Corruption, institutional quality and innovation: firms' heterogeneous reactions in emerging countries.

Roberto Iorio[1] and Maria Luigia Segnana[2]

August, 2020

FIRST DRAFT (incomplete)

Not to be quoted

Abstract

Corruption research in economics has a long history and seminal early articles. On the one side recent comparison of empirical results on causes and consequences of corruption show contrasting recent with older findings and newer development which have not been measured empirically yet. On the other side, there is a general consensus on the negative effect of corruption on a country but its implications for firms' strategies are still insufficiently understood. In particular the link between corruption and innovating activities suffers of the "grease and sand" multiple results, at both country and firm level.

This paper examines the corruption-innovation link in emerging countries. In these markets corruption remains an ubiquitous feature of doing business, frequently reported in press, and surely Central Asia and Eastern Europe exhibit substantial heterogeneity in bribing practices, institutional quality and innovative potential.

The paper shows that, when the selection effect is considered, different firms' strategies arise. In particular, the treatment effect of corruption on innovation is positive for corrupt firms and negative for non corrupt firms. Corrupt firms appear rational because paying bribes increases their innovation activities. Even non-corrupt firms appear rational because in presence of bribes their innovating activities would be lower. Corrupt firms pay bribes because they are capable to exploit the advantages of corruption on innovation. Non-corrupt firms do not pay bribes because there is no effect of corruption on innovation activities. In the first case, corruption greases the wheels of innovation, in the second case it sands the wheels of innovation. Only when the selection effect is adequately considered, they may actually coexist, depending on the level of the analysis and whether or not selection processes play a role. Building on this result, future research can reexamine the well established economic outcomes such as the productivity or the economic performance impact of corruption, in presence (absence) of selection processes. The role of training, market competition and, in general, the role of institutional quality is also adequately considered.

Kewords: corruption, bribery, emerging markets, innovation, endogeneous switching

[1] Department of Political and Social Studies, University of Salerno

[2] Department of Economics and Management, University of Trento

1. Introduction

The World Economic Forum estimates that the cost of corruption is at least $2.6 trillion — or 5 per cent of global gross domestic product. According to the World Bank, businesses and individuals pay more than $1 trillion in bribes each year. Corruption is often self-sustaining and fosters a corrosive culture of impunity. According to Transparency International , 69 per cent of the countries today are facing "a serious corruption problem".

The causes and effects of corruption have been a topic of debate for last 50 years. Defined as the abuse of entrusted power for private gain, it includes various actions associated to grand (political) and petty (administrative) corruption, to organized and disorganized corruption. Among these actions, bribery remains the most common in practice, usually in the form of small cash payments to public officials to influence or speed up their actions. Anyway, no definition of corruption is completely clear-cut because "corruption is an outcome - a reflection of a country's legal, economic, cultural and political institutions" (Svenssson, 2005). However, corruption, or in some cases bribery (as in Krammer, 2019) is not the same as rent-seeking, although the terms are often interchanged.
We shall mostly confine ourselves to the application of corruption term, used here as synonimous of bribery, one of the most common manifestation of corruption, usually in the form of small cash payments to influence favourably or speed-up the action of public[3].

There is a general consensus on the negative effects of corruption on a country but its implications for firms and firms' strategies are still insufficiently understood (Cuervo-Cazurra. 2016) especially for the innovating activities. More precisely, although the connection between innovation and corruption has been ubiquitous, scholars have yet to establish an exact nature of this relationship: some researchers have found that corruption can boost the innovation via removing the rigid obstacles to investment and foster innovation which eventually greases economic growth. Conversely, others demonstrated that corruption could deter innovation levels and the adverse relationship between corruption and innovation can slow down economic growth.

In emerging markets corruption remains a ubiquitous feature of doing business, frequently reported in press. Examples are multinationals like Siemens, Samsung, major pharmaceutical companies, Wal-Mart and others. Firm-level analysis shows that bribes have national as well transnational characteristics in emerging markets. Cross-border corruption can affect FDI, shift the ownership structure and use strategically the local partners (Javorcik and Shang-Jing Wei, 2009). At the same time, innovating firms in emerging countries face significant corruption pressure: innovators pay more bribes and are often the target of

[3] For the many features of corruption see Bardhan (1997) and for alternative classification of corruption in the business perspective see Cuervo-Cazurra, 2016

rent-seekig activity (Ayyagari et al. 2014). Emerging markets appear as the appropriate environment to study firms' responses to corruption (Cuervo-Cazurra, 2016).

This paper uses an endogenous switching technique which allows us to utilize micro-survey data to construct counterfactual scenarios of the corruption-innovation relationship in firms of emerging countries.
This study contributes to the literature in the following way.
First, it expands the body of work on the causes of corruption and the strategies of firms' adaptation to corrupt environment. Second, it widens the results on the effects of corruption, by suggesting that it can affect differently firms in the emerging markets, augmenting recent evidence on the strategic use of corruption (Iriyama et al. 2016) for innovation purpose. Third, this study speaks to heterogeneous effects, in our case mainly due to the country-effect. On this basis it applies a method for taking this heterogeneity effect into consideration when the firms' innovation responses are estimated. Finally, this work advances our understanding for better manageable anti-corruption policies.

2. Related literature on innovation and corruption

Corruption research in economics has a long history and seminal early articles include Rose-Ackerman (1975) and Shleifer and Vishny (1993). A number of influential and frequently cited surveys on the economic analysis of corruption as well as handbooks (Rose-Ackerman, 2011) have appeared in this field that surely provide details on the subjects. But empirical studies on the economic impact of corruption show very mixed results. Recently Dimant and Tosato (2018) have compared empirical work on causes and consequences of corruption, contrasting recent with older findings and surveying newer developments which have not previously been measured empirically. The results of their exercise is to show that the empirical results of older and more recent studies contradict each other, a contradiction attributed to a number of factors, such as different econometric approaches or more extensive data sets.

One branch of the literature depict corruption as "sand" the wheels of growth and development through additional costs. In contrast, an opposite view argues for positive effects ("grease-the wheels") of corruption, especially in weak institutional setting where the costs of preventing, outweigh the expected benefits (Acemoglu and Verdier, 2000).

On the corruption side, there is vast, yet inconclusive, empirical literature exploring the links between corruption and economic growth, measured by a whole range of indicators like (GDP, total factor productivity growth, investment rates). However, there is an increasing consensus on the negative country-level implications of corruption. For instance, the empirical evidence on corruption growth and input misallocation dynamics for Central and Eastern European countries shows that the link between changes in corruption and input misallocation is positive and conditional on the geographical, institutional and political setting, as it is larger the smaller the country, the lower the degree of political stability and of civil liberties, and the weaker the quality of its regulations.

On the innovation side, there is vast theoretical and empirical consensus about the major benefits of innovation for economic growth. But, as in the case of corruption and growth, even the link between corruption and innovation, although under researched, have engendered the two contrasting hypotheses: the 'sand-the-wheels' and 'grease-the-wheels' hypotheses. The former contends that corruption is detrimental to innovation whereas the latter argues that it is favourable to innovation. The available evidence concerning the effect of corruption on firms' innovation activities has yet to reach a consensus.

Despite the increasing consensus on the negative country-level implications of corruption, its consequences for firms are less understood. Prior research has offered several explanations on why firms engage in bribing, but recent scholarly attention has been devoted at examining the consequences for firm strategies, as it is very unlikely that firms are uniformly affected by this phenomenon. Hence, firms' responses to corrupt practices differ significantly across countries, contingent on the existing institutional configuration. The same is likely to be applied to firm's innovation responses to corruption.

2.1 State-of-the-art. Overview of existing literature on corruption and innovation

Although there is a vast literature on corruption's effects on firms' performance[4] and investment decisions, the relationship between corruption and firm-level innovation has only recently received attention with many comparative or single-country studies. Scholars seem to agree that corruption affects the degree of innovation employed by firms, but no consensus has been reached on whether the effect should be considered negative or positive.

One of the common results across the literature is that it is very unlikely that firms are uniformly affected by corruption so that heterogeneous effects are on stage. And this seems to apply to innovation well.

This result has a theoretical root in Murphy, Shleifer and Vishny (1993). They suggested several reasons why countries with easy corruption, poor laws, weak legal system can suffer economically. First, rent-seeking activities are naturally subject to increasing returns with self-sustaining high level and multiple equilibria, bad and good, at least; second, public rent seeking afflict innovators the most and hence reduce the rate of economic growth. Innovators are more vulnerable to public corruption that established firms, victims rather than perpetrators.

Heterogeneous effects are also associated to the empirical comparison between static and dynamic effects. The case of Italian firms competition strategies,

[4] Fisman and Svensson (2007) find that an increase of one percentage point of the bribery rate decreases firm growth by three percentage points

examined in presence of political connections, can be taken as an important example. Since the seminal paper by Faccio (2006) a substantial literature has developed on the value of political connections wondering on whether firms that have politicians or their relatives on the board or as owners perform differently. But establishing the relevant political connections is far from straightforward. Akcigit U., S. Baslandze and F. Lotti (2020) found that firm-level political connections are widespread in Italy, especially among large firms. Matching multiple administrative datasets, the results indicate that static advantages of political connections might be associated with dynamic losses and worse industrial dynamics because resources are reallocated towards connected firms characterized by low incentives to innovate and increase productivity. In this case, static benefits (overcoming regulatory or bureaucratic burden) are evaluated with the likely dynamic losses in terms of innovation and growth. If factor reallocation from low productivity incumbents to high productivity entrants is an important source of economic growth, these results suggest that in the Italian case, political connections are an important impediment to factor reallocation and productivity growth.

2.2 Corruption and innovation in emerging countries

Shifting our attention to the specific effect of corruption in emerging markets at the firm-level, even in this case the starting point is the link between corruption and firms' performances with greasing, sanding and ambiguous effect on firm performances. An example is the case of East Asian paradox, a greasing puzzle with high levels of corruption but very fast economic growth, a puzzle treated at the micro-level for Chinese firms (Wang and You, 2012), with empirical evidence that corruption enhances the growth of firm income as well as innovating activities by Chinese firms. A similar evidence supports even the Turkish case. Another example is the two-way effect of bureaucratic corruption on firm performance in Central and Eastern Europe (Hanousek and Kochanova 2015) explained by divergent effects of the mean and dispersion of corruption.
But, even when the corruption-innovation link is better focused, results can again be read with the lenses of the "sanding" and "greasing", in this case positive and negative effects of corruption on innovation practices.

Negative effect. Shleifer and Vishny (1993) was one of the first papers to suggest that government corruption discourages innovation since high demand of secrecy prevents entry of foreign firms. 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. Even for African countries Mahagaonkar (2008) found a detrimental impact of corruption on product and organisational innovation. 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. Finally, Maryam(2020) 176 countries over a period of 18 years (2000-2017).

Positive effect. However, some of the studies find evidence for the positive ("greasing") effect of corruption on innovation. Krammer (2013) provides evidence of positive effects of petty corruption on developing new products in transition economies. . Smith et al. (2014) empirically examined the micro-level using multi-national firms, institutions and innovation in Russia, they found that in environments with high political risk — in corrupt environments — corruption may act as a hedge against such risk, boosting the scope and scale of innovation. 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. They find that corruption reduces the negative effect of red tape on product innovation.

Matching country-level and firm-level results we can conclude observing contrasting findings, the persistence of the mixed sand and grease results together with the heterogeneous impact of corruption on innovation. We can also add different methods applied to survey and longitudinal data.

Comparatively we can observe:

- Institutional environment matters. Countries with weak institutions in their efforts to control corruption enhance the ability of bribes to function as an efficient grease, where bribes act as a tax on firms' innovative activities. In contrast, strong regulatory control of corruption will significantly reduce the ability of bribes to facilitate the introduction of innovation, thus reducing the payoffs for bureaucrats to collude and diminishing the ability of bribery to get the desired outcome. This will be empirically tested by showing that the country effect is dominant in emerging markets.

- There is a heterogeneous effect of corruption and political connections on different firms, e.g. on innovators versus non innovators. This differentiation mirror into a selection effect across countries and between firms that adapt to corruption and firms that do not adapt. An effect that might be explained on one side by the country effect and on the other side by specific firms' characteristics.

- The selection effect acts differently on the propension to innovate.

Bringing these conclusions to data implies that we can proceed with the following empirical testing:

- H1. Corruption has a positive effect (greasing the wheels) on firms' innovative activities in emerging markets.
- H2. There is a selection effect between corrupt and uncorrupt firms. This selection effect is mainly due to country' characteristics and firm's characteristics.
- H3. In presence of selection, the treatment effect of corruption has a different impact on innovation

These hypothese are tested using data from more than 17,000 firms in 36 emerging markets in Central and Eastern Europe that show substantial heterogeneity in terms of corruption practices, institutional quality and innovative potentials.

3. Data source and descriptive statistics

We employ firm-level data on innovation and corruption from the Business Environment and Performance Survey (BEEPS), a joint initiative of the European bank for Reconstruction and Development and the World Bank group which covers 36 emerging markets, including more advanced Central and Eastern European countries, transition economies from the Balkans and Central Asia plus Turkey. The final sample utilized consists of 17133 firms. Descriptive statistics and an overview of the variables are provided are reported in the Appendix.

3.1 Variables, descriptive and multivariate statistics

CORRUPTION and BRIBES: in the empirical analysis we use a variable for bribes in relation to the percentage of total annual sales paid as informal payment "to get things done" and a binary variable for corruption indicating whether or not the firm paid an informal payment "to get things done".
The variables are drawn from the answers to J7 question of the BEEPS questionnaire: "It is said that establishments are sometimes required to make gifts or informal payments to public officials to "get things done" with regard to customs, taxes, licenses, regulations, services etc. On average, what percentage of total annual sales, or estimated total annual value, do establishments like this one pay in informal payments or gifts to public officials for this purpose?". The binary variable *corruption* indicates if a firm paid or not informal payment; the variable *bribes* indicates the payment amount as a percentage of total sales.[5]

[5] The respondents could indicate the amount paid in "informal payment" as a percentage of total annual sales or as an absolute amount. 13678 firms choose the first kind of answer, 836 the second one. In our empirical analysis. In this first stage of the paper, we considered only the first group of firms; the second group has been counted as missing about corruption (we have anyway to underline that such exclusion did not mean to exclude only corrupted firms; in fact for both questions there are firms who declared to have paid no informal payment; therefore, among the 836 excluded firms, we have both firms paying bribes and firms not paying bribes).

INNOVATION: in order to account for innovative activities, we use different empirical specifications: if a firm introduced a product innovation in last three years (*innoprod*); the percentage of annual sales accounted for by new or significantly improved products (*innosales*).
The definitions of other variables are reported in table A1 in Appendix

Some obervations can be summarized on the basis of what is reported in Tables A2, A3 and A4 in Appendix.

- More than a quarter of the firms introduced at least one product innovation
- The percentage of annual sales accounted for by innovating activity is on average 6.8%, a percentage that increases to 31% when only innovative firms are considered.
- the difference between the innovative sales at the country and firm level is on average -0.06 because of the overwhelming presence of non innovative firms. But the mean for all firms is almost +24 for innovators and -6.5 for noninnovators.
- Overall, informal payments touch 10.2% of the firms but the incidence on total sales is very low, only 0.66% of total sales. But corrupt firms pay a significantly higher percentage: 6.4% of their annual sales are devoted to "get the things done" with an incidence ten times higher.
- Correlations (Tab A. 3) between innovation and corruption is positive and significant for most variables.

In the bivariate tables A4 and A5 we first examine whether innovating firms pay more bribes that non innovators. In particular, 15% of innovators pay bribes versus 8.7% of non innovators. Second, we look at subsample of firms that pay bribes. Even in this case innovators pay more. Third, considering all firms, innovators pay a higher percentage of their sales as bribes.
The results show that innovating firms are disproportionately affected by corruption confirming that bribe payments are a tax on innovation (Ayyagari et al., 2014) and innovators are more vulnerable to corruption (Murphy et al, 1993) However we know little from existing literature about whether innovators pay more bribes because this facilitates the introduction of significant improvement (innovating activities) avoiding or overcoming bureaucratic obstacles.

The link between corruption and innovation needs to be better investigated through a multivariate analysis. As dependent variables we considered both *corruption* and *innosales.* The first one is a binary variable, therefore a probit is the suited analysis; the second one is a percentage, with a large amount of zero values, therefore it may be considered a truncated variable and a Tobit is a suited analysis; we also reported the results on an OLS estimation.
As "corruption" variables we used *corruption, bribes* and *bribes_yes*: the last one is equal to *bribes* but has values only for firms that did actually paid a bribe, therefore the analysis is limited to these firms.

The link between innovation and corruption identified by the basic statistics include both country and firm characteristics, comprehensive of a between country and a within country effect. In order to isolate the importance of the country effect in our comparative perspective we estimate the link by introducing country dummies in the regression analysis. Such variables explain an high percentage of the variability of the dependent variable, confirming the presence of a strong "between country" effect.

The results, reported in Table 1, show that corruption and bribes are positive and significant in all cases, showing an interesting "within country" connection. Only the variable *bribes-yes* is non significant, indicating that what is important for innovation is whether or not bribing activities has entered into play rather than its amount.
Significant and positive variables are R&D, the foreign technology licences (*fortech*) and the training programmes (train). Significant and negative is the degree of competition (*ncomp*). The size of the firm does not show a coherent result, probably reflecting an ambiguity: on the one side we are in presence of a the positive connection between size and innovating activities; on the other side, when you consider only innovative firms, *size* and *innosales* are negatively linked. This ambiguity together with the correlation with other covariates make this variable insignificant (Tobit) or when significant, with a different impact (probit and OLS). We also introduced sectoral dummies, that also contributes to explain the variability of the dependent variables.

The results indicates that the positive corruption impact on innovative activities within country, together with the tradition indicators of the propension to innovate (like R&D training and foreign licences). On the contrary, competition affects negatively innovation as more competition decrease in all cases the innovative sales.

Table 1. Corruption and innovation.

	Dependent variable (model)								
Covariates	**Innoprod (probit)(1)**			**Innosales (Tobit)(2)**			**Innosales (OLS)(3)**		
corruption	0.27**			13.11**			2.27°		
bribes		0.01**			0.63**			0.13	
bribes_yes			0.01			0.20			0.02
R&D	0.99**	0.90**	0.69**	43.74**	44.09**	25.52**	12.09**	12.15**	10.49**
Fortech	0.35**	0.35**	0.31**	17.51**	17.65**	10.51*	4.16**	4.19**	2.72
train	0.32**	0.32	0.41**	15.55**	15.67**	13.08**	2.68**	2.69**	1.68
ncomp	-.012**	-0.12**	-0.08	-8.38**	-8.13**	-4.98	-1.59**	-1.54**	-0.29
size	0.04**	0.04**	0.11**	0.46	0.44	2.97*	-0.28	-.281	.618
Country dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	13346	13346	1360	12756	12756	1306	12756	12756	1306
Pseudo R^2	0.1678	0.1660	0.1632	0.0531	0.0524	0.0547	0.1060	0.1053	0.1207

4. Estimation strategy

The decision to corrupt and its implications in terms of innovations can be modeled in the setting of a two-stage framework. In the first stage (Selection equation), we use a selection model for corruption where a firm chooses to implement corruption adaptation strategies if they generate net benefits. In the second stage (Outcome equation), we model the effect of adaptation to corruption on innovation via a representation of the effects of corruption on innovation. This choice is motivated by the presence of simultaneity bias and heterogeneous effects in the corruption-innovation link.

The simplest approach to examine the impact of corruption on innovation would be to include in the innovation equation a dummy variable and then, to apply ordinary least squares (OLS). This approach, however, might yield biased estimates because it assumes that adaptation to corruption is exogenously determined while it is potentially endogenous. The decision to adapt or not to corruption is voluntary and may be based on individual self-selection. Firms that corrupt may have systematically different characteristics from the firms that did not adapt, and they may have decided to adapt based on expected benefits. Unobservable characteristics of firms may affect both the decision to corrupt and innovation, resulting in inconsistent estimates of the effect of corruption on innovation. The self-selection or endogeneity problem arises here as outcome's predictors are themselves associated with other unobserved or observed variables, a very common problem in cross-sectional data. The IV method is a widely approach to address endogeneity and has been used by many authors that have studied the corruption-innovation link. Matching techniques have also been used for detecting substantial self-selection bias, examining proper treatment effects. In both cases (matching and IV) a drawback has been identified in presence of heterogeneity (Blundell and Costa Dias, 2002). For instance, in "heterogeneous" treatment effect models, in which the impact parameter can differ in unobservable ways across individuals, the IV estimator will not generally identify the average treatment effect unless in presence of very strong assumptions and ones that are unlikely to hold in practice[6].
In our case, the key concerns look at the endogeneity between corruption and innovation as well as at heterogeneous behavior between corrupted and non corrupted firms. Even the possible occurrence of heterogeneity has become a major topic in evaluation research in recent years and in our case it appears crucial.

[6] A survey of microeconometric estimation of treatment effects with special attention to heterogeneity is in Caliendo and Hujer(2005).

The ESM model is an application of the control function method[7] that directly analyses the choice problem facing firms deciding to adapt to corruption participation.
The control function approach specifies the joint distribution of the assignment rule and treatment. It uses the specification of the assignment rule together with an excluded "instrument" to derive a control function which, when included in the outcome equation, fully controls for endogenous selection. This approach relates directly to the selectivity estimator of Heckman (1979). In contrast to the Heckman model, in the switching regression approach, firms are partitioned according to their adaptation to corruption in order to capture the differential responses of the two groups. This is the way for an adequate treatment of heterogeneity.

The ESM offers an alternative estimation choice which not only accounts for endogeneity but also controls for possible heterogeneity effects and is therefore chosen for the corruption-innovation case.
We account for the endogeneity of the corruption by estimating a simultaneous equations model of corruption and innovation with endogenous switching by full information maximum likelihood (FIML). An alternative estimation method is the two-step procedure. However, this method is recognized as less efficient than FIML, as it requires some adjustments to derive consistent standard errors[8].

The determinants of corruption and the impact of corruption on innovation are estimated in a selection and an outcome equation jointly. In fact, the firms that innovate typically present a different level of bribes with respect to those firms that do not innovate. An endogenous switching regression model is advocated as a better way of modeling the joint determination of firm's innovation and bribes. The endogeneity of switching from corruption to non-corruption comes from the fact that the decision to corrupt and the innovation decision are not independent.
The firm's perception of the environment in terms of competition and operating environment are the key variables in explaining firms' propensity to self-select into two regimes: the corrupted and the non corrupted regime. However, the importance of these factors differs across firm types. The relationship between the variable of interest (i.e.innovation) and a set of explanatory variables may vary across the two discrete regimes (i.e., corrupted and non-corrupted firms). More specifically, in the first stage, a self-selection equation is estimated and in the second stage, the outcome equation conditional on the treatment (i.e. corruption decision) is modeled.

This two-stage switching regression model hence has the advantage of estimating separate regression equations for corrupted and non-corrupted as well as determining the counterfactuals, based on returns to characteristics of innovators and non-innovators. This means that even if the average values of these characteristics may be the same, they may have different impacts on outcome and selection choice in terms of coefficient estimates.

---

[7] Murtazashvili I. and J. M. Wooldridge (2016) .
[8] Details in Maddala(1983) pp 224 -225.

The ESM takes the following form:

(1) $CORRi = \alpha Z_i + \eta_i$, with

$$CORR_i = \begin{cases} 1, if & CORR_i > 0 \\ 0, & otherwise \end{cases}$$

where (1) represents the selection equation, Z_i the determinants of the latent variable *CORRi* at the firm level for the decision to adapt to corruption. This allows to control and explain selection into alternative regimes Y_{1i} and Y_{2i}, observing two different outcomes with different coefficients across the different regimes: regime 1 for corrupted firms and regimes 2 for non corrupted firms:

(2a) Regime 1 $Y_{1i} = \beta_1 X_{1i} + \varepsilon_{1i}$ if $CORR_i = 1$
(2b) Regime 2: $Y_{2i} = \beta_3 X_{2i} + \varepsilon_{2i}$ if $CORR_i = 0$

Where *Y*i is the innovation variable in regimes 1 and 2, and *X*i represents variables affecting innovation choices.

In this case, an important implication of the error structure is that because the error term of the selection equation (1) is correlated with the error terms of the outcome function (2a) and (2b), the expected value of the error term (2a and 2b) conditional on the sample selection are nonzero. If the estimated covariances are statistically significant, then the decision to adapt to corruption corrupted and the decison to innovate are correlated. This indicates evidence of endogenous switching and the null hypothesis of the absence of sample selectivity bias is not accepted.

This approach to survey data can be used to compare the expected outcome of the corrupted firms (a) with respect to the firms that did not (b), and to investigate the expected innovation results in the counterfactual hypothetical cases (c) that the corrupted firms did not corrupt and (d) that the noncorrupted firms corrupt[9].

After running the ESM, we can calculate the conditional expectation outcomes of innovator's performance if the firms practice corruption or do not practice it by looking at the conditional expectations reported in the following table 2.

The treatment effect (corruption) on the treated (corrupted firms) is the difference TT between (a) and (c). It shows the effect of corruption adaptation on the outcome (innovation) of the firms that adapted to corruption. The treatment effect (corruption) on the untreated (non-corrupted firms) is the difference TU between (b) and (d). It shows the effect the adaptation to

[9] (a) is the expected outcome in the Regime 1 (the "corruption regime") calculated for firms that actually corrupted; (b) is the expected outcome in the Regime 2 (the "non-corruption regime) calculated for firms that actually did not corrupt; (c) is the expected outcome in the Regime 2 (the "non-corruption regime") calculated for firms that actually corrupted; (d) is the expected outcome in the Regime 1 (the "corruption regime") calculated for firms that actually corrupted.

corruption would have on the outcome (innovation) of the firms that do not adapt to corruption.

Table 2. Counterfactual cases

	Decision stage		Treatment effects
Subsamples	**Corruption**	**No corruption**	
Firms that adapted to corruption	(a) E (Y_{1i} | $CORR_i$ = 1)	(c) E (Y_{2i} | $CORR_i$ = 1)	**TT**
Firms that did not adapt to corruption	(d) E (Y_{1i} | $CORR_i$ = 0)	(b) E (Y_{2i} | $CORR_i$ = 0)	**TU**
Heterogeneity effect	BH1	BH2	TH=TT-TU

Cases (a) and (b) along the diagonal represent the actual expectations in the sample; (c) and (d) represent the counterfactual expected outcome.

Where:

(a) $E\ (Y_{1i} \mid CORR_i = 1) = \beta_1 X_{1i} + \sigma_{1\eta}\lambda_{1i}$

(b) $E\ (Y_{2i} \mid CORR_i = 0) = \beta_2 X_{2i} + \sigma_{2\eta}\lambda_{2i}$

(c) $E\ (Y_{2i} \mid CORR_i = 1) = \beta_2 X_{1i} + \sigma_{2\eta}\lambda_{1i}$

(d) $E\ (Y_{1i} \mid CORR_i = 0) = \beta_1 X_{2i} + \sigma_{1\eta}\lambda_{2i}$

being: $\sigma_{1\eta}$ the covariance of η_i and ε_{1i}; $\sigma_{2\eta}$ the covariance of η_i and ε_{2i}; $\lambda_{1i} = \varphi(Z_i,\alpha)/\Phi(Z_i,\alpha)$; $\lambda_{2i} = \varphi(Z_i,\alpha)/(1-\Phi(Z_i,\alpha))$, where φ (.) and Φ (.) are the standard normal probability density function and normal cumulative density function respectively.

It follows that:

$TT = (a) - (c) = (\beta_1 - \beta_2)\ X_{1i} + (\sigma_{1\eta} - \sigma_{2\eta})\ \lambda_{1i}$

$TU = (d) - (b) = (\beta_1 - \beta_2)\ X_{2i} + (\sigma_{1\eta} - \sigma_{2\eta})\ \lambda_{2i}$

Following Di Falco et al. (2011) we can use the previous results also for calculations of the heterogeneity effect BH1 and BH2 in the table. BH1 is the difference between (a) and (d). BH2 is the difference between (c) and (b). They show the effect of base heterogeneity for firms that decide to adapt (BH1) or not to adapt (BH1). Furthermore, the transitional heterogeneity(TH), can be proxied that is whether the effect of adapting to corruption is larger or smaller for firms that actually adapted to corruption or for firm that actually did not adapt in the counterfactual case that they did adapt, that is the difference between (TT) and (TU).[10]

Summing up, the empirical strategy suggests a way to use survey data on the corruption-innovation link by the identification of the driving forces behind firm decisions to adapt or not to adapt to corruption, and to investigate wehether or not these choices impact on innovation.

5. Results

5.1 Any selection effect? Identifying the regimes

The results of the analysis above show that firms that pay an informal payment are different, in terms of innovative capacity, with respect to those that do not pay any informal payment. We suppose that the difference among the two groups of firms concerns other aspects than the simple innovative performance. We also suppose that the innovation itself is generated in different ways. In other words, we suppose that the groups of firms have different determinants of innovation and/or the same determinants differently affect the innovation.

Therefore, there are two regimes of firm innovation, one characterized by the presence of corruption and one by the absence of corruption). Paying a bribe or not to pay it determines a switch between the two different regimes.

This switch (the choice) between corruption and not corruption may be endogenous or exogenous. In the case of endogenous switching, there is a correlation between the unobservable, determinants of corruption and the unobservable determinants of innovation. In other words, there are some unobservable characteristics of the firms that push them to be both corrupted and innovators. On the contrary, if the switch is exogenous no correlation exists between such unobservable characteristics: in this case, if we observe that a "corrupted" firm innovate more than a "not corrupted" firm, this should not be attributed to some unobservable characteristics that push a firm to corrupt and innovate more.

The existence of these two different regimes and the nature of the choice (endogenous or exogenous) may be tested by an endogenous switching model.

[10] If the switching between the two different regimes is exogenous, $\sigma_{1\eta}$ and $\sigma_{2\eta}$ are equal to zero; In such a case, the difference between TT and TU is given by ($\beta 1 - \beta 2$) (X_{1i}–X_{2i}), therefore it depends on the different amount of the observable determinants of the outcome in the two groups and on their different effect on the outcome in the two regimes; if the switch is endogenous the difference is given by the previous effect plus the effect given by the correlation among the residuals of the outcome functions and the residual of the selection equation.

This analysis requires some steps:

1. we need to find support for the existence of two regimes. Therefore, a check about the observable determinants of the corruption is crucial.

2. in presence of two regimes, we need to identify the variables explaining the self-selection into one or another regime. Therefore we need to search for the observable selection factors,

In order to look for the existence of two regimes, we run the same regressions of the previous analysis (see Table 3) in both groups of firms: those that pay a bribe (corruption=1) and those that do not pay a bribe (corruption=0). Table 4 reports the results of regressions: three different groups are represented by the combinations of dependent variables and methods used before (*innoprod* with probit, *innosales* with Tobit and *innosales* with OLS). In each group the two columns show the results of the regressions among the firms that pay informal payments (corruption=1) and among the firms that do not pay any informal payments (corruption=0). To test the significance of difference among coefficients we also tested models with interactions.

The results support the existence of two "regimes": not only firms that pay a bribe innovate more than the firms not paying informal payments, but in the two subgroups the linkage between covariates and the innovative capacity shows a different strength. *R&D* is more "important" for innovation in the group of "non corrupted" firms; the positive link between *size* and innovation is stronger among the "corrupted" firms.

the negative effect on innovation of a high number of competitors is significant only among the "non corrupted" firms.

Considering the determinants of *innoprod*, we observe that the impact of R&D on innovation is much stronger in the "non corrupted" group (the difference is significant at 5%) and the impact of *size* is stronger among the "corrupted" firms (the difference is significant at 5%); the number of competitors negatively affect the probability to introduce a product innovation among the "not corrupted" firm, while this effect is not significant among the "corrupted" firms.

The differences are also clear considering the determinant of *innosales* (Tobit analysis): the difference among the coefficients of R&D in the two groups of firms is also very high at it is significant at 1%; *size* significantly affects *innosales* among the "corrupted" firms, but not among the "non corrupted", while the number of competitors has a significant, negative impact on the dependent variable only among the "non corrupted" firms.

If the determinants of *innosales* are analysed through the OLS, only R&D is a significant determinant among the "corrupted" firms, while all the other variables are significant among the "non corrupted" firms.

Table 3. Determinants of innovation among "corrupted" and "not corrupted" firms

	Dependent variable (model)					
Covariates/ Stattistica	**innoprod (probit)**		**innosales (Tobit)**		**innosales (OLS)**	
	Corruption=1	Corruption=0	Corruption=1	Corruption=0	Corruption=1	Corruption=0
R&D	0.70**	1.03**	25.80**	44.62**	10.37**	12.17**
Fortech	0.32**	0.36**	10.74**	18.88**	3.33	4.20**
Train	0.40**	0.31**	12.96**	15.98**	2.46°	2.67**
size	0.11**	0.03*	2.93°	.081	-.605	-.350**
ncomp	-0.09	-0.13**	-5.23	-9.16**	-1.46	-1.67**
Country dummies	YES	YES	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES	YES	YES
N	1360	11972	1306	11450	1306	11450
(Pseudo) R^2	0.1623	0.1693	0.0546	0.0536	0.1892	0.1012

If the existence of the "regimes" is supported by data, the endogeneity of the switching requires the identification of the variables that affect the decision to self-select into one or another regime. That is, we have to look for the observable selection factors .

The analysis of the correlations and of the results of multivariate analysis lead us to conclude that the payment of an informal payment, besides to innovation (this relationship has been widely explored above) is linked to:

(i) the level of corruption in the firm's country;

(ii)the increasing number of competitors.

Among the other variables, which do not reach the threshold of 10% significance in a multivariate analysis, firm size needs to be cited, as it is near to the threshold (larger firms are less corrupted) and the size of the town, which presents a non linearity, so that firms located in middle-big towns (from 250.000 to 1 milion inhabitants) result less corrupted than firms located in towns of other dimensions.

Table 4 presents a probit on corruption with country dummy and *ncomp*. Because of the link between innovation and corruption, *innoprod* is also included among the covariates Country dummies explain a lot of the dependent variable's variability: their exclusion would lower the Pseudo R2 from the global 0.1199 to 0.0185; sectorial variables are also added, with a minor effect.

Table 4 Determinants of corruption

Dependent variable: corruption (probit)	
Covariates/Statistica	**Coeffcicients**
innoprod	.287**
ncomp	.121**
Country dummy variables	YES
Sector dummy variables	YES

N	13599
Pseudo R^2	0.1199

5.2. Managing the selection effect: the endogenous switching model

Table 4 suggests the variables affecting corruption: the number of competitors (ncomp) and countries' heterogeneity, excluding sectoral dummies as they do not explain too much of corruption's variability.

Table 3 suggests the determinant of innovation. *R&D, fortech , train, size and ncomp*. As a great part of variability in innovation and corruption is explained by the different innovation levels in different countries, we introduce as controls the mean of firms' Country level of innovation and corruption, respectively *innosales_mean and bribes_mean*[11] *.*

Table 5 shows the results: in the first column the results of the selection equation (determinants of corruption) are reported; in the second and third column of the outcome regressions (determinants of *innosales*), results are reported respectively for "corrupted" and "not corrupted" firms. In the fourth column we report the results of a linear regression (OLS), having *innosales* as dependent variable and, as covariates, the same included in the two outcome regressions of the endogenous switching model, plus the selection variable corruption.

The last rows of the column report the value of ρ1 and ρ2 (rho1 and rho2), which are the covariance between the error terms of the selection equation with respectively the outcome equation of the corrupted and the outcome equation of the non corrupted, and of the Wald test of independence between the two equations.

Table 5 Results of the endogenous switching model

	Selection equation Dependent Var.: *corruption*	**Outcome equations Dependent Var.: *innosales***		**"Control" OLS regression Dependent Var.: *innosales***
Covariates		Firms with *corruption* = 1	Firms with *corruption* = 0	
corruption				2.129°
R&D	0.260**	11.502**	12.609**	12.445**
fortech	0.119**	4.330	4.238**	4.215**
train	0.000	1.119	1.842**	1.815**
size	-0.013	0.724	-0.057	0.021
innosales_mean	0.032	1.316**	0.880**	0.923**

[11] This model is quite cumbersome to estimate, therefore we had to avoid the use of the 35 country dummy variables and we used such variables to control for country level of innovation and corruption. The loss in terms of goodness of fit is limited.

ncomp	0.145**	0.544	-1.531**	-1.348**
bribe_mean	0.495**			
N: 12769				R^2 = 0.0861
Wald chi2 (6) = 209.69 (Prob > chi2 = 0.000)				
rho1: 0.067 (p-value: 0.085)				
rho2: 0.011 (p-value: 0.518)				
Wald test of independent equations: chi2(1) = 3.11 Prob>chi2 = 0.0780				

Table 6 shows the counterfactual results, already identified in Table 2.

- $E(Y_{1i}|CORR_i = 1)$ is the expected value of *innosales* calculated in the "corruption regime" for the firms that actually corrupted.
- $E(Y_{2i}|CORR_i = 1)$ is the expected value of *innosales* calculated in the "non corruption regime" for the firms that actually corrupted.
- $E(Y_{1i}|CORR_i = 0)$ is the expected value of *innosales* calculated in the "corruption regime" for the firms that actually did not corrupt.
- $E(Y_{2i}|CORR_i = 0)$ is the expected value of i*nnosales* calculated in the "non corruption regime" for the firms that actually corrupted.
- TT: it is the effect of the Treatment on the Treated, the expected value of the difference between $E(Y_{1i}|CORR_i = 1)$ and $E(Y_{2i}|CORR_i = 1)$, that is the advantage given by the corruption to the firms that are corrupted respect to the hypothetical situation they were not corrupted.
- TU: it is the effect of the Treatment on the Untreated, the expected value of the difference between $E(Y_{1i}|CORR_i = 0)$ and $E(Y_{2i}|CORR_i = 0)$, that is the advantage the corruption would give to the firms that are not corrupted.

Table 6. Counterfactual results

$E(Y_{1i}\|CORR_i = 1) = 10.410$
$E(Y_{2i}\|CORR_i = 1) = 8.615$
$E(Y_{1i}\|CORR_i = 0) = 6.192$
$E(Y_{2i}\|CORR_i = 0) = 6.691$
TT = 1.408 (95% confid.interval: lower bound:1.333; upper bound: 1.483)
TU = -0.790 (95% confid.interval: lower bound -0.813 upper bound:- 0.767)
Heterogeneity effects: BH1=4.218 BH2=1.923 TH=TT-TU=2.198

The main results can now be summarized as follows.

1) The degree of competition is an important determinant of the propensity of a firm to pay informal payment: this propensity increases with the number of competitors. The firm decision to pay a bribe is clearly influenced by the competition context.
2) Two different "regimes" are identified, determined by the choice to pay or not to pay any informal payments. In the two regimes firms behave differently: there are different determinants of innovation or the same determinants have different effects. Among firms that pay informal payments, besides the country effect, only R&D has a significant link with innovative activity, while among the firms that do not pay any informal payments there are several variables, beyond the country effect and R&D, significantly linked with innovation, like internal training, foreign technology and the number of competitors.
3) $\rho 1$, the coefficients of correlation between the errors of the selection and outcome regression for the "corrupted" firms, is different from zero with a significance of 10%. Even though beyond the usual threshold of 5%, this result suggests anyway the possibility of an endogenous selection process. The result of the Wald test of independency of the equations is in line with the previous result: in presence of endogenous switching, the equations should not be independent and the hypothesis of independency should be rejected at a 10% level of significance.
4) The effect of the "treatment corruption" on the firm that decide to pay informal payment is significantly positive (TT>0): the firm that pay a bribe would perform worse without corruption. In other word, "corrupted" firms perform better than not-corrupted firms with similar characteristics. The effect of the "treatment corruption" on the firms that decide not to pay informal payment is negative (TU<0) and significant. In this case, "not corrupted" firms would perform worse if they would decide to pay informal payment. The behavior of firms appears therefore rational and the corruption an opportunity (or a need) only for a group of them.

In terms of the hypotheses formulated at the end of Section 2 we may conclude that:

H1: Corruption (paying informal payment "to get things done") has, on average, a positive relationship with the probability to introduce a product innovation and with the percentage of sales deriving from the innovation.

H2: There are signs of a selection effect involving innovation and corruption: not only there are some observable determinants of innovation that are also determinant of corruption (particularly: country effect, degree of competition) but there are also signs of correlation among the unobservable determinants of both.

H3: An analysis that keeps into account the selection effect shows that corruption has different effects in two different groups of firms: it has a positive effect, in terms of innovative capacity, on those firms that resort to it; firms that do not pay informal payment, on the contrary, would perform worse if they paid it.

Conclusions (incomplete)

Prior research shows that innovators are disproportionately affected by bribing practices as opposed to non-innovators (Ayyagari, 2014). Our results show that the effectiveness of bribery in greasing the wheels of innovative activities is contingent upon the selection processes between corrupt and non corrupt firms, across countries.

Thus, the most interesting finding of this study is that greasing and sanding may actually coexist, depending on the level of analysis and whether or not selection processes play a role. Building on this result, future research can reexamine the well established economic outcomes such as the productivity or the economic performance impact of corruption, in presence (absence) of selection processes.

More broadly, the result suggests that bribery has very complex consequences beyond that simple transactions between firms and officials. Bribery can act as an incentive as well as a tax for innovative activities, creating room for a rational adaptation of firm's strategies to corrupt business environment.

This work is not without limitations but it can provide some further footpaths for future research data and method-related. First, the dominant cross-section nature of the BEEPS data prevents us from drawing any across time implications of bribery strategy. Surely future work in the area should confirm our conjecture empirically by employing longitudinal datasets. Second, although BEEPS stand out as one of the best sources of data for capturing firm-level corruption, it is open to measurement issues. Biases pointing to the downward perception of corruption in these markets are well recognized in presence of informational asymmetries and reticence suggesting methods for reticence-adjusted estimates of corruption.

References (incomplete)

Akcigit U., S. Baslandze and F. Lotti (2020), Connecting to Power: Political Connections, Innovation, and Firm Dynamics, NBER Working Paper No. 25136.

Athanasauli D. and A. Goujard (2015), Corruption and management practices: Firm level evidence, Journal of Comparative Economics, vol. 43, 1014-1034

Bardhan P. (1997), Corruption and Development: A Review of Issues, *Journal of Economic Literature*, Vol. XXXV, 1320–1346.

Blundell R. and M. C. Dias(2009), Alternative Approaches to Evaluation in Empirical Microeconomics, *Journal of Human Resources*, vol. 44, No. 3, 565-640.

Ayyagari M., A. Demirgüç-Kunt and V. Maksimovic (2014) Bribe Payments and Innovation in Developing Countries: Are Innovating Firms Disproportionately Affected? *Journal of Financial and Quantitative Analysis*, vol. 49, No.1, 51-75

Caliendo M.and R. Hujer(2005) The Microeconometric Estimation of Treatment Effects. An Overview, IZA Discussion paper 1653.

Crowley F. and P. Mcann(2017), Firm innovation and productivity in Europe: evidence from innovation driven and transition driven economies. *Applied Economics,* vol. 50, no. 11, 1203- 1221.

Cuervo-Cazurra, A., (2016), Corruption in international business. *Journal of World Business*, vol. 51, 35-49.

Di Falco S. , M. Veronesi and M. YesufuF.(2011) Does adaptation to climate change provide food security? A micro perspective from Ethiopia, American Jounal of Agricultural Economics, vol. 93, No.3, 829–84.

Dimant E. and G. Tosato(2018) Causes and effects of corruption: What Has Past Decade's Empirical Research taught us? A Survey, *Journal of Economic Surveys*, Vol. 32, No. 2, pp. 335–356.

Faccio M.(2006), Politically connected firms, *American Economic Review*, vol. 96, pp. 369-386.

Gamberoni, E., Gartner, C., Giordano, C., and Lopez-Garcia, P. 2016, Is corruption efficiency-enhancing? A case study of nine Central and Eastern European countries' , ECB Working paper no. 1950

Goedhuys - Degelin, M., Mohnen, P., & Taha, T. (2016). Corruption, Innovation and Firm Growth: Firm level Evidence from Egypt and Tunisia. *Eurasian Business Review*, 6(3), 299-322

Hanousek J and A Kochanova (2015), Bribery environment and firm performance: Evidence from Central and Eastern European Countries", CEPR Discussion Paper 10499.

Iriyama A. Kishore R. and Talukdar D.(2016) Playing dirty or building capability? Corruption and R&D training as competitive actions to threats from informal and foreign firms rivals, *Strategic Management Journal* 37, 2152 - 2173.

Javorcik B.S. and Shang-Jin Wei (2009) Corruption and Cross-Border Investment in Emerging Markets: Firm-Level Evidence, *Journal of International Money and Finance,* vol. 28, No.4, 605-624.

Krammer S. M. (2019) Greasing the wheel of change: Bribery, Institutions and New Product introductions in emerging markets, *Journal of Management*, vol. 45, No.5, 1889- 1926.

Kraay A. and P. Murrel (2016) Misunderestimating corruption, *The Review of Economics and Statistics*, 98, 455-466.

Maryam A.B. (2020), Essays on innovation and corruption : a cross-country analysis, Ph.D. Thesis, University of Bath.

Mauro P. (1995) Corruption and growth, *The Quarterly Journal of Economics*, vol. 110, 681-712.

Murphy K, Shleifer A. and R.W.Vishny (1993), Why is rent-seeking so costly to growth?, *American Economic Review*, vol. 83, 409-414.

Murtazashvili I. and J. M. Wooldridge (2016) A control function approach to estimating switching regression models with endogenous explanatory variables and endogenous switching, *Journal of Econometrics*, vol. 190, Issue 2, 252-266.

Rose-Ackerman S. (2006)

Rose-Ackerman S. and Soreide (2011)

Svenssson J. (2005) Eight questions about corruption, *Journal of Economic perspectives*, 19, 19-42.

Shleifer A. and R.W.Vishny (1993), Corruption, *The Quarterly Journal of Economics*, vol. 108, 599-617.

Wang, Y. and J. You, 2012, Corruption and firm growth: Evidence from China, *China Economic Review*, vol. 23, no. 2, pp. 415–433.

APPENDIX

Table A1. Description of the variables

Variable	Description
innoprod	Product innovation in last three years(0/1)
innosales	Innovative sales as a % of annual sales
innosales_yes	Innovative sales by innovators as a % of annual sales
innosales_mean	County's mean innovative sales
corruption	Informal payment "to make things done" (0/1)
bribe	Informal payment as a % of annual sales
bribe_yes	Informal payment, as a % of annual sales by corrupt firms.
bribe_mean	Country's mean bribes
R&D	R&D expenditure in the last three years (0/1)
fortech	Licensed foreign technology (0/1)
train	Formal training for permanent emplyees(0/1)
ncomp	Number of firm's competitors, more (less/equal) than five (0/1)
dmon	Competitors, more(less) than 1 (0/1)
size	Natural logarithm of full-time employees
employees	Number of full-time employees

Table A2. Descriptive statistics

	N	**Mean**	**ST DEV**
innoprod	17072	0.25	0.43
innosales	16280	6.74	18.37
innosales_yes	3521	31.15	28.27
innosales_mean	17133	6.75	2.67
corruption	13678	0.10	0.30
bribes	13678	0.66	3.61
bribes_yes	1319	6.45	9.48
bribe_mean	17135	0.82	0.99
R&D	17031	0.11	0.32
fortech	16992	0.12	0.33
train	16993	0.32	0.47
ncomp	17133	0.74	0.44
dmon	14436	0.04	0.19
size	17069	3.14	1.32
employees	17069	80.66	330.81

Table A3. Correlations betwee innovation and corruption variables

	innoprod	innosales	corruption	bribes	bribes_yes
innoprod	1.000				
innosales	0.698**	1.000			
corruption	0.091**	0.062**	1.000		
bribes	0.051**	0.039**	0.542**	1.000	
bribes_yes	0.007	0.013**	-	1.000	1.000

Table A4. Innovation and corruption

	No informal payment (corruption=0)	**Informal payment (corruption=1)**	**All firms**
No product innovation	9304 (91.3%)	882 (8.7%)	10186 (100%)
Product innovation	2936 (85%)	517 (15%)	3453 (25.3%)
Total	12240 (89.7%)	1399 (10.3%)	13639 (100 %)

Table A5 Mean bribes between innovators and non innovators

	Mean of positive bribes.	**Mean bribes. All firms**
No product innovation	6.40	0.55
Product innovation	6.54	0.98
All firms	6.45	0.66