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## **Corruption and Innovation: A Grease or Sand relationship?**

by

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## **Corruption and Innovation: A Grease or Sand relationship?**

March 2008

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### **Abstract**

This paper provides a firm-level empirical analysis on the ways in which corruption affects innovative activity. Particularly with respect to the African continent that is striving to reconcile with instability and poverty, this issue seems to be of utmost importance. Using a newly available dataset on African firms, it is shown that corruption has a negative effect on product innovation and organisational innovation. Corruption does not affect process innovation while it facilitates marketing innovation.

JEL-classification: D73, O14, O31, H11, H25

Keywords: Corruption, Developing Economies, Product Innovation, Process Innovation, Organisational Innovation, marketing Innovation, Taxation

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## 1. Introduction

One of the main, yet confounding features of many economies is corruption. Lambsdorff (2002) finds that corruption is much detrimental than rent-seeking to welfare. Therefore leakages of this form are of an interesting nature particularly in the context of economic growth. While one strand of research views corruption as a boost to economic growth (For example- Leff, 1964), the other views it as a hindrance (for example-Mauro, 1995). While most of the “hindrance” literature relies on the linkage of corruption to growth through its affect on investment, Meon and Sekkat (2005) find that corruption affects growth independently from its impact on investment. There is a need therefore to study channels of economic growth that are affected by corruption. This paper deals with one such channel namely-innovative activities. Innovation has been found increasingly positive for economic growth (mainly from the technology-gap approach, see Fagerberg 1994). Innovative activities might get affected by corruption due to lack of resources or lack of trust in institutions. A related view is suggested by Schleifer and Vishny (1993) that corrupt firms would often report having advanced technologies, even though they are not needed necessarily. This would mean that the amount of innovative activity seems large only due to the presence of corruption. This issue is of utmost importance in the context of less developed countries (LDCs) that have to cope with socio-political-economic instabilities and bureaucratic pressures and yet at the same time have to keep up with economic growth.

There is a need therefore to empirically investigate the assumption that corruption hinders innovation. I take the approach of corruption as a barrier to innovation, but still maintain that not all kinds of innovative activities are affected negatively by corruption. Innovative activities that require use of public property (like permits, licenses) might get affected differently by corruption. Innovative activities that do not require use of public property exclusively need not get affected by corruption. This paper tries to contribute to the literature on innovation and public choice by exploring this issue by using a large-scale firm-level database- the World Bank Enterprise Survey conducted in 2004<sup>1</sup>. Using probit and Instrumental variable probit models it is found that corruption hinders product

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<sup>1</sup> Enterprise Surveys, The World Bank Group. <http://www.enterprisesurveys.org/>

innovation and organisational innovation and has a positive effect on marketing innovation. Process innovation however, does not get affected.

## **2. Corruption: does it *grease or sand the wheels of innovation?***

One can ask if corruption<sup>2</sup> greases or sands the wheels of innovation. Using the adage generally applied to growth<sup>3</sup> to innovation leads us conveniently into two types of arguments. One corruption as a barrier and other as a boost to innovation. Taking the 'grease the wheels aspect' one can argue in terms of four dimensions. *Firstly*, innovative firms need faster approvals of permits, new licenses and permissions to get new technology as fast as possible. If these have to come through a heavily bureaucratized structure the time lag involved would ultimately cost the firms a market leading advantage. Such scenario can be viewed as a race between two symmetric firms needing permits for starting innovative activities or getting their innovative output in the market. The only difference we could assume is that of the ability to corrupt a government official handling the permit procedures. In this case if the official allots permits to the firm that has a higher ability to corrupt, then it wins the innovation race and therefore a market lead. On the other hand, corruption could act as an incentive for bureaucrats to help fasten the process of getting the permits etc. This argument follows closely in line with the formal model of Lui (1985). Mainly it can be seen as the need for government property on order to either launch innovative activities or to introduce finished innovative products into the market.

*A second dimension* can be regarding firms undertaking incremental innovation. Corruption can act as a regular feature that a firm has to undertake to avoid any uncertainty. Corrupt firms can be certain that their requirements of permits etc. will be granted since it can be seen that a long term relationship may exist between the corrupt firms and officials. Relationship corruption may therefore act as a facilitator for long-

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<sup>2</sup> Throughout the study corruption means bureaucratic corruption, where interaction between public and private actors is the avenue for corruption (see Schielfer and Vishny, 1993 for definition of bureaucratic corruption)

<sup>3</sup> see Meon and Sekkat (2005) for an empirical test of corruption and growth argued in these lines.

term planning and as an uncertainty reducing mechanism mainly in countries with sluggish administration and low monitoring levels.

*The third dimension* is that of jumping the policy hurdle. Practice of the policy regulations by firms is limited to their discretion of whether it is perceived as harmful or beneficial. Policy makers need not always come up with the solutions that business owners think of best, rather there seems to be a gap between second best and best solutions that are undertaken. Bailey (1966) argues that private agents may adopt and overlooked better solution than the solution provided by policy makers, through corruption. On the other hand, in unfriendly governance systems which do not allow much scope for innovation, corruption just might prove helpful for firms that would like to innovate and undertake entrepreneurial activities. Leff (1964) and Bailey (1966) view corruption therefore as a reaction to bad policies and hence jump the policy hurdle. *The fourth dimension* comes again from Leff (1964) of corruption as a facilitator to boost the scope and scale of investment since it acts as a hedge against political risks. Corruption may prevent blockage to firms' flow and planning of innovative activities by keep away organised crime and vandalism.

Having discussed the four aspects relating to the grease the wheels of innovation argument, some problems can be associated with the above. Firstly, are corrupt officials taking the right decisions? In lieu of corruption incentives officials may resort to adverse selection where firms with good projects but having low bribing abilities may never get the needed permits. Secondly, in terms of relationship corruption, it is highly questionable that such long lasting relations will keep away uncertainty since political stability and need for secrecy may only allow short-term dealings. So in this way a firm can never be assured of any future benefits from corruption from the same person. Since these assumptions can be very well questioned, we turn to view arguments that put forward corruption as 'sanding the wheels'.

## **2.1 Corruption: “The sand –the- wheels of Innovation” hypothesis**

Apart from the usual suspects (Finance, networks, intellectual property framework, lack of skills, market-barriers) of barriers to innovation, the aspect of bureaucratic barriers cannot be ignored. Apart from long administrative procedures and restrictive laws and regulations (Acs and Audretsch, 1990), corruption may actually hinder innovative activities. Qian and Xu (1998) put forward a theoretical model to suggest that ‘bureaucracy makes mistakes by rejecting promising projects and delays innovation. As discussed in the ‘grease the wheels’ argument, if two firms are thought of in a race for permits, the loser cannot -as a result- initiate innovative activities. Secondly, if the financial markets were thought of as perfect, any loss to investment due to corruption costs could have been made up for. On the investment angle therefore, corruption can be seen as hindering R&D investment or early stage investments mainly in the presence of imperfect financial markets. Qian and Xu (1998) attribute another aspect- namely the governance of the economy. In centralised economies parallel projects involving high uncertainties are discouraged by bureaucracy. This is especially true if projects are government funded rather than private funded. A fourth aspect is that of deliberate delay. Government officials tend to delay granting permits, until they reach a threshold level of bribe that they can extract and/or wait until the maximum offer is made. This can act as a discouragement to firm which would therefore prefer not undertaking any innovative activity.

Hierarchical structure of bureaucratic decision making may also lead to delays (Myrdal 1968) and subsequent increase in the total bribe payments. On the other hand, if many independent actors are involved the cost of corruption gets higher (Schleifer and Vishny 1993). In this case the firm either chooses to undertake the cost or not take it at all. If it chooses to take the cost then the investment on innovative activities may get hit. In both the cases the firm’s optimal R&D is either not reached or never undertaken, making the firm stick to routinised activities in the industry it belongs to.

Are corrupt firms innovative? Not necessarily. Rose-Ackerman (1997) and Mankiw and Whinston (1986) put forward two ways in which low quality firms exist and enter the markets. Firstly, the highest briber payer might just compromise on the quality of products, since the market existence is assured. Second- entry of a bribing firm might be

detrimental to welfare. In these two cases, it can be argued that existence and persistence of corruption may very well hinder either innovative firms to continue innovation activities or firms to start innovative activities in general.

All the above arguments also show that it is governance, institutions and hierarchical structure of bureaucracy that hinders firms from either starting innovative activities or getting their innovative products to enter the markets. It can be quickly observed that activities that require public property explicitly are affected by innovation rather than the activities that do not- specifically activities within the firm.

Inherently this can be seen as an empirical question in the context of relevant economy or a group of economies with similar socio-political and economic and cultural backgrounds. Empirically, the connection between corruption and innovation has not been undertaken yet. I contribute to the literature on public choice and innovation by suggesting that one of the channels that corruption uses to affect growth is through innovation. However empirically I do not claim to test this triple link of growth-innovation and corruption. I initiate the process by looking into the ways in which corruption affects four types of innovation namely- product innovation, process innovation, marketing innovation and organisational innovation. I use the OECD definitions (OECD, 2005) for these concepts. The detailed definitions and measurement are provided in the data section.

I test the 'grease the wheels' vs. 'sand the wheels hypotheses' on the above four types of innovation. By far I explore the issue empirically but I also propose that only innovative activities that require explicit permits etc, are affected by corruption rather than the 'within firm' activities. In the present context I argue that product, process and organisational innovations are the likely candidates that corruption might affect and not necessarily process innovation.

In the following section, I throw some light on literature dealing with corruption and innovation in the African context, after which I put forward the data and estimation



methodology used. This will be followed by the results of the empirical analyses. In the last section I conclude and provide some implications for further research.

### **3. Corruption and Innovation in Africa**

African countries have been consistently identified as the most corrupt by the Transparency International<sup>4</sup> in terms of the corruption perception index. Schleifer and Vishny (1993) provide innumerable examples on how and in what forms corruption prevails in the continent. They put forward an interesting example that shows that in Mozambique a bottle making factory had to resort to ordering a unique technology ten times the cost of the technology actually needed. This happened solely because secrecy can be easily imposed on transactions that are unique to the country since no alternate bids exist and therefore invoices can be inflated and everyone gets the share.

Mbaku (1997) puts forward an excellent historical perspective on reasons for high level corruption in Africa. The general view is that bureaucratic corruption in Africa is said to be a result of the weakness of the state. Incumbent regimes often shape their policies to cater the need of small business elite and thus may not be able to suit the common masses. It can be easily seen as to why entrepreneurship can face many hindrances in this case. Mbaku views that inefficiency and incompetence among civil servants as an important issue. 'An important prerequisite for steady economic growth is an efficient civil service'. Further 'the bureaucracy must be responsive to the needs of the entrepreneurial class in order to encourage and enhance innovation and productivity in the economy' (Mbaku, 1997, p.127). The most important fact is that African countries suffer with poor and ineffective enforcement of regulations which encourages corruption. This corroborates with Schleifer and Vishny (1993) who view that this might pave way for distortionary effects.

Apart from these reasons, chronic poverty, political instability, low literacy levels, widespread income inequalities continue to be prominent reasons for corruption. Even

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<sup>4</sup> For transparency international's country wise Corruption Perception Index, visit: <http://www.icgg.org>

though we can see that in the African context corruption may be a bad news for innovative activity, the arguments posed by Leff (1964) basing on LDCs, against this conclusion need to be verified too. Mainly studies in this line refer to benefits of corruption (see Mbaku, 1997 for a concise review in the African context). No evidence was found supporting the argument of formation of investible capital from corruption (LeVine, 1975 for Ghana), as was the same with the argument of access to bureaucracy. The question whether corruption removes bottlenecks in the bureaucracy has not been tested specifically. Just as in other cases, in the African context too a very few studies have been conducted to test the effect of corruption on economic growth and particularly with respect to innovation. The main obstruction has mainly been the lack of reliable data and usable measures of corruption for the continent.

#### **4. Data and Methodology**

Finding corruption data along with innovation is rare. The need to provide the interested parties in providing quality information on country investment climates led to the World Bank 'Productivity and the Investment Climate Private Enterprise Survey'. The data provides firm level information on investment climate depending on legal, financial and social dimensions. Additionally information on crime, corruption and innovation is also provided. The data provides views of the respondents on these aspects and also information on the firm. This survey was conducted from 2002 to 2004 for different countries.

The initial country sample consisted of Benin, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mali, Mauritius Mozambique Nigeria, Senegal, South Africa, Tanzania, Uganda and Zambia. Due to data completeness requirement samples from Benin, Madagascar, Mali, Mauritius, Tanzania, Zambia and South Africa were only considered. The sample size was 3477 firms out of which 292 are from Madagascar, 84 from Mali, 157 from Malawi, 184 from Mauritius, 584 from South Africa, 184 from Tanzania and 88 from Zambia. Due to the nature of the sample, all the firms were pooled and country effects were accounted for.

#### **4.1 Variables and Empirical Strategy**

Since the main motive is to analyse the effect of corruption on four types of innovations, four different equations were estimated. The following is the description of the dependent variables and how they were measured. The dependent variable of interest is innovation. Innovation can be measured in different manners depending on what is being studied. In this paper the focus is on the OECD manual on guidelines for collecting and interpreting innovation data that helps in measuring innovation (OECD, 2005). Broadly innovations are classified into four types basing on the responses in the World Bank survey:

*Product Innovations:* Introduction of a good or service that is new or significantly improved with respect to its characteristics and intended uses. From the World Bank survey, this data is coded as binary from the questions on whether the firm has developed a new product line and /or upgraded an existing product line.

*Process Innovations:* Implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. The process innovations can be intended to decrease unit costs of production or delivery. Process innovation was measured as a binary using response from the questions on whether the firm introduced new technology that has substantially changed the way that the main product is produced and if a major production activity was outsourced that was previously conducted in-house.

*Marketing Innovations:* Implementation of a new marketing method involving significant changes in product placement, promotion etc. Examples of marketing innovations include introduction or obtaining new product licensing. This was measured again as a binary from responses whether the firm obtained a new licensing agreement.

*Organisational Innovations:* Implementation of new organisational method in firm's business practices, workplace organisation and external relations. This variable was measured also as a binary with response to the answer whether the firm agreed to a new joint venture with a foreign partner. Although the OECD definitions have been widely

debated upon, the OSLO manual has continuously adopted the critical changes that were suggested. For empirical purposes and suitability of data source, the OECD definitions have been used.

Most of the explanatory variables are consolidated from different strands of literature along with the variable of interest-corruption and some are included for exploratory purposes. Since this paper concentrates on bureaucratic corruption, corruption is measured as gifts or informal payments to public officials to 'get things done' on an average as a percentage of sales. The variables regarding determinants and barriers of innovation were consolidated from different strands of literature. Even though the set of variables is very vast, only the stylised variables are taken into consideration here since the variable of interest is mainly corruption. Morck and Yeung (2001) provide a complete review of the economic determinants of innovation. Some of the variables could not be taken due to unavailability of data.

The following are the stylised variables in the innovation literature Firm size (for example., Kamien and Schwartz, 1982; Acs and Audretsch 1988; Scherer, 1992, Geroski, 1994), reinvested profits and problems with access to finance (Schumpeter, 1952; King and Levine 1993; Hall, 2002), technology transfer and networking effects (Love and Roper, 1999), human capital and skilled workforce or technological change that is skill biased (Lawrence and Slaughter, 1993; Berman, Bound and Griliches, 1994). The variables regarding technology transfer and networking effects were measured by questions on whether the firms use technology from clients or suppliers or develop in house. Skill levels were measured by observing if the firm's manager is highly educated and if the firm has a highly educated workforce (in both measures high is measured as more than 12 years of education). Firm size is measured as three categories based on number of employees [small <20, medium(20-99), Large 100> ]

The following four equations were empirically tested:

Equation 1: Product innovation as a function of corruption, reinvested profits, firm size, client technology, supplier technology, in-house technology, foreign ownership, financial access problem and country effects were considered.

Equation 2: Process innovation as a function of corruption, reinvested profits, firm size, highly educated manager, highly educated workforce, financial access problem, foreign ownership and country effects.

Equation 3: Marketing innovation as a function of corruption, reinvested profits, firm size, client technology, supplier technology, in-house technology, foreign ownership, financial access problem, highly educated manager, highly educated workforce.

Equation 4: Organisational innovation as a function of corruption, reinvested profits, firm size, client technology, supplier technology, in-house technology, foreign ownership, financial access problem, highly educated manager, highly educated workforce.

Since the dependent variables are binary in nature discrete choice estimation methods were used. Since there might exist an inherent endogeneity problem in the corruption variable that it might itself be a function of the success of the firm or any other corruption related behavior or the firm and its environment, suitable instruments were used for each of the above estimations. The instrument list includes sales to government, firm's perception of the efficiency of the government (Schleifer and Vishny, 1993), faith in judiciary, taxes paid. Due to the rank and order condition requirement of instrumental variable estimation, the program STATA<sup>5</sup> automatically uses all the other explanatory variables also as instruments for the instrumented variables.

The Wald test of exogeneity is then used to decide if the proposed model of endogeneity was the right decision to use. In the case of product, marketing and organisational innovation the null hypothesis of Wald test (that there is no endogeneity inherent) was rejected and that supports the use of instrumental variable model, while in case of process innovation and ordinary probit model was found to be sufficient. Instrumental variable

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<sup>5</sup> Stata version 10.0 <http://www.stata.com/> ; estimation commands: ivprobit, probit

probit (Newey, 1987) estimation was used for product, process and marketing innovations whereas probit estimation was used for process innovation. In the following section some descriptive statistics and estimation results are presented.

## 5. Results

Out of the sample of 3477 firms, 1289 firms report product innovations, 902 firms report process innovations, 93 report marketing innovations and 81 report organisational innovations. The descriptive statistics and estimation tables are provided in the appendix. Table 1 provides descriptive statistics of the variables of interest. As can be seen there is much variation in the data. This might be due to country level differences. Table 2 provides some indicative country level statistics<sup>6</sup> through which we can see that countries are different in many aspects. On an average almost 1.4% of sales is reported to have been given as bribes, the highest in Kenya and the lowest in South Africa. Government efficiency is relatively high in South Africa, followed by Mali and Senegal, the lowest being Zambia and Kenya. South Africa also leads in terms of faith in judiciary, least losses due to vandalism. Firms in Senegal, however pay less in terms of taxes. Mali has the youngest firms while Senegal has many small firms. However, it has to be noted that in absolute terms all the countries except Kenya report similar views on judiciary, losses due to vandalism and government efficiency.

Table 3 reports the maximum values reported as unofficial payments to government officials as a percentage of sales. The reported values vary a lot with the countries. The maximum reported values happen to be mostly in South Africa, whereas the least are in Tanzania. Overall it can be seen that there is a high level of corruption amounts that reaches the government officials from firms. Especially in the countries where the frequency is high, the effect might be multifold. Table 4, 5, 6 and 7 report the four main estimations. The estimation strategy was to first estimate innovation dependent on the explanatory variables, controls and country dummies, while instrumenting the corruption variable and then checking for the Wald test for exogeneity. Several control variables

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<sup>6</sup> detailed statistics will be provided on request.

were considered in each estimation such as sales, asset size, industry common bribes, sector dummies but none of these were found to be significant.

### 5.1 Estimation results

*Product Innovation:* Table 4 presents the instrumental variable probit estimates of the effect of corruption on product innovation. An increase in corruption affects negatively on the likelihood for product innovation. Reinvested profits increase the likelihood of product innovation while problem with access to finance decreases the likelihood. Technology from suppliers and clients seems to increase the likelihood of product innovation. Coming to firm size, as is well known in other developing countries- it is the large firms that increase the likelihood to have product innovations. The country dummies were coded with respect to South Africa, therefore it can be observed that Benin and Zambia are significantly different in product innovations.

These results confirm the expectations that corruption is a bigger hindrance to product innovation since the firms have to get the new products into the market and therefore have to face many bureaucratic hurdles in the process. As mentioned in the ‘sand-the-wheels’ hypothesis, this effect stays valid since we can see the negative effect of an imperfect financial market through the financial access variable. Not just financial access but the fact that firms have to rely on their retained profits shows that the pressure of corruption as a cost on investment in innovative activities might be large.

*Process Innovation:* Due to the acceptance of the Wald test, only probit estimates were used and presented in Table 5. As expected there is no significant effect of corruption on process innovations. Reinvested profits, large firms, highly educated managers and workforce increase the likelihood of process innovations. Tanzania is likely to produce less process innovations than South Africa whereas Mali is likely to produce more.

This result too confirms the earlier expectations made that corruption does not affect activities inside the firm since process innovation does not need a direct usage and requirement of government property. Inherently it is a ‘within’ firm activity.

*Marketing Innovation:* Table 6 presents the instrumental variable probit estimates for marketing innovations. Marketing innovation was measured as whether firms obtained new licensing agreement. In this manner, corruption increases the likelihood of marketing innovation as does the financial access problem. No significant country effects are found. This result is interesting. In one way it can be thought of the support for the ‘grease-the wheels’ hypothesis. Especially in the context of Africa, it seems to be important to be corrupt to obtain licenses. This can also be thought of an empirical support that obtaining licences needs corruption. How far is licensing an innovation is a matter of debate. Firms that have a problem with financial access may resort to more licensing in order to increase their market opportunity in the future and may want to use the grant of licenses as a signal to obtain finance.

*Organisational Innovation:* Table 7 presents the instrumental estimation results for organisational innovation. Organisational innovation was measured with respect to the starting of an external joint venture. Corruption decreases the likelihood of organisational innovations, if technology from clients is utilised then it decreases the likelihood too, financial access problem decreases the likelihood to have organisational innovations. Mali and Zambia are significantly different and more likely than South Africa to have organisational innovations. This result too confirms the ‘sand the wheels’ hypothesis showing that corruption decreases the probability of external relations. One argument that can be posed is that when it comes to external relations one might expect more bureaucratic hurdle especially in societies that are totalitarian, or centrally managed. On the other hand client relationships decrease the likelihood to have an external joint venture. This may be due to cultural reasons and to keep new foreign entrants away from the domestic markets. Imperfect markets also hinder organisational innovation.

## **6. Conclusion**

In this paper I presented arguments of corruption as a sand and grease in the wheel of innovation. I put forward arguments on both points of view and propose that what matters inherently is the type of innovation that is in the context and what is the degree of involvement of public property in the given innovative activity. In this manner, I considered four types of innovation namely- product, process, marketing and



organisational innovation basing on the OECD definitions. I proposed that corruption is more disruptive to innovative activities mainly due to imperfect financial markets, selection of wrong projects by officials due to adverse selection, deliberate delays, decrease investment and increase in cost of corruption. I also proposed that the 'within' firm activity may not be affected by corruption since it does not exclusively use public property. The empirical results on countries in African continent suggest that corruption affects product innovation, process innovation and organisational innovation negatively and helps improve marketing innovation. This paper has started the process of linking the effect of corruption on growth through innovation. Of course the paper has its own limitations due to sample size and some definitional issues. Future avenues for research include theoretically linking the triple link of growth-innovation-corruption. This paper contributes both to the literature on public policy and economics of innovation. One of the main aspects of the paper was to give four dimensions of innovation measure and see the effect of corruption on each of this dimension. This method proves useful in showing that it depends on the type of innovation when it comes to analysing whether corruption is a grease or sand in the wheels of innovation.

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## APPENDICES

**Table 1. Descriptive Statistics**

Variable	Mean	Standard Deviation
Corruption (percentage of sales)	1.38	5.50
Govt. Efficiency (low1-high 6)	3.08	1.27
Faith in judiciary (low1-high6)	3.76	1.38
Losses due to vandalism (percentage of sales)	0.90	3.04
Firm size (number of workers)	140.1	404.8
Taxes (percentage of sales)	71.35	36.09
Firm age (survey year-year of establishment)	20.97	19.6

Source: Enterprise Surveys, The World Bank Group

**Table 2. Country-Wise Averages**

Variable	Kenya	Mali	Senegal	South Africa	Tanzania	Zambia
Corruption (percentage of sales)	4.41	3.16	0.44	0.12	0.63	1.42
Govt. Efficiency (low1-high 6)	1.89	3.43	3.22	3.56	3.17	2.11
Faith in judiciary (low1-high6)	3.42	3.48	3.63	4.29	3.09	3.52
Losses due to vandalism (percentage of sales)	1.17	0.67	0.74	0.48	0.94	3.66
Firm size (number of workers)	146.5	41.35	56.28	237.29	99.88	145.15
Taxes (percentage of sales)	86.46	71.71	20.18	90.84	65.75	86.66
Firm age (survey year-year of establishment)	27.26	12.60	16.01	24.63	18.20	23.55

Note: Means reported, Source: Enterprise Surveys, The World Bank Group

**Table 3. Maximum values of corruption as a percentage of sales**

Country	Percentage of Sales
Benin	50
Madagascar	70
Malawi	30
Mali	15
Mauritius	66
South Africa	90
Tanzania	10
Uganda	29
Zambia	30

**Table 4. Effect of Corruption on Product Innovation –probit estimates**

Explanatory Vars	Product Innovation			
	PRODINN	Instrumented Var Corruption	athrho	Insigna
Corruption	-0.159*** (0.042)			
Reinvested Profits	0.00222* (0.0012)	0.00943** (0.0047)		
Firm Size	0.319** (0.15)	-0.176 (0.25)		
ownership	-0.164 (0.12)	-0.345 (0.42)		
client_tech	0.242 (0.20)	-0.819* (0.43)		
supp_tech	0.238* (0.14)	-0.118 (0.39)		
inhousetech	0.312* (0.18)	-0.291 (0.38)		
Financial Access Problem	-0.524*** (0.11)	-2.433*** (0.32)		
Multiple Businesses		3.738 (4.44)		
Sales to Govt.		-0.0104 (0.0091)		
Efficiency of Govt.(low-high)		0.0856 (0.13)		
Faith in Judiciary		-0.252** (0.13)		
Quality Certification Awarded		-0.652* (0.35)		
Taxes Paid generally		-0.0119** (0.0055)		
Benin	0.838*** (0.27)	4.480*** (0.74)		
Madagascar	0.102 (0.17)	0.927* (0.56)		
Mali	-0.0887 (0.26)	1.082 (0.80)		
Mauritius	0.0349 (0.17)	0.540 (0.63)		
Tanzania	-0.0224 (0.19)	-0.465 (0.74)		
Zambia	0.858*** (0.29)	3.130*** (0.95)		
Constant	0.0647 (0.26)	-0.0590 (4.58)	0.918** (0.44)	1.555*** (0.023)
Observations	953	953	953	953
P>Chi2	0.0000			

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table 5. Effect of Corruption on Process Innovation –probit estimates**

	<b>PROCESS INNOVATION</b>
	<b>PROCINN</b>
<b>Reinvested Profits</b>	0.00558*** (0.0019)
<b>Firm Size</b>	0.200** (0.090)
<b>Highly Educated Manager</b>	0.177*** (0.049)
<b>Highly Educated Workforce</b>	0.00403** (0.0020)
<b>Finance Access Problem</b>	0.0866 (0.12)
<b>Mali</b>	0.604** (0.24)
<b>Tanzania</b>	-0.586*** (0.20)
<b>Zambia</b>	-0.365 (0.23)
<b>Corruption</b>	0.00329 (0.013)
<b>Constant</b>	-1.473*** (0.33)
<b>Observations</b>	591
<b>P&gt;chi2</b>	0.0000
<b>Standard errors in parentheses</b>	
*** p<0.01, ** p<0.05, * p<0.1	



**Table 6. Effect of Corruption on Marketing Innovation – Instrumental variable probit estimates**

	Marketing Innovation			
	Instrumented variable		athrho	Insigma
	MARKINN	Corruption		
<b>Corruption</b>	0.199*** (0.050)			
<b>Reinvested Profits</b>	-0.000687 (0.0018)	0.00657 (0.0070)		
<b>Firm Size</b>	0.218 (0.18)	-0.315 (0.33)		
<b>client_tech</b>	0.0854 (0.15)	-0.737 (0.45)		
<b>supp_tech</b>	-0.199 (0.16)	0.402 (0.43)		
<b>inhousetech</b>	0.149 (0.14)	-0.283 (0.41)		
<b>Highly Educated manager</b>	0.0682 (0.069)	-0.0828 (0.17)		
<b>High Educated workforce</b>	0.00268 (0.0019)	-0.00847 (0.0072)		
<b>Finance Access problem</b>	0.288*** (0.11)	-1.101*** (0.41)		
<b>Mali</b>	-0.302 (0.26)	1.623* (0.90)		
<b>Tanzania</b>	0.230 (0.26)	-0.203 (0.79)		
<b>Ownership</b>	0.210 (0.14)	-0.731 (0.54)		
<b>Sales to govt</b>		-0.0246 (0.015)		
<b>Efficiency of Govt.</b>		0.0291 (0.11)		
<b>faith in Judiciary</b>		-0.114 (0.17)		
<b>Quality certification awarded</b>		0.507 (0.34)		
<b>Taxes</b>		-0.00667 (0.0083)		
<b>Constant</b>	-1.614 (1.13)	3.138** (1.54)	-2.032* (1.06)	1.477*** (0.032)
<b>Observations</b>	508	508	508	508
<b>P&gt;chi2</b>		0.0000		

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Table 7. Effect of Corruption on Organisational Innovation – Instrumental variable probit estimates**

	Organisational Innovation			
	ORGINN	Corruption	athrho	Insigma
<b>Corruption</b>	-0.212***			
	(0.011)			
<b>Reinvested Profits</b>	0.00234	0.00813		
	(0.0016)	(0.0070)		
<b>Firm Size</b>	-0.0172	-0.185		
	(0.085)	(0.34)		
<b>client_tech</b>	-0.189*	-0.910**		
	(0.10)	(0.46)		
<b>supp_tech</b>	0.0137	0.281		
	(0.11)	(0.45)		
<b>inhousetech</b>	0.00487	-0.287		
	(0.11)	(0.42)		
<b>Highly Educated manager</b>	0.0120	-0.110		
	(0.052)	(0.18)		
<b>High educated workforce</b>	-0.000480	-0.00621		
	(0.0019)	(0.0073)		
<b>Finance Access Problem</b>	-0.289***	-1.383***		
	(0.095)	(0.41)		
<b>Mali</b>	0.459**	1.421		
	(0.23)	(0.92)		
<b>Tanzania</b>	-0.0367	-0.214		
	(0.18)	(0.79)		
<b>Zambia</b>	0.784***	3.504***		
	(0.22)	(0.95)		
<b>Sales to govt</b>		-0.00897		
		(0.0079)		
<b>Efficiency of Govt.</b>		0.141		
		(0.12)		
<b>faith in Judiciary</b>		-0.0638		
		(0.090)		
<b>Quality certification awarded</b>		-0.599		
		(0.41)		
<b>Taxes</b>		0.00120		
		(0.0026)		
<b>Ownership</b>		-0.173		
		(0.22)		
<b>Constant</b>	-0.218	1.948	2.358***	1.517***
	(0.61)	(1.24)	(0.77)	(0.031)
<b>Observations</b>	535	535	535	535
<b>P&gt;chi2</b>	0.0000			
<b>Standard errors in parentheses</b>				
<b>*** p&lt;0.01, ** p&lt;0.05, * p&lt;0.1</b>				