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Does Firm Level Corruption Increase Innovation: A Case of Lower-Middle Income Economies

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Firms take part in innovation to increase their market share, competitiveness, and productivity which eventually expands their profits. Significant literature has been devoted to exploring the factors determining innovation, however, the impact of corruption on innovation is rarely studied. The purpose of this paper is to estimate the effect of bribe payments on innovative activities of the firms. For this purpose, the Logistic Regression model is applied to Word Enterprise Survey data of lower-middle-income countries. The results supported the grease the wheels' hypothesis in the case of lower-middle-income countries, i.e. corruption increase the likelihood of innovation. The registered firms, manager's experience, external audit, and exporting firms have a positive effect on the probability of innovation.

Key words: *Firm level corruption, Innovation, World Enterprise Survey, Logistic regression, Lower-middle income economies*

JEL Classification: D73, O31, L25

1. Introduction

It is generally understood that innovation is the engine of growth and competitiveness. The procedure of innovation comprises of different layers of information and physical assets (Schumpeter, 1934). It is a process, in which knowledge and other resources are converted into an output (Aghion and Tirole, 1994). New products that result from the innovation process remain at the heart of economic growth (Lööf & Heshmati, 2006). Innovation contributes to the evolution of new firms, industries and large corporations. The economic literature suggests that innovation activities are a significant driver for firm performance (Basile, 2001; Damijan

& Kostevc, 2015). In the literature, though much effort has been devoted for exploring the factors determining innovation[1], the impact of corruption on innovation is rarely studied. Corruption has shown mixed effects on economic growth. Economic growth corruption works to "grease the wheel" (Jiang and Nie, 2014; Mendoza et al., 2015; Sequeira and Djankov, 2014; Veracierto, 2008; Vial and Hanoteau, 2010) as well as to "sand the wheel" (Anokhin and Schulze, 2009; Asiedu and Freeman, 2009; Fisman and Svensson, 2007). Based on these relationships, it is assumed that corruption may give rise to innovation, as it may drive firms to design products to evade the tax net and initiate marketing innovation to maximise the sales by illegal means such as concealing the facts about a product from the inspection teams. In this way corruption may increase the innovation capacity of the firm. On the other hand, corruption encourages the firms to maximise the profits through illegal means, so they do not need to instate innovation activities. Consequently, corruption may affect the innovation negatively.

Lower middle-income nations have specific characteristics of high corruption and lower innovation. It is shown in Table 1.

Table 1: Corruption and Innovation in Global Income Groups of the Countries

Corruption		Innovation	
Income Groups	**Percentage of firms giving informal payment to public officials**	**Income Groups**	**Innovation Index**
High Income	10.44	High Income	61.5
Upper Middle Income	12.82	Upper Middle Income	38.6
Lower Middle Income	20.80	Lower Middle Income	20.36
Low Income	26.13	Low Income	15.93

Source: Calculated by the authors using the data set from World Enterprise Survey (2019) and Global Innovation Index (2019).

The figures in Table 1 reveal that lower-middle income nations have a high percentage of corruption in the form of informal payments to public officials and the second lowest innovation index in global income groups. The researchers and policymakers are interested in investigating the effects of corruption in the economies. Keeping in view the incidence of corruption in lower-middle income groups and the importance of innovation in a firm's long-term growth, this paper examines the impact of corruption on a firm's innovation in lower-middle income economies. Macroeconomic studies provide aggregate measures that cannot disclose variation in corruption and innovation within the economies (Fisman and Svensson, 2007). Cross-country evidence shows that corruption impedes innovation in emerging countries (Paunov, 2016). Similarly, corrupt nations have weak organisations that are probably going to decrease firms' innovation

[1] It ranges from national level factors (Cameron, 1996; Furman, Porter, & Stern, 2002; Hirshleifer et al., 2013; Jain, 2001; Lederman, 2010; Paunov, 2016b) to firm level determinants (Goedhuys et al., 2016; Imran et al., 2020; Jiang & Nie, 2014; Kuncoro, 2004; Mendoza et al., 2015; Vu, Tuyen, Nguyen, & Lim, 2016).

(Hirshleifer et al. 2013; Jain, 2001). However, there is large heterogeneity in the nature of institutions in different income groups. The current study focuses on a group of economies rather than a single country to identify the real effect of corruption on innovation. Irrespective of the massive research work on firm-level studies in this area, to the best of our understanding, no study has investigated this issue for lower-middle income economies. It is an attempt to empirically test the hypothesis that firm level corruption "grease the wheel" or "sand the wheel" for firm innovation.

Earlier studies have identified several determinants of innovation, such as credit market requirements (Acharya et al., 2013; Benfratello et al., 2008), financial constraints (Brown et al., 2013) and institutional investors (Aghion et al., 2013). However, only a few studies explored the effects of institutional features on a firm's innovation, such as bankruptcy and labour laws (Acharya et al., 2013), financial development (Ayyagari et al., 2014) and political uncertainty (Bhattacharya et al., 2017; Cumming et al., 2016). Only a few studies have analysed the effect of corruption on business policies and outcomes. For example, Beck et al. (2005) and Fisman and Svensson (2007) discovered that corruption constrains firm growth. The current study will add to the literature by taking an institutional feature, that is, corruption, as an important factor in the innovation-generating process by using a data set of the World Enterprise Survey.

2. Review of Literature

There is a consensus among researchers and policymakers that corruption may have a negative or positive effect on firm innovation and performance. "Sand the Wheel" is evidenced by a number of studies. For instance, corruption reduces likelihood of innovation (Aidt, 2009; Anokhin & Schulze, 2009; Shleifer & Vishny, 1997; Ugur & Dasgupta, 2011). Waldemar (2012) proved the sanding hypothesis of corruption and governance for Indian enterprises. Beltrán (2016) analysed the effect of corruption on the employment of Latin American firms. The study used the World Enterprise Survey and concluded that corruption decreases employment in Latin American firms. Lee, Wang, and Ho (2020) examined the sanding hypothesis in emerging and developing countries using firm level data of the World Enterprise Survey. They measured innovation activity through patents and quality certificates. The results confirmed the existence of a sanding hypothesis which is that corruption decreases the likelihood of innovation. At the macro level, corruption creates distortions in the economy (Kurer, 1993), diverts resources to inefficient areas and reduces investment (Mauro, 1995).

On the other side, corruption has a positive effect on innovation and firm performance and supports the "grease the wheels" hypothesis (Dreher & Gassebner, 2013; Huang, 2016; Imran, Rehman, & Khan, 2019; Imran, Rehman, & Khan, 2020; Méon & Weill, 2010; Nguyen, Doan, Nguyen, & Tran-Nam, 2016). Goedhuys, Mohnen, and Taha (2016) investigated the effect of corruption and institutional obstacles on innovation. The results of the conditional recursive

mixed process model revealed that corruption has a positive effect on innovation when interacted with bureaucracy to bypass the problems of red tape in obtaining a permit for starting a new innovative business. Wen, Zheng, Feng, Chen, and Chang (2018) measured domestic innovative activity by trademark applications and the number of patents. They estimated the effect of corruption on innovation using a linear panel fixed-effect model for 29 OECD countries. The study also employed non-linear panel smooth transition regression by using lagged values of explanatory variables as instrumental variables. The results explained the positive relationship between corruption and innovation.

Xia, Tan, and Bai (2018) measured corruption by informal payments and concluded that corruption increases the possibility of innovation. Riaz and Cantner (2019) used six different types of innovation to measure the effect of corruption on innovation for 16 developing and emerging economies using data from the World Bank Enterprise Survey. They used monetary and institutional measures of corruption and found that the monetary dimensions of corruption have a positive impact on innovation. The results also revealed that political corruption improves innovative activities of large firms. Xie, Qi, and Zhu, (2019) used institutional theory to identify the contextual condition of the impact of corruption on innovation in China using the World Enterprise Survey. The results showed that competitive threat and policy instability positively moderates the effect of corruption on product innovation. The study blamed institutional weaknesses and managerial implications as an ethical dilemma regarding the positive effect of corruption on innovation. The current study contributes in terms of data by filling the gap in the existing literature related to lower-income groups and also by considering the effect of corruption in the form of informal payments to public officials on product, process, marketing and organisational measures of innovation.

3. Methodology

To test the impact of corruption on firm innovation, the World Bank Enterprise Survey (WBES) of 48 lower middle-income countries is utilised. The sample consists of 11069 firms. The dependent variable in the analysis is firm level innovation, which covers all four indicators of firm innovation provided by WBES: production innovation, process innovation, marketing innovation and organisation innovation. Corruption is the core variable, while the control variables are mainly comprised of firm-specific characteristics.

The probability of firm innovation in logit specification is shown in Equation 1:

$$L_i = Ln\left(\frac{P_i}{1-P_i}\right) = \Omega_0 + \Omega_1 COR_i + \Omega_2 X_i + u_i \qquad 1$$

Where, $P_i = 1$ is the probability of innovation and $P_i = 0$ is that of no innovation. COR (corruption) is a variable of interest and X_i is the vector of control variables specifically exports, external audit, skilled workers, manager experience and firm-specific characteristics such as

registration and ownership of firm, firm age, and size. The above model is given in equation form as:

$$\Pr(\text{PRODINN}_i = 1) = \Omega_0 + \Omega_1\text{COR}_i + \Omega_2\text{DOMF}_i + \Omega_3\text{REGF}_i + \Omega_4\text{AOF}_i + \Omega_5\text{SOF}_i + \Omega_6\text{MEXP}_i + \Omega_7\text{EAUD}_i + \Omega_8\text{SWOR}_i + \Omega_9\text{EXP}_i + \varepsilon_i \quad (2)$$

$$\Pr(\text{PROCINN}_i = 1) = \Omega_0 + \Omega_1\text{COR}_i + \Omega_2\text{DOMF}_i + \Omega_3\text{REGF}_i + \Omega_4\text{AOF}_i + \Omega_5\text{SOF}_i + \Omega_6\text{MEXP}_i + \Omega_7\text{EAUD}_i + \Omega_8\text{SWOR}_i + \Omega_9\text{EXP}_i + \varepsilon_i \quad (3)$$

$$\Pr(\text{MARINN}_i = 1) = \Omega_0 + \Omega_1\text{COR}_i + \Omega_2\text{DOMF}_i + \Omega_3\text{REGF}_i + \Omega_4\text{AOF}_i + \Omega_5\text{SOF}_i + \Omega_6\text{MEXP}_i + \Omega_7\text{EAUD}_i + \Omega_8\text{SWOR}_i + \Omega_9\text{EXP}_i + \varepsilon_i \quad (4)$$

$$\Pr(\text{ORGINN}_i = 1) = \Omega_0 + \Omega_1\text{COR}_i + \Omega_2\text{DOMF}_i + \Omega_3\text{REGF}_i + \Omega_4\text{AOF}_i + \Omega_5\text{SOF}_i + \Omega_6\text{MEXP}_i + \Omega_7\text{EAUD}_i + \Omega_8\text{SWOR}_i + \Omega_9\text{EXP}_i + \varepsilon_i \quad (5)$$

Where $PRODINN_i$ is product innovation, measured by "firms that introduce new or significantly improved products or services over the last three years". PROCINN_i is the process innovation, measured by "firms that introduce new or significantly improved process". MARINN_i is marketing innovation, measured by "firms that introduce new or significantly improved marketing technique". ORGINN_i is organisational innovation, measured by "firms that introduce new or significantly improved management practices". The innovation measures are converted into binary variables coded 1 for yes and 0 for no. Based on the empirical evidences discussed in the previous section, it is speculated that corruption has a negative impact on innovation. Corruption (COR) is measured by "firm gives gifts to public officials (to get things done)". Diaby and Sylwester (2014) has taken this measure as a proxy for petty corruption[2]. We used a more inclusive approach by taking it as a measure of aggregate corruption at the firm level to quantify the relationship between innovation and corruption to explain whether introduction of new products, process, marketing technique and management practices is associated with greater bribe payments to public officials. The aggregate measures of corruption have two advantages over the disaggregated measures in the sense that firms conceal bribe payments and disaggregated measure are not accurate because they are not reported officially. Fan, Lin, & Treisman (2009) and Paunov (2016) measured corruption as the average percentage of bribery paid by firms. The domestic ownership of the firm (DOMF) is measured by the "the firms that have at least 10% ownership by the domestic individuals, companies, or organisations". REGF is firm registration and is measured by the "establishment formally registered when it began operations." AOF is firm age and is measured by "the year the establishment began operations". The firms' size (SOF) is measured by "the number of permanent workers" (small firms= worker

[2] Transparency International (2017) classified corruption into three groups, i.e. petty, grand and political corruption.

> 5 and < 20; medium firms= worker > 20 and < 99; large firms= worker >100). We have combined smaller and medium size firms and coded them as 0, large firms are coded as 1. MEXP is manger experience in completed years. EAUD is external audit and is measured by "firms with annual financial statement reviewed by an external auditor" (Safavian et al., 2001). SWOR is skilled workers and is measured by "proportion of skilled workers out of all production workers". EXP represent exports of the firm measured by "proportion of total sales that are exported directly".

4. Results and Discussion

The results of binary logistic model to estimate the probability of innovation are given in Table 2.

Table 2: The Result of Logistic Regression

Variables	Product Innovation	Process Innovation	Marketing Innovation	Organisational Innovation
Corruption (COR)	.3321049* (.0710528) {4.67} [0.000]	.3326605* (.0478742) {6.95} [0.000]	.3369902* (.0227947) {14.78} [0.000]	.2159121* (.0309312) {6.98} [0.000]
Domestic Firms (DFIRM)	.0672006 (.0727667) {0.92} [0.356]	.0003214 (.0011398) {0.28} [0.778]	.0011073 (.0008193) {1.35} [0.177]	.0205588 (.0131821) {1.56} [0.119]
Registered Firms (RFIRM)	1.72261* (.0724816) {23.77} [0.000]	.8411334* (.0404037) {20.82} [0.000]	.0580655 (.0930092) {0.62} [0.604]	.0017388 (.0023458) {0.74} [0.459]
Firm Age (FAGE)	.0929652* (.0331368) {2.81) [0.005]	.8257342* (.0695681) {11.87} [0.000]	.9175361* (.02939) {31.22} [0.000]	.1392568* (.0406518) {3.43} [0.001]
Firm Size (FSIZE)	.0122064 (.0743321) {0.16} [0.870]	.1090293 (.1322449) {0.82} [0.410]	.0001742 (.0014583) {0.12} [0.905]	.0021598 (.0022302) {0.97} [0.333]
Manager Experience (MEXP)	.2268151* (.0291152) {7.79} [0.000]	.2594087* (.0258842) {10.02} [0.000]	1.07686* (.0452515) {23.80} [0.000]	.3811568* (.0473047) {8.06} [0.000]
External Audit (EAUDIT)	.5732402* (.1656518) {3.46} [0.001]	.2794362* (.0444358) {6.29} [0.000]	.7047473* (0495413) {14.23} [0.000]	.0561665* (.0167507) {3.35} [0.001]

Skilled Workers (SWORK)	.0033606 (.0021725) {1.55} [0.123]	.001207 (.0028125) {0.43} [0.668]	.0014745 (.0012777) {1.15} [0.249]	.0010892 (.0015833) {0.69} [0.492]
Exporting Firm (EXPORT)	.6407795* (.0537105) {11.93} [0.000]	.4493355* (.0553461) {8.12} [0.000]	.0734536* (.032955) {2.23} [0.026]	.5785249* (.0378293) {15.29} [0.000]
Constant	-1.240618* (.1414747) {-8.77} [0.000]	-.1111226 (.0714229) {-1.56} [0.120]	-.4421695* (.0425007) {-10.40} [0.000]	-.5903466* (.0613783) {-9.62} [0.000]
Observation	11,069			
Wald chi2 (9)	214.57			0.0000

Note: * and ** shows statistically significant at 5 and 10 percent level of significance respectively.

Corruption is the principal variable of analysis included in the model to see its impact on firm innovation. The econometric estimates revealed that corruption positively affects the innovation activities of the firms. Corruption is comparatively high in lower middle-income nations and firms' consider it as perk to overcome bureaucratic hurdles. It is supported by the literature (Goedhuys et al., 2016; Riaz & Cantner, 2019; Wen et al., 2018; Xie et al., 2019). The results support the grease the wheel hypothesis, that is, corruption augments all types of innovation. The reason for this positive relationship in lower-middle nations is the second-best alternative use of corruption. Corruption works as an "efficient tool" for firms to boost innovation activities, importing goods and services and introducing new products and processes when dealing with bureaucracy (Dejardin & Laurent, 2014). The estimates indicate a higher likelihood of innovation for products and processes by registered firms. It explains that registered firms act more seriously and professionally. The results of registered firms are insignificant for marketing and organisational innovation.

The estimates revealed that older firms are more likely to innovate. It signifies the capacity of the firm for expenditure on innovation, research and market exploration. They are more inclined towards the introduction of new products, the new design of the products as well as to adjust to the needs of the consumers. So, they spend more on innovation. The older firms are probably more efficient and have the experience of market (Kuncoro, 2004), so, they are more likely to be involved in innovation as compared to the new entrants of the industry.

Management experience contributes to firm development in a number of ways like cost minimisation, market exploration, quality of product and human resource management. In the current study the logit regression estimates have shown that an additional year of firms' management experience results in a 10.69 percent increase in product innovation, 1.67 percent

increase in process innovation, 63.91 percent increase in marketing innovation and a 83.78 percent increase in organisational innovation of the firm.

For the firm, the source of the audit has importance in a number of perspectives. That is, the audit by the external auditors makes the firms cost and resource efficient. It is assumed that the practice of external audit of the firm makes the firm efficiently utilise innovation expenditure, ultimately resulting in good innovative practices. The results of the current study have shown that the firms audited by external auditors are more likely to be innovative in product, process, marketing and organisational activities. It is supported by the literature (Wu (2009).

Firms generally face two types of markets for competition that is the domestic market and the global market. In the international market a variety of competitive products are produced by global economies. So, to compete in the international market, firms have to stress innovative activities to produce efficient and improved designs well as attractive products. So, it may be assumed that firms who are exporting the major part of the product in the international market are more likely to innovate. For the low middle-income economies, the results of the current study have shown the same, that is, exporting firms increase product, process, marketing and organisation innovation.

5. Conclusion and Policy Recommendations

The focus of the current study was to investigate the effect of corruption on different types of innovation. For this purpose, Word Enterprise Survey data of lower-middle income countries were utilised for logistic regression to find the likelihood of innovation. The results support the grease the wheel hypothesis, that is, corruption increases the probability of all types of innovation in lower-middle income countries.

As lower-middle income nations are comparatively more involved in corrupt practices and that corruption works as grease the process of innovation, the gaps in efficiency of bureaucracy in these economies are highlighted. The benefits of corruption to the firms in the form of innovation are short-term. We suggest that the government should take anti-corruption measures to reduce the corruption at firm level by institutional development in bureaucracy. The results indicate that registered firms are more inclined towards innovation so government should take measures to reduce bureaucratic hurdles for registration of firms.

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