

ESSAYS ON CORRUPTION, ALLOCATIVE INEFFICIENCY, AND MERGERS AND ACQUISITIONS

Derrick Abudu



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General Introduction

The motivation for this thesis is to unearth, for developing countries, how investment climate constraints – i.e., electricity supply and corruption – affect firms' performances and the misallocation of production inputs (i.e., capital and labour); as well as the efficacy of tax incentives in attracting inward investments in the form of mergers and acquisitions (M&As).

The first chapter assesses the implication of electricity shortages on the allocative efficiency (or misallocation) of capital and labour for a sample of about 750 Ghanaian manufacturing firms spanning the period 2011–2015. The motivation for and relevance of this empirical inquest stems from insights from nascent literature (Restuccia and Rogerson 2008; Banerjee and Duflo 2005; Hsieh and Klenow 2009) that demonstrate how allocative inefficiency of production inputs contributes to the low aggregate total factor productivity (TFP) in developing countries. The novelty of this chapter is that it does not only enhance our understanding of an underlying source of allocative inefficiency of production inputs but does so using data from a sample, as opposed to an industrial census, dominated by micro and small-sized firms, which are a salient component of a typical developing country's private sector to examine this issue.

This chapter argues that by increasing production losses, electricity shortages could dwindle firm net worth and consequently inhibit optimal employment of capital and labour. What is more, electricity shortages could heighten production uncertainty and as a result, induce firms to use capital and labour sub-optimally. Additionally, firms unable to adopt coping strategies such as using a generator might bear a higher consequence of allocative inefficiency of capital and labour and even for those opportune to do so, self-generated power, for instance, might not be sufficient to augment the deficit in power supply from the national grid. Finally, were general business conditions, such as lending relationships with financial institutions to wane as a result of electricity shortages this could also cause sub-optimal employment of capital and labour.

I gauge allocative inefficiency for capital and labour by observing firm-level gaps in marginal revenue products to marginal costs for these inputs. Specifically, I rely on an approach due to Petrin and Sivadasan (2013) to quantify the marginal revenue products of capital and labour from parameters obtained by estimating production functions. These measures of allocative inefficiency of production inputs are then combined with firms' self-reported electricity outages data which I deem to be arguably random because the observed variation in this information across firms owes to the sporadic power rationing schedule the Electricity Company of Ghana implemented during the course of that time.

My findings on this empirical inquest confirm that electricity shortages induce firms to reduce the employment of capital and labour as well as the compensation (wages) for the latter. There is also evidence indicating that electricity shortages are efficiency (TFP) sapping. Coming to the substantive findings, they uncover that electricity shortages increase the allocative inefficiency capital and labour. What is more, I unearth that the electricity shortages–induced allocative inefficiency of capital are more pronounced for firms that are electricity constrained. Finally, the findings uncover that for firms that own generators, the effect of allocative inefficiency of production inputs is more pronounced. Implying that, intuitively, for these firms either self-generated power is insufficient to augment deficit power supply from the national grid or the net benefit of self-generating power is unfavourable hence inhibiting optimal usage of production inputs.

The second chapter investigates the impact of tax incentives on inward foreign investments in the form of mergers and acquisitions (M&As) for a sample of 91 developing countries. Although the extant literature (Hines, 1996; Devereux and Griffith, 1998; Bénassy-Quéré, Fontagné and Lahrière-Révil, 2005; Huizinga and Voget, 2009) evidentially informs us about the sensitivity of firm location decision or FDI to taxation particularly for advanced countries, little is known about the efficacy of conditional (or targeted) tax incentives in inducing foreign investors particularly for developing countries.

The essentiality of understanding how conditional concessionary tax rates matter for inward M&As owes its credence, in part, to studies that evidence that low tax rates attract intangible foreign capital and enhance R&D activities (Karkinsky and Riedel 2012; Bandick, Görg, and Karpaty 2014), and that location-based tax incentives increase the number of new entrants (Chaurey 2017). So that if developing countries' governments are providing conditional concessionary tax rates, it is policy-relevant to ascertain their efficacy in inducing foreign investors. What is more, developing countries represent an important case study for an empirical inquest of this nature because the efficacy of tax incentives in advanced countries might not be the same for these countries owed to differences in physical and institutional infrastructures as well as potential agglomeration benefits.

The empirical inquest of this chapter relies on a recently created unique data set which contains information on standard tax rates as well as conditional concessionary tax rates which include those that hinge on specific locations or special economic zones (SEZs), R&D, scale of capital or employment, and exporting. Empirically, the chapter utilises econometric approaches – i.e., a control function approach combined with Poisson and negative binomial estimation techniques – which are deemed suitable for handling models of which regressands are count and contain zeros, and some regressors, in this case, tax indicators, are endogenous.

The findings of this chapter confirm that both standard tax rates and conditional concessionary tax rates induce or increase inward M&As. Furthermore, the chapter's findings unearth that of all conditional tax incentives, that which hinges on an investor locating in a specific location or SEZ exerts the largest inducement effect on inward M&A. Inferring from the quantitative magnitudes of the results, they indicate that the tax incentives inducement effect on M&As is rather modest. Specifically, I uncover that a typical developing country will have to, for instance, reduce its standard tax rate by as much as 1.6% in order to attract a single inward merger or acquisition.

The last (third) chapter uses firm-level data from the World Bank's Enterprise Surveys to examine the economic consequences of corruption on the performances of firms in Africa. The novelty of this chapter stems from the fact that most studies (Aidt 2009; P. G. Méon and Weill 2010; Méndez and Sepúlveda 2006; Mauro 1995) that have probed this issue have been macro-based hence failing to unearth any micro insights, and the only micro-based study (Fisman and Svensson 2007) was undertaken for a cross-section of Ugandan firms.

This chapter thus enlightens our understand of the effects of corruption at the micro-level. And does so using the most recent data from a panel of firms from 11 African countries. By way of empirical execution, endogeneity issues pertaining to firms' bribery payments is circumvented by use of an instrumental variable approach and first-difference techniques.

The findings of the chapter indicate that older firms and more visible (larger) firms are less likely to pay bribes. The findings also reveal that the least productive firms are more likely to engage in bribery payments to corrupt bureaucrats. Coming to the main results, the findings show that corruption has a negative and significant contemporaneous and a lag-effect on firm performance particularly for larger and older firms.

Chapter 1: Electricity Shortages and Allocative Inefficiency

Abstract¹

The purpose of this study is to examine the impact of electricity shortages on the allocative inefficiency (or misallocation) of capital and labour using information from a panel of 750 Ghanaian manufacturing firms. Using a methodology due to Petrin and Sivadasan (2013), the allocative inefficiency of each input (i.e., capital and labour) is measured by computing the absolute gap between its value of marginal revenue product and price (cost). I then combine these measures of allocative inefficiency of inputs with electricity outages data which lends its variation across firms to a sporadic power rationing schedule implemented by power authorities. The findings uncover that electricity outages increase the allocative inefficiency of capital and labour. What is more, these effects appear to be more pronounced for firms that own generators. Finally, the findings reveal that firms that report been electricity constrained, i.e., those that are arguably more reliant on electricity, appear to suffer the most from the allocative inefficiency of capital.

¹ This study benefited from data produced by an IGC-funded project, ‘Analysing the extent and sources of productivity losses from electricity shortages for small and medium-sized enterprises’, of which the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, was a co-investigator. As a visiting research fellow at ISSER, I utilised this dataset to co-author a paper on ‘Misallocation of Resources and Productivity: The Case of Ghana’. [Link to paper:

<http://pubdocs.worldbank.org/en/573721527993012696/208-Misallocation-and-TFP-in-Ghana-Ackah-and-others.pdf>].

This paper investigated, using the Hsieh and Klenow (2009) framework, the aggregate TFP implications of resource misallocation (gauged by the dispersion in revenue productivity indicators for Ghanaian manufacturing SMEs.

The current study (chapter), using the same dataset, provides a complementary but distinct understanding of resource misallocation in Ghana by providing a more nuanced understanding of its (their) sources using a more robust micro-founded approach. The chapter specifically unearths electricity shortages as a source of resource misallocation and does so by utilising a much more robust framework due to Petrin and Sivadasan (2013) to gauge measures of allocative inefficiency (misallocation) combined with firms’ self-reported information on power outages.

1.1 Introduction

Nascent literature (Hsieh and Klenow 2009, 2010; Restuccia and Rogerson 2008; Hopenhayn 2014; Restuccia and Rogerson 2017, 2013; Banerjee and Duflo 2005) has identified allocative inefficiency of production inputs (or misallocation) as a contributing factor to low aggregate total factor productivity (TFP) particularly in laggard economies. The insight from these studies is that developing countries have low aggregate TFP because certain market imperfections or distortions prevent the efficient allocation of resources and consequently cause firms or sectors, particularly the most productive ones, to use inputs sub-optimally. Insightful as these findings are, little is known about specific sources of market imperfections that lead to allocative inefficiency of production inputs. Understanding the sources of allocative inefficiency of production inputs will be essential in explaining the observed wide differences in TFP (Francesco Caselli 2005) between advanced and developing countries.

In this study, I argue that electricity shortages could be a source of market distortions contributing to the allocative inefficiency of production inputs (i.e., capital and labour) such that firms end up employing these inputs sub-optimally. To begin with, electricity shortages could cause production losses in the form of output losses, spoilage of materials, and damage to equipment hence dwindling firm net worth (Alby, Dethier, and Straub 2013). Consequently, inhibiting access to (or leading to the sub-optimal use of) capital and labour.

What is more, the margin of opportunity to adopt coping strategies including investing in energy-efficient equipment and a generator in order to attenuate the adverse effects of power shortages (Davis, Grim, and Haltiwanger 2008; Fisher-Vanden, Mansur, and Wang 2015; Reinikka and Svensson 2002) are likely not to be available to all firms equally, hence leading to sub-optimal use of inputs particularly for those that are inopportune². Even for those opportune, due to differences in sensitivity of production processes to electricity outages, an adopted coping strategy, say, use of a generator, might still not be enough.

Finally, the heightened uncertainty surrounding when a power crisis will end could induce firms to suspend the employment of production inputs. What is more, uncertainty could also deteriorate firm lending relationships with financial institutions thus inducing them (firms) to use capital and labour sub-optimally.

From the foregoing discussions, we can intuit that one of the underlying reasons for the reported negative effect power outages exerts on income per capita in Africa (Andersen and Dalgaard, 2013) is because they

² For instance, not all firms can afford a generator or energy-efficient capital. Also, rigidities in the labour market, particularly those due to regulations (such as fulfilment of workers social security payments), could imply some firms might face constraints in adjusting labour (Allcott, Collard-Wexler, and O'Connell 2016).

are a source of distortions contributing to firms' sub-optimal use of production inputs. Hence, unearthing the microeconomic implications of power outages or crisis for firms' marginal revenue products could prove fruitful for the formulation of policies aimed at boosting and sustaining manufacturing productivity in developing countries.

The purpose of this study is to uncover the implications of a recent power crisis, 2012–2015, on the allocative efficiency of capital and labour for a sample of about 750 Ghanaian manufacturing firms. In order to gauge firm-level allocative inefficiency of capital and labour, I rely on approach due to Petrin and Sivadasan (2013). The foundation of this approach is that in the absence of distortions or market rigidities, a forward-looking firm will employ a production input to the point where its marginal revenue product will equal that of its price, that is, the revenue–cost gap will arguably be zero. Intuitively, for a given production input, the presence and extent of allocative inefficiency can be gauged by observing its revenue–cost gap. The novelty of this methodology owes to its micro-founded framework in that measures of allocative inefficiency of production inputs are obtained from production function estimates. Implying, the methodology accommodates for heterogeneity of production techniques across firms and avoids having to gauge allocative inefficiency by benchmarking against industrial parameters of other countries.

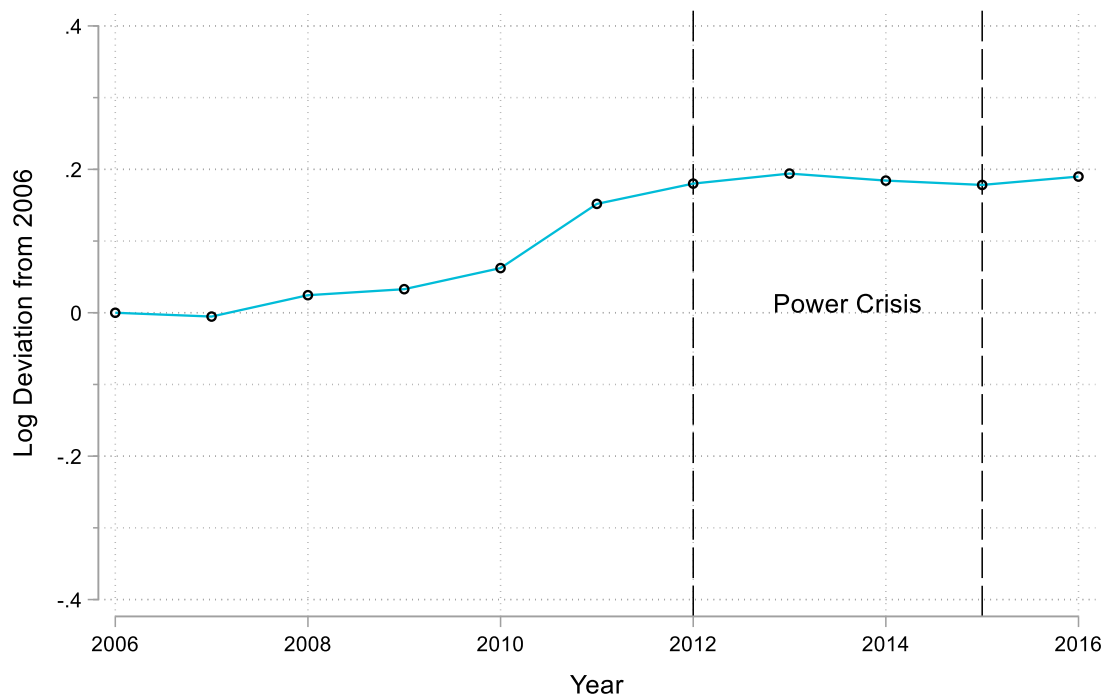
Using this methodology, in order to gauge each firm's allocative inefficiency of capital and labour, I measure its revenue–cost gaps for these inputs using parameters of estimated production functions and proxies for costs of inputs – i.e., average wage and interest rate. Following Petrin and Sivadasan (2013) I consider the absolute revenue–cost gap for a particular input as a measure of its allocative inefficiency. The logic here follows from the fact that a positive revenue–cost gap (underutilization of input) and a negative revenue–cost gap (overutilization of an input) depict sub-optimal use of production input. A higher absolute gap measure is akin to higher allocative inefficiency. I then combine measures of absolute revenue–cost gap of production inputs with information from firms on the prevalence of outages. I consider firms' self-reported power outages information to be, arguably, good as random. Because at the onset of the power crisis, the power authorities implemented a power rationing schedule which implies that the observed variation in power outages across firms is largely driven by a mechanism (i.e., rationing) which is out of their (firms) influence. What is more, contributing to the variation in power outages were occasional natural occurrences such as thunderstorms which destroy power infrastructure.

To preview my findings, for starters, I find that electricity shortages have a negative effect on firms' usage of capital and labour, and workers' compensation (wages). The findings also indicate that electricity shortages retard firm efficiency (TFP). Coming to the substantive results, I unearth that electricity shortages exert a positive effect on the revenue–cost gaps for capital and labour, implying that electricity shortages are associated with the allocative inefficiency (or sub-optimal use) of production capital and

labour. Probing further, I find that the contribution of electricity shortages to the allocative inefficiency of capital is more pronounced for firms whose production processes are more electricity reliant, i.e., those that report that power outages are a severe constraint to their operations. Finally, I uncover that the effect of power outages on the absolute gaps for capital and labour is more pronounced for firms that own generators.

Ghana offers an interesting case in uncovering the implications of power crisis on the allocative inefficiency of production inputs for a few reasons. First, in recent times, and particularly spanning the period of Ghana's immediate past power crisis i.e., – (2012–2015) aggregate productivity stagnated (*Figure 1.1*). A compelling task is, therefore, to attempt an explanation from a micro perspective of the role of resource misallocation for this observed stagnation in aggregate productivity. Second, findings of the recent World Bank's enterprise surveys show that about 61% of Ghanaian firms compared with the African average of 40% identify electricity as the most binding constraint to their business operations (World Bank Enterprise Survey 2013). Findings from the same surveys reveal that 89% of Ghanaian firms compared with an African average of 77%, experienced electrical outages.

Figure 1.1: Trend in Aggregate Productivity in Ghana from 2006–2016



Source: Author's own calculation using data from the World Development Indicators of the World Bank. TFP is computed as $Y = K^\alpha L^{1-\alpha}$ with capital share, $\alpha = 0.3$. NB: using the perpetual inventory method, capital stock is computed using data on investment and assuming a depreciation rate of 10%.

1.2 Related Literature

This study relates to and improves upon a few strands of literature. The first strand of literature relates to how deficiencies in electricity – in terms of insufficiency in quantity, quality, or costs – impacts firm behaviour and or performance, and economic growth. Abeberese (2017) shows that, for Indian manufacturing plants, high costs of electricity induce them (plants) to switch to low electricity-intensive industries³, which then has a deleterious effect on output, machine intensity, and productivity.

In a similar study also on Indian manufacturing plants, Allcott, Collard-Wexler, and O’Connell (2016) find that a 1 percentage point increase in electricity shortages cause a decrease in materials input by as much as 1.137 per cent, and on revenues, about 1.091 per cent. They further show that the detrimental effects of shortages on inputs and revenues are more pronounced for firms that do not have a generator (particularly smaller plants) consequently distorting the plant size distribution in favour of large plants.

This latter finding – i.e., the distortionary effect of shortages – corroborates those of an earlier study (i.e., Rud, 2012) on Indian plants which reveal that shortages do not only increase the productivity threshold required for firm survival but also reallocate sales and profit from the least productive firms to the most productive ones which are able to adopt a generator to sustain survival. These findings contradict those of Fisher-Vanden, Mansur, and Wang (2015) who reveal that power scarcity does not necessarily induce firms to resort to self-generation – i.e., use generators, but outsource the production of intermediate inputs rather than produce them in-house. Specifically, they uncover that, for a given firm, a one standard deviation increase in its neighbour’s scarcity leads to a 21% increase in output.

A notable missing piece in the power outages–firm behaviour and performances strand of the literature is the effect of power crisis on the allocative inefficiency of production inputs. This study fills this void in the literature. Particularly this is relevant in that power shortages could dwindle firm net worth, exacerbate production uncertainty, and deteriorate the general business climate, for instance, lending conditions, thus sapping firm efficiency and causing the use of inputs sup-optimally. More importantly, the increasing misallocation of production inputs could have an adverse implication for aggregate TFP.

Also, the electricity shortages data used in this study, unlike those used in the literature thus far, was solicited from firms at a time when electricity was rationed due to a power crisis. So that since firms had no influence over the Electricity Commission of Ghana’s (ECG) design and implementation of the

³ It is the case that that some industries use the same primary input and produce the same product but differ in terms of the production process.

rationing schedule we could consider such information as good as random and thus less vulnerable to issues of endogeneity.

The second strand of literature related to this study is that which examines the role of factor misallocation in productivity growth. Hsieh and Klenow (2009) make an ingenious attempt to examine the extent of resource misallocation in China, India, and the USA. They find that misallocation is more pronounced in China and India compared with the USA and that by improving allocative efficiency to the levels in the USA, aggregate productivity gains of about 30% (in China) and 59% (in India) could be realised. Additions to this literature in recent times have attempted to unearth the sources of misallocation causing low TFP. Investigations so far have revealed that reductions in interest rates due to unfettered capital inflows (Gopinath et al. 2017); uncertainty shocks (Bloom 2009; Asker, Collard-Wexler, and De Loecker 2014), size-dependent policies in the labour market (Garicano, Lelarge, and Van Reenen 2016); small-scale reservation laws (García-Santana and Pijoan-Mas 2014); and conflict (Amodio and Di Maio 2017), are among distortions that contribute to the misallocation of resources within countries.

An investigation into the implications of power outages for the allocative inefficiency of production inputs adds to our understanding of potential sources of misallocation of resources in developing countries. Further, most, if not all, studies that examine this issue often use data from industrial census which often excludes micro and small firms – a subset of firms that are more salient in the private sectors of most developing countries. By relying on data from a sample of micro and small firms and particularly from an African country, this study makes a novel contribution on this front.

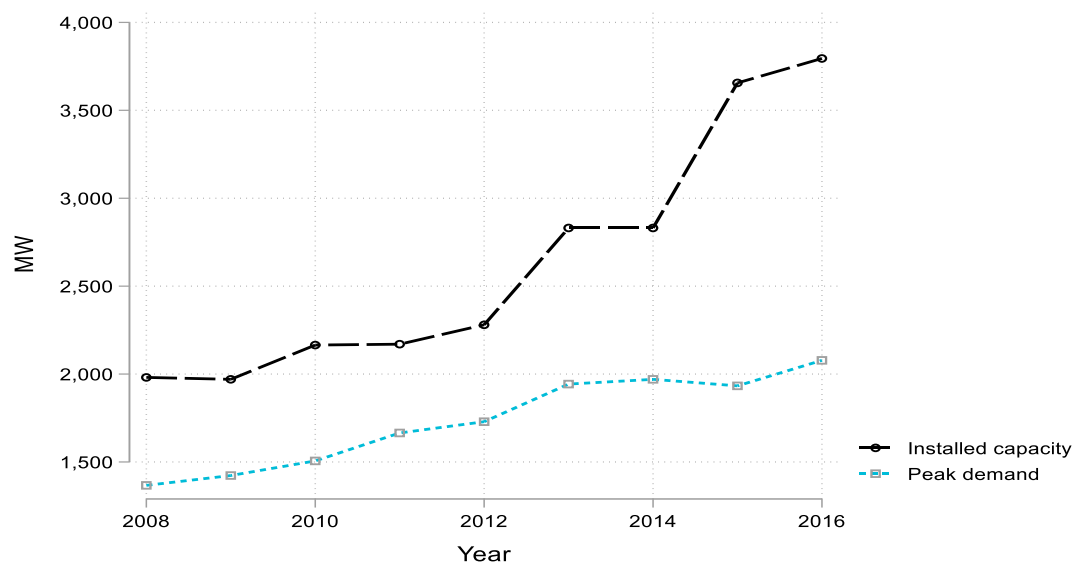
The third and final strand of literature closer to this study concerns studies on the significance of various infrastructural deficiencies on economic development. Findings from this strand of literature are suggestive that dams, including electricity-generating ones (Duflo and Pande 2007; Kline and Moretti 2014) and; transportation network, railroads or highways, (Donaldson and Hornbeck 2016; Donaldson 2018; Ghani, Goswami, and Kerr 2016), exert a positive influence on various facets of economic progress including – GDP per capita growth, agricultural production and employment, manufacturing efficiency, trading, and poverty. Particularly for Africa, Andersen and Dalgaard, (2013), show that electricity shortages retard the growth of GDP per capita.

1.3 Institutional Background and Data

1.3.1 Ghana's Power Sector and the 2012–2015 Crisis

There are three major players – i.e., the Volta River Authority (VRA), Bui Power Authority, and Independent Power Producers (IPPs) – that produce Ghana's power from a mix of hydroelectricity, thermal, and renewable (i.e., wind and solar) sources. The most prominent of these three power producers is the VRA which was established in 1961 under the Volta River Development Act, Act 46 of the Republic of Ghana (Volta River Authority 2013). At its establishment, the VRA enjoyed a near-monopoly status not only in the generation but also the transmission and distribution of power. However, following the Government of Ghana's quest to attract (more) IPPs to the Ghana energy market, Power Sector Reforms were undertaken in 2005 which resulted in the VRA been stripped of its power transmission and distribution responsibilities. The Ghana Grid Company (GRIDCo) was allotted the role of power transmission and the distributions function was assigned to the Electricity Company of Ghana (ECG) and the Northern Electricity Distribution Company (NEDCo)⁴.

Figure 1.2: Trend in Installed Capacity and Peak Demand



Source: Author's own calculation using data from the National Energy Commission of Ghana's National Energy Statistics (2008–2017).

⁴ Notably, the ECG is responsible for distributing power in the Southern part of Ghana whereas NEDCo is responsible for the norther part.

Ghana's power sector reforms alongside the Ministry of Energy's implementation of the flagship policy – National Electrification Scheme (NES) – has led to a significant increase in installed capacity and access to electricity over the years. As shown in *Figure 1.2*, for over a decade now, installed capacity has seen a steady increase (i.e., from 1,981 MW in 2008 to 3,795 MW in 2016) and has always exceeded peak demand (Energy Commission of Ghana 2018).

Despite this impressive performance seen over the years, Ghana's power sector is still susceptible to crisis. Challenges weighed on power producers in the form of high indebtedness, inadequate supply of natural gas, insufficient funds to purchase fuel to support thermal generation, and adverse weather shocks which result in low levels of water in the Akosombo Dam have led to shortages in power supply and consequently power rationing in the years, notably, 1997–1998, 2006–2007, and 2012–2015 (Ministry of Finance 2016; Volta River Authority 2014). Taking a narrower view on the 2012–2015 power crisis only, it was chiefly caused by a disruption in the supply of gas to power thermal plants due to the rapture of the newly constructed West Africa Gas Pipeline⁵ (WAGP) (Volta River Authority 2013).

To confront the situation of insufficient power supply, the ECG came out with a load shedding schedule in order to implement electricity rationing particularly in the southern part of the country where electricity demand is higher than that of the north. At the onset (i.e., 2012) of the crisis the ECG designated areas into separate blocks – i.e. A, B, and C, and rationed power based on initially, 6 hours off which then rose to 12 hours off (or higher) as the crisis severed. This implied that at any given time while one block had no power, both the second and third could have power with that of the latter placed on a standby basis implying it could be denied power if it were inadequate. *Figure A 1.1 (in Appendix A)* provides a sample load shedding schedule provided by the ECG⁶. It is worth noting that there are numerous areas within a block and within each area differentiation in exposure to load shedding occurs depending on the phase of the sub-station transformer a firm is connected to.

Further, adherence to a given load shedding schedule by the ECG could be vulnerable to the vagaries of the weather in that rainfall or wind disruptions to sub-station transformers or other electrical infrastructure could cut off electricity for affected areas. Considering this alongside the sporadic power supply due to the load shedding exercise, I rely on firms self-reported average power outages for a given month which could be deemed, arguably, good as random in order to construct a proxy for average annual outages.

⁵ The West Africa Gas Pipeline (WAGP) is a 20-inch 600km long gas transmission facility laid from Nigeria to Ghana.

⁶ Per the details of the sample, for instance, on the 06/02/2015, block B will be without power between the hours of 6am – 7pm, block C will have power while blocks A will be on standby.

1.3.2 Data

The data used for this study was obtained from a survey of Ghanaian manufacturing firms. The sampling frame used was that of the Ghana Integrated Business Establishment Survey (IBES), which is an economic census of non-household enterprises conducted by the Ghana Statistical Service (GSS). The sampling methodology used to collect the data is like that – stratified random sampling – of the World Bank used for its Enterprise Surveys. As such, a firm was considered the sampling unit, and stratification was by firm size, manufacturing sub-sector and location. Stratification by size followed a modified version of that employed by the World Bank (World Bank, 2009) using micro (< 6 employees), small (6-30 employees), medium (31-100 employees), and large (> 100). In order to accommodate for the small number of large firms in the sample, I combined this group of firms with medium-sized firms into one size.

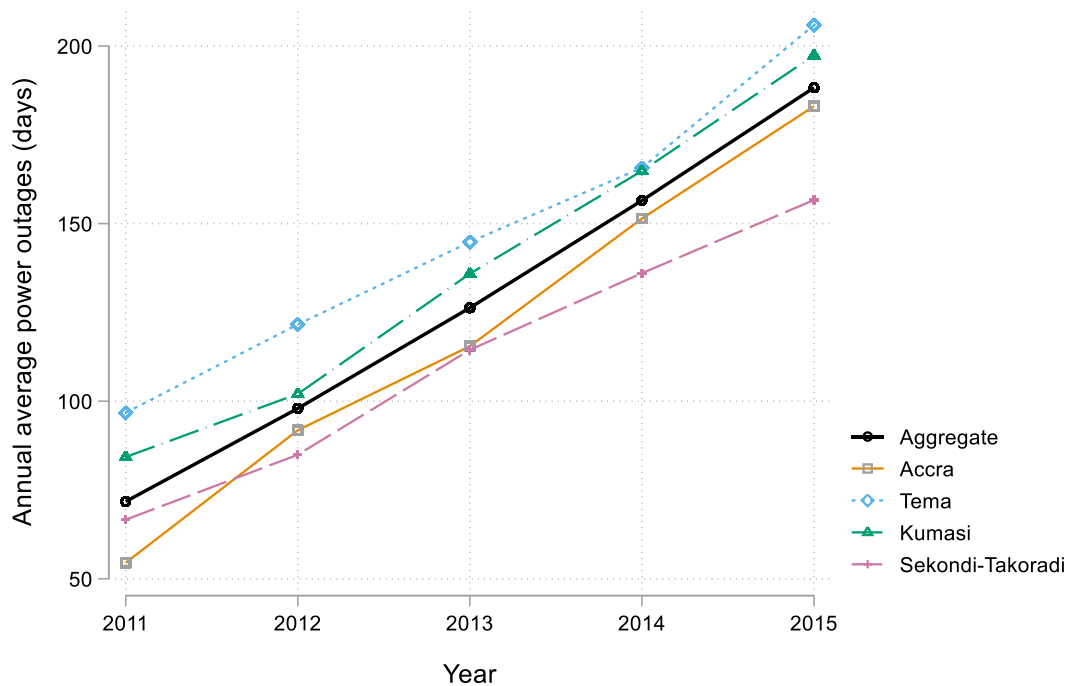
The sample consists of micro, small and medium-sized manufacturing firms located in the main industrial clusters in the country – i.e., the cities of Accra, Tema, Kumasi and Sekondi-Takoradi –which are all in the southern part of Ghana. The universe of micro, small, and medium-sized manufacturing firms obtained from the IBES was 1,244 firms. An attempt was made to survey all these firms. Of these, 73 firms refused to participate in the survey, 55 had folded up and 231 could not be located using the contact information obtained from the GSS. As a result, 885 firms were surveyed. These firms operated in 20 distinct ISIC Rev. 4 2-digit industries in the following sectors: food and beverage products, textiles and wearing apparel, chemicals, metal, machinery and equipment, wood and wood products, and other manufacturing.

The survey collected information on firms' output and inputs, production processes, assets and investments, employment activities, costs of operations, ownership type, adopted coping strategies during the power crisis, and assessment of how electricity shortages are a major or severe constraint to operations. Given that the primary focus of this study is to examine the implication of electricity shortages on allocative efficiency of production inputs, I utilize firms' information on electricity shortages, wages, materials cost, capital, and labour for computations of allocative efficiency measures – i.e., marginal revenue–cost gaps for capital and labour. Industry producer price indices obtained from the GSS are used to deflate capital and other monetary variables to 2010 constant prices. Similarly, wages are deflated to 2010 constant prices using consumer price index, also, obtained from the GSS.

To enhance the robustness of my findings, observations with missing information or negative values for reported power outages, value-added, capital, materials, and labour were dropped. Also, firms without any industrial affiliation were deleted from the sample. Finally, firms that were zero years old and had no employee were dropped. This exercise results in a final sample of about 3,616 observations from the initial

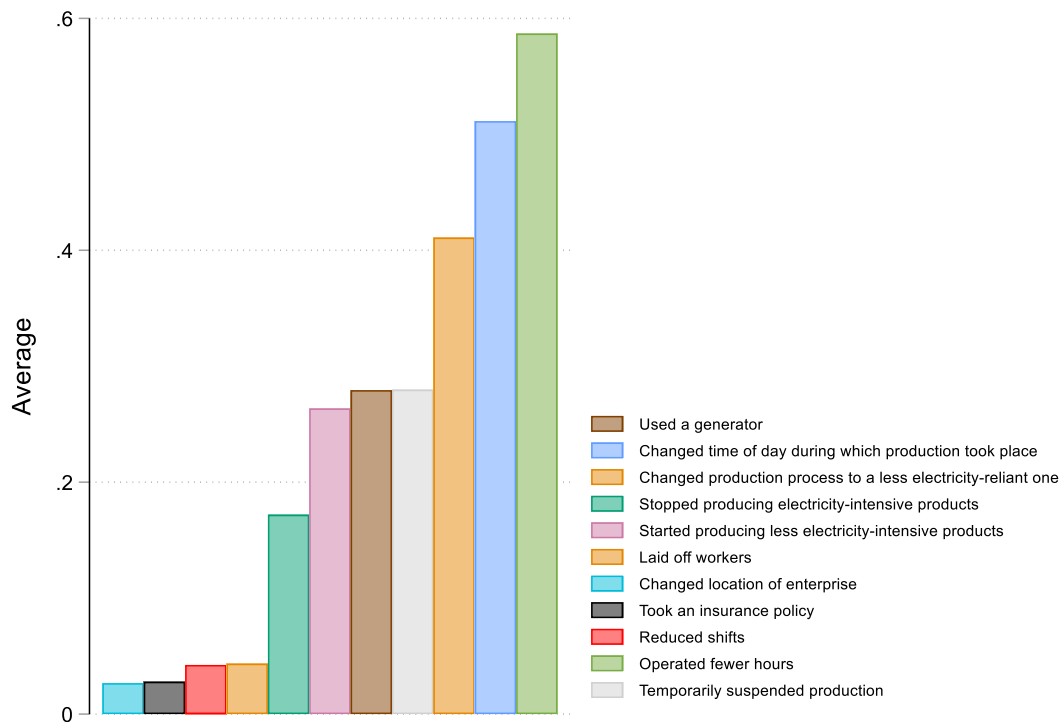
sample of 4,400 observations, for the sample's entire time period – i.e., 2011-2015. Finally, this cleaning exercise results in an unbalanced panel structured as follows: 702, 717, 733, 739, and 735 firms, respectively, for the years 2011, 2012, 2013, 2014, and 2015. Observing from the summary statistics provided in *Table B 1.1 (in Appendix B)*, on average, in a year a firm experienced a power outage in 128 days. Considering a more detailed account of the severity of power outages over the years, details in *Figure 1.3* indicate that on aggregate it increased over the years and that the towns, Tema and Kumasi, were the worst affected areas.

Figure 1.3: Average Annual Power Outages Over Time



The survey also collected information from firms on coping strategies adopted during the power crisis. This allows us to infer which coping strategies were the most adopted by firms during the power crisis. *Figure 1.4* details the average number of firms that adopted a coping strategy as a means of adjusting to the power crisis. When faced with rationed power, the top three strategies firms opted for were operating for fewer hours, changing production times, and reorienting production processes to a less electricity-reliant one. What is more, the findings also indicate that on average only 28% of firms managed to resort to use of a generator to cope with the power outages. Given that reliance on a generator is one of the most rudimentary and popular forms of coping with power outages, this low prevalence (i.e., 28%) of its usage could be indicative of firms either lacking the resources to acquire one or it not being cost-effective for their production processes.

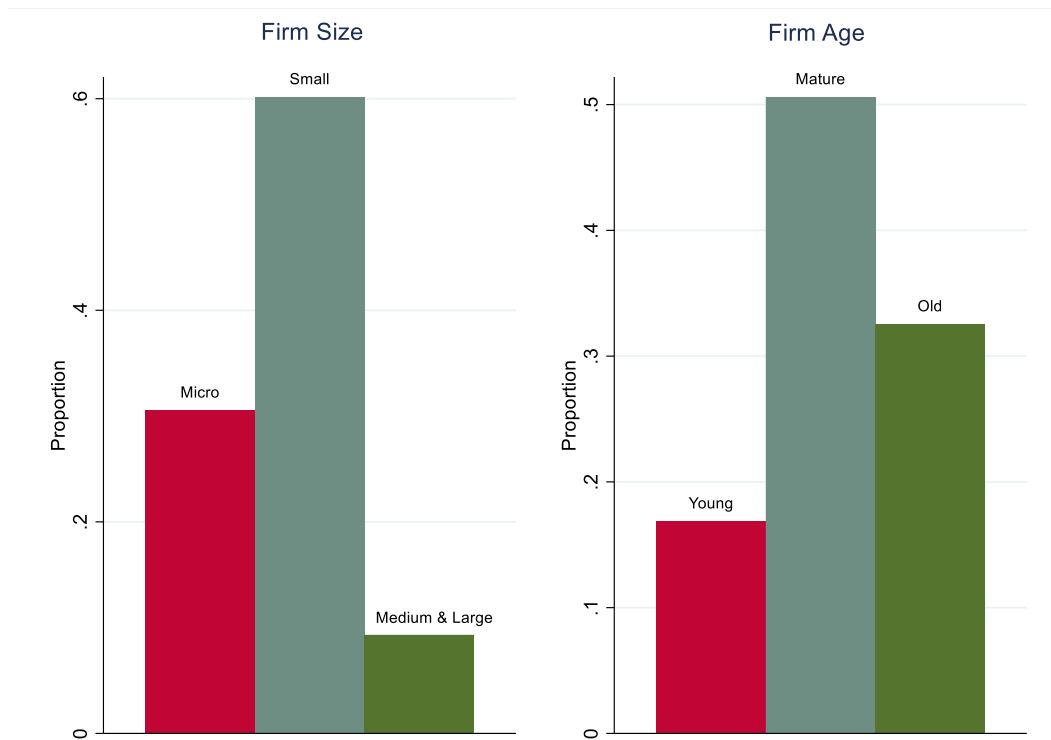
Figure 1.4: Coping Strategy



On firm characteristics, the summary statistics in *Table B 1.1 (in Appendix B)* indicate that the average firm is about 13 years old and has a size of about 10 full-time employees. Moreover, as shown in *Figure 1.5*, in terms of the size structure of the sample, small-sized firms dominate with 60.15% followed by micro-sized ones who command 30.53%, and the combined medium and large-sized group representing the least with a 9.32% share. Coming to the age structure of the sample, the results presented in the same figure (*Figure 1.5*) reveal that mature firms make up the largest proportion while younger firms command the least share.

Also, the analysis reveals that nearly 23% of the sample engage in some form of international (export at least 10% output or import at least 10% input) trade. Finally, 46% of firms rely on formal finance, and 5% claim corruption is a severe hindrance to their operations.

Figure 1.5: Firm Size and Age



1.4 Measuring and Conceptualising Firm-Level Allocative Inefficiency

This section provides a brief description of the concept of allocative inefficiency (misallocation) and details the framework employed in this study to gauge firm-level allocative inefficiency of labour and capital.

The literature on allocative inefficiency relates to the inquest on the wide dispersion in productivity observed between rich and poor countries. This line of research (Hsieh and Klenow 2009; Restuccia and Rogerson 2008; Bartelsman, Haltiwanger, and Scarpetta 2013) offer a distinctive but complementary explanation that, besides slow diffusion of frontier technologies and new ideas into low-income countries, distortionary regulations, market rigidity, and other constraints inhibit the efficient allocation of resources to the ablest firms hence enfeebling aggregate productivity growth. Particularly, the aggregate productivity-sapping effect of allocative inefficiency stems from the fact that inefficient firms command more production resources than their optimal size can support while more efficient firms have fewer resources than their optimal production capacity.

Although the concept of allocative inefficiency has been around for some time (for instance, as discussed by Banerjee and Duflo, 2005) its formal characterisation was provided by Restuccia and Rogerson (2008) and Hsieh and Klenow (2009) with the latter particularly offering empirical evidence of higher

misallocation in China and India using the USA as a benchmark. Hsieh and Klenow's (2009) framework entails the setting of a benchmark against which the dispersion in revenue-based measures of productivity can be compared. Wider dispersion of productivity across firms within a given industry relative to that of the benchmark is then indicative of higher misallocation.

An alternative measure of misallocation (Olley and Pakes 1996; Bartelsman, Haltiwanger, and Scarpetta 2013), which is micro-founded, follows the argument that in the absence of constraints firm size should increase with productivity, so that observed higher covariance between productivity and size is indicative of improved allocative efficiency. Finally, another micro-founded approach provided by Petrin and Sivadasan (2013) based on Petrin and Levinsohn (2012) considers the gap or difference between an input's marginal product and costs as a gauge of allocative inefficiency.

This approach is founded on the notion that in the absence of distortionary policies, market rigidities, or other constraints, a forward-looking firm should continue to employ and input (e.g., capital or labour) to the point where the value of their marginal product equals the marginal cost. Intuitively, the gap between an input's value of marginal product (VMP) and its costs is indicative of a firm employing such input(s) sub-optimally. Specifically, a firm with a negative gap evidences employment of inputs beyond the optimal whereas a positive gap depicts the reverse scenario. So that by reallocating production inputs from firms with negative gaps to those with positive gaps, aggregate productivity could be bolstered. Petrin and Sivadasan (2013) pioneer this approach in order to gauge the extent and costs (output loss) of inefficiency associating with labour market policies in Chile.

In this study, I employ the framework of Petrin and Sivadasan (2013) in order to assess the implications of electricity shortages on firm allocative inefficiency or in simple terms gaps between VMP and marginal cost. A notable advantage of this micro-founded approach is that measures of allocative inefficiency are based on estimating firm-level production functions and, arguably, the need for setting an, arguably, contentious benchmark to infer the extent of allocative inefficiency from is avoided.

As a prequel to providing a formalization of the Petrin and Sivadasan (2013) methodology, I discuss the potential avenues through which power outages could be a source of market distortions or constraints which dissuade firms from equalizing the VMPs of inputs to their costs. Hereafter, I use the term (phrase) gap (revenue-costs gaps) to denote allocative inefficiency or a firm employing inputs sub-optimally.

For starters, shortages in electricity could increase production losses in the form of output losses, spoilage of materials, and damage to equipment hence dwindling firm net worth (Alby, Dethier, and Straub 2013) and consequently inhibiting access to finance. An outcome which could contribute to higher VMPs for

capital and labour and consequently positive revenue–costs gaps. This scenario will particularly be more pronounced for firms who are more electricity reliant such that the production process must be started anew when there is an interruption in electricity supply.

Moreover, the response of firms to power shortages partly depends on whether they are planned (rationed) or unplanned. Unplanned outages could be likened to uncertainty shocks (Bloom 2009) which would increase production uncertainty and consequently lead to sub-optimal use of production inputs, hence causing revenue–costs gaps. If power is rationed, then firms respond by optimising their production process by adopting certain coping strategies including investing in energy-efficient production techniques or relying on a generator (Davis, Grim, and Haltiwanger 2008; Fisher-Vanden, Mansur, and Wang 2015; Reinikka and Svensson 2002). However, since the window of opportunity for adopting a coping strategy is likely not to be available to all firms equally, productive but inopportune firms could have positive revenue–costs gaps while unproductive but opportune firms will have lower or negative revenue–costs gaps. Even were all firms to have equal opportunity to adopt a coping strategy such as relying on a generator, due to the associated increase in costs in implementing a coping strategy and differences in production processes, it could still be insufficient to meet the production needs of some firms thus resulting in them having revenue–costs gaps.

What is more, the uncertainty associated with when a power crisis will end could have detrimental effects on a firm's hiring decisions regarding workers and its lending relationship with financial institutions thus contributing to revenue–costs gaps. This effect could be more pronounced for firms that cannot rely favourably on internal finance or, arguably, low-cost finance from friends and family or do not have a modicum of flexibility in organising workers or working times. Additionally, were general financial conditions to deteriorate as a result of the power crisis, the cost of external finance could increase hence limiting firms' accessibility of capital and consequently resulting in a revenue–costs gap particularly for those firms that rely heavily on external finance.

Finally, as the intensity of power crisis and consequently rationing differs by location, labour could be induced to relocate to areas where power crisis is less severe implying firms in certain locations may face challenges in hiring labour hence use labour sub-optimally – i.e. have a higher VMP for labour which cause a revenue–costs gap for labour.

1.4.1 Production Function Estimation

In order to gauge firm-level revenue–costs gaps, the initial step involves estimating parameters of a production function. The approach I adopt in order to compute production function estimates is that due

to Levinsohn and Petrin (2003) which is an extended approach of Olley and Pakes (1996). I assume each firm in each industry utilises a Cobb-Douglas production technology which can be expressed as

$$1 \quad q_{it} = \beta_0 + \beta_L l_{it} + \beta_K k_{it} + \omega_{it} + \mu_{it},$$

where q_{it} denotes the logarithm of real value-added measured as real output net of intermediate inputs and cost of electricity purchased, l_{it} is the logarithm of the number of employees, the logarithm of real capital stock is captured by k_{it} , ω_{it} and μ_{it} together form an error term; $\varepsilon_{it} = \omega_{it} + \mu_{it}$. Specifically, ω_{it} is the transmitted component pertaining to firm-specific productivity shocks and μ_{it} denoting the iid (unexpected) productivity shock or measurement error. A notable difference between the two terms is that the transmitted component is a state variable in that it affects firms' input choices or decisions whereas the iid term does not. As such, since productivity shocks are observable to the firm but not to the Econometrician, the transmitted component could be a source of simultaneous bias that frets production function estimations which when ignored by any estimator leads to inconsistent results. Specifically, simultaneity or endogeneity of inputs stems from the fact that productivity shocks, which are unobservable to the Econometrician, inform firms' input decisions⁷. Another potential source of bias is that due to firm entry or exit or selection into the sample.

To circumvent the simultaneity problem, following Levinsohn and Petrin (2003), I proxy for unobserved firm-specific productivity shock with intermediate inputs, in this case, materials. Formerly, I consider the demand for intermediate inputs to be a function of a firm's productivity (i.e., the transmitted component) and state variable, capital, expressed as

$$2 \quad m_{it} = z_t(k_{it}, \omega_{it})$$

Further, to allow for the invertibility of a firm's intermediate demand function (i.e., equation 2), I assume that, conditional on state variables, the demand function is monotonically increasing in firm productivity. Also, productivity, w_{it} , is assumed to follow a first-order Markov process. The inverted intermediate demand function can then be expressed as

$$3 \quad w_{it} = \gamma_t(k_{it}, m_{it}),$$

⁷ For instance, a firm that observes a positive productivity shock will increase its demand for variable inputs will then lead to an upward bias in the input coefficients for these inputs. A reverse scenario applies in the case of a negative productivity shock.

so that firm-specific unobservable productivity is now a function of observables – i.e., capital and intermediate input. For the purpose of this study, the use of intermediate input as a proxy, as opposed to the value of investments used by Olley and Pakes (1996), is more feasible for the monotonicity condition and probably the efficiency of results since intermediate input is more likely to respond to productivity shocks and nearly all firms report positive expenditures on this variable compared with investment values⁸.

Using the monotonicity condition, equation 1 can be rewritten as:

$$4 \quad q_{it} = \beta_L l_{it} + \varphi_t(k_{it}, m_{it}) + \mu_{it},$$

where

$$5 \quad \varphi_t(k_{it}, m_{it}) = \beta_0 + \beta_K k_{it} + \gamma_t(k_{it}, m_{it})$$

In order to estimate equation 1, as in Levinsohn and Petrin (2003), in a two-step estimation procedure, I approximate for $\varphi_t(k_{it}, m_{it})$ using third-order polynomials in k_{it} and m_{it} and employing OLS to uncover estimates for the variable inputs, β_L , in the first step. In the second step, relying on an estimated value of φ_t , I uncover estimates of the state variables, β_K . For each industry, I estimate a separate production function to cater for differences in production technologies amongst others. Note that from estimations of the production function I uncover TFP which is used for further analysis.

1.4.2 Gauging Firm-Level Value of Marginal Product Gaps

As in Petrin and Sivadasan (2013), I define a firm's inefficient use of inputs as the gap or difference between its VMP and price. Relying on the yielded production function estimates and observed inputs levels, a firm's marginal product of an input is considered as the additional increase in output per unit change in that input which can be expressed, respectively for labour and capital, as

$$6 \quad \frac{\partial Q_{it}}{\partial L} = \beta_L e^{\varepsilon_{it}} L_{it}^{\beta_L - 1} K_{it}^{\beta_K} = \beta_L \cdot \frac{Q_{it}}{L_{it}}$$

$$7 \quad \frac{\partial Q_{it}}{\partial K} = \beta_K e^{\varepsilon_{it}} L_{it}^{\beta_L} K_{it}^{\beta_K - 1} = \beta_K \cdot \frac{Q_{it}}{K_{it}},$$

⁸ A notable limitation of using the value of investment as a proxy for productivity shocks is that for the monotonicity condition – that, in this case, investment should be increasing in productivity – to hold then firms must report positive investment values. A further limitation in using this proxy is the likelihood in adjustment costs making it difficult for firms to adjust investments in response to productivity shocks.

where Q_{it} is the real value-added, labour is captured by L_{it} , the real capital stock is K_{it} , and $\varepsilon_{it} = \omega_{it} + \mu_{it}$. The VMP for input is then computed simply as the price of that input multiplied by its marginal product:

$$8 \quad VMP_{it}^L = P_{st} \left(\beta_L \cdot \frac{Q_{it}}{L_{it}} \right)$$

$$9 \quad VMP_{it}^K = P_{st} \left(\beta_K \cdot \frac{Q_{it}}{K_{it}} \right),$$

where P_{st} denotes the industry-specific (s) price index to which a firm (i) belongs to. Then the level of firm-level inefficiency pertaining to input use, i.e., the absolute revenue to cost gap, can be calculated as:

$$10 \quad Gap_{it}^L = VMP_{it}^L - W_{it}$$

$$11 \quad Gap_{it}^K = VMP_{it}^K - R_t,$$

where W_{it} and R_t represent the prices of inputs – i.e., labour and capital respectively. Finally, the computed absolute gaps for labour and capital are deflated with a CPI in order to obtain real values comparable across years.

Clearly, arguably, ideal measures of marginal costs of labour and capital should be those reported at the firm level, however, in my sample total values for workers' wages are reported, and in the case of capital, loan-specific data are unavailable. I, therefore, follow common practice in the literature (Petrin and Sivadasan 2013; Petrin and Levinsohn 2012; Fontagné and Santoni 2019) and adopt proxies for these costs measures. Specifically, as a measure of the marginal cost of labour I use firm-level average wage – i.e., total wage divided by the number of workers. For the marginal costs of capital, I use the average annual lending rates obtained from the Bank of Ghana and, following the literature (Bigsten et al. 2005; Hsieh and Klenow 2009), adjust for a depreciation rate of 5%.

Using industry price index in the computation of VMPs instead of firm-specific price and quantity data could introduce measurement error in prices⁹. For instance, Foster, Haltiwanger and Syverson (2008) show that revenue-based productivity measures tend to confound demand shocks and as a result bear a positive

⁹ Particularly, firm-level total revenues, which I use as a proxy for output, are deflated with industry price indexes before been used to compute (real) value added.

correlation with the price of output which could result in an underestimation of productivity for efficient firms, particularly younger firms, which charge lower prices compared with those of incumbents.

However, as stated by Petrin and Sivadasan (2013), production function estimates could still be consistent if inputs aren't correlated with the deviation of firm-specific price from the industry price. Further, to attenuate any price measurement error even if it existed, following the literature (Petrin and Sivadasan 2013; Szabó 2018; Fontagné and Santoni 2019), I condition on productivity when computing MRP. By doing so the initial estimate of the MRP will entail the ratio of firm-level price to industry price index, so that by multiplying this estimate with the industry price index only the firm-level price times the marginal product, i.e. the VMP, remains.

1.4.3 Descriptive Statistics on the Allocative Inefficiency of Capital and Labour

Table 1.1 contains summary statistics on the average absolute gaps of capital and labour over the sample period. The table contains the log-transformed and raw averages of capital and labour gaps. The average absolute gaps of labour are expressed in monetary values – i.e., (thousands of) Ghana Cedis (GHS)¹⁰ while those of capital are expressed in percentages. By way of interpretation, the average absolute gap of an input (i.e., capital or labour) equals the value added gain that can be realised from reallocating that input in the optimal direction by one unit, which is, from firms overutilizing that input to those underutilizing the input, holding everything else constant. So that, for instance, the average absolute gap figure of GHS 30,730 reported for the year 2011, is the value-added that could have been realised from reallocating labour from firms with negative gaps for labour to those with positive ones. The interpretation for capital is analogous but with a slight difference in that since it is expressed in percentages it depicts the percentage increase in value added that could have been realised by adjusting capital by one unit in the optimal direction.

Observably, the results reveal that the average values for both gap indicators saw an increasing trend over the period under study. Specifically, the results unearth that average capital gaps increased from 3.13% in 2011 to 5.60% in 2015. A similar occurrence can be observed for labour gaps, specifically, on average they increased from 30,730 Ghana Cedis in 2011 to 62,482 Ghana Cedis in 2015. Since, both capital gaps and labour gaps depict a deviation of a firm from employing capital and labour inputs optimally, these observed trends indicate a rise in the misallocation of these inputs over the period. In simple terms, the value added

¹⁰ All values are in 2010 constant prices.

forgone as a result of inefficient allocation of capital and labour increased over the sample period. A cursory look at the data indicate most firms have positive gaps for both inputs. Since positive gaps indicate underutilisation of inputs, it is safe to conclude that potential efficiency gains can be realised by moving capital and labour from firms with negative gaps for these inputs to those with positive gaps. Finally, evidentially, both gap indicators also bear a positive correlation with the average annual power outages (*Figures 1.6 and 1.7*).

Table 1.1: Average Capital and Labour Gaps by Year

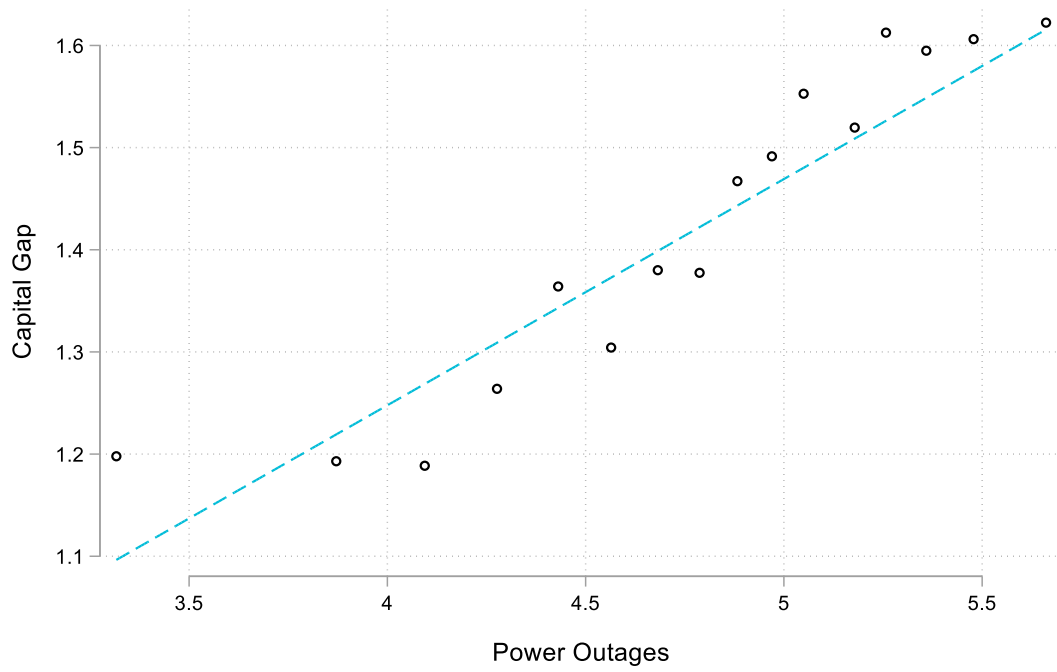
	N	Mean	Mean (log)	Std Dev.	Minimum	Maximum
2011						
Capital Gap	700	3.134	1.116	0.246	0.134	1.852
Labour Gap	700	30730.06	9.755	1.136	7.016	12.557
2012						
Capital Gap	714	3.471	1.229	0.194	0.134	1.852
Labour Gap	714	34978.37	9.923	1.118	7.016	12.557
2013						
Capital Gap	731	3.887	1.342	0.196	0.134	1.852
Labour Gap	731	42407.12	10.133	1.112	7.016	12.557
2014						
Capital Gap	737	5.001	1.598	0.180	0.134	1.852
Labour Gap	737	50563.98	10.332	1.096	7.016	12.557
2015						
Capital Gap	723	5.640	1.722	0.150	0.134	1.852
Labour Gap	723	62482.13	10.563	1.083	7.016	12.557

Note that absolute values of capital and labour gaps have been used.

Labour gaps are expressed in 2010 Ghana Cedis while those of capital are expressed in percentages

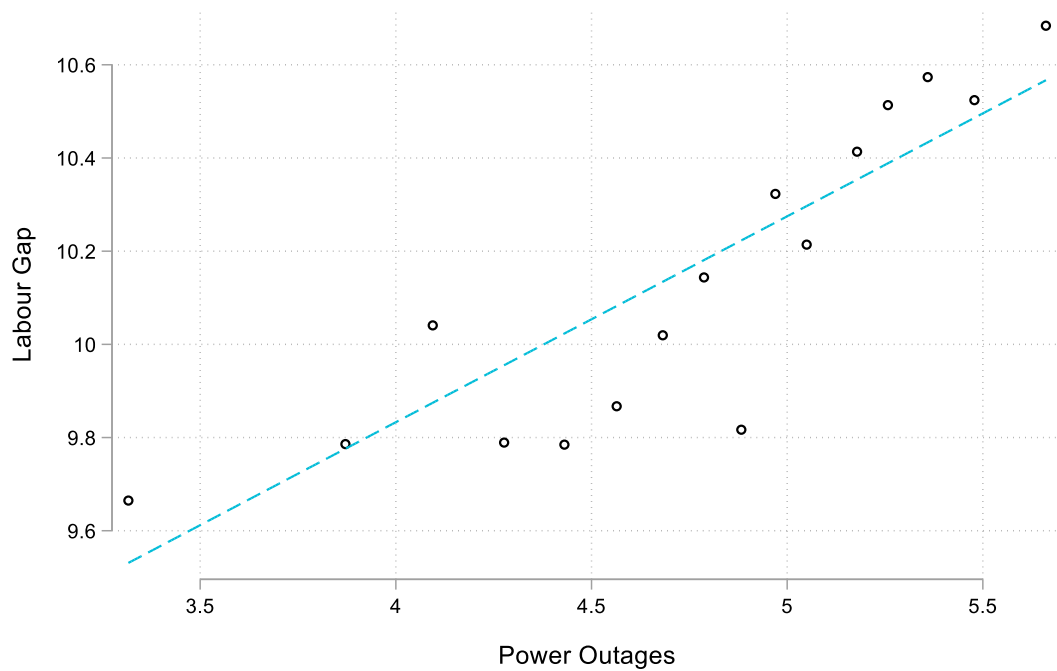
Remaining statistics (standard deviation, minimum and maximum are based on Logged transformed indicators of gaps.

Figure 1.6: Correlation between Capital Gaps and Power Outages



Power outages are computed as the log average number of days a firm experienced an outage each year.

Figure 1.7: Correlation between Labour Gap and Power Outages



Power outages are computed as the log average number of days a firm experienced an outage each year

1.5 Empirical Strategy

The conceptual framework detailed in the previous section provides an insight that electricity shortages are likely to explain firms' sub-optimal use of production inputs implying higher revenue–cost gaps. However, for one to empirically test this claim, certain econometric issues must be considered. For starters, even in the absence of electricity shortages, firms in certain locations, due to unobservable factors potentially correlated with power outages, will still face more (or less) capital and or labour distortions than their peers elsewhere. Further, it could be the case that electricity shortages are demand-induced – i.e., as a result of an increase in firms' demand. In this case, firms that face the least allocative inefficiency (i.e. those with negative revenue–cost gaps) are those likely to experience higher electricity outages. A scenario that will potentially mask or neuter any underlying positive effect that electricity outages exert on distortions.

To confront these econometric issues, I rely on electricity outages data which is arguably random across firms per the power rationing schedule that was adopted by electricity providers during the power crisis. As can be gleaned from the sample power rationing schedule (i.e., *Figure A 1.1*) utilised by the Electricity Company of Ghana during the power crisis, one could safely argue that this rationing resulted in power outages that were random and outside the influence of any individual firm or a group of firms irrespective of location or sector.

Besides the fact that power rationing schedule in itself could be deemed a source of fluky variation in outages firms face, the Electricity Company of Ghana, due to weather conditions including torrential rainfall and storms that cause damage to substation transformers and other electrical equipment, is unable to adhere strictly to its rationing schedule. Hence, heightening the randomness and variation of power outages across firms belonging to the same location and sector each year.

Also, included in all econometric estimations are year, location-year and firm fixed effects in order to net out any, time-specific, location-specific, or time-invariant unobservable firm-specific characteristics that are likely to affect the relationship between electricity shortages and distortions.

Finally, pertaining to the issue of electricity shortages being potentially demand-induced, information from the VRA and Ministry of Finance (Volta River Authority 2013; Ministry of Finance 2016) indicate that power shortages were mostly as a result of damage to the WAGP which resulted in insufficient gas to power thermal plants, low levels of water to support hydro dams; insufficient finance to support the generation and or distribution of power; and some power plants fraught with mechanical problems. What is more, as depicted by the descriptive statistics provided earlier, a significant proportion of my sample is

made up of micro and small-sized firms, whose demand for (or consumption of) electricity, arguably, is unlikely to significantly induce power shortages.

1.5.1 Empirical Models

Although the focus of this paper isn't on how electricity shortages affect firms' input choices and efficiency (TFP), findings from such an inquest will aid the interpretation and understanding of how electricity shortages affect revenue–cost gaps. Hence, as a prequel to examining the substantive question of this study, I examine the impact of electricity shortages on firms' input choices and TFP.

Formerly, in order to test the impact of electricity shortages on firms' usage of inputs and TFP, I estimate equation 12 below. And to test how electricity shortages impact TFP and revenue–cost gaps for inputs, respectively, I estimate equations 13 and 14. The three specifications estimated are

$$12 \quad Y_{it} = \delta + \varphi Outages_{it} + \vartheta Z_{it} + T_y + L_l + \epsilon_{it},$$

$$13 \quad TFP_{it} = \lambda + \psi Outages_{it} + \varrho Z_{it} + T_y + L_l + \epsilon_{it},$$

$$14 \quad Gap_{it}^X = \phi + \xi Outages_{it} + \psi Z_{it} + T_y + L_l + \epsilon_{it},$$

where Y_{it} captures capital, labour, or wages; TFP_{it} denotes productivity; the absolute revenue–cost gap of an input, x , is represented by Gap_{it}^X ; average annual outages is contained in $Outages_{it}$; and Z_{it} represents other controls – size, age, trade orientation, use of formal finance, and perceived severity of corruption¹¹. Note that both regressands in addition to all regressors but for those that proxy for export status, usage of bank loan, and corruption, are log-transformed. Also, since either a positive or negative revenue–cost gap for an input denotes suboptimal usage of that input (i.e., under usage in the former case and over usage in the latter), as is done in the literature (Petrin and Sivadasan 2013; Fontagné and Santoni 2019), I use the absolute value of a gap indicators.

The selection of these controls is informed by the literature. Large firms could be more visible to bureaucrats and thus subject to strict adherence to labour market laws (e.g. payment of workers' social security). This could induce lower demand for labour than would be optimal compared with, particularly, micro and small-sized or informal firms which do not face similar strict rules. As a result, large firms or even medium-sized firms compared with smaller ones could have positive gaps for labour. Conversely,

¹¹ Variables – capital, labour wages, TFP, revenue–cost gaps, outages, size, and age are log transformed.

large firms could rely on their clout or size (e.g. – monopsony power) to attract labour at a more competitive rate implying a higher demand for labour than would be optimal – i.e. lower VMPL –, resulting in negative revenue–cost gaps for labour. Moreover, since large firms are more likely to possess ‘quality collateral’ (Banerjee and Duflo 2005) which facilitates easy access to formal finance they are likely to, compared with micro and small firms, employ more capital than would be optimal and as a consequence have a negative gap for capital. VMPK could be higher for large firms if the costs of credit are higher compared with those of informal sources or they require higher amounts of credit to adopt coping strategies in order to attenuate adverse effects of power outages. Implying that large firms could end up with positive revenue–cost gaps for capital.

Older firms, through “learning effects” (Jovanovic 1982), are likely to be more adept at coping with power crisis since they would have experienced a similar crisis in the past. Further, older firms are likely to face fewer credit constraints and to have enough and well-trained workers with specific skills tailored to their production processes. By implication, one could expect older firms to have relatively lower levels of VMPK and VMPL, and if anything, negative revenue–cost gaps. However, although the summary statistics reveal that the average firm is 13 years old, sufficient for a firm to benefit from “learning effect”, such benefits are likely not to be realised when forms of management are dynastic (Francesco Caselli and Gennaioli 2013) and inept descendants are at the helm of management. In this case, older but not well-managed firms could employ inputs sub-optimally and will see a declension in efficiency levels. Also, irrespective of firm age, were production processes more sensitive to electricity shortages, VMPK and VMPL could increase thus causing positive revenue–cost gaps.

Firms that engage in either import or export are often found to be the most productive and offer competitive wages (Amiti and Konings 2007; De Loecker 2007; Melitz and Ottaviano 2008), hence contributing to lower VMPK and VMPL. However, their VMPL could be higher if bureaucrats subjected them to strict adherence to labour laws of which their compatriot domestically oriented firms evaded. Further, internationally oriented firms tend to have competitive product (i.e., higher quality) standards to meet compared with domestic firms, so that the net worth loss effect due to power outages could be more pronounced for these firms hence increasing their VMPK and VMPL.

Formal (bank loan) financing as one would expect should lessen firm credit constraints and thus access to related inputs which could translate into lower VMPK and VMPL. However, the higher cost of external credit could leave firms with higher VMPK and VMPL due to the inability to raise enough capital and or higher cost of debt servicing. General deterioration in financial conditions during a power crisis could particularly contribute to a higher cost of external finance. For instance, in order to enhance macroeconomic stability which had deteriorated partly due to the power crisis, the Bank of Ghana (BoG)

adopted a much sterner monetary policy stance which resulted in the discount rate more than doubling to about 26% between 2011 and 2015 (Bank of Ghana 2016).

Firms operating in locations with poor institutions (i.e. corrupt bureaucracy) are more likely to have difficulty in accessing certain public services including permits which could hamper demand for inputs contributing to higher revenue–cost gaps. Further, with corrupt public officials, firms, particularly those with the potential to increase the size of their workforce and improve their capital holdings, will deliberately remain small and acquire second-tier capital (or technology) (J. Svensson 2003; Jakob Svensson 2005) in order to reduce the risk of rent extraction from future revenues implying higher VMPK and VMPL which could lead to positive revenue–cost gaps. Notably, corruption could also contribute to negative revenue–cost gaps if it afforded some firms a competitive advantage by aiding them to circumvent bureaucratic red tape easily and to access preferential treatment.

Having controlled for fixed effects and included the afore-discussed set of controls, I consider the coefficients – φ , ψ , and ξ – from equations 12, 13, and 14 to reflect the variation in input choices, TFP, and revenue–cost gaps for inputs across firms which are exposed randomly to power shortages.

Moreover, the data contains information regarding firms’ assessment of how electricity shortages are a major or severe constraint to their operations. Relying on this information, I further estimate specification 14 for these separate groups – i.e. firms that are electricity constrained vs those that aren’t, so that if electricity shortages significantly impact revenue–cost gaps of inputs, such an effect would be expected to be more pronounced for firms of the former group. Similarly, in order to examine the efficacy of relying on a generator as a coping strategy, I estimate specification 14, for generator owning vs non-generator owning firms.

1.6 Results

1.6.1 Power Outages and Firms’ Production Input Choices

Table 1.2: The Impact of Power Outages on Capital, Labour and Wages

Regressor	Regressand					
	(1) Capital	(2) Capital	(3) Size (Labour)	(4) Size (Labour)	(5) Wages	(6) Wages
Outages	-0.129*** (0.031)	-0.140*** (0.032)	-0.091*** (0.018)	-0.091*** (0.018)	-0.061*** (0.021)	-0.059*** (0.020)
Age	-0.531*** (0.102)	-0.543*** (0.102)	0.153*** (0.046)	0.160*** (0.046)	-0.253*** (0.060)	-0.238*** (0.062)
Size (Labour)	0.054 (0.054)	0.056 (0.054)			0.456*** (0.048)	0.456*** (0.048)
Exporter	-0.194* (0.100)	-0.193* (0.100)	0.105* (0.061)	0.110* (0.062)	-0.005 (0.060)	0.001 (0.061)
Bank Finance	-0.004 (0.052)	0.002 (0.052)	0.027 (0.039)	0.029 (0.039)	-0.012 (0.047)	-0.008 (0.047)
Bribe	0.011 (0.069)	0.009 (0.069)	-0.008 (0.043)	-0.009 (0.044)	-0.048 (0.067)	-0.049 (0.068)
Observations	3,423	3,423	3,432	3,432	3,432	3,432
R-squared	0.124	0.129	0.020	0.024	0.145	0.158
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Year-Location FE	No	Yes	No	Yes	No	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NB: Outages denote the log of the average annual number of days a firm experience electricity outage

The control variable size is omitted in estimations in which this indicator is the regressand.

The results displayed in Table 1.2 show the effect of power outages on firms' input choices. Power outages appear to have a negative impact on firms' capital accumulation. Specifically, a one per cent increase in power outages is associated with a decrease in capital accumulation by 0.140%. Expectedly, shortages in electricity supply could increase the costs of production (in the form of an "input tax") and consequently hamper capital accumulation. Moreover, firms will reduce capital equipment if their productivity falls following a reduction in the availability of electricity¹². Finally, owing to the unpredictability of the timing of the end to the power crisis, firms are likely to adopt a 'wait-and-see' approach – i.e. hold (or cut) back on any investments including those related to capital equipment until the crisis is over.

The results also show that power outages do adversely affect firms hiring decisions and wages paid to workers. Specifically, a percentage increase in power outages implies a 0.091% and 0.059% reduction in, respectively, the number of full-time workers employed and wages. The observably low adverse effect of

¹² This scenario could be more debilitating for firms whose production processes are more electricity reliant. For such firms their production processes require uninterrupted power supply and any disruption to power supply implies starting the production process anew.

power outages on labour and wages compared with capital could be indicative of the former input (labour) being comparatively less flexible due to labour laws and search costs among others.

1.6.2 Power Outages, Allocative Inefficiency, and TFP

Before analysing the results for revenue–cost gaps, it’s worth reiterating that allocative inefficiency could entail either a firm using an input less than is optimal (i.e., depicting a positive VMP–cost gaps) or more than is optimal (i.e. depicting negative VMP–cost gaps). So that the (log) absolute gap captures both forms of allocative inefficiency; a higher absolute gap indicates higher allocative inefficiency.

Table 1.3: The Impact of Power Outages on TFP, the Allocative Inefficiency of Capital & Labour

<i>Regressor</i>	<i>Regressand</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
	Capital Gap	Capital Gap	Labour Gap	Labour Gap	TFP	TFP
Outages	0.211*** (0.011)	0.197*** (0.010)	0.297*** (0.022)	0.292*** (0.022)	-0.286*** (0.035)	-0.299*** (0.035)
Age	0.508*** (0.027)	0.456*** (0.025)	0.491*** (0.063)	0.453*** (0.065)	-0.669*** (0.081)	-0.676*** (0.082)
Size (Labour)	-0.035** (0.016)	-0.031* (0.016)	-0.588*** (0.052)	-0.581*** (0.052)	0.331*** (0.060)	0.332*** (0.060)
Exporter	-0.007 (0.026)	-0.019 (0.024)	0.040 (0.070)	0.029 (0.071)	-0.031 (0.111)	-0.018 (0.111)
Bank Finance	0.045* (0.024)	0.041* (0.022)	0.031 (0.051)	0.026 (0.052)	-0.034 (0.078)	-0.027 (0.077)
Bribe	-0.007 (0.019)	-0.008 (0.018)	-0.085 (0.063)	-0.083 (0.063)	0.007 (0.115)	0.009 (0.114)
Observations	3,423	3,423	3,423	3,423	3,423	3,423
R-squared	0.514	0.569	0.376	0.388	0.203	0.213
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Year-Location FE	No	Yes	No	Yes	No	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NB: Outages denote the log of average annual number of days a firm experience an electricity outage

Gap indicators denote the absolute difference between an input’s value of marginal revenue and its marginal cost
The methodology used to compute gap measures is that due to Petrin and Sivadasan (2013). As an initial step of implementing this approach, production function estimates are estimated by the Levinsohn and Petrin (2003) algorithm.

The findings on the impact of power shortages on firms’ VMP–cost gaps for inputs and efficiency are displayed in *Table 1.3*. As could be gleaned from the table, power shortages exert a positive and significant impact on firm VMP–cost gaps for capital and labour. Considering the estimates, a one per cent increase in power outages appear to increase VMP–gaps for capital by 0.197% and that of labour by 0.292%. These findings indicate that electricity shortages are associated with firms’ sub-optimal use of capital and labour

with that of the latter been more pronounced. Further, the findings unearth that electricity shortages retard firm efficiency. A finding which contrasts the argument that in response to power outages, firms can reoptimize production techniques and as consequence increase efficiency.

To put these findings into perspective, there are several underlying reasons for electricity shortages to contribute to allocative inefficiency of production inputs and to retard efficiency. For starters, since electricity is a key complement to production inputs (capital and labour), unreliability in its supply will have an effect akin to an implicit “input tax” (Allcott, Collard-Wexler, and O’Connell 2016) which could result in sub-optimal use of capital and labour, and hamper efficiency. Further, particularly on VMP–cost gaps for labour, some firms who are unable to readjust their workforce, due to, for instance, labour market rigidities, could be left with more workers than the optimal. A situation could contribute to negative VMP–cost gaps for labour and sap efficiency. Finally, increased production costs could mean a reduction in net worth (Alby, Dethier, and Straub 2013) a situation which will be more pronounced for firms with limited access to credit, and by implication inhibit investments into self-generation equipment or electricity-efficient capital, thus contributing to sub-optimal use of capital and labour and sapping efficiency.

In addition, *Table 1.3* provides findings on how firm characteristics, access to formal finance, and a salient feature of business climate quality – i.e., corruption –, correlate with VMP–cost gaps for inputs and efficiency. The findings reveal that, surprisingly, VMP–cost gaps for capital and labour increases with firm age implying that older firms use capital and labour less optimally compared with young firms. What is more, efficiency levels appear to decline with firm age. Overall, inferring from the findings reported in *Table 1.3* which indicate that older firms are likely to reduce capital stock but increase the size of their workforce albeit at a declining (lower wages) costs, we could intuit that the observed absolute VMP–cost gaps reflect underutilization of capital and overutilization of labour by this group of firms.

The findings also indicate that VMP–cost gaps for capital and labour decline with firm size with that of the latter being more pronounced. By implication, larger firms tend to use capital and labour more efficiently compared with small firms. What is more, corroborating findings of an earlier study (Van Biesebroeck 2005), I find that efficiency levels tend to increase with firm size. Overall, these results could be justified on the grounds that larger firms, compared with smaller firms, arguably, are less credit constrained, and possess a competitive edge in hiring and compensating workers¹³, hence the observed relatively better optimal use of capital and labour.

¹³ The results reported in *Table 1.2* indicate that workers’ compensation increases with firm size.

On firm internalisation, the results suggest that firm exporting status bears no statistically significant relationship with allocative inefficiency or productivity. This finding is rather surprising in that firms that engage in international trade face the extra hurdle of meeting certain production or product standards (e.g. ISO). So that one will expect the VMP–cost gaps for production inputs and productivity of this group of firms to be affected during times of power crisis.

On the use of formal (bank) finance, the findings unearth that this form of financing has a positive effect on VMP–cost gaps for capital and labour albeit that of the latter not statistically significant. From *Table 1.3*, there isn't any statistically convincing evidence on how formal finance use correlates with actual input demand. Hence, the finding of a positive impact of formal finance on absolute VMP–cost of capital could either be down to lesser credit constraints allowing firms to employ more capital than the optimal or higher costs of external credit constraining firms from employing capital at optimal levels.

Finally, constraints in the investment climate due to corruption or solicited bribes appear not to bear any statistically significant relationship with allocative inefficiency of production inputs or productivity. This finding is surprising owing to the fact that lapses such as corruption could come in the form of an unforeseen financial burden which could either compel some firms to underutilize production inputs or could afford some others (firms) preferential access to public services or to circumvent bureaucratic red tape thus culminating into overutilization of inputs.

1.6.3 Power Outages, Allocative Inefficiency: Electricity-Constrained vs Unconstrained Firms

To this point, my findings confirm that conditional on controlling for firm-specific, year and location-year fixed effects, power outages increase the allocative inefficiency of capital and labour. One plausible explanation for such findings is that the sensitivity of firms' production processes to electricity differ¹⁴. For instance, for some, power outages will imply starting an entire production process anew and for others the productivity of installed capital is more vulnerable to electricity shortages.

¹⁴ From a list of nine investment climate constraints firms were asked to rank from 1 (most) to 9 (least) how they impact their operations. From this information, I gauge an electricity-constrained/sensitive firm as one that ranked power outages at least 2 for a given year. Intuitively, I depict ranking electricity shortages 1 to imply it is a major constraint and 2 meaning it is severe.

Table 1.4: Electricity Constrained Vs Unconstrained Firms

Regressor	Regressand							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Capital Gap	Capital Gap	Labour Gap	Labour Gap	Capital Gap	Capital Gap	Labour Gap	Labour Gap
Electricity Constrained				Electricity Unconstrained				
Outages	0.213*** (0.013)	0.197*** (0.013)	0.278*** (0.027)	0.273*** (0.026)	0.173*** (0.022)	0.171*** (0.020)	0.295*** (0.042)	0.300*** (0.044)
Age	0.549*** (0.033)	0.486*** (0.031)	0.527*** (0.065)	0.482*** (0.066)	0.380*** (0.045)	0.369*** (0.046)	0.347** (0.156)	0.307** (0.148)
Size (Labour)	-0.034* (0.019)	-0.028 (0.018)	-0.565*** (0.058)	-0.557*** (0.057)	-0.017 (0.030)	-0.020 (0.028)	-0.632*** (0.185)	-0.617*** (0.182)
Exporter	0.004 (0.024)	-0.007 (0.020)	0.059 (0.082)	0.055 (0.082)	-0.118 (0.094)	-0.124 (0.096)	-0.026 (0.171)	-0.030 (0.176)
Bank Finance	0.038 (0.028)	0.036 (0.027)	-0.000 (0.056)	-0.007 (0.058)	0.106*** (0.039)	0.101*** (0.035)	-0.013 (0.103)	0.013 (0.102)
Bribe	0.020 (0.035)	0.002 (0.035)	-0.005 (0.097)	-0.012 (0.098)	0.034 (0.028)	0.041 (0.029)	0.008 (0.096)	0.001 (0.094)
Observations	2,788	2,788	2,788	2,788	634	634	634	634
R-squared	0.496	0.554	0.344	0.359	0.501	0.557	0.363	0.378
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Year-Location FE	No	Yes	No	Yes	No	Yes	No	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NB: Outages denote the log of average annual number of days a firm experience an electricity outage

Gap indicators denote the absolute difference between an input's value of marginal revenue and its marginal cost

The methodology used to compute gap measures is that due to Petrin and Sivadasan (2013).

The difference between electricity constrained and unconstrained firms is that the former depict electricity shortages as a major hindrance to operations whereas the latter does not.

Thus, I investigate whether firms that reported that power outages are a major or severe constraint to their operations exhibit significantly different allocative inefficiency for capital and labour compared with those that find power outages less constraining. The results reported in *Table 1.4* indicate that power outages exert a positive impact on VMP–cost gaps for capital and labour across both electricity–constrained firms and those that less electricity–constrained. Taking a closer look at the results, the allocative inefficiency–enhancing effect of electricity shortages for capital tend to be more pronounced for electricity–constrained firms while that of labour is more pronounced for less electricity–constrained firms. Notably, these differences appear to be modest.

1.6.4 Power Outages and Allocative Inefficiency: Generator-Owning vs Non-Generator-Owning Firms

A firm's natural response to a deficient power supply, besides investing in electricity-efficient capital is to invest in costly self-generation (i.e., own a generator). However, financial constraints could preclude such investments leading to shut down or contraction of inputs (Allcott, Collard-Wexler, and O'Connell 2016)¹⁵ and or a greater loss of output (Oseni and Pollitt 2015). Consequently, there is likely to be differences in allocative inefficiency of capital and labour between generator-owning firms and non-generator owning firms. What is more, even among generator-owning firms, differences in the net benefit (costs versus benefits) of installing and operating a generator among others could still induce heterogeneity in allocative inefficiency of capital and labour. In this light, I test whether the impact of power outages on the allocative inefficiency of capital and labour vary significantly between generator-owning firms and non-generator owning ones.

Table 1.5: Generator Owning Vs Non-Generator Owning Firms

Regressor	Regressand							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Capital Gap	Capital Gap	Labour Gap	Labour Gap	Capital Gap	Capital Gap	Labour Gap	Labour Gap
Generator Owners				Non-Generator Owners				
Outages	0.225*** (0.022)	0.207*** (0.021)	0.343*** (0.045)	0.328*** (0.044)	0.199*** (0.014)	0.188*** (0.013)	0.274*** (0.025)	0.273*** (0.025)
Age	0.457*** (0.045)	0.396*** (0.040)	0.528*** (0.142)	0.474*** (0.146)	0.535*** (0.035)	0.491*** (0.033)	0.472*** (0.064)	0.445*** (0.065)
Size (Labour)	-0.062* (0.034)	-0.068** (0.030)	-0.246** (0.099)	-0.244** (0.102)	-0.037** (0.019)	-0.028 (0.019)	-0.665*** (0.063)	-0.656*** (0.063)
Exporter	-0.029 (0.034)	-0.017 (0.032)	0.169 (0.183)	0.173 (0.188)	-0.005 (0.034)	-0.018 (0.032)	-0.025 (0.065)	-0.037 (0.063)
Bank Finance	0.048 (0.031)	0.024 (0.028)	0.066 (0.071)	0.055 (0.071)	0.052 (0.037)	0.060* (0.034)	0.028 (0.077)	0.031 (0.078)
Bribe	0.000 (0.033)	-0.032 (0.028)	-0.166 (0.167)	-0.196 (0.167)	-0.016 (0.023)	-0.004 (0.022)	-0.060 (0.050)	-0.052 (0.051)
Observations	950	950	950	950	2,422	2,422	2,422	2,422
R-squared	0.541	0.628	0.303	0.329	0.492	0.539	0.408	0.416
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes	No	Yes

¹⁵ Allcott, Collard-Wexler, and O'Connell (2016) argue that such an effect could be more pronounced for non-generator owning firms in the form of an "infinite input tax" which then results in a shut down or severer contraction; the latter arising as a result of wastage of non-flexible inputs.

Year-Location FE	No	Yes	No	Yes	No	Yes	No	Yes
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Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

NB: Outages denote the log of average annual number of days a firm experience an electricity outage

Gap indicators denote the absolute difference between an input's value of marginal revenue and its marginal cost

The methodology used to compute gap measures is that due to Petrin and Sivadasan (2013).

The results in *Table 1.5* indicate that deficient power supply has a statistically positive impact on the VMP–cost gaps for capital and labour across both groups of firms with that of generator-owning firms being more pronounced. Intuitively, it could be the case that a firm which invests in a generator wouldn't be able to generate enough power to compensate for the deficit from the national grid which will still imply output and related losses (Oseni and Pollitt 2015), hence incapacitating the abilities of such a firms to employ capital or labour optimally. Additionally, firms that are more electricity reliant are likely to acquire generators (Alby, Dethier, and Straub 2013), however, the net benefit of self-generating power (Steinbuks and Neuhoﬀ 2014) for these firms might not be favourable hence contributing to sub-optimal use of production inputs. Finally, resorting to self-generation could crowd out funds which could have been used for alternative productive investments (Reinikka and Svensson 2002) resulting in sub-optimal use of inputs.

The discussion of the results so far indicates that overall investing in a generator isn't the most economical means to cope with power outages. However, these results should be interpreted with caution as it is likely that some firm's capital stock is inclusive of generators which influence their levels of marginal revenue products of inputs. Particularly, during the surveys, in order to infer total stock of capital, a firm was asked of its total value of machinery and equipment and not that excluding generators. Hence, there is the likelihood that firms that own generators possess different levels of capital and consequently different levels of absolute gaps for inputs compared with those that do not own generators. An analysis of the data indicate that generator-owning firms have average absolute gaps (log transformed) of capital and labour, respectively, of 4.4 and 10.6 compared with those of non-generator owning ones which are 4.1 and 10.0. By implication any underlying positive correlation that exists between electricity shortages and VMP-gaps for inputs could be more pronounced for generator-owning firms.

Another source of caution in interpreting these findings stems from the possibility that firms that are more likely to suffer the most from power outages are those that self-select into using a generator to cope with power outages. Again, if power outages exerted a positive correlation with VMP-gaps for inputs this effect could be heightened by this self-selection effect for the group of generator-owing firms.

1.7 Robustness Checks

In order to ascertain whether the results reported thus far on the effect of power outages on VMP–cost gaps for capital and labour are robust, I conduct a battery of checks including using alternative production function specifications to gauge VMP for capital and labour, deflating monetary values with an alternative deflator, and characterising or computing indicators of capital and labour misallocation using a different methodology.

1.7.1 Fixed Effects Estimation

The first production function estimator used to ascertain the effect of power outages on VMP–cost gaps for capital and labour is the fixed effects estimator. The fixed effects estimator will yield consistent results under the assumption that unobservable productivity shocks are firm-specific and do not vary over time. Using this estimator, I estimate an equation like equation 1 separately for each industry and include firm fixed effects. Formally the model estimated is

$$15 \quad q_{it} = \beta_0 + \beta_L l_{it} + \beta_K k_{it} + \omega_i + \mu_{it}$$

The results using the fixed effects specification are reported in *Table 1.6*. As in those reported in the base case, the findings evidence that electricity shortages exert a positive impact on VMP–gaps for both capital and labour. Further, these findings also corroborate those reported earlier that electricity shortages are efficiency sapping.

Table 1.6: Fixed Effects Estimation

Regressors	Regressand					
	(1)	(2)	(3)	(4)	(5)	(6)
	Capital Gap	Capital Gap	Labour Gap	Labour Gap	TFP	TFP
Outages	0.229*** (0.014)	0.214*** (0.014)	0.299*** (0.022)	0.293*** (0.022)	-0.241*** (0.028)	-0.253*** (0.029)
Age	0.568*** (0.036)	0.515*** (0.035)	0.494*** (0.064)	0.456*** (0.065)	-0.303*** (0.069)	-0.298*** (0.070)
Size (Labour)	-0.061*** (0.019)	-0.058*** (0.018)	-0.592*** (0.052)	-0.585*** (0.053)	-0.076* (0.041)	-0.072* (0.041)
Exporter	-0.016 (0.036)	-0.029 (0.034)	0.032 (0.067)	0.020 (0.067)	0.048 (0.060)	0.066 (0.061)
Bank Finance	0.034 (0.039)	0.030 (0.039)	0.052 (0.057)	0.048 (0.057)	0.016 (0.078)	0.015 (0.078)
Bribe	-0.003 (0.026)	-0.007 (0.025)	-0.112 (0.069)	-0.110 (0.070)	0.070 (0.059)	0.063 (0.058)
Observations	3,423	3,423	3,423	3,423	3,243	3,243
R-squared	0.455	0.505	0.378	0.389	0.106	0.119
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Year-Location FE	No	Yes	No	Yes	No	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NB: Outages denote the log of average annual number of days a firm experience an electricity outage

Gap indicators denote the absolute difference between an input's value of marginal revenue and its marginal cost

The methodology used to compute gap measures is that due to Petrin and Sivadasan (2013) in which production function estimates are estimated by a fixed effects estimator.

1.7.2 Translog Production Function

The second specification I consider is a translog production function which caters for, in addition to a linear relationship between inputs and output, possible nonlinear interactions. Further, unlike the Cobb–Douglas specifications, the translog production function relaxes the assumption of constant elasticity of production factors hence allowing for increasing and decreasing returns to scale. I estimate this translog specification separately for each industry and include firm fixed effects. I consider a translog specification of the form

$$16 \quad q_{it} = \beta_L l_{it} + \beta_{LL} l_{it}^2 + \beta_K k_{it} + \beta_{KK} k_{it}^2 + \beta_{LK} l_{it} k_{it} + \omega_{it} + \mu_{it}$$

Clearly, the results using the translog specification, which are reported in Table 1.7, dovetail those of the baseline analysis and the fixed effects estimator. Implying that the findings in the base case aren't susceptible to functional form misspecification of the production function.

Table 1.7: Translog Estimation

<i>Regressor</i>	<i>Regressand</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
	Capital Gap	Capital Gap	Labour Gap	Labour Gap	TFP	TFP
Outages	0.236*** (0.015)	0.219*** (0.014)	0.297*** (0.022)	0.292*** (0.022)	-0.224*** (0.028)	-0.234*** (0.029)
Age	0.554*** (0.035)	0.500*** (0.034)	0.497*** (0.064)	0.459*** (0.065)	-0.290*** (0.068)	-0.285*** (0.069)
Size (Labour)	-0.065*** (0.020)	-0.061*** (0.018)	-0.592*** (0.052)	-0.585*** (0.052)	-0.029 (0.043)	-0.026 (0.044)
Exporter	0.029 (0.026)	0.018 (0.023)	0.027 (0.064)	0.015 (0.064)	0.010 (0.064)	0.027 (0.065)
Bank Finance	0.044 (0.045)	0.041 (0.045)	0.027 (0.055)	0.023 (0.055)	0.033 (0.076)	0.031 (0.076)
Bribe	0.002 (0.028)	-0.002 (0.028)	-0.098 (0.065)	-0.097 (0.066)	0.082 (0.056)	0.077 (0.056)
Observations	3,423	3,423	3,423	3,423	3,243	3,243
R-squared	0.455	0.505	0.378	0.389	0.106	0.119
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Year-Location FE	No	Yes	No	Yes	No	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NB: Outages denote the log of average annual number of days a firm experience an electricity outage

Gap indicators denote the absolute difference between an input's value of marginal revenue and its marginal cost

The methodology used to compute gap measures is that due to Petrin and Sivadasan (2013) in which production function estimates are estimated by a translog estimator.

1.7.3 Alternative Deflator

In the baseline analysis, I used CPI data to deflate nominal values of revenue–cost gaps to 2010 Ghana Cedis. Since the CPI is reflective of prices pertaining to a fixed basket of goods, it will be worth ascertaining the influence on results using an alternative deflator, i.e., GDP deflator, which is more susceptible to changes conditional on changes in general consumption patterns. *Table 1.8* entails results using a GDP deflator to denote values of gaps for capital and labour in 2010 Ghana Cedis. The results generally conform to those yielded using CPI to deflate VMP–cost gaps for inputs. A notable difference is that findings using the GDP deflator yield relatively larger coefficients.

Table 1.1: GDP Deflator

Regressors	Regressand					
	(1)	(2)	(3)	(4)	(5)	(6)
	Capital Gap	Capital Gap	Labour Gap	Labour Gap	TFP	TFP
Outages	0.385*** (0.016)	0.329*** (0.015)	0.475*** (0.025)	0.427*** (0.024)	0.385*** (0.016)	0.329*** (0.015)
Age	0.851*** (0.042)	0.734*** (0.037)	0.824*** (0.073)	0.720*** (0.072)	0.851*** (0.042)	0.734*** (0.037)
Size (Labour)	-0.062*** (0.023)	-0.053** (0.021)	-0.620*** (0.053)	-0.609*** (0.054)	-0.062*** (0.023)	-0.053** (0.021)
Exporter	0.005 (0.041)	-0.009 (0.033)	0.047 (0.076)	0.034 (0.074)	0.005 (0.041)	-0.009 (0.033)
Bank Finance	0.044 (0.033)	0.056* (0.030)	0.027 (0.057)	0.038 (0.056)	0.044 (0.033)	0.056* (0.030)
Bribe	-0.007 (0.029)	-0.016 (0.025)	-0.088 (0.068)	-0.094 (0.067)	-0.007 (0.029)	-0.016 (0.025)
Observations	3,423	3,423	3,423	3,423	3,423	3,423
R-squared	0.627	0.701	0.504	0.539	0.627	0.701
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes	No	Yes
Year-Location FE	No	Yes	No	Yes	No	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NB: Outages denote the log of average annual number of days a firm experience an electricity outage

Gap indicators denote the absolute difference between an input's value of marginal revenue and its marginal cost

The methodology used to compute gap measures is that due to Petrin and Sivadasan (2013).

Monetary values are deflated with an alternative deflator – i.e., a GDP deflator.

1.7.4 Alternative Characterisation of Allocative Inefficiency

In order to assess the robustness of reported findings to an alternative characterisation of allocative inefficiency, I employ the framework developed by Hsieh and Klenow (2009) but depart from it in one way – i.e., by focusing on capital and labour distortions – instead of capital-labour and output distortions. So that the focus is on how power outages-induced distortions affect firms in the inputs market only, specifically, the dispersions in marginal revenue product of capital (MRPK) and marginal revenue product of labour (MRPL).

Conceptual Framework

Formally, following Hsieh and Klenow (2009), I assume that a representative firm operating in a perfectly competitive market utilizes a Cobb-Douglas production technology to combine the output, Y_s , of several industries to produce a final good, Y :

$$17 \quad Y = \prod_{s=1}^s Y_s^{\theta_s} \quad \text{where} \quad \sum_{s=1}^s \theta_s = 1$$

Cost minimization then implies that

$$18 \quad P_s Y_s = \theta_s P Y \quad \text{where a sector's share is denoted } \theta_s = \frac{P_s Y_s}{P Y}$$

If we assume that the final good is the numeraire, then its price could be set equal to one $P = 1$. In turn, at the industry level, total output, Y_s , is a constant elasticity of substitution aggregate of differentiated products M_s :

$$19 \quad Y_s = \left(\sum_{i=1}^{M_s} Y_{si}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

To produce products, Y_{si} (or output), individual firms within a given industry require capital and labour inputs and utilize a Cobb-Douglas production technology in the form of:

$$20 \quad Y_{si} = A_{si} (K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}),$$

where A_{si} , K_{si} , and L_{si} are, respectively, productivity, capital, and labour at the firm level. There is heterogeneity in firm productivity, A_{si} , in that the most cost-efficient firms have high A_{si} . The factor shares (α_s and $1 - \alpha_s$) can vary across industries but not across firms within the same industry.

To maximise current profits firms do not only have to consider input choices but are also having to face capital and labour distortions, thus

$$21 \quad \pi_{si} = P_{si} Y_{si} - (1 + \tau_{L_{si}}) w L_{si} - (1 + \tau_{K_{si}}) r K_{si},$$

where P_{si} , Y_{si} , w , and r are, respectively, value added by the firm (P_{si} is the price level the firm faces while Y_{si} is its output), the wage rate a firm face, and the rental rate of capital. Further, following Hsieh and Klenow (2009), I assume that profit maximisation yields the standard condition that the optimal price of a firms output is its markup over marginal cost:

$$22 \quad P_{si} = \frac{\sigma}{\sigma-1} \left(\frac{r}{\alpha_s} \right)^{\alpha_s} \left(\frac{w}{1-\alpha_s} \right)^{1-\alpha_s} \frac{(1 + \tau_{K_{si}})^{\alpha_s} (1 + \tau_{L_{si}})^{1-\alpha_s}}{A_{si}}.$$

Using the profit function as captured in equation 21, production inputs (capital and labour) demand can be derived and expressed as follows

$$(23) \quad L_{si} \propto A_{si}^{\sigma-1} (1 + \tau_{K_{si}})^{\alpha_s(1-\sigma)} (1 + \tau_{L_{si}})^{\alpha_s(1-\sigma-\alpha_s)},$$

24

$$K_{si} \propto A_{si}^{\sigma} (1 + \tau_{K_{si}})^{\alpha_s} 1^{-\sigma-1} (1 + \tau_{L_{si}})^{\sigma} \alpha_s^{-1 - \alpha_s + 1},$$

$$(25) \quad \frac{K_{si}}{L_{si}} = \frac{\alpha_s}{1 - \alpha_s} \frac{w (1 + \tau_{L_{si}})}{r (1 + \tau_{K_{si}})},$$

By implication, the presence of distortions $\tau_{L_{si}}$ and $\tau_{K_{si}}$ affects (distorts) firms' demand for production inputs which consequently creates differences in the marginal revenue products of labour (MRPL) and capital (MRPK)¹⁶. Particularly, since these distortions are firm-specific, they will prevent heterogeneous firms belonging to the same industry from achieving their optimal size. Intuitively, a higher observed dispersion in marginal revenue products of inputs across firms (in each industry) is indicative of allocative inefficiency¹⁷.

I argue that electricity shortages could induce firm-specific capital distortions, $\tau_{K_{si}}$, and labour distortions, $\tau_{L_{si}}$, which prevents inputs to be allocated in tandem with firm physical productivity. As discussed earlier, we could think of these electricity shortages-induced distortions to include, dwindling net worth due to increase in production costs, increased production uncertainty, and unequal availability of margins to adopt coping strategies to attenuate adverse effects of power outages. Generally, these distortions could then constrain a firm in accessing capital and or labour at their optimal market prices or employing such inputs in their optimal quantities¹⁸.

Taking the first-order conditions of the profit function and rearranging, marginal products can formally be expressed as:

$$26 \quad MRPL_{si} = (1 - \alpha_s) \left(\frac{\sigma - 1}{\sigma} \right) \left(\frac{P_{si} Y_{si}}{L_{si}} \right) = (1 + \tau_{L_{si}})w,$$

$$27 \quad MRPK_{si} = \alpha_s \left(\frac{\sigma - 1}{\sigma} \right) \left(\frac{P_{si} Y_{si}}{K_{si}} \right) = (1 + \tau_{K_{si}})r,$$

¹⁶ Note that in the absence of distortions, a typical firm's demand for inputs would be a function of only its efficiency, A_{si} .

¹⁷ Arguably, in the absence of distortions marginal revenue products will equalize across firms in that the most productive firms will consume higher shares of inputs which then leads to increases in output and lower prices. This then causes a decline in revenues until they equal those of firms that have lower physical productivity, hence, equalizing marginal revenue products of firms within the same sector.

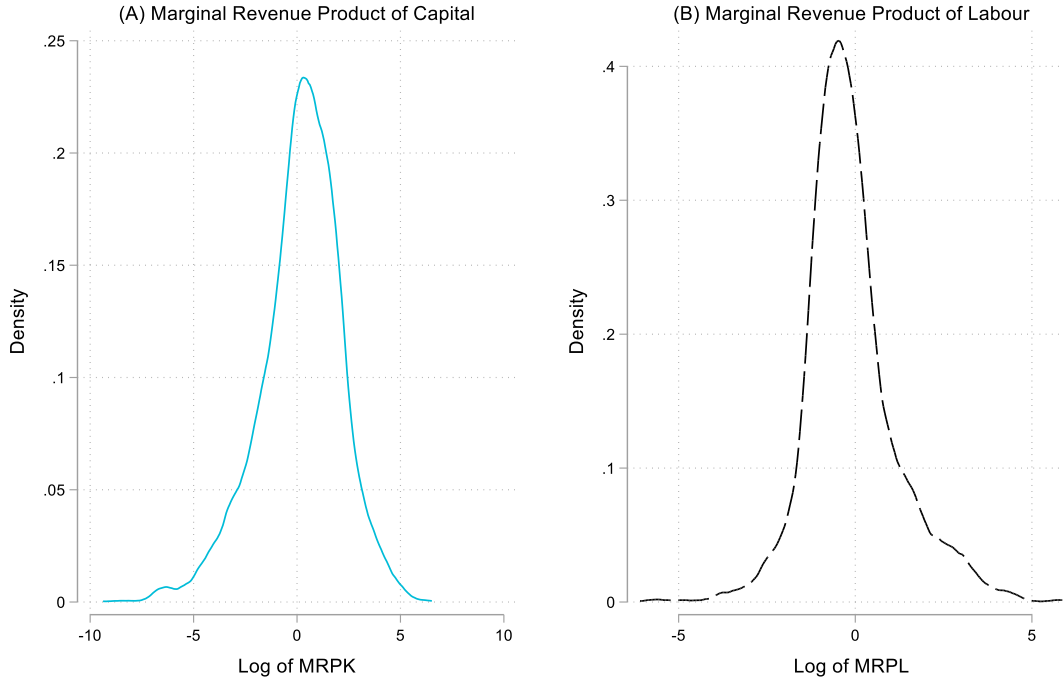
¹⁸ In addition, as expositied in the literature, capital and labour distortions will be high for firms that face a higher interest rate, that face discriminatory credit allocation, or subject to strict social security provisions for workers, but will be low for firms with connections with creditors, beneficiaries of credit subsidies, or are not subject to strict labour market regulations.

where α_s and $1 - \alpha_s$ denote capital and labour shares respectively, the mark-up is represented by $\frac{\sigma-1}{\sigma}$, and w and r denote cost of labour and capital respectively¹⁹. Equations 26 and 27 simply imply that, adjusting for mark-up, $\frac{\sigma-1}{\sigma}$, a profit maximising firm will hire inputs (labour and capital) until marginal revenue product equals marginal cost, but the presence of distortions, $\tau_{L_{si}}$ and $\tau_{K_{si}}$, could prevent that from happening. In simple terms, a firm's marginal revenue product for each input is proportional to the distortion on that input – i.e., $\tau_{L_{si}}$ and $\tau_{K_{si}}$. Implying that, arguably, firms with higher distortions will have higher marginal revenue products and vice versa.

The positive standard deviations (as shown in *Table B 1.1*) reported for both MRPK and MRPL indicate that there is significant variation across firms regarding optimal use of production inputs. Moreover, observing from *Figure 1.8*, the distributions of both MRPK and MRPL, particularly considering the right tails of each graph, depict that a significant proportion of firms are subject to distortions that constrain access to capital and labour.

¹⁹ Note that, as posited in the literature (Hsieh and Klenow 2009; León-Ledesma and Christopoulos 2016; Kalemli-Ozcan and Sorensen 2012) since the elasticity of substitution is assumed to be constant, then the mark-up for each firm will be identical and will have no effect on marginal revenue products implying it (mark-up) drops as it is a constant. Hence, the marginal revenue products could also be reformulated as:

Figure 1.8: Distribution of Marginal Revenue Product of Capital & Labour



Empirical Setup

From these equations, I create measures of misallocation consistent with Hsieh and Klenow's (2009) argument that dispersion in marginal revenue products across firms in a given sector is indicative of the presence of distortions causing misallocation. Specifically, arguably, the deviation of firm i 's marginal revenue product from the that of the mean of its sector s each year is indicative of misallocation. Thus, to test whether electricity shortages correlate with the dispersion of marginal revenue products – i.e. misallocation – I estimate the following specification:

$$28 \quad \ln \left(\frac{MRP_{ist}}{MRP_{st}} \right) = \delta + \varphi Outages_{it} + \vartheta Z_{it} + T_y + L_l + \epsilon_{it},$$

where the dependent variable captures the logarithm of the deviation of a given firm's marginal revenue from that of its sector's mean and all the right-hand variables are the same, and explained, like those used in the main text.

The underlying logic for characterising misallocation using this approach hinges on some, arguably, contentious assumptions which could affect the plausibility of yielded results from estimating equation 28. Specifically, as in Hsieh and Klenow (2009), I also consider that a firm with higher marginal revenue

product implies it is charging a relatively higher price compared to the rest of its sector, which is then indicative of misallocation. Underlying this interpretation is the assumptions that each firm within a given sector uses the same production technology and has the same labour and capital shares. However, arguably, there is no convincing reason why marginal revenue products should not be heterogenous across firms since their variation could be reflective of differences in production methods and or adjustment costs (Restuccia and Rogerson 2017; Asker, Collard-Wexler, and De Loecker 2014). Observed dispersion in marginal revenue products could indeed reflect the presence of distortions but also other potential influencers hence misallocation could be overestimated or underestimated. Wary of these caveats, any reported significant association between electricity shortages (and other covariates) should be interpreted with caution. I interpret such results to imply electricity shortages contributing to the dispersion of marginal revenue products.

To empirically examine the impact of electricity shortages on firm marginal revenue products, the elasticity of substitution, capital and the labour inputs shares must be set or computed. Following Hsieh and Klenow (2009) I set the elasticity of substitution = 3. Labour and capital inputs shares for each industry s are computed as the ratio of the industry's input to its output (value added). Capital shares are then obtained as 1 minus the shares of labour input. By constructing factor shares in this manner I depart from Hsieh and Klenow's (2009) approach where they rely on USA industrial factor shares. Although relying on USA factor shares allows for benchmarking, for instance, distortions against an efficient economy, due to underlying differences in technological intensity and quality among others, the use of such factor shares might not be suitable for my sample which is particularly micro, small and medium-sized dominated.

Results

The results from using Hsieh and Klenow's (2009) approach to gauge firm-level allocative inefficiency are reported in *Table 1.9*. As can be observed from the table, electricity shortages exert a positive and statistically significant effect on MRPK and MRPL. Implying that power outages contribute to the dispersion in the marginal revenue products of inputs across firms belonging to the same sector.

Table 1.9: Hsieh and Klenow's (2009) Approach

Regressor	Regressand			
	(1)	(2)	(3)	(4)
	MRPK	MRPK	MRPL	MRPL
Outages	0.081** (0.041)	0.099** (0.041)	0.061 (0.038)	0.071* (0.037)
Age	0.135 (0.117)	0.088 (0.119)	-0.099 (0.078)	-0.071 (0.079)
Size (Labour)	0.236*** (0.068)	0.240*** (0.068)	-0.174*** (0.047)	-0.180*** (0.048)
Exporter	0.206* (0.122)	0.207* (0.124)	-0.007 (0.098)	0.014 (0.095)
Bank Finance	-0.008 (0.082)	-0.012 (0.082)	-0.041 (0.091)	-0.027 (0.089)
Bribe	0.060 (0.120)	0.064 (0.118)	-0.030 (0.136)	-0.033 (0.134)
Observations	3,423	3,423	3,432	3,432
R-squared	0.017	0.027	0.012	0.030
Firm FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Year-Location FE	No	Yes	No	Yes

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

NB: Outages denote the log of average annual number of days a firm experience an electricity outage

MRPK and MRPL denote the log of marginal revenue product of capital and labour respectively

Both indicators were computed using the Hsieh and Klenow (2009) methodology

1.8 Conclusions

Understanding the sources of factors that cause allocative inefficiency or sub-optimal use of production inputs is essential in unearthing the reason for the low productivity performance in developing countries. This study provides evidence, using data from a sample of Ghanaian manufacturing firms, that electricity shortages contribute to the allocative inefficiency of capital and labour.

I rely on a methodology proposed by Petrin and Sivadasan (2013) to gauge allocative inefficiency for capital and labour which are simply the absolute marginal revenue–cost gaps for these inputs. I then combine these allocative inefficiency measures with firms’ self-reported electricity outages data which I consider to be arguably random per the power rationing schedule implemented by power authorities during the period when surveys were conducted.

I confirm that when faced with power outages, firms reduce capital and labour inputs, and reduce workers’ wages. What is more, the findings reveal that power shortages retard firm efficiency (TFP). Furthermore, I uncover that electricity shortages positively impact revenue–cost gaps for capital and labour. Specifically, for the revenue–cost gaps of capital, I find that this effect is more pronounced for firms that are more electricity constrained – i.e., those which may have production techniques that are more electricity reliant. Finally, my findings indicate that the allocative inefficiency–increasing effect of electricity for both capital and labour is more pronounced for firms that own generators, implying that self-generated power might not be sufficient to augment the deficit in power supply from the national grid.

The qualitative meaning and statistical inference of my substantive results regarding absolute revenue–cost gaps of capital and labour still hold after a battery of robustness checks. These include using fixed effects and trans-logarithmic production functions to uncover parameters used to measure marginal revenue of capital and labour as well as TFP, deflating revenue–cost gaps of capital and labour with a GDP deflator, and gauging allocative inefficiency using a different methodology – i.e., that due to Hsieh and Klenow (2009)²⁰.

²⁰ I use an augmented version of this approach in that I focus on capital and labour distortions, hence, MRPK and MRPL are gauged instead of output and capital distortions as presented in the original model.

Appendix 1A: Sample Power Load-Shedding Schedule

Figure A 1.1: Sample Power Load-Shedding Schedule

LOAD-SHEDDING GUIDE

The Electricity Company of Ghana wishes to inform its cherished customers that due to generation shortfall it has become necessary to publish this load shedding guide.

All Communities in the bracket are on loadshedding, but all or some may not go off depending on the quantum of power to be shed.

	FRIDAY 06/02/2015	SATURDAY 07/02/2015	SUNDAY 08/02/2015	MONDAY 09/02/2015	TUESDAY 10/02/2015	WEDNESDAY 11/01/2015	THURSDAY 12/02/2015
DAY 6AM TO 7PM	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)
NIGHT 6PM TO 6AM	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)
	FRIDAY 13/02/2015	SATURDAY 14/02/2015	SUNDAY 15/02/2015	MONDAY 16/02/2015	TUESDAY 17/02/2015	WEDNESDAY 18/01/2015	THURSDAY 19/02/2015
DAY 6AM TO 7PM	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)
NIGHT 6PM TO 6AM	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)
	FRIDAY 20/02/2015	SATURDAY 21/02/2015	SUNDAY 22/02/2015	MONDAY 23/02/2015	TUESDAY 24/02/2015	WEDNESDAY 25/01/2015	THURSDAY 26/02/2015
DAY 6AM TO 7PM	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)
NIGHT 6PM TO 6AM	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)
	FRIDAY 27/02/2015	SATURDAY 28/02/2015	SUNDAY 01/03/2015	MONDAY 02/03/2015	TUESDAY 03/03/2015	WEDNESDAY 04/03/2015	THURSDAY 05/03/2015
DAY 6AM TO 7PM	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)
NIGHT 6PM TO 6AM	A; (C)	B; (A)	C; (B)	A; (C)	B; (A)	C; (B)	A; (C)
	FRIDAY 06/03/2015						
DAY 6AM TO 7PM	C; (B)						
NIGHT 6PM TO 6AM	B; (A)						

Appendix 1B: Descriptive Statistics and Regression Table

Table B 1.2: Descriptive Statistics

	Obs	Mean	St. Dev	Min	Max
Capital Gap (Lev Pet)	3605	1.404	0.298	0.134	1.852
Labour Gap (Lev Pet)	3605	10.145	1.145	7.016	12.557
Capital Gap (FE)	3605	1.365	0.372	-0.542	1.762
Labour Gap (FE)	3605	10.143	1.146	7.014	12.561
Capital Gap (Translog)	3605	1.377	0.363	-0.543	1.884
Labour Gap (Translog)	3605	10.145	1.146	7.014	12.561
MRPK	3605	0.160	1.980	-9.380	6.250
MRPL	3616	-0.120	1.300	-6.090	5.880
Outages	3616	128.686	63.766	12.000	365.000
Age	3445	13.884	9.496	1.000	64.000
Exporter	3616	0.200	0.400	0.000	1.000
Bank Finance	3616	0.084	0.277	0.000	1.000
Bribe	3598	0.047	0.212	0.000	1.000
Size (Labour)	3616	10.679	17.210	1.000	385.000

NB: All gap measures are log transformed. MRPK and MRPL denote marginal revenue product of capital and labour respectively, also log transformed
Lev Pet, FE, and Trans-log, denote, respectively, the Levinson and Petrin, fixed effects, and translog estimation techniques used to estimate production functions.

Chapter 2: Tax Incentives and Inward Mergers and Acquisitions

Abstract

In this paper, for a sample of 91 developing countries, I examine the efficacy of tax incentives in attracting a salient component – i.e., mergers and acquisitions – of foreign investments. Specifically, this study relies on a recently created fiscal incentives data set which contains unique information on concessionary tax rates that are unconditional (i.e. standard tax rates) as well those that are conditioned on an investor locating in a specific location, meeting a minimum scale of capital, contributing to innovative activities such as R&D, and promoting exporting activities. At the empirical front, in order to circumvent any potential endogeneity issues with tax incentives indicators as well as appropriately account for zeros in the regressand – i.e. the total number of inward M&As, I utilize a control function approach combined with a Poisson and negative binomial estimation techniques. I unearth that tax incentives increase inward M&As. The tax incentives which are more prominent in attracting M&As are those conditioned on an investor locating in specific locations and contributing to exports. Quantitatively, the tax incentives inducement effect on M&A appears to be rather modest. Specifically, I uncover that for a typical developing country to attract an additional merger or acquisition, it has to reduce the standard tax rate by 1.6%.

2.1 Introduction

Inward FDI, it is argued, offers developing countries the opportunity to access foreign technologies, enhance corporate governance, access inputs essential for the upgrade and diversification of exports, and to improve labour compensation (Jovanovic and Rousseau 2008; Aggarwal et al. 2011; Huttunen 2007; Javorcik and Spatareanu 2008; Taglioni and Winkler 2016; Antràs and Yeaple 2015). Buoyed by these potential benefits of inward FDI, governments often provide incentives such as concessionary tax rates to attract more FDI. Arguably, cognisant of their development priorities and the different motives of foreign investors²¹, governments of, particularly, laggard economies, do not only reduce the standard corporate tax rate but also provide conditional (or targeted) concessionary tax rates.

Empirically, there is evidence (Bénassy-Quéré, Fontagné, and Lahrière-Révil 2005; Huizinga and Voget 2009; Becker, Egger, and Merlo 2012; Herger, Kotsogiannis, and McCorriston 2016; Da Rin, Di Giacomo, and Sembenelli 2011; Klemm and Van Parys 2012; Hines 1996; Devereux and Griffith 1998) to suggest that lower host country tax rates attract higher inward FDI and investment. However, particularly for developing countries, little is known about the impact of conditional (or targeted) tax concessions on inward mergers and acquisitions (M&As) which is a salient component of FDI²².

This study seeks to enhance our knowledge on this topic by using data from a panel of 91 developing countries to assess the impact of both the standard tax rate (or unconditional) and conditional tax concessions on inbound M&As. This inquest is made possible by the availability of a unique and comprehensive fiscal incentives data set covering 160 countries²³ of which developing countries are significantly represented. Contained in this data set is information on the standard tax rate as well as those provided on the condition that an investor sights in a specific location or a special economic zone (SEZ), contribute to innovation-related activities such as R&D, contribute towards exporting activities, and meet a minimum scale of capital investment or employment. I combine this unique information on concessionary tax rates with cross-border inbound M&As to construct a panel data set spanning the period 2009-2015 for 91 developing countries.

As an empirical strategy, I rely on econometric approaches – i.e., Poisson and negative binomial models – which are not only suitable for a count regressand²⁴ but more importantly one that includes zeros. Further,

²¹ Notably, market-seeking, resource-seeking, strategic asset-seeking, and efficiency-seeking.

²² For instance, of the \$1.7 trillion FDI recorded in 2015, \$721 billion was made up of CBAs (UNCTAD 2016).

²³ Details on the global tax incentives can be found here: <https://elibrary.worldbank.org/doi/abs/10.1596/978-1-4648-1175-3>

²⁴ In this case, the total number of inbound M&As.

I consider tax concession indicators to be potentially endogenous given the possibility that tax policy, as well as the total number of inbound M&As are likely to be simultaneously driven by certain unobservable country-level conditions, and that dwindling inbound investments could in turn influence tax policy, that is, reverse causation. Thus, in all estimations, I include country and year fixed effects as well as lag all regressors including tax indicators by one year to reduce the potential effect of endogeneity on estimates. In a more robust econometric approach, to circumvent the endogeneity issue, I employ two instruments and rely on a control function approach combined with a Poisson estimator and a negative binomial estimator.

To preview my findings, they reveal that all tax concession indicators exert a negative and statistically significant impact on inbound M&As, implying that a reduction in tax rates by developing countries' governments induce an inflow of FDI in the form of M&As. What is more, I unearth that of all conditional tax concession indicators, those targeted at SEZs or specific locations exert the highest impact on M&A inflows. Inferring from the quantitative magnitudes of these findings, a typical developing country will have to reduce, for instance, the unconditional tax rate by about 1.6% in order to attract one merger or acquisition, implying that the impact of tax incentives is rather modest.

This paper relates to and contributes to two strands of the empirical literature. The first strand pertains to the empirical studies (Hines, 1996; Devereux and Griffith, 1998; Bénassy-Quéré, Fontagné and Lahrière-Révil, 2005; Huizinga and Voget, 2009; Da Rin, Di Giacomo and Sembenelli, 2011; Becker, Egger and Merlo, 2012; Herger, Kotsogiannis and McCorriston, 2016) that examines the effect of tax rates on inward FDI. This line of empirical research follows from the theoretical underpinnings that postulate that the mobility of capital will induce countries to undercut their tax rates in order to attract investments (Wilson 1987; Zodrow and Mieszkowski 1986; Bucovetsky 1991).

Although these empirical studies provide conclusive evidence to indicate that lower tax rates are a precursor to inward FDI, they still leave certain gaps unfilled. For starters, most, if not all, of these studies examine the issue for developed countries hence offering little insight as to what pertains in developing countries. The issue for developing countries with weak institutions and physical infrastructures may differ such that investments are discouraged. Further, foreign investors might be interested in locating in countries or locations with the potential of agglomeration benefits (Brühlhart, Jametti, and Schmidheiny 2012; Devereux, Griffith, and Simpson 2007). The comparatively low levels of agglomeration in developing countries, on the one hand, could be seen by foreign investors as an opportunity to tap into new territories to contribute and benefit from increasing agglomeration or on the other hand deter investments because they are deemed not so beneficial. What is more, the fiscal ramifications for developing countries granting fiscal incentives could present a different picture from that which will

pertain in advanced countries. With relatively larger informal sectors, if a developing country undercuts its tax rates, this could arguably increase formalisation and tax compliance but could at the same time lead to loss in potential tax revenue from existing and incoming businesses.

The second strand of empirical literature (Emmanuel Cleeve 2008; Klemm and Van Parys 2012; Van Parys and James 2010) looks at the role of concessionary tax rates or incentives on investments. One way this study improves upon this line of empirical studies is its focus on a plethora of targeted or conditional tax concessions implemented by governments. To understand why this is relevant, for instance, studies (Bertrand et al. 2012; Karkinsky and Riedel 2012; Bandick, Görg, and Karpaty 2014; Guadalupe, Kuzmina, and Thomas 2012) show that low tax rates attract intangible foreign capital and improve R&D intensity by foreign multinationals. Similarly, location-based tax incentives have been found not only to improve the performance of incumbent business but also improve the number of new entrants (Chaurey 2017).

With these evidences, it will be worthwhile investigating for developing countries, among other targeted tax incentives, the efficacy of tax concessions targeted at improving innovativeness and industrial clustering or regional balancing in attracting M&As. Finally, this study also differs from these other studies in its scope – i.e., focusing on a much broader sample (91) of developing countries –, and focusing explicitly on inward M&As as opposed to inward investments. M&As is the most dominant form of FDI (di Giovanni 2005) and is a more strategic form of foreign entrants into territories for which they have less knowledge on.

The remainder of the paper is structured as follows: In section 2, sources of data and some descriptive analysis are provided. Section 3 details the empirical setup which includes a brief conceptual framework, a brief discussion of empirical challenges, and econometric methods used. Robustness checks are discussed under section 4. Finally, conclusions are provided under section 5.

2.2 Data

2.2.1 Data Sources

I utilise information from alternative sources for a sample of 91 developing countries. The data on M&As was obtained from Thomson Reuters SDC M&A Database. From this data source, for all 91 countries, I extracted all M&A deal information covering the period 2009-2015. For each deal, I focus on majority interest or complete change in ownership, thus a requirement of an acquirer owning at least 50% of the target's share after the deal is completed is imposed. Additionally, following standard practice in the literature (Erel, Liao, and Weisbach 2012; Bris and Cabolis 2008; Rossi and Volpin 2004), I further impose

the following restrictions on the sample: exclude leveraged buyouts, spinoffs, exchange offers, recapitalization, share repurchases, tender offers, and buyback transactions; drop self-dealing transactions for which acquirer and target Ticker codes and announcement dates are identical – i.e., duplicates. The final sample is made up of 6851 from the 91 countries.

As for concessionary tax indicators, information on these variables was solicited from the Global Tax Incentives Database of the World Bank. This database contains information on the prevalence of tax incentives for a panel of 160 countries over the period of 2009-2015. From this database, I utilise information on the availability and level of preferential tax rates below the standard corporate income tax (CIT) rate. Specifically, I utilise standard tax rates as well as four concessionary tax rate indicators: tax concession provided conditional on an investor locating at a specific location or SEZs, tax concession provided conditional on a minimum scale of capital or employment been met, tax concession provided conditional on engagement in innovation-related activities such as R&D, and tax concession for an investment that supports exporting.

The standard tax rate is the rate that a country offers without any conditions attached. The concessionary tax rates on the other hand are special or preferential tax rates offered below the standard tax rate conditioned on specific requirements, in this case, an investor locating in a SEZ, meeting a certain scale of capital or employment, supporting R&D activities, or exporting. In simple terms, a reduction in the rate (percentage) of the standard tax rate to induce investments is a tax concession. Each of these concessionary tax rates indicators are available at the sectoral level in the Global Tax Incentives Database, hence, to obtain a country-level indicator, I take the annual average across all sectors. So that, if for instance, for Ghana, the average concessionary tax rate for an investor locating at a specific location is 25% compared with its standard tax rate of 28%, this is interpreted as Ghana offered a concessionary tax rate of 25% for SEZs.

Other indicators used in the analysis include macroeconomic variables, a measure of institutional quality, and an indicator on the overall tax burden. Macroeconomic indicators were obtained from the World Bank's World Development Indicators and include GDP, GDP per capita, trade as a proportion of GDP, and the proportion of credit channelled to the private sector as a proportion of GDP. From the Freedom House Database, I use the indicator on a country's level of democracy²⁵ to depict its quality of institutions. From the same database, the indicator on a country's tax burden pertaining to indirect taxes such as value-added tax (VAT), tariffs, payroll, sales, and excise taxes among others, are solicited. Finally, information on the two instrumental variables – i.e., labour tax and the share of workers in agriculture –, which I

²⁵ Note that this ranges from 0 lowest to 10 the highest.

elabourate on later, was obtained from the quality of governance database and the World Bank's World Development Indicators.

2.2.2 Descriptive Statistics

Table 2.1 contains descriptive statistics on all variables used in the analysis. The average country attracted 11 inbound M&A over the period 2009-2015, a figure which is rather low given the time span. Further, *Figure 2.1* shows that aggregate M&A activity²⁶ saw an upward trend from the year 2009 but fell in 2011 until 2015 when it started to increase again. On tax concession indicators, the summary statistics provided in *Table 2.1* indicate that governments tend to provide higher concessions to investments earmarked for specific locations or SEZs and those that will boost exports. Interestingly, the standard tax rate is on average higher than all tax concessions which are conditional on certain requirements, implying that governments, arguably, at least are cognizant of their development priorities when designing tax policy. In general, tax rates have taken a downward trend (*Figure 2.2*), implying that more likely governments are increasingly relying on the provision of concessionary tax rates in order to attract foreign investments.

At the country level, as shown in *Table A 2.1*, the countries that receive the most inbound M&As are Brazil, Mexico, Indonesia, Turkey, and Malaysia. Interestingly, tax concessions provided by these countries offer a mixed picture. Of all five countries, Turkey and Malaysia consistently, on average, provide concessionary tax rates that are below those of the sample averages. By contrast, Brazil and Mexico provide concessionary tax rates that are higher than those of the sample averages but, considering, for instance, Brazil alone, still attract more M&As than Turkey and Malaysia combined. It is obviously hard to tell from the mere observation of these statistics the role concessionary tax rates play in attracting inbound M&A without resorting to a rigorous empirical investigation.

²⁶ Note that this is a simple count of the total number of M&A activities for the entire sample. The difference between cross-border M&A and total M&A is that the latter includes domestic M&As activities whereas the former does not.

Table 2.1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total Cross-Border M&A (number/count)	637	10.76	24.31	0	213.00
Standard Tax Rate (%)	601	25.46	7.86	0	45.00
Tax Concession Rate - Location (%)	601	22.76	9.52	0	45.00
Tax Concession Rate - Scale (%)	601	25.30	7.94	0	45.00
Tax Concession Rate - R&D (%)	601	24.13	8.18	0	45.00
Tax Concession Rate - Export (%)	601	23.98	8.62	0	45.00
Indirect Taxes	630	79.06	8.98	44.10	98.80
GDP	636	0	1	-2.93	2.57
GDP Per Capita	636	7.85	1.02	5.43	9.90
Trade	613	4.32	0.42	3.07	5.19
Private Credit	608	3.36	0.79	0.98	5.55
Institutions	637	5.87	2.55	0.25	10.00
Agric Employment Share	637	0	17.54	-50.32	38.33
Labour Tax (%)	610	15.69	9.97	0	52.00

Figure 2.1: Aggregate M&A Activity

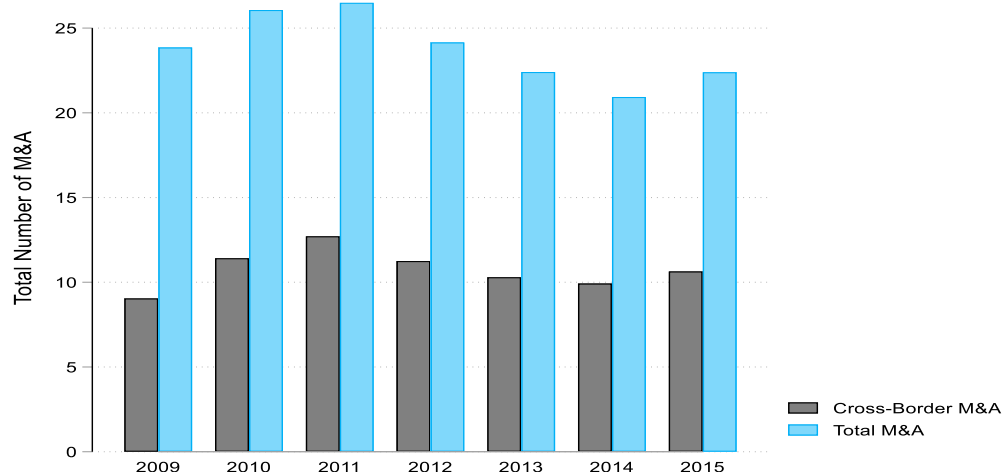
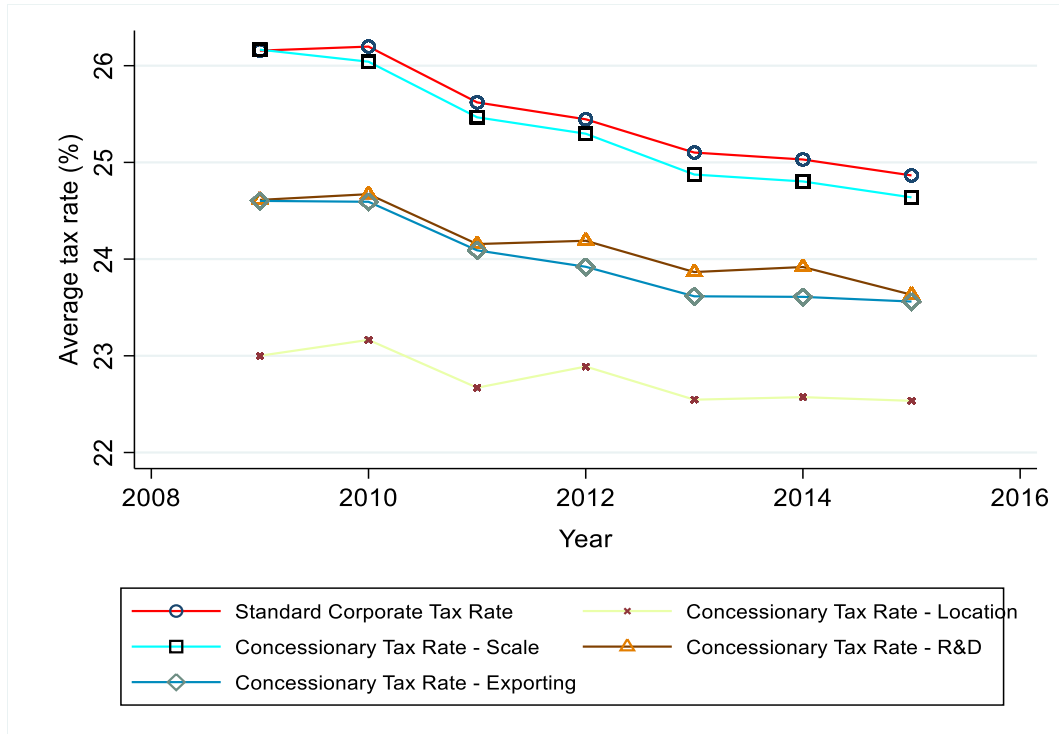


Figure 2.2: Aggregate Trend in Concessionary Tax Indicators



2.3 The Empirical Setup

2.3.1 Conceptual Framework

Acquisition activity can be considered in the context of a location choice framework in which an acquiring firm in its investment decision considers a target in a host country that yields the largest synergies or surplus over all countries. From the perspective of the acquiring firm's managers, the decision to invest in or acquire a foreign company is a profit maximisation problem. This implies that certain factors, including notably fiscal incentives in the form of concessionary tax rates, which could potentially affect the expected returns from an acquisition could also influence acquisition activity.

More formerly, following the literature (Brühlhart, Jametti and Schmidheiny, 2012; Herger, Kotsogiannis and McCorriston, 2016), I liken expected returns of an acquisition to expected profits which then informs the formulation of a profit function. That is

$$1 \quad \pi_{kt} = U_{kt} + \epsilon_{kt},$$

which reflects the fact that the desire for a firm to invest in a foreign target k at time t hinges on expected profits which are in turn determined by a deterministic part, U_{kt} , and a random error, ϵ_{kt} . Relying on observable completed M&As, I posit that among host countries, k^τ , a firm invest in the country that yields the highest surpluses, that is

$$2 \quad \pi_{kt} > \pi_{k^\tau t} \quad \forall k^\tau \neq k.$$

2.3.2 Baseline Estimation: Log-Linear Models

Drawing from the intuition of *equation 1*, I model the number of acquisitions, π_{kt} , as a (log-linear) function of the concessionary tax rates, T_{kt} , and other control variables Z_{kt} :

$$3 \quad \ln(\pi_{kt}) = \psi T_{kt-1} + \gamma Z_{kt-1} + \phi_k + \eta_t + \varepsilon_{kt},$$

where, ϕ_k and η_t are the target country fixed effects and year fixed effects, and the error term is contained in ε_{kt} . The target country fixed effects are essential in controlling for any unobserved country-level characteristics that are likely to affect the intensity of inbound M&As. For the time fixed effects, they control for transitory global or economic shocks from time to time that is likely to affect the cross-border acquisition activities. Moreover, to attenuate any bias resulting from contemporaneous influences on the regressand (i.e., the total number of M&As) and the regressors, all regressors are lagged by one year. *Equation 3* highlights the relation between target countries' average concessionary tax rates and the total number of inbound acquisitions conditional on controlling for other variables as well as neutering unobservable time-invariant country-level characteristics and time fixed effects. As a baseline estimation, I estimate *equation 3* with an OLS estimator. Estimating a log-linear model of the form expressed in *equation 3* could lead to inconsistent and unreliable estimates (reasons elaborated on below), however, owed to the popularity of such models in the literature it could be a worthwhile exercise so as to compare results to those of earlier studies. What is more, results from estimating the log-linear model could also serve as a benchmark for those of the Poisson and negative binomial models.

The choice of candidates of variables to control for is informed by insights from the literature. For starters, as expected, other forms of taxes, specifically indirect taxes (Desai, Foley, and Hines 2004), are likely to adversely affect acquisition synergies and consequently the intensity of inbound M&As. Thus, the tax burden encapsulating other forms of taxes including payroll, sales, excise taxes, and value-added taxes (VATs), as well tariffs, are quantified as a proportion of GDP and included as a control variable.

Additionally, access to a larger market as in real GDP, cheap or high-quality labour, as in GDP per capita, could be pull factors for inbound acquisitions (Head and Mayer 2004). Expectedly, a host country with a larger GDP should attract more M&As. As for GDP per capita, since a higher or increasing value could be indicative of either the presence of high-quality labour or high-cost labour, its expected impact on inbound M&As could be positive or negative.

Next, a host country with a developed financial sector depicted by the intensity of credit provided to the private sector should incentivise inbound M&As. In simple terms, better access to credit should correlate positively with expected synergy gains and consequently increases the number of M&As. Further, a country's degree of openness, trade as a proportion of GDP, could be a vital source of intermediate inputs, serve as an export platform, and or integration into global value chains (GVCs) hence positively influence inbound acquisitions.

Moreover, better institutional capacity denoted by stability in governance, contractual arrangements, and protection of shareholders' interest is associated with higher synergy gains (Rossi and Volpin 2004; Bris and Cabolis 2008; Cao, Li, and Liu 2019; Erel, Liao, and Weisbach 2012). By implication a host country with better democratic institutions should attract more M&As.

2.3.3 Empirical Challenges

Regarding the econometric formulation provided in the baseline estimation framework, although simple to implement, conventional and its results could be comparable with those in the literature, it confronts a few econometric issues. The first issue has to do with the fact that the baseline framework involves applying an OLS estimator to a model (log-linear) which has a count-dependent-variable. In doing so, I am effectively treating a count-dependent-variable as a continuous variable even though its structure informs that of only nonnegative integer values. The second issue has to do with the presence of zeros in the dependent variable which is as a result of (some) countries not witnessing inbound acquisition activity in some years. Specifically, the summary statistics of the sample reveal that the occurrence of zeros is about 21.4% for total numbers of inbound acquisitions. Although this value isn't particularly large, it could still present a challenge in the reliability of yielded results.

These issues are particularly untenable in a modelling framework of the kind that I have adopted in that applying a least squares estimator to a count dependent variable could lead to inconsistent and biased estimates. Further, this issue could be exacerbated since log-linearizing the dependent variable leads to loss of information which could contribute to biased estimates and in the extreme case, that the zeros aren't randomly drawn, sample selection bias. For instance, a good number of studies (Gómez-Herrera

2013; Silva and Tenreyro 2006; Siliverstovs and Schumacher 2009) show that applying least squares to a log-linear model particularly in the presence of heteroscedasticity leads to biased and inconsistent estimates.

The second econometric issue confronting the baseline estimation framework has to do with the potential endogeneity of the tax concessionary variable. Although I control for country and time fixed effects, as well as lag all independent variables by a year, reverse causality and time-varying unobservable country-level factors could still be sources of endogeneity. Specifically, for instance, a country that witnesses low levels of inbound M&As may decide to lower its tax rates in order to attract more M&As, which could cause a downward bias in yielded estimates. What is more, although M&As are undertaken, most likely, by (foreign) new entrants, it's still highly possible that the stock of domestic firms would in a way exert some influence on tax rates, again making concessionary tax rate endogenous to the number of inbound M&As.

The econometric challenges discussed above require different solutions. Whereas the former requires an econometric formulation that is capable of dealing with dependent variables with a significant proportion of zeros the latter warrants an approach that could neuter or at least reduce the endogeneity concerns relating to concessionary tax rates.

2.3.4 Poisson Model

In order to accommodate the presence of zeros in a more econometrically appropriate way, I resort to a Poisson estimator. More formally, I model the total number of M&As as a non-linear function of concessionary tax rates and other regressors of the form

$$4 \quad E[\pi_{kt} | T_{kt-1}, Z_{kt-1}, \phi_k, \eta_t] = \exp(\xi T_{kt-1} + \lambda Z_{kt-1} + \phi_k + \eta_t + \varepsilon_{kt}),$$

where all variables are defined as in *equation 3*. In characterizing a Poisson model of this form, I assume that the dependent variable, the number of M&As, is Poisson distributed with a conditional mean, μ , which defines the intensity of the distribution and is guaranteed to be zero or positive once the exponents of concessionary tax rates and other control variables are taken. More formally, this can be expressed as

$$5 \quad f(\pi | Z) = \frac{\exp(-\mu) \mu^\pi}{\pi!}, \quad \pi = 0, 1, 2, \dots,$$

$$6 \quad \mu = E[\pi | Z] = \exp(\xi T + \lambda Z + V),$$

where the vector V contains country and time fixed effects ϕ_k and η_t . In implementing *equation 4*, standard errors are clustered at the country level, which implies that the estimator employed is that of Poisson Pseudo-Maximum Likelihood (PPML). As shown by Silva and Tenreyro (2006) and Wooldridge (2010) the PPML has an additional advantage that even if a dependent variable isn't Poisson distributed provided the conditional mean (as in, *equation 6*) is correctly specified, it (PPML) is still efficient.

2.3.5 Negative Binomial Model

Although the PPML estimator is efficient in handling dependent variables with zeros particularly in the presence of heteroscedasticity, it has the condition of *equidispersion*: equality of the conditional variance and mean:

$$7 \quad E \pi|Z = Var \pi|Z ,$$

which could pose a limitation in practical implementation. Particularly, due to the presence of unobserved heterogeneity which induces additional variability (Greene 1994), the conditional variance of the dependent variable might be actually larger than the conditional mean (*overdispersion*) and by implication lead to consistent but inefficient results.

An alternative model often used in the literature to cater for *overdispersion* is the negative binomial regression model. In a practical sense, the negative binomial model has the same mean structure as that of the Poisson model, implying that in my case the formulation in *equation 6* holds for both models. However, the variance of the negative binomial model is a function of both the conditional mean and a dispersion parameter, α , which reflects unobserved heterogeneity²⁷. More formally

$$8 \quad E \pi|Z = \mu,$$

$$9 \quad Var \pi|Z = \mu (1 + \alpha\mu) ,$$

so that, observably, the negative binomial model reduces to a Poisson model if the dispersion parameter is zero. Although the proportion of zeros in my regressand isn't particularly large, and studies (Silva and Tenreyro 2011; Blackburn 2015) show that the PPML is still an efficient estimator (well behaved) even when the proportion of zeros are large, I still consider the negative binomial model alongside that of the

²⁷ By implication, the distribution of the negative binomial model is that of a Poisson distribution and a gamma distribution.

PPML estimator so as to compare results from both estimators as well as against those reported in the literature.

2.3.6 Control Function Approach and Two-Stage Least Squares

Thus far, the proposed empirical approaches can handle the econometric constraint relating to the presence of zeros in dependent variables in the presence of observed and unobserved heterogeneity across countries. However, the remaining econometric challenge relating to the potential endogeneity of concessionary tax variables warrants different remedies.

In order to circumvent the endogeneity issue of concessionary tax variables, I rely on a control function approach proposed by Wooldridge (2010; 2015). As an initial step, as with the baseline specification – i.e., *equation 3* –, I ignore the empirical challenges associated with using a log-linear model and apply a 2SLS estimator to a model which entails the logarithm of the total number of M&As to concessionary tax rates and other control variables.

In a more robust econometric approach, I apply a control function approach with a Poisson estimator and a negative binomial estimator. Particularly, I treat the endogeneity of concessionary tax variables as an omitted variable problem as in certain unobservable country-level factors correlates with both inbound M&As as well as concessionary tax variables. More formally, that is

$$10 \quad E \pi|T, Z, X, \varphi = \exp \xi T + \lambda Z + \vartheta X + \varphi ,$$

where φ captures country-level unobservable characteristics or omitted variables which causes concessionary tax variables, T , to be endogenous, and X contains excluded instruments. I assume the remaining control variables contained in Z as well as the excluded instruments contained in X are exogenous. Note that for ease of disposition I drop the country and time subscripts as well as country and time fixed effects. Using information on the exogenous control variables as well as the excluded instruments I implement the following two-step control function procedure:

First stage:

$$T = \lambda Z + \vartheta X + v,$$

Second stage:

$$11 \quad E \pi|T, Z, v = \exp \xi T + \lambda Z + \rho v + \varepsilon ,$$

where v contains the predicted residuals and ε is the error term. In simple terms, in the first stage, an OLS regression of the concessionary tax rates variables on exogenous variables including excluded instruments is performed and the residuals are extracted. In the second stage, a Poisson or negative binomial model is then estimated such that the number of M&As is regressed on the (endogenous) tax variables, the remaining control variables, as well as the predicted residuals from the first stage²⁸. The term v is deemed capable of neutering the endogeneity of concessionary tax variables. Thus, the coefficient ρ provides a gauge of the presence and extent of endogeneity. In any case that concessionary tax variables are exogenous, the $\rho = 0$. As proposed by Wooldridge (2015), In the second stage procedures, i.e., the implementation of the Poisson and negative binomial estimators, I bootstrap standard errors in order to obtain valid standard errors for all coefficients.

2.3.7 Instrumental Variables

For a successful implementation of the control function approach, instrumental variables are required. Natural candidates of instrumental variables should significantly affect tax policy, i.e., tax concession indicators, but should bear no such correlation with the number of inbound M&As.

The first instrument I consider is the difference between a country's share of workers employed in the agricultural sector as a proportion of the total workforce and that of the average of its regional²⁹ neighbours. Specifically, for each region the average share of workers as a proportion of the total labour force is computed. Which is then subtracted from the agricultural share of employment of each country belonging to this region to form a country-level instrumental variable. The motivation for this instrument stems from the structural change argument.

It depicts that a country's level of development could be improved significantly by the reallocation of productive resources from the least productive units to the ablest ones within sectors and from the agricultural sector to the manufacturing and services sectors (F. Caselli and Coleman II 2001; McMillan, Rodrik, and Verduzco-Gallo 2014). Tax policy, particularly, for laggard economies are largely motivated by the need to transform the structure of their economies into modern, formal, and industrial and services led ones so as to boost employment, broaden the tax base and improve tax revenue generation (Besley and Persson 2013). Hence, I consider that a larger difference between a country's agricultural share of

²⁸ Note that country and time fixed effects are included in the implementation of both the first stage and second stage procedures.

²⁹ The regional breakdown in the sample is as follows: Eastern Europe and post-Soviet Union, Latin America, North Africa & the Middle East, Sub-Saharan Africa, East Asia, South-East Asia, South Asia, The Pacific, and The Caribbean.

workers and that of its neighbours depicts, arguably, a lagging economic structure which will then be a motivation for reliance on tax concessions to restructure the economy. Arguably, there is no reason to suspect that the difference between a country's agricultural share of workers and that of its neighbours correlates with inbound M&As directly.

Despite the arguably intellectual underpinnings motivating and justifying the use of this instrument it is worth noting its potential shortcomings. The first has to do with the fact that owed to the similar economic structures of developing countries the variation in agriculture workers shares across countries is likely to be low. The second concern stems from the fact that the measure of the share of agriculture workers could be fret with measurement errors. Despite these two concerns, I still consider this instrument to be at least capable of reducing the potential endogeneity of tax indicators because my sample contains large enough countries which could guarantee that at least the economic structures of some countries would have varied over time. On the issue of measurement errors, by using the average agriculture labour share of a countries neighbours it could be argued that measurement errors are be reduced.

The second instrument is labour tax which is the amount of tax and contributions paid on labour by businesses. The motivation for considering labour tax as an instrument is drawn from a strand of the public economics literature (Wilson 1987; Zodrow and Mieszkowski 1986; Bucovetsky 1991) that postulates that the mobility of international capital induces countries to reduce taxes in order to attract foreign investments. So, particularly for developing countries where institutional and infrastructural structures are comparatively low or weak, the incentive to reduce taxes in order to attract foreign capital should be more pronounced. However, intuitively, governments of developing countries in as much as they want to attract capital are also, arguably, cognisant of the need to meet their fiscal priorities. Implying, a reduction in corporate tax rates, all things equal, should be borne by, at least, by a non-reduction if not an increase in other taxes such as labour tax in order to sustain tax revenue. Thus, we could consider that labour tax will be correlated with tax concession indicators but have no suspicion of it been correlated directly with inbound M&As.

For both instrumental variables, I lag them by one year when performing the first stage of the control function estimations. This is to further attenuate if there is any at all a contemporaneous correlation between instruments and inbound M&As. Specifically, for instance, in using labour tax an instrument, tax indicator variables are regressed on the lag of this instrument. Besides firming uncorrelation with M&As, lagging instruments in the first stage regressions also owe to the logic that economic structure and tax revenue (or fiscal performance) concerns should take a while to influence tax policy.

2.4 Empirical Findings

In this section, I present results from estimating the baseline model (i.e., log-linear) as well as those of the Poisson and negative binomial models. As discussed earlier, since the log of zero is undefined, results from the log-linear model are likely to be biased and inconsistent. However, these results could still serve as a useful benchmark against which those of the Poisson and negative binomial models will be gauged. What is more, first stage results from applying a two-stage least squares estimator to the log-linear model could provide an insight on the validity of instrumental variables.

In order to control for unobserved time-invariant, country-level characteristics and temporary yearly shocks, included in all regressions are country and year fixed effects. Further, to attenuate any bias resulting from contemporaneous influencers on the regressand (i.e., the total number of M&As) and the regressors, the latter are lagged by one year.

2.4.1 OLS Estimation

Table 2.2: OLS Results

	<i>Regressand: Log Total Number of Inbound M&As</i>				
	(1)	(2)	(3)	(4)	(5)
Standard Tax Rate	-0.055*** (0.013)				
Tax Concession Rate - Location		-0.033*** (0.009)			
Tax Concession Rate - Scale			-0.053*** (0.011)		
Tax Concession Rate - R&D				-0.045*** (0.011)	
Tax Concession Rate - Exporting					-0.032** (0.015)
Indirect Taxes	-0.008 (0.014)	0.004 (0.015)	-0.006 (0.014)	0.004 (0.014)	0.006 (0.015)
GDP	1.362*** (0.152)	1.341*** (0.173)	1.365*** (0.152)	1.348*** (0.164)	1.387*** (0.185)
GDP Per Capita	-0.211** (0.090)	-0.192** (0.096)	-0.225** (0.089)	-0.118 (0.094)	-0.192* (0.106)
Trade	1.192*** (0.243)	1.274*** (0.250)	1.224*** (0.241)	1.250*** (0.255)	1.370*** (0.262)
Private Credit	0.094 (0.165)	0.091 (0.189)	0.080 (0.167)	0.106 (0.177)	0.119 (0.195)
Institutions	0.221*** (0.035)	0.265*** (0.034)	0.222*** (0.034)	0.224*** (0.035)	0.240*** (0.040)

Observations	386	386	386	386	386
R-squared	0.567	0.564	0.568	0.565	0.559
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1					

Results from applying the OLS estimator to the model in which the dependent variable is the log of the total number of inbound M&As are reported in *Table 2.2*. Overall, the findings indicate that both standard tax rates and concessionary tax rates that hinge on certain conditions (location or enterprise zones, size of capital or employment, conducting R&D, and contributing to exporting) all bear a negative and statistically significant association with the total number of inbound M&As. Since concessionary tax rates are simply reductions in the standard tax rate, these findings could be interpreted to mean that the provision of fiscal incentives in the form of a reduction in tax rates (or increasing tax concessions) have a tendency of increasing inbound M&As. Observing from the magnitudes of the coefficients, an increase in the standard tax rate appears to exert the largest impact on increasing inward investments. Specifically, a one percentage point increase in the standard tax rate leads to gains in inbound M&As of about 5.5% per year.

As stated earlier, log-transforming the number of M&As omits zero observations implying that for certain years, countries that do not witness inbound M&As are dropped from the regressions. By implication, the afore discussed results are conditional on only a select sample of countries which have at least one inbound M&As across the time span for which data is available.

2.4.2 Poisson Estimation

Table 2.3: Results from Poisson (PPML) Estimation

<i>Regressors</i>	<i>Regressand: Total Number of Inbound M&As</i>				
	(1)	(2)	(3)	(4)	(5)
Standard Tax Rate	-0.043*** (0.010)				
Tax Concession Rate - Location		-0.048*** (0.007)			
Tax Concession Rate - Scale			-0.043*** (0.009)		
Tax Concession Rate - R&D				-0.050*** (0.009)	
Tax Concession Rate - Exporting					-0.039*** (0.011)
Indirect Taxes	-0.003 (0.012)	-0.003 (0.011)	-0.002 (0.011)	0.001 (0.011)	0.003 (0.012)
GDP	1.685***	1.748***	1.697***	1.774***	1.730***

	(0.109)	(0.104)	(0.106)	(0.115)	(0.127)
GDP Per Capita	-0.285***	-0.325***	-0.322***	-0.269***	-0.260***
	(0.083)	(0.075)	(0.082)	(0.078)	(0.087)
Trade	1.045***	1.134***	1.137***	1.128***	1.067***
	(0.189)	(0.164)	(0.192)	(0.183)	(0.204)
Private Credit	0.067	-0.008	0.023	0.036	0.086
	(0.142)	(0.135)	(0.144)	(0.140)	(0.149)
Institutions	0.244***	0.290***	0.253***	0.246***	0.238***
	(0.039)	(0.032)	(0.037)	(0.037)	(0.042)
Observations	465	465	465	465	465
Log likelihood	-1116	-1081	-1110	-1101	-1127
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1					

The Poisson model, unlike the OLS estimator applied to a log-linear model, can accommodate the full sample inclusive of countries that witness zero inflows of M&As in certain years. Since results from a Poisson model cannot be interpreted as marginal effects, I resort to a different approach in interpreting results. Particularly, in order to infer the average percentage change in the total number of M&As induced by a unit change in tax incentives variables, I apply:

$$\% \Delta \pi \approx 100 \times e^{\psi} - 1$$

The results of estimating this model are reported in *Table 2.3*. Similar to the results obtained by using the OLS estimator, all tax variables appear to bear a negative and statistically significant effect on the total number of inbound M&As. Observing from the coefficients, contrary to the results found by using the OLS estimator, concessionary tax rates conditioned on the engagement of innovative activities such as R&D appear to exert the largest impact on drawing in M&As. Specifically, the point estimate for this tax indicator is -0.050 , which implies that a one percentage point decrease is expected to increase the total number of M&As by 4.9% per year³⁰. Quantitatively, a close magnitude (i.e. 4.2% per year) is found for concessionary tax rates conditioned on investment size, scale of capital or employment, and for that of the standard tax rate. Further, the point estimates for concessionary tax rates conditioned on location or locating in a SEZ suggest its impact on per annum inbound M&As is closer to those of the other tax indicators. Concessionary tax rates targeted at promoting exports appear to exert the least inducement effect.

³⁰ This is computed as: $4.9\% = 100 \times e^{-0.050} - 1$.

2.4.3 Negative Binomial Estimation

Owing to potential overdispersion of inbound M&As, the adequacy of the results yielded by the Poisson model could be biased and perhaps inefficient. Although studies (Silva and Tenreyro 2011; Blackburn 2015) indicate that the Poisson model is well behaved even in the presence of a large proportion of zeros in the dependent variable, and the prime interest of this study is to unearth the relationship between concessionary tax rates and inbound M&As by estimating and testing coefficients rather than predicting probabilities, the negative binomial model is considered as an alternative.

Table 2.4: Results from the Negative Binomial Estimation

Regressor	Regressand: Total Number of Inbound M&As				
	(1)	(2)	(3)	(4)	(5)
Standard Tax Rate	-0.052*** (0.010)				
Tax Concession Rate - Location	-0.049*** (0.007)				
Tax Concession Rate - Scale		-0.049*** (0.009)			
Tax Concession Rate - R&D			-0.051*** (0.010)		
Tax Concession Rate - Exporting				-0.041*** (0.013)	
Indirect Taxes	-0.009 (0.012)	-0.006 (0.011)	-0.007 (0.011)	-0.002 (0.011)	0.000 (0.012)
GDP	1.727*** (0.110)	1.736*** (0.113)	1.733*** (0.109)	1.757*** (0.115)	1.769*** (0.131)
GDP Per Capita	-0.391*** (0.076)	-0.381*** (0.072)	-0.413*** (0.075)	-0.314*** (0.075)	-0.363*** (0.083)
Trade	1.208*** (0.193)	1.183*** (0.179)	1.272*** (0.194)	1.239*** (0.194)	1.305*** (0.212)
Private Credit	0.138 (0.156)	0.053 (0.152)	0.107 (0.160)	0.118 (0.160)	0.153 (0.178)
Institutions	0.263*** (0.034)	0.306*** (0.032)	0.267*** (0.033)	0.260*** (0.034)	0.262*** (0.039)
Observations	465	465	465	465	465
Log likelihood	-1049	-1040	-1047	-1047	-1057
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results from using the negative binomial model are shown in *Table 2.4*. Overall, the results dovetail those yielded by the Poisson model. Thus, confirming that investment inflows in the form of M&As do react to concessionary tax rates. Observably, the parameter estimates of all concessionary tax indicators are within 5–10% of those of the OLS and Poisson estimators. What is more, the reported standard errors when applying the negative binomial model bear similar numerical magnitudes to those of the Poisson model.

Thus far, the results unearth that inbound M&As are responsive to concessionary but could be misleading due to potential endogeneity issues.³¹ I circumvent any potential endogeneity issue by using a control function approach with the Poisson and negative binomial estimators. By implication, in addition to reducing or neutering bias resulting from the endogeneity of tax variables, I am also able to econometrically accommodate zeros in the dependent variable in an appropriate manner.

2.4.4 Two-Stage Least Squares Estimation

As a prequel to the control function approach, I rely on a 2SLS estimator which will provide statistics to assess the reliability or relevance of my chosen instrumental variables.

Table 2.5: Results from Two-Stage Least Squares Estimations

<i>Regressor</i>	<i>Regressand: Log Total Number of Inbound M&As</i>				
	(1)	(2)	(3)	(4)	(5)
Standard Tax Rate	-0.106*** (0.021)				
Tax Concession Rate - Location		-0.073*** (0.016)			
Tax Concession Rate - Scale			-0.091*** (0.019)		
Tax Concession Rate - R&D				-0.094*** (0.021)	
Tax Concession - Exporting					-0.117*** (0.026)
Indirect Taxes	-0.032** (0.015)	-0.011 (0.015)	-0.023 (0.014)	-0.018 (0.015)	-0.023 (0.016)
GDP	1.312*** (0.123)	1.312*** (0.178)	1.305*** (0.124)	1.263*** (0.141)	1.518*** (0.195)
GDP Per Capita	-0.401*** (0.095)	-0.381*** (0.110)	-0.411*** (0.097)	-0.206* (0.110)	-0.496*** (0.128)
Trade	0.444* (0.110)	0.587** (0.110)	0.550** (0.110)	0.511** (0.110)	0.538* (0.110)

³¹ Specifically, simultaneity bias and or bias as result of reverse causality could be the culprits here since tax policy changes by governments could be influenced by certain unobservable socio-economic conditions that affect concessionary tax rates and inbound M&As at the same time or past performance of inbound M&As could induce changes to tax rates.

	(0.231)	(0.282)	(0.229)	(0.251)	(0.300)
Private Credit	0.174	0.099	0.170	0.187	0.068
	(0.159)	(0.209)	(0.154)	(0.175)	(0.222)
Institutions	0.150***	0.234***	0.160***	0.152***	0.136***
	(0.031)	(0.030)	(0.030)	(0.033)	(0.042)
Observations	360	360	360	360	360
R-squared	0.548	0.540	0.553	0.548	0.532
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Wooldridge Endogeneity Test	7.655	9.422	6.255	7.082	11.64
P-value	0.006	0.002	0.012	0.008	0.001
Test of Overidentifying Restrictions	0.345	1.550	0.691	1.122	1.040
P-value	0.557	0.213	0.406	0.290	0.308
F-Statistic	20.987	15.724	17.675	18.589	18.488
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1					

Coming to the substantive results which are reported in *Table 2.5*, like those found when using the OLS estimator, all tax indicators appear to exert a negative effect on M&As inflows. Now, having controlled for endogeneity, we observe that the parameter estimates for each tax indicator are larger.

Also entailed in the results reported in *Table 2.5* are test statistics which could be used to assess the instruments. The first test result is the Wooldridge test for endogeneity which can be used to assess whether tax variables are indeed endogenous. All the reported p-values are less than 0.05 implying that the test score's null hypothesis of exogeneity can be rejected. With two instruments, I can test for their validity. Observing the p-values associated with the Wooldridge test of overidentifying restrictions are all insignificant at any conventional level implying that instruments are valid. What is more, the F statistics value is 15 which is above the figure (i.e.,10) that Stock, Wright and Yogo (2002) suggest for efficient estimations.

Despite reducing or solving the endogeneity issues, the 2SLS estimator still leaves one econometric challenge unresolved, which is, the presence of zeros in the dependent variable – i.e., the total number of inbound M&As. Thus, I consider the results of the control function approach employed with the Poisson and negative estimators to be more reliable and attempt a more thorough discussion of those results.

2.4.5 Control Function Approach

Table 2.6: Results from Control Function (CF) with Poisson Model

Regressor	Regressand: Total Number of Inbound M&As				
	(1)	(2)	(3)	(4)	(5)
Standard Tax rate	-0.059*** (0.009)				
CF - Standard Tax rate	0.032* (0.018)				
Tax Concession Rate - Location		-0.066*** (0.011)			
CF - Location		0.033** (0.016)			
Tax Concession Rate - Scale			-0.052*** (0.010)		
CF - Scale			0.020 (0.018)		
Tax Concession Rate - R&D				-0.058*** (0.009)	
CF - R&D				0.016 (0.021)	
Tax Concession Rate - Exporting					-0.064*** (0.010)
CF - Exporting					0.043*** (0.016)
Indirect Taxes	-0.006 (0.020)	-0.008 (0.021)	-0.003 (0.020)	-0.002 (0.022)	-0.002 (0.020)
GDP	1.466*** (0.152)	1.527*** (0.132)	1.492*** (0.157)	1.510*** (0.158)	1.500*** (0.135)
GDP Per Capita	-0.328** (0.147)	-0.350*** (0.129)	-0.359** (0.139)	-0.262* (0.146)	-0.314** (0.158)
Trade	0.623** (0.291)	0.650** (0.269)	0.728** (0.302)	0.714** (0.280)	0.599** (0.286)
Private Credit	0.121 (0.173)	0.047 (0.172)	0.089 (0.195)	0.114 (0.208)	0.121 (0.155)
Institutions	0.189*** (0.033)	0.244*** (0.032)	0.202*** (0.031)	0.199*** (0.035)	0.177*** (0.031)
Observations	437	437	437	437	437
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Bootstrapped standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

CF denotes control function which is the predicted residuals from the first stage regressions

All regressions include the controls: Tax burden – indirect taxes as a proportion of GDP, GDP per capita, trade, and a measure of the level of institutional quality – democracy.

The results of the control function approach applied with the Poisson estimator are reported in *Table 2.6*. Before delving into the main results, observably the control function indicator is significant in some instances hence evidencing that at least some tax indicators are endogenous to the number of inbound M&As. Since it is hard to justify that tax policy is highly centred on targeted locations or SEZs or sectors rather than harmonised, it is not implausible to still consider regressions involving tax indicators for which the control function parameter is insignificant to be endogenous.

Coming to the main results, the parameter estimates for all concessionary tax indicators bear a negative sign and are significant at the 1% conventional level. However, a noticeable difference is the modest increase in the magnitudes of the coefficients. Specifically, the least coefficient value for any tax indicator is now -0.052 which is still higher than any of the values found for the baseline Poisson model. Quantitatively, a one percentage point decrease in the standard tax rate increases annual inbound M&As by 5.7% and respectively, for those that are conditional on locating in a specific location or SEZs, size of investment or employment, engaging in R&D, and exporting, by 6.4%, 5.1%, 5.6%, and 6.2%

Qualitatively, these findings generally dovetail those of earlier studies (Becker, Egger, and Merlo 2012; Barrios et al. 2012; Huizinga and Voget 2009; Dischinger and Riedel 2011; Görg and Strobl 2007; Herger, Kotsogiannis, and McCorriston 2016). However, quantitatively, I am unable to compare these results to those reported in the literature as studies have not employed the kind of tax incentives indicators I use in this study. Also, most of these studies are either often centred on developed economies and more importantly at the sub-national level. Nonetheless, to unearth a nuanced implication of a one percentage point reduction for inbound M&As, consider, for instance, the result found for the standard tax rate which induce a 5.7% increase in M&As per a one percentage point reduction in this tax rate. Considering that the unconditional mean of inbound M&As is about 10.8, of this 5.7% is about 0.6. Implying that, the average developing country will have to reduce the standard tax rate by 1.6% to attract a single merger or acquisition, which could be, arguably, a difficult task.

To put these results into perspective, the finding that a reduction in the standard tax rate increases the number of inbound M&As isn't particularly surprising since a reduction in host country's tax rates affords an additional benefit of increased post-merger synergies in terms of profits. Which depict that a higher corporate tax rate in a host country deters inward acquisition activity.

Also, on the result on concessionary tax rates conditioned on location, one interpretation that could be given to this finding is that targeted locations for such incentives also avail network opportunities or externalities which could bode well for post-merger synergy gains. What is more, since the business environment in most SEZs such as the quality of infrastructure is likely to be healthier than that of alternative locations, multinationals are more likely to be persuaded by a tax inducement to invest in SEZs.

As for the result for concessionary tax rates geared towards scale or size of capital injection, which appears to exert the least impact compared with other forms of tax concessions, this could be reasoned along the lines of large-scale acquisitions targeting developing countries' firms making up a significant proportion of the overall value of investments but not in terms of numbers. Particularly, market-seeking and efficiency-seeking foreign investors may not necessarily inject as much capital as that of resource-seeking ones but are more likely to dwarf the latter in terms of numbers.

Finally, for efficiency and market-seeking investors, post-(investment) merger gains could be significantly determined by the engagement in and returns to R&D as well as the competitiveness of products destined for international markets. A tax concession which will ease the financial burden of these types of investors will induce inward M&As.

Coming to the remaining control variables, their outcomes accord with predictions depicted by the literature (Erel, Liao, and Weisbach 2012; Rossi and Volpin 2004). The findings (still in *Table 2.6*) indicate that the measure of market size, GDP, bears a positive and significant impact on inward M&As. A finding which concurs with the market-seeking hypothesis. GDP per capita, on the other hand, appears to exert a negative impact on M&As. Prima facie, this result seems to be implausible but could be justified on the grounds that higher GDP per capita reflects the cost of labour which could reduce post-merger synergy gains and thus a deterrent to inbound M&As as potentially. Finally, the results unearth that inbound M&As increases with trade integration as well as quality institutions. An outcome which confirms that the opportunity to join and integrate further into GVCs and the stability of the regulatory environment are important to foreign investors.

Turning to the estimation results produced by the negative binomial model, these are reported in *Table 2.7*. Comparing these findings to those produced by the Poisson estimator, we notice that the magnitudes of the coefficients on all tax indicators are slightly smaller albeit slightly larger than those produced by the baseline negative binomial model in which endogeneity isn't controlled. Particularly, as in the case of the results of the Poisson model, concessionary tax rates conditioned on locating in a location or SEZs and exporting are found to exert the largest impact on inbound M&As.

Table 2.7: Results from Control Function (CF) with the Negative Binomial Model

Regressor	Regressand: Total Number of Inbound M&As				
	(1)	(2)	(3)	(4)	(5)
Standard Tax rate	-0.055*** (0.014)				
CF - Standard Tax rate	0.016 (0.016)				
Tax Concession Rate - Location		-0.058*** (0.010)			
CF - Location		0.023* (0.013)			
Tax Concession Rate - Scale			-0.048*** (0.016)		
CF - Scale			0.009 (0.017)		
Tax Concession Rate - R&D				-0.051** (0.022)	
CF - R&D				0.005 (0.025)	
Tax Concession Rate - Exporting					-0.059*** (0.006)
CF - Exporting					0.034*** (0.003)
Indirect Taxes	-0.003 (0.010)	-0.003 (0.006)	0.000 (0.020)	0.002 (0.013)	0.001 (0.017)
GDP	1.610*** (0.141)	1.596*** (0.387)	1.618*** (0.113)	1.612*** (0.098)	1.641*** (0.154)
GDP Per Capita	-0.498*** (0.092)	-0.473** (0.198)	-0.513*** (0.061)	-0.404*** (0.081)	-0.497*** (0.155)
Trade	0.709*** (0.236)	0.660 (0.471)	0.787*** (0.170)	0.754*** (0.233)	0.706** (0.274)
Private Credit	0.286 (0.192)	0.189 (0.248)	0.264** (0.134)	0.281*** (0.108)	0.275 (0.239)
Institutions	0.230*** (0.042)	0.272*** (0.015)	0.237*** (0.043)	0.233*** (0.048)	0.220*** (0.017)
Observations	437	437	437	437	437
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Bootstrapped standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

CF denotes control function which is the predicted residuals from the first stage regressions

All regressions include the controls: Tax burden – indirect taxes as a proportion of GDP, GDP per capita, trade, and a measure of the level of institutional quality – democracy.

What is more, the reported (bootstrapped) standard errors do not appear to look significantly different from those produced by the Poisson model. Implying that, the efficiency of the Poisson model cannot be

cast in doubt. Further, as in the results of the Poisson model, the results of the negative binomial model also evidence that the control function parameter is significant in some instances, again evidencing the presence of endogeneity of tax indicators. Finally, parameter estimates and statistical significance for the macro and institutional indicators conform with those produced by the Poisson model.

2.5 Robustness

In this section, I perform a robustness check in order to ascertain the robustness of findings. I consider an alternative estimation approach – a Tobit model – which, just like the Poisson and negative binomial models, is suitable for a specification with a count regressand and endogenous regressor.

2.5.1 Tobit Model

Regarding the econometric constraints posed by the endogeneity of concessionary tax variables and the absence of M&As for some countries in particular years, an alternative suitable model to those employed in the main text is a censored Tobit model. As a first robustness check, I employ an instrumental variable Tobit estimator using the same instruments discussed in the main text. More formally, in order to implement a Tobit model, I consider

$$12 \quad \pi_{kt}^* = \exp \left(\psi T_{kt} + \gamma Z_{kt} + \phi_k + \eta_t + \varepsilon_{kt} \right), \quad \varepsilon \sim N(0, \sigma^2),$$

which yields the observation rule that observed numbers of M&As is related to the latent variable, π_{kt}^* , that is

$$\pi_{kt} = \exp \left(\pi_{kt}^* \right) \quad \text{if} \quad \pi_{kt}^* \geq 0,$$

$$13 \quad \pi_{kt} = 0 \quad \text{if} \quad \pi_{kt}^* < 0$$

In estimating the instrumental variable Tobit model, as done with the regression models employed in the main text, I lag regressors by one year and adjust for robust standard errors. Also, as done in the literature, the dependent variable, the total number of inbound M&As, is log-transformed.

Table 2.8: Results from Tobit Model

<i>Regressors</i>	<i>Regressand: Total Number of Inbound M&As</i>				
	(1)	(2)	(3)	(4)	(5)
Standard Tax rate	-0.103*** (0.023)				
Tax Concession Rate - Location		-0.076*** (0.019)			
Tax Concession Rate - Scale			-0.087*** (0.021)		
Tax Concession Rate - R&D				-0.091*** (0.023)	
Tax Concession Rate - Exporting					-0.121*** (0.030)
Indirect Taxes	-0.034** (0.017)	-0.016 (0.017)	-0.026 (0.017)	-0.021 (0.017)	-0.028 (0.018)
GDP	1.358*** (0.138)	1.367*** (0.193)	1.351*** (0.139)	1.309*** (0.154)	1.578*** (0.209)
GDP Per Capita	-0.421*** (0.105)	-0.408*** (0.118)	-0.429*** (0.108)	-0.233* (0.119)	-0.525*** (0.136)
Trade	0.494* (0.279)	0.605* (0.332)	0.602** (0.277)	0.553* (0.299)	0.559 (0.351)
Private Credit	0.189 (0.183)	0.108 (0.246)	0.185 (0.179)	0.208 (0.198)	0.075 (0.255)
Institutions	0.165*** (0.035)	0.247*** (0.032)	0.175*** (0.033)	0.167*** (0.035)	0.145*** (0.046)
Observations	360	360	360	360	360
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Log likelihood	-1067	-1205	-1083	-1121	-1038
Wald Test of Exogeneity	4.326	5.230	3.310	3.844	7.527
P-value	0.038	0.022	0.070	0.050	0.006

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The results of the Tobit model are reported in *Table 2.8*. Considering the reported Wald test of exogeneity, observably all p-values are significant, thus confirming that tax indicators are endogenous. Moreover, all tax indicators bear a negative and statistically significant impact on the total number of M&As, thus confirming that the earlier results produced by the Poisson and negative binomial models are robust to an alternative specification.

2.6 Conclusions

Inward FDI in the form of M&As offers developing countries the opportunity to access foreign technologies, improve the governance of domestic business, boost exports, and to improve their fiscal capacities. Buoyed by these potential benefits of inward M&As or investments, governments of developing countries offer certain fiscal incentives including tax incentives in order to induce foreign investors.

In this paper I investigate the efficacy of reducing the standard tax rate as well as providing conditional tax incentives in attracting inward M&As using data from a sample of 91 developing countries spanning the period 2009-2015. Specifically, I examine how tax incentives provided unconditionally as well as those provided conditional on an investor locating in a specific site or SEZ, an investment meets a certain minimum scale of capital or employment, an investor engaging in or contributing to innovation or R&D, and contribute to exports, induce inward M&A.

In my empirical analysis, I consider tax incentives indicators to be endogenous due to omitted country-level variables potentially correlated with both tax policy and M&A activity, and or reverse causation from M&A performance to tax policy formulation. Thus, I do not only implement a Poisson model and a negative binomial model which are appropriate techniques for handling models of which the dependent variable is count and contains zeros but additionally combine these techniques with a control function approach in order to neuter or circumvent the potential endogeneity of tax indicators.

My findings suggest that tax concessions tend to attract inward M&As. What is more, of all conditional or targeted tax concessions, that which is targeted at investments slated for specific locations or SEZs appear to exert the most impact on inward M&As. By way of quantitative interpretation, specifically the results unearth that a typical developing country will have to reduce, for instance, unconditional tax concessions by as much as 1.6% in order to attract a single merger or acquisition. This finding implies the tax concession-inducement effect on inward investments in the form of M&A is rather modest in developing countries.

Appendix 2A: Descriptive Statistics

Table A 2.1: M&A Activity and Tax Concessions by Country

	Total Cross- Border M&As	Tax Concessionary - Unconditional	Tax Concessionary - Location	Tax Concessionary - Scale	Tax Concessionary - R&D	Tax Concessionary - Exporting
Albania	10.00	10.71	10.71	10.71	10.71	10.71
Algeria	9.00	22.25	22.25	22.25	22.25	22.25
Angola	4.00	34.32	19.05	34.32	32.96	34.32
Argentina	294.00	35.00	35.00	35.00	35.00	35.00
Armenia	16.00	20.00	20.00	20.00	20.00	20.00
Azerbaijan	7.00	20.27	20.27	20.27	20.27	20.27
Bangladesh	16.00	37.75	37.75	37.75	26.83	29.98
Belarus	26.00	18.00	8.59	18.00	15.00	18.00
Belize	7.00	25.00	25.00	25.00	25.00	25.00
Bolivia	20.00	25.59	25.59	25.59	25.59	25.59

Bosnia and Herzegovina	20.00	10.00	10.00	10.00	10.00	0.00
Botswana	20.00	19.90	19.90	19.90	19.90	19.90
Brazil	1212.00	34.27	24.05	34.27	34.27	34.27
Bulgaria	100.00	10.00	10.00	10.00	10.00	10.00
Burundi	0.00	30.83	30.83	30.83	30.83	30.83
Cambodia	27.00	20.46	20.46	20.46	19.77	20.46
Cameroon	15.00	38.14	38.14	38.14	38.14	38.14
Cape Verde	1.00	25.00	25.00	25.00	25.00	25.00
Chad	1.00	40.00	40.00	40.00	40.00	40.00
Colombia	310.00	28.43	15.00	28.43	15.00	28.43
Congo	14.00	34.44	34.44	34.44	34.44	34.44
Costa Rica	58.00	28.54	22.40	28.54	28.54	22.40
Cote d'Ivoire	18.00	25.00	25.00	25.00	25.00	25.00
DR Congo	17.00	37.16	37.16	37.16	37.16	37.16
Dominican Republic	28.00	26.67	19.86	26.67	26.67	26.67
Ecuador	60.00	23.29	23.29	23.29	23.29	23.29
Egypt	101.00	25.18	25.18	25.18	25.18	25.18
Equatorial Guinea	1.00	35.00	35.00	35.00	35.00	35.00
Eswatini	3.00	29.33	29.33	29.33	29.33	29.33
Ethiopia	12.00	30.20	30.20	30.20	29.97	30.20

Fiji	6.00	25.00	25.00	25.00	25.00	25.00
Gabon	8.00	33.64	33.64	33.64	33.64	33.64
Gambia	1.00	23.80	23.80	23.80	23.80	23.80
Georgia	22.00	15.00	15.00	15.00	15.00	15.00
Ghana	34.00	20.90	19.68	20.90	20.90	20.90
Guatemala	39.00	30.57	0.00	30.57	30.57	0.00
Guinea	4.00	34.94	34.94	34.94	34.94	34.94
Guyana	25.00	38.33	38.33	38.33	38.33	38.33
Haiti	4.00	30.00	30.00	30.00	30.00	30.00
Honduras	9.00	25.00	25.00	25.00	25.00	25.00
Indonesia	453.00	24.31	24.31	24.31	24.31	24.31
Iraq	9.00	15.65	15.65	15.65	15.65	15.65
Jamaica	17.00	30.10	30.10	30.10	30.10	30.10
Jordan	25.00	17.29	17.29	17.29	17.29	17.29
Kazakhstan	77.00	19.36	0.00	19.36	19.36	19.36
Kenya	45.00	30.00	30.00	30.00	20.00	30.00
Lao PDR	4.00	25.00	25.00	25.00	25.00	25.00
Lebanon	13.00	15.00	15.00	15.00	14.32	15.00
Lesotho	1.00	18.86	18.86	18.86	18.86	15.94
Liberia	9.00	25.11	25.11	16.39	16.39	25.11
Libya	4.00	31.32	31.32	31.32	31.32	31.32
Madagascar	6.00	21.43	16.75	21.43	20.91	21.43

Malawi	8.00	30.00	17.14	30.00	23.34	30.00
Malaysia	384.00	24.82	21.82	24.82	7.64	24.82
Maldives	8.00	9.32	9.32	9.32	9.32	9.32
Mauritania	4.00	25.00	25.00	25.00	25.00	25.00
Mauritius	33.00	15.50	15.50	15.50	14.80	15.50
Mexico	493.00	29.71	29.71	29.71	29.71	29.71
Moldova	3.00	6.73	6.73	6.73	4.21	3.38
Mongolia	40.00	9.55	9.55	9.55	9.55	9.55
Morocco	47.00	27.68	20.09	27.68	27.68	20.09
Mozambique	38.00	24.00	24.00	24.00	17.14	24.00
Namibia	29.00	34.86	34.86	34.86	28.31	34.86
Nepal	4.00	23.07	11.73	22.96	23.07	17.46
Nicaragua	27.00	30.00	0.00	30.00	30.00	30.00
Nigeria	49.00	31.64	32.11	32.38	31.64	32.50
Pakistan	20.00	34.59	34.59	34.59	32.89	31.45
Panama	86.00	26.69	26.69	26.69	26.69	26.69
Papua New Guinea	27.00	30.68	26.14	25.68	30.00	30.68
Paraguay	20.00	10.00	10.00	10.00	10.00	10.00
Peru	247.00	30.21	30.21	30.21	30.21	30.21
Philippines	101.00	28.86	15.23	28.86	28.86	18.64
Romania	231.00	16.00	16.00	16.00	16.00	16.00

Rwanda	16.00	30.00	30.00	30.00	30.00	30.00
Sao Tome and Principe	1.00	25.23	25.23	25.23	25.23	25.23
Senegal	7.00	26.43	26.43	26.43	26.43	26.43
Sierra Leone	8.00	31.54	31.54	31.54	31.54	31.54
South Africa	380.00	30.66	30.66	30.66	30.66	30.66
Sri Lanka	43.00	25.61	25.61	25.61	25.61	12.86
Tajikistan	5.00	20.00	13.18	20.00	20.00	20.00
Tanzania	36.00	30.00	30.00	30.00	30.00	30.00
Thailand	191.00	25.71	25.71	25.71	25.71	25.71
Tunisia	23.00	29.19	21.30	29.19	29.19	21.30
Turkey	401.00	20.00	16.88	16.88	19.03	20.00
Uganda	20.00	30.68	30.68	30.68	30.20	30.68
Ukraine	370.00	20.94	20.94	20.94	20.85	20.94
Uzbekistan	10.00	9.27	9.27	9.27	9.27	9.27
Venezuela	14.00	34.73	34.73	34.73	34.73	34.73
Vietnam	146.00	22.47	11.05	22.47	18.78	22.47
Zambia	23.00	33.83	33.83	33.83	28.00	15.00
Zimbabwe	16.00	27.19	22.27	27.19	15.07	24.15

Chapter 3: Corruption and Firm Performance in Africa

Abstract

This study uses recently collected firm-level data from 15 African countries by the World Bank between 2006–2015 to test the effect of bureaucratic corruption on firm performances – sales, labour productivity and employment. To cater for potential endogeneity issues concerning firm bribery payments an IV approach is employed with the country-industry-year averages of bribery payments and percentage of time firm manager spends with public officials in a month (bureaucracy) serving as instrumental variables. Further, the first-difference estimator is employed to handle potential firm-specific time-invariant effects that could influence our analyses. I find evidence that corruption has both a contemporaneous and lag-effect on firm performances in Africa. I further uncover that this negative effect is more pronounced for larger and older firms than small and medium-sized firms and young ones.

3.1 Introduction

Although several factors have been identified as essential ingredients of economic development the role of economic institutions has gained prominence in recent years. It has been argued that an improvement in the protection of property rights, the regulatory environment, and the efficiency in delivering public goods, creates an enabling environment for the development of talent (i.e. entrepreneurs) and for incumbent entrepreneurs to increase productive investment (Acemoglu and Johnson 2005; Acemoglu, Johnson, and Robinson 2002; Hall and Jones 1999). In recent times, Africa has seen impressive growth largely owed to high commodity prices, an improved macroeconomic environment, greater political stability, increased public investment in infrastructure, and a rise in domestic demand IMF 2015; AfDB/OECD/UNDP 2016).

However, the region (Africa) is seeing this economic progress despite still having comparatively weaker economic institutions, a situation which raises concerns about the strength and sustainability of this economic progress. Certainly, the sustainability and inclusiveness of this rapid economic growth will largely depend on the health of the continent's private sector which is mostly dominated by small and medium-sized enterprises (SMEs). Since weaker institutions are likely to serve as a foundation for corruption³² to thrive, how the health of Africa's private sector could be influenced by corruption is a subject worth investigating. For example, a global behemoth on corruption issues – Transparency International (TI) – in its latest report stated that 87% of countries in Sub-Saharan Africa (SSA) score less than 50 in its corruption perceptions index and the regional average is 33³³ (TI 2016).

On the issue of corruption, two strands of literature have emerged concerning its economic consequences. The first “grease the wheels of” hypothesis – asserts that by bribing public officials producers could circumvent bureaucratic red tape and inefficient institutions to foster their commercial activities, also, bribe payments could serve as an incentive for bureaucrats to improve upon their performance (Aidt 2003; Leff 1964; Lui 1985; P. J. Beck and Maher 1986). By contrast, a second strand of the literature views corruption as inimical to economic growth (i.e. “sand in the wheels of commerce” hypothesis) since the first best option will be to do away with the inefficiencies or distortions in the economy rather than condoning them. In this regard, the growth retarding effects of corruption could stem from losses in economic efficiency (Bardhan 1997), resource misallocation and low productivity (Murphy, Shleifer, and

³² Here I define corruption as the abuse of public office for personal gain.

³³ The corruption perceptions index is ranged 0 – 100 from most corrupt to least corrupt.

Vishny 1991, 1993), and an increase the costs of investment and reduction in the rate of technological progress (Murphy, Shleifer, and Vishny 1993; Jakob Svensson 2005).

In light of the mixed theoretical predictions about the economic consequences of corruption, investigating how corruption affects firm dynamics for Africa will not only enhance our understanding of how bureaucratic corruption affects firms in this region but also provide credible practical recommendations to support policy formulation for accelerating and sustaining the region's development. Thus, the objective of this study is to assess the impact of corruption on firm performances in Africa.

Most studies (Aidt 2009; P. G. Méon and Weill 2010; Méndez and Sepúlveda 2006; Mauro 1995; Balamoune-Lutz and Ndikumana 2008; Faruq, Webb, and Yi 2013) on the economic consequences of corruption thus far have been macro-level and fail to unearth the effects of corruption at the micro-level, and/or, often rely on subjective measures of corruption³⁴. The few firm level studies that have examined this issue have often either looked at the determinants of firms engaging in corruption or its (corruption) impact of firm performance. Additionally, findings from firm level studies that examine the consequences of corruption on performance produce mixed results. An understanding of what type of firms under what conditions engage in bribery payments could be essential in discerning or interpreting the performance implications of bribery payments particularly for practical policy formulation and implementation. Hence the first contribution of this study is that it uses recently collected firm-level data which entails objective measures of corruption in order to, first, ascertain the determinants of the incidence and extent of bribery payments, and second, to examine its (bribery payment) implication on various firm performance indicators – sales, labour productivity, and employment.

Additionally, in the case of Africa, firm-level studies are scant. Fisman & Svensson (2007) use data from the 1998 Ugandan enterprise survey to assess the impact of corruption on sales growth. Also, Asiedu & Freeman (2009) use firm-level data collected in 1999/2000 to assess the impact of corruption on firm investments growth for Transition countries, Sub-Saharan Africa (SSA), and Latin America and the Caribbean (LAC). Further, using firm level data from Ghana, Kenya and Tanzania Faruq et al. (2013) show that corruption and bureaucratic inefficiency exert a negative impact on efficiency and productivity. Birhanu et al. (2016) also provide findings to show that corruption has a negative effect on investments for a sample of SSA and Latin American firms. Finally, using a large cross-country sample of firm level data Gillanders and Parviainen (2018) show that although perception-based indicators matter for amounts of inward FDI actual experiences of corruption as reported by firms matters not albeit for only amounts of inward greenfield investments.

³⁴ These measures rely on experts' subjective assessments of corruption or risk-assessments of firms and not necessarily firms experience of corruption and are thus susceptible to perception biases.

Clearly, firm-level studies on corruption for Africa have focused on one country, are dated and not exclusively performed for Africa, and focus on one firm performance indicator. Hence by investigating the issue exclusively for a broader sample of African countries and assessing how it (corruption) relates with various firm performances – sales, labour productivity, and employment – this study fills a significant void in the literature. To emphasize, lessons from recent impressive economic performances of the Asian Tigers (Hong Kong, Singapore, South Korea and Taiwan) and China despite significant levels of corruption show that the impact of across regions and countries could vary tremendously.

The third and final contribution of this study is on the methodological front. In order to circumvent any endogeneity issues³⁵ I employ an instrumental variable approach³⁶ and first difference³⁷ techniques. Additionally, with the benefit of a two-period panel, I can ascertain whether there is a lagged-effect of the impact of corruption on firm performance, and control for potential attrition bias.

To preview the findings, they indicate that older firms and more visible (larger) firms are less likely to pay bribes. Moreover, least productive firms appear to have a higher likelihood of engaging in bribery payments. On the impact of corruption on firm performance, the findings reveal that corruption has a negative and significant contemporaneous and a lagged effect on firm performance, particularly for larger and older firms.

The rest of the chapter is described as follows. Section 2 provides an in-depth review of the literature on the economic consequences of corruption at the firm-level. Section 3 looks at the data and measurement of variables used in estimations. Section 4 discusses the empirical strategy. Results are discussed in section 5, and robustness checks in section 6. Then section 7 concludes the chapter.

3.2 Literature Review on Bureaucratic Corruption

3.2.1 Theoretical Literature on The Effects of Corruption

On the economic consequences of bureaucratic corruption, there are generally two views. The first view emphasizes the positive effects corruption could have in countries with inefficient bureaucracies and weak

³⁵ Firm bribery payments (corruption) could be endogenous if it were the case that corrupt bureaucrats went after the ablest firms, or firms resorted to bribery payments to gain preferential treatment from bureaucrats (J. Svensson 2003).

³⁶ The instruments used in the IV estimations are the country-industry-year averages of bribery payments and country-industry-year averages of the percentage of time a firm's top management spends with bureaucrats in a month as instruments for firm level bribery payments. The economic justification underlying the use of these instrumental variables is provided in section 4.

³⁷ This technique is favoured to cater for firm-specific time-invariant characteristics such as managerial talent that be a source of endogeneity.

governance. Corruption in this sense “greases the wheels of commerce” as it is simply a response to distortions in the market (Aidt 2003).

Leff (1964) is one of the pioneering voices of this view. The author argues that corruption could be efficiency-enhancing under conditions where entrepreneurs must compete for a limited (or fixed) number of government goods; consequently, the highest bidder (i.e. the most efficient firms) grabs these goods and accompanying favors. Further, political uncertainty (e.g. political interference) poses additional risk to producers and could discourage them from expanding their investments. However, by building corrupt networks with bureaucrats, producers can reduce such risk and are thus likely to expand their investments.

Leff (1964) views have since been given some theoretical backing. As an example, Lui (1985) present an ‘auction model’ in which customers must queue for industrial licenses sold by bureaucrats. The model shows that customers have different values for time, and bureaucrats grant preferential treatment to customers that offer the highest bribes. Intuitively, customers that value time most (i.e. the most efficient firms) will pay bribes to obtain better positions in the queue i.e. get services rendered to them fast. Also, Beck and Maher (1986) model and compare bribery to a competitive bidding process. They show that the outcome for the bribery model is isomorphic to that of the bidding model since bureaucrats are likely to offer the contract to the firm that pays the highest bribe. One can surmise from the arguments of the proponents of corruption being efficiency-enhancing that although corruption might not be a first best option, it could be a second-best option which allows firms to circumvent inefficiencies or distortions within an economy to meet their commercial objectives.

The second view on the effects of corruption, by contrast, sees it as inimical to economic growth as the first best option will be to do away with the inefficiencies or distortions in the economy rather than condoning them. Bureaucratic inefficiency is one possible way in which corruption could hamper economic growth. Corrupt bureaucrats are likely to award contracts and render services to firms that can possibly pay the highest bribes but not necessarily the most productively efficient (Bardhan 1997). On top, bureaucrats could build corrupt networks with incumbent firms and offer them preferential treatment which could serve as an (artificial) barrier to the entry of new firms (Jain 2001).

Some authors have also shown that corruption could affect investments, innovations and resource allocation. Murphy et al. (1991) model returns to ability and consequently peoples' attractiveness to occupations. They show that in countries where entrepreneurs can easily organize their business or commercial activities and protect their innovations as well as profits, more talented people are likely to become entrepreneurs. Thus, there will be improvements in technological progress, productivity, and income. By contrast, countries that have rent-seeking sectors attracting most of their ablest people will likely have a small pool of entrepreneurs or potential entrepreneurs, whose profits will be expropriated by bureaucrats through taxation, the consequence being little improvements in technological progress, productivity, and stagnating growth. Moreover, rent seeking could also hamper innovations the most as

innovators often require government goods (such as permits, licenses, and import quotas among others) to carry out their innovation activities. But unlike established firms, do not have lobbies, are cash-constrained and likely not to be able to pay bribes. Also, such firms could have projects that are long-term and require slow accumulation of capital which is prone to future expropriation by rent-seekers, and engage in risky ventures out of which they share the returns of success with rent-seekers but bear the entire cost alone when there is a failure (Murphy et al. 1993).

Shleifer & Vishny (1993) show in their model that under weak governance, abuse of discretionary power by government agencies and bureaucrats could result into endemic corruption as they individually charge bribes on producers seeking complementary goods, hence stifling investments and growth. This gets worse under regimes with non-benevolent leaders who in pursuit of keeping their corrupt activities with established firms confidential will be reluctant to allow the entry of new innovators. Also, as pointed out by Svensson (2005), when profits of entrepreneurs are eroded through corruption, entrepreneurs tend to invest less and at worse choose not to start businesses. On top, some entrepreneurs will be tempted to organize some of their production activities in a way that will demand fewer government goods or expand more into the informal sector.

3.2.2 Empirical literature on the effects of corruption

At the macro level, there is evidence to suggest that corruption has negative effects on investment, economic growth and sustainable development (Mauro 1995; Ades and di Tella 1997; Aidt 2009; P.-G. Méon and Sekkat 2005). By contrast, findings of some studies also show that corruption could have a positive impact on investments and economic growth when it (corruption) is at modest levels, institutions are inefficient and governance is weak (Méndez and Sepúlveda 2006; P. G. Méon and Weill 2010; Balamoune-Lutz and Ndikumana 2008).

Kaufmann & Wei (2000) provide a model to show that in general equilibrium, regulatory burden or red tape can be endogenous since both are subject to the influences of (or chosen) by bureaucrats; consequently, there could be a positive correlation between corruption and regulatory burden. The authors confirm the predictions of their model using firm-level data from the Global Competitiveness Reports (1996 & 1997) as well as that of the World Development Report (1997). They report a positive correlation between bribe payments and official harassment (i.e. managements' time spent with regulators, regulatory burden, and cost of capital).

Freund et al. (2016) also show that bribery payments are not associated with accelerated policy implementation pertaining to applications for public services such as operating licenses. Similarly, Svensson (2003) uses data from a sample of 250 Ugandan firms to determine 'which firms pay bribes and how much they have to pay'. His findings suggest that firms whose business activities and decisions are

subject to the influences of bureaucrats the most have a higher likelihood of paying bribes, and firms with higher “ability to pay” (i.e. high current and expected future profitability) pay higher bribes while those with higher “bargaining/refusal power” pay lower bribes. Along gender lines, Breen et al. (2017) show that female-owned firms or those with female presence at the managerial level engage less in bribery payments incidence and pay less bribes.

Using the same data set as Svensson (2003), Fisman and Svensson (2007) examine the impact of corruption and taxation on Ugandan firms’ performance (sales growth). However, wary of endogeneity of firm bribery payments they use the country-industry averages of bribery payments as an instrument for firm-level bribery payments³⁸. The finding shows a significant negative impact on bribe payments and taxation on firm growth with that of the former being more prominent especially after instrumenting for bribes and catering for outliers. However, Wang & You (2012) contend that the impact of corruption on growth could vary from country to country based on social and economic factors. The authors test their claim by examining the impact of corruption and its interaction with financial sector development (i.e. firm use of formal finance) on firm sales growth in China. Their findings show that Chinese firms that have access to formal loans and pay bribes benefit by way of higher sales growth, and that the growth-enhancing effect of corruption is conditional on low use of formal loans. Their findings are robust after controlling for sample selection bias with the Heckman two-step method and controlling for the endogeneity of firm bribery payments. Similarly, Mendoza et al. (2015), for a cross-section of Philipian firms, show that corruption has a positive effect on firm sales growth. Vial & Hanoteau (2010) also find a positive effect of corruption on plant-level output and labour productivity for Indonesian manufacturing plants.

Firm sales growth could be more appropriate in gauging firm performance in the short term but not for the longer term. As a result, some authors investigate how corruption relates with firm long-term performance – i.e. investments and efficiency. Faruq et al. (2013) assess the effect of bureaucratic quality and corruption on firm efficiency in Ghana, Kenya, and Tanzania. They find that poor bureaucratic quality and corruption have significant negative effects on firms’ efficiency and productivity growth with that of corruption being more pronounced. Also, Asiedu & Freeman (2009) look at the impact of corruption on firms’ investment growth for separate regions: Transition countries, Sub-Saharan Africa (SSA) and Latin America and the Caribbean (LAC). They employ three different categories of corruption measures: internal (i.e. firms’ perception of investment climate), external (i.e. experts’ assessment of a countries investment climate) and hybrid (i.e. a composite index comprising both internal and external measures). Their findings suggest that corruption has a significant negative effect on firms’ investment growth for the pooled sample; however, for the separate regions, corruption has a negative effect on investment growth in Transition

³⁸ The authors argue that the industry-specific component of bribes is uncorrelated with firm-specific unobservable factors that may be correlated with both bribery rates and firm growth because across locations there are differences in bureaucrats’ abilities to extract rents.

countries but has no significant effect on investment growth for firms in SSA or LAC³⁹. Similarly, a recent study by Birhanu et al. (2016) for African and Latin American firms show that corruption has a negative and significant effect on firms investments in fixed assets. O'Toole & Tarp (2014) assess the impact of corruption on firm investment efficiency for a sample of firms from 90 developing and transition countries. The authors consider two measures of firm efficiency – absolute measure and a relative measure⁴⁰. Their findings show that corruption has a negative and significant effect on firm investment efficiency. However, for large firms and foreign-owned firms' corruption is found not to have any effect on their investment efficiency. Provincial level governance and firm ownership status could influence which firms are likely to pay bribes and how much, thus even within a country corruption's impact on firms could vary. Nguyen & van Dijk (2012) provide evidence for Vietnamese firms that corruption has a significant negative effect on private sector firms' growth (change in book value of total assets) but no similar effect on SOEs.

From the empirical literature reviewed so far, one can infer that the results on the effects of corruption on firm performances are mixed. Focusing on Africa, the closest study is that of Fisman & Svensson (2007) which looked at the relationship between bribery payments and firm sales growth using cross-sectional data from 243 Ugandan firms surveyed in 1998. This study thus contributes to the literature by using recent firm-level data from a broader sample of a panel of African firms to assess how corruption relates to African firms' performances. Additionally, the availability of a panel subsample makes it possible to control for time-invariant factors which are likely to yield more reliable results. Finally, I investigate both the contemporaneous and the lag-effect of bribery payments on firm performances.

3.3 Data and Measurement

The data used in this study was obtained from the World Bank's Enterprise Surveys (WBES), which are surveys conducted in 135 countries and cover about 130,000 firms. The World Bank conducts the Enterprise Surveys (ES) in order to collect information on the investment climate and thus to assess the constraints to private sector growth in most developing countries. The WBES uses a stratified random sample methodology to draw its sample of firms for each survey and targets mostly privately-owned micro, small, medium, and large-scale non-agricultural firms. The sample stratification framework employed in each survey is based on firm size (small firms, 5-19 employees; medium firms, 20-99 employees; and large

³⁹ The authors by way of interpreting the latter finding argue that it is possible corruption provides private benefits to firms in SSA and LAC at the expense of social benefits, and corruption could serve as an artificial barrier to entry of new firms also leading to loss of potential investments.

⁴⁰ The absolute measure of firm investment efficiency is the return on investments by using capital productively, while that of relative investment efficiency is the firm's return on investments relative to that of average in its sector.

firms, 100 or more employees), sector, and geographical location⁴¹. A notable concern with one of the stratification indicators – i.e., size – is that medium and large sized firms compared with micro and smaller sized ones are oversampled. By implication, any potential findings from an inquest relying on the WBES would likely not be convincingly reflective of micro and small sized firms which turn to be salient in the private sectors of developing countries.

A standardized questionnaire is being employed for all waves of surveys beginning from 2006 hence making it possible for a comparative study. Each survey contains information on firms' characteristics, performance and their (firms) objective and subjective assessment of the business environment in which they operate. Specifically, on performance indicators, firms were asked to provide information on activities including employment and sales for the recent fiscal year as well as retrospective information (mostly for past three years) on these indicators, making it possible for growth rates of firm performance indicators to be computed. The sample of firms used in this study was obtained after some restrictions. Firms with missing observations on variables used (described below) in estimations were dropped. Additionally, firms which are less than a year old were also eliminated. Also, a few firms reported outrageous numbers (for instance, 2002 in the case of one firm) for the number of years of managerial experience in the same sector. Hence, I trim the data on managerial experience – i.e. firms whose managers have years of experience 4 standard deviations away from the mean managerial experience for the country such firms operate in. Finally, I create a balanced panel by eliminating firms with some data for one wave only.

This sample restrictions (cleaning process), results in a final sample of 1,126 firms from 2,410. The list of countries is provided in *Table B 3.1*.

Below, a detailed description of the measurement, as well as descriptive analyses of key variables used in this study.

3.3.1 Dependent Variables

To gauge firm performance in Africa over the period 2006-2015, three indicators – sales growth, employment growth, and labour productivity growth – are used. Using alternative measures of firm performance not only makes it possible to gauge the performance of private non-agricultural firms in Africa in a granular way, but also makes it possible to avoid shortcomings associated with a single performance indicator. For instance, although sales growth has been widely used in the literature on firm

⁴¹ Details on the Enterprise Surveys sampling methodology and implementation can be found at: http://www.enterprisesurveys.org/~media/GIAWB/EnterpriseSurveys/Documents/Methodology/Sampling_Note.pdf

growth⁴², firms may underreport their sales figures due to taxation purposes. Additionally, since sales could also include material purchases it could overstate the size and perhaps the growth of a firm (Coad and Hölzl, 2010). However, employment growth could reduce these measurement problems as it does not require deflation (Coad and Hölzl, 2010). Thus, employment growth could be a more suitable measure of firm growth for cross-country analyses. On the other hand, adjustment costs and labour indivisibility could imply that small firms witness lesser employment growth compared with larger firms (Coad and Hölzl, 2010).

Employment growth and sales⁴³ growth is computed as the log difference between waves divided by the number of years over the period. Labour productivity is defined as the real sales per employee and its growth rate is computed analogously as that of sales growth and employment growth. More formally, let S_{ijct} be the sales, employment, or labour productivity of firm i in industry j in country c in year t (i.e. recent wave) and S_{ijct-1} represent sales, employment, or labour productivity in initial/first wave. Then firm-level growth can be computed as:

$$G_{ijc} = \frac{\ln(S_{ijct} - S_{ijct-1})}{no. \text{ of years}}$$

Table 3.2 entails details on overall firm performance for the whole sample. Overall African firms saw an increase in growth rates in employment (1.6%) and sales (14%), but a negative growth rate in labour productivity (12.5%).

3.3.2 Independent Variables

Corruption

Owing to the secretive nature of corruption firms are likely to misreport their bribery activities or decline to provide any information on such activities altogether. Thus, in order to obtain reliable data on firms' bribery activities, the WBES team asks firms about their bribery payments later during the interview when some trust between the interviewer and the respondent had been established. Additionally, the question of firms' bribery engagement is phrased indirectly in order not to implicate firms of guilty of being corrupt. Specifically, the question asked firms during the survey is: "On average, what percentage of total annual sales, or estimated total annual value, do establishments like this one pay in informal payment to public officials to get things done?" The measure of corruption thus adopted in this study, i.e., bribe intensity, is

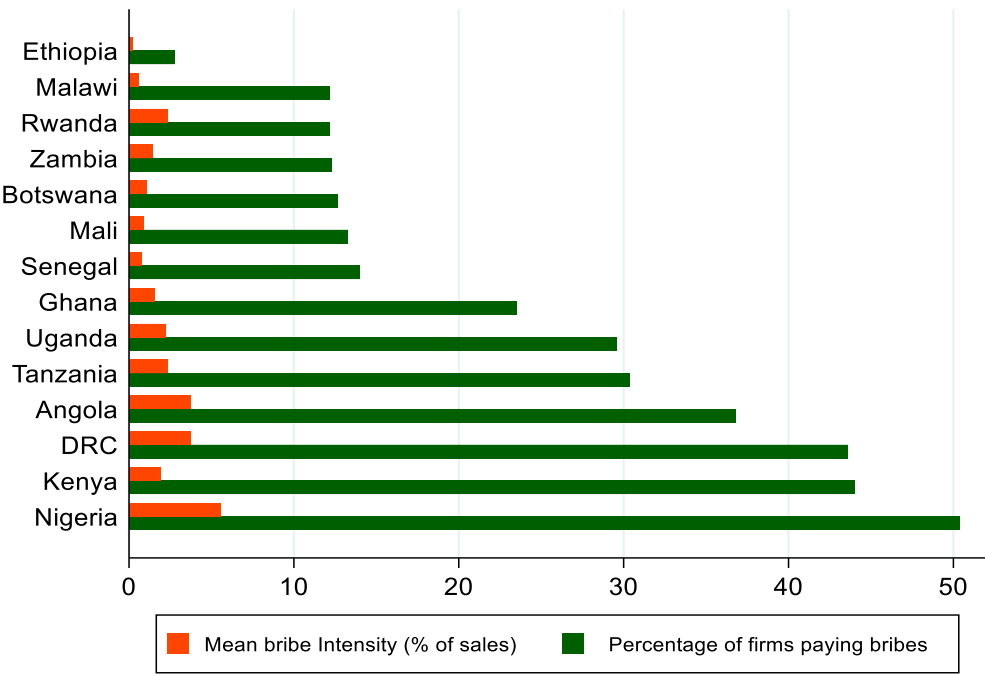
⁴² Specifically in the case of how corruption relates to firm growth, Fisman & Svensson (2007); Wang & Yu (2012), use the log difference of firm sales as a measure of firm growth.

⁴³ All sales figures are deflated (inflated) to 2010 prices and converted to USD using exchange rate and CPI data from the WDI of the World Bank.

the percentage of firm’s total annual sales paid as bribe in a given fiscal year. Thus far this bribe intensity measure of corruption is about the most reliable measure of corruption available.

As detailed in *Table 3.2*, about 24% of firms engaged in bribe payments, with an average of 1.8% of annual sales paid as bribes. At the country level, as shown in *Figure 3.1*, Nigeria have the largest percentage of firms engaging in bribery payments. Its firms also tend to pay on average the highest amounts as a proportion of sales in bribes. Conversely, firms in Ethiopia engage the least in bribery payments and equally pay the least average amounts as a proportion of total sales. Details in the same figure also reveal that within a country, a higher incidence rate (percentage) of bribery payments does not necessarily translate into higher average bribery payments. For instance, bribery incidence, for instance, in Rwanda is almost half that of Tanzania but the former’s firms pay on average equal proportions of their sales in bribes as those in the latter.

Figure 3.1: Bribe Incidence and Intensity across Countries



Probing further, an analysis of the data indicates that bribery incidence and intensity decreases with firm size – i.e., smaller firms tend to engage more in bribes and pay more on average compared with medium and large sized ones (*Figure 3.2*). At the industry level, on average firms operating in the wood and furniture sector are found to pay the highest proportion of their total annual sales as bribes while those in the textiles sector pay the least (*Figure 3.3*).

Figure 3.2: Bribe Incidence and Intensity by Firm Size

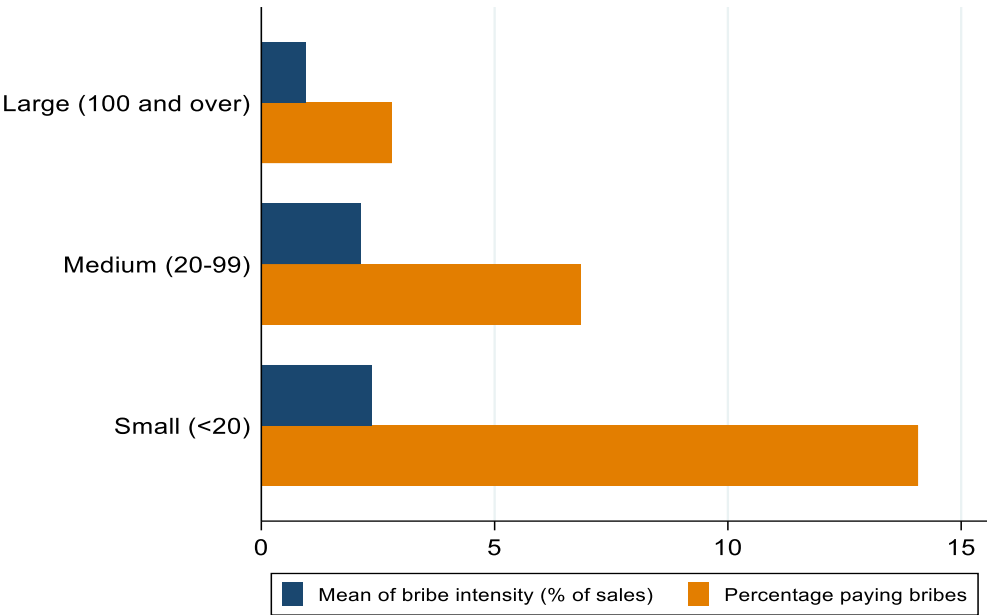
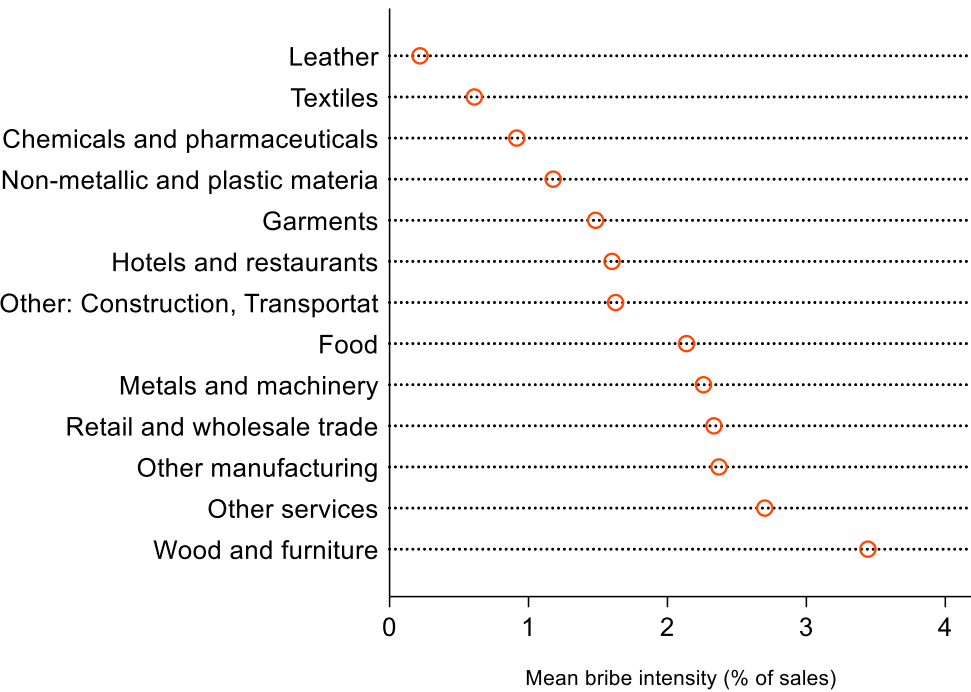


Figure 3.3: Bribe Incidence and Intensity by Industry



Age of firm

To assess the impact of firm age on performance, I construct firm age by taking the log of the difference between the year a firm was surveyed and the year it was established. The average age of the sample is

about 15 years old⁴⁴, with the youngest being 1 year old and the oldest 80 years old. Additionally, younger and mature firms also tend to be the majority (65%) in the sample.

Top manager's work experience

In the WBES, firms were asked to provide information on the number of years of experience top management has in a similar industry. Thus, the measure of managerial experience used in this study is the log of the number of years of a firm's top manager has in its industry. As reported in *Table 3.2* top managers in Africa's private sector tend to have a modest (14.5 years) experience⁴⁵ within the industry their firm operates.

Foreign ownership

The variable of foreign ownership used in this study is measured by creating a dummy equal one if a firm has at least 50% foreign ownership share. Using this measure of foreign ownership, foreign-owned firms make up about 12% of the sample.

Access to finance

Firm access to formal finance is measured by using a dummy variable to which takes the value one if firm obtained a bank loan or overdraft facility in the previous fiscal year, and zero otherwise. Using this measure of firm use of formal finance, about 43% of firms had access to finance in the sample.

Export status

The trading activities of a firm - exporting status - is computed as a dummy variable for firms that sell at least 10% of the total output directly or indirectly to a foreign market. Firms that engage in exporting appear to make up a significant proportion (15%) of the sample.

Technology and innovation

A dummy variable is used to capture firm use of email, ownership of a website, and use of internationally recognized quality certificate as a measure of innovation and technology use. Going by this proxy, about 50% of African firms use technology.

Multi-plant firms

⁴⁴ It is worth noting that the figure reported in table 2 on firm age isn't log transformed

⁴⁵ As with firm age, reported managerial experience is not also log transformed.

Ownership structure of firm i.e. whether a multi-plant firm or singleton is computed by using a dummy variable which takes the value 1 if a firm responded it where part of a multi-plant, and 0 otherwise. A significant proportion (42%) of the sample is multi-plant firms.

Table 3.1: Data description

Variable	Definition
<i>Employment growth</i>	Log difference of full-time permanent employees between surveys divided by the number of years between surveys.
<i>Sales growth</i>	Log difference of total annual sales between surveys divided by the number of years between surveys.
<i>Labour productivity growth</i>	Log difference of real sales per employee between surveys divided by the number of years between surveys.
<i>Employment_{t-1}</i>	The log of the number of full-time permanent employees in the initial survey
<i>Sales_{t-1}</i>	The log of real sales in the initial survey
<i>Labour productivity_{t-1}</i>	The log of real sales per employee in the initial survey
<i>Bribe intensity</i>	The percentage of total annual sales paid as informal payments to bureaucrats to get things done
<i>Bribe incidence</i>	Dummy variable that takes the value 1 if a firm paid a bribe, and 0 otherwise
<i>Age</i>	Firms age- year firm was surveyed minus the year the firm was established (log-transformed)
<i>Young</i>	Dummy variable that takes the value 1 if a firm is less than 6 years old, and 0 otherwise
<i>Mature</i>	Dummy variable that takes the value 1 if a firm is between 6 and 15 years old, and 0 otherwise
<i>Older</i>	Dummy variable that takes the value 1 if a firm is more than 15 years old, and 0 otherwise
<i>Small</i>	Dummy variable that takes the value 1 if a firm has fewer than 20 employees, and 0 otherwise
<i>Medium</i>	Dummy variable that takes the value 1 if a firm has between 20 and 99 employees, and 0 otherwise
<i>Large</i>	Dummy variable that takes the value 1 if the firm has over 100 employees, and 0 otherwise
<i>Foreign</i>	Dummy variable that takes the value 1 if the firm has at least 50% foreign ownership, and 0 otherwise
<i>Exporter</i>	Dummy variable that takes the value 1 if the firm exports at least 10% of its output, and 0 otherwise
<i>Bank loan</i>	Dummy variable that takes the value 1 if the firm has a loan or overdraft facility, and 0 otherwise
<i>Experience</i>	The log of the number of years of experience a firm's top manager has in the sector
<i>Multi-plant firm</i>	Dummy variable that takes the value 1 if the firm is part of a multi-plant, and 0 otherwise

<i>Innovation and Technology</i>	Dummy variable that takes the value 1 if the firm has its own website, uses emails for business transactions, or possesses an internationally recognized quality certificate, and 0 otherwise
<i>Competition</i>	The log of the number of firms within the same industry in a location.

Table 3.2: Table of Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Employment growth	1,126	0.016	0.258	-1.021	1.406
Sales growth	1,126	0.141	0.585	-3.136	3.161
Labour productivity growth	1,126	0.125	0.534	-3.058	2.930
Employment	2,252	3.064	1.310	0	8.987
Sales	2,252	13.300	3.333	4.640	26.340
Labour productivity	2,252	10.240	2.944	1.046	20.400
Bribe	2,252	1.883	6.074	0	100
Bribe incidence	2,252	0.243	0.429	0	1
Age	2,252	14.900	11.220	1	80
Young	2,252	0.150	0.357	0	1
Mature	2,252	0.484	0.500	0	1
Older	2,252	0.366	0.482	0	1
Small	2,252	0.538	0.499	0	1
Medium	2,252	0.308	0.462	0	1
Large	2,252	0.154	0.361	0	1
Foreign	2,252	0.120	0.325	0	1
Exporter	2,252	0.148	0.355	0	1
Bank loan	2,252	0.432	0.495	0	1
Experience	2,252	14.530	9.998	1	72
Multi-plant firm	2,252	0.221	0.415	0	1
Technology	2,252	0.633	0.482	0	1
Manufacturing	2,252	0.343	0.475	0	1
Retail services	2,252	0.322	0.467	0	1
Nonretail services	2,252	0.335	0.472	0	1

Notes: Author's own calculations using WBES data. Summary statistics are computed for the sample of panel firms (from 15 countries) and using survey weights provided by the WBES.

3.4 Empirical strategy

3.4.1 Determinants of Corruption

In order to ascertain the effects of bribery payments on firm performances, an investigation into the probability of a firm paying bribes and the amount paid is carried out. This will be informative as to which firms, based on characteristics, are likely to engage in bribery payments and the amount paid. More formally, the potential of firm bribery payments is tested by estimating the following models

$$1 \quad \text{Prob}(\text{bribe}_{ijct} = 1) = \Phi(\beta_0 + \beta_1 FC_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + v_{ijct}),$$

$$1a \quad \text{Prob}(\text{bribe}_{ijct} = 1) = \Phi(\beta_0 + \beta_1 FC_{ijct-1} + \gamma C_c + \delta I_j + u_{ijct}),$$

$$2 \quad \ln \text{bribe}_{ijct} = \beta_0 + \beta_1 FC_{ijct} + \gamma C_c + \delta I_j + v_{ijct},$$

$$2a \quad \ln \text{bribe}_{ijct} = \beta_0 + \beta_1 FC_{ijct-1} + \gamma C_c + \delta I_j + u_{ijct},$$

where the probability of firm i , belonging to industry j , in country c , at time t , engaging in bribery payment is captured by $\text{bribe}_{ijct} = 1$, $\ln \text{bribe}_{ijct}$ is e log of 1+ bribe intensity; Φ is the standard (cumulative) normal distribution term; FC_{ijct} and FC_{ijct-1} represent contemporaneous firm controls and initial values (i.e. taken from first surveys) of regressors respectively; C_c , I_j , and T_t are country, industry, and time fixed effects respectively; and v_{ijct} and u_{ijct} are zero-mean error terms. I include as part of firm controls: measures of firm visibility (size – small, medium; large firms are used as the base group), productivity of firm (labour productivity), trading activities (export engagement), foreign capital (foreign), firm age, firm manager's experience in same sector her/his firm operates, use of technology and innovation, formal finance use (bank loan), and ownership structure – multi-plant firm status. Equations (1) and (1a) are estimated with a pooled probit model while equations (2) and (2a) are estimated with a pooled Tobit model. Estimations results of equations (1) and (2) are expected to inform the contemporaneous determinants of the probability and amount of firm bribery payments whereas those from equations (1a) and (2a), the lagging determinants.

3.4.2 Impact of Corruption on Firm Performances

To test the effect of bribe payment on firms' growth the following equations are estimated

$$3 \quad y_{ijct} = \beta_0 + \beta_1 \text{bribe}_{ijct} + \beta_2 X_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + \varepsilon_{ijct}$$

$$\Delta y_{ijct} = \vartheta_0 + \vartheta_1 \text{bribe}_{ijct-1} + \vartheta_2 X_{ijct-1} + \gamma C_c + \delta I_j + \delta T_t + \varepsilon_{ijct},$$

where y_{ijct} is firm employment, sales and labour productivity levels/sizes, and Δy_{ijct} – firm employment growth, sales growth, and labour productivity growth between waves; bribe_{ijct} is the contemporaneous bribe intensity⁴⁶ measure, and its initial value denoted by bribe_{ijct-1} ; X_{ijct} and X_{ijct-1} are the contemporaneous controls and their initial values, respectively: age (log), manager’s experience (log), foreign ownership, trade activity (i.e. exporting), access to finance (bank loan), technology and innovation, and ownership structure (i.e. multi-plant firm; C_c , I_j , and T_t are used to control for country, industry, and year fixed effects respectively; and ε_{ijct} is a zero-mean error term. The inclusion of the afore-listed controls is motivated by previous theoretical and empirical studies.

The age of a firm has been found to influence its performance. Conditional on survival, young firms are more likely to grow more rapidly than older firms (Haltiwanger, Jarmin, and Miranda 2013; Dunne and Hughes 1994). This finding (i.e. the negative correlation between firm age and growth) has been affirmed for Africa (Van Biesebroeck 2005; Goedhuys and Sleuwaegen 2009; Ayyagari, Demirguc-Kunt, and Maksimovic 2014). Moreover, firm age might be correlated with its bribery payments. Particularly, younger firms faced with a higher probability of exit may be inclined to resort to bribing officials in order to stay afloat. Older firms with established contacts with officials could also be inclined to pay bribes to gain preferential commercial treatment.

Managerial experience has been reported as one of the key ingredients of firm growth. The positive and significant impact of managerial experience on firm performance, as elaborated by Nichter & Goldmark (2009), could stem from the direct effect of expansion in the skills and capabilities of firm owners and those of their employees owed to “learning-effects”; and indirectly, by an improvement in the social networks of top management. There is some empirical evidence on the positive impact of managerial experience on firm growth. For instance, for a sample of firms operating in Romania, Brown et al. (2005), find that an entrepreneur’s prior work experience in similar industry was correlated positively with firm growth. Moreover, for industries that rely so much on public services, the length of time a manager spends within these industries could be linked (positively) with social ties with public officials and possibly bribe payments.

Foreign ownership is also controlled for due to its potential to influence firm growth and bribery payments. Wholly or partial foreign ownership is often linked with greater export market access, superior technology,

⁴⁶ A positive and statistically significant coefficient on this variable (bribe) will be interpreted in favour of the “grease the wheels of commerce” hypothesis, while a negative and statistically significant coefficient will be interpreted as evidence in support of the “sand the wheels of commerce” hypothesis.

highly-skilled and experienced personnel, and easier access to finance which could improve the performance of partner firms. Hallward-Driemeier et al. (2006), provide some firm-level evidence in support of a positive correlation between foreign ownership and firm performances. Relating ownership status with bribery engagement, in a quest to attract more foreign investors, African governments could shield firms with some foreign ownership from bureaucratic harassment. Conversely, as newcomers, foreign-owned firms might have little governmental connections and could as a result pay bribes to corrupt bureaucrats in order to get things done (Fisman and Svensson 2007). By way of empirical evidence, in Africa, firms with foreign capital have been found to have a lesser probability of engaging in bribery (Pelizzo et al. 2016).

Ever since it was established that finance plays a vital role in economic development (T. Beck, Levine, and Loayza 2000; Levine 1999; King and Levine 1993), the significance of finance at the micro-level particularly for SMEs has received some attention. With most of the evidence (Girma and Vencappa 2015; T. Beck and Demirguc-Kunt 2006; Ayyagari et al. 2016) supporting a positive effect of formal financing on firm performance.

There is a wide literature on the relationship between firm exporting and performance. To export, firms often have to incur an additional cost, as such, it is the most productive firms that are more likely to self-select into exporting (Melitz 2003; Bernard et al. 2007). Empirical evidence suggests that exporting firms witness higher performance than non-exporting firms (Şeker 2012; Foster-McGregor, Isaksson, and Kaulich 2014; De Loecker 2007). Moreover, owing to the positive association between firm performance and exporting, exporting firms could potentially be more attractive to corrupt bureaucrats, on the one hand, or could resort to bribery payments to engage or enhance exporting, on the other hand.

Following the established positive effect, it could have on firm performance, I also control for firms' use of technology. To emphasize, the performance-enhancing effect of technology and innovation stems from its potential to make it possible for firms to have effective communication with trading partners and customers, access new business opportunities, enable firms access vital information, to benefit from technical knowledge within their industry, and improve their competitiveness (Paunov and Rollo 2016, 2015). At the same time, applying to obtain internationally quality certificates or use of technology could make firms vulnerable to corrupt bureaucrats.

An additional firm characteristic that is linked with its growth is whether the firm is multi-plant firm or a single-plant firm, with evidence in favour of multi-plant firms more likely to survive and grow faster compared with stand-alone firms (Bernard and Jensen 2007; Coad 2008).

3.4.3 Endogeneity

For any estimator to produce consistent estimates from the above-specified equations (3 and 4), it should be the case that conditional on having a randomly drawn sample of firms, the model's error term (ε_{ijct}) should be uncorrelated with the bribe intensity (*bribe*_{*ijct*} or *bribe*_{*ijct-1*}) variable. This condition, in the case of this study, is untenable for a few reasons.

The first issue to contend with has to do with sample selection. For the subset of panel firms, it can be observed that a significant number of firms that were surveyed in the first round of surveys exited or were, per the sampling design adopted by the World Bank for subsequent surveys, deliberately not resampled although eligible. In the panel firms, survivor bias could potentially be an issue particularly if it is the case that firm survival was conditional on bribery payments and/or performance.

Another potential source of inconsistent estimates has to do with measurement error in firms' bribe payment. Since bribe payment is an illegal activity, it is possible some firms may not provide accurate information on their bribe payment activities. Thus, data on individual firm's bribery activities could entail some measurement error which could potentially be pooled into the error term (i.e. ε_{ijct}) and become a source of variance in firms actual bribe payments thus creating endogeneity. More formally, to conserve space, if we consider only equation (3) above, and consider *bribe*^{*}_{*ijct*} as a firm's actual bribe payment and *bribe*_{*ijct*} as the firm's reported bribe payment, we have:

$$5 \quad y_{ijct} = \beta_0 + \beta_1 \textit{bribe}^*_{ijct} + \beta_2 X_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + \varepsilon_{ijct}$$

Implying that:

$$\textit{bribe}_{ijct} = \textit{bribe}^*_{ijct} + \mu_{ijct}$$

where μ_{ijct} is a measurement error. If we assume that the error term in the true model, ε_{ijct} , is uncorrelated with either a firm's reported bribe payment or actual bribe payment, and also, that the

measurement error, μ_{ijct} , is uncorrelated with a firm's actual (unobserved) bribe payment⁴⁷, then by simple substitution, we end up estimating:

$$6 \quad y_{ijct} = \beta_0 + \beta_1 \text{bribe}_{ijct} + \beta_2 X_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + z_{ijct},$$

where $z_{ijct} = \varepsilon_{ijct} - \beta_1 \mu_{ijct}$. Clearly bribe_{ijct} is endogenous as it is correlated with z_{ijct} in the above equation.

The third issue relating to the inconsistency of estimates has to do with the joint determination between a firm's growth and corruption. To begin with, although corruption could have an effect on firm performance (Aidt 2009; Hanousek and Kochanova 2016; Fisman and Svensson 2007), firm performance could also influence bribe payments. For instance, Rand & Tarp (2012) using Vietnamese firm-level data, show that bribe incidence is associated with firm-level differences in visibility, sunk costs, and ability to pay. Bai et al. (2013) also for Vietnamese firms, find that firms' growth is associated with a decline in bribe payments. This implies that on a quest to test the impact of corruption on firm performance, potentially there could also be:

$$\text{bribe}_{ijct} = f(\Delta y_{ijct}, X_{ijct}) + \omega_{ijct},$$

which renders bribe payments variable endogenous. Relatedly, firms may also resort to bribing bureaucrats to achieve growth (Collins, Uhlenbruck, and Rodriguez 2009). In which case, there could be a positive correlation between bribery payments and performance hence masking any negative correlation between bribery payments and firm performance (Fisman and Svensson, 2007).

Finally, given that the sample contains only firms that appear twice across waves, "unobserved" time-invariant firm-specific characteristics such as managerial talent captured in the idiosyncratic error term, may correlate with a firm's bribery payments.

The foregoing discussion on potential sample selection, measurement error in bribe payments, simultaneity bias, and 'unobserved effect' implies that the bribe variable could potentially be endogenous.

3.4.4 Selection Model Estimation

The first issue approached is potential survivor bias which could result in sample selection. Details or reasons for firm exit is only available for 8 countries - DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania,

⁴⁷ Which is the classical errors-in-variables (CEV) assumption (Wooldridge 2010), which stems from $\text{bribe}_{ijct} = \text{bribe}^*_{ijct} + \mu_{ijct}$; which establishes a non-correlation between bribe_{ijct} and bribe^*_{ijct} .

Uganda, and Zambia. So, for this sub-sample of countries, a *t-test* is performed for firms that survived and firms that exited, and in addition, the following model is estimated to ascertain whether bribery payments predicted firm exit:

$$7 \quad P(exit)_{t+1} = \alpha_0 + \alpha_1 bribe_{ijct} + \alpha_2 F_{ijct} + \alpha_3 P_{ijct} + \alpha_4 S_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + v_{ijct},$$

Where the probability of a firm exiting before the second round of surveys, $Pr(exit)_{t+1}$, is predicted by firm i in industry j country c bribe payments ($bribe_{ijct}$) at time t (i.e. first round of surveys), a vector of firms' characteristics, as discussed above, (F_{ijct}), labour productivity (P_{ijct}), number of employees for firm size (S_{ijct}). C_c , I_j , and T_t are country, industry and year dummies respectively; and v_{ijct} is a zero-mean error term.

Second, a *t-test* is performed to ascertain whether firms with missing data on bribery payments differ significantly in observables from those with data on bribery payments. Following Wooldridge (1995) and Semykina & Wooldridge (2010), upon estimating equation (7) above with a pooled probit model, obtained coefficients are used to construct an Inverse Mills Ratio (IMR) for surviving firms. This IMR is then inserted into the main equations (3 & 4) to control for survivorship bias.

3.4.5 Instrumental Variable Estimation

To correct for endogeneity issue pertaining to the bribery payments data, I estimate the effect of a firm's bribery payments on performances using an IV estimator. Following Fisman and Svensson (2007), I use the country-industry-year averages of bribe payments as an instrument for firm-level bribe payment. The economic reasoning underlying the validity of this instrument is that country-industry-year averages level of bribes are dependent on industry characteristics (such as industries' underlying technologies, and dependence on government services) which should allow for a correlation between these averages and firm-level bribery, but should, however, be uncorrelated with firm-level unobservables that could potentially be correlated with firm performance indicators. I also consider the country-industry averages of the percentage of top management's time spent dealing with bureaucrats in a month as an instrument. Firms with social ties with bureaucrats could spend an appreciable amount of time interacting with bureaucrats (Collins, Uhlenbruck, and Rodriguez 2009). Alternatively, the amount of time a firm's top management spends with bureaucrats could depict the degree of control bureaucrats exert on the firm (Svensson 2003). Either way, one will expect that managers that spend more time with bureaucrats are

more likely to pay bribes⁴⁸, however, there is no reason to believe that their (i.e. manager's) interaction with a public official should have a direct impact on its performance. Using these set of instruments, I estimate the following model:

$$8 \quad \Delta y_{ijct} = \beta_0 + \beta_1 \widehat{bribe}_{ijct-1} + \beta_2 X_{ijct-1} + \gamma C_c + \delta I_j + \vartheta T_t + \varepsilon_{ijct}$$

where $\widehat{bribe}_{ijct}$ is the predicted value from the first-stage estimations.

3.4.6 First Difference Estimation

Finally, to control for possible 'unobservable' constant firm characteristics such as managerial talent which is a potential source of endogeneity; I estimated the following first differenced equation with OLS estimator.

$$9 \quad \Delta y_{ijct} = \vartheta_0 + \vartheta_1 y_{ijct-1} + \vartheta_2 \Delta bribe_{ijc} + \vartheta_3 \Delta X_{ijc} + \delta T + \Delta \varepsilon_{ijc}$$

Wooldridge (2010) asserts that with a sample spanning only two time periods, the first difference transformation, just as the fixed effects transformation, eliminates any time-invariant firm-specific characteristic - 'unobserved effect'.

3.4.7 OLS Estimation

As a benchmark, the OLS estimator will be used to test the relationship between corruption and firm performances without controlling for any potential endogeneity biases. Potentially the inclusion of a 'rich' set of controls in the models could control for some endogeneity, specifically that related to selection bias⁴⁹. If that were the case, however, the consistency of the OLS estimates could still be in doubt as one cannot downplay the potential impact endogeneity bias owed to measurement errors in firms' bribery activities, the simultaneity between firms' bribery activities and their performances, and 'unobserved effect' could have on estimates.

⁴⁸ For instance, Collins et al., (2009) for a survey of 341 Indian firms' executives, find that firms whose executives had ties with government officials were more likely to pay bribes.

⁴⁹ The underlying reasoning here is owed to the "conditional independence assumption" (Angrist and Pischke 2009) which implies that conditional on controlling for 'relevant and valid' covariates, selection bias could be eliminated.

3.5 Empirical Results

In this section, discussion of empirical results for the determinants of firm bribery payments and its impact on their performances are provided. All estimations include country, industry and year fixed effects except for the first-difference estimations that include only year fixed effects. Additionally, all standard errors reported are corrected for heteroscedasticity and clustered by country-industry level.

3.5.1 The Determinants of Corruption

Table A 3.2 reports results for probit and Tobit estimations of the determinants of bribery payments. From column 1 – column 8, the coefficient on firm age is negative and significant, corroborating Diaby & Sylwester's (2015) finding. By way of interpretation, older firms, compared with younger ones, are less likely to engage in bribery payments or upon engaging in bribery payments, pay comparatively, a lesser share of their total annual sales. The lower likelihood of older firms paying bribes could stem from the fact that these firms are more productive (perhaps due to learning effects) and also have more resources which make urgency to resort to bribing public officials to obtain preferential treatments in order to survive or enhance performance very low.

A second interesting finding is that smaller and medium-sized enterprises (SMEs) are more likely to engage in bribery payments and pay higher amounts of their sales as bribes if they were to do so. Intuitively, more visible firms – i.e. larger firms – are less likely to pay bribes. A possible explanation could be that larger firms, although more visible to corrupt bureaucrats, have either more resistance to bribery extortions or potentially have alternative ways of satisfying the needs of corrupt bureaucrats. An informal example concerning the later claim could be that firm manager who agrees to employ the relation of a corrupt bureaucrat could be exempted from bureaucratic harassment. An earlier study on Africa (Pelizzo et al. 2016) also find that SMEs are more prone to bribery engagement.

The results also show that productive firms have a lower probability of engaging in bribery payments or pay lesser amounts of bribes. However, although a negative coefficient is found for contemporaneous firm productivity and its initial value, statistical significance is obtained only for the contemporaneous effect. The negative and significant effect of productivity could mean that productive firms, which are firms also less likely to be concerned with survival, also have stronger bargaining power or resistance against corrupt bureaucrats.

Managers that stay in the same sector for an appreciable length of time (i.e. experience) are also, generally, found to be more prone to bribery payments. For firms with foreign presence, the reported coefficient is negative but insignificant. Indicating that, foreign-owned firms have a lower probability of engaging in bribery payments. The contemporaneous effect of firm export engaged is also linked with a higher

probability of such firms engaging in bribery payments or paying higher amounts compared with non-exporting firms. The reasoning underlying this relationship could be that firms that receive public services mostly and as a result interact frequently with public officials (customs officials in the case of exporting firms) are prone to bribery extortions or to pay bribes to circumvent bureaucratic red tape. The reported coefficients on firm formal finance use (bank loan) are mostly positive but significant in the case of only the contemporaneous use of formal finance. Evidencing that firms that rely on formal external finance are also more likely to pay bribes and higher amounts relative to firms that use internal or alternative funding sources. One could reason into this finding to mean that if it were the case that firms that are SMEs and also less productive and as a result have to rely on external finance, per then these firms in a quest to survive and enhance performance will complement their externally generated funds with bribery payments. Finally, the results also reveal that firms that are part of a multi-plant compared with singleton firms could pay higher bribes although none of the coefficients is statistically significant.

3.5.2 The Impact of Corruption on Firm Performances

As discussed earlier, firm bribe payments could be endogenous and as a result, render results on the effect of corruption on firm performance inconsistent. I use the country-industry-year averages of bribe payments and that of the amount of time firm top management is estimated to spend with public officials in a month (bureaucracy) as an instrument for firm-level bribe payments.

Table A 3.3 provides IV results for the instantaneous effect of bribery payments on firm size (employment), sales, or labour productivity. Column 1 – column 6 show results without the IMR while column 6 – column 12 show results when it is included. The *Table A 3.3* also details a series of tests that show the validity of the instruments – (country-industry-year averages of bribes and bureaucracy) – used in the IV estimations. To begin with, the f-statistics for the joint significance of the instruments in the first stage (exclusion restriction) exceed the minimum threshold of 10%. Also, results for Hansen’s J-statistic⁵⁰ which is used to test for over-identifying restrictions (validity of instruments) shows that the null hypothesis of instrument validity cannot be rejected but for estimations which include the IMR. Moreover, the Kleibergen-Paap rk LM statistic⁵¹ which is used to test for underidentification test yields results which are high and statistically significant indicating that the null hypothesis of underidentification can be rejected. Finally, the results of the test for weak identification (Cragg-Donald f-statistic) are sufficiently high thus indicating that the instruments aren’t weakly correlated with firm bribe payments.

⁵⁰ This test has the null hypothesis that the instruments are valid instruments, i.e., uncorrelated with the error process.

⁵¹ The Kleibergen-Paap rk LM test is an LM test is used to test for instrument relevance with the null hypothesis that that the equation is underidentified.

Coming to the signs and magnitudes of the main regressor, bribery payments, it can be inferred that overall contemporaneous bribery payments have a negative effect on firm size⁵² (employment, although not statistically significant), sales amounts, and labour productivity. More specifically, the coefficients reveal that a 1% point increase in firm bribery payments amount will reduce firm sales amount and labour productivity each by about 0.9%. Considering this finding, a possible explanation for an instantaneous retarding effect of bribery payments on firm size could be that, in order to ameliorate the extra burden of financial costs entailed in bribery payments, firms at best maintain their size. Relating to sales amount, if it were the case that bureaucrats are uncoordinated and or coercive in their bribery extortion activities, firm engagement in bribery payments could have a retarding effect on its sales as a result of the uncertainty that comes with uncoordinated bribery extortions from different bureaucrats and the extra financial burden (cost-increasing effect). A consequence of the cost-increasing effect which adversely affects sales amounts could result in the same amount of input (employees) producing a given (lesser) output (sales), hence the negative effect of bribery payments on firm sales per employee (labour productivity).

Overall, for the sub-sample of 8 countries⁵³ for which an IMR was computed and used as a control for survivorship bias the results on the instantaneous effect of bribery payments of firm performance remain largely similar as those of the entire sample (15 countries). A notable exception is that bribery payments appear to have a positive and significant effect on firm size (employment) (column 8), however, as shown in the same column, the coefficient for the IMR is significant evidencing the presence of possible survivor bias. This finding is not surprising as the *t-test* results (*Table B 3.2*) of mean comparisons show that surviving firms differ significantly from exiting firms when it comes to size. However, probit estimation results (*Table A 3.1*), from which the IMR are computed, do not corroborate that firm bribery payment in the initial wave was a significant predictor of survival. I thus interpret the significant coefficient for the IMR – depicting possible survivor bias – with caution as, 1) we are uncertain about the replicability of this finding for the whole sample (15 countries), and 2) if even in the worst-case survivor bias were present in the analyses, it should have little or no influence on the bearing of the results as the negative and significant contemporaneous effect of bribery payments is persistent for most of the models but for only 1 (column 8), and the significance of the IMR isn't persistent.

Additionally, still in *Table A 3.3*, the results highlight the importance of firm characteristics and the business environment for firm performance in Africa. Firm age correlates positively and significantly with firm size (employment), sales amount, and labour productivity. This positive relationship could be interpreted as evidence of “learning effects” (Jovanovic 1982) among African firms. An earlier study by Harrison et al. (2014) using firm-level data from the WBES also find a positive impact of firm age on labour productivity

⁵² This finding corroborates that of Beltrán (2016), who finds a negative and significant effect of corruption on firm size for a sample of firms in Latin America and the Caribbean.

⁵³ DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania, Uganda, and Zambia.

in Africa. Another interesting finding is that firms that have at least 50% of the ownership being foreign appear to have a larger size, sell higher amounts of output and are more efficient compared with private domestic and state-owned firms. Also, firms that self-select into exporting are larger, sell more and are more efficient. A similar finding can be observed for firms that use formal sources of finance, use technology and innovate, and for firms that are part of a multi-plant. Finally, the length of exposure of firm manager in a similar industry its firm operates has a positive (but not significant) effect on the size of her/his firm, a number of sales, and sales per employee.

Table A 3.4 shows IV estimation results of the lag effect of firm bribery payments on growth. Again, tests result for instrument validity, underidentification, and weak identification, indicate that the instrumental variables pass required tests. Considering the effect of the lag of bribery payments on firm performances, the results are like those of the contemporaneous effect of bribery payments on firm performances in *Table A 3.3*. To emphasize, an increase in the bribery rate by a percentage point is associated with 0.006%, 0.02%, and 0.01% reduction in the annual growth of firm employment, firm sales, and firm labour productivity in Africa.

These findings, particularly for firm sales growth, although notably small in magnitude, dovetail those of Fisman & Svensson's (2007) for a sample of Ugandan firms. A possible interpretation of the growth-retarding effects of corruption on firm employment could be that firms decide to expand less rapidly in order to reduce the extra costs that come with compliance with government regulations (taxes and levies, for instance) and the associated costs (bribery payments) that accompany compliance (by way of interacting with corrupt public officials) with these regulations. Relating to firm sales growth, as discussed earlier, cost-increasing coercive corruption could push the cost of production up hence leading to a reduction in firm sales growth. Higher extortions of bribes by public officials are likely to divert managerial efforts away from productive management and efficient investments to inefficient managerial practices such as modestly increasing inputs (number of employees) in order to produce a given output (sales), thus leading to a reduction in labour productivity growth. Moreover, all firm size measures (initial values of employment and sales) are negative and economically significant, indicating that larger firms tend to grow less compared with smaller firms. A finding which contradicts Gibrat's law, which says that firm growth is independent of size and most likely due to random shocks (Coad and Hölzl 2012).

Firm age correlates negatively with employment growth (confirming earlier findings for Africa, Goedhuys & Sleuwaegen 2009; Ayyagari et al. 2014), but positively with sales growth and labour productivity growth again showing evidence of "learning effects" (Jovanovic 1982) among African firms. Interestingly, foreign ownership, exporting, use of technology, and use of formal finance are associated with firm growth in Africa. The coefficient on the lag of the IMR now shows possible survivorship bias for only estimations for firm employment growth.

Up to this point, we still do not know how a reduction (or increase) in firm bribery payments will likely affect firm performances, and possibly, whether our findings are robust to controlling for firm-specific time-invariant factors such as managerial talent which could influence the reliability of estimations results. In *Table A 3.5*, results for the first-differenced estimations are provided. The change in bribery payments (which is an increase in the case of our sample⁵⁴) is negatively associated with firm sales growth and labour productivity growth. On firm employment growth, a weak positive impact is found initially (column 1), however, upon controlling for the first differences of other firm characteristics, the statistical significance disappears, and a negative coefficient is obtained. Overall, the change (increase) in corruption over time, is found to have a negative effect on African firm performances.

The lower economic impact obtained from estimation results of the first-difference estimations compared with those of the IV estimations results using the lag of corruption could signal that there could still be influenced by other potential endogeneity issues such as reverse causality. For example, if it were the case that public officials resorted to coercive bribery extortions and as such went after the ablest of firms, then this could bias our estimates downward. Alternatively, the low economic impact could also imply that the weakest or most inefficient firms are resorting to corruption to ‘bend the rules’ in order to survive. A situation which leads to an increase in firm bribery payments in return for survival albeit mediocre performance. On the issue of potential survivorship bias influencing the results, again, the IMR shows a possible influence of this effect.

Comparing the results discussed thus far with those of our benchmark estimations – OLS results – they vary significantly when considering the association between the lag of bribery payments and firm performance but look similar in the case of the contemporaneous effect of bribery payments. *Table A 3.6* shows the contemporaneous effects of bribery payments on firm performance. Evidently, bribery payments appear to be associated negatively with firm size, sales amount, and efficiency. The main difference between these results and those of the IV estimations is that the economic impact observed in the latter case is about 3 times larger compared with those of the former. Considering the results on the association of the lag of bribery payments on firm growth (*Table A 3.7*), generally, bribery payments are found to be negatively associated with firm performances but none of the coefficients are statistically significant. The contrast between the IV results and those of the OLS (specifically those related to firm growth, *Table A 3.7*) could be evidence that firm bribe payments are endogenous. For instance, if it were the case that corrupt bureaucrats target the ablest firms and/or some firms resort to bribery as a means of survival or to gain competitive advantage, then any underlying negative correlation between bribe

⁵⁴ Summary statistics for variables used in these estimations are provided in *Table B 3.3*. On bribe payments, the change in bribe is positive, indicating that on average firms have witnessed about 0.094% increase in the amount paid as bribery.

payments and firm growth will not be accurately captured by the OLS estimator. Firm characteristics maintain the same sign and with a similar economic magnitude as those of the IV.

3.6 Robustness Checks

So far, I have considered how corruption affects firm performances irrespective of size and age. However, as discussed earlier, the size and age of a firm could determine its bribery payments status and consequently how performance is influenced. Evidently, the preliminary evidence (*Table A 3.2*) revealed that SMEs and less productive firms are prone to bribery payments while older firms are less prone to bribery payments. Following these scenarios, I investigate the impact of corruption on firm performance by firm size and age category. I perform IV estimations (using the same instrumental variables as above) for the contemporaneous effect of corruption on firm size, sales amount, and efficiency, separately for SMEs and for large firms. Similar estimations are conducted to ascertain the impact of the lag of corruption of firm growth.

The findings are shown in *Table A 3.8* and *Table A 3.9*. Interestingly, the instrumental variables overall perform well in most of the estimations. We can infer from the values reported in *Table A 3.8* that bribery payments have a contemporaneous negative impact on firm performances across all sizes and ages albeit inconsistent statistical significance. It is now obvious that the contemporaneous negative effect of corruption on firm size is driven largely by larger firms, whereas that of sales amount and labour productivity is driven by SMEs. Further, the findings also reveal that older firms suffer a more severe instantaneous effect of bribery payments on their size, sales amount and labour productivity than young and mature firms. Coming the lag effect of corruption on firm growth, similarly, the results shown in *Table A 3.9*, reveal that larger and older firms suffer the growth-retarding effect of corruption than SMEs and young and mature firms.

3.7 Conclusions

Africa's recent impressive economic performance despite having comparatively weaker economic institutions has cast doubt about the sustainability and inclusiveness of its economic performance. Of interest to policymakers and scholars alike has been the implications of one symptom of weaker economic institutions – bureaucratic corruption – for the growth of firms particularly SMEs, which are a salient part of most African economies. Most studies on the economic consequences of corruption in Africa thus far have been at the macro level. Macro or cross-country studies reveal little concerning the economic consequences of corruption on firm performances. In this study, I used recently collected firm-level data – panel data – to examine both the contemporaneous effects of bribery payments on firm size (employment), sales amount, and labour productivity, on the one hand, and the lag effect of bribery

payments on firm sales growth, employment growth, and labour productivity growth. To cater for potential endogeneity issues concerning firm bribery payments I used IV approach with the country-industry-year averages of bribery payments and percentage of time firm manager spends with public officials in a month (bureaucracy) as instrumental variables. Additionally, first-difference estimations are employed to handle potential firm-specific time-invariant effects that could influence the analyses. Additionally, the benefit of panel data made it possible to test whether corruption affects firm performance with a lag. Generally, upon controlling for the endogeneity of firm-level bribery payments, the findings show that corruption not only has a contemporaneous negative effect on firm size, sales, and efficiency (labour productivity) but also has a growth retarding effect on firm growth in Africa. A finding which corroborates that of an earlier study for Uganda (Fisman & Svensson 2007). What is more, corruption appears to be more harmful to the performances of older and larger African firms than SMEs and young and mature firms.

Appendix 3A: Regression Tables

Table A 3.1: Probit estimations of bribery payments and probability of firm exit

Regressors	(1)	(2)	(3)
	exited	exited	exited
Bribe	0.00390 (0.00385)	0.00388 (0.00384)	0.00383 (0.00385)
Labour productivity	-0.00334 (0.0165)	0.00134 (0.0167)	0.00933 (0.0171)
Age	-0.0999*** (0.0310)	-0.0993*** (0.0311)	-0.0955*** (0.0311)
Employment	-0.0593*** (0.0226)	-0.0481** (0.0237)	-0.0277 (0.0256)
Experience	-0.00245 (0.0345)	-0.00130 (0.0346)	-0.00513 (0.0346)
Foreign		-0.151* (0.0795)	-0.141* (0.0806)
Exporter		-0.0437 (0.0783)	-0.0210 (0.0789)
Technology			0.00171 (0.0471)
Multi-plant			-0.0777 (0.0616)
Bank loan			-0.149*** (0.0533)
Years gap			1.735*** (0.0522)
Constant	-5.056*** (0.237)	-5.099*** (0.236)	-10.43*** (0.251)
Observations	4,507	4,507	4,507
Country FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Log likelihood	-2938	-2936	-2931

Notes: The table above shows results of probit estimations of the probability of firm exit – i.e. discontinuing business, not available or unreachable, and not resurveyed in the second round of surveys as a result. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A 3.2: Determinants of firm bribery payments

	Probit		Tobit		Probit (regressors from initial waves)		Tobit (regressors from initial waves)	
	Bribe incidence		Bribe intensity (%)		Bribe incidence		Bribe intensity (%)	
Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	-0.0829 (0.0504)	-0.133** (0.0537)	-0.218** (0.107)	-0.298*** (0.112)	-0.0859 (0.0559)	-0.138** (0.0639)	-0.190* (0.100)	-0.268** (0.112)
Small	0.108 (0.112)	0.245* (0.126)	0.180 (0.245)	0.493* (0.273)	0.129 (0.159)	0.240 (0.181)	0.210 (0.271)	0.403 (0.301)
Medium	0.156 (0.112)	0.235** (0.116)	0.366 (0.239)	0.547** (0.249)	0.107 (0.155)	0.179 (0.163)	0.188 (0.261)	0.324 (0.271)
Labour productivity	-0.0345* (0.0180)	-0.0384** (0.0185)	-0.0970** (0.0402)	-0.106*** (0.0407)	-0.0410 (0.0361)	-0.0428 (0.0375)	-0.0764 (0.0598)	-0.0831 (0.0617)
Experience		0.104** (0.0486)		0.164 (0.103)		0.0939 (0.0714)		0.135 (0.126)
Foreign		-0.140 (0.115)		-0.258 (0.243)		-0.226 (0.149)		-0.315 (0.269)
Technology		-0.0160 (0.0804)		-0.0461 (0.171)		-0.0205 (0.106)		-0.0829 (0.185)

Exporter		0.161		0.405*		0.247		0.501**
		(0.102)		(0.211)		(0.150)		(0.251)
Bank loan		0.196**		0.411**		0.123		0.209
		(0.0843)		(0.178)		(0.118)		(0.203)
Multi-plant firm		0.110		0.300		0.142		0.239
		(0.0927)		(0.195)		(0.134)		(0.225)
Constant	0.103	-0.0534	2.318***	2.304***	-0.171	-0.198	1.946***	1.935***
	(0.347)	(0.357)	(0.0630)	(0.0628)	(0.669)	(0.665)	(0.0703)	(0.0697)
Observations	2,252	2,252	2,252	2,252	1,126	1,126	1,126	1,126
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-982.4	-974.4	-1785	-1777	-547.8	-543.5	-1026	-1022
Pseudo-R-squared	0.204	0.210	0.119	0.123	0.209	0.215	0.117	0.121

Notes: Results shown in the table above are obtained from probit and tobit estimations of the following models: $Bribe_{ijct} = \beta_0 + \beta_1 FC_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + v_{ijct}$ and $Bribe_{ijct} = \beta_0 + \beta_1 FC_{ijct-1} + \gamma C_c + \delta I_j + u_{ijct}$ using data from the panel of firms. The Regressand, $Bribe_{ijct}$, in the case of the probit estimations, is the bribe incidence dummy (yes/no) while that in the tobit estimations is the bribe intensity measure – percentage of firm total annual sales paid as bribes. FC_{ijct} denote firm controls – age (log), size (small, medium; large firms are used as the base), labour productivity (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, ownership structure – multi-plant firm, and exporting status. C_c , δI_j , and T_t denote country, industry, and year fixed effects respectively. Specifically, estimations in column 1 – column 4 use contemporaneous regressors while those in column 5 – column 8 use regressors from initial or first surveys. Robust standard errors, in parentheses, are clustered at the country-sector level. *** p<0.01, ** p<0.05, * p<0.1

Table A 3.3: IV estimations of the contemporaneous effect of bribery payments on firm employment, sales, or labour productivity levels

Regressors	Employment		Sales		Labour productivity		Employment		Sales		Labour productivity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bribe	0.00859	-0.00212	-0.0729***	-0.0878***	-0.0815***	-0.0857***	-0.00985	0.0192**	-0.0738***	-0.0736***	-0.0639***	-0.0928***
	(0.00817)	(0.00674)	(0.0175)	(0.0197)	(0.0184)	(0.0193)	(0.00749)	(0.00893)	(0.0204)	(0.0231)	(0.0191)	(0.0207)
Age	0.375***	0.230***	0.614***	0.386***	0.239***	0.156***	0.207***	-0.335***	0.430***	0.497***	0.223***	0.832***
	(0.0447)	(0.0421)	(0.0740)	(0.0710)	(0.0513)	(0.0549)	(0.0535)	(0.0844)	(0.0906)	(0.162)	(0.0671)	(0.133)
Experience		0.0461		0.0766		0.0305	0.0699	-0.140***	0.0585	0.0661	-0.0114	0.206**
		(0.0355)		(0.0666)		(0.0527)	(0.0481)	(0.0428)	(0.0906)	(0.0979)	(0.0698)	(0.0815)
Foreign		0.418***		0.904***		0.487***	0.391***	-0.652***	1.108***	1.305***	0.717***	1.956***
		(0.0860)		(0.153)		(0.122)	(0.111)	(0.163)	(0.196)	(0.323)	(0.152)	(0.267)
Technology		0.611***		1.022***		0.411***	0.649***	0.558***	1.146***	1.162***	0.497***	0.604***
		(0.0507)		(0.110)		(0.0949)	(0.0624)	(0.0527)	(0.122)	(0.120)	(0.104)	(0.0994)
Exporter		0.510***		0.847***		0.338***	0.669***	0.407***	0.868***	0.953***	0.199	0.546***
		(0.0851)		(0.138)		(0.115)	(0.0979)	(0.0917)	(0.167)	(0.178)	(0.135)	(0.142)
Bank loan		0.557***		0.783***		0.226***	0.480***	-0.673***	0.931***	1.040***	0.451***	1.713***
		(0.0549)		(0.106)		(0.0859)	(0.0663)	(0.142)	(0.130)	(0.308)	(0.103)	(0.263)

Multi-plant firm	0.467***		0.481***		0.0140		0.448***	-0.256**	0.406***	0.430*	-0.0422	0.686***
	(0.0646)		(0.125)		(0.109)		(0.0801)	(0.109)	(0.156)	(0.236)	(0.134)	(0.204)
IMR								10.38***		-1.110		-11.49***
								(1.160)		(2.471)		(2.171)
Constant	2.864***	2.645***	12.12***	11.71***	9.256***	9.064***	2.602***	-53.66***	9.006***	15.00	6.404***	68.66***
	(0.326)	(0.265)	(0.498)	(0.413)	(0.305)	(0.288)	(0.415)	(6.399)	(0.635)	(13.54)	(0.500)	(11.92)
Obs	2,252	2,252	2,252	2,252	2,252	2,252	1,307	1,282	1,307	1,282	1,307	1,282
R-squared	0.313	0.483	0.571	0.634	0.631	0.642	0.528	0.628	0.750	0.751	0.770	0.778
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	21.47	21.44	21.47	21.44	21.47	21.44	20.42	25.84	20.42	25.84	20.42	25.84
Hansen J-statistic	1.759	2.537	1.099	1.460	0.226	0.324	2.984	7.830	5.083	4.583	2.575	1.328
p-value	0.185	0.111	0.294	0.227	0.634	0.569	0.084	0.005	0.024	0.032	0.109	0.249
Kleibergen-Paap LM statistic	33.628	34.017	33.628	34.017	33.628	34.017	31.370	47.307	31.370	47.307	31.370	47.307
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cragg-Donald F-statistic	21.466	21.437	21.466	21.437	21.466	21.437	20.415	25.845	20.415	25.845	20.415	25.845

Notes: Results shown in the table above are obtained from IV estimations of the following model: $y_{ijct} = \beta_0 + \beta_1bribe_{ijct} + \beta_2X_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + \varepsilon_{ijct}$ using data from the panel of firms. The regressand, y_{ijct} , is firm employment, sales, or labour productivity level/size, all in logs. The main regressor, bribe intensity (% of total annual sales paid as bribes), is captured by $bribe_{ijct}$. X_{ijct} denote firm controls – age (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, multi-plant firm status, and exporting status. C_c , δI_j , and T_t denote country, industry, and year fixed effects respectively. Column 1 to column 7, report results using the full panel sample of 15 countries. However, from column 7 to column 12, regressions are performed for a subset of the panel sample (8 countries - DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania, Uganda, and Zambia.), and include an inverse mills ratio in order to ascertain

whether survivorship bias is present. Robust standard errors, in parentheses, are clustered at the country-sector level. Instruments used in all estimations are the country-industry-year averages of bribe payments and bureaucracy. The Hansen J-statistic, Kleibergen-Paap LM statistic, and Cragg-Donald F-statistic are used for instruments validity, underidentification test, and weak identification test, respectively. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A 3.4: IV estimations of the effect of the lag of bribery payments on firm employment, sales, or labour productivity growth

Regressors	Employment growth		Sales growth		Labour productivity		Employment growth		Sales growth		Labour productivity growth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bribe _{t-1}	-0.00650**	-0.00634**	-0.0159**	-0.0164**	-0.0124**	-0.0123**	-0.00234	-0.00764**	-0.00461	-0.00414	-0.00373	-0.00625
	(0.00253)	(0.00251)	(0.00676)	(0.00668)	(0.00568)	(0.00564)	(0.00238)	(0.00375)	(0.00613)	(0.00791)	(0.00512)	(0.00719)
Employment _{t-1}	-0.0472***	-0.0604***					-0.0705***	-0.0345**				
	(0.00726)	(0.00810)					(0.00947)	(0.0138)				
Sales _{t-1}			-0.108***	-0.134***					-0.129***	-0.129***		
			(0.00937)	(0.0105)					(0.0134)	(0.0136)		
Productivity _{t-1}					-0.176***	-0.187***					-0.164***	-0.168***
					(0.0107)	(0.0111)					(0.0149)	(0.0168)
Age _{t-1}	-0.00184	-0.00190	0.0643***	0.0617***	0.0572***	0.0552***	0.00838	0.143***	0.0768***	0.0594	0.0655***	0.116
	(0.00820)	(0.00987)	(0.0180)	(0.0194)	(0.0158)	(0.0164)	(0.0109)	(0.0457)	(0.0219)	(0.0754)	(0.0180)	(0.0709)
Experience _{t-1}		-0.00481		-0.00892		-0.0107	-0.00664	0.00514	-0.00321	-0.00484	-0.00442	-0.000738
		(0.0107)		(0.0208)		(0.0188)	(0.0136)	(0.0140)	(0.0253)	(0.0262)	(0.0225)	(0.0240)
Foreign _{t-1}		0.0255		0.105*		0.0767*	-0.00710	0.198***	0.0918	0.0651	0.0973**	0.177
		(0.0221)		(0.0537)		(0.0454)	(0.0270)	(0.0765)	(0.0567)	(0.126)	(0.0462)	(0.114)
Technology _{t-1}		0.0113		0.114***		0.0807**	0.0235*	0.0129	0.0867**	0.0854**	0.0397	0.0459
		(0.0148)		(0.0366)		(0.0327)	(0.0139)	(0.0150)	(0.0357)	(0.0350)	(0.0305)	(0.0311)
Exporter _{t-1}		0.0421*		0.0358		-0.0219	0.0400	0.0686**	0.0911*	0.0855	0.0286	0.0477
		(0.0249)		(0.0449)		(0.0349)	(0.0254)	(0.0275)	(0.0501)	(0.0526)	(0.0367)	(0.0459)
Bank loan _{t-1}		0.0501***		0.124***		0.0484*	0.0532***	0.261***	0.0622	0.0345	-0.00179	0.0797
		(0.0178)		(0.0341)		(0.0266)	(0.0169)	(0.0723)	(0.0385)	(0.119)	(0.0310)	(0.117)
Multi-plant firm _{t-1}		-0.00470		0.0465		0.0196	-0.00171	0.111**	0.00658	-0.00919	-0.0120	0.0335

		(0.0208)		(0.0380)		(0.0319)	(0.0236)	(0.0450)	(0.0481)	(0.0795)	(0.0449)	(0.0696)
IMR _{t-1}								-2.131***		0.264		-0.743
								(0.733)		(1.132)		(1.042)
Constant	0.343***	0.388***	2.088***	2.374***	2.158***	2.231***	0.362***	2.012***	1.192***	0.980	0.910***	1.552*
	(0.0741)	(0.0728)	(0.268)	(0.269)	(0.260)	(0.262)	(0.0954)	(0.585)	(0.256)	(0.930)	(0.193)	(0.932)
Obs	1,126	1,126	1,126	1,126	1,126	1,126	653	653	653	653	653	653
R-squared	0.108	0.122	0.416	0.434	0.461	0.470	0.232	0.248	0.363	0.364	0.405	0.403
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	42.1	42.42	42.26	42.53	41.95	42.32	30.01	20	29.34	25	29.05	21.62
Hansen J-statistic	2.198	2.573	0.051	0.162	0.049	0.010	0.453	0.400	0.330	0.342	0.351	0.304
p-value	0.138	0.109	0.822	0.688	0.824	0.921	0.501	0.527	0.566	0.559	0.554	0.581
Kleibergen-Paap LM statistic	50.749	50.069	51.878	51.164	51.755	51.088	35.342	32.042	36.222	40.234	36.032	39.194
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cragg-Donald F-statistic	42.099	42.416	42.265	42.532	41.954	42.317	30.010	19.998	29.345	24.996	29.046	21.619

Notes: Results shown in the table above are obtained from IV estimations of the following model: $\Delta y_{ijct} = \vartheta_0 + \vartheta_1 \text{bribe}_{ijct-1} + \vartheta_2 X_{ijct-1} + \gamma C_c + \delta I_j + \delta T_t + \varepsilon_{ijct}$ using data from the panel of firms. The regressand, Δy_{ijc} , is firm employment, sales, or labour productivity growth – i.e. log differences between waves. The main regressor, bribe intensity (% of total annual sales paid as bribes), is captured by bribe_{ijct-1} . X_{ijct-1} denote firm controls – age (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, multi-plant firm status, and exporting status, all taken from initial/first surveys. C_c , δI_j , and T_t denote country, industry, and year fixed effects respectively. Column 1 to column 7, report results using the full panel sample of 15 countries. However, from column 7 to column 12, regressions are performed for a subset of the panel sample (8 countries - DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania, Uganda, and Zambia.), and include an inverse mills ratio in order to ascertain whether survivorship bias is present. Robust standard errors, in parentheses, are clustered at the country-sector level. Instruments used in all estimations are the country-industry-year averages of bribe payments and bureaucracy. The Hansen J-statistic, Kleibergen-Paap LM statistic, and Cragg-Donald F-statistic are used for instruments validity, underidentification test, and weak identification test, respectively. *** p<0.01, ** p<0.05, * p<0.1.

Table A 3.5: First-differenced estimations of the effect of change in bribery payments on firm growth

Regressors	Employment growth		Sales growth		Labour productivity growth		Employment growth		Sales growth		Labour productivity growth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ΔBribe	0.000716*	-7.90e-05	-0.00438***	-0.00522***	-0.00508***	-0.00533***	-0.000191	-0.000243	-0.00482***	-0.00411***	-0.00465***	-0.00393***
	(0.000409)	(0.000682)	(0.00151)	(0.00187)	(0.00156)	(0.00171)	(0.000516)	(0.000507)	(0.00166)	(0.00151)	(0.00159)	(0.00149)
Employment _{t-1}	-0.0399***						-0.0418***	-0.0399***				
	(0.00664)						(0.00730)	(0.00739)				
Sales _{t-1}			-0.0545***	-0.0608***					-0.0332***	-0.0424***		
			(0.00598)	(0.00587)					(0.00572)	(0.00605)		
Productivity _{t-1}						-0.0710***					-0.0291***	-0.0375***
						(0.00609)					(0.00608)	(0.00617)
ΔAge	0.0236	-0.0120	0.0683*	-0.0883*	0.0555	-0.0530	-0.00527	-0.00635	0.0239	-0.0706*	0.0220	-0.0612*
	(0.0172)	(0.0189)	(0.0407)	(0.0505)	(0.0380)	(0.0459)	(0.0159)	(0.0145)	(0.0389)	(0.0378)	(0.0356)	(0.0346)
ΔExperience		0.0181**		0.0685***		0.0508***	0.0133	0.00965	0.0364*	0.0385*	0.0226	0.0276
		(0.00717)		(0.0196)		(0.0180)	(0.00854)	(0.00905)	(0.0211)	(0.0207)	(0.0199)	(0.0193)
ΔForeign		0.0269		0.0630		0.0446	0.0329	0.0265	0.0883*	0.0989**	0.0484	0.0705
		(0.0178)		(0.0486)		(0.0445)	(0.0227)	(0.0236)	(0.0503)	(0.0483)	(0.0455)	(0.0445)
ΔTechnology		0.0461***		0.0178		-0.0214	0.0322***	0.0293**	0.101***	0.0732***	0.0677**	0.0456*
		(0.0126)		(0.0343)		(0.0315)	(0.0124)	(0.0124)	(0.0285)	(0.0280)	(0.0268)	(0.0264)
ΔExporter		0.0359**		0.0986**		0.0583	0.0551***	0.0616***	0.0619*	0.0817**	0.00781	0.0191
		(0.0158)		(0.0432)		(0.0396)	(0.0176)	(0.0165)	(0.0364)	(0.0342)	(0.0321)	(0.0319)
ΔBank		0.0349***		0.0378		0.00476	0.0179	0.0222*	0.0269	0.0500*	0.00817	0.0305
		(0.0116)		(0.0320)		(0.0292)	(0.0120)	(0.0121)	(0.0312)	(0.0289)	(0.0293)	(0.0278)
ΔMulti-plant firm		0.0261**		-0.0428		-0.0586*	0.0434***	0.0392**	0.00951	0.000469	-0.0350	-0.0386

		(0.0125)		(0.0340)		(0.0311)	(0.0158)	(0.0161)	(0.0357)	(0.0337)	(0.0334)	(0.0318)
IMR								-0.00962		-0.146***		-0.135***
								(0.00909)		(0.0326)		(0.0317)
Constant	0.131***	0.0852***	0.934***	0.809***	0.830***	0.721***	0.137***	0.147***	0.331***	0.724***	0.177**	0.508***
	(0.0265)	(0.0223)	(0.0989)	(0.0868)	(0.0866)	(0.0687)	(0.0271)	(0.0293)	(0.0918)	(0.109)	(0.0702)	(0.0891)
Obs	1,126	1,126	1,126	1,126	1,126	1,126	653	628	653	628	653	628
R-squared	0.076	0.078	0.198	0.114	0.195	0.128	0.193	0.190	0.105	0.232	0.064	0.191
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Results shown in the table above are obtained from first-differenced estimations of the following model: $\Delta y_{ijct} = \vartheta_0 + \vartheta_1 y_{ijct-1} + \vartheta_2 \Delta bribe_{ijc} + \vartheta_3 \Delta X_{ijc} + \delta T + \Delta \varepsilon_{ijc}$ using data from the panel of firms. The regressand, Δy_{ijct} , is firm employment, sales, or labour productivity growth – i.e. log differences between waves. The main regressor, change in bribe intensity (% of total annual sales paid as bribes), is captured by $\Delta bribe_{ijc}$. ΔX_{ijc} denote firm controls – age (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, multi-plant firm status, and exporting status, all first-differenced. T_t denote year fixed effects. Column 1 to column 7, report results using the full panel sample of 15 countries. However, from column 7 to column 12, regressions are performed for a subset of the panel sample (8 countries - DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania, Uganda, and Zambia.), and include an inverse mills ratio in order to ascertain whether survivorship bias is present. Robust standard errors, in parentheses, are clustered at the country-sector level.. *** p<0.01, ** p<0.05, * p<0.1.

Table A 3.6: OLS estimations of the contemporaneous effect of bribery payments on firm employment, sales, or labour productivity levels

Regressors	Employment		Sales		Labour productivity		Employment		Sales		Labour productivity	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bribe	0.000957	-0.000251	-0.0237***	-0.0240***	-0.0247***	-0.0237***	-0.00226	0.0282***	-0.0237**	-0.0130	-0.0215**	-0.0412***
	(0.00308)	(0.00282)	(0.00747)	(0.00771)	(0.00767)	(0.00768)	(0.00364)	(0.00403)	(0.0106)	(0.0115)	(0.00961)	(0.00973)
Age	0.370***	0.231***	0.643***	0.420***	0.273***	0.189***	0.210***	-0.370***	0.448***	0.261**	0.239***	0.630***
	(0.0442)	(0.0418)	(0.0730)	(0.0695)	(0.0493)	(0.0527)	(0.0534)	(0.0758)	(0.0897)	(0.132)	(0.0660)	(0.106)
Experience		0.0465		0.0884		0.0419	0.0745	-0.150***	0.0887	0.00197	0.0142	0.152**
		(0.0354)		(0.0654)		(0.0513)	(0.0475)	(0.0429)	(0.0892)	(0.0922)	(0.0687)	(0.0760)
Foreign		0.418***		0.924***		0.505***	0.394***	-0.721***	1.133***	0.841***	0.738***	1.561***
		(0.0862)		(0.153)		(0.121)	(0.112)	(0.149)	(0.198)	(0.262)	(0.153)	(0.206)
Technology		0.612***		1.073***		0.460***	0.657***	0.560***	1.200***	1.175***	0.543***	0.616***
		(0.0501)		(0.105)		(0.0894)	(0.0614)	(0.0524)	(0.116)	(0.118)	(0.0978)	(0.0967)
Exporter		0.508***		0.786***		0.278**	0.664***	0.382***	0.830***	0.791***	0.167	0.409***
		(0.0843)		(0.134)		(0.112)	(0.0975)	(0.0875)	(0.166)	(0.167)	(0.134)	(0.129)
Bank loan		0.557***		0.786***		0.229***	0.480***	-0.752***	0.929***	0.508**	0.449***	1.261***
		(0.0549)		(0.103)		(0.0824)	(0.0662)	(0.119)	(0.126)	(0.226)	(0.0995)	(0.189)
Multi-plant firm		0.464***		0.400***		-0.0641	0.439***	-0.312***	0.342**	0.0536	-0.0964	0.366**
		(0.0640)		(0.121)		(0.105)	(0.0783)	(0.0915)	(0.150)	(0.185)	(0.129)	(0.157)
IMR								11.09***		3.688**		-7.401***
								(0.946)		(1.713)		(1.509)
Constant	2.893***	2.637***	11.93***	11.45***	9.038***	8.817***	2.539***	-57.59***	8.588***	-11.45	6.049***	46.14***
	(0.324)	(0.264)	(0.497)	(0.413)	(0.300)	(0.285)	(0.410)	(5.227)	(0.620)	(9.384)	(0.474)	(8.269)

Obs	2,252	2,252	2,252	2,252	2,252	2,252	1,307	1,282	1,307	1,282	1,307	1,282
R-squared	0.314	0.483	0.581	0.651	0.649	0.663	0.530	0.629	0.759	0.763	0.779	0.789
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Results shown in the table above are obtained from IV estimations of the following model: $y_{ijct} = \beta_0 + \beta_1bribe_{ijct} + \beta_2X_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + \varepsilon_{ijct}$ using data from the panel of firms. The regressand, y_{ijct} , is firm employment, sales, or labour productivity level/size, all in logs. The main regressor, bribe intensity (% of total annual sales paid as bribes), is captured by $bribe_{ijct}$. X_{ijct} denote firm controls – age (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, multi-plant firm status, and exporting status. C_c , δI_j , and T_t denote country, industry, and year fixed effects respectively. Column 1 to column 7, report results using the full panel sample of 15 countries. However, from column 7 to column 12, regressions are performed for a subset of the panel sample (8 countries - DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania, Uganda, and Zambia.), and include an inverse mills ratio in order to ascertain whether survivorship bias is present. Robust standard errors, in parentheses, are clustered at the country-sector level *** p<0.01, ** p<0.05, * p<0.1.

Table A 3.7: OLS estimations of the effect of the lag of bribery payments on firm employment, sales, or labour productivity growth

Regressors	Employment growth		Sales growth		Labour productivity		Employment growth		Sales growth		Labour productivity growth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Bribe _{t-1}	-0.000869	-0.000893	-0.000471	-0.000392	-0.000208	0.000181	8.44e-05	-0.00359**	0.00148	0.00422	0.000652	0.000798
	(0.000758)	(0.000744)	(0.00194)	(0.00194)	(0.00181)	(0.00178)	(0.00113)	(0.00154)	(0.00242)	(0.00290)	(0.00202)	(0.00249)
Employment _{t-1}	-0.0460***	-0.0593***					-0.0702***	-0.0445***				
	(0.00716)	(0.00802)					(0.00945)	(0.0113)				
Sales _{t-1}			-0.105***	-0.130***					-0.127***	-0.129***		
			(0.00910)	(0.0102)					(0.0133)	(0.0135)		
Productivity _{t-1}					-0.173***	-0.183***					-0.162***	-0.162***
					(0.0104)	(0.0108)					(0.0147)	(0.0155)
Age _{t-1}	0.000358	0.000961	0.0697***	0.0695***	0.0622***	0.0618***	0.00894	0.105***	0.0774***	0.00276	0.0661***	0.0623
	(0.00805)	(0.00976)	(0.0177)	(0.0190)	(0.0158)	(0.0163)	(0.0108)	(0.0314)	(0.0217)	(0.0629)	(0.0179)	(0.0565)
Experience _{t-1}		-0.00627		-0.0128		-0.0137	-0.00688	0.00152	-0.00346	-0.0105	-0.00444	-0.00472
		(0.0106)		(0.0200)		(0.0183)	(0.0136)	(0.0136)	(0.0251)	(0.0245)	(0.0224)	(0.0226)
Foreign _{t-1}		0.0248		0.101*		0.0745*	-0.00732	0.139***	0.0895	-0.0254	0.0958**	0.0899
		(0.0219)		(0.0530)		(0.0449)	(0.0268)	(0.0540)	(0.0565)	(0.0966)	(0.0461)	(0.0832)
Technology _{t-1}		0.0159		0.126***		0.0914***	0.0259*	0.0184	0.0908***	0.0856**	0.0433	0.0428
		(0.0144)		(0.0360)		(0.0323)	(0.0136)	(0.0138)	(0.0348)	(0.0346)	(0.0297)	(0.0312)
Exporter _{t-1}		0.0369		0.0195		-0.0335	0.0382	0.0585**	0.0851*	0.0604	0.0250	0.0236
		(0.0245)		(0.0438)		(0.0343)	(0.0252)	(0.0258)	(0.0498)	(0.0483)	(0.0365)	(0.0401)
Bank loan _{t-1}		0.0495***		0.121***		0.0474*	0.0539***	0.203***	0.0622	-0.0567	-0.00144	-0.00756
		(0.0176)		(0.0335)		(0.0263)	(0.0168)	(0.0500)	(0.0385)	(0.0930)	(0.0310)	(0.0901)

Multi-plant firm _{t-1}		-0.00721		0.0391		0.0150	-0.00101	0.0798**	0.00743	-0.0601	-0.0109	-0.0143
		(0.0207)		(0.0375)		(0.0316)	(0.0236)	(0.0346)	(0.0480)	(0.0682)	(0.0449)	(0.0574)
IMR _{t-1}								-1.521***		1.133		0.0557
								(0.498)		(0.894)		(0.790)
Constant	0.324***	0.370***	2.007***	2.291***	2.095***	2.171***	0.355***	1.534***	1.158***	0.243	0.885***	0.837
	(0.0735)	(0.0720)	(0.268)	(0.269)	(0.261)	(0.263)	(0.0957)	(0.404)	(0.257)	(0.738)	(0.193)	(0.712)
Obs	1,126	1,126	1,126	1,126	1,126	1,126	653	653	653	653	653	653
R-squared	0.128	0.141	0.435	0.455	0.476	0.485	0.237	0.257	0.368	0.371	0.408	0.408
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Results shown in the table above are obtained from OLS estimations of the following model: $\Delta y_{ijct} = \vartheta_0 + \vartheta_1 \text{bribe}_{ijct-1} + \vartheta_2 X_{ijct-1} + \gamma C_c + \delta I_j + \delta T_t + \varepsilon_{ijct}$ using data from the panel of firms. The regressand, Δy_{ijct} , is firm employment, sales, or labour productivity growth – i.e. log differences between waves. The main regressor, bribe intensity (% of total annual sales paid as bribes), is captured by bribe_{ijct-1} , taken from the initial wave. X_{ijct-1} denote firm controls – age (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, multi-plant firm status, and exporting status, all taken from initial/first surveys. C_c , δI_j , and T_t denote country, industry, and year fixed effects respectively. Column 1 to column 7, report results using the full panel sample of 15 countries. However, from column 7 to column 12, regressions are performed for a subset of the panel sample (8 countries - DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania, Uganda, and Zambia.), and include an inverse mills ratio in order to ascertain whether survivorship bias is present. Robust standard errors, in parentheses, are clustered at the country-sector level. *** p<0.01, ** p<0.05, * p<0.1.

Table A 3.8: Robustness check, IV estimations of the contemporaneous effect of bribery payments on firm employment, sales, or labour productivity levels

Firm characteristic	Firm size:						Firm age:					
	Small & medium sized firms			Large firms			Young & mature firms			Older firms		
	Employment	Sales	Labour productivity	Employment	Sales	Labour productivity	Employment	Sales	Labour productivity	Employment	Sales	Labour productivity
Regressors	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12
Bribe	-0.00230	-0.0775***	-0.0752***	-0.0304**	-0.0348	-0.00438	-0.00259	-0.0735***	-0.0709***	-0.00632	-0.125***	-0.118**
	(0.00496)	(0.0182)	(0.0178)	(0.0134)	(0.0314)	(0.0322)	(0.00647)	(0.0209)	(0.0193)	(0.0189)	(0.0481)	(0.0509)
Age	0.194***	0.314***	0.120*	0.216***	0.541***	0.324***	0.0672	0.193**	0.125*	0.525***	0.707***	0.182
	(0.0289)	(0.0703)	(0.0630)	(0.0752)	(0.132)	(0.102)	(0.0557)	(0.0951)	(0.0753)	(0.132)	(0.240)	(0.185)
Experience	-0.000626	0.0504	0.0510	-0.0340	-0.140	-0.106	0.111**	0.278***	0.167**	-0.00886	-0.139	-0.130
	(0.0284)	(0.0678)	(0.0595)	(0.0722)	(0.132)	(0.112)	(0.0465)	(0.0848)	(0.0682)	(0.0540)	(0.105)	(0.0846)
Foreign	0.240***	0.563***	0.324**	0.243*	0.922***	0.679***	0.505***	0.895***	0.390**	0.265**	0.861***	0.597***
	(0.0638)	(0.153)	(0.140)	(0.129)	(0.260)	(0.228)	(0.111)	(0.204)	(0.170)	(0.130)	(0.224)	(0.174)
Technology	0.427***	0.868***	0.441***	0.129	0.312	0.183	0.449***	0.746***	0.297***	0.836***	1.421***	0.586***
	(0.0408)	(0.109)	(0.0988)	(0.170)	(0.502)	(0.472)	(0.0584)	(0.126)	(0.109)	(0.0881)	(0.202)	(0.176)
Exporter	0.181***	0.515***	0.334**	0.135	0.350	0.215	0.473***	0.786***	0.314**	0.493***	0.743***	0.249
	(0.0610)	(0.157)	(0.144)	(0.139)	(0.222)	(0.181)	(0.118)	(0.178)	(0.157)	(0.119)	(0.210)	(0.169)
Bank loan	0.307***	0.553***	0.246***	0.184*	0.0593	-0.124	0.500***	0.777***	0.277**	0.617***	0.807***	0.190
	(0.0415)	(0.106)	(0.0933)	(0.0969)	(0.239)	(0.221)	(0.0700)	(0.136)	(0.110)	(0.0864)	(0.181)	(0.150)
Multi-plant firm	0.323***	0.344**	0.0213	0.186*	0.0899	-0.0963	0.470***	0.459***	-0.0117	0.487***	0.504**	0.0166
	(0.0480)	(0.138)	(0.130)	(0.109)	(0.219)	(0.198)	(0.0863)	(0.150)	(0.131)	(0.0976)	(0.219)	(0.194)
Constant	2.159***	11.26***	9.101***	4.958***	13.71***	8.754***	2.623***	10.89***	8.263***	2.045***	11.99***	9.947***
	(0.157)	(0.469)	(0.424)	(0.463)	(2.181)	(2.032)	(0.319)	(0.462)	(0.349)	(0.571)	(0.982)	(0.735)
Obs	1,885	1,885	1,885	363	363	363	1,379	1,379	1,379	873	873	873

R-squared	0.358	0.642	0.655	0.239	0.625	0.661	0.429	0.645	0.669	0.546	0.626	0.621
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	22.5	22.5	22.5	24.76	24.76	24.76	16.52	16.52	16.52	14.56	14.56	14.56
Hansen J-statistic	1.784	1.190	0.451	1.854	1.772	0.701	0.385	1.419	0.980	2.633	1.393	0.191
p-value	0.182	0.275	0.502	0.173	0.183	0.402	0.535	0.234	0.322	0.105	0.238	0.662
Kleibergen-Paap LM statistic	34.316	34.316	34.316	9.729	9.729	9.729	23.187	23.187	23.187	25.963	25.963	25.963
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cragg-Donald F-statistic	22.504	22.504	22.504	24.762	24.762	24.762	16.516	16.516	16.516	14.565	14.565	14.565

Notes: Results shown in the table above are obtained from IV estimations, by firm size and firm age, of the following model: $y_{ijct} = \beta_0 + \beta_1 \text{bribe}_{ijct} + \beta_2 X_{ijct} + \gamma C_c + \delta I_j + \vartheta T_t + \varepsilon_{ijct}$ using data from the panel of firms. The regressand, y_{ijct} , is firm employment, sales, or labour productivity level/size, all in logs. The main regressor, bribe intensity (% of total annual sales paid as bribes), is captured by bribe_{ijct} . X_{ijct} denote firm controls – age (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, multi-plant firm status, and exporting status. C_c , δI_j , and T_t denote country, industry, and year fixed effects respectively. Firm size is defined by the number of full-time permanent employees; small-sized firms – fewer than 19 employees, medium-sized firms -20 99 employees, and larger firms – greater than 100 employees. The period from firm establishment to the year firm is surveyed is used to define firm age status. Young age firms (< 5 years), mature firms (6-15 years), and older firms (> 16 years). Robust standard errors, in parentheses, are clustered at the country-sector level. Instruments used in all estimations are the country-industry-year averages of bribe payments and bureaucracy. The Hansen J-statistic, Kleibergen-Paap LM statistic, and Cragg-Donald F-statistic are used for instruments validity, underidentification test, and weak identification test, respectively. *** p<0.01, ** p<0.05, * p<0.1.

Table A 3.9: Robustness check, IV estimations of the effect of the lag of bribery payments on firm employment, sales, or labour productivity growth

Firm characteristic	Firm size:						Firm age:					
	Small & medium sized firms			Large firms			Young & mature firms			Older firms		
	Employment growth	Sales growth	Labour productivity growth	Employment growth	Sales growth	Labour productivity growth	Employment growth	Sales growth	Labour productivity growth	Employment growth	Sales growth	Labour productivity growth
Regressors	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12
Bribe _{t-1}	-0.00662*** (0.00244)	-0.0176*** (0.00670)	-0.0127** (0.00578)	0.0141* (0.00724)	-0.0148 (0.0137)	-0.0246** (0.0109)	-0.00570** (0.00278)	-0.0152** (0.00743)	-0.0124* (0.00651)	-0.0170 (0.0121)	-0.0551** (0.0278)	-0.0379* (0.0226)
Employment _{t-1}	-0.0694*** (0.0115)			-0.0429*** (0.0163)			-0.0781*** (0.0101)			-0.0362*** (0.0123)		
Sales _{t-1}		-0.150*** (0.0128)			-0.129*** (0.0205)			-0.144*** (0.0128)			-0.121*** (0.0184)	
Productivity _{t-1}			-0.193*** (0.0128)			-0.175*** (0.0181)			-0.184*** (0.0132)			-0.197*** (0.0194)
Age _{t-1}	-0.000310 (0.0104)	0.0647*** (0.0224)	0.0521*** (0.0192)	0.00537 (0.0177)	0.0572* (0.0322)	0.0510* (0.0283)	-0.0210 (0.0132)	0.0441* (0.0268)	0.0649*** (0.0235)	-0.000790 (0.0405)	0.0428 (0.0782)	0.0508 (0.0636)
Experience _{t-1}	-0.00967 (0.0104)	-0.0169 (0.0240)	-0.00590 (0.0214)	0.0387 (0.0254)	0.0588 (0.0368)	0.000979 (0.0342)	0.0111 (0.0124)	0.0230 (0.0265)	0.00682 (0.0236)	-0.0237 (0.0204)	-0.0714* (0.0377)	-0.0610** (0.0305)
Foreign _{t-1}	0.0358 (0.0261)	0.0949 (0.0672)	0.0588 (0.0585)	0.0295 (0.0366)	0.214*** (0.0712)	0.183*** (0.0641)	0.0497* (0.0266)	0.108 (0.0706)	0.0430 (0.0590)	-0.00130 (0.0414)	0.149* (0.0877)	0.180** (0.0732)
Technology _{t-1}	0.0203 (0.0152)	0.120*** (0.0389)	0.0798** (0.0354)	-0.129*** (0.0429)	0.125 (0.133)	0.264** (0.125)	0.00532 (0.0174)	0.0773* (0.0409)	0.0537 (0.0376)	0.0300 (0.0279)	0.226*** (0.0831)	0.165** (0.0668)
Exporter _{t-1}	0.0282 (0.0320)	-0.0378 (0.0592)	-0.0668 (0.0458)	0.0508 (0.0394)	0.0476 (0.0615)	-0.000364 (0.0521)	0.0172 (0.0339)	-0.0283 (0.0594)	-0.0563 (0.0479)	0.0750** (0.0373)	0.0830 (0.0714)	-0.00566 (0.0542)

Bank loan _{t-1}	0.0527*** (0.0193)	0.0956*** (0.0368)	0.0308 (0.0300)	0.0271 (0.0419)	0.241*** (0.0742)	0.191*** (0.0600)	0.0526** (0.0225)	0.133*** (0.0402)	0.0564* (0.0310)	0.0281 (0.0281)	0.0781 (0.0680)	0.0307 (0.0538)
Multi-plant firm _{t-1}	0.00880 (0.0242)	0.0553 (0.0431)	0.0184 (0.0365)	-0.0489 (0.0344)	0.0488 (0.0634)	0.0736 (0.0532)	0.0279 (0.0241)	0.0933** (0.0461)	0.0423 (0.0391)	-0.0740* (0.0394)	-0.0363 (0.0668)	-0.0251 (0.0541)
Constant	0.492*** (0.116)	2.944*** (0.347)	2.688*** (0.387)				0.344*** (0.0620)	2.764*** (0.370)	2.560*** (0.381)	0.341** (0.140)	2.245*** (0.415)	2.386*** (0.376)
Observations	952	952	952	171	171	171	810	810	810	316	316	316
R-squared	0.097	0.439	0.465	0.412	0.593	0.622	0.153	0.440	0.461	0.106	0.405	0.503
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	4.546	20.105	23.700	18.866	12.591	11.621	4.685	16.036	19.725	2.704	12.497	13.455
Hansen J-statistic	1.595	1.004	0.791	0.353	0.402	0.110	0.988	0.930	1.562	0.782	2.823	3.896
p-value	0.450	0.605	0.673	0.838	0.082	0.101	0.320	0.335	0.211	0.676	0.244	0.143
Kleibergen-Paap LM statistic	53.645	54.980	54.666	6.873	6.697	6.229	44.453	45.750	45.593	12.981	12.911	12.896
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cragg-Donald F-statistic	29.462	29.537	29.430	5.814	5.676	5.548	35.515	35.507	35.158	4.015	3.980	3.957

Notes: Results shown in the table above are obtained from IV estimations, by firm size and firm age, of the following model: $\Delta y_{ijct} = \vartheta_0 + \vartheta_1 \text{bribe}_{ijct-1} + \vartheta_2 X_{ijct-1} + \gamma C_c + \delta I_j + \delta T_t + \varepsilon_{ijct}$ using data from the panel of firms. The regressand, Δy_{ijct} , is firm employment, sales, or labour productivity growth – i.e. log differences between waves. The main regressor, bribe intensity (% of total annual sales paid as bribes), is captured by bribe_{ijct-1} , taken from the initial wave. X_{ijct-1} denote firm controls – age (log), managerial experience (log), foreign ownership, technology, use of bank loan or overdraft, multi-plant firm status, and exporting status, all taken from initial/first surveys. C_c , δI_j , and T_t denote country, industry, and year fixed effects respectively. Firm size is defined by the number of full-time permanent employees; small-sized firms – fewer than 19 employees, medium-sized firms -20 99 employees, and larger firms – greater than 100 employees. The period from firm establishment to the year firm is surveyed is used to define firm age status. Young age firms (< 5 years), mature firms (6-15 years), and older firms (> 16 years). Robust standard errors, in parentheses, are clustered at the country-sector level. Instruments used in all estimations are the country-industry-year averages of bribe payments and bureaucracy. The Hansen J-statistic, Kleibergen-Paap LM statistic, and Cragg-Donald F-statistic are used for instruments validity, underidentification test, and weak identification test, respectively. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 3B: List of Countries and Further Descriptive Statistics

Table B 3.1: List of countries				
Country	First round	Second round	Freq.	Percent
Angola	2006	2010	204	9.060
Botswana	2006	2010	142	6.310
DRC	2010	2013	78	3.460
Ethiopia	2011	2015	362	16.07
Ghana	2007	2013	34	1.510
Kenya	2007	2013	166	7.370
Malawi	2009	2014	74	3.290
Mali	2007	2010	128	5.680
Nigeria	2007	2014	284	12.61
Rwanda	2006	2011	74	3.290
Senegal	2007	2014	236	10.48
Tanzania	2006	2013	178	7.900
Uganda	2006	2013	88	3.910
Zambia	2007	2013	204	9.060
Total			2,252	100

Table B 3.2: Summary statistics and difference in means between surviving firms and exiting firms

Variable	Overall			Surviving		Exiting		Mean difference
	Obs	Mean	Std. Dev.	Obs	Mean	Obs	Mean	
Bribe	4,568	2.252	5.024	1325	2.177	3243	2.283	-0.106
Labour productivity	4,706	9.833	2.647	1365	10.030	3341	9.753	0.276***
Age	4,740	2.191	0.826	1402	2.317	3338	2.138	0.178***
Employment (size)	4,756	2.829	1.054	1406	3.032	3350	2.745	0.287***
Experience	4,740	2.198	0.730	1399	2.310	3341	2.151	0.159***
Foreign	4,758	0.084	0.278	1408	0.119	3350	0.069	0.050***
Exporter	4,758	0.086	0.281	1408	0.107	3350	0.078	0.030***
Technology	4,758	0.409	0.492	1408	0.467	3350	0.385	0.082***
Multi-plant	4,758	0.132	0.338	1408	0.166	3350	0.117	0.049***
Bank loan	4,758	0.261	0.439	1408	0.320	3350	0.237	0.084***

Notes: Author's own calculations using WBES data. Summary statistics regressions are performed for only a subset of the panel sample (8 countries - DRC, Malawi, Nigeria, Kenya, Senegal, Tanzania, Uganda, and Zambia) because data on reason for firm survival or exit was not provided for the remaining sample. *** p<0.01, ** p<0.05, * p<0.1.

Table B 3.3: Summary statistics - first differenced data

Variable	Obs	Mean	Std. Dev.	Min	Max
Employment growth	1,126	-0.001	0.227	-1.021	1.406
Sales growth	1,126	-0.011	0.634	-3.136	3.161
Labour productivity growth	1,126	-0.010	0.585	-3.058	2.930
Employment _{t-1}	1,126	3.040	1.472	0	8.987
Sales _{t-1}	1,126	12.950	3.529	4.640	25.940
Labour productivity _{t-1}	1,126	9.913	3.078	1.046	20.400
ΔBribe	1,126	0.094	9.644	-95	100
ΔAge	1,126	0.520	0.366	0.056	2.079
ΔExperience	1,126	0.267	0.934	-3.332	3.045
ΔForeign	1,126	-0.007	0.368	-1	1
ΔTechnology	1,126	0.054	0.523	-1	1
ΔExporter	1,126	0.068	0.416	-1	1
ΔBank loan	1,126	0.058	0.567	-1	1
ΔMulti-plant	1,126	0.003	0.534	-1	1

Notes: Author’s own calculations using WBES data.

General Conclusions

The role of a better investment climate and inward FDI on the performance of the private sector and general economic prospects of a developing country cannot be overemphasised. The central focus of this thesis has been to conduct an empirical inquest to enhance our understanding of the effects of investment climate constraints on firm behaviour, and the efficacy of tax incentives in drawing in foreign M&As. The first chapter examined the implications of unreliable electricity supply on the misallocation of production inputs (i.e., capital and labour) for a sample of Ghanaian manufacturing firms. The second chapter investigated the efficacy of concessionary tax rates in attracting inward foreign direct in the form of M&As for a sample of 91 developing countries. The last chapter looked at the effects of bureaucratic corruption on the conduct and performance of African firms.

The empirical investigation of the first chapter finds that when faced with unreliable and insufficient power supply, firms respond by curtailing the employment of capital, labour and the compensation (wages) to the latter. Additionally, electricity shortages appear to inhibit firms' efficiency (TFP) performance. What is more, electricity shortages are found to also increase the misallocation of or the allocative inefficiency of capital and labour. This effect is more pronounced for firms that own generators implying that for these set of firms, which are also those most likely more reliant on electricity, self-generation is not sufficient to attenuate the adverse effects of insufficient and unreliable power supply from the national grid. The last set of results indicate that, particularly for the misallocation of capital, this effect is more pronounced for firms that are electricity constrained. A finding which leads to the conclusion that these group of firms have capital or production techniques that are more electricity reliant.

The second chapter uncovers that concessionary tax rates have the tendency to attract inward M&As into developing countries. This finding is found to be more pronounced for concessionary tax rates that are geared towards or conditional on investors locating in a specific location or SEZs or contributing to domestic exporting activities. Unimpressively, the quantitative magnitudes are rather modest in that, for instance, a developing country will have to reduce tax rates by as much as 1.6% in order to attract a single inward M&A.

As for the last chapter, its empirical results suggest that firms that are likely to be more established – i.e., older and larger firms – are less likely to engage in bribery payment, rather it is the least productive ones that are more likely to do so. The chapter's findings further reveal that corruption has both a contemporaneous and lag effect on firm performances in Africa. Finally, the results confirm that this negative effect is more pronounced for larger and older firms than small and medium-sized firms and young firms.

The findings of this thesis provide some practical policy implications. The findings of the first chapter provide new insights to justify that the economic (welfare) implications of electricity shortages should at least consider their effect on the misallocation of production inputs (i.e., capital and labour) as well. What is more, the findings show that firms that are likely to be more reliant on electricity as well as those that even adopt generators suffer the most, in terms of misallocation of production inputs, from electricity shortages. This lends support to the claim that in designing policies to assist firms to attenuate the adverse effects of electricity shortages, policymakers should be cognizant of differences in firms' reliance on electricity.

The second chapter's findings support the claim that targeted concessionary tax rates should be the way to go for developing countries. However, to the extent that the quantitative magnitudes of these effects are modest, considerations should be given to other essential business environment conditions that could enhance the efficacy of tax incentives.

Finally, the last chapter's findings clearly show that as reported in macro studies, corruption is equally a canker at the micro (firm-level) in Africa. Particularly that established firms – i.e., large and old ones, are the most affected, anti-corruption measures should consider this group of firms a priority.

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