggest obstacles that firms and the government need to tackle, but there are other factors that also prevent firms from expanding their innovative potential. According to firms' perception, corruption and informal practices of competitors are among the most notable ones (Figure 4). Transparency International ranks Bulgaria on 77th place out of 177 countries in the Corruption Perceptions Index in 2013. Despite being far from the countries with the highest level of corruption in the public sector on an international level, on the EU

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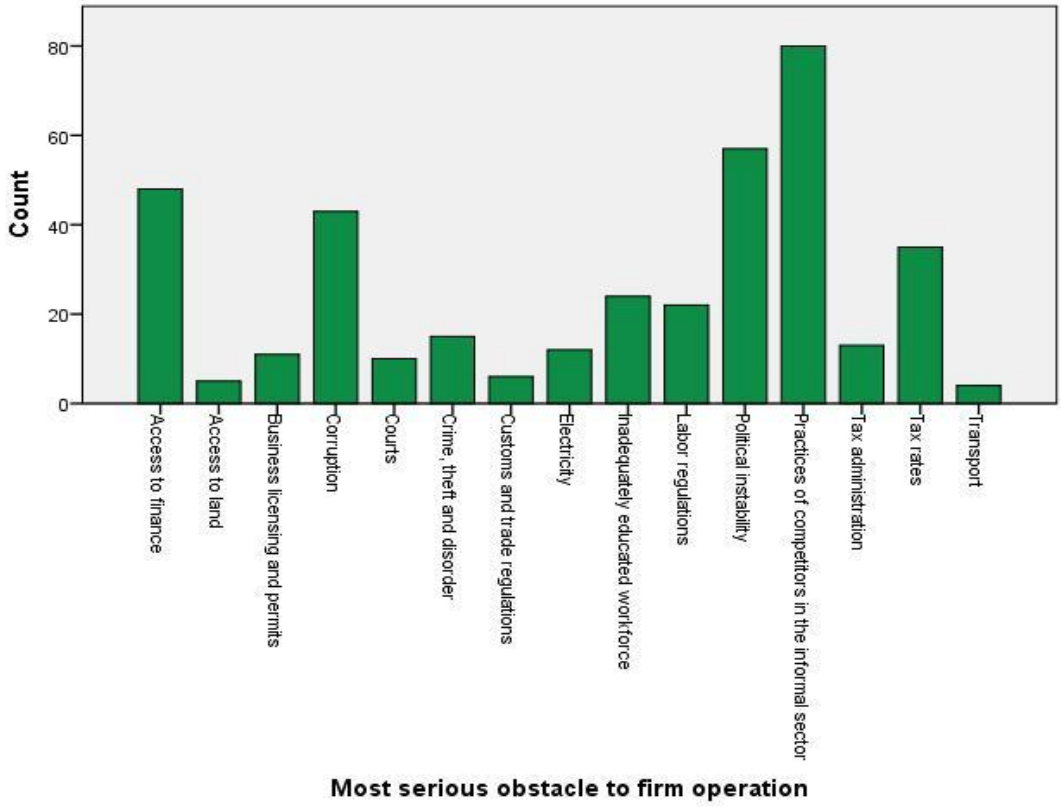
level Bulgaria ranks as the most corrupt Member state after Greece (Sofia News Agency 2013).

Figure 4: Most serious obstacles to firm operations. Source: BEEPS



The question whether corruption and informality have a positive or negative effect on countries' innovation level and growth perspectives has been a subject of debates in the economic literature. There are two main opposing views on the matter – some economists (Leff 1964, Lui 1986, Kaufmann and Wei 1999) believe that in certain situations (especially in developing countries) corruption can be a facilitator of business activities and it can positively influence innovations and economic growth, while others (Shleifer and Vishny 1993, Mauro 1995, Wei 2000) support the idea that corruption is an obstacle for the economy because it causes a decline in the investment rates and hinders innovations and economic development. However, the relation between innovation and corruption and practices of the informal sector is a relatively new research area, where a limited number of studies have been performed, therefore leaving the results of these studies inconclusive. I will contribute to the

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existing literature on the influence of corruption and informal practices of competitors on the innovative performance of firms by analyzing this relation in the context of firm innovation in the Bulgarian economy.

The purpose of this thesis is to examine how corruption and firm informality affect the propensity of firms to develop new products and services and introduce them on the market. My hypothesis is that due to obstructive regulations and procedures and time-consuming bureaucracy in the Bulgarian public sector, the ability to bribe government officials can have a positive effect on firm innovativeness. Furthermore, informal competition can hinder companies' inclination to engage in innovative activities, while informal practices of firms themselves can positively impact their innovativeness. My findings can be useful for policy makers in the Bulgarian government and the Council for Innovations of the Bulgarian Chamber of Commerce and Industry, which is focusing efforts into enhancing firm innovativeness in the country, supporting the cooperation between the academic and business spheres, and assisting the introduction of new products and services on the national market.

To check my hypothesis I am constructing a number of probit models using firm-level data for Bulgaria from the Business Environment and Enterprise Performance Survey (BEEPS) conducted by the World Bank Group in cooperation with the European Bank for Reconstruction and Development. The available unbalanced panel data includes the surveys conducted in 2009 and 2013. There has been no such study conducted for Bulgaria before and my thesis will contribute to the better understanding of the determinants of firm innovation, the relationship between corruption, informality, and firm engagement in innovations, and the areas where intervention is needed. Figuring out what are the underlying problems that prevent firms from investing in innovations and R&D is important because only by tackling the obstacles that firms face in their daily operations can Bulgaria improve its innovative performance, move away from the bottom of the Innovation Scoreboard, and assure itself

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sustainable economic growth.

The next chapter reviews the relevant literature on how innovations and firm informality (informal practices and corruption) relate to each other. Chapter 3 describes the data and methodology used. Chapter 4 presents an empirical analysis and results from the econometric models developed in the thesis. It is followed by a conclusion and policy recommendations.

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Chapter 2: Literature Review

Firm innovation plays an important role in the economic development of every country. This is especially true for small developing countries, which are trying to catch up with the developed world and have a potential to be unfolded. Hence, understanding this importance and the factors which impact firm innovation is crucial if countries want to overcome the most serious obstacles to firm operation and enhance their innovation performance.

Formal competition can have a stimulating effect for firms to innovate (Porter 1990), but whether informal practices of competing firms have the same effect on firm innovation is still a debatable topic. Therefore, it is worth looking at what previous studies have found about the relationship between firm innovation and informality. Corruption and informal practices of competitors influence firms' decision to engage in innovation, but whether they have a positive or negative impact is still a controversial issue in the academic literature. In spite of being interconnected to some extent, it makes sense to distinguish between corruption and firm's informal practices as two separate components of informality when analyzing their relation to firm innovation.

2.1. Innovation and Firms' Informal Practices

Formal competition can induce firms to be more innovative, but this is not exactly the case with rivals from the informal sector. Perry et al. (2007) look at the case where informality encompasses both unregistered firms and firms which Djankov et al (2003) classify as the "unofficial economy". These are formally registered firms that engage in informal practices such as keeping employees or sales hidden from the authorities, or choose not to comply with one or more government regulations, for instance obtaining certain licenses or permits. The authors find that the degree of informality of the firms tends to

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increase with the number of product market and labor regulations, and decrease with an improvement in the quality of governance and rule of law.

The presence of corruption in a country is positively related to informal practices of the firms. On the one hand, firms can bribe government officials when being caught in informal operation and thus to avoid fines and other problems related to their informal practices. On the other hand, there is evidence from transition economies that some firms may decide to operate informally in order to reduce their exposure to blackmailing from corrupt government officials, which often happens to registered firms in these economies (Johnson, Kaufmann, and Shleifer 1997, Johnson et al. 2000, Friedman et al 2000). Friedman et al. (2000) find that indicators of poor governance, such as weak legal protection, corruption, and too many regulations, are positively related to the scope of the informal sector. However, advancements in the court reliability, financial markets, and the business links between firms can reduce the incidence of informality.

Usually firms engaging in social security and tax evasion, the two most common informal practices, are small and with lower productivity and growth prospects. Moreover, these firms compete unfairly with formal firms, thus making the process of creative destruction (more efficient firms replacing the inefficient ones) harder and reducing the incentives for formally registered firms to invest in new technologies and innovation (Perry et al. 2007). Therefore, if more firms start formalizing their activities, productivity gains and enhancement of innovations in the economy can be expected to increase significantly.

According to Perry et al. (2007) a high degree of informality in the economy can result in a low productivity growth due to its negative effect on the incentives of formally registered firms to invest in new technologies and innovation. In "Rising Informality" Palmade and Anayiotos (2005) show worrisome trends of an increasing size of the informal economy and slower economic growth all over the world as a result of informal firms with better

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connections using unfair practices to beat the more productive, formally registered competitors. Farrell (2004) and Kenyon and Kapaz (2005) find the informal sector responsible to a large extent for the productivity gap between developing and developed economies, the distorted competition and the lack of incentives for firm investments resulting in lower growth potential in these economies.

However, Cunha (2006) argues that this is not necessarily the case. According to the author, innovations and investments in new technology can either increase or decrease in relation to dishonest competition from informal firms. If an innovation is defined by the introduction of new or significantly improved qualities in the intermediary goods used in production, the informal practices of firms can hamper the innovating firm from choosing a selling price that will push all other producers to exit the market. When the expenditures on adjustment of foreign technologies to national conditions are also included, the impact on investments in research and development can be dubious. On the one hand, informal practices may lead to a decline in the market power and the size of the profits of the more innovative producers, but on the other side they may be prolonging the lifespan of edge products by increasing the improvements in quality required to dethrone the present leaders on the market (Cunha 2006). Therefore, the R&D expenditures can increase or decrease depending on which of the two effects of informality will gain a dominant position.

All in all, most of the previous research conducted in the area of informality concludes that informal practices of competitors harm the firms' innovation propensity in an economy. When it comes to the relationship between corruption and innovation, the results are not so conclusive. The next section deals with the debate in the academic area regarding this relationship.

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2.2. Innovation and Corruption

Studies have shown that the investment rate in a country is not the only factor that induces economic growth in the long run, but the level of innovation in the economy also plays an important role (Romer 1990, Grossman and Helpman 1991, Aghion and Howitt 1992). Corruption can influence the innovation rate and thus has an effect on the economic growth and development of every country. Therefore, it is important to establish how the presence of corruption impacts the rate of innovation.

The relationship between corruption and economic growth is a widely discussed topic with various studies dealing with it. The research conducted on the matter can be divided into two main opposing views – economists such as Andrei Shleifer and Robert Vishny (1993), Paolo Mauro (1995), and Shang-Jin Wei (2000) concluded that it is an obstacle for the economy because it causes a decline in the investment rates and hinders economic growth, while others such as Nathaniel Leff (1964), Francis Lui (1986), Daniel Kaufmann and Shang-Jin Wei (1999) came to the conclusion that corruption is a facilitator of business activities that can positively influence economic growth.

However, unlike the relation between corruption and economic growth, the relation between corruption and innovation has received limited attention in the academic literature and the empirical support of this relation is not sufficient to give conclusive results. There is an ongoing debate about the effects of corruption on firm innovation. Some researchers find evidence for a negative relationship, while others conclude that in certain types of environments corruption can have a positive effect on the decision of firms to innovate.

As mentioned before, some of the research conducted in recent years finds evidence for the negative impact of corruption on the innovation levels of firms. Felipe Starosta de Waldemar (2011) investigates the effect of corruption on product innovation in Indian firms and finds evidence that the relationship is strongly negative and significant. Sergey Anokhin

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and William Schulze (2009) conclude in their research that the rates of innovation and entrepreneurship will be rising if states can maintain good control over the corruption levels, otherwise firm productivity and investments in innovations will be hampered.

Ayyagari et al (2010) argue that innovative firms have substantially higher chances of having to pay bribes than firms that do not engage in innovative activities. Moreover, Murphy et al (1993) find that innovative firms are more exposed to blackmailing from governments officials as their demand for goods supplied by the government, for example permits and licenses, is more inelastic. The authors conclude that corruption erodes the trust in the government and the related institutions albeit such a trust is crucial for spurring engagement in entrepreneurship and innovation. It also affects negatively the incentives for investments in inventive projects and new technologies.

Habiyaremye and Raymond (2013) investigate the relation between innovation and transnational corruption (multinational corporations bribing government officials in the hosting country of operations). Despite the popular view that foreign companies bring good practices and improve the business environment in the host country, firm-level analysis shows that they also aggravate the corruption climate and try to achieve competitive advantage over domestic firms. The authors show that the engagement of foreign companies in corruption practices curtails the inclination of local firms to invest in R&D activities and worsens their chances of improving existing products or services.

Nevertheless, some studies find a positive relation between corruption and innovation levels. Krammer (2013) shows that in transition economies bribery facilitates the launch of new and cutting edge products on markets. Moreover, the author argues that the presence of organized corruption in these countries has a strong positive impact of the firms' decision to innovate due to the reduced financial burden and informational asymmetry with which firms need to deal. Elizabeth Asiedu and James Freeman (2009) also find support for the positive

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relation between corruption and innovation. The authors show that in corrupted environments firms can extract private gains from paying bribes to win a government contract. Other occasions when corruption can have a positive impact on the business activities of firms are if they need to withdraw credits at interest rates below the market level, to acquire access to raw materials at low prices subsidized by the government, or to collude with tax authorities to pay less taxes, which can result in freed up funds and thus higher investment and innovation rates (Habiyaremye and Raymond 2013).

Mahagaonkar (2008) argues that corruption may boost innovation when it comes to obtaining special documents in a short period of time. The author argues that if the firm-innovator can pay a bribe to a government official and receives faster the permit or license needed to introduce a new product or technology, its incentives to engage in innovation will increase because bribing will allow the firm to gain a leading position on the market. Corruption can also serve as a mechanism for reducing uncertainty and hedging against political risks through the establishment of long lasting relationships between firms and corrupted officials.

This view is also supported by Leff (1964), who looks at corruption as a response to bad governmental policies. He argues that bribery can be helpful in countries where economic activities are hindered by incompetent governments and institutions, superfluous bureaucratic systems, and stiff and ineffective legislative systems. Nye (1967) expresses a similar opinion, stating that through bribery firms can avoid red tape and have better investment incentives, which can result in positive economic development. Moreover, Lien (1990) argues that bribery can facilitate an efficient allocation of resources, given that it is competitive and non-discriminatory. In the same line of thought, Meon and Weill (2010) find a positive influence of corruption on efficiency in countries with inefficient institutions. Therefore, the authors

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conclude that the impact of corruption on the economy of a given country depends to a large extent on the quality of the institutions in this country.

In conclusion, the importance of innovation for economic growth on the national and firm level is a widely discussed topic with various studies providing evidence for a positive relationship between these variables. However, the relation between innovation and corruption and practices from the informal sector is a relatively new research area, where a limited number of studies have been performed, therefore leaving the results of these studies inconclusive. The purpose of this thesis is to contribute to the existing literature on the influence of corruption and informal practices from competitors on the innovative performance of firms by shedding light on this relation in the context of firm innovation in the Bulgarian economy.

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Chapter 3: Data and Methodology

3.1. Data

To test how corruption and informal practices of competing firms affect the innovation level in Bulgaria, I use unbalanced firm-level panel data from the Business Environment and Enterprise Performance Survey (BEEPS) conducted by the World Bank Group in cooperation with the European Bank for Reconstruction and Development. The available data covers the surveys conducted in 2009 and 2013. The panel is unbalanced since not all firms participating in the survey in 2009, participated again in 2013. The dataset consists of 463 enterprises, but most estimations include around 300-400 firms due to incomplete data for some of the variables of interest. Missing observations and answers "Don't know" are excluded from the dataset. The fact that my dataset includes only one country helps to significantly reduce the heterogeneity in the measurement of firm informality, which may arise from unobserved heterogeneity across countries or from cross-country analysis (Fisman and Svensson 2007).

The sampling methodology used to conduct the BEEP survey is stratified random sampling. This means that population units are organized in homogenous groups and within each group simple random samples are selected. Therefore, the survey allows for calculating the estimates for each of the strata with a particular level of precision. The survey includes three strata: firm size, the sector of business operations, and the region of firm location. More specifically, it covers micro, small, medium, and large companies from the manufacturing, wholesale and retail trade, construction, and service sectors located in all six regions of Bulgaria.

The Enterprise Survey displays a representative sample of the private sector in Bulgaria. It covers a wide range of topics regarding the business environment in the country. The main areas covered are access to finance, level of infrastructure, perception of corruption, competition, and crime, and different measures of firm performance, for example sales,

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capacity, export activities, certification, usage of foreign technologies, and engagement in innovation activities. Due to the sensitivity of some of the questions, for instance informal practices and bribery, the survey is conducted by private contractors hired by the World Bank. Questions are usually answered by the owner of the firm or the top manager. In order to ensure higher survey participation and better confidence in the quality of the responses collected, the private contractors and the World Bank guarantee a high degree of confidentiality.

The variables used for estimating the impact of corruption and informal practices of firms on the innovation level in Bulgaria are all taken from the Enterprise Survey conducted in the country. The next sub-section presents a detailed description of these variables.

3.2. Variables

The dependent variable (*New product/service*) tries to capture firm innovation activities. The focus of the analysis in on radical innovations, therefore the dependent variable is a binary variable describing whether the firm has introduced new products or services in the last three years. The data shows that only 33.5% of the firms participating in the survey have performed radical innovation activities. Around 45% of the firms that have introduced new products or services are small firms. However, the usual trend of large firms being more innovative than small firms (Goedhuys 2007) can also be found when we look at the total sample of firms – more than half of the large firms have introduced a new product or service, while for small firms this number is around 30%. The domination of small firms among the innovative ones comes from the fact that small firms constitute around a half of the available sample.

Firms in all regions and all sectors engage in innovation, but with different proportions[1]. The sector with the highest level of innovation is the wholesale and retail trade

[1] Tables with detailed data can be found in Appendix II.

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(48.4% of the newly introduced products or services). It is followed by the manufacturing sector (38.1%). The least innovative sectors are the service and the construction sectors – only 5.8% and 7.7% of the newly introduced products or services can be attributed to these sectors. Looking at the innovation level by regions, the southern part of Bulgaria (Yugozapaden, Yugoiztochen, and Yuzhen tsentralen regions) is significantly more innovative than the northern part (Severozapaden, Severoiztochen, and Severen tsentralen regions). As expected, the highest level of innovations is achieved in the Yugozapaden region, where the capital city is situated (46.5%). However, we should keep in mind that the innovation variable can be describing new products or services only for the firm, but not for the market where the firm operates (Starosta de Waldemar 2011).

The main independent variables try to capture three components of firm informality: corruption (*Bribes paid*), described by the percentage of total annual sales paid as informal payments; informal competition faced by firms (*Informal competition*) and estimated as a binary variable describing whether firms have informal competitors and see them as an obstacle for the firm operations; engagement in informal practices of the firms themselves (*Firm informal activities*), estimated as a binary variable describing if the firm has been asked for an informal payment after tax inspection (the assumption is that if the firm was asked for an informal payment after an inspection, maybe it is not complying with all governmental regulations and has something to hide).

Table 1 below contains descriptive statistics of the variables employed in the estimation models. Around 34% of firms have introduced new product or service in the last 3 years, while the firms that have upgraded an existing product or service are 37%. Firms that have made informal payments are 8.3% of the total number of participants in the survey that gave an answer to this question and the mean bribe payment as a percentage of firm sales is 0.43%; 46% of the firms consider informal competition as an obstacle, and around 3% have

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Table 1: Summary statistics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
New product/service (dummy)	New product or service introduced in the last 3 years	463	.3347732	.4724216	0	1
Bribes paid (% of sales)	Percentage of total annual sales paid as informal payments	421	.43038	2.301558	0	25
Informal competition (dummy)	Does the firm consider informal competition as an obstacle to its operations	463	.4643629	.4992678	0	1
Firm informal activities (dummy)	Was the firm asked to make informal payment after tax inspection	298	.033557	.1803889	0	1
Investments in R&D (dummy)	R&D investment in the last 3 years	463	.1835853	.3875644	0	1
Firm age (logs)	Firm age (in logs)	454	1.188176	.1970575	.30103	2.071882
Firm size (logs)	Number of full-time employees (in logs)	462	1.355829	.5889082	0	3.30103
Foreign ownership (dummy)	Has the firm major foreign ownership (>50%)	461	.0802603	.2719909	0	1
Firm exporter (dummy)	Is the firm exporter	462	.2077922	.4061671	0	1
Dealing with Gov regulations (% of mnmg time spent)	Percentage of the time of the senior management spent to deal with government regulations	457	13.59956	16.04706	0	80
Loan/overdraft Available (dummy)	Does the firm have credit line or overdraft facility	456	.5460526	.4984215	0	1
Upgraded product/service (dummy)	Has the firm upgraded product or service in the last 3 years	463	.3714903	.4837258	0	1
Educated workforce (% of employees)	Percentage of firm employees with university diploma	444	22.35135	23.80779	0	100
Subsidy received (dummy)	Has the firm received government subsidy in the last 3 years	462	.0562771	.2307058	0	1
International certification (dummy)	Does the firm has some international certification	463	.2656587	.4421611	0	1
Foreign technology (dummy)	Does the firm use foreign technologies in its operations	362	.1077348	.3104743	0	1

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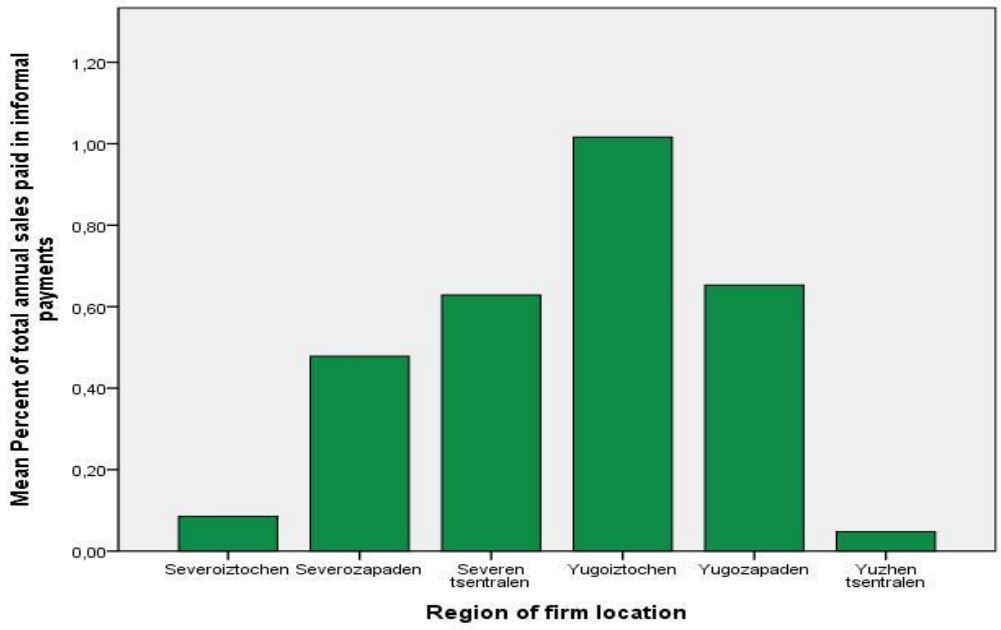
been involved in informal practices themselves. Regarding the firm characteristics, 18% of the firms have invested in R&D, 21% are exporters, 55% have access to finance, and only 8% have major foreign participation. On average, 22% of the full-time employees have a university degree. Moreover, 27% of the firms have some kind of international certification for product quality, 11% use licensed technology acquired from abroad, and only 6% have used a government subsidy in the past 3 years. Finally, the average percentage of senior management's time spent on dealing with governmental regulations is 14%.

Since the main explanatory variable of interest accounts for the level of bribery in Bulgaria, it is important to analyze how bribes are distributed among the regions and sectors in the country (Figure 5). Here, the patterns are a bit different than the ones observed for the innovation activities in the country.

Figure 5: Mean percent of total annual sales paid as bribes by region of firm location. Source: BEEPS



When looking at the average percentage of total annual sales paid as informal payments, the region with the highest level of bribes is Yugoiztochen. Despite being the richest and the most innovative region, the capital region (Yugozapaden) has a lower average bribe level than the Yugoiztochen region by around a third. Yuzhen tsentralen is the region

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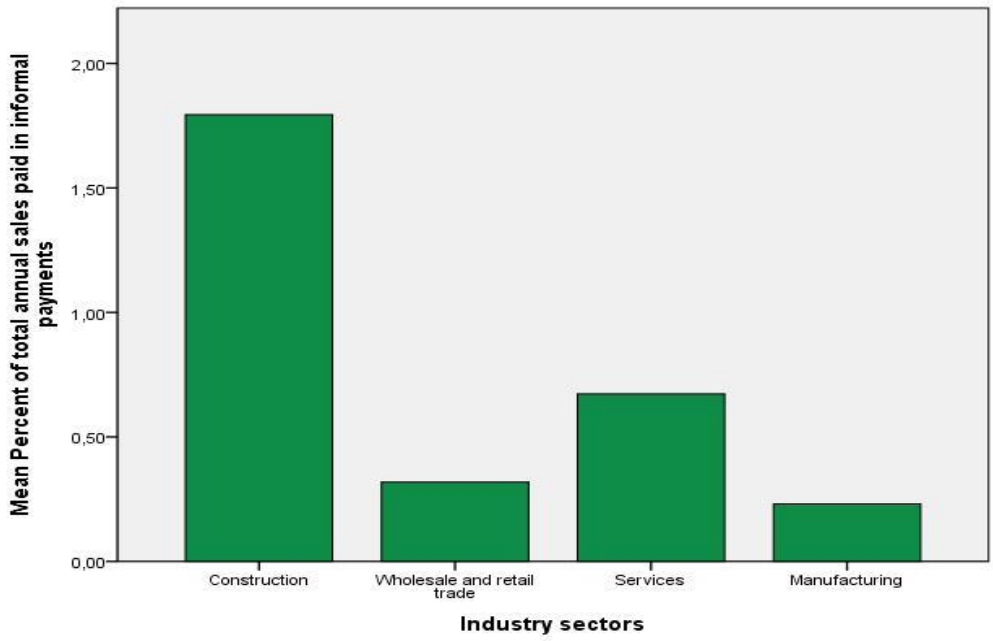
with the highest level of innovation after the Yugozapaden region, but the average level of bribing is the lowest in the country. For the rest of the regions, the average level of bribing is proportional to the distribution of innovation activities – the higher the firm innovation, the bigger the bribes.

However, considering the percentage of total annual sales paid as informal payments in absolute terms, the Yugozapaden region has the highest level of bribery. The rest of the regions have a level of bribery proportional to their innovation levels except for the Yuzhen tsentralen region, which is the second most innovative region but it has the lowest level of bribery. Nevertheless, there is no clear relation between the innovativeness of regions in Bulgaria and their levels of bribery. The data does not explicitly support the idea that regions that are richer and have higher innovation levels are the ones that make the highest informal payments.

Figure 6: Mean percent of total annual sales paid as bribes by industrial sector. Source: BEEPS



After examining the distribution of bribes across regions, it is worth looking at the distribution of bribes across industrial sectors (Figure 6). In spite of being among the less innovative sectors, the construction sector is the one where the highest levels of bribes are

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paid on average. The service sector also maintains high levels of bribing despite being the least innovative one. The wholesale and retail trade and manufacturing are the sectors with the lowest average levels of bribes. The results in the graph above lead to the conclusion that there is a negative relationship between the level of innovations and the average bribery levels across industrial sectors. Furthermore, sectors with lower barriers to entry tend to have higher levels of bribery[2].

In pursuance of reliable model estimates and following the empirical literature on the matter (Goedhuys 2007, Lederman 2010), I include other explanatory variables and firm specific controls. Furthermore, fixed effects are included in all models in order to account for possible idiosyncratic disparities between regions and years.

The empirical literature (Mansfield 1965, Romer 1994, Grossman and Helpman 1991, Goedhuys and Veugelers 2008, Lederman 2010) considers investments in research and development (R&D) and firm innovation efficacy as closely linked together. Therefore, I include a binary variable (*Investments in R&D*) describing whether a firm has invested in R&D in the past three years. Firm age is also important for the innovative performance of firms. Older firms are expected to be less innovative than younger firms. I include a control variable for firm age, which is computed by subtracting the year when the firm was established from the year of the last survey (2013) and taking its log form. Furthermore, a variable controlling for firm size is included since larger firms have more financial resources and this allows them to have higher investments in R&D activities, which can result in the introduction of more new products or services (Cohen and Klepper 1996). Firm size is measured as the number of permanent full-time employees and is taken in its log form.

Girma, Gong, and Görg (2009) show that major stake of foreign ownership in a firm has a positive relation to firm's innovative performance. Thus, I include a binary variable to

[2] Detailed results of the percentage of annual sales paid as bribes of industries (by ISIC categories) can be found in Appendix II of this paper.

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control for major foreign participation (50% or more). The export status of firms is also included in the estimation models as a binary variable (*Firm exporter*). Recent research suggests that the export status will be positively related to firm innovations (Golovko and Valentini 2011). To control for the extent of the government bureaucracy, I include a variable that measures the percentage of senior management's time spent on dealing with government regulations and others required procedures. Considering the system in Bulgaria as characterized by obstructive regulations and procedures and time-consuming bureaucracy, I expect this variable to be positively related to firm innovation – if a firm wants to introduce a new product on the market it will have to spend a sufficient amount of time in complying with all government requirements. Finally, I include a binary variable (*loan/overdraft available*) to account for firms' accessibility to financing. Since access to finance is important for firm's innovation activities and growth prospects (Ayyagari, Demirgüç-Kunt, and Maksimovic 2011), the variable reports whether firms have a credit line or overdraft facility.

Additional explanatory variables related to firm innovation are included in the robustness checks. A highly educated workforce has a positive impact on firm innovation (Krammer 2009) and the variable (*Educated workforce*) measures the percentage of full-time employees with a university degree. The other control variables describe whether firms use government funding (*Subsidy received*) or licensed technology acquired from abroad (*Foreign technology*), or they possess certification for their product quality that is internationally recognized (*Int certification*).

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3.3. Methodology

Since the dependent variable (*New product/service*) is a binary variable, I use probit models reporting the marginal effects to estimate the impact of informality on firm innovation. My estimations can be affected by two major econometric issues: endogeneity and measurement errors. For example, government officials can be extracting higher bribes

from more profitable firms, firms may be specializing in rent-seeking as a means of innovation (firm innovation can be a result of more favorable bureaucratic treatment due to informal payments, not because of investments in technologies, R&D, and high-skilled workers), or there could be measurement errors in the data concerning informality due to its sensitive nature. Moreover, bribery and firm innovation can be jointly determined by different factors that are specific for certain industrial sector or region of firm operations, for instance underlying technologies or propensity of government official to extract bribes (Fisman and Svensson 2007). To mitigate these problems I construct instrumental variables following the strategy of Fisman and Svensson (2007)[3].

$$b_{isr}=B_{isr}+B_{sr}$$

The indices i, s, r stand for firm, sector, and region of operations

The authors decompose the variable describing the level of bribery (b_{isr}) into two components: one specific for the firm (B_{isr}) and one specific to the sector-region where the firm operates (B_{sr})[4]. B_{sr} is computed by taking the average level of bribes for a sector s and region r, therefore it is a function of the specific characteristics related to each sector-region that determine the degree to which government officials are able to obtain bribes[5]. Fisman and Svensson assume that B_{sr} is exogenous for the firm since the industry-specific component of the bribe level is affected by "underlying technologies and the rent-extraction talents and inclinations of bureaucrats" (2007, p. 66). Thus, if there is an unobservable firm-specific factor (omitted variable) that may influence both innovation and the level of bribes, B_{sr} should

[3] Only compendious description of the Fisman and Svensson (2007) instrumental variable approach is presented. Details can be found in their original paper.

[4] The same strategy is used to create instrumental variables for the variables accounting for informal competition and firm informal practices.

[5] Just for comparison I also created an instrumental variable by taking the sector-region averages of all firms except from the firm in question (for example if there are n firms operating in certain sector and region, I calculate the sector-region average for n-1 firms i.e. all other firms competing in the same sector and region except the one for which I am calculating the sector-region average). The results were similar to the results estimated using the Fisman and Svensson approach, but the instrumental variable created in this manner was weaker and not significantly correlated to the bribes variable. Therefore, I decided to use the Fisman and Svensson strategy.

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be uncorrelated with it and could be used as an instrument for b_{isr}.

By employing sector-region averages as an instrumental variable for bribery at the firm level, "the bias resulting from unobservables that are correlated with bribery at the firm, but not industry-location, level" (Fisman and Svensson 2007, p.66) should be removed. Moreover, this instrumental variable can reduce the noisiness of the micro-level data and mitigate the impact of measurement errors, since these issues are generally considered as firm-specific and should be uncorrelated with the sector-region averages of bribery (Fisman and Svensson 2007). Therefore, the presented instrumental variable approach should result in reliable estimates for the variables of interest.

After describing the data and variables, and developing an estimation strategy to analyze the impact of informality on firm innovation and mitigate the possible econometric issues that may arise during the analysis, the next chapter proceeds with the empirical models used for estimation and the results from these models.

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Chapter 4: Empirical Models and Results

4.1. Base Model Specifications

After describing the data and methodology, I can proceed with the empirical models used to establish the impact of firm informality on innovation in Bulgaria. The base probit model[6] used to estimate the impact of corruption on firm innovation is the following:

$$NEWPROD_{itsr}=\alpha_0+\beta BRIBES_{itsr}+\alpha_1 FC_{itsr}+ \alpha_2 GOVREG_{itsr}+\lambda_s+\delta_t+\varepsilon_{itsr} \quad (1)$$

where NEWPROD is a binary variable equal to 1 if a firm has introduced new products or services in the past three years, otherwise equal to 0; BRIBES is the independent variable of interest and it accounts for the percentage of total annual sales paid as informal payments; FC includes the set of firm characteristics I control for (R&D spending, age, size, foreign ownership, export status, access to financing); GOVREG accounts for the extent of bureaucracy in the country and it is equal to the percentage of senior management's time spent on dealing with government regulations; λ_s and δ_t are the fixed effect dummies controlling for industrial sector where the firm operates and year of the survey; i, t, s, and r are indices for firm, year, sector and region; and ε is the error term.

Similar models are estimated with the explanatory variables accounting for informal competition (INFORMAL) and informal practices of the firms themselves (TAXINF):

$$NEWPROD_{itsr}=\alpha_0+\beta INFORMAL_{itsr}+\alpha_1 FC_{itsr}+ \alpha_2 GOVREG_{itsr}+\lambda_s+\delta_t+\varepsilon_{itsr} \quad (2)$$

$$NEWPROD_{itsr}=\alpha_0+\beta TAXINF_{itsr}+\alpha_1 FC_{itsr}+ \alpha_2 GOVREG_{itsr}+\lambda_s+\delta_t+\varepsilon_{itsr} \quad (3)$$

First, I run three probit models[7] with each of the main explanatory variables of interest (*bribes*, *informal*, and *taxinf*) as a benchmark. In these regressions I do not control for the biases that may arise from econometric issues, such as endogeneity and measurement errors. In Table 2 the results reporting for marginal effects are presented, which allows for a

[6] The base models were estimated using OLS regressions as well. Results can be found in Appendix IV.
[7] Since probit models are non-linear, reporting robust standard errors is not an appropriate approach to address potential heteroscedasticity. Instead, I perform the White's test and find the models' errors to be homoscedastic.

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meaningful interpretation of the coefficients. The models show that there is a positive and highly significant relationship between firm informality and the innovation level in Bulgaria.

Table 2: Probit model estimates for radical innovation (reporting marginal effects)[8]

Dependent variable: new product or service			
Method	dprobit	dprobit	dprobit
Variables	(1)	(2)	(3)
Bribes paid (% of sales)	0.032		
	(0.012)***		
Informal competition faced (dummy)		0.132	
		(0.052)**	
Firm informal activities (dummy)			0.397
			(0.146)***
Investments in R&D (dummy)	0.645	0.659	0.652
	(0.052)***	(0.048)***	(0.059)***
Firm age (logs)	-0.150	-0.218	-0.256
	(0.140)	(0.133)	(0.169)
Firm size (logs)	0.115	0.121	0.186
	(0.055)**	(0.053)**	(0.070)***
Major foreign ownership (dummy)	0.117	0.080	0.059
	(0.112)	(0.108)	(0.134)
Firm exporter (dummy)	-0.033	-0.006	-0.068
	(0.072)	(0.072)	(0.088)
Dealing with Gov' regulations (% of mgmt time)	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
Loan/overdraft available (dummy)	-0.010	-0.032	-0.013
	(0.057)	(0.054)	(0.072)
Wholesale and retail trade sector	0.132	0.095	0.284*
	(0.105)	(0.100)	(0.151)
Service sector	0.027	0.039	0.188
	(0.157)	(0.146)	(0.207)
Manufacturing sector	0.196	0.177	0.367
	(0.112)*	(0.108)*	(0.158)**
Year 2013	-0.058	-0.067	-0.083
	(0.061)	(0.057)	(0.079)
N	404	440	285
Pseudo R^2	0.27	0.26	0.30

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

More specifically, a one percentage point increase in the amount of total annual sales of a firm paid as informal payments increases the probability of this firm to introduce a new product or service on the market by 3.2%. Given that the mean value of bribes is 0.43%, firms

[8] Estimation of the probit models with equalized number of observations can be found in Appendix III.

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that pay bribes will have on average a 1.4% higher probability to introduce a new product or service than firms that do not pay bribes. Firms facing informal competition have a 13.2% higher probability to introduce a new product or service than firms for which informal competition is not an obstacle, while firms that engage in informal practices, tax evasion for instance, have a 39.7% higher probability of introducing a new product or service than firms which comply with all government rules and regulations.

The results for firm characteristics follow a similar pattern across the three models. As expected, investments in R&D and firm size have a positive and highly significant relation to firm innovation. These results indicate that firms that engage in R&D activities and larger firms have a higher propensity to innovate. Firm age has a negative, though insignificant coefficient, suggesting that older firms are less innovative than younger ones. The senior management's time spent on dealing with governmental regulations is positively but not significantly correlated to firm innovation indicating that the more time the senior management spend in dealing with bureaucratic procedures, the higher the probability of introducing a new product or service on the market.

The export status of firms was expected to be positively correlated to innovation due to knowledge spillovers (Aghion and Howitt 1992) and higher competition on the international market, which induces firms to be more innovative. In the case of Bulgarian firms being an exporter affects negatively firms' likelihood to engage in radical innovations. However, this relation is not significant even at the 10% level.

The case of the variable *Loan/overdraft available* accounting for a firm's access to finance is similar. The variable has a negative coefficient despite the general expectation that access to finance will be positively correlated to firm's decision to introduce a new product or service on the market. However, this coefficient is not significant and its interpretation is not reliable.

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Firms that participated in the survey in 2013 have a lower likelihood to introduce a new product or service on the market than firms that participated in 2009. Although not significant, this coefficient probably refers to the financial crisis that hit the country in 2009 and hindered the regular operations of the enterprises in Bulgaria. During the three years before 2009 the economy of the country was booming and firms had more business opportunities, but with the arrival of the financial crisis, the economy went into a downturn, which left only few firms unaffected.

Proceeding forward, I use sector-region averages as instruments for the explanatory variables accounting for firm informality. The instrumental variables (IV) are expected to mitigate the possible estimation biases arising from endogeneity and measurement errors issues. The estimated base model including the IV for bribery is the following:

$$NEWPROD_{itsr}=\alpha_0+\beta IVBRIBES_{sr}+\alpha_1 FC_{itsr}+ \alpha_2 GOVREG_{itsr}+\lambda_s+\delta_t+\varepsilon_{itsr} \quad (4)$$

The models estimated with IVs for the other two explanatory variables of interest are constructed in the same way as model (4). Results from the IV-estimation models are presented in Table 3.

The coefficient of IVBRIBES is positive and highly significant indicating that a one percentage point increase in the bribes paid by firms translates into a 16.5%[9] higher probability for radical firm innovation. This means that firms that pay bribes have on average a 7.1 % higher probability to innovate than firms that do not pay bribes. The probit model using instrumental variable estimates a higher coefficient for bribes. This result suggests that there was a downward bias causing underestimation of the effects of bribery and by using the sector-region averages this bias was addressed.

The coefficients of the IVs accounting for obstructive informal competition and

[9] Using an instrumental variable created as the sector-region average for all other firms operating in the same sector and region except for the firm in question yielded a coefficient for radical firm innovation equal to 17.7%. The difference is not substantial, hence, I will stick to the Fisman and Svensson approach.

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informal practices of the firms themselves lose their significance, which suggests that the results in the base model without instrumental variables were driven by firm specific characteristics. However, it is worth noting that after removing the idiosyncratic component the coefficient for informal competition becomes negative which indicates that this type of competition can be actually harmful to firm innovation.

Table 3: Probit models for radical innovation with IV estimates (reporting marginal effects)[10]

Dependent variable: new product or service			
Method	dprobit with IV	dprobit with IV	dprobit with IV
Variables	(4)	(5)	(6)
Bribes paid (% of sales)	0.165		
	(0.050)***		
Informal competition faced (dummy)		-0.154	
		(0.183)	
Firm informal activities (dummy)			0.551
			(0.788)
Investments in R&D (dummy)	0.656	0.640	0.639
	(0.051)***	(0.050)***	(0.061)***
Firm age (logs)	-0.109	-0.172	-0.236
	(0.140)	(0.131)	(0.171)
Firm size (logs)	0.115	0.113	0.179
	(0.055)**	(0.053)**	(0.070)***
Major foreign ownership (dummy)	0.108	0.089	0.042
	(0.111)	(0.109)	(0.133)
Firm exporter (dummy)	-0.037	-0.028	-0.064
	(0.072)	(0.071)	(0.088)
Dealing with Gov' regulations (% of mgmt time)	0.000	0.001	0.001
	(0.002)	(0.002)	(0.002)
Loan/overdraft available (dummy)	-0.005	-0.023	-0.034
	(0.057)	(0.054)	(0.072)
Wholesale and retail trade sector	0.329	0.107	0.281
	(0.125)***	(0.100)	(0.154)*
Service sector	0.268	0.024	0.183
	(0.196)	(0.144)	(0.216)
Manufacturing sector	0.418	0.137	0.363
	(0.136)***	(0.109)	(0.159)**
Year 2013	-0.061	-0.080	-0.097
	(0.061)	(0.059)	(0.079)
N	404	440	285
Pseudo R^2	0.27	0.25	0.29

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

[10] Estimation of the probit models with equalized number of observations can be found in Appendix III.

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Nevertheless, due to the lack of significance of the coefficients their interpretation becomes meaningless. When looking at the other coefficients in Table 3, R&D investments and firm size remain positive and highly significant. For instance, firms investing in R&D have on average around 66% higher probability of introducing new product or service than firms that do not engage in R&D activities. The coefficients of the rest of the variables in the models preserve their signs from the base models.

In the estimated models above, the dependent variable *New product/service* is a binary variable equal to 1 if a firm has introduced new products or services in the past three year and 0 otherwise. Therefore, it accounts for radical innovation. Another possibility for firms is to engage in incremental innovation i.e. to introduce small improvements in already existing products or services in order to maintain their competitive position on the market. To check how corruption and firm informal practices are related to the incremental innovation efforts of firms, I estimate the same probit models with IVs. The only difference is that I replace the dependent variable *New product/service* with a binary variable *Upgraded product/service*, which equals 1 if a firm has upgraded an existing product or service in the past three years and 0 otherwise.

Table 4 presents the results from the estimated models. The coefficient for bribes remains positive and highly significant but increase in the bribes paid by firms has a lower probability to result in incremental innovation than in the case with radical innovation. Nevertheless, the positive effect of bribing indicates that the ability to corrupt a government official facilitates not only the introduction of new products or services by reducing the bureaucratic burden for the innovating firm, but it also eases the processes of incremental innovation. R&D investments are also positively and significantly correlated to incremental innovation, but firm size loses its explanatory power. Firms that participated in the survey in 2013 have a 33.9% lower likelihood to upgrade an existing product or service than firms that

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participated in 2009. The relationship between the year of survey and incremental innovation is highly significant and probably the global financial crisis has a substantial contribution to such a relationship.

Table 4: Probit models for incremental innovation with IV estimates (reporting marginal effects)[11]

Dependent variable: upgraded product or service			
Method	dprobit with IV	dprobit with IV	dprobit with IV
Variables	(7)	(8)	(9)
Bribes paid (% of sales)	0.126		
	(0.051)**		
Informal competition faced (dummy)		-0.155	
		(0.189)	
Firm informal activities (dummy)			-0.131
			(0.819)
Investments in R&D (dummy)	0.543	0.549	0.545
	(0.060)***	(0.058)***	(0.070)***
Firm age (logs)	-0.100	-0.106	-0.235
	(0.145)	(0.136)	(0.175)
Firm size (logs)	0.022	0.035	0.092
	(0.057)	(0.055)	(0.070)
Major foreign ownership (dummy)	-0.045	-0.071	-0.135
	(0.107)	(0.101)	(0.121)
Firm exporter (dummy)	-0.006	0.009	-0.050
	(0.076)	(0.074)	(0.090)
Dealing with Gov' regulations (% of mgmt time)	0.000	0.001	-0.000
	(0.002)	(0.002)	(0.002)
Loan/overdraft available (dummy)	0.080	0.039	0.020
	(0.058)	(0.055)	(0.072)
Wholesale and retail trade sector	0.223	0.069	0.277
	(0.130)*	(0.104)	(0.156)*
Service sector	0.187	0.036	0.248
	(0.187)	(0.146)	(0.200)
Manufacturing sector	0.342	0.139	0.370
	(0.135)**	(0.111)	(0.155)**
Year 2013	-0.339	-0.308	-0.300
	(0.058)***	(0.057)***	(0.073)***
N	404	440	285
Pseudo R^2	0.26	0.24	0.28

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

In this model specification the coefficients for informal competition and informal practices of the firms themselves remain insignificant and have no explanatory power on the

[11] Estimation of the probit models with equalized number of observations can be found in Appendix III.

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relationship between these two variables and incremental innovation, Therefore, I will exclude them from my analysis and proceed with the robustness checks by analyzing only the impact of bribery on firm innovation.

4.2. Robustness Checks

I perform several robustness checks[12] to test the explanatory power of my results. First, I estimate four models including additional control variables, which are positively related to innovation according to the empirical literature. Then, I estimate a model where separate binary variables for firm size are added. Finally, I estimate a model with a data sample that includes firms participating only in the 2013 survey.

4.2.1. Models with Additional Controls

In the first robustness check I estimate four probit models with an additional control variable included in each of the models. The results are presented in Table 5. The main results in the models do not change much compared to the results in the base model with IV estimates, presenting additional support for its findings. The coefficient of the instrumental variable for bribes remains positive and highly significant through all specifications, although it takes smaller values than in model 4.

In Model 10 I include a control variable (*Educated workforce),* which accounts for the percentage of full-time employees holding a university degree. The results show that this variable is positively and significantly related to radical innovation, indicating that firms with more educated employees are more innovative. Such a relationship was expected since high-skilled labor is perceived as more creative, sciential, and efficient, and could be an indicator for firms' ability to engage in innovations (Habiyaremye and Raymond 2013).

[12] The same robustness checks were performed using OLS regressions as well. Results can be found in Appendix IV.

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Table 5: Probit models with IV estimates including additional controls (reporting marginal effects)

Additional controls				
Method	dprobit with IV	dprobit with IV	dprobit with IV	dprobit with IV
Variable	(10)	(11)	(12)	(13)
Bribes paid (% of sales)	0.113	0.115	0.111	0.109
	(0.051)**	(0.051)**	(0.051)**	(0.051)**
Educated workforce (% of employees)	0.002			
	(0.001)*			
Subsidy received (dummy)		-0.180		
		(0.064)***		
Int certification (dummy)			0.045	
			(0.069)	
Foreign technology (dummy)				0.276
				(0.097)***
Investments in R&D (dummy)	0.603	0.636	0.597	0.605
	(0.077)***	(0.074)***	(0.078)***	(0.077)***
Firm age (logs)	-0.060	-0.028	-0.060	0.012
	(0.143)	(0.143)	(0.142)	(0.143)
Firm size (logs)	0.080	0.084	0.053	0.056
	(0.055)	(0.056)	(0.058)	(0.055)
Foreign ownership (dummy)	0.011	0.086	0.058	0.015
	(0.111)	(0.120)	(0.116)	(0.112)
Firm exporter (dummy)	-0.020	-0.016	-0.012	-0.026
	(0.071)	(0.072)	(0.072)	(0.071)
Dealing with Gov' regulations (% of mnmg time)	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Loan/overdraft (dummy)	0.000	0.005	0.001	-0.009
	(0.058)	(0.058)	(0.058)	(0.059)
Wholesale & retail trade sector	0.062	0.043	0.067	0.048
	(0.142)	(0.143)	(0.144)	(0.143)
Service sector	0.032	0.004	0.013	-0.001
	(0.189)	(0.180)	(0.183)	(0.181)
Manufacturing sector	0.204	0.189	0.193	0.173
	(0.145)	(0.146)	(0.146)	(0.148)
Year 2013	-0.035	-0.014	-0.038	-0.034
	(0.084)	(0.083)	(0.084)	(0.084)
N	312	312	312	312
Pseudo R^2	0.198	0.199	0.189	0.212

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

The additional control variable in Model 11 is *Subsidy received.* It is a binary variable that takes the value of 1 if a firm has used government subsidy in the past three years and 0

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otherwise. This variable is expected to have a positive sign since access to funding will cut down the costs of innovations for the firms themselves and incentivize them to engage in innovation (Habiyaremye and Raymond 2013). However, the results in Table 5 show a significant negative coefficient, implying that on average firms that use government subsidies are less likely to innovate. One possible explanation for these results is that access to funding is not attached to any policies for stimulating innovations, therefore, it does not achieve the expected positive outcomes.

In model 12 I add the binary variable *Int certification*, which takes the value of 1 if a firm has obtained an internationally recognized quality certification like ISO and 0 otherwise. Model 13 includes a binary variable that equals to 1 if a firm uses a licensed technology acquired from abroad and 0 otherwise. Both control variables are expected to be positively correlated to firm innovation, but for quality certification this relationship is not significant. The coefficient for licensed foreign technology is highly significant, suggesting that firms that implement technologies obtained from external sources have a higher probability to introduce a new product or service. In the academic literature, Arora, Fosturi, and Gambardella (2001) also find empirical evidence that firms lean on external sources of technologies to achieve technological progress.

4.2.2. Models with Firm Size Dummies and Different Subsample

Table 6 contains the results from the second set of robustness checks, which test the positive effect of corruption on innovations when firm size dummies and subsample with firms participating only in 2013 are included.

The main results are similar to the results from the base model with IV estimates. In both specifications the coefficient for bribery remains positive, but when estimating the model over the subsample of 2013, it becomes only marginally significant (at the 11% level). This effect could be due to the reduced sample size for 2013 (only 265 firms). As expected larger

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firms have the highest probability to introduce a new product or service, while medium-sized enterprises are the least innovative. However, the results for firm size are not statistically significant. Therefore, they are only suggestive for the average expected innovativeness by firm size, but should be taken as certain.

Table 6: Probit models with IV estimates including firm size dummies and 2013 subsample only (reporting marginal effects)

Robustness checks		
Method	dprobit with IV	dprobit with IV (2013 only)
Variables	(14)	(15)
Bribes paid (% of sales)	0.162	0.078
	(0.051)***	(0.048)
Investments in R&D (dummy)	0.657	0.562
	(0.051)***	(0.099)***
Firm age (logs)	-0.110	-0.042
	(0.141)	(0.139)
Firm size (logs)	0.119	0.033
	(0.082)	(0.054)
Major foreign ownership (dummy)	0.101	0.099
	(0.112)	(0.121)
Firm exporter (dummy)	-0.036	-0.012
	(0.072)	(0.075)
Dealing with Gov' regulations (% of mgmt time)	0.000	0.001
	(0.002)	(0.002)
Loan/overdraft available (dummy)	0.006	0.010
	(0.057)	(0.058)
Wholesale and retail trade sector	0.329	0.005
	(0.126)**	(0.130)
Service sector	0.262	-0.045
	(0.199)	(0.150)
Manufacturing sector	0.416	0.121
	(0.136)**	(0.145)
Year 2013	-0.069	
	(0.062)	
Small firms	0.079	
	(0.071)	
Large firms	0.097	
	(0.107)	
N	404	265
Pseudo R^2	0.28	0.14

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

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All in all, the base model and the models estimated as robustness checks have similar results, suggesting that there is a positive and significant correlation between informal payments made to government officials and firm propensity to engage in innovation. Estimates for the impact of informal competition and informal practices of the firms themselves were not significant so inference about their relation to innovation would be unreliable.

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Chapter 5: Conclusion and Policy Recommendations

5.1. Summary of Results

In 2013 Bulgaria ranked at the bottom of the Union Innovation Scoreboard remaining the least innovative country in the European Union, a place saved for the country almost every year since 2008. Since innovation is perceived as one of the main drivers of economic growth, the fact that Bulgarian firms fail to keep up with the rest of the Union regarding their innovative performance is worrisome and needs to be addressed.

The purpose of this thesis was to establish how firm informality is affecting the propensity of firms to engage in innovation activities. In my analysis firm informality consisted of the two biggest obstacles to firm operation according to the World Bank Enterprise Survey (corruption and practices of informal competitors), but I also checked how informal practices of the firms themselves impact firm innovation. To investigate these relations I used an unbalanced panel dataset for 2009 and 2013 from the BEEPS, which I tested through a number of probit model specifications. To address the issues of endogeneity and measurement errors, I instrumented for the primary explanatory variables of interest using sector-region averages as described by Fisman and Svensson (2007). Moreover, I performed several robustness checks to provide additional support for the findings from the base models.

The results of the conducted econometric estimations suggest that the bribes that firms pay to government officials are positively and significantly correlated to their radical innovation activities. Moreover, the ability to corrupt a government official facilitates not only the introduction of new products or services by reducing the bureaucratic burden for the innovating firm, but it also eases the processes of incremental innovation. However, my analysis did not find any statistically significant relation between the practices of informal competitors and the informal practices of the firms themselves and the innovativeness of firms.

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My findings provide support to the theories about the "greasing wheels" effect of corruption on firm innovation. In transition countries with weak institutional framework and obstructive and time-consuming bureaucracy like Bulgaria, the ability to bribe a government official "to get things done" can have a stimulating effect on firms' propensity to engage in innovations. This is especially true when bribing allows for speeding up the procedures of receiving a permit or license necessary to introduce a new product or service on the market, because it gives firms a competitive advantage.

However, my analysis has numerous limitations. First, it would have been good to be able to work with a balanced panel data for Bulgaria where firms and variables of interest can be traced over a certain period of time, because this would have shed more light on the effects of firm informality on innovation. Moreover, having a bigger sample size would have given more robustness to my findings. Second, it is questionable to what extent the scope of firm informality has been captured by the available dataset. The Enterprise survey includes questions about corruption and informal practices, but there are a lot of missing observations due to the sensitivity of the questions. Furthermore, firms' self-reporting might be ambiguous. Third, although I used instrumental variables to mitigate the possible endogeneity and measurement errors issues, my estimates can still suffer from some omitted variable bias which was not captured by the IVs. Finally, my findings can be applicable only for the case of Bulgaria, so making inferences about the environment in other transition countries might not be proper. Nonetheless, the empirical literature on the relation between innovation and firm informality is not sufficient to draw conclusions and further research in this area is needed.

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5.2. Policy Recommendations

Based on the findings described above several policy recommendations can be suggested to policy makers in the Bulgarian government and the Council for Innovations of the Bulgarian Chamber of Commerce and Industry. First, the government should reduce the

red tape in Bulgaria, because bribery can be the response to bad government policies (Leff 1964). Obstructive and time-consuming bureaucratic procedures have a deterring effect on firms' propensity to innovate. Improvement in the administrative system in the country will certainly have a positive effect on firms operations, but it will also reduce the need of firms to give bribes and stimulate them to engage in innovative activities. Moreover, improvements in the Bulgarian legislative system are needed, since the protection of intellectual property and against informal practices of competitors is very weak. Investments in R&D and innovations can take a substantial part of firms' revenues and firms need to be sure that they will be able to recoup their investments and make profits from the newly introduced products or services. Therefore, a rule of law should be promoted and enforced.

Second, Bulgaria needs an explicitly defined state policy in the field of innovations and firms' competitiveness, which the country lacks at the moment. There is a draft of law for innovations which has been discussed in the past few years but still it has not been passed to come into implementation. Practices of developed countries show that certain governmental policies enhance the innovation efforts of businesses. For example, the Bulgarian government can incentivize firms to engage in innovations through the tax system. More specifically, the government should consider a reduction of the corporate tax for innovation-related revenues or a provision of tax credits for firms undertaking R&D activities.

Third, there should be EU and governmental subsidies attached to an innovation policy, because this will stimulate firm innovativeness. Access to funding will reduce the total cost of innovation that firms need to cover and thus encourage them to engage in innovative activities. For example, the government can define priority areas for development and subsidize firms that choose to perform innovations in these areas. This is a win-win situation for both firms and the government and it will have a stimulating effect on the economic growth in Bulgaria.

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Finally, strong monitoring is needed: a monitoring of government officials not to take bribes; a monitoring of law enforcement; and a monitoring of where the subsidies go and how are they spent, so that there are no misuses of the funding. To illustrate my point with an example, two years ago BGN 14 million (around 7 million Euro) of the Bulgarian Science Fund designed for R&D activities were wrongly allocated not to the firms with best projects, but to the firms that managed to bribe some government officials and win the funding. Unfortunately, such cases are not precedent in Bulgaria. Therefore, a monitoring of where the funding goes and how is it utilized is extremely important for enhancing firm innovation and reducing the incidence of bribery.

To conclude, the results of this paper suggest that bribery has a positive impact on firm innovation, while no evidence for the impact of informal competition and informal practices of the firms themselves on firm innovativeness was found. My findings indicate that when it comes to firms' propensity to innovate, corruption is not the biggest obstacle that needs to be tackled. Reducing the red tape, defining an innovation policy, and improving the monitoring should come first in the government agenda if Bulgaria wants to move away from the bottom of the Innovation Scoreboard.

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APPENDICES

Appendix I. Correlations

	newprod	bribes	informal	taxinf	rd	lage	lemp	mforeign	exporter	govreg	loanor~d	upgrade
newprod	1.0000											
bribes	0.1046	1.0000										
informal	-0.0355	0.0907	1.0000									
taxinf	0.0921	0.1594	0.0957	1.0000								
rd	0.5578	0.0446	-0.1473	-0.0561	1.0000							
lage	-0.0285	-0.0697	0.0161	-0.0447	0.0140	1.0000						
lemp	0.2205	-0.0527	-0.1291	-0.1097	0.1934	0.2685	1.0000					
mforeign	0.1232	0.0284	-0.0403	-0.0652	0.1465	-0.0317	0.2529	1.0000				
exporter	0.0458	-0.0204	-0.1782	-0.0693	0.0432	0.1402	0.3330	0.2335	1.0000			
govreg	-0.0796	0.0323	0.1070	0.0273	-0.0884	0.0204	-0.1334	-0.0210	0.0527	1.0000		
loanoroverd	-0.0562	-0.0858	-0.0083	-0.0989	-0.1613	0.0927	0.1960	-0.0957	0.1695	0.0771	1.0000	
upgrade	0.8172	0.0565	-0.0217	-0.0047	0.4934	-0.0201	0.1493	0.0189	0.0045	-0.1265	-0.0226	1.0000

	newprod	bribes	informal	taxinf
newprod	1.0000			
bribes	0.1264* 0.0094	1.0000		
informal	0.0186 0.6902	0.1496* 0.0021	1.0000	
taxinf	0.0862 0.1375	0.1445* 0.0175	0.0847 0.1448	1.0000

	upgrade	bribes	informal	taxinf
upgrade	1.0000			
bribes	0.0915 0.0608	1.0000		
informal	0.0280 0.5472	0.1496* 0.0021	1.0000	
taxinf	-0.0036 0.9512	0.1445* 0.0175	0.0847 0.1448	1.0000

Correlations between explanatory and instrumental variables.

	bribes	ivbrib~y
bribes	1.0000	
ivbribery	0.3600* 0.0000	1.0000

	informal	ivinfc
informal	1.0000	
ivinfc	0.3445* 0.0000	1.0000

	taxinf	ivtaxi
taxinf	1.0000	
ivtaxi	0.2525* 0.0000	1.0000

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Appendix II. Innovations by firms size, sectors, regions.

Table I: Radical Innovation by firm size.

New product or service * Firm Size Crosstabulation

Count

		Firm Samplig Size				
		Micro <=4	Small >=5 and <=19	Medium >=20 and <=99	Large >=100	Total
New product or service	No	17	160	96	35	308
	Yes	4	67	48	36	155
Total		21	227	144	71	463

Table II: Radical Innovation by industrial sector.

Industry sectors * New product or service Crosstabulation

Count

		New product or service		
		No	Yes	Total
Industry sectors	Construction	24	12	36
	Wholesale and retail trade	151	75	226
	Services	26	9	35
	Manufacturing	107	59	166
Total		308	155	463

Table III: Radical Innovation by region.

Region of firm location * New product or service Crosstabulation

		New product or service		
		No	Yes	Total
Region of firm location	Severoiztochen	39	9	48
	Severozapaden	22	9	31
	Severen tsentralen	24	12	36
	Yugoiztochen	37	19	56
	Yugozapaden	80	72	152
	Yuzhen tsentralen	106	34	140
Total		308	155	463

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Table IV: Incremental Innovation by firm size.

Upgraded product or service * Samplig Size Crosstabulation

Count

		Samplig Size				
		Micro <=4	Small >=5 and <=19	Medium >=20 and <=99	Large >=100	Total
Upgraded product or service	No	17	152	84	38	291
	Yes	4	75	60	33	172
Total		21	227	144	71	463

Table V: Incremental Innovation by industrial sector.

Industry sectors * Upgraded product or service Crosstabulation

Count

		Upgraded product or service		
		No	Yes	Total
Industry sectors	Construction	24	12	36
	Wholesale and retail trade	147	79	226
	Services	25	10	35
	Manufacturing	95	71	166
Total		291	172	463

Table VI: Incremental Innovation by region.

Region of firm location * Upgraded product or service Crosstabulation

Count

		Upgraded product or service		
		No	Yes	Total
Region of firm location	Severoiztochen	39	9	48
	Severozapaden	23	8	31
	Severen tsentralen	23	13	36
	Yugoiztochen	41	15	56
	Yugozapaden	78	74	152
	Yuzhen tsentralen	87	53	140
Total		291	172	463

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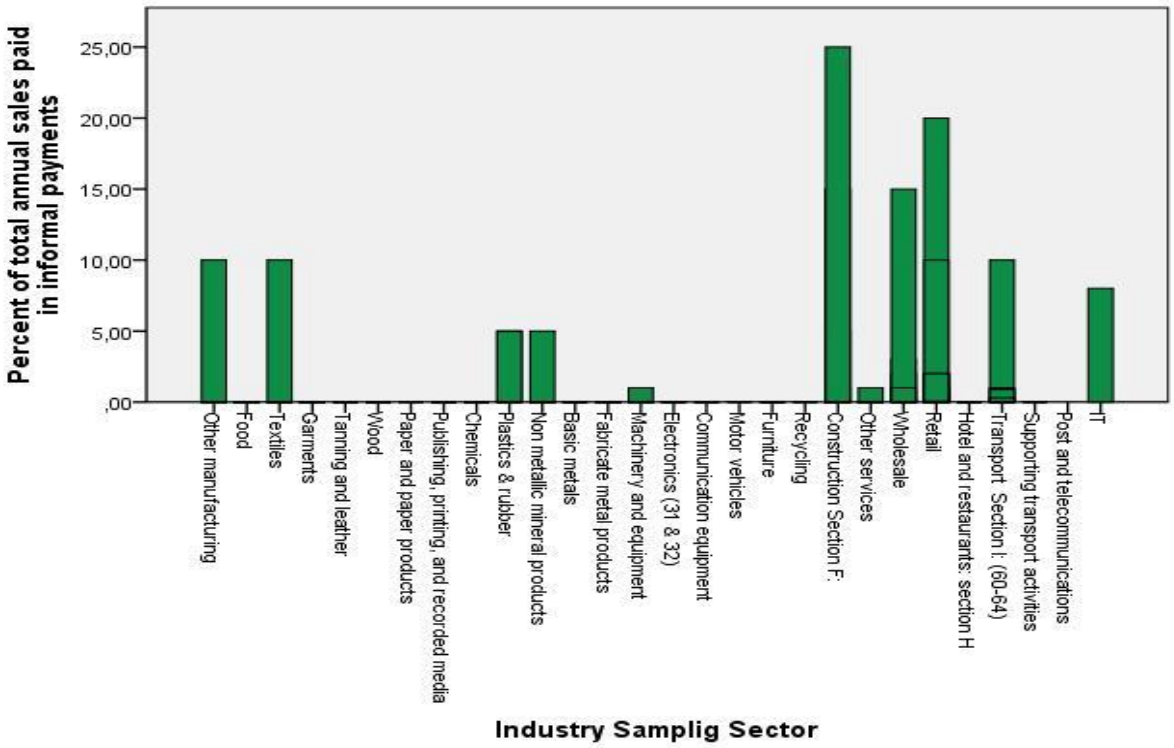
Graph I: Percentage of total annual sales paid as informal payment by industry.



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Appendix III. Probit models with equalized number of observations

Table I: Probit models for radical innovations (reporting marginal effects)

Dependent variable: new product or service			
Method	dprobit	dprobit	dprobit
Variables	(1)	(2)	(3)
Bribes paid (% of sales)	0.069		
	(0.033)**		
Informal competition faced (dummy)		0.076	
		(0.072)	
Firm informal activities (dummy)			0.417
			(0.143)***
Investments in R&D (dummy)	0.642	-0.277	0.647
	(0.064)***	(0.182)	(0.064)***
Firm age (logs)	-0.261	0.162	-0.277
	(0.182)	(0.072)**	(0.181)
Firm size (logs)	0.169	0.076	0.166
	(0.072)**	(0.135)	(0.072)**
Major foreign ownership (dummy)	0.063	-0.058	0.110
	(0.138)	(0.091)	(0.137)
Firm exporter (dummy)	-0.069	-0.000	-0.066
	(0.090)	(0.002)	(0.091)
Dealing with Gov' regulations (% of mgmt time)	-0.000	-0.006	-0.000
	(0.002)	(0.075)	(0.002)
Loan/overdraft available (dummy)	0.004	0.285	0.015
	(0.076)	(0.153)	(0.076)
Wholesale and retail trade sector	0.286	0.146	0.269
	(0.152)*	(0.221)*	(0.154)*
Service sector	0.102	0.364	0.090
	(0.224)	(0.160)**	(0.221)
Manufacturing sector	0.349	-0.079	0.347
	(0.160)**	(0.082)	(0.161)**
Year 2013	-0.080	-0.067	-0.075
	(0.083)	(0.057)	(0.084)
N	260	260	260
Pseudo R^2	0.30	0.289	0.304
LR Chi Square	103.39	99.89	104.76

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

The probit models reports marginal effects

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Table II: Probit models for radical innovations with IV estimates (reporting marginal effects)

Dependent variable: new product or service			
Method	dprobit with IV	dprobit with IV	dprobit with IV
Variables	(1)	(2)	(3)
Bribes paid (% of sales)	0.192		
	(0.073)***		
Informal competition faced (dummy)		-0.294	
		(0.254)	
Firm informal activities (dummy)			0.354
			(0.827)
Investments in R&D (dummy)	0.650	0.624	0.631
	(0.064)***	(0.067)***	(0.065)***
Firm age (logs)	-0.182	-0.263	-0.260
	(0.187)	(0.180)	(0.182)
Firm size (logs)	0.172	0.156	0.159
	(0.073)**	(0.072)**	(0.072)**
Major foreign ownership (dummy)	0.085	0.084	0.090
	(0.137)	(0.137)	(0.137)
Firm exporter (dummy)	-0.089	-0.062	-0.067
	(0.090)	(0.091)	(0.090)
Dealing with Gov' regulations (% of mgmt time)	-0.001	0.000	0.000
	(0.002)	(0.002)	(0.002)
Loan/overdraft available (dummy)	-0.003	-0.000	-0.010
	(0.076)	(0.075)	(0.075)
Wholesale and retail trade sector	0.589	0.313	0.278
	(0.161)***	(0.152)**	(0.156)*
Service sector	0.490	0.138	0.114
	(0.198)*	(0.224)	(0.232)
Manufacturing sector	0.668	0.325	0.349
	(0.156)***	(0.165)*	(0.161)**
Year 2013	-0.092	-0.104	-0.090
	(0.083)	(0.085)	(0.084)
N	260	260	260
Pseudo R^2	0.308	0.29	0.287
LR Chi Square	106.07	100.15	98.98

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

The probit models reports marginal effects

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Table III: Probit models for incremental innovations with IV estimates (reporting marginal effects)

Dependent variable: upgraded product or service			
Method	dprobit with IV	dprobit with IV	dprobit with IV
Variables	(1)	(2)	(3)
Bribes paid (% of sales)	0.132		
	(0.072)*		
Informal competition faced (dummy)		-0.157	
		(0.256)	
Firm informal activities (dummy)			-0.336
			(0.863)
Investments in R&D (dummy)	0.529	0.513	0.525
	(0.077)***	(0.080)***	(0.077)***
Firm age (logs)	-0.177	-0.243	-0.253
	(0.189)	(0.184)	(0.185)
Firm size (logs)	0.069	0.062	0.066
	(0.074)	(0.073)	(0.073)
Major foreign ownership (dummy)	-0.089	-0.092	-0.088
	(0.131)	(0.130)	(0.130)
Firm exporter (dummy)	-0.065	-0.049	-0.056
	(0.092)	(0.092)	(0.092)
Dealing with Gov' regulations (% of mgmt time)	-0.002	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
Loan/overdraft available (dummy)	0.056	0.054	0.051
	(0.076)	(0.076)	(0.076)
Wholesale and retail trade sector	0.465	0.284	0.282
	(0.176)**	(0.155)*	(0.158)*
Service sector	0.382	0.175	0.196
	(0.210)	(0.211)	(0.218)
Manufacturing sector	0.555	0.342	0.365
	(0.170)***	(0.159)**	(0.157)**
Year 2013	-0.331	-0.336	-0.318
	(0.076)***	(0.078)***	(0.077)***
N	260	260	260
Pseudo R^2	0.288	0.279	0.279
LR Chi Square	101.50	98.47	98.24

Standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

The probit models reports marginal effects

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Appendix IV. OLS Regressions

Table I: Base model estimations using OLS regressions

Base model regression, robust SE			
Method	OLS	OLS	OLS
Variables	(1)	(2)	(3)
Bribes paid (% of sales)	0.022		
	(0.011)**		
Informal competition faced (dummy)		0.101	
		(0.041)**	
Firm informal activities (dummy)			0.341
			(0.133)**
Investments in R&D (dummy)	0.617	0.637	0.613
	(0.056)***	(0.052)***	(0.067)***
Firm age (logs)	-0.116	-0.168	-0.165
	(0.111)	(0.108)	(0.144)
Firm size (logs)	0.084	0.090	0.138
	(0.042)**	(0.040)**	(0.051)***
Major foreign ownership (dummy)	0.091	0.062	0.031
	(0.082)	(0.081)	(0.088)
Firm exporter (dummy)	-0.020	-0.002	-0.048
	(0.055)	(0.055)	(0.066)
Dealing with Gov' regulations (% of mgmt time)	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Loan/overdraft available (dummy)	-0.004	-0.019	-0.004
	(0.042)	(0.041)	(0.052)
Wholesale and retail trade sector	0.085	0.059	0.173
	(0.087)	(0.079)	(0.090)*
Service sector	0.013	0.015	0.090
	(0.100)	(0.095)	(0.104)
Manufacturing sector	0.135	0.123	0.235
	(0.090)	(0.082)	(0.095)**
Year 2013	-0.042	-0.048	-0.059
	(0.048)	(0.047)	(0.061)
Constant	0.156	0.204	0.104
	(0.177)	(0.169)	(0.226)
R^2	0.33	0.32	0.37
N	404	440	285

Robust standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

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Table II: Base model estimations with IVs

Base model regression with IVs, robust SE			
Method	OLS with IV	OLS with IV	OLS with IV
Variables	(1)	(2)	(3)
Bribes paid (% of sales)	0.117		
	(0.038)***		
Informal competition faced (dummy)		-0.085	
		(0.112)	
Firm informal activities (dummy)			0.478
			(0.572)
Investments in R&D (dummy)	0.624	0.621	0.603
	(0.055)**	(0.053)***	(0.069)***
Firm age (logs)	-0.086	-0.127	-0.155
	(0.108)	(0.108)	(0.144)
Firm size (logs)	0.080	0.083	0.132
	(0.041)*	(0.041)**	(0.052)**
Major foreign ownership (dummy)	0.080	0.063	0.019
	(0.084)	(0.082)	(0.088)
Firm exporter (dummy)	-0.020	-0.017	-0.046
	(0.054)	(0.054)	(0.068)
Dealing with Gov' regulations (% of mgmt time)	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)
Loan/overdraft available (dummy)	0.002	-0.010	-0.017
	(0.042)	(0.041)	(0.052)
Wholesale and retail trade sector	0.223	0.071	0.168
	(0.098)**	(0.081)	(0.095)*
Service sector	0.156	0.012	0.083
	(0.110)	(0.098)	(0.110)
Manufacturing sector	0.282	0.103	0.233
	(0.102)***	(0.087)	(0.095)**
Year 2013	-0.045	-0.058	-0.069
	(0.048)	(0.049)	(0.064)
Constant	-0.038	0.258	0.118
	(0.178)	(0.183)	(0.227)
R^2	0.34	0.31	0.35
N	404	440	285

Robust standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

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Table III: OLS regressions for radical and incremental innovation, firm size dummies and subsample only for 2013

OLS regressions, robust SE				
Variables	(1) New product	(2) Upgraded product	(3) New product	(4) Only 2013 sample
Method	OLS with IV	OLS with IV	OLS with IV	OLS with IV
Bribes paid (% of sales)	0.117	0.089	0.114	0.076
	(0.038)***	(0.037)**	(0.037)***	(0.050)
Investments in R&D (dummy)	0.624	0.477	0.622	0.543
	(0.055)***	(0.058)***	(0.055)***	(0.106)***
Firm age (logs)	-0.086	-0.068	-0.086	0.043
	(0.108)	(0.116)	(0.107)	(0.151)
Firm size (logs)	0.080	0.014	0.077	-0.013
	(0.041)*	(0.042)	(0.058)	(0.058)
Major foreign ownership (dummy)	0.080	-0.036	0.073	0.178
	(0.084)	(0.075)	(0.083)	(0.158)
Firm exporter (dummy)	-0.020	-0.009	-0.017	-0.001
	(0.054)	(0.057)	(0.055)	(0.088)
Dealing with Gov' regulations (% of mgmt time)	0.000	0.000	0.000	0.003
	(0.001)	(0.001)	(0.001)	(0.002)
Loan/overdraft available (dummy)	0.002	0.065	0.010	-0.020
	(0.042)	(0.044)	(0.043)	(0.066)
Wholesale and retail trade sector	0.223	0.157	0.222	-0.062
	(0.098)**	(0.100)	(0.097)**	(0.148)
Service sector	0.156	0.128	0.152	-0.073
	(0.110)	(0.115)	(0.109)	(0.175)
Manufacturing sector	0.282	0.257	0.280	0.032
	(0.102)***	(0.104)**	(0.102)***	(0.148)
Year 2013	-0.045	-0.291	-0.051	
	(0.048)	(0.053)***	(0.048)	
Small firms			0.052	
			(0.050)	
Large firms			0.074	
			(0.083)	
Constant	-0.038	0.287	-0.068	0.117
	(0.178)	(0.188)	(0.183)	(0.226)
R^2	0.34	0.32	0.34	0.21
N	404	404	404	199

Robust standard errors in brackets; Significance level: * p<0.10, ** p<0.05; *** p<0.01

Table IV: OLS regressions including additional control variables

Additional controls, robust SE				
Method	OLS with IV	OLS with IV	OLS with IV	OLS with IV
Variables	(1)	(2)	(3)	(4)
Bribes paid (% of sales)	0.094	0.100	0.091	0.093
	(0.042)**	(0.042)**	(0.042)**	(0.041)**
Educated workforce (% of employees)	0.002			
	(0.001)*			
Subsidy received (dummy)		-0.201		
		(0.104)*		
Int certification (dummy)			0.035	
			(0.061)	
Foreign technology (dummy)				0.244
				(0.092)***
Investments in R&D (dummy)	0.576	0.601	0.574	0.573
	(0.076)***	(0.071)***	(0.076)***	(0.076)***
Firm age (logs)	-0.066	-0.036	-0.060	0.003
	(0.122)	(0.124)	(0.126)	(0.127)
Firm size (logs)	0.061	0.070	0.042	0.040
	(0.049)	(0.050)	(0.049)	(0.049)
Major foreign ownership (dummy)	0.027	0.081	0.058	0.015
	(0.107)	(0.113)	(0.110)	(0.110)
Firm exporter (dummy)	-0.008	-0.011	-0.006	-0.016
	(0.063)	(0.063)	(0.065)	(0.063)
Dealing with Gov' regulations (% of mgmt time)	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Loan/overdraft available (dummy)	0.001	0.010	0.005	-0.003
	(0.050)	(0.049)	(0.050)	(0.049)
Wholesale and retail trade sector	0.044	0.026	0.043	0.034
	(0.115)	(0.113)	(0.114)	(0.113)
Service sector	0.027	-0.001	0.005	0.004
	(0.132)	(0.132)	(0.133)	(0.129)
Manufacturing sector	0.161	0.148	0.151	0.139
	(0.119)	(0.117)	(0.118)	(0.117)
Year 2013	-0.029	-0.008	-0.029	-0.028
	(0.076)	(0.075)	(0.077)	(0.076)
Constant	0.050	0.042	0.100	0.032
	(0.199)	(0.200)	(0.204)	(0.203)
R^2	0.24	0.24	0.23	0.26
N	312	312	312	312

Robust standard errors in brackets; Significance level: * p<0.10, ** *p*<0.05; *** *p*<0.01

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