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The impact of (petty) corruption on firm innovation in Vietnam[1]

Nguyen Ngoc Anh • Doan Quang Hung • Nguyen Ngoc Minh • Binh Tran-Nam

Abstract: Corruption has been found to have complex effects on firm innovation. Limited theoretical and empirical evidence to date has been rather inconclusive. The literature suggets that corruption could have a negative or positive impact on innovation and, in some cases, both of these effects can exist simultaneously. This article employes established econometric estimation techniques and Vietnam's small and medium manufacturing enterprise data to quantitatively analyze the impact of petty corruption on firm innovation in Vietnam. The empirical results obtained tend to support the greasing hypothesis of corruption on innivation. More specifically, informal payments by Vietnam firms are shown to encourage overall innovation, product improvement innovation and new innovation. This is not entirely unexpected, in view of other findings reported in this special issue, and in view of the business practice of paying small informal fees to speed up transactions with the public sector in Vietnam. However, the findings also strongly implies that in the fight against corruption it is critically important to highlight (to firms) the true costs of corruption in the long run.

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Introduction

This article is part of a series of related studies on the costs of corruption in Vietnam, which have been funded by the Department for International Development (DFID) Vietnam and managed by Coffey International. The principal aim of this research is to analyze quantitatively the effects of corruption on firm innovation activities in Vietnam. In so doing, the article intends to make a contribution to the relatively small body of international and national literature on the relationship between corruption and innovation. The research approach is quantitative, utilizing established econometric techniques with the best data currently available from Vietnam. Nevertheless, due to data availability, the scope of this article is restricted to petty corruption and to small and medium manufacturing enterprises in the private sector in Vietnam.

Before proceeding, it may be useful to make some brief remarks concerning innovation and corruption. Innovation is widely regarded as a key driver of increased productivity worldwide, especially in view of the new growth theory ([1], [2], [3]). In this sense, innovation can also be viewed as an important channel for economic growth. Different types of innovation in the production and distribution process have been identified in the literature, including, for example, process innovation, product innovation, organizational innovation and marketing innovation ([4], [5]). We will draw from these distinctions for our own analysis, as elaborated later in this article.

Corruption refers to the abuse of public office by civil servants or officials for illegitimate private gains [6]. In country-level empirical studies, corruption is often measured by some kind of summary indexes (e.g., Transparency International's Corruption Perceptions Index or the World Bank's Worldwide Governance Indicators) while at firm level, the focus is on bribery behaviors. Some authors (see, for example, [7]) further classify corruption by scale (grand vs. petty). It has been argued that firms engage in grand corruption to gain market advantages (e.g. to win a government's procurement contract) and in petty corruption to 'get things done' (e.g. to speed up business applications). While the grand corruption, often associated with high-level public officials is generally seen as detrimental harmful for a long term viable economy ([8], [9], [10], [11]; see also Nguyen et al [12] in this issue], the impact of petty corruption, often associated a small amount of money and low level of public officers, can be positive in certain situations of defective institutions by speeding up and improving the quality of public services,

i.e. in a 'second best world', aka the so-called 'greasing the wheels hypothesis' (see, for example, [13], [14] Huntington, 1968 [15]). Empirical evidence of positive impact of corruption at the country level can be found in Méon and Weill [16] and at state level for India could be found in Kato and Sato [17] where corruption 'greases the wheels' of productivity or growth.

The impact of petty corruption is often studied using firm/plant level data. Overall the literature shows that the impact of corruption is not uniform and depends on the effectiveness of local institutions. While there is evidence of negative impact of corruption on performance of firms (see, for example, [18]), at the micro (firm/plant) level, Dreher and Gassebner [19] provide evidence that corruption may temper the negative effect of regulation on early-stage entrepreneurship. Zhou and Peng [20] find that bribery hurts growth for small and medium-size firms but not for large firms due to the fact that large firms may choose to engage in bribery strategically while smaller firms are forced to do so. Chen et al [21] report that bribery helps private firms to access bank credit in China. Interestingly, an empirical microanalysis of Indonesian firms by Vial and Hanoteau [22] demonstrates the co-existence of negative and positive impacts of corruption in the sense that at plant level there is evidence of the 'grease the wheel' effect, i.e. plants offering bribes enjoy higher productivity growth, corruption remains harmful at the aggregated level of manufacturing industries.

In this article, we contribute to the above empirical literature by estimating the impact of petty corruption on an important factor of growth, namely, the innovation activities of firms. In a country like Vietnam where competitiveness of the private sector is hampered by beaurocratic administrative burden and the existence of low-pay public sector, the 'sensible strategy' for firms would be to pay a small informal payment for speeding up transactions with the government.[2] The article makes use of the small and medium enterprise (SME) survey data conducted biennially since 2005 by the Central Institute of Economic Management (CIEM) and Danish International Development Agency (DANIDA). Our empirical analysis suggests that bibery in the form of informal payment by Vietnamese SMEs grease the wheel of the beaurocratic machinery.

The remainder of this article is organized as follows. The next section provides a succinct summary of theoretical arguments concerning the possible effects of corruption on innovation.

[2] The high cost of tax compliance in term of time has been highlited, for example http://baobaohiemxahoi.vn/vi/tin-chi-tiet-thu-tuong-chinh-phu-chi-dao-ve-cai-cach-thu-tuc-hanh-chinh-thue-bhxh-a7d518cb.aspx

This is basically a review of the sand vs. grease the wheel hypotheses as applied to innovation. This theoretical discussion is followed by a review of the evidence from empirical studies, focusing on definitions of key variables, data sources, estimating methods and key findings. The research methodology and the dataset employed in the present study are discussed next. This is then followed by the findings of the present study, which confirm that corruption has a greasing impact on different types of firm innovation in Vietnam. The final section concludes.

Review of theoretical models

The literature on the theoretical relationship between corruption and innovation is meager in terms of number of studies and indeterminate in terms of findings. There is a paucity of theoretical studies on how corruption affects innovation, although there is of course a related and much more substantial strand of literature relating to corruption and economic efficiency/growth. The competing sand-the-wheels and grease-the-wheels hypotheses concerning the impact of corruption and economic growth apply equally well in the case of corruption and innovation. That is, these hypotheses can be modified to provide arguments on how corruption 'sands' or 'greases' innovation.

The sand-the-wheels hypothesis is the formal statement of the common-sense observation that corruption, however defined, is detrimental to innovation and economic development. This is basically how international organizations such as the International Monetary Fund (IMF), World Bank or the Organisation for Economic Co-operation and Development (OECD) perceive corruption, culminating in international initiatives such as the United Nations (UN) Convention against Corruption [23] or the OECD's Convention on Combating Bribery of Foreign Public Officials in International Business Transactions [24].

Various theoretical arguments have been put forward in the literature to support the above orthodox viewpoint. Myrdal [25] suggested that corrupt public servants may cause unnecessary delays to extract a bribe. Such delays tend to harm innovative efforts. Likewise, Veracierto [26] constructed a game theoretic model that demonstrates a positive effect of corruption controls on production innovation, although his model does not shed light on the precise channel of this positive effect. As pointed out by Rose-Ackerman [27], although corruption and competitive auction are analogous, the highest briber may also be the one who is most

willing to compromise on the quality of the goods produced once a license is obtained. It is also quite possible that corruption may divert entrepreneurial efforts away from factor of production coordination activities such as innovation into dealing with bureaucracies as suggested by Bó and Rossi [28]. In this case, corruption may reduce rather than increase the incentive to innovate.

Corruption has also been argued to increase uncertainty and transaction costs and thus make a potentially promising innovative opportunity much less attractive commercially (see, for example, Luo [29]. It has also been suggested that innovative activities may be adversely affected by corruption due to lack of resources (from investment) or lack of trust in institutions ([5]: 81). Shleifer & Vishny [30] also argue in a similar fashion that the true level of innovation may get inflated in the presence of corruption. This is because corrupt firms would often report as having advanced technologies, even though they are not necessarily needed.

Corruption may also act as a barrier to innovation through various indirect channels. For example, Murphy et al [31] argue that, due to the economic benefits of corruption to some individuals, economic agents are likely to move from productive to unproductive rent-seeking activities. Such a sub-optimal reallocation would harm human capital accumulation and consequently innovation. Along a similar line, Kurer [32] contends that corrupt officials have an incentive to create distortions in the economy to protect their illegal income. Such distortions may hinder innovation. Further, corruption in a host country may also have a negative impact on the inflow of foreign direct investment, which is a well-known source of technology transfer for the host country. Additionally, corrupt practice by foreign firms may also potentially retard the host country's innovative activity [7].

The grease-the-wheels hypothesis represents the alternative viewpoint. According to this line of thinking, advanced by Leff [13] and Leys [14], corruption can be efficiency- or innovation-enhancing. This is so because corruption may alleviate the distortions in an economy caused by ill-functioning institutions or poor governance structure. An important bureaucratic inefficiency that can be compensated for through corruption is time losses in legally establishing new firms [14]. This idea has been supported by Lui [33] who demonstrates in a formal model that corruption could reduce time spent in a queue. Another important bureaucratic inefficiency is caused by the government's inability to attract quality public servants. In this context, it has been argued by Leys [14] and Bailey [34] that corruption can improve the quality of public servants when government salaries are low. A similar argument

offered by Leff [13] is that the most generous briber can also be the most efficient producer. Subsequently, Lien [35], and Beck and Maher [36] formally demonstrate that corruption can duplicate the outcome of a competitive auction aimed at assigning government procurement contract. In this sense, corruption can stimulate innovation by assigning the projects to the most efficient firms.

Opponents of the efficiency- or innovation-enhancing schools of thought have argued that the positive impact of corruption is based on weak and unjustifiable assumptions. For instance, the size of the bribe may be determined by corrupt officials rather than by corrupt firms. Similarly, corrupt bureaucrats are most unlikely to work to promote economic growth or innovation. Against Leff's argument [13], Tanzi [37] claims that the rigidities are not the nature of the society, but created by the government officials, especially if such obstacles can attract more bribes. Consequently, it is unreasonable to claim that corruption can enhance efficiency or innovation by removing these rigidities. Myrdal [25] also states that in case of corruption, rather than accelerating the administrative procedure, officials would maintain the rigidities in order to receive more bribes. Kaufmann and Wei [38] support this view, arguing that since bureaucrats can endogenously choose regulatory burdens and delays, they tend to extract the largest amount of corruption. Thus, firms are likely to spend more time in negotiating with corrupt officials, leading to higher costs of capital.

In contrast to Beck and Mahers' claim [36], firms which pay the highest bribe may not necessarily be the most economically efficient ones. The firm which offers the highest bribe may simply do so because they consider bribe as an investment with a high rate of return [23]. Further, a later study of Acemoglu & Verdier [39] suggests that property rights enforcement, which is decided by public officials, is the key condition for wealth creation. Firms need to get it to resolve environmental problems by internalizing externalities and relying on incentives of private owners to conserve resources for the future; it would be difficult and costly for firm if public officials require bribes to complete the administration process. Consequently, it is necessary to prevent all corruption.

In summary, there are different ways to view the theoretical impact of corruption on innovation, particularly in countries with weak governance structure and institutions. Thus, it is necessary to turn to empirical studies to resolve this difference. It is important to note that it is conceivable for both hypotheses to hold simultaneously. A more recent and perhaps more plausible approach is to disaggregate corruption into different types which may in turn have

opposite effects on different types of innovation. This approach will be further considered below.

Review of empirical studies

There are very few empirical studies that directly examine corruption as a determinant of innovation at either firm or national levels. The available evidence, however shows no consensus on the effects of corruption on innovation. Broadly speaking, empirical studies relating innovation to corruption can be classified into two groups by reference to the level of aggregation of data. The first group utilizes data at the country level whereas the second group employs firm-level data. Most of studies using aggregate data at the national level find that corruption negatively affects innovation.

In a study of the socioeconomic determinants of innovation, Griffiths and Kickul [40] classify several EU countries, Japan and the US into four groups (leaders, followers, trailing and catching up) on the basis of each country's innovation index. Using data from Eurostat 2006 and supplemented with Transparency International's 2005 CPI within a multivariate discriminant analysis framework, the authors report a positive relationship between the two variables, i.e. more/less innovative countries have higher/lower CPI (less/more corruption). This finding has also been confirmed by Golla [41] in her study of the simple correlation between CPI and Summary Innovation Index (SII) in formerly centrally planned EU economies (Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Slovenia, Bulgaria and Romania) for the year 2009.

In a study similar in spirit to that of Griffiths and Kickul [40], Natário et al [42] set out to test, among other things, the hypothesis that institutional efficiency has a positive influence on a country's innovative capacity. Using a cluster analysis with data derived from the European Innovation Scoreboard for 2008, Natário et al [42] show a strong association between corruption and innovation. The first cluster of countries including Australia, Germany, Estonia and Luxemburg that has the greatest innovative capacity is associated with the highest level of corruption control, whereas the third cluster including Bulgaria, Spain, Hungary, Lithuania, Malta, Poland, Romania and Slovakia that has the least innovative capacity is associated with the lowest level of control of corruption.

Anokhin & Schulze [43] draw on longtitudinal data covering 64 countries from 1996 to 2002 to test the hypothesis that improvement in corruption control raises the level of innovation at a decreasing rate. Using random-effects negative binomial regression where innovation was defined as the number of patent applications, the linear effect of control of corruption on innovation was not significant but the squared-term effect was significantly positive, implying a convex relationship between innovation and corruption.

On the other hand, at the firm level, there is evidence of both sanding and greasing. A recent study by de Waldemar [44] finds strong evidence to support the sand the wheels hypothesis. The data for this study is derived from the World Bank Enterprise Survey for Indian firms in 2005, consisting of 2,280 enterprises located in 17 states in all regions of the country. The key variables are product innovation (whether a new product has been introduced) and bribery (sector-sate average of firms' responses). Using probit estimation, bribery is shown to have a negative and significant effect in all specifications. The results are robust in terms of both the endogeneity test (via the use of instrumental probit estimation) and the introduction of a multi-product dummy variable, providing the evidence that corruption in the form of bribery diminishes the probability of new products being introduced by Indian firms.

A relatively recent study using firm-level data is that of Mahagaonkar [5]. This study focuses on African countries which are often considered to have weak governance structures and burdensome regulations, making them suitable test-cases for the sand/grease the wheels hypotheses. An interesting feature of this study is the recognition of four separate types of innovation: process, product, organizational and marketing innovation. This separation is important because innovative activities that require exclusively the use of public properties such as licenses or permits may be impacted differently by corruption. Using the probit and instrumental variable probit models with the African subset of a large-scale firm-level data set derived from the 2004 World Bank Enterprise Survey, it is found that corruption impedes product and organizational innovation but has a beneficial effect on marketing innovation. Process innovation appears to be unaffected by corruption. The findings of this study lend support to the possibility of simultaneous occurrence of the sand/grease the wheels hypotheses.

There is evidence showing a positive greasing relationship between corruption and innovation. Krammer [45] employs data from 7,000 firms in 30 emerging markets to examine the impact of corruption, proxied by bribes, on firm innovation. Despite significant heterogeneity in terms of both bribing practices and innovative performance, the study shows

that bribes have a positive effect on firm innovation by greasing the regulatory apparatus to facilitate the introduction of innovative products to markets but local arbitrariness in corruption practices defined as the dispersion of individual firm bribes within a sector-region-city unit, has a negative impact on firm innovation. More interstingly, the study also reports that the efficiency of bribes is mitigated by the quality of formal (control of corruption) and informal institutions.

The harmful effect of corruption on innovation can also arise from foreign firms' practice in host countries. Habiyaremye and Raymond [7] examine transnational corruption and innovation in transition countries using data derived from the fourth wave of the European Bank for Reconstruction and Development (EBRD) – World Bank Business Environment and Enterprise Survey, which relies on information for the year 2007 from about 12,000 firms in 30 countries in Eastern Europe and Central and Western Asia. Three measures of innovation are employed, namely, innovation effort (R&D spending), incremental innovation (upgrading of existing goods/services), and major innovation (introduction of new goods/services). Similarly four measures of corruption are utilized, namely, the percentages of firms in each two-digit industry, taken separately for each country, that engage in grand and petty corruption, which are further broken down into foreign and domestic firms. The authors find that: (i) grand corruption by foreign firms is detrimental to all types of innovation while grand corruption by domestic firms have no effect on the three innovation measures, (ii) petty corruption by local firms has a stifling effect on innovation effort and incremental innovation, but not major innovation, while petty corruption by foreign firms has a positive direct effect on major innovation (evidence of a wheel greasing effect), (iii) the combination of grand corruption by foreign firms and petty corruption by domestic firms causes the most harm to innovation.

Another useful reference for the present study is a recent paper by Rand and Tarp [46]. Although this study does not examine the relationship between corruption and innovation, it utilizes the same panel data set that will also be employed in the present study. Rand and Tarp [46] examine the determinants of bribes and changes in bribe-paying behavior in Vietnam in 2005 and 2007. Employing a pooled probit model and a fixed-effects linear probability model, bribe incidence was found to be significantly positively related to firm's size, firm's willingness to pay (proxied by profit per employee) and firm's outside options (proxied by capital/labor ratio). Conversely, bribe incidence was negatively associated to a time dummy variable. Other explanatory variables such as receipt of government assistance, international trade and business registration are also found to be statistically significant.

Although the literature on corruption and innovation is only emerging recently as reviewed above, the currently available evidence tends to suggest that the connection between innovation and corruption is complex with possible two-way causality and the impact of corruption on innovation may be depedent upon types of innovation, types of corruption and the local institution. In the following section of our article, we attempt to deal with the possible endogeneity between corruption and innovation and at the same time explore the impacts of corruption on different types of innovation, namely production innovation, process innovation and product improvement.

Research approach and data description

Estimation strategy

Following Oslo manual guidelines for collecting and interpreting innovation data ([4]), in our article a firm's innovation activities are measured by its introduction of new products, adoption of new production process or modified an existing product within the last three years.[3] As a result, in our study, several types of firm innovation activity are considered: (i) product innovation (whether a firm produces a new good or not), (ii) process innovation (whether a firm adopts a new production process), (iii) product improvement (whether a firm improves an existing product). To estimate the impact of corruption on innovation at the firm level, the binary nature of our dependent variables renders the OLS method inappropriate. We thus follow prior literature ([44], [47] & [48]) and model innovation using a logit specification. Our initial empirical model is given by

$$INNO_{ij} = \beta_0 + \beta_1 + \beta_2 Corr_{ij} + X'_{ij}\beta_X + \beta_\theta \theta_{ij} + \varepsilon_{ij}$$

where $INNO_{ij}$ is a dummy variable indicating the innovation activity of the i-th firm at time j, X_{ij} is a vector of observable factors that affect innovation of the firm, θ_{ij} is an unobservable factor and ε_{ij} is a classical random error term. In the model above, corruption, $Corr_{ij}$, is the variable of our interest and β_2 captures the impact of petty corruption (bribery) on innovation.

[3] The questionnaire contains three important items asking about a firm's innovation activities during the last three years: (i) Has the firm introduced new product groups (ii) Has the firm introduced new production process; and (iii) Has the firm made any improvements of existing products.

It has been pointed out in previous studies since the pioneering work of Fisman & Svensson [18] that corruption behavior in general and bribe payment in particular may be endogenous to firm performance, rendering the estimated parameter β_2 to be biased. There are a number of reasons why corruption and firm performance are potentially endogeneous. First, corrupt bureaucrats could observe firms performance across time and develop their own assessment of the ability to pay of each firm. Corrupt bureaucrats would demand/extort bribes in accordance with the perceived capacity of firm to pay, which depends on profits brought about by product innovation, process innovation and product improvement. Thus, more innovative firms are more likely to experience bribes given their higher perceived ability to pay. On the one hand, many business elements could have an effect on both corruption and firm productivity (as well as firm innovation capacity). In some circumstances, there exists a potential reverse causality between corruption and firm performance. For example, in a business environment where long administrative delays and slow-moving queues for public services are common, a firm that needs to have a license to develop their products or to access a preferential market could be willing to pay a larger amount in corruption than other firms. Our previous discussion suggests that there are several unobservable factors that could affect both firm innovation capacity and corruption, leading to a biased estimate of $Corr_{ij}$.

To correct for this endogeneity bias, we use the sector-location average approach proposed by Fisman & Svensson [18]. In particular, they propose that the corruption faced by a typical firm operating in the i-th industry at the j-th location ($Corr_{ij}$) consists of two components:

$$Corr_{ij} = corr_{ij} + corr_j$$

where $corr_{ij}$ refers to idiosyncratic element and $corr_j$ is average amount of bribe common to all firms in the i-th industry at the j-th location. The underlying assumption is that sector-province average bribing rates are uncorrelated with the firm innovative performance. For Vietnam, we use sector-province average as our instrument. Using the instrumental variable method, our model becomes:

$$INNO_{ij} = \beta_0 + \beta_1 + \beta_2 corr^{IV}{}_i + X'_{ij}\beta_x + \beta_\theta \theta_{ij} + \varepsilon_{ij}$$

where $corr^{IV}_i$ is the fitted value from the first-stage regression where corruption is regressed on location-province bribe average and other control variables.

Data and variables

All necessary data is drawn from the Survey of Small and Medium Scale Manufacturing Enterprises (SMEs) in Vietnam from 2005 to 2011. The survey has been jointly conducted by tCIEM and DANIDA in 10 provinces of Vietnam since 2005 biennially. It provides information of about 2,500 firms in 12 industries in each surveyed year. A list of industries and provinces included in our study is provided in Appendix 1. One advantage of using data from the Vietnamese SMEs Survey is that it contains information about all aspects of business activities such as firm history, production characteristics, investments, assets, liabilities, credit, networks of enterprise and entrepreneurs, economic constraints and potential, etc. It is thus a fruitful source for studying the performance of Vietnamese SMEs.

The information of firm corruption is derived from the SMEs survey and constructed as a dummy variable that describes whether or not firms pay for informal fees. Although surveyed firms are asked about the amount of bribes they pay, they tend to under-report such payments. Using a dummy variable is thus considered as more reliable. Summary statistics of all variables are reported in Appendix 2.

Findings and discussions

Endogeneity

To control for endogeneity problem, we employ an instrument for corruption using the standard two stage instrumental approach outlined above. In the first stage, the dependent variable, an indicator taking value of one if a firm report that it pays informal payment and zero otherwise is modelled as a function of the average industry-location bribery rate and other control variables. We estimate this model as a linear probability model and the estimated results are presented in Table 1. Essentially, the model can be seen as a model of the determinants of bribing behavior at the firm level. The results are qualitatively similar to those of Rand & Tarp [46]. Our variable of interest at the first stage is the average bribe in *i*-sector of the *j*-province. The estimated result indicates that there is a strong correlation between firm level bribe and the

sector-location average bribery rate, which implies that the sector-location average is not a weak instrument. In the second stage, we use the predicted value of the dependent variable as an instrument for the firm level bribery.

We also perform several statistical tests checking the validity of our instruments. Following Wooldridge [49], we cannot run the over-identification tests since the model is only exactly identified with one endogenous variable and one instrument. The testing results are summarized in Table 2. First, the *p*-values for the Anderson's canonical correlation and Cragg–Donald–Wald tests confirm the adequate explanatory power of our instruments. Second, the Cragg–Donald *F*-statistics tests reject the null hypothesis of weak instrument. Finally, while the Wu–Hausman test statistic suggests that we cannot use our instruments to predict the impact of corruption on process and product innovation, the Durbin–Wu–Hausman test only confirms the invalidity of our instrument in the case of process innovation. By contrast, the instrumental variables estimators should be employed in case of product improvement innovation, new innovation and general innovation.

Empirical results

The empirical results are summarized in Table 3. We estimate both simple logit model and random effect logit model for each of the three types of innovation. Breusch & Pagan Lagrangian multiplier test rejects the pool regression model for product improvement and process innovation while pool regression is appropriate for new product innovation. Our analysis suggests that capital is important for innovation but its impacts depend on the type of innovation activities involved. For marginal innovation like product improvement, capital does not seem to play any important role. This is interesting as it implies that Vietnamese SMEs can still innovate and improve its competitiveness in this aspect without the burden of capital investment. Capital has a negative and significant impact on product innovation while its impact on process innovation is positive and significant. Usually, for SMEs in developing countries like Vietnam, investment in new production process and technology may require intensive investment in capital but not necessarily for new product innovation as SMEs would be more likely to imitate 'new product', (new to the firm but not necessarity new to the market) rather than develop totally new product. Human capital variables as capture by training policy and the percentage of professional workers in total workforce have positive and significant impact on all types of innovation. Our results also provide evidence to the importance of size for innovation. Firm's engagement in internationalization (exporting) helps in product

improvement and new product innovation, but not statistically significant in process innovation.

Across all our models, corruption in the form of bribery is found to have a greasing effect on firm's innovation activities. The estimated marginal effects are positive and statistically significant. The impact of corruption is strongest for process innovation. Our finding here is consistent with previous studies that corruption in the form of bribery greases the wheel, even after controlling for potential endogeneity. In the context of Vietnam, where institutions are not strong enough to fight corruption, such results are not unexpected. For firms, it is a sensible strategy to circumvent burdensome and lengthy administrative procedures. Indeed, in Vietnamese language, bribery is literally called 'facilitation money' or 'greasing money'. As such, the estimated positive impact of corruption on innovation may not come as a surprise. It should be noted however that our results should not be interpreted as to 'support' or reinforce corruption. Rather, it highlights an important point that in an over-regulated business environment such as Vietnam, it may be in the interest of firms to grease the state machinery.

Conclusion

Using panel data of Vietnamese Small and Medium Scale Manufacturing Enterprises from 2005 to 2011, we have examined the impact of corruption on firm innovation in Vietnam and obtained a positive and statistically significant relationship between the two. Our analysis confirms the greasing effect of corruption on a firm's decision to innovate in several dimensions such as overall innovation, product improvement innovation and new innovation.

To the best of our knowledge, our study provides the very first evidence for the impact of corruption on firm innovation in Vietnam. While our study is preliminary and rather limited in scope, it nevertheless makes a useful contribution to the literature in general and the recent wave of corruption studies in Vietnam in particular. Further studies are necessary to examine the long-run impact of corruption on firm innovation. In the meantime, the results of our study suggest that in the fight against corruption in Vietnam it is critically important to highlight the true costs of corruption in the long run, as pointed out in other studies reported in this special issue.

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Table 1: Determinants of Bribery – First-stage equation (OLS)

Dependent variable: Bribery/ Informal Payment	
Average Bribe in i-sector j-province	0.946***
	(0.029)
Log of Capital	0.170***
	(0.043)
Training of workers	0.054***
	(0.015)
Percentage of professional staff	0.294***
	(0.078)
Owner's Higher Education	0.007
	(0.014)
Exports	0.005
	(0.022)
Log of Firm Size	0.067***
	(0.007)
Constant	-0.403***
	(0.062)
Sector dummies	Yes
Province dummies	Yes
N	6197
R^2	0.240

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Endogeneity Test

	Improving product	New product	New process
Anderson canon. corr. (Under-identification test)	889.41***	889.41***	889.41***
Cragg–Donald N*CDEV Wald statistic (Under-identification test)	1038.45***	1038.45***	1038.45***
Cragg–Donald Wald F-statistic (Weak identification test)	1033.76***	1033.76***	1033.76***
Wu–Hausman F test	2.56	95.99***	14.95***
Durbin–Wu–Hausman chi-square test	2.57	94.96***	14.99***

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

Note: The result of tests from ivregress in Stata

Table 3. Marginal effects of independent variables on innovation using logit method and random-effect logit method

	(Logit) Improving product	(RE) Improving product	(Logit) New product	(RE) New product	(Logit) New process	(RE) New process
Bribery (instrumented)	0.100***	0.533***	0.283***	2.322***	0.130***	0.880***
	(0.034)	(0.161)	(0.027)	(0.213)	(0.029)	(0.188)
Log of capital	0.002	-0.052	-0.235***	-1.931***	0.090**	0.500*
	(0.047)	(0.231)	(0.034)	(0.285)	(0.040)	(0.277)
Training of workers	0.036**	0.169**	0.051***	0.421***	0.075***	0.497***
	(0.017)	(0.079)	(0.011)	(0.089)	(0.013)	(0.084)
Percentage of professional workers	0.190**	0.883**	0.136**	1.118**	0.355***	2.366***
	(0.090)	(0.416)	(0.056)	(0.465)	(0.066)	(0.442)
Owner Higher Education	0.020	0.086	-0.009	-0.074	0.005	0.032
	(0.015)	(0.073)	(0.011)	(0.088)	(0.012)	(0.081)
Export	0.058**	0.287**	0.041***	0.336***	0.019	0.143
	(0.025)	(0.122)	(0.015)	(0.124)	(0.018)	(0.121)
Log of Firm size	0.066***	0.316***	0.021***	0.173***	0.056***	0.374***
	(0.009)	(0.042)	(0.006)	(0.050)	(0.007)	(0.047)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	6197	6197	6197	6197	6197	6197
pseudo R^2	0.0691		0.0852		0.0939	
Breusch&Pagan Lagrangian multiplier test		37.65***		0.04		27.01***

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

Appendix 1. List of industries and provinces under study

No.	Sector	No	Provinces
1	food product	1	Hanoi
2	beverages	2	Phu Tho
3	textiles	3	Ha Tay
4	apparel and leather products	4	Hai Phong
5	wood products	5	Nghe An
6	paper products	6	Quang Nam
7	printing and reproduction of recorded media	7	Khanh Hoa
8	petroleum products, chemical, pharmaceutical and plastics	8	Lam Dong
9	non-metallic mineral products	9	Ho Chi Minh City
10	basic metal products	10	Long An
11	electronic products, equipment, machinery, transport equipment		
12	furniture and others		

Appendix 2. Description and summary statistics of key variables

VARIABLES	DESCRIPTION	2005		2007		2009		2011		All dataset	
		No. of obs. 1582		No. of obs. 1491		No. of obs. 1662		No. of obs. 1474		No. of obs. 6209	
		mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
New product	1 if firm introduces new product(s); 0 otherwise	0.481	0.500	0.0617	0.241	0.0367	0.188	0.0421	0.201	0.157	0.364
Product improvement	1 if firm makes major improvements of existing product(s); 0 otherwise	0.665	0.472	0.510	0.500	0.480	0.500	0.415	0.493	0.519	0.500
New process	1 if firm introduces new production process; 0 otherwise	0.378	0.485	0.216	0.412	0.187	0.390	0.147	0.354	0.233	0.423
Informal payment (bribery)	1 if firm bribes; 0 otherwise	0.568	0.496	0.392	0.488	0.452	0.498	0.463	0.499	0.469	0.499
Training of worker	1 if firm normally trains its workers; 0 otherwise	0.233	0.423	0.300	0.458	0.144	0.351	0.131	0.337	0.201	0.401
Percentage of professional worker	Ratio of professional workers to employees	0.0597	0.0915	0.0474	0.0755	0.0504	0.0768	0.0402	0.0712	0.0496	0.0796
Owner Higher Education	1 if respondent has at least a university degree; 0 otherwise	0.313	0.464	0.292	0.455	0.292	0.455	0.278	0.448	0.294	0.456
Export	1 if firm is an exporter; 0 otherwise	0.0784	0.269	0.0711	0.257	0.0650	0.247	0.0421	0.201	0.0644	0.246
Log of firm size	Log of number of employees	2.524	1.127	2.457	1.130	2.376	1.060	2.126	1.048	2.374	1.102
Average Bribe in i-sector j-province	Mean of bribe by sector and province	0.568	0.208	0.392	0.179	0.452	0.243	0.463	0.207	0.469	0.221