Corruption and Innovation: The Case of EECA Countries

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Abstract

Although the effect of corruption on country-level investment is studied widely in literature, only a limited number of research has sought to understand how corruption affects firm-level innovation. Using firm-level data for twenty seven Eastern European and Central Asian countries, we empirically investigate how corruption affects innovation. We find that corruption has a positive effect on the rate of innovation. This finding is robust to alternative measurement proxies.

Keywords: Innovation, Corruption, EECA

JEL Codes: D73, L26, O31, P37

Introduction

The World Bank defines corruption as "*the abuse of public office for private gain*". It mainly appears as bribes and officials may seek bribes to supply many things such as government contracts, government benefits (such as subsidies), licenses, and permits (World Bank, 1997).

Corruption can be classified in three groups as *i.)* grand (acts committed at a high level of government that distort policies or the central functioning of the state), *ii.)* petty (everyday abuse of entrusted power by low- and mid-level public officials) and *iii.)* political (manipulation of policies, institutions and rules of procedure in the allocation of resources and financing by political decision makers) (Transparency International, 2017).

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There are two opposing views on the role of corruption on growth and development. On the one hand, corruption has negative effects on growth and development (see for example Ben Ali and Sha, 2016 for Middle Eastern and North African (MENA) countries; Asiedu and Freeman, 2009 for transition countries; Mauro, 1995 for a cross-section of 67 countries). This view argues that corruption sands the wheels of growth since it is associated with lower levels of investment (see Mo, 2001; Reinikka and Svensson, 2005; Shleifer and Vishny, 1993). In contrast, other researchers have argued that corruption may be beneficial in countries with low institutional quality since it may help investors to avoid bureaucratic delay though the use of "speed/grease money" (see for example, Leff, 1964; Leys, 1965; Paul, 2010; Wang and You, 2012; Dreher and Gassebner, 2013). Many channels through which corruption may affect economic development have been analyzed in the literature and since innovation is considered to be the engine of economic growth, the impact of corruption on innovation is gaining attention by researchers.

The aim of this paper is to find out whether the grease or the sand effect of corruption on innovation dominates for the Eastern Europe and Central Asia (EECA) region. According to the Transparency International Corruption Perceptions Index 2016, most countries in the EECA region scored below 50 and thus are perceived to be highly corrupt (Figure 1). As widely discussed in literature, corruption weakens institutions and their functioning. Of particular importance to the understanding the effects of corruption is its role on innovative activities of firms, which in turn effects long term economic growth. Countries in the region have low innovation R&D intensities ranging from 2.4% (Slovenia) to 0.1% (Georgia) and low per capita growth rates*. Thus, the data suggest that high corruption in the region may be one of the reasons that these countries find it hard to catch up developed economies.

This paper builds upon this literature in two ways. First, to the best of our knowledge there are only two other studies on the impact of corruption on innovative activity in EECA countries. Secondly, firm-level studies on

* Countries with highest GDP per capita growth rates for 2015 in the region are Uzbekistan (6.13%), Turkey (4.4%), Bulgaria (4.28%) and Czech Republic (4.28%). For the same year lowest rates are for Ukraine (-9.54%), Belarus (-4.19%) and Russian Federation (-3.93%). Source: World Development Indicators

corruption-investment relationship are rare and we contribute to this literature by examining the relationship between innovation and Research & Development (R&D) investments of firms. Our results indicate that corruption has a positive effect on the rate of innovation regardless of how we measure innovation and corruption. Therefore, we find evidence of the grease effect of corruption.

In Section 2, we discuss a review of literature. In Section 3, we describe our research method and present empirical results. Section 4 concludes.

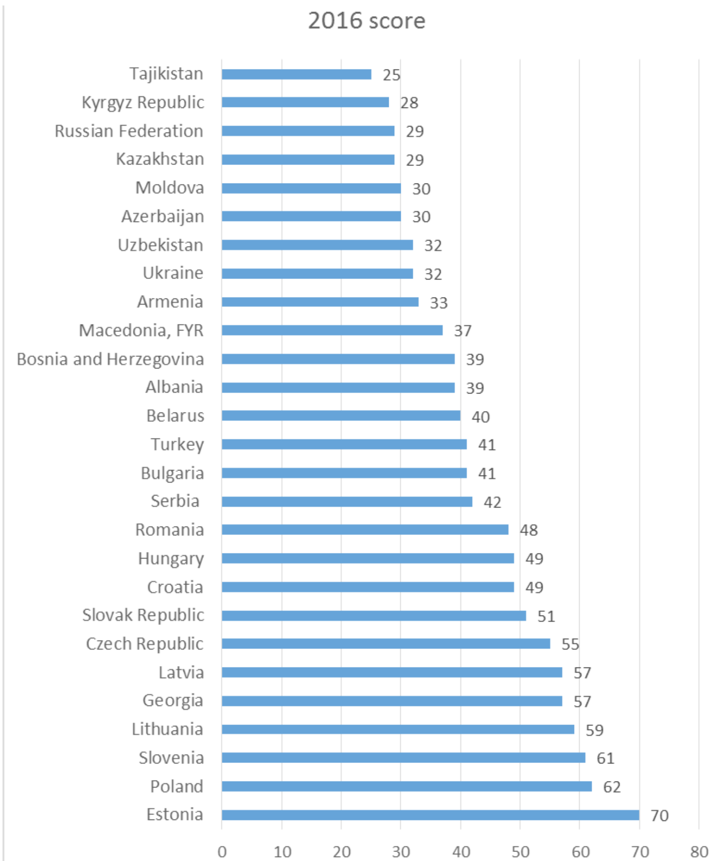

Figure 1: Corruption Perceptions Index, 2016

Source: Figure adapted from Transparency International Corruption Perceptions Index 2016

Literature Review

Corruption is mainly seen as a hindrance for innovators as it increases the level of uncertainty and ambiguity they must bear. Empirical evidence suggests that firms regard corruption as a major obstacle to doing business (for example, Beck et al., 2005; Fisman and Svensson, 2007).

Although there is a vast literature on corruption's effects on firms' performance and investment decisions, the relationship between corruption and firm-level innovation has only recently received attention. Shleifer and Vishny (1993) is one of the first papers to suggest that government corruption discourages innovation since high demand of secrecy prevents entry of foreign firms. Veracierto (2008) theoretically argues that higher penalties on corruption will increase the rate of product innovation. Anokhin and Schulze (2009) also argue that in corrupt environments firms are less likely to benefit from foreign direct investment by companies that employ sophisticated technologies. Using data from 64 countries and for the period 1996-2002, the authors show that there is a positive concave relationship between the control of corruption (measured by World Governance Indicators) and the amount of domestic innovative activity (measured by either the number of patent applications or the rate of technological advancement). Similarly, Habiyaremye and Raymond (2013) show that foreign firms' corruption practices in transition economies are detrimental to R&D efforts in the host country. Finally, Ayyagari et al. (2014) conclude in their research that corruption acts as a tax on innovation, i.e., innovator firms pay more in bribes than they gain by underreporting revenues to tax authorities.

However, some of the studies find evidence for the positive effect of corruption on innovation. One firm-level study which addresses the relationship between innovation and corruption directly is Mahagaonkar (2008). In this paper, using data from 7 African countries, the author finds that higher informal payments to public officials has a negative effect on product & organizational innovation, a positive effect on marketing innovations while there is no significant effect on process innovation. Another paper Krammer (2013) provides evidence of positive effects of petty corruption on developing new products in transition economies. Institutional environment also matters for the impact of regulations on entrepreneurship. Dreher and Gassebner (2013) show that when regulations abound, corruption increases the number of new entrepreneurs, thus acts as an efficient "grease". Nyugen et al. (2016) also finds empirical support for the grease effect on petty corruption in Vietnam, where public sector is inefficient like the EECA region. Using data from Egypt and Tunisia to represent the MENA region, where corruption is perceived to be persistently high, Goedhuys et al. (2016) test the hypothesis that the effect of corruption on innovation depends on how severe bureaucratic and institutional obstacles are. The authors assume corruption exists if firms perceive it as a cost increasing factor. They find that corruption reduces the negative effect of red tape on product innovation.

Krammer (2013) [K] is the closest work to this paper. Similar to our findings, they find support for "greasing the wheels" hypothesis. Our paper is different from K in three important respects. First, our innovation measures include R&D expenditures, incremental innovation, and an innovation index to capture all innovative activities of firms. K measures innovation by major innovation (introducing new products or services). However, major innovation is mostly done in developed countries and not very relevant in this set of countries. Second, we focus on two main corruption types (petty and grand) and also control for differences across corruption environments by taking honesty of officials and predictability of bribe payments into account. However, K uses average bribe in a given sector-region-country and does not consider differences across corruption environments. Finally, we use the second (2002) and third (2005) waves of Business Environment and Enterprise Performance Survey (BEEPS) rather than the fourth wave (2009).

Empirical Model

Data and Definitions

We derive our firm-level data from the second (2002) and third (2005) waves of the EBRD-World Bank BEEPS for twenty seven Eastern European and Central Asian countries*. The surveys use stratified random sampling

* World Bank also provides data for 2009, and a panel data for 2009-2013. But survey questionnaires are different for these years. For example, in 2009, R&D expenditures include both in house and outsourced activities and some sectors and countries have no or very few observations. We have only 967 observations for this variable out of 11,668 firms in 2009. Also, some of the dimensions of innovation like joint ventures with foreign partners

to ensure that the samples are representative of the relevant population of firms and to make sure that the final total sample includes establishments from all different sectors and that it is not concentrated in one or two of industries/sizes/regions.

There are 6667 and 9655 firms in 2002 and 2005 surveys respectively*. All surveys cover both manufacturing and services sectors according to the group classification of ISIC Revision 3.1. For both years, the highest number of firms are in manufacturing and wholesale and retail trade sectors. BEEPS collects information about various firm characteristics (size, location, age, ownership, employment composition, obstacles to doing business etc.).

There are various innovation and corruption measures that can be calculated from the survey questions.

We use three measures of innovation. Our first measure of innovation is R&D intensity, *rdint*, calculated as average R&D expenditures as a percentage of sales. Table 1 shows that manufacturing among industry sectors and real estate among service sectors have the highest innovation rates. One of the drawbacks of measuring innovation with R&D data is that it is usually done by means of explicitly classified data. Thus, these may miss a considerable amount of informal or part-time innovative activities by small firms. Moreover, the definitions of R&D activities may differ across firms and industries (Ahn, 2002).

For most developing countries, product innovation is in terms of upgrading the existing products. Therefore, our second measure of innovation is *upgprod* which takes the value 1 if the firm upgraded an existing product line and 0 otherwise.

In developing economies, it is also important to define innovation broadly. Following Ayyagari et al. (2014) we construct an innovation dynamism index called *dynind* which includes all innovative activities undertaken by firms. The index includes new-to-firm innovation (new product, upgraded product, new technology), as well as activities that promote knowledge

and quality accreditations are not measured. In addition, one of our corruption measures, predict, is not included in either 2009 or panel questionnaire.

* These firms do not overlap.

transfers (new joint venture with a foreign partner, new licensing agreement), and other actions that help the firms to adapt their organizations to meet market conditions (opened a new plant, outsourced activity, brought in-house a previously outsourced activity).

About 31% of the firms in BEEPS 2002 and 8% in BEEPS 2005 report they spent on R&D activities. In both years half of the firms reported that they upgraded a product line[**]. Table 2 gives innovation by sectors. The highest figure is for manufacturing with 69% in 2002 and 59% in 2005. Mining & quarrying sector has the second highest rates with 51% in 2002 and 56% in 2005.

Since the focus of this study is to explore the relationship between innovation and corruption, we check the percentages of innovative firms reporting corruption as an obstacle to doing business. Figure 2 highlights that corruption is especially important for innovation outputs rather than input (*rdint*).

BEEPS also provides information regarding the frequency of bribe payments (*dbribe* in Table 2). When we check the firms' response to "It is common for firms in my line of business to pay some irregular additional payments to get things done (1=never, 6=always)", we see that there is not much difference across country groups. 30% of all firms in 2002 and 37% in 2005 report it is not common to pay bribes at all.

The question "What per cent of senior management's time over the last 12 months was spent in dealing with public officials about the application and interpretation of laws and regulations and to get or to maintain access to public services" is used to assess the opportunities for the officials to extort greater bribe payments (*tspent)*. Most firms report that they have to spend some time dealing with bureaucracy (Table 2). Firms in Yugoslavia, Ukraine, and Georgia report the highest percentages. For sector subgroups; mining, real estate and other services spend more time dealing with government officials compared to other sectors.

** Author's own calculations.

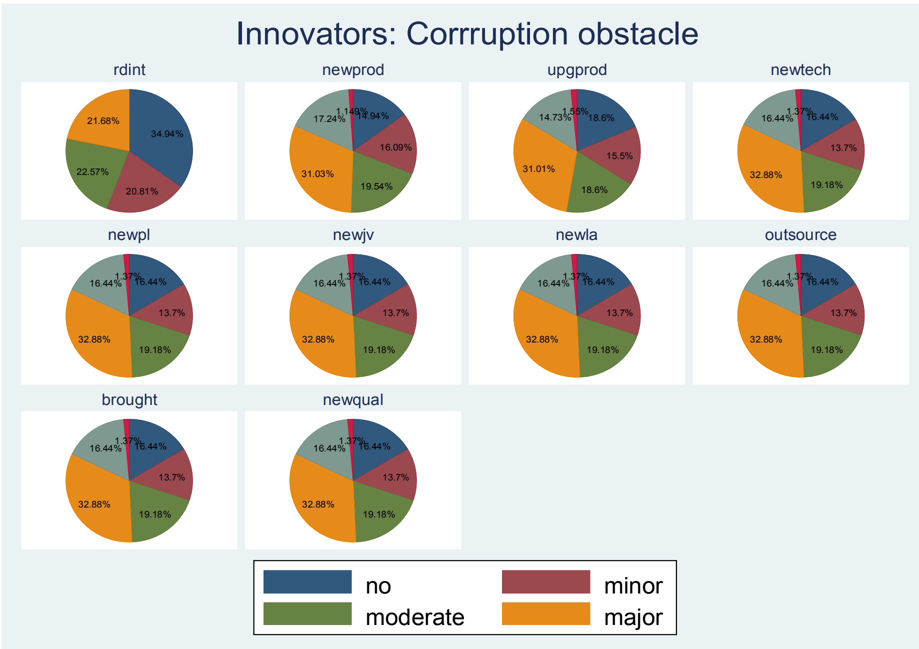

Figure 2: Innovators' perception of corruption

Source: Author's own calculations

We use two main corruption measures following Diaby and Sylwester (2014). Our first measure is *pbribe,* which is the average percent of revenues that firms pay annually as bribes. In literature, this type of corruption is referred as "*petty*". Although construction sector has the highest mean for this indicator, petty corruption seems to be a major problem for all firms regardless of their sector. Out of all firms, 43% in 2002 and 31% in 2005 report positive bribe payments. Individual firm data shows that highest mean payments are in Albania and Kyrgyzstan. Out of country groups, non-EU countries have higher mean than EU countries.

Ayyagari et al. (2014) argue that introducing new products and new technologies are associated with greater bribe payments to government officials. We use a more inclusive approach and compare different types of innovation and check whether innovators of all types pay higher bribes. For firms which report the following innovation activities: "*outsource*", "*newqual*" and "new*jv*", mean bribe payment is higher for non-innovators in both 2002 and 2005. For firms which report "*newprod*", "*upgprod*", "*newtech*" and "*newla*", mean bribe payment is higher for innovators*.

Our second measure of corruption is *govbribe* which is the amount of contract value that firms typically pay in additional or unofficial payments to secure the government contract (1=0%, 2=up to 50%, 3=6-100%, 4=11-150%, 5=16-200%, 6=greater than 200%). Traditional literature refers to this indicator as *grand corruption*. Majority of firms report no bribe payment. Sectoral data show a higher share for construction sector compared to other sectors (35% in 2002 & 34% in 2005). Countries Albania and Turkey have the highest bribe payments with means around %6 in 2005. Azerbaijan and Bulgaria follow them with means %4 and %3. Table 3 reports the correlations between our innovation and corruption measures.

We also control for the proneness of the business environment to corruption. If corruption is more *organized* (predictable), its effect of investment will be lower since it becomes more transparent (see Shleifer and Vishny, 1993 for an earlier discussion) and bribe payments will be lower which in turn affects the fixed cost of R&D (Blackburn and Forgues-Puccio, 2009). In addition, if firms know the availability of uncorrupt officials, they pay lower bribes (Diaby and Slywster, 2014). In order to shed some light on such differences across corruption environments, we first construct the variable *predict* which measures whether firms know in advance about the amount of bribe (1=never, 6=always). 37% in 2002 and 46% in 2005 report they *never* know the amount of payment beforehand which increases the uncertainty of the investment. This again seems to be an important concern across firms, specifically for firms in "other services". In 2002, 42% of the firms in this sector report "never".

We also use the variable *honest,* which is constructed from the firms' response to "If a government agent acts against the rules I can usually go to another official or his supervisor and get the correct treatment without reco-

* These results prevail if we compare median bribe payments for innovators and non-innovators, except for firms which report "yes" for new joint-venture. For this group, innovators' median bribe payment is higher. If we use another corruption measure: *govbribe*; innovators report higher mean bribe payment for *newprod* and *newla* groups.

urse to unofficial payments (1=never, 2: seldom, 3: sometimes, 4: frequently, 5: usually, 6=always)". Majority of the firms think they do not have a chance but to pay the bribe. 66% of firms in 2002 and 60% of firms in 2005 report values between 1-3. If we compare country groups, firms in EU seem to have more trust in the system compared to firms located elsewhere. Cross-check with *pbribe* shows that there are some firms which report honest=6 (always) but also a positive *pbribe*. This suggests that they have some other expectations from officials such as evading other regulations.

The Enterprise Surveys also contain information regarding firm characteristics such as size (number of full time workers), physical infrastructure (number of days that firms experience power outages) and ownership (state: 1 vs. private: 0). We use all of these as controls in our study following Karaman and Lahiri (2014). Additionally, we include a dummy for exporting status (exporter=1) following Habiyaremye and Raymond (2013) who find that having export activities increase the likelihood of performing R&D. Firms in poor institutional environments are less likely to be engaged in innovative activities (Zhao, 2006); face barriers to new technology absorption (Correa et al., 2010); are more likely to hit financial constraints (Gorodnichenko and Schnitzer, 2013); and are less likely to generate knowledge spillovers (Rodriguez-Pose and Di Cataldo, 2015). EU countries are ranked higher than al non-EU countries in the 2016 Global Competitiveness Index of The World Economic Forum which ranks countries according to their *competitiveness* defined as "the set of institutions, policies, and factors that determine the level of productivity of a country". Noutcheva and Duzgit (2012) find evidence for the influence of the EU on political and legal reforms. We therefore repeat our analysis for EU members and non-EU countries to highlight differences in institutional quality.

We also control for sectoral differences by using sectoral GDP shares and country heterogeneity by using GDP per capita data (values in constant 2005 dollars for 1995) from United Nations Conference on Trade and Development (UNCTAD) data base*. Correlations for variables are not high except for *un1995* and *sectorsh* which is 0.22 for the full sample. However we do not see a systematic relationship between the two when we draw a scatter diagram.

* Sector and Country fixed effects cannot be used because of collinearity problem.

Methodology and Results

In our empirical analysis, we explore the following question; "Is sand or grease effect of corruption dominant for EECA countries?" and investigate the relationship between innovation and corruption. Our literature review suggests that corruption increases innovation where institutions are ineffective. Therefore, we hypothesize:

Corruption greases the wheels of innovation.

To test our hypothesis, we estimate the following model:

$$İnnovation_{isc} = \alpha + \beta_1\ Corruption_{isc} + \beta_2\ Sectorsh_{sc} + \beta_3\ GDPPC_c + \beta_4 X_{isc} + \varepsilon_{isc}$$

where innovation is one of the three types of our innovation measures (*rdint*, *upgprod*, *dynin*d), is defined either as petty (*pbribe*) or grand (*govbribe*)denotes sectoral GDP share, $GDPPC_c$ is the GDP per capita data of country *c*, X_{ji} is a vector of control variables for firm-specific factors and corruption environment, is the error term, and *i, s, c* index firm, industry, and country, respectively.

The results for BEEPS 2002 are displayed in Table 4. Since R&D intensity variable includes a large set of zeros, we use a corner solution Tobit model when measuring innovation input of firms. We estimate a logit model when innovation is measured with *upgprod* (0: no, 1: yes) and an ordered logit model when we use innovation dynamism index which is a categorical measure (for related techniques see Green, 2008). We also report marginal effects of each estimation.

All results, regardless of how we measure innovation or corruption show that there is a positive association between corruption and innovation[**]. Therefore, we find evidence of "*grease the wheels*" argument in literature for EECA countries.

We also see that higher per capita GDP and unavailability of physical infrastructure are negatively associated with both innovation input and outputs. Size of the sector that the firms operate in seems to be an important determinant of innovation efforts whereas firms' own size is more important

** The only exception is for the year 2005 when we measure corruption by *govbribe* and innovation by *upgprod* but the negative relationship is not significant for this estimation.

to realize these efforts as innovation outputs. For example, a 10% increase in sectoral size increases the R&D intensity by 0.34 percentage points in 2002. We also find that exporters innovate more as these firms are expected to be more efficient. Regarding corruption environment, predictability of corruption has a positive influence on the likelihood of innovation. By contrast, presence of honest officials does not have a significant effect on innovation.

Table 5 reports estimation results for BEEPS 2005. Though weakly, the positive relationship between innovation and petty corruption prevails and results are consistent with those for 2002. Firm size, export activities, and predictability of corruption are all important determinants of firm innovation. Both state ownership and poor infrastructure reduce the likelihood of innovation.

Panel B and C report results for country groups. In most cases, the coefficient upon corruption is positive and statistically significant, especially for non-EU countries. This result supports the findings of Basseetti et al. (2015:220) who argues that "corruption is a tool for overcoming institutional inefficiencies in some cases, thereby greasing the wheels of economic development".

Conclusion

This paper investigates the relationship between innovation and corruption. We use firm-level data for the Eastern Europe and Central Asia and show that the grease effect of corruption on innovation dominates for the region. One disadvantage of our approach is using firm responses to measure corruption. However, BEEPS questions are phrased in ways that allows respondents to answer without admitting that they pay bribes (for a discussion of using BEEPS for corruption related studies, see Clarke, 2011). In addition, some studies have shown that lying and non-responses both are likely to bias estimates downwards (see, for example, Azfar and Murrell, 2009).

Most countries in the EECA region are perceived to be highly corrupt which in turn leads to weak institutions and increases uncertainty. However, our findings reveal that innovative firms use this poor intuitional quality to their advantage. There may be a number of reasons for this. First, corruption may help firms speed up lengthy procedures such as getting new licenses and permits in a rapidly changing environment (Krammer, 2013). Secondly, least efficient firms which cannot afford higher bribes will be crowded out so the quality of investments will increase (Leff, 1964). This is also in line with Ayyagari et al. (2014)'s argument which states that innovators pay greater bribes.

Our results also reveal that predictability of bribe payments increases the likelihood of innovation. This finding supports an earlier study of Blacburn and Forgues-Puccio (2009) who model how level of bribes affect research activity and growth. They predict that an increase in bribe payments increases the cost of research, reduce the total number of innovative firms and therefore increase the level of research input. But economic growth would be lower since corruption limits entry to into business innovation. They also show that if corruption is organized (*predictable*) economic growth will be higher. In the same line of thought, Diaby and Sylwester (2014) indicate that higher degree of centralization lower bribe payments. Our findings also suggest that firms operate more efficiently when corruption is organized.

We do not claim that corruption practices would contribute to an economy's development. However, given the dysfunctional institutional structure in EECA, firms will continue to use such illegal practices to overcome cumbersome barriers to innovative and to remain competitive. Therefore, policymakers should take these firms' incentives into account when fighting corruption. We would like to stress that our sample period does not allow us to study long-run effects. Once more years of data become available, our future research will expand the existing literature.

We also have not considered competition environment in our study. Some studies on EECA region suggest that competition may promote corruption and greater competition could provide more incentives for firms to pay bribes. However, some other researchers show that corruption decreases the level of competition in the market. These two opposing views suggest that there may a non-linear relationship between competition and corruption. In addition, competition's direct effects on innovation are also widely studied in literature. Thus, market structure may affect the relationship between corruption and innovation as well. If that is the case, endogeneity could be a problem. Future work will address these issues.

Sectors	Mining and quarrying (1)	Construction (2)	Manufacturing (3)	Transport storage and communication (4)	Wholesale and retail trade (5)	Real estate, renting and business services (6)	Hotels and restaurants (7)	Other services (8)	TOTAL
2002									
R&D intensity *(rdint)*	37	308	745	161	440	232	74	92	2089
Upgraded products, services *(upgprod)*	40	385	1155	266	775	312	191	208	3332
New products, services *(newprod)*	29	240	947	169	631	194	125	140	2475
New technology *(newtech)*	24	248	720	150	333	174	100	134	1883
New plant *(newpl)*	15	86	290	64	289	63	47	44	898
New joint-venture with foreign partner *(newjv)*	9	66	204	52	144	50	13	22	560
New licensing agreement *(newla)*	18	195	253	132	360	129	48	55	1190
Outsourced activity *(outsource)*	11	100	161	58	122	51	12	18	533
Brought-in production *(brought)*	10	88	189	39	124	35	19	22	526
New quality accreditation *(newqual)*	21	139	387	52	176	73	28	21	897
Total # of firms in the sector	78	808	1685	524	2027	675	457	413	6667
2005									
R&D intensity *(rdint)*	20	75	510	39	70	60	19	27	820
Upgraded products, services *(upgprod)*	53	440	2227	301	939	392	243	254	4849
New products, services *(newprod)*	34	275	1653	194	655	260	147	150	3368
New joint-venture with foreign partner *(newjv)*	10	31	185	37	85	34	6	16	404
New licensing agreement *(newla)*	17	166	504	105	272	93	43	47	1247
Outsourced activity *(outsource)*	8	98	362	67	113	60	20	25	753
Brought-in production *(brought)*	6	101	343	39	138	38	23	20	708
New quality accreditation *(newqual)*	17	148	641	69	191	77	38	22	1203
Total # of firms in the sector	95	929	3762	629	2389	833	532	486	9655

Appendix

Table 1: Innovation variables[a] Table 2: Corruption variables

Sectors	Mining and quarrying (1)	Construction (2)	Manufacturing (3)	Transport storage and communication (4)	Wholesale and retail trade (5)	Real estate, renting and business services (6)	Hotels and restaurants (7)	Other services (8)	TOTAL
2002									
pbribe>0	29	400	701	203	915	256	202	154	2860
govbribe>0	16	286	389	105	500	143	71	64	1574
tspent>0	54	549	1098	353	1248	474	255	264	4295
dbribe=1	28	218	467	170	525	244	170	168	1990
dbribe=6	2	44	78	24	110	19	18	15	310
predict=1	29	223	484	180	577	239	171	175	2078
predict=6	2	46	68	26	98	34	21	20	315
honest=1	16	142	274	86	435	122	90	78	1243
honest=6	10	57	135	42	113	51	60	30	498
2005									
pbribe>0	32	380	1104	211	743	250	142	127	2989
govbribe>0	19	320	705	126	471	161	79	61	1942
tspent>0	55	506	1852	354	1101	434	254	258	4814
dbribe=1	32	254	1367	247	888	345	224	204	3561
dbribe=6	5	52	111	28	88	37	17	18	356
predict=1	29	258	1382	233	910	350	233	211	3606
predict=6	8	62	125	33	83	45	17	10	383
honest=1	16	179	678	111	426	140	106	72	1728
honest=6	2	63	316	68	210	93	64	40	856

Table 3: Pairwise correlations between innovation and corruption measures[a]

	rdint	upgprod	dynind	pbribe	govbribe
	2002				
rdint	1				
upgprod	0.0390	1			
	(0.0523)				
dynind	0.0470	0.6537*	1		
	(0.0198)	(0.0000)			
pbribe	0.0788*	0.0458*	0.0521*	1	
	(0.0002)	(0.0003)	(0.0000)		
govbribe	0.0652	0.0233	0.0459	0.3453	1
	(0.0022)	(0.0785)	(0.0005)	(0.0000)	
	2005				
rdint	1				
upgprod	0.0890*	1			
	(0.0000)				
dynind	0.1440*	0.6900*	1		
	(0.0000)	(0.0000)			
pbribe	0.0164	0.0362*	0.0472	1	
	(0.2529)	(0.0009)	(0.0000)		
govbribe	0.0146	0.0050	0.0468*	0.3946*	1
	(0.3233)	(0.6544)	(0.0000)	(0.0000)	

Notes: [a] Standard errors are in parentheses. * indicates 1% significance.

Table 4: Results[a] (BEEPS 2002)

Estimation	TOBIT				LOGIT				OLOGIT			
Dep. var.	rdint				upgprod				dynind			
corruption	pbribe	mfx[b]	govbribe	mfx	pbribe	mfx	govbribe	mfx	pbribe	mfx	govbribe	mfx
	0.2403***	0.1168***	0.1628***	0.0792***	0.0214**	0.0053**	0.0073	0.0018	0.0245***	-0.0049***	0.0135**	-0.0026**
	(0.0663)	(0.0322)	(0.0428)	(0.0208)	(0.0096)	(0.0024)	(0.0065)	(0.0016)	(0.0081)	(0.0016)	(0.0056)	(0.0011)
un1995	-0.0002**	-0.0001**	-0.0002**	-0.0001**	-0.0001***	-0.0000***	-0.0000***	-0.0000***	-0.0001***	0.0000***	-0.0001***	0.0000***
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
sectorsh02	0.0689***	0.0335***	0.0724***	0.0352***	0.0085**	0.0021**	0.0077**	0.0019**	0.0017	-0.0003	0.0010	-0.0002
	(0.0248)	(0.0121)	(0.0248)	(0.0121)	(0.0035)	(0.0009)	(0.0036)	(0.0009)	(0.0031)	(0.0006)	(0.0031)	(0.0006)
labor	0.0001	0.0001	0.0001	0.0000	0.0003***	0.0001***	0.0004***	0.0001***	0.0004***	-0.0001***	0.0005***	-0.0001***
	(0.0004)	(0.0002)	(0.0004)	(0.0002)	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
export	1.2487***	0.6135***	1.1181**	0.5492**	0.9259***	0.2241***	0.8580***	0.2069***	1.1113***	-0.1950***	1.0382***	-0.1745***
	(0.4460)	(0.2215)	(0.4513)	(0.2239)	(0.0697)	(0.0159)	(0.0727)	(0.0165)	(0.0605)	(0.0093)	(0.0626)	(0.0093)
state	0.3493	0.1710	0.3653	0.1791	-0.1297	-0.0324	-0.1062	-0.0265	-0.1912**	0.0394**	-0.1249	0.0244
	(0.5845)	(0.2883)	(0.5995)	(0.2963)	(0.0892)	(0.0223)	(0.0936)	(0.0234)	(0.0777)	(0.0165)	(0.0807)	(0.0161)
dpower	-0.0192***	-0.0093***	-0.0196***	-0.0095***	-0.0009	-0.0002	-0.0009	-0.0002	-0.0013	0.0003	-0.0016*	0.0003*
	(0.0068)	(0.0033)	(0.0067)	(0.0033)	(0.0009)	(0.0002)	(0.0009)	(0.0002)	(0.0008)	(0.0002)	(0.0008)	(0.0002)
honest	-0.0531	-0.0258	-0.0817	-0.0397	-0.0247	-0.0062	-0.0136	-0.0034	-0.0094	0.0019	-0.0050	0.0009
	(0.1472)	(0.0716)	(0.1489)	(0.0724)	(0.0198)	(0.0049)	(0.0207)	(0.0052)	(0.0174)	(0.0035)	(0.0182)	(0.0035)
predict	0.0376	0.0183	0.1132	0.0551	0.0522***	0.0131***	0.0586***	0.0146***	0.0855***	-0.0171***	0.0900***	-0.0172***
	(0.1417)	(0.0689)	(0.1392)	(0.0677)	(0.0194)	(0.0049)	(0.0196)	(0.0049)	(0.0169)	(0.0034)	(0.0171)	(0.0033)
Obs	1,865		1,774		4,931		4,595		4,896		4,563	
Panel B: EU												
corruption	0.3125*	0.1379*	0.1335*	0.0593*	0.0156	0.0039	0.0135	0.0034	-0.0230	0.0046	0.0024	-0.0005
	(0.1744)	(0.0770)	(0.0801)	(0.0356)	(0.0240)	(0.0060)	(0.0125)	(0.0031)	(0.0213)	(0.0042)	(0.0100)	(0.0020)
Panel C: non-EU												
corruption	0.2246***	0.1136***	0.1839***	0.0931***	0.0225**	0.0056**	0.0033	0.0008	0.0310***	-0.0062***	0.0180***	-0.0034***
	(0.0721)	(0.0365)	(0.0506)	(0.0256)	(0.0106)	(0.0026)	(0.0077)	(0.0019)	(0.0088)	(0.0018)	(0.0067)	(0.0013)

Notes: [a] Standard errors are in parentheses. *** indicates 1% significance. ** indicates 5% significance. * indicates 10% significance.

[b] Mfx stands for marginal effects.

Table 5: Results[a] (BEEPS 2005)

Estimation	TOBIT				LOGIT				OLOGIT			
Dep. var.	rdint				upgprod				dynind			
corruption	pbribe	mfx[b]	govbribe	mfx	pbribe	mfx	govbribe	mfx	pbribe	mfx	govbribe	mfx
	0.0010	0.0002	0.0006	0.0001	0.0256**	0.0064**	-0.0029	-0.0007	0.0213**	-0.0048**	0.0099	-0.0022
	(0.0008)	(0.0002)	(0.0005)	(0.0001)	(0.0107)	(0.0027)	(0.0072)	(0.0018)	(0.0093)	(0.0021)	(0.0062)	(0.0014)
un1995	0.0000*	0.0000*	0.0000	0.0000	-0.0001***	-0.0000***	-0.0001***	-0.0000***	-0.0001***	0.0000***	-0.0001***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
sectorsh02	0.0004*	0.0001*	0.0005*	0.0001*	0.0195***	0.0049***	0.0185***	0.0046***	0.0036	-0.0008	0.0041	-0.0009
	(0.0003)	(0.0000)	(0.0002)	(0.0000)	(0.0034)	(0.0009)	(0.0035)	(0.0009)	(0.0030)	(0.0007)	(0.0031)	(0.0007)
labor	0.0000***	0.0000***	0.0000***	0.0000***	0.0005***	0.0001***	0.0006***	0.0002***	0.0005***	-0.0001***	0.0006***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0000)
export	0.0434***	0.0090***	0.0402***	0.0083***	0.6804***	0.1665***	0.6650***	0.1621***	0.9789***	-0.1977***	0.9753***	-0.1924***
	(0.0043)	(0.0010)	(0.0043)	(0.0010)	(0.0640)	(0.0151)	(0.0668)	(0.0156)	(0.0559)	(0.0100)	(0.0579)	(0.0101)
state	0.0090	0.0017	0.0087	0.0017	-0.4252***	-0.1054***	-0.4937***	-0.1223***	-0.2745***	0.0637***	-0.3599***	0.0829***
	(0.0065)	(0.0013)	(0.0065)	(0.0013)	(0.0941)	(0.0229)	(0.0979)	(0.0237)	(0.0836)	(0.0199)	(0.0866)	(0.0207)
dpower	-0.0001**	-0.0000**	-0.0001**	-0.0000**	-0.0021***	-0.0005***	-0.0025***	-0.0006***	-0.0016***	0.0004***	-0.0022***	0.0005***
	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0006)	(0.0002)	(0.0006)	(0.0002)	(0.0005)	(0.0001)	(0.0006)	(0.0001)
honest	0.0015	0.0003	0.0011	0.0002	0.0243	0.0061	0.0237	0.0059	0.0332**	-0.0075**	0.0317**	-0.0070**
	(0.0012)	(0.0002)	(0.0013)	(0.0002)	(0.0169)	(0.0042)	(0.0177)	(0.0044)	(0.0151)	(0.0034)	(0.0157)	(0.0035)
predict	0.0012	0.0002	0.0007	0.0001	0.0560***	0.0140***	0.0561***	0.0140***	0.0955***	-0.0215***	0.0855***	-0.0189***
	(0.0013)	(0.0002)	(0.0013)	(0.0002)	(0.0171)	(0.0043)	(0.0176)	(0.0044)	(0.0151)	(0.0034)	(0.0156)	(0.0034)
Obs	3,725		3,490		6,405		5,945		6,405		5,945	
Panel B: EU												
corruption	-0.0019	-0.0004	-0.0011	-0.0002	0.0221	0.0055	0.0049	0.0012	0.0234	-0.0055	0.0083	-0.0019
	(0.0016)	(0.0003)	(0.0009)	(0.0002)	(0.0271)	(0.0068)	(0.0172)	(0.0043)	(0.0231)	(0.0054)	(0.0152)	(0.0035)
Panel C: non-EU												
corruption	0.0015	0.0003	0.0011*	0.0002*	0.0283**	0.0071**	-0.0068	-0.0017	0.0216**	-0.0048**	0.0078	-0.0017
	(0.0010)	(0.0002)	(0.0006)	(0.0001)	(0.0117)	(0.0029)	(0.0080)	(0.0020)	(0.0101)	(0.0022)	(0.0069)	(0.0015)

Notes: [a] Standard errors are in parentheses. *** indicates 1% significance. ** indicates 5% significance. * indicates 10% significance.

[b] Mfx stands for marginal effects.

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