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Corruption and firm innovation: evidence from post-Soviet countries

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Abstract

In view of the missing consensus on how corruption relates to firm innovation, this paper empirically studies the relationship between petty corruption and product, process, marketing and organizational innovations in the post-Soviet region. Exploiting cross-sectional firm-level data from the fifth round of the Business Environment and Enterprise Performance Survey (BEEPS V), the paper argues that institutional context has utmost importance when approaching this link. Probit estimations for a full sample of post-Soviet countries indicate a positive link between bribes and firm innovation. Considering variations in institutional development levels, the paper distinguishes three clusters of countries within the region with respect to the quality of institutional structures based on Worldwide Governance Indicators (WGI) data from the World Bank. The results reveal that the grease-the-wheel effect of bribery on firm innovation strongly remains in countries with weak institutional quality. To explore this link further, the paper made several additional estimations and robustness checks.

Keywords: corruption, bribery, firm innovation, product innovation, process innovation, marketing innovation, organizational innovation, institutions, post-Soviet region

JEL classification numbers: O17, D73, O38

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1. INTRODUCTION

In recent years, there has been an increasing interest in studying the link between corruption and firm activities. Nevertheless, literature has emerged that offers contradictory findings about the consequences of corruption on firm innovation. One perspective puts forward the "sand the wheel effect" of corruption on innovation that indicates a negative relationship between corruption and innovation. More specifically, corruption is assumed to be a deterrent for businesses as it creates additional costs, leads to the misallocation of resources, reduces investments in research and development (R&D), slows innovation activities, and weakens trust (DiRienzo & Das, 2015; Lee et al., 2020; Mahagaonkar, 2010; Mauro, 1995; Waldemar, 2012). The alternative perspective, on the other hand, is known as the "grease the wheel" effect of corruption on innovation, which suggests that corruption may facilitate firm innovation by means of "getting things done". For example, firms may bribe public officials to secure contracts, obtain licenses and permissions, and remove small barriers to operate (Krastanova, 2014; Nguyen et al., 2016; Taha, 2016; Vial & Hanoteau, 2010).

In this paper, we aim to widen our understanding of the consequences of corruption on firm innovation by highlighting the importance of the institutional context in countries. Institutions have a crucial role in understanding corruption (Rose-Ackerman, 1999; Gupta and Abed, 2002) and institutional theory has been adopted to investigate firm inclination towards corruption (e.g. Misangyi et al., 2008). According to this theory, corruption might have become the "rules of the game" in the business environments of countries where institutional quality is weak (Ashyrov, 2020). Therefore, firms could prefer to operate by following the "rules of the game" in order to facilitate their survival in their business environments (North, 1990; Van Vu et al., 2018). Indeed, such business environments apply certain institutional pressures that will impose corrupt practices to facilitate firm competitiveness and survival (DiMaggio and Powell, 1991). Accordingly, these pressures can have a potential impact on firms in forming their aims and road plans (Chan and Ananthram, 2018).

Heterogeneity in institutional development in the post-Soviet region (PSR) makes it appealing to study the relationship between bribery (i.e. petty corruption) and innovation. To date, in the analysis of corruption, post-Soviet transition countries have been approached as a homogenous group of countries in terms of institutional quality. However, after the collapse of the Soviet Union, member countries have followed different development paths, which lead to dissimilar levels of institutional development. Therefore, we argue that the sand or grease effect of corruption is highly conditional on the institutional quality of a country. To investigate the link between corruption and firm innovation, we exploit cross-sectional firm-level data from the fifth round of the Business Environment and Enterprise Performance Survey (BEEPS), which was implemented by the European Bank for Reconstruction and Development in partnership with the World Bank. In addition, for the purpose of addressing the role of institutional differences, by using Worldwide Governance Indicators (WGI) data from the World Bank, we have created three groups of countries based on their levels of institutional quality and run additional separate estimations for each sample group. Several additional estimations have also been performed to approach the link between corruption and firm innovation in terms of different dimensions.

Accordingly, probit estimation results for the whole sample of countries reveal that there is a positive link between bribes and firm innovation. More precisely, estimations suggest that there is a grease-the-wheel effect of corruption on product and marketing innovations. However, this effect exhibits different directions once the analysis is undertaken for subsamples of countries, which were divided based on institutional quality. Although the relationship between bribery and innovation remains the same in countries with weak institutional structures, as it was for the full sample, the grease-the-wheel effect of corruption on product, process and marketing innovation disappears in estimations for countries with strong institutional environments. The positive relationship between bribery and innovation also completely vanishes in countries where institutional settings are of moderate quality. These results suggest that historically inherited corruption may still be used as a strategy for reducing business risks and uncertainty in innovation activities in transition countries, which attribute to ineffective institutional settings.

This paper contributes to corruption literature in several ways. To the best of our knowledge, the relationship between corruption and firm innovation has been overlooked in post-Soviet countries. Empirical studies have been conducted for either wider sets of transition countries such as Africa, Asia, Central and Eastern Europe or country specific cases; for example, the cases of India (De Waldemar, 2012), and China (Xie et al., 2019). This raises a question about the extent to which the results can be generalized for the PSR. Therefore, the paper builds on the literature by studying how bribery, defined as a form of corruption, relates to firm innovation in post-Soviet states. Previous studies tend to approach firm innovation by using a limited set of proxy variables; for example, only using product (e.g. Krammer, 2019) or process innovation (Goel & Nelson, 2018). However, our novelty is to include new proxy variables for innovation by diversifying innovation variables, such as product, process, marketing and organizational innovation. In this way, we endeavour to enrich our knowledge regarding the link between corruption and firm innovation.

The next section discusses the relevant literature. Section 3 presents the dataset and methodology used to conduct the research. Section 4 demonstrates the results of the empirical analysis. The conclusion presents our concluding remarks.

2. Literature review

2.1. Innovation and the role of institutions

Constant technological advances, shorter product lifecycle and increased rate of rivalry have made it challenging for companies to sustain competitive advantage. In such a globalized world, competition is becoming more dynamic and innovation is seen as one of the key drivers of competitive advantage. In order to outperform others in the market and sustain competitive advantage, companies must take advantage of the latest technological innovations and continuously develop and improve products and processes (Hitt et al., 2001)

The environment in which a firm operates can affect its innovation capability and performance. For example, political and economic instability, lack of regulations on intellectual property (IP) rights, and non-compliance with contracts are attributes of an environment with a weak institutional structure and may hinder the innovation performance of firms (Volchek et al., 2013). Inefficient regulations may result in time-consuming exercises for firms and increase the transaction costs of introducing innovations. When strong institutional structures are not established, firms would prefer to adopt non-market strategies, such as corruption, in order to overcome inefficient bureaucratic procedures and to reduce the firms' costs and risks in innovation activities (Xie et al., 2019). On the other hand, well-functioning institutions may encourage efficient working environments, and hence, may not create an environment for corruption. In this situation, corruption may have adverse effects on firms due to the high risk of being caught and penalised.

2.2. The relationship between corruption and innovation

Although innovation and corruption are key determinants of economic development and growth, there is disagreement regarding conclusions on the relationship between innovation and corruption. One of the hypotheses is *sand in the wheels* of innovation, which sees corruption as a hindrance to innovation. According to this view, some actors in the hierarchical structure of a bureaucracy may create artificial barriers to firm innovation activities to extort bribes from them (Myrdal, 1968). Sometimes, public officials can also act unwillingly to control corruption in order not to lose their illegal incomes. In the long run, it can result in a highly corrupt environment where the illegal expenses of businesses are increased significantly, which would consequently hurt innovation activities (Kurer, 1993). Corruption also causes uncertainty and less predictability in the business (Uhlenbruck et al., 2006). There is no corruption deal where the terms and agreements are specified in detail, and the side which terminates the agreement carries the legal responsibility for its behaviour. Hence, innovation as an outcome of such deals is never guaranteed (Luo, 2005).

Sand in the wheels of innovation hypothesis is supported by several empirical studies. Utilizing firm-level data from BEEPS 2008 and taking PSR partially into the scope,

(Habiyaremye & Raymond, 2018) suggests that when the proportion of foreign firms involved in grand corruption increases, R&D investments in host countries fall relatively and product innovation is hindered. Conversely, foreign petty corruption is positively associated with product innovation. However this effect tends to decrease when the level of corruption gets higher. Research also suggests that the engagement in corrupt activities by foreign firms decreases the likelihood of the host country's ability to introduce new products and services in the long term. The negative relationship between corruption and product and organizational innovation was also identified in the context of African firms (Goedhuys et al., 2016; Mahagaonkar, 2010).

The *greasing the wheels* of innovation hypothesis argues that corruption can make innovation more likely to happen, particularly in the case of underdeveloped and transition countries where institutional weaknesses are present. Riaz and Cantner (2020) document that petty and grand corruption are positively associated with innovations which require more interactions with public officials, especially in the case of developing or emerging countries. Their study sample covers Ukraine, Armenia and Estonia from among post-Soviet states.

Using data from 7000 firms from 30 transition economies, including the countries in the South Caucasus (Krammer, 2019), suggests that firms use bribery as a tool to minimize uncertainties, and bypass institutional and bureaucratic barriers in order to bring product innovation to market. Moreover, the study argues that bribe efficiency is mitigated by the quality of existing institutions, being both formal (control of corruption) and informal (trust) institutions.

Similarly, Xie et al. (2019) find a positive link between corruption and new product innovation using World Bank Enterprise Survey panel data collected in 2012 from 27 transition countries, which partially include the PSR region. They explain this impact on the basis of weak institutional structures revealed in the forms of policy instability and uncertainty, and threats to informal competition. In such circumstances, companies use

corruption to overcome the increasing informal competitive pressure, bureaucratic red tape and government inefficiency.

2.3. Institutional quality differences across post-Soviet countries

Empirical results demonstrate that both sand and grease effects of corruption on innovation are possible, depending on the strength of local institutions, forms of corruption and types of innovation. Hence, when studying the relationship between petty corruption and different innovation types in the PSR, we should also consider differences in the institutional environments of the countries of this region.

Countries of the PSR could be divided into three groups based on their selection of development paths. The first group of countries could be the Baltic countries – Estonia, Latvia and Lithuania. Due to their close ties with Scandinavian countries, which rank in the top 10 on the Corruption Perceptions Index (Transparency International, 2019), the Baltics exhibit significant differences from the rest in terms of law practices and enforcement. EU, NATO and OECD memberships in the case of Estonia and Latvia helped the Baltic states to effectively introduce institutional reforms and establish free market economies, a democratic political atmosphere and strong law enforcement. Officials in the Baltic region are also less likely to take bribes compared to other FSU countries (Sanyal & Samanta, 2017).

Despite being classified as more corrupt or the most corrupt countries in the PSR (Transparency International, 2019), Georgia, Moldova and Armenia are displaying significant efforts to fight corruption. In addition to local government actions to cope with corruption, these countries benefit from The Eastern Partnership programme, which is a joint initiative between member states and the EU aiming to build “a common area of shared democracy, prosperity, stability and increased cooperation” (European External Action Service, 2016). As a result, the quality of institutional structures in these countries is moderate. Policy reforms introduced by official bodies also reveal positive outcomes in the business environments of these countries. For example, according to the Ease of Doing

Business report of 2019, Georgia even leaves behind the Baltic states and at 6th place out of 190 countries. Armenia and Moldova are also among the first 50 countries in the ranking (World Bank Group, 2020).

According to the Corruption Perception Index of Transparency International, Azerbaijan, Ukraine, Belarus, Russia, Kazakhstan, Kyrgyzstan, Uzbekistan and Tajikistan are ranked as highly corrupt countries. Moreover, the first three countries are also members of The Eastern European Partnership. However, despite this programme and actions taken to fight corruption, all eight countries are attributed weak institutional structures. Although this relates to the efficiency of actions taken against corruption by local governments, initial institutional levels also matter. As seen from Figure 1, the initial level of institutions was the best for the Baltic states in 1996. Uzbekistan and Tajikistan had and still have the worst institutions in the region. While institutions stood more or less at the same level for other countries at the initial point, Georgia has shown impressive continuous progress since 2002.

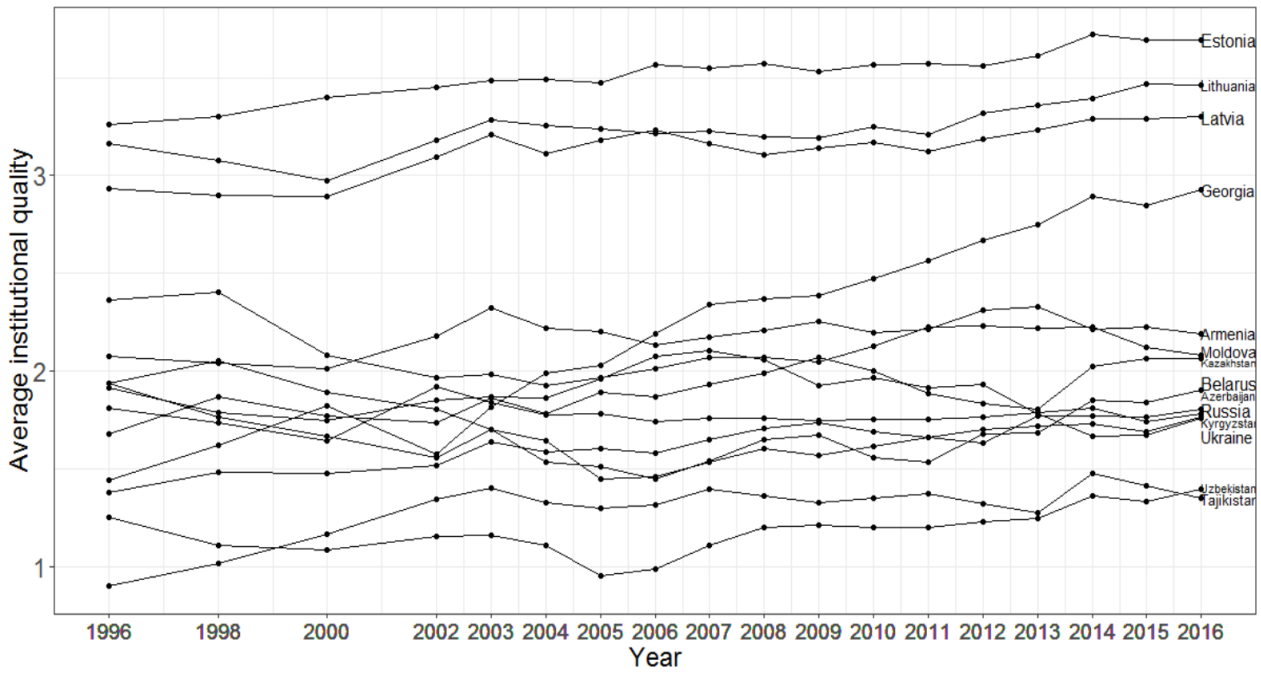

Figure 1. Average institutional quality in the countries of the region for 1996–2016

Source: Authors' calculations and The World Bank (n.d.).

3. DATA AND METHODOLOGY

3.1. Data

This paper uses cross-sectional firm-level data from the fifth round of the Business Environment and Enterprise Performance Survey (BEEPS), which was implemented by the European Bank for Reconstruction and Development in partnership with the World Bank. This survey is intended to capture business perceptions of the largest environmental factors that obstruct firm growth, the importance of different constraints for increasing labour force and productivity, and the impact of a country's business environment on its global competitiveness. BEEPS V was undertaken between 2012 and 2016 and consists of data from 16,566 enterprises in 32 countries in Eastern Europe and Central Asia. It used a stratified random sampling method and applied this structure on three levels for all subject countries: industry, establishment size and region (BEEPS | 2012-2016, n.d.). One additional reason why this dataset is suitable for the study is that the fifth round of BEEPS introduced a new concept, namely Innovation Module, which distinguishes product, process, organizational and marketing innovation. Such a differentiation is compliant with the classification of innovation by the OSLO Manual.

Countries in the BEEPS dataset are filtered out leaving only post-Soviet states. Turkmenistan is not covered in this study because no data is available for it in the survey. A cleaning process is continued by excluding "Don't know", "Refused", "DOES NOT APPLY" answers from all variables of the estimation strategy. After cleaning, 5,194 responses are left for the focus countries in total.

In addition to the BEEPS dataset, the paper is elaborated using The Worldwide Governance Indicators (WGI) data from the World Bank in order to capture institutional qualities in the

countries included. WGI is a panel dataset which consists of aggregate and individual governance indicators for more than 200 countries and territories over the world between 1996 and 2018. Considering that BEEPS V was conducted for 2012–2016, the WGI dataset will also be restricted to the same period to ensure data integrity. WGI reports six dimensions of governance, namely voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption. Standard normal units of these governance indicators in the original WGI dataset vary in -2.5 and 2.5. But to avoid confusion, the units of all governance indicators are rescaled to vary in the range of (0; 5) with higher values corresponding to better governance. After shifting the focus to the post-Soviet region, this range becomes (1.3; 3.6). Considering this, countries of the PSR are grouped according to their institutional qualities by dividing the latter interval by three. Consequently, Uzbekistan, Tajikistan, Kyrgyzstan, Azerbaijan, Belarus, Ukraine, Russia and Kazakhstan are countries with weak institutional structures in a respective order. Moldova, Armenia and Georgia are countries with moderate institutional quality, while Lithuania, Latvia and Estonia have strong institutional setups and law enforcement. This grouping pattern will be followed in the rest of the paper.

3.2. Methodology

By following the guidelines of the OSLO Manual, we operationalized four different binary dependent variables from the survey, which correspond to four types of innovation: product, process, marketing and organizational innovation. Firms were asked whether they introduced new or significantly improved products or services (product innovation); introduced any new or significantly improved methods for the production or supply of products or services (process innovation); introduced new or significantly improved marketing methods (marketing innovation); and introduced any new or significantly improved organizational or management practices or structures (organizational innovation) during the last three years. If the response is “Yes”, then it is equal to 1, otherwise, 0.

The analytical expressions of the probit model regressions are as follows:

$$\Pr(Y_{k,ij} = 1) = F(\lambda_0 + \lambda_1 Bribes_{ij} + \lambda_2 X_{ij} + \lambda_3 \mathrm{I}_j + \lambda_4 \mathrm{C}_j + \varepsilon_{ij})$$

where F is the cumulative distribution function of the standard normal distribution, $Y_{k,ij}$ is a dependent variable where (k=1,…,4): Product, Process, Marketing and Organizational Innovation. Bribesi,j is the main explanatory variable. It is defined as the percentage of total annual sales paid as informal payment/gift. Such a measurement of bribery is in line with previous studies (Fisman & Svensson, 2007; Mahagaonkar, 2010; Waldemar, 2012). Xi,j is a set of control explanatory variables, such as firm size, firm age, firm's R&D expenditures, firm's financial limitations, firm's threat perception of informal competition, education of firm's employees, training provided to employees, firm's ownership type, firm being an exporter, firm manager's gender and experience in the sector, Time Tax measured in terms of senior management's time spent dealing with regulations. Indices i and j are read as firm i in country j. Ij and Cj denote industry and country dummies which capture industry and country fixed effects, respectively. Moreover, we follow the approach of Ashyrov and Masso (2020) and introduce a set of dummy variables for industries according to the ISIC classifications Revision 3.1: 15–37, 45, 50, 51, 52, 55, 60–64, 72 in order to capture industry-specific effects (United Nations, 2004). (Detailed descriptions of both dependent and all independent variables are given in Table 1A under Appendices).

Table 1 presents summary statistics of dependent and independent variables. The average shares of innovation activities tend to be similar to each other. Around 23% of firms report having marketing innovation, which is the highest percentage among innovation types, while only 20% of firms on average report having process innovation, which is the lowest share among innovation activities. The average percentage of bribery is approximately 0.8 %, which is less than 1%. Although this average seems an ignorably small percentage, when a firm has large sales, this becomes quite a sizeable amount. Only 15% of firms report facing informal competition in the market, while 19% of firms indicate that access to finance is a major or very severe obstacle to their current operations.

Table 1. Summary statistics of the variables

Variables/Statistic	N	Mean	St. Dev.	Median	Min	Max
Dependent variables						
Product Innovation	5,194	0.219	0.414	0	0	1
Process Innovation	5,194	0.197	0.398	0	0	1
Organizational Innovation	5,194	0.214	0.410	0	0	1
Marketing Innovation	5,194	0.228	0.419	0	0	1
Independent variables						
Bribes (in percentages)	5,194	0.842	3.708	0	0	80
R&D	5,194	0.088	0.283	0	0	1
Informal Competition	5,194	0.152	0.359	0	0	1
Firm Age (logs)	5,194	2.250	0.736	2.303	0	4.997
Firm Size (logs)	5,194	3.007	1.202	2.773	0	9.306
Foreign Ownership	5,194	0.057	0.231	0	0	1
Exporter	5,194	0.088	0.283	0	0	1
Time Tax	5,194	14.379	19.980	10	0	100
Financial Limitations	5,194	0.188	0.391	0	0	1
Training	5,194	0.373	0.484	0	0	1
Education	5,194	44.680	31.719	40	0	100
Management's Expertise	5,194	14.772	9.623	12	1	60
Female Manager	5,194	0.356	0.479	0	0	1

Source: Authors' calculations.

Domestic firms constitute a larger portion of the dataset. Out of 5,194 companies, only 295 are foreign-owned; 4,899 enterprises are identified as domestic companies. This also reveals that almost half of the firm employees are educated. On average, 44.7% of the firms' employees have obtained a university degree. Top managers in firms have approximately 15 years of experience working in the underlying sector.

Figure 2 illustrates mean bribes per industry in each country group. Retail is the most corrupt industry in both countries with strong and moderate quality institutional structures. It is followed by transport and telecommunications, and hotel and restaurant industries in countries where institutional settings are of high quality. It can also be observed that while IT and motor services are corruption-clean industries, in the country cluster with moderate institutions, no bribery is reported for hotel and restaurant, IT and transport and telecommunications industries in the countries with moderate institutions. By contrast, there is no corruption-clean industry in the countries with weak institutional setups. IT is the most corrupt industry, followed by construction, manufacturing and wholesale industries. Hotel and restaurant, and transport and telecommunications industries are reported as having roughly the same average percentage of bribes, whereas motor services is the least corrupt industry in countries with poor quality institutional structures. Overall, average bribery percentages are the highest where institutional quality is low.

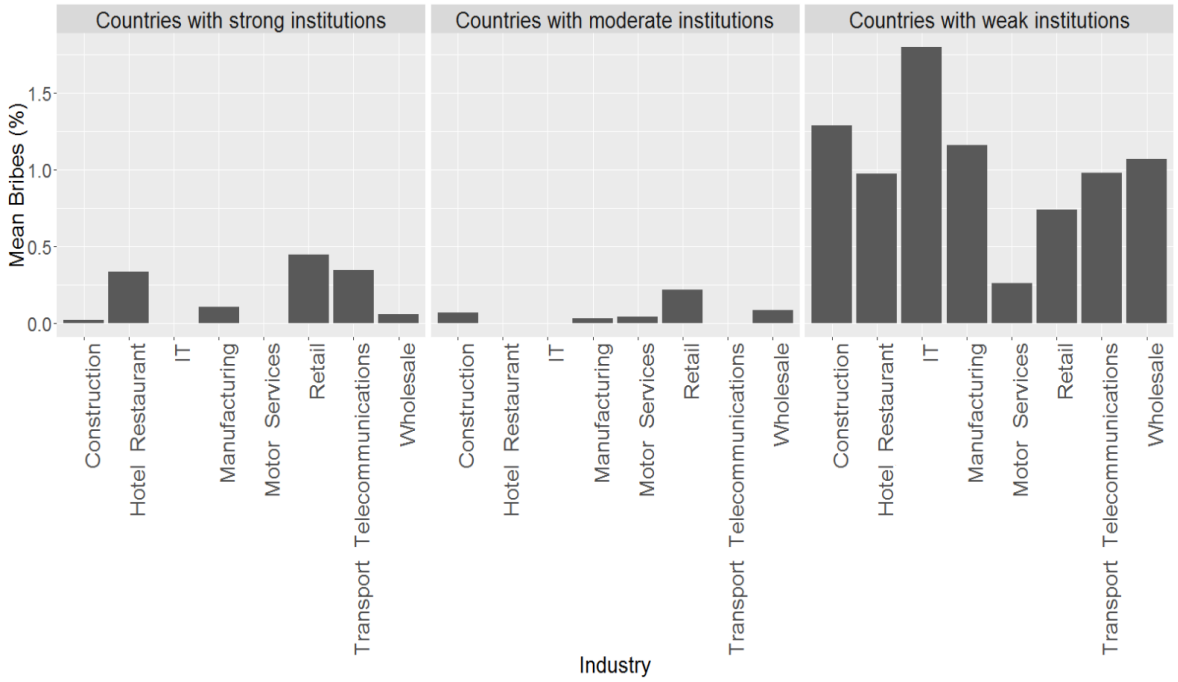

Figure 2. Mean bribes per industry in each country group

Source: Authors' calculations.

Figure 3 shows that domestic firms tend to pay more bribes on average in countries with strong institutional structures. The situation is the other way around in countries with moderate institutions where foreign firms pay a significantly higher percentage of bribes on average. As in Figure 2, firms

pay higher bribes in countries with poor institutions no matter their ownership type. Also, average bribes paid by domestic firms is slightly higher than that of foreign-owned companies in the underlying country cluster. (Table 2A presents a correlation matrix of the variables before conducting econometric estimations, see appendices).

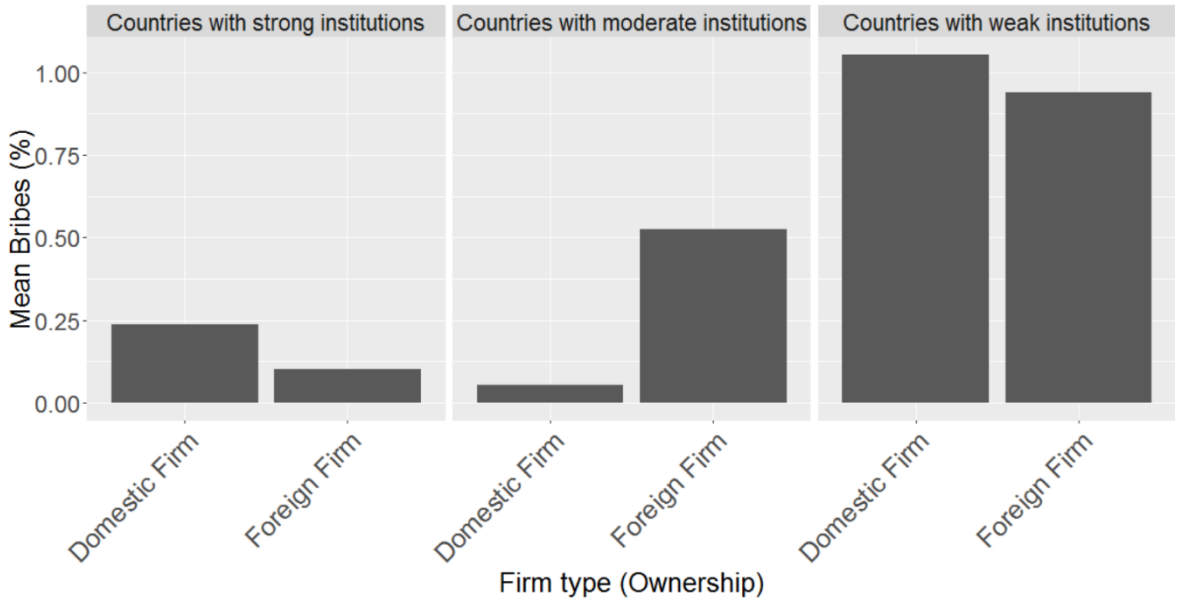

Figure 3. Mean bribes per firm ownership in each country group

Source: Authors' calculations.

4. EMPIRICAL ANALYSIS AND RESULTS

4.1. Estimations for the full sample

We first run our probit model estimations for the overall PSR and the results are shown in Table 2. It can be seen that bribery is positively associated with all four innovation types across the region. However, such a positive effect is statistically significant only for product and marketing innovations at 1%. More specifically, a 1% increase in total annual sales paid as an informal payment or gift, increases the probability of firms introducing product and marketing innovations.

This positive relationship is not totally unexpected and can be justified by the unsatisfactory level of institutional quality across the region, where the countries are in a transition period.

In such environments, public bodies tend to have greater control over resources which are crucial to innovation, and this fact provides an opportunity for them to extract bribes from firms. The Soviet legacy and its resulting misperception of corruption in the region leads to the easy involvement of firms in corrupt activities to access underlying resources. Moreover, companies may consider only the short-term benefits of corruption and favour being involved in corrupt activities. Apart from that, firms are usually eager to bring their innovations to market immediately, and generally inefficient institutions of the PSR increase the level of bureaucracy which lags this process. This results in the usage of bribery as a by-product. Hence, our results support the "greasing the wheels of innovation" hypothesis and confirms that petty corruption facilitates product and marketing innovations in the PSR.

Table 2. Probit model estimations for the full sample

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.014***	0.008	0.013***	0.008
	(0.005)	(0.005)	(0.005)	(0.005)
R&D	1.030***	1.047***	1.039***	1.143***
	(0.070)	(0.070)	(0.070)	(0.070)
Informal Competition	0.136**	0.218***	0.099*	0.162***
	(0.059)	(0.060)	(0.059)	(0.059)
Financial Limitations	0.107**	0.112**	0.190***	0.157***
	(0.054)	(0.055)	(0.053)	(0.055)
Firm Age	0.020	0.065*	-0.003	0.005
	(0.034)	(0.035)	(0.034)	(0.034)
Firm Size	0.088***	0.076***	0.073***	0.134***
	(0.021)	(0.021)	(0.021)	(0.021)
Foreign Ownership	0.194**	-0.075	0.394***	0.270***
	(0.090)	(0.099)	(0.091)	(0.093)
Exporter	0.143*	0.016	-0.073	-0.025
	(0.075)	(0.079)	(0.079)	(0.079)
Time Tax	0.001	0.003***	0.004***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Training	0.316***	0.373***	0.370***	0.367***
	(0.046)	(0.047)	(0.046)	(0.046)
Management's Expertise	0.002	0.001	-0.003	-0.002
	(0.002)	(0.003)	(0.002)	(0.003)
Female Manager	-0.156***	-0.111**	-0.074	-0.096**
	(0.047)	(0.048)	(0.046)	(0.047)
Education	0.002***	0.0001	0.002***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-1.502***	-1.626***	-1.423***	-1.630***

	(0.197)	(0.201)	(0.194)	(0.199)
Observations	5,194	5,194	5,194	5,194
Log Likelihood	-2,226.728	-2,066.355	-2,271.559	-2,146.124
Akaike Inf. Crit.	4,521.457	4,200.710	4,611.119	4,360.249

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$.
Source: Authors' calculations.

4.2 Estimations based on differences in institutional quality

Taking discussions further and focusing on the link between bribery and firm innovation in each particular country cluster within the PSR, Table 3 presents the results for countries with strong institutional structures. It can be observed that bribery has a statistically significant positive relationship only with organizational innovation in the EU member post-Soviet countries. While it decreases the probability of introducing product and marketing innovations, these effects are statistically insignificant. The positive link between bribery and process innovation is also insignificant. The insignificant relationships are due to strong law enforcement and no control of government over critical resources for innovation unlike the PSR in general. One possible explanation of how corruption can find its niche in regard to organizational innovation could be through the implementation of new ways of organizing a company's external relations. Examples of such organizational innovation could be establishing cooperation with new organizations, outsourcing and working with public institutions. As this requires transactions with external stakeholders, it is possible that there can be corruption at the core of such cooperation agreements.

This finding is inconsistent with the previous literature (Lee et al., 2020; Mahagaonkar, 2010), which reports a negative link between corruption and organizational innovation. However, it should be noted that the latter studies report the negative link for countries with weak country-level governance, which is not the case for the EU member post-Soviet countries. However, comprehensive analysis of the exact market conditions, legislation, national innovation systems and institutional structures of the underlying cluster countries might be conducted to reveal further insights into this conflict.

Table 3. Probit model estimations for the sample of countries with strong institutional structures

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	-0.174	0.012	-0.122	0.076*
	(0.177)	(0.042)	(0.134)	(0.043)
Control variables	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-0.922*	-2.047***	-1.890***	-1.981***
	(0.560)	(0.680)	(0.703)	(0.685)
Observations	426	426	426	426
Log Likelihood	-200.507	-183.008	-163.198	-159.317
Akaike Inf. Crit.	447.014	412.016	372.395	364.634

Note: *p<0.1; **p<0.05; ***p<0.01. Table is in shortened form. Full table is presented in Table 3A Appendices. **Source:** Authors' calculations.

Table 4 shows the results of estimations for the countries where institutional structures are of moderate quality. Similar to the group of countries with high quality institutional setups, the insignificant relationships between bribery and product, process and marketing innovations in this country cluster indicate that the institutional structures are strong enough to prevent the use of bribery as a tool to "get things done" in regard to the mentioned three innovation types. These results indicate that, unlike the first cluster, institutions concerning organizational innovation are also strong enough in this country group, so that the relationship between bribery and organizational innovation is insignificant.

Table 4. Probit model estimations for the sample of countries with moderate institutional structures

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.085	0.019	0.009	-0.169
	(0.061)	(0.063)	(0.055)	(0.153)
Control variables	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-1.532***	-2.025***	-1.816***	-2.217***
	(0.503)	(0.596)	(0.532)	(0.639)
Observations	744	744	744	744
Log Likelihood	-260.198	-212.212	-230.968	-190.781
Akaike Inf. Crit.	566.396	470.424	507.936	427.561

Note: *p<0.1; **p<0.05; ***p<0.01. Table is in shortened form. Full table is presented in Table 4A in Appendices.

Source: Authors' calculations.

Table 5 presents the results of the analysis of countries with weak institutional structures. Like the PSR in general, bribery increases the likelihood of product and marketing innovations in this country cluster. Justifications for the PSR in general are valid for this country group, as well.

Table 5. Probit model estimations for countries with weak institutional structures

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.014***	0.008	0.015***	0.008
	(0.005)	(0.006)	(0.005)	(0.005)
Control variables	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-2.117***	-1.844***	-1.134***	-1.573***
	(0.249)	(0.245)	(0.225)	(0.236)
Observations	4,024	4,024	4,024	4,024
Log Likelihood	-1,741.980	-1,649.481	-1,835.163	-1,758.297
Akaike Inf. Crit.	3,539.959	3,354.961	3,726.326	3,572.593

Note: *p<0.1; **p<0.05; ***p<0.01. Table is in shortened form. Full table is presented in Table 5A in Appendices.

Source: Authors' calculations.

4.3 ROBUSTNESS CHECKS

4.3.1. Robustness check for bribery outliers

The BEEPS V dataset used to run regressions for the full sample included firms that reported bribes equal to and even more than 50% of their total annual sales in a year. Such high percentages of bribes prompt the question of whether those firms affect the estimations. In order to address this issue, bribery outliers are removed from the dataset by filtering out firms which reported bribes higher than 20% of their total annual sales in a year. The filtered dataset includes 5,166 observations and the main regressions, which are for the PSR as a whole, are recalculated using the filtered dataset. The results reported in Table 6 show that bribery

increases the odds of product, process and marketing innovations across the PSR. The positive relationship between bribery and organizational innovation is insignificant.

Table 6. Robustness checks for the full sample by removing bribery outliers

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.025***	0.018**	0.022***	0.009
	(0.008)	(0.008)	(0.008)	(0.008)
Control variables	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-1.513***	-1.629***	-1.426***	-1.629***
	(0.197)	(0.202)	(0.195)	(0.199)
Observations	5,166	5,166	5,166	5,166
Log Likelihood	-2,204.292	-2,043.744	-2,250.121	-2,129.705
Akaike Inf. Crit.	4,476.584	4,155.488	4,568.242	4,327.411

Note: *p<0.1; **p<0.05; ***p<0.01. Table is in shortened form. Full table is presented in Table 6A in Appendices.

Source: Authors' calculations.

4.3.2. Robustness check for alternative corruption variable

When the corruption proxy is defined as the percentage of total annual sales paid as informal payments or gifts, the reported figures by managers might be inaccurate and biased, and therefore not revealing the actual level of corruption in the environment. To overcome this, another corruption proxy, namely "Corruption" is chosen from the BEEPS survey. This is obtained by considering answers to "How common is it for firms to have to pay some irregular "additional payments or gifts" to get things done with regard to customs, taxes,

licenses, regulations, services etc.?". Considering the secretive nature of corruption, the answers "Never" and "Seldom" are coded as "0", and answers "Sometimes", "Frequently", "Very frequently" and "Always" are coded as "1". Given that regressions for the PSR in general are recalculated, the estimation results are presented in Table 7 With the new proxy, corruption is still positively related to firm innovation and increases the chances of introducing product, process and organizational innovations. Underlying positive links are found to be statistically significant at 1%. The relationship between corruption and marketing innovation is also positive, but statistically insignificant.

Table 7. Robustness checks for the full sample with a new "Corruption" proxy

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Corruption	0.121***	0.113***	0.041	0.144***
	(0.042)	(0.043)	(0.042)	(0.043)
Control variables	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-1.519***	-1.737***	-1.490***	-1.666***
	(0.185)	(0.192)	(0.186)	(0.190)
Observations	6,354	6,354	6,354	6,354
Log Likelihood	-2,773.268	-2,539.478	-2,758.621	-2,603.328
Akaike Inf. Crit.	5,614.537	5,146.956	5,585.242	5,274.656

Note: *p<0.1; **p<0.05; ***p<0.01. Table is in shortened form. Full table is presented in Table 7A in Appendices.

Source: Authors' calculations.

4.3.3. Endogeneity

Endogeneity is a common problem in these types of studies. In order to address this, we first run a Wu-Hausman test to see if the main explanatory variable, *Bribes,* is indeed endogenous. The results of this test are presented in Table 8. In the case of process and organizational innovations, we cannot reject the null hypothesis, which assumes that the *Bribes* variable is an exogenous variable. However, when product and marketing innovations are dependent variables in the model, we reject the null hypothesis and conclude that *Bribes* is endogenous. In order to tackle this issue, we elaborate our study by running instrumental variable (IV) regressions. We follow the approach of Ashyrov and Masso (2020) using a variable which indicates whether the company was expected or requested a gift or informal payment by tax officials upon their inspection in the establishment over the last year. This variable assumes two main criteria in order to be chosen as an instrument. Firstly, it is correlated with the main explanatory variable in a way that if such requests or expectations are frequent then it gets easier for other tax inspectors to bribe firms and bribery becomes a common practice in the business environment. Secondly, this variable is not correlated with the error term of the model where the dependent model is any type of innovation. Table 8 contains the results of IV regressions for the full sample of countries. According to the results, *Bribes* is positively associated with both product and marketing innovations at a significance level of 5%.

Table 8. IV estimation results for the full sample

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.022**	0.006	0.026**	0.013
	(0.01)	(0.009)	(0.01)	(0.01)
Control variables	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	0.031	-0.095	0.054	0.028
	(0.069)	(0.065)	(0.072)	(0.070)
Observations	2,593	2,593	2,593	2,593
R^2	0.205	0.241	0.181	0.227
Adjusted R^2	0.195	0.232	0.170	0.217
Wu-Hausman p-value	0.0416	0.657	0.0192	0.261

Note: *p<0.1; **p<0.05; ***p<0.01. The table here is in a shortened form – the full table is presented as Table 8A in the Appendices. Source: Authors' calculations.

CONCLUSIONS

This paper has provided a deeper insight into the link between corruption and firm innovation by placing emphasis on the institutional quality of countries. Since there has not been an established common agreement regarding the consequences of corruption on firm innovation, this paper aims to fill the gap by investigating the role of bribery in firm innovation in post-Soviet countries. One stream of research lends support to the idea of the "sand the wheel

effect of corruption" whereby corruption hinders innovation by leading to misallocations of resources and decreasing investments in R&D and innovation activities. On the contrary, the alternative stream of scholars has put forward that corruption fosters innovation by being used by firms to overcome bureaucratic red tape, accelerating the processes of obtaining licenses and permissions, and secure contracts.

Estimation results for the full sample of post-Soviet countries have shown that there is support for the "greasing the wheels of innovation" hypothesis by confirming that bribery increases the probability of introducing product and marketing innovations. In addition, the link between bribery and process and organizational innovations appears to be insignificant in the region in general. Another important finding is that the institutional context is critical. Accordingly, we considered differences in institutional quality across the post-Soviet countries, and ran estimations for three different samples of countries. Previous results showing statistically significant relationships disappeared in estimations for country samples which had moderate and strong institutions. Estimations for the sample of countries with weak institutional quality demonstrated that bribery increases the likelihood of product and marketing innovations. One may say that corruption ceases to be a rule of the game and loses its function in countries which have achieved institutional development, and persists in business environments in countries which have not improved their institutional setting since the Soviet Union collapsed.

The current study has several limitations. First, as corruption is an illegal and hidden activity, it is not an easy task to measure it accurately. The political atmosphere and levels of freedom of speech in the focus region might affect how willing respondents are to answer certain questions and they might be biased in reporting the actual situation accurately. Moreover, there are many missing observations as the respondents avoided answering questions because of their sensitivity. Although BEEPS data provides some insights into the extent to which an environment is corrupt, it is not completely unbiased and there is a need for more accurate, objective and less perception-based data. In this sense, this research could be repeated using more precise and unbiased datasets. Second, corruption might seem to encourage innovation

activities in the short term, but it might be detrimental for firm innovation in the long run. Due to data related restrictions, we are not able to conduct a panel analysis of the relationship. Therefore, this paper is limited in observing how the relationship between firm innovation and corruption evolves over time. Further works might focus on the long-term effects of corruption and firm innovation. Third, the focus of this paper is the relationship between petty corruption and firm innovation. Further research could focus on the relationship between grand corruption and firm innovation.

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Appendices

Table 1A. Detailed description of the variables

Variable	Description
Dependent variables	
Product Innovation	Whether any new or significantly improved products or services were introduced in the last 3 years, 1 = "YES"
Process Innovation	Whether any new or significantly improved methods for the production or the supply of products/services were introduced in the last 3 years, 1 = "YES"
Marketing Innovation	Whether any new or significantly improved marketing methods were introduced in the last 3 years, 1 = "YES"
Organizational Innovation	Whether any new or significantly improved organizational or management practices/structures were introduced in the last 3 years, 1 = "YES"
Independent variables	
Bribes	Percentage of total annual sales paid as informal payment/gift
R&D	Whether the establishment spent on research and development activities, either in-house or contracted with other companies (outsourced?) during the last 3 years, 1="YES"
Informal Competition	Whether practices of informal competitors in the sector are major or severe obstacles to the current operations of a firm, 1 = if the answer is either "Major obstacle" or "Very severe obstacle"
Firm Size (log)	Logarithm of the number of permanent, full time individuals working at the end of last fiscal year
Firm Age (log)	Logarithm of the number of years since the firm began to operate
Foreign Ownership	Foreign-owned company, if at least 10% of the company's equity shares are owned by foreign individuals
Exporter	If direct exports > 0, then Exporter = 1
Time Tax	Percentage of senior management's time spent on dealing with regulations
Financial Limitations	Whether access to finance is an obstacle to firms' current operations, 1 = if the answer is either "Major obstacle" or "Very severe obstacle", 0 = if the answer is either "Moderate obstacle" or "Minor obstacle" or "No obstacle"
Training	Whether a firm had formal training programs for its permanent, full time employees over fiscal year, 1 = "YES"
Education	Percentage of full-time employees who completed a university degree
Management's Expertise	Top manager's number of years of experience working in this sector
Female Manager	1 = if the main respondent's gender is female

Source: Authors' calculations.

Table 2A. Correlation matrix of the variables used in the regression analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Product Innovation	1																
Process Innovation	0.51	1															
Marketing Innovation	0.38	0.43	1														
Organizational Innovation	0.39	0.5	0.6	1													
Bribes	0.06	0.05	0.07	0.06	1												
R&D	0.35	0.35	0.32	0.36	0.04	1											
Informal Competition	0.06	0.07	0.05	0.06	0.1	0.04	1										
Firm Age (logs)	0.06	0.07	0.02	0.03	-0.02	0.06	0.02	1									
Firm Size (logs)	0.16	0.15	0.11	0.16	-0.03	0.17	-0.01	0.28	1								
Foreign Ownership	0.1	0.04	0.11	0.1	-0.01	0.07	0.01	0.02	0.17	1							
Exporter	0.14	0.11	0.07	0.09	0	0.16	-0.01	0.1	0.22	0.17	1						
Time Tax	0.03	0.06	0.09	0.07	0.07	0.03	0.04	0	0.07	0.02	0	1					
Financial Limitations	0.06	0.06	0.08	0.07	0.06	0.07	0.1	-0.02	-0.02	-0.02	0.02	0.04	1				
Training	0.2	0.22	0.22	0.24	0.02	0.19	0.05	0.05	0.25	0.09	0.08	0.08	0.05	1			
Education	0.04	0	0.07	0.05	0.03	0.05	-0.03	-0.17	-0.2	-0.01	-0.06	0.03	0.04	0.05	1		
Management's Expertise	0.06	0.06	0.01	0.03	0.02	0.05	0.06	0.38	0.14	-0.03	0.05	0	0.03	0.08	-0.08	1	
Female Manager	-0.08	-0.06	-0.05	-0.06	-0.04	-0.09	-0.06	0.02	-0.02	0	-0.05	0.03	-0.06	-0.03	0	-0.04	1

Source: Authors' calculations.

Table 3A. Probit model estimations for the sample of countries with strong institutional structures

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	-0.174	0.012	-0.122	0.076*
	(0.177)	(0.042)	(0.134)	(0.043)
R&D	1.033***	0.855***	1.456***	1.256***
	(0.224)	(0.223)	(0.234)	(0.236)
Informal Competition	0.211	0.348*	0.586***	0.709***
	(0.194)	(0.200)	(0.209)	(0.206)
Financial Limitations	-0.339	-0.381	0.053	-0.113

	(0.238)	(0.248)	(0.245)	(0.251)
Firm Age (logs)	0.029	0.177	0.075	0.106
	(0.137)	(0.149)	(0.156)	(0.162)
Firm Size (logs)	0.004	0.079	-0.040	0.200**
	(0.077)	(0.080)	(0.086)	(0.087)
Foreign Ownership	0.166	0.149	0.363	0.139
	(0.247)	(0.256)	(0.270)	(0.269)
Exporter	0.221	0.344*	0.067	0.211
	(0.187)	(0.196)	(0.215)	(0.213)
Time Tax	0.002	0.009	0.0003	0.005
	(0.006)	(0.006)	(0.006)	(0.006)
Training	0.446***	0.317*	0.271	0.210
	(0.160)	(0.167)	(0.177)	(0.180)
Management's Expertise	-0.012	-0.008	0.0001	-0.034***
	(0.009)	(0.010)	(0.010)	(0.012)
Female Manager	0.123	0.070	-0.139	0.171
	(0.156)	(0.162)	(0.173)	(0.175)
Education	0	0.003	0.005*	0.004
	(0.003)	(0.003)	(0.003)	(0.003)
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-0.922*	-2.047***	-1.890***	-1.981***
	(0.560)	(0.680)	(0.703)	(0.685)
Observations	426	426	426	426
Log Likelihood	-200.507	-183.008	-163.198	-159.317
Akaike Inf. Crit.	447.014	412.016	372.395	364.634

Note: *p<0.1; **p<0.05; ***p<0.01

Source: *Authors' calculations.*

Table 4A. Probit model estimations for the sample of countries with moderate institutional structures

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.085	0.019	0.009	-0.169

	(0.061)	(0.063)	(0.055)	(0.153)
R&D	1.415***	1.485***	2.071***	2.068***
	(0.241)	(0.248)	(0.282)	(0.280)
Informal Competition	0.345**	0.375**	0.258	0.192
	(0.161)	(0.171)	(0.172)	(0.188)
Financial Limitations	0.295*	0.218	0.567***	0.319*
	(0.157)	(0.181)	(0.159)	(0.183)
Firm Age (logs)	0.106	0.266**	0.214*	0.215*
	(0.109)	(0.120)	(0.118)	(0.129)
Firm Size (logs)	0.008	-0.009	0.104*	0.109
	(0.060)	(0.068)	(0.063)	(0.068)
Foreign Ownership	-0.006	-0.345	-0.119	0.370
	(0.236)	(0.289)	(0.253)	(0.250)
Exporter	0.308	-0.060	0.194	0.098
	(0.215)	(0.256)	(0.239)	(0.251)
Time Tax	0.006	0.005	0.008*	0.005
	(0.004)	(0.005)	(0.004)	(0.005)
Training	0.386**	0.444***	0.608***	0.441***
	(0.157)	(0.172)	(0.159)	(0.171)
Management's Expertise	-0.001	-0.003	-0.006	0.006
	(0.008)	(0.009)	(0.008)	(0.009)
Female Manager	0.106	0.158	-0.325**	0.008
	(0.134)	(0.145)	(0.148)	(0.154)
Education	0.002	-0.002	-0.002	-0.005*
	(0.002)	(0.002)	(0.002)	(0.003)
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-1.532***	-2.025***	-1.816***	-2.217***
	(0.503)	(0.596)	(0.532)	(0.639)
Observations	744	744	744	744
Log Likelihood	-260.198	-212.212	-230.968	-190.781
Akaike Inf. Crit.	566.396	470.424	507.936	427.561

Note: *p<0.1; **p<0.05; ***p<0.01

Source: Authors' calculations.

Table 5A. Probit model estimations for the sample of countries with weak institutional structures

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.014***	0.008	0.015***	0.008
	(0.005)	(0.006)	(0.005)	(0.005)
R&D	0.993***	1.027***	0.910***	1.063***
	(0.078)	(0.077)	(0.077)	(0.078)
Informal Competition	0.084	0.174**	0.025	0.082
	(0.067)	(0.068)	(0.067)	(0.067)
Financial Limitations	0.115*	0.126**	0.154***	0.154***
	(0.060)	(0.061)	(0.058)	(0.059)
Firm Age (logs)	0.007	0.039	-0.024	-0.014
	(0.037)	(0.038)	(0.036)	(0.037)
Firm Size (logs)	0.107***	0.087***	0.080***	0.140***
	(0.023)	(0.024)	(0.023)	(0.023)
Foreign Ownership	0.232**	-0.080	0.541***	0.286**
	(0.109)	(0.119)	(0.112)	(0.113)
Exporter	0.117	-0.027	-0.132	-0.096
	(0.094)	(0.097)	(0.096)	(0.096)
Time Tax	0.0004	0.003***	0.004***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Training	0.289***	0.376***	0.354***	0.363***
	(0.051)	(0.052)	(0.050)	(0.051)
Management's Expertise	0.004	0.002	-0.003	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Female Manager	-0.234***	-0.163***	-0.045	-0.135**
	(0.053)	(0.055)	(0.052)	(0.053)
Education	0.003***	0.00001	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-2.117***	-1.844***	-1.134***	-1.573***
	(0.249)	(0.245)	(0.225)	(0.236)

Observations	4,024	4,024	4,024	4,024
Log Likelihood	-1,741.980	-1,649.481	-1,835.163	-1,758.297
Akaike Inf. Crit.	3,539.959	3,354.961	3,726.326	3,572.593

Note: *p<0.1; **p<0.05; ***p<0.01 **Source:** Authors' calculations.

Table 6A. Robustness checks for the full sample by removing bribery outliers

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.025***	0.018**	0.022***	0.009
	(0.008)	(0.008)	(0.008)	(0.008)
R&D	1.031***	1.059***	1.049***	1.135***
	(0.070)	(0.070)	(0.070)	(0.071)
Informal Competition	0.144**	0.223***	0.095	0.162***
	(0.059)	(0.060)	(0.059)	(0.060)
Financial Limitations	0.104*	0.113**	0.194***	0.156***
	(0.054)	(0.056)	(0.053)	(0.055)
Firm Age (logs)	0.020	0.063*	-0.005	0.005
	(0.034)	(0.035)	(0.034)	(0.034)
Firm Size (logs)	0.091***	0.079***	0.075***	0.136***
	(0.021)	(0.022)	(0.021)	(0.021)
Foreign Ownership	0.201**	-0.075	0.388***	0.266***
	(0.090)	(0.099)	(0.092)	(0.093)
Exporter	0.145*	0.030	-0.066	-0.035
	(0.076)	(0.080)	(0.079)	(0.080)
Time Tax	0.001	0.003***	0.004***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Training	0.311***	0.367***	0.366***	0.365***
	(0.046)	(0.048)	(0.046)	(0.046)
Management's Expertise	0.002	0.001	-0.003	-0.002
	(0.002)	(0.003)	(0.002)	(0.003)
Female Manager	-0.149***	-0.109**	-0.071	-0.092*
	(0.047)	(0.049)	(0.046)	(0.048)

Education	0.002***	-0.0001	0.002***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-1.513***	-1.629***	-1.426***	-1.629***
	(0.197)	(0.202)	(0.195)	(0.199)
Observations	5,166	5,166	5,166	5,166
Log Likelihood	-2,204.292	-2,043.744	-2,250.121	-2,129.705
Akaike Inf. Crit.	4,476.584	4,155.488	4,568.242	4,327.411

Note: *p<0.1; **p<0.05; ***p<0.01. **Source:** Authors' calculations.

Table 7A. Robustness checks for the full sample with a new "Corruption" proxy

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Corruption	0.121***	0.113***	0.041	0.144***
	(0.042)	(0.043)	(0.042)	(0.043)
R&D	1.033***	1.023***	1.085***	1.105***
	(0.062)	(0.062)	(0.063)	(0.063)
Informal Competition	0.116**	0.175***	0.060	0.143***
	(0.052)	(0.053)	(0.052)	(0.053)
Financial Limitations	0.107**	0.106**	0.204***	0.161***
	(0.048)	(0.049)	(0.047)	(0.049)
Firm Age (logs)	0.015	0.060*	-0.0001	-0.001
	(0.031)	(0.032)	(0.031)	(0.031)
Firm Size (logs)	0.102***	0.083***	0.071***	0.135***
	(0.018)	(0.019)	(0.019)	(0.019)
Foreign Ownership	0.238***	0.032	0.370***	0.239***
	(0.082)	(0.088)	(0.083)	(0.085)
Exporter	0.140**	0.045	-0.057	-0.034
	(0.066)	(0.069)	(0.069)	(0.070)
Time Tax	0.001	0.002**	0.003***	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Training	0.297***	0.400***	0.398***	0.372***
	(0.041)	(0.043)	(0.041)	(0.042)

Management's Expertise	0.004*	0.003	-0.003	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Female Manager	-0.142***	-0.092**	-0.059	-0.080*
	(0.042)	(0.044)	(0.042)	(0.043)
Education	0.002***	0.0004	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	-1.519***	-1.737***	-1.490***	-1.666***
	(0.185)	(0.192)	(0.186)	(0.190)
Observations	6,354	6,354	6,354	6,354
Log Likelihood	-2,773.268	-2,539.478	-2,758.621	-2,603.328
Akaike Inf. Crit.	5,614.537	5,146.956	5,585.242	5,274.656

Note: *p<0.1; **p<0.05; ***p<0.01. **Source:** Authors' calculations

Table 8A. IV estimation results for the full sample

	Dependent variable:			
	Product Innovation	Process Innovation	Marketing Innovation	Organizational Innovation
	(1)	(2)	(3)	(4)
Bribes	0.022**	0.006	0.026**	0.013
	(0.010)	(0.009)	(0.010)	(0.010)
R&D	0.355***	0.393***	0.386***	0.420***
	(0.026)	(0.025)	(0.028)	(0.027)
Informal Competition	0.033	0.048**	0.004	0.042*
	(0.022)	(0.021)	(0.023)	(0.023)
Financial Limitations	0.024	0.022	0.052***	0.035*
	(0.019)	(0.018)	(0.020)	(0.019)
Firm Age	0.009	0.035***	-0.003	0.003
	(0.012)	(0.011)	(0.013)	(0.012)
Firm Size	0.036***	0.023***	0.030***	0.037***
	(0.007)	(0.007)	(0.008)	(0.007)
Foreign Ownership	0.083***	-0.012	0.117***	0.054*
	(0.032)	(0.030)	(0.034)	(0.032)
Exporter	0.050*	0.008	0.0003	0.007
	(0.029)	(0.027)	(0.030)	(0.029)
Time Tax	-0.0001	0.001***	0.001**	0.0004

	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Training	0.071***	0.093***	0.101***	0.100***
	(0.016)	(0.015)	(0.017)	(0.017)
Management's Expertise	0.001	-0.00002	-0.0005	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Female Manager	-0.027*	-0.013	-0.011	-0.021
	(0.016)	(0.015)	(0.017)	(0.016)
Education	0.0005*	0.00003	0.0004	0.001*
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Countries	Yes	Yes	Yes	Yes
Industries	Yes	Yes	Yes	Yes
Constant	0.031	-0.095	0.054	0.028
	(0.069)	(0.065)	(0.072)	(0.070)
Observations	2,593	2,593	2,593	2,593
R^2	0.205	0.241	0.181	0.227
Adjusted R^2	0.195	0.232	0.170	0.217
Wu-Hausman p-value	0.0416	0.657	0.0192	0.261

Note: *p<0.1; **p<0.05; ***p<0.01. **Source:** Authors' calculations