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The impact of petty corruption on firm innovation in Vietnam

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I. The effect of corruption on firm innovation

1. Introduction

The literature on the relationship between corruption and innovation is both meager in terms of number of studies and indeterminate in terms of findings. First, there is a paucity of theoretical and empirical studies on how corruption affects innovation, although there is of course a related and more substantial strand of literature relating to corruption and economic efficiency/growth. There are in fact very few, relatively recent empirical studies that directly examine the impact of corruption on innovation at either firm level or national level. However, countries under study include economies at different levels of development with an emphasis on transition and developing economies. Second, there is not yet a universal consensus on the effects of corruption on innovation. While most authors find that corruption negatively affects innovation, there is also some evidence that indicates a positive relationship between corruption and innovation, especially for countries where institutions and governance structures are not effective.

Before proceeding further it seems worthwhile to briefly consider of innovation and corruption. Innovation is regarded as a key driver of increased productivity and economic growth worldwide, especially in view of the new growth theory (see, for example, Romer (1990); Grossman and Helpman (1991); Aghion and Howitt (1992)). In this sense, innovation can be regarded 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.

By corruption is meant the abuse of public office by civil servants or officials for illegitimate private gain (World Bank (1997)). In most empirical studies corruption is typically measured by Transparency International's Corruption Perception Index (CPI) or briberies of public officials. Some authors (see, for example, Habiyaremye and Raymond (2013)) further classify corruption by scale (grand vs. petty) or by country of origin of bribe offerors (domestic firms vs. foreign firms). Under this approach 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. relatively small payment to bureaucrats).

The remainder of this section is organized as follows. Section 1 provides a succinct summary of theoretical arguments concerning the possible effects of corruption on innovation. This is basically a review of the sand the wheels vs. grease the wheels hypotheses as applied to

innovation. Section 2 reviews the empirical studies, focusing on their definitions of key variables, data sources, estimating methods and findings.

a. Review of theoretical arguments/models

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. 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 IMF, World Bank or OECD perceive corruption, culminating in international initiatives such as the United Nations (UN) Convention against Corruption (UN Office on Drugs and Crime (2004)) or the OECD's Convention on Combating Bribery of Foreign Public Officials in International Business Transactions (OECD (2011)).

Various theoretical arguments have been put forward in the literature to support the above orthodox viewpoint. Myrdal (1968) suggested that corrupt public servants may cause unnecessary delays to extract a bribe. Such delays tend to harm innovative efforts. Consistently, Veracierto (2008) 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 (1997), although there is analogy between corruption and competitive auction, 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. In this case, corruption may reduce rather than increase the incentive to innovate.

Corruption has been argued to increase uncertainty and transaction costs and thus make a potentially promising innovative opportunity much less attractive commercially (see, for example, Luo (2004)). 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 (see, for example, Mahagaonkar (2010: 81)). There is also a related view put forward by Shleifer and Vishny (1993) that true level of innovation may get inflated in the presence of corruption. This is because corrupt firm 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 (1991) suggested 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 (1998) argued that corrupt officials have an incentive to create distortions in the economy to protect their illegal income. Such distortions may hinder innovation. Further, the host country's corruption may also have a negative impact on its inflow 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 host country's innovative activity (Habiyaremye and Raymond (2013)).

The grease the wheels hypothesis represents the alternative, more controversial viewpoint. According to this line of thinking, advanced by Leff (1964) and Leys (1965), 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 (Leys (1965)). This idea was supported by Lui (1985) who demonstrated 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 (1965) and Bailey (1966) that corruption can improve the quality of public servants when government salaries are low.

An insight offered by Left (1964) is that the most generous briber can also be the most efficient producer. Subsequently Lien (1986) and Beck and Maher (1986) formally demonstrated that corruption can duplicate the outcome of a competitive auction aimed at assigning government procurement contract. In this sense, corruption can improve efficiency or innovation by providing the projects for the most efficient firms. A later study of Acemoglu and Verdier (1998) suggested that property rights enforcement, which is decided by public officials, is the key condition for wealth creation. Consequently, it is necessary to prevent all corruption. However, the cost associated with so doing may be prohibitively high, making the socially optimal recourse allocation obtained with less than full enforcement of property rights and some corruption.

Opponents of the 'efficiency enhancing' or 'innovation enhancing' school of thoughts have argued that the positive impact of corruption is based on weak and unjustifiable assumptions. For instance, the size of the bribery may be determined by corrupt officials

rather by corrupt firms. Similarly, corrupt bureaucrats are most likely to work to promote economic growth or innovation. Against Leff (1964)'s argument, Tanzi (1998) claimed that the rigidities are not the nature of the society, but created by the governmental 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 (1968) also stated that in case of corruption, rather than accelerating the administrative procedure, officials would maintain the rigidities in order to receive more briberies. Kaufmann and Wei (2000) supported this view, arguing that since bureaucrats can endogenously choose regulatory burden 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 cost of capital. Furthermore, in contrast to Beck and Maher (1986)'s claim, 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 (Tanzi, 1998).

In summary, there are alternative theoretical ways of viewing the impact of corruption on innovation, particular for 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 that both hypotheses can 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 in the next subsection.

b. Review of empirical studies

There are very few empirical studies that directly examine corruption as a determinant of innovation. Broadly speaking, those empirical studies 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 employs firm-level data. In general, findings from those studies tend to confirm the sand the wheels hypothesis that corruption hampers innovation although evidence to support the grease the wheel hypothesis has also been established in more limited circumstances. Like the literature on corruption and economic growth, the two problems most frequently encountered in empirical studies on corruption and innovation are the simultaneity and robustness of the relationship between the two key variables under study.

In a study of socioeconomic determinants of innovation, Griffiths and Kickul (2008) classified EU countries, Japan and the US into four groups (leaders, followers, trailing and catching up) on the basis of each country's innovation index. Data for this study was mainly derived from Eurostat 2006 supplemented with Transparency International's 2005 CPI. A multivariate discriminated analysis (with the four groups as dependent variables and nine independent variables including CPI) found three significant discriminated functions where the first accounts for 76.4% of the discriminating power and highly aligned with CPI, high-tech workers (as a percentage of labor force), R&D (as a percentage of GDP) and industrial R&D (also as a percentage of GDP). Further, a box plot of country innovation classifications and CPI reveals 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 (2010) 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 (2008), Natário et al (2011) 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 (2011) identified four groups of European countries with different patterns regarding their performance in terms of innovative capacity. Their analysis showed the first cluster (Australia, Germany, Estonia and Luxemburg) having the greatest innovative capacity is associated with the highest level of corruption control, whereas the third cluster (Bulgaria, Spain, Hungary, Lithuania, Malta, Poland, Romania and Slovakia) having the least innovative capacity is associated with the lowest level of control of corruption. Thus, the findings of this study support the sand the wheels hypothesis.

Anokhin and Schulze (2009) drew on longtitude data covering 64 countries from 1996 to 2002 (from multiple sources) to test the hypothesis that improvement in corruption control raises the level of innovation at a decreasing rate. The key explanatory variable, control of corruption, was taken from Kaufmann, Kraay and Mastruzzi (2006)'s World Governance Indicators (WGI) whereas information about domestic innovation was obtained from World Devepoment Indicators (WDI) data series (World Bank (2003)). Other control variables included wealth (log of GDP per capita in constant 1995 US dollars), trade openness (log of

foreign trade as a percentage of GDP) and size (log of population). Using random effects negative binomial regression when innovation was defined as number of patent application, the linear effect of control of corruption on innovation was not signfificant but the squared-term effect was significantly positive. In contrast, using feasible generalized least squares when innovation was proxied by the rate of increase in domestic factor productivity, the study identified a marginally significant linear effect of control of corruption on innovation, but no effect for its square. In summary, there is some evidence to support a positive relationship between corruption control and innovation but the evidence is not strong.

A relatively recent study using firm-level data is that of Mahagaonkar (2010). This study focused on African countries which are often considered to have weak governance structures, making them suitable to test the sand/grease the wheels hypotheses. An interesting feature of this study was 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 was 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.

A more recent study by de Waldemar (2012) found strong evidence to support the sand the wheels hypothesis. The data for this study was 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. They key variables are product innovation (whether a new product has been introduced) and bribery (sector-sate average of firms' responses). Other control variables are conventional determinants of product innovation and firm characteristics. Using probit estimation, bribery was shown to have a negative and significant effect in all specifications. The results were robust in terms of both the endogeneity test (via the use of instrumental probit estimation) and the introduction of a multi-product dummy variable. Thus, there is solid evidence that corruption in the form of bribery diminishes the probability of new products being introduced by Indian firms.

The harmful effect of corruption on innovation can also arise from foreign firms' practice in host countries. In a very recent study, Habiyaremye and Raymond (2013) examined 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 collected information for the year 2007 from about 12,000 firms in 30 coutnries in Eastern Europe and Central and Western Asia. Three binary measures of innovation were employed: 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 were utilized, namely the percentages of fimrs 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 full information amximum likelihood methoad was then employed to estimate a simultaneous-equatiosn trivariate probit models involving three innovation measures as the dependent variables. The findings can be summarized as follows: (i) grand corruption by foreign firms is detrimental to all types of innovation while grand corruption by doemstic firms have no effect on the three innovation emasures, (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 doemstic firms causes the most harm to innovation.

Another useful reference for the present study is a recent paper by Rand and Tarp (2012). Although this study did not examine the relationship between corruption and innovation, it utilized the same panel data set that will also be employed in the present study. Rand and Tarp (2012) aimed to study the determinants of bribes and changes in bribe paying behavior in Vietnam using a panel data set with information on 1,658 SMEs in 10 major provinces of Vietnam in 2005 and 2007. Employing a pooled probit model and a fixed effects linear probability model, bribe incidence was found to be significantly related positively to firm's size, firm's willingness to pay (proxied by profit per employee) and firm's outside option (proxied by capital/labour ratio), and negatively to a time dummy variable. Other explanatory variables such as receipt of government assistance, international trade and business registration were also found to be statistical significant. Using the Blinder–Oaxacca decomposition, their study suggested that "changing 'preferences' played the key role in lowering bribe incidence between 2005 and 2007 (Rand and Tarp (2012: 585)).

2. Empirical Strategy and Data Description

Our empirical strategy bases on the analysis of Fisman and Svensson (2007). In their studies, the authors discussed that corruption behavior in general and bribe payment in particular may be endogenous to firm performance. Actually, many business elements could have effect on both of corruption and firm productivity (as well as firm innovation capacity). Corrupt bureaucrats could observe firms performance across time and have their own assessment of firm ability, therefore, firms in the same sector and/or in the same area may pay different bribes. In some circumstances, there exists a potential reverse causality between corruption and firm performance. For example, in a business environment where exists long administrative delays and slow-moving queues for public services, a firm who 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.

To deal with preceding barriers, following Fisman and Svensson (2007), we classify corruption of firm into two types.

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

where $corr_{ij}$ refers to idiosyncractic element and $corr_j$ is the part of corruption determined by industry-location. It means that the location element of corruption $corr_j$ is affected by the underlying characteristics inherent in a particular area; therefore, we assume that $corr_j$ is exogenous to the firm.

Our previous discussion showed that there are several unobservable factors that could affect both firm innovation capacity and corruption, leading to the bias estimate of $corr_{ij}$. However, with assumption about $corr_j$, it is clearly seen that $corr_j$ is uncorrelated with firm innovation capacity; hence, we can overcome the bias estimation by using $corr_j$ as an instrumental variable of $corr_{ij}$.

Our initial empirical model is:

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

$INNO_i$ is a dummy variable that proxy for whether firm has any type of innovation activities or not. We concern several types of firm innovation activities in our model such as (i) product innovation: whether firm produce new goods or not, (ii) process innovation: whether firm has a new production process, (iii) improving product: whether firms improve

its available products, (iv) new innovation: whether firm has new innovation or new production process, and (v) general innovation: whether firm has at least one of above innovation activities.

X_{ij} is a vector of observable factors that affect innovation, while θ_{ij} is unobservable one; ε_{ij} is zero-mean error term.

Using instrumental variable, our model becomes:

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

where $corr^{IV}_i$ is the fitted value from the first stage regression, using dummy variable of corruption by industry and location. Meanwhile, we use four other instrumental variables in order to have overidentifying restrictions: (i) the Vietnam provincial competitiveness index (PCI), (ii) whether firm is customer of a state firm or not, (iii) whether firm is supplier of a state firm or not, (iv) whether firm is inspected by government officials or not.

All necessary data could be achieved by using the database of the Survey of Small and Medium Scale Manufacturing Enterprises (SMEs) in Vietnam from 2005 to 2011. The survey is conducted every 2 year from 10 provinces of Vietnam and provides information of about 2500 firms in 12 industries each year. For each interviewed enterprise, two types of questionnaire were taken: (i) the main questionnaire asked about various characteristics and performance of enterprise; (ii) the labour questionnaire was to collect information on wages, work and job satisfaction of workers. One advantages of using data from Vietnamese SMEs survey is that it collects information about all aspects of business activities such as enterprise history, production characteristics, investments, assets, liabilities, credit, networks of enterprise and entrepreneurs, economic constraints and potential, etc. It is a fruitful source for study on Vietnamese SMEs performance.

In line with the dummy variable of corruption by industry and location, we also use PCI as one of instrumental variables for corruption. Introduced in 2005 as the results of the collaboration between the Vietnam Chamber of Commerce (VCCI) and the U.S Agency for International Development (USAID), PCI is designed to assess the ease of doing business, economic governance, and administrative reform efforts by local governments of 63 provinces and cities in Vietnam.

The information of firm corruption is collected from SMEs survey and measured as a dummy variable that describe whether firm pays for informal or communication fee. Though in SMEs survey, firms are asked about the amount of bribe, firms surely tend to deny answering the question or to cheat at their answer. Hence, it is obviously that using dummy variable is more reliable.

When studying the factors that affect on firm innovation activities, we should pay attention on firm investment in several aspects such as (i) production capacity, (ii) replacing old equipments, (iii) improving their productivity, and (iv) improving their quality of outputs. In addition, human capital is also needed to improve firm innovation; therefore, we add the dummy variable of whether firm invests in training workers, the ratio of profesional worker over firm workforce and the dummy variable of whether the respondent got higher education or not in our model. Finally, we include a dummy variable denoting whether firm exports or not and log of firm size to capture firm competitiveness. Summary statistics are reported in Appendix 1.

3. Empirical Results

The empirical results are introduced in table 1. In general, corruption has negative impact on all types of innovation; however, the magnitude and significance of coefficients for each type are different. There are three main types of innovation in our paper as (i) improving product, (ii) new product, and (iii) new process. They are dummy variables describing whether firm implements these types of innovation or not. Using logit method, corruption has a significant impact on only the decision of developing new product. The coeficient of corruption in case of new product is -0.045 and it significant at level of 10%. If a firm corrupts, the probability of developing new product will decrease 0.045. Corruption has largest impact on firm decision of improving product (-0.057) however, this impact is insignificant.

When we consider innovation in a wider perspective such as whether firm implements any type of new innovation (new process or new product) or any type of innovation (improving product or new process or new product), the impact of corruption becomes clearer and more significant. Probability of implementing new innovation and general innovation of corrupted firm is less than transparent firms of 0.083 and 0.075, respectively (coressponding to the significance at 1% and 5%, respectively).

In addition, almost control variables have impact on innovation as expected. The more firm invests in their infrastructure (such as production capacity, equipments) and outputs, the larger probability firm implements innovation activities. It is also understandable that bigger firms would have more innovation activities. All coeficients of investment variables and log of firm size are positive and significant at level of 1% for all types of innovation.

In the rest of control variables, whether the respondent got higher education (variable higherEdu) does not affect the firm decision of implementing innovation. The other variables affect this decision in different ways. The investment in training workers affects all types of innovation at 1% level of significant, but improving products. The ratio of professional worker over workforce does not affect innovation of new products, and export does not affect innovation of new process.

In our models, we also capture the differences among years, industrials, and provinces. The main highlight is the decisions of innovation decreases from 2005 to 2011. All coeficients of year variables are negative and significant at level of 1% for all types of innovation.

Table 1. Logit estimates and IV estimates of corruption on innovation

	(Logit) Improving product	(RE) Improving product	(Logit) New product	(RE) New product	(Logit) New process	(RE) New process	(Logit) New innovation	(RE) New innovation	(Logit) innovation	(RE) innovation
corruptionDHat	-0.057	-0.239	-0.045*	-0.503*	-0.019	-0.137	-0.083***	-0.558***	-0.075**	-0.360*
	(0.035)	(0.180)	(0.026)	(0.284)	(0.030)	(0.217)	(0.032)	(0.205)	(0.035)	(0.184)
invCapacity	0.122***	0.595***	0.038***	0.416***	0.174***	1.255***	0.175***	1.141***	0.164***	0.859***
	(0.015)	(0.077)	(0.010)	(0.109)	(0.012)	(0.095)	(0.012)	(0.089)	(0.014)	(0.080)
invReplace	0.133***	0.658***	0.046***	0.504***	0.182***	1.317***	0.179***	1.170***	0.213***	1.116***
	(0.023)	(0.118)	(0.015)	(0.162)	(0.018)	(0.135)	(0.020)	(0.129)	(0.023)	(0.126)
invProductivity	0.174***	0.848***	0.057***	0.629***	0.190***	1.362***	0.203***	1.313***	0.202***	1.041***
	(0.031)	(0.161)	(0.018)	(0.199)	(0.023)	(0.170)	(0.025)	(0.166)	(0.032)	(0.169)
invQuality	0.311***	1.536***	0.079***	0.870***	0.361***	2.665***	0.368***	2.450***	0.351***	1.828***
	(0.055)	(0.263)	(0.026)	(0.289)	(0.032)	(0.248)	(0.038)	(0.257)	(0.059)	(0.291)
invNew	0.168***	0.850***	0.093***	1.027***	0.248***	1.815***	0.255***	1.673***	0.208***	1.106***
	(0.043)	(0.219)	(0.024)	(0.260)	(0.029)	(0.222)	(0.033)	(0.225)	(0.044)	(0.233)
training	0.026	0.128	0.063***	0.696***	0.069***	0.512***	0.087***	0.576***	0.052***	0.276***
	(0.017)	(0.083)	(0.010)	(0.111)	(0.013)	(0.092)	(0.013)	(0.090)	(0.017)	(0.087)
rpro	0.178**	0.860*	0.083	0.920	0.360***	2.636***	0.357***	2.364***	0.188**	0.959**
	(0.091)	(0.440)	(0.052)	(0.575)	(0.067)	(0.486)	(0.070)	(0.481)	(0.090)	(0.458)
higherEdu	0.026*	0.125	0.002	0.019	0.013	0.095	0.014	0.087	0.017	0.077
	(0.016)	(0.077)	(0.009)	(0.106)	(0.012)	(0.088)	(0.013)	(0.085)	(0.015)	(0.080)

exportD	0.058*	0.307**	0.037**	0.413**	0.024	0.202	0.040*	0.276*	0.061*	0.343**
	(0.032)	(0.155)	(0.016)	(0.177)	(0.022)	(0.152)	(0.024)	(0.152)	(0.033)	(0.167)
lnFirmSize	0.062***	0.307***	0.020***	0.223***	0.052***	0.378***	0.056***	0.373***	0.065***	0.342***
	(0.008)	(0.041)	(0.005)	(0.055)	(0.006)	(0.047)	(0.006)	(0.045)	(0.008)	(0.043)
2.time	-0.134***	-0.675***	-0.408***	-2.934***	-0.117***	-0.779***	-0.311***	-1.737***	-0.165***	-0.899***
	(0.017)	(0.089)	(0.015)	(0.157)	(0.015)	(0.104)	(0.016)	(0.104)	(0.016)	(0.094)
3.time	-0.166***	-0.834***	-0.427***	-3.390***	-0.151***	-1.049***	-0.344***	-1.969***	-0.194***	-1.042***
	(0.017)	(0.087)	(0.014)	(0.175)	(0.014)	(0.102)	(0.016)	(0.104)	(0.016)	(0.091)
4.time	-0.173***	-0.873***	-0.411***	-2.994***	-0.149***	-1.032***	-0.331***	-1.876***	-0.176***	-0.963***
	(0.018)	(0.090)	(0.014)	(0.166)	(0.016)	(0.110)	(0.017)	(0.108)	(0.017)	(0.094)
2.sector	-0.036	-0.193	0.019	0.248	-0.032	-0.229	-0.029	-0.194	-0.027	-0.134
	(0.038)	(0.199)	(0.022)	(0.269)	(0.033)	(0.229)	(0.033)	(0.222)	(0.039)	(0.198)
3.sector	0.188***	0.935***	0.093***	1.037***	-0.074***	-0.523**	0.012	0.101	0.183***	0.952***
	(0.036)	(0.185)	(0.026)	(0.241)	(0.026)	(0.214)	(0.031)	(0.199)	(0.036)	(0.194)
4.sector	0.229***	1.109***	0.047***	0.564***	-0.074***	-0.524***	-0.022	-0.114	0.194***	0.994***
	(0.027)	(0.135)	(0.017)	(0.193)	(0.022)	(0.167)	(0.023)	(0.155)	(0.026)	(0.138)
5.sector	0.200***	0.959***	0.064***	0.750***	-0.016	-0.069	0.040	0.287*	0.188***	0.951***
	(0.032)	(0.154)	(0.020)	(0.218)	(0.026)	(0.174)	(0.028)	(0.168)	(0.030)	(0.159)
6.sector	0.017	0.064	0.017	0.223	-0.051*	-0.352*	-0.027	-0.163	0.030	0.141
	(0.035)	(0.177)	(0.020)	(0.257)	(0.026)	(0.205)	(0.028)	(0.200)	(0.035)	(0.180)

7.sector	0.118***	0.580***	0.059**	0.695***	0.014	0.116	0.053	0.360*	0.105***	0.533***
	(0.035)	(0.182)	(0.024)	(0.254)	(0.031)	(0.210)	(0.034)	(0.204)	(0.034)	(0.186)
8.sector	0.115***	0.565***	0.047***	0.569***	-0.025	-0.159	0.008	0.063	0.102***	0.525***
	(0.025)	(0.124)	(0.015)	(0.178)	(0.021)	(0.147)	(0.022)	(0.141)	(0.025)	(0.126)
9.sector	0.037	0.200	0.037**	0.459**	-0.065***	-0.466**	-0.030	-0.198	0.040	0.212
	(0.033)	(0.154)	(0.019)	(0.214)	(0.024)	(0.186)	(0.026)	(0.175)	(0.032)	(0.156)
10.sector	0.186***	0.913***	0.058***	0.687***	-0.043**	-0.287**	0.006	0.061	0.158***	0.810***
	(0.021)	(0.104)	(0.013)	(0.151)	(0.018)	(0.126)	(0.018)	(0.119)	(0.020)	(0.105)
11.sector	0.100***	0.512***	0.058***	0.687***	-0.039	-0.259	-0.008	-0.035	0.081***	0.427***
	(0.030)	(0.155)	(0.021)	(0.220)	(0.025)	(0.183)	(0.027)	(0.176)	(0.031)	(0.158)
12.sector	0.199***	0.945***	0.114***	1.234***	-0.033	-0.230	0.058**	0.392***	0.184***	0.928***
	(0.027)	(0.136)	(0.018)	(0.183)	(0.023)	(0.158)	(0.025)	(0.149)	(0.026)	(0.141)
25.province	0.017	0.098	-0.022	-0.235	-0.052*	-0.367*	-0.072**	-0.478**	-0.012	-0.046
	(0.038)	(0.189)	(0.026)	(0.291)	(0.030)	(0.223)	(0.031)	(0.215)	(0.038)	(0.194)
28.province	0.057	0.290	-0.044**	-0.497**	0.016	0.114	-0.026	-0.167	0.025	0.126
	(0.042)	(0.205)	(0.020)	(0.227)	(0.033)	(0.207)	(0.034)	(0.205)	(0.043)	(0.216)
31.province	0.065**	0.322**	0.058***	0.567***	-0.071***	-0.506***	-0.042*	-0.252*	0.043*	0.236*
	(0.027)	(0.138)	(0.019)	(0.173)	(0.020)	(0.157)	(0.022)	(0.148)	(0.025)	(0.144)
40.province	-0.082***	-0.396***	-0.038**	-0.425**	-0.014	-0.069	-0.036	-0.218	-0.100***	-0.510***
	(0.028)	(0.148)	(0.018)	(0.206)	(0.022)	(0.167)	(0.024)	(0.162)	(0.027)	(0.151)

49.province	-0.019	-0.083	-0.029	-0.313	-0.053*	-0.358*	-0.038	-0.231	-0.017	-0.076
	(0.038)	(0.171)	(0.025)	(0.253)	(0.029)	(0.211)	(0.031)	(0.194)	(0.035)	(0.174)
56.province	-0.008	-0.021	-0.004	-0.045	-0.024	-0.139	-0.049*	-0.307*	-0.033	-0.157
	(0.031)	(0.162)	(0.022)	(0.223)	(0.026)	(0.191)	(0.026)	(0.185)	(0.029)	(0.165)
68.province	0.051	0.250	0.017	0.180	-0.029	-0.194	0.029	0.193	0.092***	0.505***
	(0.035)	(0.185)	(0.025)	(0.247)	(0.033)	(0.223)	(0.034)	(0.202)	(0.033)	(0.192)
79.province	-0.010	-0.043	-0.044***	-0.493***	-0.034*	-0.247**	-0.052***	-0.344***	-0.032	-0.160
	(0.022)	(0.109)	(0.014)	(0.146)	(0.018)	(0.125)	(0.019)	(0.120)	(0.021)	(0.112)
80.province	-0.065**	-0.330**	0.027	0.278	-0.044	-0.323*	-0.017	-0.111	-0.040	-0.221
	(0.032)	(0.164)	(0.022)	(0.225)	(0.027)	(0.196)	(0.029)	(0.182)	(0.030)	(0.165)
N	5968	5968	5968	5968	5968	5968	5968	5968	5968	5968
R^2	0.103		0.328		0.171		0.209		0.127	

Endogeneity

Controlling for the endogeneity, we instrument for corruption using the mean of dummy variable of corruption by industry and location as well as several instrumental variables such as PCI, the dummy variable of whether firm is supplier/customer of state firms, and of whether firm is inspected by government officials. The first stage is introduced in Appendix 2.

Using instrumental variable and running regressions with firm random effect method, the trend of impact of variables is unchanged; however, the magnitude of coefficient generally bigger in absolute value. In more detail, the coefficient of corruption still negative and significant at level of 10% in case of innovation of new product, but the absolute value of coefficient increase from 0.045 to 0.503, the change in magnitude is quite large. Similary, this absolute value increases from 0.083 to 0.558 in case of new innovation (the significance is at 1%), and from 0.075 to 0.360 in case of general innovation (the significance decrease from at 5% to 10%). Although the coefficient of corruption in case of improving product and innovation in new process are still larger and negative, they are statistical insignificance. These findings consolide above evidence for the impact of corruption on firm innovation activities.

4. Conclusion

Using the panel data of Vietnamese Small and Medium Scale Manufacturing Enterprises from 2005 to 2011, we have checked the impact of corruption on firm innovation activities and have shown a negative, robust, and strong relationship. To our knowledge, this paper provides the very first evidence for the impact of corruption on firm innovation activities in Vietnam. It contributes to recent studies that pay attention on corruption as well as its effects. In line with our paper on the effect of corruption at country level data, this paper using firm level data confirms that corruption is a major barrier against development and growth. As expected, corruption is generally harmful to economics and the policy makers should try more to create and to change the institutions and incentive systems in order to prevent corrupted activities.

APPENDIX 2. First stage resutl

	corruptionD		
mean_SL	0.906***	2.time	-0.034
	(0.022)		(0.022)
pci	0.001	3.time	-0.032
	(0.001)		(0.022)
stateFirm_C	0.002	4.time	0.047**
	(0.015)		(0.024)
stateFirm_S	0.052**	2.sector	-0.044
	(0.022)		(0.031)
inspected	0.076***	3.sector	-0.067**
	(0.013)		(0.032)
invCapacity	0.095***	4.sector	-0.059**
	(0.014)		(0.024)
invReplace	0.036	5.sector	-0.048*
	(0.022)		(0.027)
invProductivity	0.123***	6.sector	-0.091***
	(0.028)		(0.032)
invQuality	0.053	7.sector	-0.044
	(0.046)		(0.032)
invNew	0.125***	8.sector	-0.056**
	(0.037)		(0.022)
training	0.046***	9.sector	-0.050*
	(0.016)		(0.026)
rpro	0.219***	10.sector	-0.010
	(0.080)		(0.018)
higherEdu	0.005	11.sector	-0.073***
	(0.014)		(0.026)
exportD	0.031	12.sector	-0.031
	(0.027)		(0.024)
lnFirmSize	0.063***	_cons	-0.294***
	(0.007)		(0.073)
		N	5968
		R^2	0.249

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