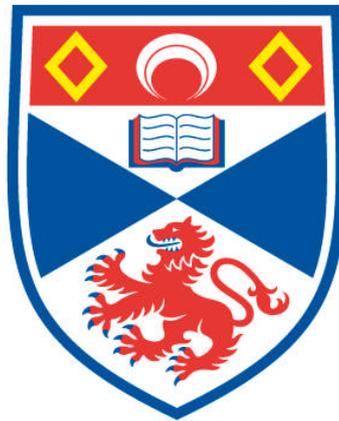


**ESSAYS ON GOVERNANCE, PUBLIC FINANCE, AND  
ECONOMIC DEVELOPMENT**

**Ibrahim Mike Okumu**

**A Thesis Submitted for the Degree of PhD  
at the  
University of St Andrews**



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**Essays on Governance, Public Finance, and Economic  
Development**



University of  
St Andrews

by

Ibrahim Mike Okumu  
Submitted for the degree of  
Doctor of Philosophy (Economics)  
At the University of St Andrews

February, 2014

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I,.....hereby certify that this thesis, which is approximately 41,827 words in length, has been written by me, that it is the record of work carried out by me and that it has not been submitted in any previous application for a higher degree.

I was admitted as a research student in October, 2010 and as a candidate for the degree of PhD in October, 2010; the higher study for which this is a record was carried out in the University of St Andrews between 2010 and 2014.

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Gonzalo Forgues-Puccio and I have developed the model in Chapter three together based on a model that he had published before. We derived the results together and the analysis is also joint work. I developed the models in Chapter four and five with assistance from my supervisor. The results were derived by me and the analysis is my own.

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## **Dedication**

To my: Grandfathers, Okumu Michael and Amos Musitwa (R.I.P);  
Grandmothers, Josephina Okumu Makhoha (R.I.P) and Naume Nabwire

Durukasi;

Dad, Hajji Okumu Ikata;

Mum, Hajjati Norah Okumu Musitwa;

Brothers; Sisters

nieces; nephews; and cousins



# Chapter 1

## Abstract

This thesis is composed of three distinct but related essays. The first essay studies the role of the size of the economy in mitigating the impact of public sector corruption on economic development. The analysis is based on a dynamic general equilibrium model in which growth occurs endogenously through the invention and manufacture of new intermediate goods that are used in the production of output. Potential innovators decide to enter the market considering the fraction of future profits that may be lost to corruption. We find that depending on the number of times bribes are demanded, the size of the economy may be an important factor in determining the effects of corruption on innovation and economic growth.

The second essay presents an occupational choice model in which a household can choose either formal or informal entrepreneurship or at the subsistence livelihood. Credit market constraints and initial wealth conditions (bequest) determine an agent's occupational choice. Corruption arises when bureaucrats exchange investment permits for bribes. Corruption worsens credit market constraints. Equilibrium with corruption is characterised by an increase (decrease) in informal (formal) entrepreneurship and a decrease in formal entrepreneurship wealth. Since corruption-induced credit constrained households choose informal entrepreneurship as opposed to subsistence livelihood income in the formal sector, the informal economy is shown to mitigate the extent of income inequality.

The third essay explains the role of bureaucratic corruption in undermining public service delivery, public finance, and economic development through incentivising tax evasion. The analysis is based on a dynamic general equilibrium model in which a taxable household observes the quality of public services and decides whether or not to fulfil his tax obligation. Bureaucratic corruption compromises the quality of public services such that a taxable household develops incentives to evade tax payment. We show that corruption-induced tax evasion increases the likelihood of a budget deficit, renders tax payable increase counter-productive, and aggravates the negative effect of bureaucratic corruption on economic development.

JEL Classifications: O11; O41; O31; I32; E26; E62; D73

Key words: Economic development; growth; innovation; inequality; informal economy; fiscal policy; corruption.

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# Chapter 2

## Background

### 2.1 Introduction

This thesis makes a contribution towards the macroeconomic literature on the relevance of the quality of governance to fostering economic development. Specifically, the thesis uses the dynamic general equilibrium technique to explore how bureaucratic corruption affects: economic growth, income inequality, fiscal consolidation, tax evasion, and economic development. In the process the thesis answers the following questions: 1) what role does the size of the economy play in mitigating the impact of corruption on innovation and economic growth? 2) Does the existence of multiple bribes account for the non-linear relationship between corruption and economic growth given the size of the economy? 3) Does the informal sector mitigate the extent of income inequality in a corruption riddled economy? 4) What role does corruption play in the interaction between the quality of public services, tax evasion, and fiscal consolidation? 5) What role does corruption play in the interaction between the quality of public services, tax evasion, and economic development?

The analysis shows that: 1) indeed the size of the economy mitigates the impact of corruption on innovation and economic growth. However when corruption is characterised by multiple bribe payments, irrespective of the size of the economy both innovation and economic growth are compromised;

2) the existence of the informal sector mitigates the extent of income inequality in an economy characterised by corruption. The model implies that institutional restructuring with the aim of alleviating the informal sector while not putting in place income safety nets would increase the extent of income inequality; 3) corruption through reducing the quality of public services incentivises tax payers to evade taxes. Corruption-induced tax evasion constrains a country's revenue flow thereby increasing the likelihood of a fiscal deficit. Attempts to eliminate the fiscal deficit through increasing the tax payable are counter-productive as the policy incentivises more tax evasion. The existence of corruption-induced tax evasion restricts the government to cutting back the quantity of public services and thus public expenditure as to reduce the fiscal deficit. The study shows that cutting back the quantity of public services has two conflicting outcomes: a) it aggravates underdevelopment through compromising productivity; and b) it potentially initiates an economy's transition from underdevelopment to a higher level of economic development through disincentivising corruptible bureaucrats from engaging in corruption since the available loot is now smaller.

Note that the governance of any country involves four pillars, that is; the executive, legislature, bureaucrats, and citizens interacting to deliver public services. The interaction of those pillars of governance determines the nature of corruption. Corruption typically involves the abuse of office by either the executive or legislature or the bureaucrat in a way that is not consistent with the generally acceptable rules and regulations to enhance self-interest. As such corruption can be categorised as grand, bureaucratic/petty, and legislative, (Jain, 2001).

Grand corruption involves the abuse of public office by the executive for private gain as opposed to the interest of the general public or electorate. The executive are typically political entrepreneurs whose choice of public policy and/or resource allocation is aimed at maximising their probability of re-election. As such they are bound to influence the allocation of public investment or public policy towards a certain constituency to earn political mileage irrespective of the potential viability of the investment or policy distortions, (Jain, 2001; and Rose-Ackerman, 2002). The existence of a con-

stituency that benefits from the executive's corruption-induced public policy or investment decision makes grand corruption cumbersome to detect unless bribes have been paid, (Jain, 2001). Examples of grand corruption include; theft of approximately \$5 billion from the Democratic republic of Congo treasury by Mobutu Sese Seko while Mohamed Suharto and Ferdinand Marcos are believed to have diverted twice and seven times more respectively, (Svensson, 2005). Also in 2008 the Prime Minister of Tanzania Edward Lowassa resigned upon being accused of influencing the awarding of an electricity supply contract to an incompetent US based electricity company that cost the Tanzanian government \$140,000 per day and yet the generators arrived late besides being functionally inefficient, (Kenny and Soreide, 2008).

Bureaucratic corruption involves bureaucrats undertaking public decisions to maximise their own private interests as opposed to the terms of reference assigned to them by the executive, (Mauro,1995). Bureaucrats are typically hired by the executive to deliver public services to the electorate. This could involve; tax audit and collection, health inspection of private and public production facilities, and inspection of manufacturing plants and factories regarding waste management and phytosanitary standards. In undertaking those activities bureaucrats either issue certificates of inspection or give a notice of closure of the facility or could caution the management of a facility. With such discretionary power and in return for bribes, bureaucrats can collude with private sector players. Collusion could result in under-declared taxes or health, safety and environmental standards being hardly met by the facilities, (Shleifer and Vishny, 1993; and Brunetti and Weder, 2003). Besides bureaucrats could extort money from the citizens by exploiting their discretionary power. For example, a tax auditor could misrepresent a tax payer's tax liability with the intention of negotiating for a bribe, (Shleifer and Vishny, 1993; and Brunetti and Weder, 2003). Also bureaucrats could as well simply embezzle funds meant for public investment. For instance, Reinnikka and Svensson (2004) show evidence where less than 30% of budgetary allocations was received by primary schools in Uganda with the other proportion being siphoned by district public officials. Equally Olken (2006) shows evidence where on average at least 18% of rice

unaccounted for in a government rice distribution program in Indonesia.

Legislative corruption involves the legislature or parliament being compromised in a way that makes public interest secondary. The legislature is typically involved in the design of policies and laws in a country. The policies and laws under normal circumstances are aimed at the protection of public interest. However, where laws and policies are not in the interest of citizens but rather benefit the legislature then corruption could potentially arise. Besides the legislature could be compromised in such a way that it acts in the interest of the executive as opposed to the interest of the general public. Also in economies where lobby groups have significant power, it is often the case that they may arm-twist legislative policy decisions in their favour as opposed to the public good.

Having characterised the different kinds of corruption, it is imperative to highlight how corruption can be measured.

### **2.1.1 Measurement of corruption**

Given its clandestine nature, corruption is difficult to measure (Kaufmann et al. 2006). Lately however, various corruption perception indices have been developed these include Corruption Perception Index (CPI), the International Country Risk Guide (ICRG) corruption index, and the Control of Corruption Index (CCI) compiled and published by Transparency International (TI), the Political Risk Services (PRS) Group, and the World Bank respectively. These capture the perceptions of private sector individuals, donor agencies, and public officials about the incidence of corruption in a given country. The ICRG index captures the possibility that public officials will seek for underhand payments in the execution of their duties. The TI index is based on an ordinal ranking of 12 institutions in a country from which the extent of corruption can be established. The Control of Corruption index is a ranking across countries about different corruption indicators, (Svensson, 2005).

In as much as success has been attained in measuring corruption using perception indices, critiques have argued that corruption estimates are vague

and not objective since they are based on subjective perceptions. The criticism of the non-objectivity of corruption indices is however weak since the indices have been shown to be highly correlated with each other and across time (Triesmann, 2000). Svensson (2005) shows that the CCI (from 2002) and the CPI (from 2003) have a correlation coefficient of 0.97. Also ICRG index (from 2001) and the CPI have a correlation coefficient of 0.75. Thus given the high level of correlation between the different corruption indices it is indicative that they measure the same phenomenon corruption.

Besides, surveys about the incidence of corruption have increasingly become specific for example, ‘...1) “When firms in your industry do business with the government, how much of the contract value must they offer in additional payments to secure the contract?”; 2) “On average, what percentage of annual revenues do firms like yours typically pay in unofficial payments to public officials?”... (Kaufmann et al. 2006).’ Therefore the argument that the corruption estimates are vague is equally nullified.

In addition to the perception indices, the incidence of corruption can be estimated through reviewing public projects to establish value for money. It is possible to find out whether a particular project was corruption free or not (Jain, 2001). For example Ferraz and Finan (2008) show evidence of audited books of accounts of municipalities in Brazil to identify incidence’s of corruption. Equally, Olken (2009) used the same technique to establish public expenditure leakages in road construction projects in Indonesia. However, while the first method of collecting information regarding corruption allows for panel and cross-country analysis the second is project specific, (Kaufmann et al. 2006).

### **2.1.2 Causes of corruption**

Jain (2001) attributes the existence of corruption to discretionary power, economic rents, income from corruption, corruption deterrents, legitimate income or fair wages, strength of political institutions, moral and political values of society and the penalties for corruption. These are discussed below.

## **Discretionary power**

Discretionary power captures the ability of the executive, legislature and bureaucrats to independently influence public policy and resource allocation decisions. Typically, the executive has discretionary power over economic policy making while legislators have discretionary power over the setting of laws and policies that structure the actions of the executive and bureaucrats. Corruption would arise when in the execution of their roles both the executive and legislators act in self-interest. In economies where executive and legislative roles are elective, engagement in grand and legislative corruption depends on the extent to which the electorate can monitor the activities of the executive and the legislature. Where the electorate have a voice of presence then the ability of the legislature and executive to engage in corrupt acts would be compromised since there is an apparent risk of not being re-elected. Besley (2006) argues that with increased information about public policy and resource allocation decisions, the electorate are empowered to keep an eye on politicians and hold them accountable. In support of the preceding argument, Ferraz and Finan (2008) use a natural experiment in Brazilian Municipalities in which they show evidence of corruption exposure negatively affecting electoral outcomes of incumbents. The result is however contingent upon free press since it allows information about detected incidences of corruption upon audits to widely trickle down to the electorate, (Ferraz and Finan, 2008).

With regard to bureaucrats, their discretionary power is derived from the terms of reference assigned to them by the executive. Their terms of reference could spell out implementation of rules and regulations and managing public finance. The rules and regulations could include; price controls, government subsidies, tax exemptions, environmental levies, import quotas, and exchange rate controls. Bureaucrats could exploit these rules and regulations to seek for bribe income. For example, a public health official might allow a restaurant to continue its operations even when it's a public health risk or an environmental official might overlook the environmental hazards associated with a factory's poor waste disposal in return for a bribe or a tax

administrator negotiating for bribe income from a private agent in return for undervaluation of the private agent's tax liability, (Bliss and Di Tella, 1997). Svensson (2003) shows evidence of rules and regulations empowering bureaucrats to seek for bribes in a cross-sectional study of Ugandan firms. Also, Shleifer and Vishny (1993) report that during the communist Russian regime, to make a foreign investment in a Russian company involved making bureaucratic payments to various government agencies for example, the ministries of Finance and Industry, the Central Bank, and the Foreign Investment Office among others.

The decision to engage in bureaucratic corruption partly depends on the quality of monitoring technology that the executive employs to detect misdemeanour. Besides, where the terms of reference are characterised by ambiguity, bureaucrats might potentially exploit the opportunity to enhance their corruption returns. In a nutshell, whether it's the environment authority official or the health official or even the tax official, their discretionary power is enshrined in the terms of reference as assigned by the executive.

However, not all incidences of corruption are attributed to the manipulation of terms of reference assigned to bureaucrats or legislature or even the executive but rather the incentive for private agents to maximise economic rents. For instance private agents might influence legislatures or politicians to establish public infrastructure in the midst of their property. This could be aimed at giving the property more value. For example if one deals in real estate and government extends electricity, water, roads and schools to an area in which their property is located, the value of their property is bound to increase. Jain (2001) argues that whether or not such public investments are corruption free depends on;

- 1) Absence of clandestine payments to the public official.
- 2) The decision undertaken by the public official is an outcome of competition.
- 3) Both the public official and the private agent do not benefit from each other's income.

## **Norms and values of society**

Different societies have different norms and values as such what is acceptable in one society might be deemed misfit in another. In the spirit of Andvig and Moene (1990) and Tanzi (1995), corruption is more likely to flourish in an economy where public officials are generally perceived as corrupt. This is because the more corrupt public officials there are, the less likely one would be caught engaging in a corrupt activity. On the contrary, where corruption is not ingrained among public officials the risk of being caught and reprimanded when corrupt is high; under such circumstances public officials would be hesitant to engage in corrupt activities. The importance of norms and values of society is further emphasised by Fisman and Miguel (2007) in their study of the parking behaviour of the United Nations diplomats in New York City to understand the effect of cultural norms and legal enforcement in controlling corruption. Using New York City as a natural experiment, diplomats from countries with low levels of corruption were less likely to behave corruptly (unpaid parking violations) unlike those from high corrupt countries in an environment of no enforcement. Specifically, going from a highly corrupt country like Nigeria to a less corrupt country like Norway is associated with approximately an 80% reduction in the average rate of unpaid parking violations or parking violations corruption measure. This result signals persistence of country anti-corruption norms. However, upon the removal of diplomatic immunity on traffic offences for at least 3 unpaid parking violations, parking violations dropped by approximately 98% in 2002. Thus both cultural norms and enforcement are instrumental in the fight against corruption.

Furthermore, overtime the frequency of unpaid violations among diplomats increased by 8.4 percent for each additional month that the diplomat lived in New York City. This perhaps shows that diplomats are more inclined not to pay parking violations as they learn about the realities of their diplomatic immunity. The increase in unpaid parking violation is more pronounced among diplomats from less corrupt countries. This signals a drop in attachment to home country anti-corruption norms the longer a diplomat

lived in New York. Note that these results hold only for the pre-enforcement period. Thus the norms and values of a society are instrumental in determining the corruption outcomes of public officials.

### **Legitimate and fair wages**

Mauro (1997) argues that when wages in the public service are lower than those in the private sector, public officials have an incentive to trade their discretionary power for more income. This is particularly so when the loss in income upon being detected is low. In support of the preceding analysis, Goel and Nelson (1998) avail empirical evidence using data from the United States in which they show that corruption and wages are inversely related. Even among developing and low income OECD countries there is evidence of an inverse relationship between corruption and wages (Van Rijckegem and Weder, 2001). Implicitly, a country may not have to adjust policies relating to transparency and accountability to fight corruption in the event wages are increased significantly, (Van Rijckegem and Weder, 2001). However Di Tella and Schargrotsky (2003) are sceptical about the initial studies that found an inverse relationship between corruption and wages. They argue that there is a possibility of; data on wages and corruption referring to different groups of people as a result of data aggregation at the country level, and omitted variable bias yet variables such as monitoring intensity and culture are important in the interaction between corruption and wages. In spite of the criticism however, Di Tella and Schargrotsky (2003) in a study of corruption in hospital procurement in the City of Buenos Aires, Argentina, equally find evidence of an inverse relationship between corruption and wages given an efficient monitoring or auditing process. Besides the Di Tella and Schargrotsky (2003) finding is consistent with the Becker-Stigler hypothesis to the extent that the incidence of corruption is decreasing with increasing wages on condition that the monitoring or auditing process is efficient.

In societies where wages are deemed to be fair, corruption is bound to be frowned upon. As such being caught in a corruption scandal breeds ostracism and berating, (Chand and Moene, 1997). While in societies where wages are

significantly low corruption is bound to flourish and accepted, (Tanzi, 1994).

### **Free press and Judiciary**

In societies where press freedom is acceptable corruption levels are low. Brunetti and Weder (2003) in a cross country analysis show that corruption is inversely related to press freedom. This is because press freedom acts as a platform upon which citizens can report extortive bureaucrats. Besides in the spirit of Besley (2006), increased information access increases the citizen's voice for more accountable leadership from both the executive and the legislature. Furthermore, even where both the citizen and bureaucrat collude to the extent that none of them has an incentive to reveal their illegal action, free press would allow for investigative journalism to unbundle such acts (Brunetti and Weder, 2003). The importance of free press in fighting corruption is highlighted by Ferraz and Finan (2008) who show evidence of corruption exposure negatively affecting electoral outcomes of incumbents in Brazilian municipalities.

The significance of an independent judicial system is to allow thorough investigation and prosecution of the corrupt public officials. Otherwise where the outcome of the courts can be predetermined implies that corrupt officials have the ability to go scot-free. This is because under such an environment corrupt officials can influence judicial processes. In support of the preceding argument, Van Aaken et al. (2008) show evidence in which corruption is inversely related to the independence of prosecutors. Besides, while it is important to have courts at arm's length from public officials it is of much great significance to have the police to be morally upright and equipped to undertake investigations. This is because where the police investigation unit can easily be corrupted implies that weak evidence against the corrupt will be presented before courts reducing the likelihood of a fair trial. Thus, both press and judicial freedom are drivers of a public official's decision to engage in corruption.

## **Penalties for corruption**

The decision to undertake a corrupt activity involves a public official weighing returns against costs. Where the return to engaging in corruption is greater than the cost, then a public official will engage in corruption. Therefore, tampering with the penalty rate has the potential to influence the public official's decision to engage in corruption. However, while increasing the penalty rate increases the cost of corruption, it might actually precipitate the demand for a higher level of bribe income from the public official (Mookherjee and Png, 1995). As such Mookherjee and Png (1995) argue that to rid the bureaucracy of accepting bribes, the penalty has to be sufficiently large thereby hindering the ability of bribe-giver to engage in bribe payment.

## **Economic rents**

Economic rents refer to the income in excess of the next possible opportunity. The existence of economic rents has the potential to incentivise public officials to profit from it. For example public officials could restrict entry of new firms into a market in return for a bribe or simply by way of extortion. In support of this thesis, Ades and Di Tella (1999) show evidence of an inverse relationship between corruption and the competitiveness of a country. They argue that high competition among firms implies less economic rents and hence reduced ability to pay bribes. Which also implies that the public official's incentive to engage in corruption is reduced since the costs of corruption remain unchanged and yet bribe income is lower due to increased competition among firms. On the contrary lower competition among firms implies high economic rents hence increased ability to pay bribes.

### **2.1.3 Corruption and economic development**

The interaction between corruption and economic development has been characterised by two diverging views. On one hand, Bailey (1966), Huntington (1968), Leff (1964), Leys (1965), Lien (1986), and Lui (1985) through casual observation and theoretical analysis argue that corruption aides eco-

conomic development through greasing bureaucratic efficiency. For instance in an environment of price controls, while a honest bureaucrat would implement such a policy disincentive to production, a corrupt bureaucrat would instead sabotage the policy thereby creating incentives for more production and as such increasing consumer welfare<sup>1</sup> (Aidt, 2009). Empirical evidence has since supported the greasing effect of corruption in bureaucratic efficiency (Meon and Weil, 2010, and Wedeman, 2002). However, Myrdal (1968) and Aidt (2009) argue that bureaucratic rigidities could endogenously increase as bureaucrats seek to increase bureaucratic income thus corruption is not efficiency enhancing. Furthermore, the existence of corruption may lead to resources being shifted away from the most efficient project for as long as the sought after project ensures utmost secrecy for corrupt activities (Shleifer and Vishny, 1993; and Jain, 2001). In the process the quality and quantity of government services are compromised leading to lower factor productivity in the economy. Consequently wages become lower implying reduced savings which inhibits the capital transmission mechanism. Inhibition of the capital transmission mechanism compromises the economic growth potential of an economy (Freille et al. 2007). Empirically, Ades and Di Tella (1997), Mauro (1995) and Meon and Sekkat (2005) argue in support of corruption being deleterious to bureaucratic efficiency and hence inhibiting economic growth.

There has been a growth in macroeconomic research using the dynamic general equilibrium technique to analyse different issues so as to understand the interaction between corruption and economic development. Among these are; Blackburn et al. (2006), Blackburn et al. (2011), Blackburn and Forgues-Puccio (2007, 2009), Erlich and Lui (1999) and Sarte (2000). This thesis equally adopts the dynamic general equilibrium technique to analyse the following issues;

- 1) What role does the size of the economy play in mitigating the impact of corruption on innovation and economic growth?
- 2) Does the existence of multiple bribe payments account for the non-linear relationship between corruption and economic growth given the size of

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<sup>1</sup>Huntington (1968) refers to that kind of behaviour by bureaucrats as personalised de-regulation

the economy?

3) Does the informal sector mitigate the extent of income inequality in a corruption riddled economy?

4) What role does corruption play in the interaction between the quality of public services, tax evasion, and fiscal consolidation?

5) What role does corruption play in the interaction between the quality of public services, tax evasion, and economic development?

In addressing the issues above, the analysis is based on bureaucratic corruption. The issues are presented in three essays. The first essay address' issues one and two, the second essay address' issue three and finally the third essay address' issues four and five.

The first essay analyses the interaction between corruption and economic development given an economy's size. Specifically the essay shows how the size of the economy mitigates the effect of corruption on innovation and economic growth. The essay also shows that when corruption is characterised by multiple bribe payments, both innovation and economic growth are compromised irrespective of the economy's size. The motivation for this essay is based on empirical observations by Rock and Bonnet (2004) that small (large) corrupt economies are characterised by poor quality of governance and low levels of economic growth trap (sustained levels of economic growth). Furthermore, the economies of scale attributed to a large economy are compromised when the economy is characterised by a weak and fragmented government where corruption networks are uncoordinated with each one of them seeking to maximise their bribe income. Cognizant of the aforementioned empirical findings, this essay fills the theoretical gap in literature about how the size of the economy mitigates the effect of corruption on economic growth. The essay adopts a dynamic general equilibrium model with an expanding variety of intermediate goods used in the production of the final good. Intermediate goods enhance efficiency in the production of the final good hence generating endogenous growth. Intermediate goods are produced through research and development. Intermediate goods are produced under monopolistic competition while the final good is produced under perfect competition. The existence of monopolistic profits incentivises

bureaucrats to seek for bribes period after period from intermediate goods producers. The analysis is undertaken under conditions of a small and large economy. Besides the size of the economy (small or large), we also consider conditions where the intermediate input producer: 1) pays a bribe once with certainty; and 2) pays bribes multiple times. Consistent with empirical evidence the model implies that: 1) the size of the economy mitigates the effect of corruption on innovation and economic growth; and 2) the size of the economy does not matter when corruption is associated with multiple bribe payments, under such circumstances corruption compromises innovation and economic growth.

The second essay analyses the interaction between corruption, income inequality and economic development. The essay shows that by corruption increasing the size of the informal sector, the informal sector mitigates the extent of income inequality. The study is motivated by Dobson and Ramlogan-Dobson (2012a), Dobson and Ramlogan-Dobson (2012b) and Kar and Saha (2012) empirical investigations which show that in economies with increasingly higher levels of informality, the effect of corruption on income inequality is dampened. This essay theoretically accounts for the trade-off between corruption and income inequality. The essay adopts an occupational choice model in which households can choose between formal entrepreneurship, informal entrepreneurship and subsistence livelihood. The essay assumes that bureaucrats demand for bribes from formal entrepreneurs in return for licenses. The effect of corruption is to increase the cost of formal entrepreneurship. As a result it increases the incentive compatible level of wealth upon which households can acquire credit. Equilibrium with corruption is characterised by an increase (decrease) in informal (formal) entrepreneurship and a decrease in formal entrepreneurship wealth. Since corruption-induced credit constrained households inevitably choose informal entrepreneurship as opposed to subsistence livelihood, the informal economy is shown to mitigate the effect of corruption on income inequality and poverty. The analysis is consistent with empirical evidence and it implies that efforts to alleviate informality should be accompanied with safety nets to facilitate the transition of households into the formal economy otherwise income inequality could

potentially increase.

The third essay analyses the interaction between corruption, tax evasion, fiscal consolidation and economic development. The essay is motivated by empirical evidence which shows that the quality of public services and economic growth are both decreasing in the level of corruption (Tanzi and Davoodi, 1997). Furthermore empirical evidence shows that tax payers have an incentive to evade taxes when they perceive the quality of services to be poor (Alm and McClellan, 2012; Frey and Torgler, 2007; and Hanousek and Palda, 2004). Also, empirical evidence shows that corruption-induced tax evasion compromises fiscal consolidation. For instance, Katsios (2006) shows that the lack of success in the government's stabilisation and management of the economy can potentially be explained by tax evasion. Also, Matsaganis and Leventi (2013) show that the Greek government's effort to restructure Personal Income Tax and at the same time introducing solidarity contributions and emergency taxes in order to cure the fiscal instability was partly weakened by tax evasion. The lower income tax collections partly offset the benefits attained from other fiscal policies such as pension and public sector pay reductions among others, (Matsaganis and Leventi, 2013). Bravely, Mehir et al. (2010) argue that if Greece was able to improve its direct tax revenue collection from 7.9% as a percentage of GDP to the average European Union average of 13.4% as a percentage of GDP, the fiscal deficit would have been history by 2007. To therefore attain the primary surplus eliminating tax evasion is of paramount importance (Mehir et al. 2010). Using the dynamic general equilibrium technique, this essay theoretically accounts for the preceding empirical evidence. The analysis is based on a social contract between government and households. Households pay taxes to Government in return for public services. The government hires bureaucrats to deliver public services. Because of information asymmetry some bureaucrats embezzle public funds by delivering poor quality public services while quoting prices for high quality expensive public services. Since households can observe the quality of public services, poor quality public services incentivise taxable households to evade tax. Consistent with empirical evidence, the essay shows that corruption-induced tax evasion increases the likelihood of a fiscal deficit,

renders tax payable increase counter-productive, and aggravates the negative effect of bureaucratic corruption on economic development. Also, this essay highlights that where a low incidence of corruption is accompanied with lower quantity of public services, there is a likelihood of an economy breaking the poverty trap and transiting to a higher economic development path.

After the three essays, the final chapter avails final remarks about corruption and economic development while highlighting avenues for further research.

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# Chapter 3

## Does size matter? Scale and Corruption

### 3.1 Introduction

The negative link between public sector corruption and economic growth has been widely explored since the seminal contribution of Mauro (1995). There is a consensus in the literature that graft undermines economic progress. This consensus is based on several studies that lend support to this result (e.g., Aidt 2009; Gyimah-Brempong 2003; Keefer and Knack 1997; Knack and Keefer 1995; Li *et al.* 2000; Méon and Sekkat, 2005; Mo 2001). There is also evidence, however, that some countries have grown at impressive rates regardless of exhibiting high levels of corruption. The best example of this is what Wedeman (2002) has labelled the East Asian Paradox. Countries such as China, Indonesia, South Korea and Thailand grew very rapidly during the 1980s and 1990s in spite of exhibiting high levels of corruption. Recent examples of this may be Brazil and India. One possible explanation for this phenomenon is related with the ‘speed money’ hypothesis. This theory postulates that corruption can be viewed as ‘greasing the wheels’ of a slow and cumbersome bureaucracy. Other, less conventional explanation, is linked with what we can call ‘corruption mitigants’, i.e., specific factors that may diminish the impact of corruption on economic development. This paper is

related with this second explanation.

We argue that the size of the economy is one of the factors that may mitigate the impact of corruption on growth. Firms that have access to large markets are able to operate on a larger scale and hence generate larger profits. Higher profits mean that the average firm can afford to have an outside option. This situation strengthens the bargaining power of firms when negotiating with corrupt public officials. Higher bargaining power results in lower bribes and a lower impact of corruption on the growth rate of the economy. In contrast, in small economies the average firm is constrained by the size of the market and is not able to generate large enough profits to absorb, for instance, the costs of relocation. In such economies, firms have low bargaining power and are at the mercy of bureaucrats. In line with the existing literature, we also show how multiple bribe payments can have devastating effects by creating disincentives to enter the market even in large economies.

In the rest of this section we discuss the literatures on the speed money hypothesis and on corruption mitigants, and elaborate on our proposal.

### **3.1.1 The Speed Money Hypothesis**

The speed money hypothesis is an application of the second best theory. It views bribes and kickbacks as convenient devices for overcoming institutional obstacles. According to their proponents, corruption may enhance efficiency by ‘greasing’ the bureaucratic rigidities that characterise a cumbersome institutional framework. A more efficient bureaucracy may potentially have a positive impact on investment and growth.<sup>1</sup>

This theory gained prominence in the 1960s with the works of Leff (1964), Leys (1965) and Bailey (1966). These studies were mainly theoretical and based on casual observations. Leff (1964) stresses that corruption works as a ‘hedging mechanism’ to reduce the losses associated with bad economic policies. Even though a government may be acting to promote development, it is not guaranteed that its policies will be well designed and implemented.

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<sup>1</sup>As Huntington (1968, p. 386) puts it: ‘In terms of economic growth, the only thing worse than a society with a rigid, overcentralised, dishonest bureaucracy is one with a rigid, overcentralised, honest bureaucracy.’

Terrible mistakes have been made in the past and the cost and time of reverting damaging policies is considerably high. Leys (1965) and Bailey (1966) point out that corruption may act as an incentive to attract talented individuals that otherwise would not have opted for a career in the public sector. Leys (1965) also argues that corruption mitigates bureaucratic sluggishness by speeding up the process of starting a new firm.

In the 1980s a second wave of works by Lui (1985), Beck and Maher (1986) and Lien (1986) explored the efficiency enhancing properties of corruption, or at least, the conditions under which corruption is efficiency equivalent to a competitive mechanism. Lui (1985) by using a non-cooperative game with incomplete information shows that corruption can improve efficiency in a queue by allowing those with a higher opportunity cost to pay to save time. The argument is based on the notion that time has a different valuation for each individual. Those who face a large opportunity cost of time are able to pay higher bribes than those to whom time has a low value. Bribery then can be efficiency enhancing by minimising the average value of time costs of the queue. Beck and Maher (1986) also use a non-cooperative game with incomplete information to demonstrate that there is an isomorphism between the outcomes of bribery and competitive bidding in the process of governmental acquisitions of goods and services. They show that under both mechanisms, the same firm (the one with the lowest costs and consequently the highest margin to bribe) wins the contract and the government pays the same net-of-bribes purchase price. After using two different model specifications, Lien (1986) confirms the findings of Beck and Maher (1986) and concludes that competitive bribery in comparison with competitive bidding produces no loss of efficiency in the allocation of resources.

The arguments in favour of the speed money hypothesis are very convincing. However, they have been challenged conceptually and empirically.<sup>2</sup> From a conceptual point of view there are two main problems with the speed money hypothesis. First, even though bribery may accelerate an individual transaction with a particular official, both the total size of bribes and the

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<sup>2</sup>Méon and Sekkat (2005) and Meon and Weill (2010) offer excellent surveys on this debate.

number of corrupt transactions may increase producing a net loss in efficiency. Second, bureaucrats may intentionally create delays (red tape) to extract bribes. As a result, bribes may not be seen as mitigating the effects of red tape. On the contrary, bribes may exist due to artificially created bureaucratic delays (Myrdal, 1968; Kurer, 1993). From an empirical point of view there is little support for the speed money hypothesis. Ades and Di Tella (1997), Mauro (1995) and Méon and Sekkat (2005) report a negative correlation between growth and corruption which is particularly strong in samples of countries with high levels of red tape. In addition, Kaufman and Wei (2000) report that the time spent negotiating with bureaucrats is increasing in the amount of bribes that are paid. In a new critical survey of the literature, Aidt (2009) re-tests the ‘grease the wheels hypothesis’ and finds that the evidence that supports this theory is weak. It is not only until very recently that Méon and Weill (2010) found empirical support for the speed money hypothesis from an efficiency point of view. Using a measure of aggregate efficiency the authors present evidence that corruption is less harmful to efficiency in countries with poor institutions. Furthermore, they report that corruption may be even efficiency-enhancing in countries with extremely weak institutions.<sup>3</sup>

### 3.1.2 Corruption Mitigants

The literature on the factors that may mitigate the growth-retarding effects of corruption is still under development. One of the first corruption mitigants that can be identified in the literature is predictability. Wei (1997), using an indicator of corruption-induced uncertainty from the 1997 Global Competitiveness Report, finds that higher uncertainty about bribe payments reduces foreign direct investment. Uncertainty about bribe payments may create a situation in which two countries with similar perceived levels of corruption

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<sup>3</sup>The work of Méndez and Sepúlveda (2006) also may lend support to this theory from a growth perspective. They find a non-monotonic relationship between corruption and growth in countries with high degree of political freedom. They report that corruption can be growth enhancing at low levels of development and growth-deterrent at high levels of development. Although their results have been challenged by Aidt *et al.* (2008).

can end up having completely different levels of foreign direct investment. It is expected that foreign investors will be asked to pay bribes in corrupt economies. In some countries, however, investors receive the goods and services they are paying for and no further bribes are requested. Whilst in other countries there is no guarantee that the goods and services will be delivered at all, and as a result, additional bribes will have to be paid. Campos *et al.* (1999) extended Wei's work by investigating the impact of the predictability of corruption on investment and growth. Using the same indicator of corruption-induced uncertainty they find that investment and growth are higher in countries in which corruption is more predictable.

Another factor that has received attention in the literature is the organisation of corruption. In their seminal contribution Shleifer and Vishny (1993) argue that the way in which bureaucrats organise themselves affect the impact of corruption on the provision of governmental goods. In order to conduct business, firms may need a set of different goods supplied by bureaucrats with monopoly power over the provision of these goods (licenses, permits, certificates, etc.) In addition, these goods and services may be provided by different corrupt governmental agencies and may be complements to each other. If firms have to deal with disorganised bureaucrats acting as independent monopolists, then each of them will seek to maximise his own individual bribe income without taking into account the negative effects of their actions on the bribe income of others. This effect arises since the demand for a bribe by one bureaucrat in exchange for his own governmental good imposes an externality on other bureaucrats by reducing the demand for their governmental goods. In contrast, if bureaucrats are organised and act as a joint monopoly, then they will maximise their total bribe income internalising the externalities. The implication of this is that a centralised network of corruption can lead to a lower level of bribe payments, a greater provision of governmental goods and services and to a smaller scale of distortions than would arise under a decentralised network of corruption. Blackburn and Forgues-Puccio (2009) seeking to explain the East Asian Paradox incorporated these ideas into a dynamic general equilibrium model to illustrate that corruption has a lower impact on innovation and growth when corruption is

organised than when it is disorganised.

Finally, Fisman and Gatti (2006) propose another factor that may mitigate the impact of graft. They report that the deadweight loss of corruption seems to be lower in countries with institutions that limit bargaining frictions allowing for a more efficient bribe negotiation. The authors use a simple model in which firms and bureaucrats negotiate the payment of bribes to avoid regulations. They assume bargaining frictions and a firm-specific exposure to bureaucratic hassle. Under these assumptions they show that bribes are an increasing function of the time spent negotiating with public officials. In their model a higher degree of bargaining frictions strengthens this result. Furthermore, using the World Bank's World Business Environment Survey they find that factors that may reduce negotiation frictions, like the formality of the legal system, mitigate the effects of corruption on economic growth.

### **3.1.3 This Paper**

We study the role of the size of the economy in mitigating the impact of corruption on economic growth. The analysis is based on a dynamic general equilibrium model with an expanding variety of intermediate inputs that are used in the production of output. We assume monopolistic competition in the intermediate goods sector. Hence innovation in this economy is motivated by the existence of positive profits in the manufacture of inputs. These profits may be exploited by corrupt bureaucrats that will ask for bribes under the threat of closing down businesses if not paid. In contrast we assume perfect competition in the production of the final good. As a result in equilibrium profits are zero in the final goods sector and there are no bribe opportunities. We assume that potential manufacturers of intermediate goods decide to enter the market by considering the value of the future bribes that may have to pay once they are operating. Assuming a fixed cost of financing relocation we show that in large economies firms generate large enough profits to afford relocation. This situation improves the bargaining power of firms when negotiating for bribes.

Our analysis is based on the empirical evidence reported by Svensson (2003) and Rock and Bonnet (2004). Svensson (2003) using a unique dataset on bribe payments by firms in Uganda finds that: (1) not all firms pay bribes and (2) the size of bribes depend on the firm's bargaining power. This heterogeneity in bribe payments reported by firms offer evidence that bureaucrats can charge different bribes to different firms. The bargaining power of firms is related with the firm's outside option: the ability to relocate, or move to a different activity that requires less contact with bureaucrats. Rock and Bonnet (2004) show that the impact of corruption on investment and growth is lower in the more populous economies. Looking at the impressive growth rates of large countries renowned for their levels of corruption one tends to challenge the view that corruption is detrimental to development. Using population as a measure of size like in Rock and Bonnet (2004), casual observation tell us that there are many relatively large corrupt countries that have achieved, and are achieving, long periods of sustained economic growth like China, Brazil, India and Mexico. In contrast, small corrupt countries seemed to be trapped by poor quality governance. In spite of this, Rock and Bonnet (2004) find that even in large economies the benefits of scale may quickly dilute depending on the way in which corruption networks are organised. In countries with weak and fragmented governments with multiple and uncoordinated corruption networks, multiple bribe payments may offset the benefits of having access to larger markets. A typical example of this is Nigeria. A large economy in which corruption is associated with multiple bribe payments. We account for this observation in our model by analysing the impact of multiple bribe payments on the firms decision to enter the market.

The theoretical research on corruption at the macroeconomic level has focused on explaining the negative effects of graft on economic progress. Seminal papers in this area are Ehrlich and Lui (1999), Rivera-Batiz (2001) and Sarte (2000). Blackburn *et al.* (2006) show how bureaucratic corruption and economic development may interact with each other producing threshold effects and multiple (history dependant) equilibria. Blackburn and Forgues-Puccio (2007) report analogous results together with showing how corruption

can affect inequality by distorting redistributive policy. Apart from Ehrlich and Lui (1999) and Blackburn and Forgues-Puccio (2009) who discuss the impact of different bureaucratic structures on economic performance, no other macroeconomic study has focused on the factors that may lessen the impact of corruption. As far as we know, we are the first ones to propose a theory to explain the role of the size of the economy in determining the impact of corruption on economic growth.

Our paper is also related to the work of Desmet and Parente (2010) in terms of highlighting the importance of the size of the economy. They show that in large economies competition and innovation are greater. They argue that this is the case because in economies with large populations, or open to international trade, the price elasticity of demand tends to be higher due to greater competition. Hence, firms have to sell more products to remain in the market; and by selling more, firms are also able to amortise the fixed cost of innovation over a larger number of products.

The remainder of the paper is structured as follows. In Section 2 we describe the model. In Section 3 we solve for the general equilibrium. In Section 4 we discuss the impact of scale on the relationship between corruption and growth. In Section 5 we discuss the impact of multiple bribe payments. In Section 6 we present our concluding remarks.

## 3.2 The Model

We consider a small open economy populated by two-period-lived agents belonging to overlapping generations of dynastic families. Agents of each generation are divided into two groups: private citizens (households) and public servants (bureaucrats). Households are differentiated further into skilled and unskilled workers and supply labour inelastically to firms. Bureaucrats work for the government. We assume a fixed population of unskilled workers equal to  $L > 1$ , and we normalise the population of skilled workers and bureaucrats to 1.<sup>4</sup> There are two sectors in the economy: a final output

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<sup>4</sup>We abstain from introducing issues related to occupational choice by assuming that individuals are separated at birth by some random process. We simplify the analysis in

sector and an intermediate input sector. A single consumption good is produced in the final output sector. A variety of intermediate (non-tradable) goods are designed and manufactured in the intermediate input sector. At any point in time,  $t$ , there is a fixed unit mass of final output firms, an endogenously-determined number,  $M_t$ , of existing intermediate input firms and an endogenously-determined number,  $N_t$ , of potentially new intermediate input firms. Intermediate inputs are indexed by  $i \in (0, M_t)$ . Research and development increases the number of intermediate goods increasing the efficiency in output production generating endogenous growth. All markets are perfectly competitive, except the market for intermediate inputs in which we assume monopolistic competition.

As in Blackburn and Forgues-Puccio (2009) our focus lies on the production side of the economy. This means that apart from the corrupt activities of public officials, the behaviour of agents is not essential and can be ignored when discussing the growth rate of the economy. In what follows, our description of the model proceeds by focusing exclusively on the behaviour of firms.

### 3.2.1 Final Output Producers

Following Romer (1990), we assume that the representative producer of final output combines  $L_t$  units of unskilled labour with  $X_t(i)$  units of intermediate good  $i$  to produce  $Y_t$  units of consumption good using the following technology:

$$Y_t = AL_t^{1-\alpha} \int_0^{M_t} X_t(i)^\alpha di, \quad (3.1)$$

( $A > 0, \alpha \in (0, 1)$ ). The final output manufacturer pays workers the wage rate  $W_t$  and each intermediate input producer the price  $P_t(i)$ . The profit

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this manner to avoid experiencing changes in the size of the bureaucracy and hence on the level of corruption. This assumption has been widely used in the macroeconomic literature of corruption. See for example the works of Blackburn *et al.* (2006); Blackburn and Forgues-Puccio (2007, 2009), Rivera-Batiz (2001) and Sarte (2000).

maximisation conditions allow us to express the factor demands as follows:

$$L_t = \frac{(1 - \alpha)Y_t}{W_t} \quad (3.2)$$

$$X_t(i) = \left[ \frac{A\alpha}{P_t(i)} \right]^{\frac{1}{1-\alpha}} L_t \quad (3.3)$$

By inspecting expressions (3.2) and (3.3) we can appreciate that the demand for unskilled labour and intermediate input  $i$  are inversely related to their prices. In addition, expression (3.3) reveals that the demand for each intermediate input is increasing on the use of unskilled labour.

### 3.2.2 Intermediate Input Producers

An intermediate good is created through a process of research and development. We assume that any firm which innovates has a perpetual monopoly right over the manufacture and sale of its new product.<sup>5</sup> In this kind of environment the incentive to undertake research and development is always present given that a firm that successfully innovates can expect to profit from its creation indefinitely.

Innovation is a risky activity and the  $j$ th research firm interested in creating a new intermediate good succeeds with probability  $q \in (0, 1)$ . As in Blackburn and Forgues-Puccio (2009) we assume that the probability of succeeding in innovation is a function of the number of efficiency units of skilled labour that is used in research,  $e_t(j) = H_t(j)M_t$ . We denote by  $H_t(j)$  the number of skilled labour employed by the  $j$ th research firm and the stock of disembodied knowledge is approximated by the existent number of intermediate goods,  $M_t$ . As a result, the probability of successful innovation is given by  $q(e_t(j))$ . We assume that this function satisfies the following properties: (1)  $q'(\cdot) > 0$  and  $q''(\cdot) < 0$  (concavity); (2)  $q(0) \geq 0$  and  $\lim_{e_t(j) \rightarrow \infty} q(\cdot) \leq 1$  (boundedness); and (3)  $e_t(j)q'(\cdot) < q(\cdot)$  (elasticity less than one). Property

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<sup>5</sup>To simplify the model we assume that the same firm that innovates produces the intermediate good. Equivalently, we could have assumed separate sectors in which innovators sell their designs to manufacturers but this scenario would only complicate the analysis.

number (1) captures the idea of diminishing returns to research, or "crowding" (i.e., doubling research input not necessarily result in doubling research output, some research output may be redundant).<sup>6</sup> Property number (2) simply guarantees that the probability of success in innovation is between 0 and 1. Finally, property number (3) ensures the existence of a unique equilibrium with a positive level of innovation.<sup>7</sup> Apart from the risk involved in innovation, we assume that the cost of designing a new intermediate good,  $\Psi$ , is proportional to the extra output that would be created by the new variety. Hence,  $\Psi = \psi \frac{Y_t}{M_t}$ , where  $\psi > 0$ .<sup>8</sup>

We assume an economy in which bureaucratic corruption is the norm and the probability of detection tends to zero. In this economy profit generating firms may be required to pay bribes to bureaucrats regularly to obtain certificates and services. In other words, firms producing intermediate inputs are 'harassed' every period by bureaucrats with the power to shut down their operations if they refuse to pay. This assumption is supported by Reinikka and Svensson (1999) that find evidence that firms are required to pay bribes on a regular basis and not only at entry level.<sup>9</sup> Let  $\pi_t(j)$  be the per-period operating profit that the firm could earn from selling a new intermediate good. Then,  $b_t(j)$  are the per-period bribe that the firm has to pay to continue in operation. Considering that the wage rate for skilled labour is given by  $W_t^H$  it follows that the expected payoff from innovation is

$$V_t(j) = q(e_t(j)) \sum_{\tau=1}^{\infty} (1+r)^{-\tau} (\pi_{t+\tau}(j) - b_{t+\tau}(j)) - \frac{W_t^H}{M_t} e_t(j) - \Psi. \quad (3.4)$$

The firm maximises (3.4) by choosing a level of skilled labour input,  $H_t(j)$

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<sup>6</sup>As in other studies (e.g., Blackburn and Hung 1998; Blackburn *et al.* 2000; Jones 1995a; Stokey 1995), we use this property for its plausibility and intuition.

<sup>7</sup>If  $q'(0)$  is finite, property number (3) is necessarily satisfied.

<sup>8</sup>These type of models are criticised because they exhibit a scale effect by construction. As in Barro and Sala-i-Martin (2004), we correct this anomaly by assuming that the cost of designing a new intermediate good is proportional to the extra output generated by the innovation

<sup>9</sup>We could assume as in Blackburn and Forgues-Puccio (2009) that intermediate input producers also have to pay bribes to start operations. However, this assumption is not crucial for our analysis and will only complicate the algebra.

such that

$$M_t q'(e_t(j)) \sum_{\tau=1}^{\infty} (1+r)^{-\tau} (\pi_{t+\tau}(j) - b_{t+\tau}(j)) = W_t^H. \quad (3.5)$$

In addition, we assume monopolistic competition among intermediate input producers. Hence each  $j$ th research firm by taking into account the demand for its product maximises its operating profits,  $\pi_t(j)$  by choosing the price  $P_t(j)$  at which it will sell its intermediate good. Assuming that it costs one unit of output to produce one unit of intermediate good, operating profits are given by  $\pi_t(j) = [P_t(j) - 1]X_t(j)$  and hence the optimal price is the following:

$$P_t(j) = P = \frac{1}{\alpha}. \quad (3.6)$$

### 3.2.3 Bargaining for Bribes

Firms are proportionally distributed among bureaucrats. Since we normalise the populations of bureaucrats to one, each bureaucrat is in charge of overseeing  $M_t$  firms. Bribe income is given by  $B_t = M_t b_t$ . Bureaucrats negotiate the bribe payment with the firms in each period. We further assume that firms that decide to move face a fixed cost of financing relocation,  $c$ , in each period.<sup>10</sup> This assumption is in line with existing empirical evidence. Pennings and Sleuwaegen (2000) find a positive effect of profitability on the firm's relocation decision and Brouwer *et al.* (2004) find that firms that operate in larger markets exhibit a higher frequency of relocation.<sup>11</sup> In addition, we assume that firms that move face lower profits in the alternative location. Per-period operating profits in the new location are equal to a fraction  $\eta \in \left(\frac{c}{\pi_t(j)}, 1\right)$  of per-period operating profits generated in the current loca-

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<sup>10</sup>We can think of financing the high cost of relocation by borrowing the funds in the form of a perpetuity that will have to be honoured period after period.

<sup>11</sup>Assuming fixed costs of relocation is the simplest way to model a situation in which larger firms face a lower relative cost of relocation. Alternatively, we could assume a relocation cost function that is increasing on profits but at a diminishing rate. Although, this would only complicate the algebra without adding any new insights to our results.

tion.<sup>12</sup> It follows that the Nash bargaining maximisation problem in each period is given by the following expression:

$$\underset{b_t \in \mathbb{R}^+}{Max} [b_t(j)]^\lambda [(\pi_t(j) - b_t(j)) - (\eta\pi_t(j) - c)]^{1-\lambda}, \quad (3.7)$$

where  $\lambda \in (0, 1)$  is the bureaucrat's bargaining power and  $(1 - \lambda)$  the firm's equivalent. In the first square bracket of expression (3.7) we can appreciate that the agreement payoff for the bureaucrat is equal to the bribe. We assume that the disagreement value for the bureaucrat is equal to zero. In the second square bracket of expression (3.7) we can see that the agreement payoff for the firm is the profit net of the bribe payment while the disagreement value is the profit in another location net of relocation costs. Solving the maximisation problem we find that the equilibrium bribe is given by  $b_t^{NE}(j) = \lambda [(1 - \eta) \pi_t(j) + c]$ . Re-arranging this result we can express the equilibrium bribe as a fraction of the firm's operating profit:

$$b_t^{NE}(j) = \lambda \left[ (1 - \eta) + \frac{c}{\pi_t(j)} \right] \pi_t(j) = \Lambda(\pi_t(j)) \pi_t(j), \quad (3.8)$$

where  $\Lambda(\pi_t(j)) = \lambda \left[ (1 - \eta) + \frac{c}{\pi_t(j)} \right]$ .<sup>13</sup> We define  $\Lambda(\pi_t(j))$  as the effective bargaining power of bureaucrats and it provides a measure of the fraction of profit that is lost to corruption in every period. By analogy  $1 - \Lambda(\pi_t(j))$  is the effective bargaining power of firms. Notice that  $1 - \Lambda(\pi_t(j))$  is an increasing function of operating profit. In other words, the higher is the operating profit generated by a firm, the higher is its effective bargaining power when negotiating with bureaucrats.

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<sup>12</sup>If  $\eta \leq \frac{c}{\pi_t(j)}$  then profits at the alternative location will be less or equal to zero. In this case the firm will not have an outside option.

<sup>13</sup>It is important to highlight that  $\lambda \left[ (1 - \eta) + \frac{c}{\pi_t(j)} \right] \in (0, 1)$  given that  $\lambda \in (0, 1)$  and  $\left[ (1 - \eta) + \frac{c}{\pi_t(j)} \right] \in \left( \frac{c}{\pi_t(j)}, 1 \right)$ . Remember that  $\eta \in \left( \frac{c}{\pi_t(j)}, 1 \right)$ , thus  $\left| -\eta + \frac{c}{\pi_t(j)} \right| < 1$ .

### 3.3 General Equilibrium

The solution to the model is symmetric by virtue of (3.6) which shows that the price of each intermediate good is identical and constant period after period. Using the equilibrium condition in the market for unskilled labour,  $L_t = L$ , it follows from (3.1), (3.2) and (3.3) that

$$Y_t = AL^{1-\alpha} X^\alpha M_t, \quad (3.9)$$

$$W_t = \frac{(1-\alpha)Y_t}{L}, \quad (3.10)$$

$$X_t(i) = X = (\alpha^2 A)^{\frac{1}{1-\alpha}} L. \quad (3.11)$$

Notice from expressions (3.9) and (3.10) that both the final output and wages of unskilled labour grow at the same rate as the number of intermediate goods. Furthermore, we can appreciate from (3.11) that the demand for each and every intermediate good is the same and constant through time.

A further implication of (3.11) is that the operating profit of intermediate input firms and bribe payments to bureaucrats are also identical and constant over time,

$$\pi_t(j) = \pi = (P-1)X = \left(\frac{1-\alpha}{\alpha}\right) (\alpha^2 A)^{\frac{1}{1-\alpha}} L, \quad (3.12)$$

$$b_t(j) = b = \Lambda\pi. \quad (3.13)$$

Given the above, we can compute the present value of the net of bribes operating profit in the following way  $\sum_{\tau=1}^{\infty} (1+r)^{-\tau} (\pi_{t+\tau}(j) - b_{t+\tau}(j)) = \frac{(1-\Lambda)\pi}{r}$ . In addition, free entry into the research and development sector will drive the expected net payoff in (3.4) to zero. Using the expected payoff maximising value of wages for skilled labour in (3.5), we find that each research firm uses the same fixed amount of efficiency units of skilled labour,  $e_t(j) = e$ , as determined by

$$[q(e) - eq'(e)](1-\Lambda)\pi = r\Psi. \quad (3.14)$$

Alternatively, using (3.12) and considering that<sup>14</sup>  $\Psi = \psi \frac{Y_t}{M_t}$  we can re-write the previous expression as:

$$[q(e) - eq'(e)](1 - \Lambda) = \frac{r\psi}{(1 - \alpha)\alpha}. \quad (3.15)$$

From (3.15) we can deduce the following<sup>15</sup>:

**Lemma 1** *Given that  $\lim_{e \rightarrow 0} [q(\cdot) - eq'(\cdot)](1 - \Lambda) < \frac{r\psi}{(1 - \alpha)\alpha}$ ,  $\exists$  an  $e = \varepsilon(\Lambda) > 0$  such that  $\varepsilon'(\cdot) > 0$ .*

**Proof.** Define  $Q(e) = q(\cdot) - eq'(\cdot)$ . Since  $Q'(\cdot) = -eq''(\cdot) > 0$ , then provided that  $\lim_{e \rightarrow 0} Q(\cdot)(1 - \Lambda) < \frac{r\psi}{(1 - \alpha)\alpha}$ ,  $\exists$  a unique value of  $e > 0$  that satisfies  $Q(e)(1 - \Lambda) = \frac{r\psi}{(1 - \alpha)\alpha}$ . Hence  $e = \varepsilon(\Lambda)$ , where  $\varepsilon'(\cdot) = \frac{Q(e)}{Q'(\cdot)(1 - \Lambda)} > 0$ .

■

Thus, we can express the equilibrium level of efficiency units of skilled labour,  $e$ , as an increasing function of the bureaucrats effective bargaining power,  $\Lambda$ . We still need to incorporate the equilibrium in the market for skilled workers. Once again due to symmetry all research firms use the same amount of skilled workers,  $H_t(j) = H_t$ . In equilibrium, the demand for skilled workers is equal the supply for skilled workers,  $N_t H_t = 1$  so that  $e = \frac{M_t}{N_t}$ . Taking into account that the term  $[q(\cdot) - eq'(\cdot)]$  in (3.15) is an increasing function of  $e$  or, equivalently, a decreasing function of  $N_t$ , we can study what happens with the number of new intermediate input producers  $N_t$  when we are not in equilibrium. If  $[q(\cdot) - eq'(\cdot)](1 - \Lambda) > \frac{r\psi}{(1 - \alpha)\alpha}$ , the existence of positive profits would be an incentive for more firms to enter the market, implying

<sup>14</sup>In conjunction with footnote 9, by including the cost of innovation which is represented by  $\Psi = \psi \frac{Y_t}{M_t}$ , we are attempting to eliminate the scale effect. Specifically, by substituting  $(\frac{1 - \alpha}{\alpha}) (\alpha^2 A)^{\frac{1}{1 - \alpha}} L$  for  $\pi$  and  $A^{\frac{1}{1 - \alpha}} \alpha^{\frac{2\alpha}{1 - \alpha}} L M_t$  for  $Y_t$  in equation (3.14)  $L$  cancels out on either sides of equation (3.14). In doing so, the scale effect is netted out in the spirit of Barro and Sala-i-Martin (2004). In essence the entry condition into innovation at this point is free of scale effects.

<sup>15</sup>Lemma 1 and its subsequent implications is developed from Blackburn and Forgues-Puccio (2009). In Blackburn and Forgues-Puccio (2009) the efficiency units of skilled labour are a function of the amount of bribe paid. In this paper however, the efficiency units of skilled labour are a function of the bureaucrat's effective bargaining power. Across the two papers, the efficiency units of skilled labour is increasing in both variables.

that  $N_t$  would increase until (3.15) holds with equality. Alternatively, if  $[q(\cdot) - eq'(\cdot)](1 - \Lambda) < \frac{r\psi}{(1-\alpha)\alpha}$  the prospect of negative profits would be an incentive for firms to leave the market. As a result,  $N_t$  would fall until (3.15) held with equality.

An important implication of equation (3.15) is that the equilibrium number of new firms engaging in research and development is higher in a non-corrupt economy than in a corrupt economy. In the absence of corruption  $\Lambda = 0$ , which means that intermediate input producers retain the totality of their operating profits. Given that the term  $\frac{r\psi}{(1-\alpha)\alpha}$  is constant,  $e$  will have to fall, or alternatively  $N_t$  will have to increase until  $[q(\cdot) - eq'(\cdot)] = \frac{r\psi}{(1-\alpha)\alpha}$ . Hence, the number of new intermediate input producers is higher in a non-corrupt than in a corrupt economy.

In equilibrium, the number of new intermediate goods,  $N_t$  grows at the same rate as  $M_t$  given that  $e$  is a constant. In the same way the wages of skilled labour also grow at the same rate since (3.5) yields  $M_t q'(e) \frac{(1-\Lambda)\pi}{r} = W_t$ .

Finally we need to determine the equilibrium growth rate of the economy. Research firms work independently, hence the flow of new intermediate inputs is given by  $M_{t+1} - M_t = q(\cdot)N_t$ . Defining the growth rate of new intermediate inputs as  $g_t = \frac{M_{t+1} - M_t}{M_t}$  and using the fact that  $e = \frac{M_t}{N_t}$ , then it follows that

$$g_t = g = \frac{q(e)}{e} \equiv g(e), \quad (3.16)$$

where  $e$  is determined by equation (3.15). Notice that the growth rate of the economy is a decreasing function of  $e$  given that  $g'(\cdot) = \frac{eq'(\cdot) - q(\cdot)}{e^2} < 0$ .<sup>16</sup> Alternatively, since  $e$  is a decreasing function of  $N_t$ ,  $g$  is an increasing function of  $N_t$ . In other words, the growth rate of the economy is higher when innovation is higher. The channel by which corruption reduces economic growth is innovation. As we showed earlier the higher are bribes the lower is innovation. The relationship between corruption and innovation has recently been investigated empirically. Anokhin and Shulze (2009) using longitudinal

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<sup>16</sup>Notice that  $g$  is also the growth rate for all other (non-stationary) variables. In the absence of any transitional dynamics, the economy evolves over time along a balanced growth path with an increasing number of firms engaged in research and development.

data for 64 countries find evidence that countries that are more successful in controlling corruption exhibit higher levels of innovation. Mahagaonkar (2010) using data for African firms from the World Bank's Enterprise Survey finds a strong and significant negative link between corruption and product innovation.

### 3.4 Scale, Corruption and Growth

After fully specifying the model we study in this section the role of the size of the economy in explaining the impact of corruption on growth. We use population as a measure of scale. Total population in our model is given by the sum of the populations of bureaucrats and workers. The size of the bureaucracy is not relevant provided we assume that there are fewer civil servants than firms. In the same way, due to our assumption about the probability of succeeding in innovation, it follows trivially that the larger is the population of skilled workers, the higher is the probability of succeeding in innovation, and the higher is the growth rate of the economy. Thus, we adopt the number of workers in the final output sector as our population measure to explore how the size of an economy affects the link between bureaucratic malfeasance and economic progress.

**Proposition 1** *Bureaucrats have higher effective bargaining power in a small than in a large corrupt economy.*

**Proof.** Define  $L^s$  and  $L^l$  as the populations of a small and a large economy respectively, where  $L^s < L^l$ . From (12) we have that  $\pi(L)$  and  $\pi'(\cdot) = \left(\frac{1-\alpha}{\alpha}\right) (\alpha^2 A)^{\frac{1}{1-\alpha}} > 0$  then it follows that  $\pi(L^s) < \pi(L^l)$ . In addition, since  $\Lambda(\pi)$  and  $\Lambda'(\cdot) = -\lambda c/\pi^2 < 0$  it follows that  $\Lambda(\pi(L^s)) > \Lambda(\pi(L^l))$ . ■

By inspecting equation (3.11) we can appreciate that the demand for intermediate goods is greater in more populated economies. Given the symmetry of the model in large economies all intermediate input firms operate at a larger scale and generate higher profits. Firms that generate large profits are in a better position to relocate and this strengthens their position when

negotiating for bribes. From the point of view of the bureaucrats, if they deal with firms that serve larger markets, they will inevitably have lower effective bargaining power.

**Proposition 2** *Growth is lower in a small than in a large corrupt economy.*

**Proof.** Using Lemma 1 define  $e^s = \varepsilon(\Lambda(\pi(L^s)))$  and  $e^l = \varepsilon(\Lambda(\pi(L^l)))$ . From Lemma 1 and Proposition 1 it follows that  $e^s > e^l$ . Given that by (3.16)  $g(e)$  and  $g'(\cdot) = \frac{eq'(\cdot) - q(\cdot)}{e^2} < 0$  it follows that  $g(e^s) < g(e^l)$ . ■

This result is intimately related with the firm's effective bargaining power. In small economies the cost of relocation as a proportion of operating profit is higher than in large economies. This situation weakens the firm's position when bargaining with bureaucrats and implies that a larger fraction of operating profit may be lost to corruption. The total number of research firms is smaller and each firm uses a higher level of efficiency units of skilled labour,  $e$ . The implications of this is that under the presence of corruption, innovation and growth is lower in a small than in a large economy. In other words, less research firms will be willing to create new intermediate goods in small corrupt economies resulting in lower innovation and growth.

### 3.5 The Role of multiple bribe payments

We have been assuming so far that intermediate input producers negotiate and pay a bribe only once in each period. Now we turn our attention to the case in which bureaucrats may ask for additional bribes. This situation is not rare and has been modelled by Choi and Thum (2004). In economies in which corruption is chaotic the payment of a bribe does not guarantee the delivery of a service, certificate or permit. Bureaucrats can always create additional regulations with the single purpose to extract further bribes. Hence, an existent intermediate input producer may end up negotiating bribes several times in each period.

In section 3 we found that in the general equilibrium firms producing intermediate goods exhibit an identical and constant operating profit over

time. In addition, we found that bribe payments may be expressed as a fraction of profits. Hence, if bureaucrats ask for bribes only in one occasion in each period, the net of bribes operating profit (per period) was found to be  $\pi - b = (1 - \Lambda)\pi$ . This result follows from the Nash bargaining maximisation problem presented in expression (3.7). We can extend the analysis to allow for the negotiation of additional bribes. We start by writing down the Nash bargaining maximisation problem for a firm when a second bribe is required in each period. The Nash bargaining maximisation problem is now:

$$\underset{b_2 \in \mathbb{R}^+}{Max} [b_2]^\lambda [((\pi - b_1) - b_2) - (\eta\pi - c)]^{1-\lambda}, \quad (3.17)$$

notice that  $b_1$  has already been paid, thus it has to be deducted from operating profit. The equilibrium second bribe is given by  $b_2^{NE} = \lambda [(1 - \eta)\pi + c] - \lambda b_1$ . Re-arranging this result and taking into account that  $b_1 = \lambda [(1 - \eta) + \frac{c}{\pi}] \pi = \Lambda\pi$ , the second bribe as a fraction of operating profit is given by the following expression  $b_2 = (1 - \lambda)\Lambda\pi$ . Repeating the same procedure we can find the equilibrium values for further possible bribe payments as  $b_3 = (1 - \lambda)^2 \Lambda\pi$ ,  $b_4 = (1 - \lambda)^3 \Lambda\pi$ , and so on and so forth. If we denote as  $b_n$  the  $n$ th bribe that has to be negotiated in each period. The net of bribes per-period operating profit when bribes are solicited in  $S$  occasions is given by:

$$\pi - \sum_{n=1}^S b_n = \left[ 1 - \Lambda \left( \frac{1 - (1 - \lambda)^S}{\lambda} \right) \right] \pi. \quad (3.18)$$

From (3.18) it follows that the associated present value of the net of bribes operating profit is given by  $\left[ 1 - \Lambda \left( \frac{1 - (1 - \lambda)^S}{\lambda} \right) \right] \pi / r$ . Assuming that with a probability  $p$  firms will have to pay bribes on  $S > 1$  occasions in each period and with probability  $(1 - p)$  they pay a bribe only once, we can write down the entry condition to the research and development sector as follows:

$$[q(e) - eq'(e)] \left\{ 1 - \Lambda \left[ p \left( \frac{1 - (1 - \lambda)^S}{\lambda} \right) + (1 - p) \right] \right\} = \frac{r\psi}{(1 - \alpha)\alpha} \quad (3.19)$$

Equation (3.19) is a more general entry condition that also incorporates

multiple bribe payments. If we assume that  $p = 0$ , then firms know with certainty that bureaucrats will ask for bribes only once in each period and (3.19) becomes equation (3.15). Conversely if  $p = 1$ , firms pay additional bribes in  $S > 1$  occasions in each period.<sup>17</sup>

**Proposition 3** *An increase in the probability of facing additional bribes reduces growth.*

**Proof.** Define  $\widehat{\Lambda}(p) = \Lambda \left[ p \left( \frac{1-(1-\lambda)^S}{\lambda} \right) + (1-p) \right]$  where  $\widehat{\Lambda}'(\cdot) = \Lambda \left( \frac{1-(1-\lambda)^S}{\lambda} - 1 \right) > 0$ . Using lemma 1 we can define  $e = \varepsilon \left( \widehat{\Lambda}(p) \right) \equiv E(p)$ . Hence  $E'(\cdot) = \varepsilon'(\cdot) \widehat{\Lambda}'(\cdot) > 0$ . Given that by (3.16) we have that  $g(e)$ , we can write the equilibrium growth rate as  $g = \gamma(E(p)) \equiv \Gamma(p)$  where  $\gamma'(\cdot) = \frac{e q'(\cdot) - q(\cdot)}{e^2} < 0$ . Hence,  $\Gamma'(\cdot) = \gamma'(\cdot) E'(\cdot) < 0$ . ■

From the proof, if the probability of paying multiple bribes in each period is considerably high, there will be few research firms each employing a large number of research input,  $e$ . Resulting in a low growth rate for the economy. An inspection of equation (3.19) and Proposition 3's proof reveals that the effect of a high probability of facing additional bribes is stronger in small than in large economies. Notice that  $\widehat{\Lambda}(\cdot)$  is increasing in the bureaucrat's effective bargaining power,  $\Lambda$ . In spite of this, even in a large economy a high  $p$  may cancel out and more than offset the higher effective bargaining power of firms. A large corrupt economy in which firms face a high probability of paying additional bribes may end up being comparable to a small corrupt economy in which the probability of additional payments to bureaucrats tends to zero. This result is consistent with empirical evidence in which Rock and Bonnet (2004) highlight that the existence of multiple and uncoordinated corruption networks have the potential to offset the mitigating effect of the size of economy on impact of corruption on economic growth.

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<sup>17</sup>Notice that if  $S = 1$  then  $\left( \frac{1-(1-\lambda)^S}{\lambda} \right) = 1$  and if  $S \rightarrow \infty$  then  $\left( \frac{1-(1-\lambda)^S}{\lambda} \right) = \frac{1}{\lambda}$ . Hence  $\left( \frac{1-(1-\lambda)^S}{\lambda} \right) \in \left( 1, \frac{1}{\lambda} \right)$ , implying that the higher is the number of additional bribes the higher the fraction of profits that is lost to corruption.

## 3.6 Conclusions

Entrepreneurship is at the centre of the process of development. The rate at which entrepreneurs generate new ideas is fundamental for economic progress. In corrupt economies firms face bureaucratic obstacles on a day to day basis that can only be ameliorated by the regular negotiation and payment of bribes. In spite of this, firms in certain countries seem to be in a better position to bargain with corrupt public officials than in others. We argue in this paper that the size of the economy plays an important role in this negotiation process and ultimately on the impact of corruption on innovation and growth. In particular, the average firm in a large economy operates at a larger scale thereby generating larger profits. Firms that generate larger profits are in a better bargaining position with bureaucrats. As a result bribes as a fraction of profits are lower and innovation and growth are higher.

In this paper we have also highlighted that size is not everything. We showed how a high probability of multiple bribe payments may reduce the incentives to enter the market. Firms may not find attractive entering a market in which there is a high probability of multiple bribe payments. As a result the positive effects of size may be reduced, or even totally canceled out.

Like in many other analyses we have taken as given that corruption exists in the economy. It was not our intention to explain why corruption arises and how the incidence of corruption may change when other aspects of the economy evolve. In contrast, we focus on trying to understand why corruption may be more damaging in some countries than in others. An important question that did not receive much attention in the literature so far.

One implication of our analysis is that policy makers in small corrupt economies face a greater challenge than their counterparts in large economies. This is because the average firm in a small corrupt economy may have very little bargaining power with bureaucrats and the stagnation we observe in some of these economies may be the result of powerful civil servants suffocating entrepreneurship.

The other implication of our analysis is that independently of the size

of the economy, under conditions of multiple bribe payments, entrepreneurs may not have any incentives to enter the market and may prefer to take their business somewhere else where bribes are payable perhaps ounce.

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# Chapter 4

## Is the Informal Sector a window of hope? Corruption, Income Inequality and Informal Sector

### 4.1 Introduction

The overarching goal among development oriented agencies is poverty reduction. The extent and speed of poverty reduction is partly hinged on an economy attaining a sustainable and robust economic growth and partly hinged on how income is distributed across households (Ravallion 1997)<sup>1</sup>. Theoretical evidence shows that income distribution is relevant because income inequality inhibits and distorts optimal investment in human and physical capital leading to low productivity<sup>2</sup>. Also, income inequality leads to social and political distress resulting in an uncertain investment climate<sup>3</sup>. By inhibiting and distorting optimal investment in human and physical capital and generating investment uncertainty, income inequality reduces an economy's growth potential. The inverse relationship between growth and inequality seems to

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<sup>1</sup> "At any positive rate of growth, the higher the initial inequality, the lower the rate at which income-poverty falls. . . ." Ravallion (1997:7).

<sup>2</sup> Galor and Zeira (1993); Banerjee and Newman (1993); Person and Tabellini (1994); Alesina and Rodrik (1994); Galor and Moav (2006); and Galor, Moav and Vollrath (2006).

<sup>3</sup> Alesina and Perotti (1996); Bourguignon and Verdier (2000); and Gradstein (2007).

be robust among developing economies<sup>4</sup>. The reduction in the economy's growth potential constrains the extent and speed in which poverty can be reduced<sup>5</sup>.

The sustainability of a robust level of economic growth over time depends partly on the existence of a competitive investment climate. However, developing countries are characterised by a less competitive investment climate because of missing markets which propagate corruption (Acemoglu and Verdier, 1998). Corruption which we define as the misuse of public office for private gain has generally been argued to inhibit economic growth through distorting optimal investment allocation<sup>6</sup>. Bribe extortion increases formal entrepreneurial investment costs leading to a reduction in returns to formal sector investment. The increase in formal sector investment costs crowds out some entrepreneurs in preference for informal entrepreneurship as they seek to evade the brazen bureaucratic machinery<sup>7</sup>. There is a general consensus that corruption partly accounts for the existence of the informal sector (Shleifer and Vishny, 1993; Kaufmann, 1997; Shleifer, 1997; Johnson, Kaufmann and Zoido-Lobaton, 1998; and Friedman, Johnson, Kaufmann and Zoido-Lobaton, 2000).

The entrepreneurial choice of entry into the informal sector has implications on household income distribution. By shutting down business, formal entrepreneurs may be condemned to income inferior employment in the formal labour market (Paulson and Townsend, 2004). However, entry into informal entrepreneurship may ensure a level of income greater than wage income although typically less than income in formal entrepreneurship. In

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<sup>4</sup>Barro (2000) and Easterly (2007).

<sup>5</sup>Galor and Zeira (1993), Alesina and Rodrik (1994), Person and Tabellini (1994), Alesina and Perotti (1996), Bourguignon and Verdier (2002), and Gradstein (2007).

<sup>6</sup>Mauro (1995), Knack and Keefer (1995), Kaufmann, Kraay and Zoido-Lobaton (1999) and Gyimah-Brempong (2002)

<sup>7</sup>The informal sector includes all economic activities that under normal circumstances would be captured in national accounts however, for reasons such as avoiding bureaucratic rigidities, high tax burden and corruption, entrepreneurs opt to go underground, (Schneider, 2012). The size of the informal sector is considerably significant. For instance, between the period 1999 and 2006/2007 the average size of the informal sector was estimated to be 34.5% of official GDP among 162 countries. Over the same period, the average size of the informal sector was 17.8% and 35.7% of the official GDP among OECD and 88 developing countries respectively (Schneider, Buehn and Montenegro, 2010).

essence, the entrepreneurial choice of entry into the informal sector may mitigate the extent of income inequality attributed to corruption. Dobson and Ramlogan-Dobson (2012a), Dobson and Ramlogan-Dobson (2012b) and Kar and Saha (2012) provide empirical evidence that the effect of corruption on income inequality is dampened in economies with high levels of informality.

This paper is a theoretical macroeconomic attempt to characterise the income inequality implications of a household's occupational behavioural pattern in an environment of corruption. Specifically, we show that the choice of entry into the informal sector offers a window of hope to households by availing them an alternative source of income as opposed to a potentially inferior subsistence livelihood.

Since the informal sector mitigates the negative effect of corruption on income inequality, it implicitly reduces the distortionary effect of income inequality on economic growth and economic development. Policy wise, this paper implies that efforts to reduce the size of the informal sector should ensure that safety nets are in place to ensure a smooth transition of households into the formal sector otherwise income inequality is bound to increase.

In what follows we present a review of the literature on corruption, informality and income inequality where we explicitly state the relevance of our research while at the same time positioning it within the related literature.

#### **4.1.1 Corruption and the informal sector**

Corruption arises due to the delegation of authority from government to bureaucrats to implement and enforce regulations aimed at abating potential externalities arising from entrepreneurial activities. Such entrepreneurial activities include: exploitation of labour, fly-by-night entrepreneurship, low quality products and pollution. The restriction of such entrepreneurial activities is aimed at improving social welfare (Djankov et al. 2001). However, the inability of the government to fully monitor bureaucratic behaviour breeds corruption as bureaucrats exploit their power to extort bribes from entrepreneurs. This could be through restricting entry into a particular sector in order to maximise their corruptible income by collaborating with incumbent

firms. Or through bureaucratic rigidities such as delaying the issuance of investment permits with the intention of incentivising an entrepreneur to pay a bribe in order to fasten the bureaucratic process. Besides entry costs, entrepreneurs might have to live up with significant costs of formality such as red tape and bribe payments as they could be required to renew their trading or investment licenses, pay import taxes, and transfer property among others.

Bribe payments affect directly entrepreneurial returns, while red tape affects them indirectly through wastage of productive time. As such, some entrepreneurs might find it desirable to operate in the informal sector.<sup>8</sup> Loayza (1996) in a study of Latin American economies shows that a robust and less burdensome institutional framework reduces the size of the informal sector. Specifically, a standard deviation improvement in the strength and efficiency of the institutional framework is associated with 0.42 standard deviation decrease in the size of the informal sector. Similarly, Friedman et al. (2000) using the International Country Risk Guide (ICRG) corruption index shows that irrespective of a country's level of economic activity as proxied by GDP per capita, a one-point improvement in the corruption index is associated with a 9.7% reduction in the size of the informal sector. Finally, in a study of 49 countries in Latin America, former Soviet Union and the OECD, Johnson et al. (1998) show that a one-point improvement in the Transparency International (TI) corruption index is associated with a 5.1% reduction in the informal economy. Equally, using the Global Competitiveness Survey proxy for bribery, a one-point improvement in the index implies an 8% reduction in the informal sector, (Johnson et al. 1998). Clearly, irrespective of an economy's level of economic activity and the kind of corruption index used, the size of the informal sector is increasing in the level of corruption.

In a theoretical account of the interaction between corruption, growth and informality, Sarte (2000) argues that as bureaucrats seek to maximise rents, they would have an incentive to restrict the number of economic units or firms in the formal sector. This implies that agents that would have operated in

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<sup>8</sup>Refer to Loayza (1996) for an explicit discussion on the costs to an economic unit for going informal. These among others include the inability to fully utilise the judiciary, inaccessibility to capital markets, and inability to enjoy economies of scale.

the formal sector in a free entry environment are condemned to the informal sector. Under such circumstances, the level of economic activities would be compromised in comparison to when there is free entry into the formal economy. However, the level of growth will be higher than that without the informal sector given corruption.

Besides corruption, the size of the informal sector can equally be attributed to distortionary tax regimes<sup>9</sup> and voluntary choice by agents. Maloney (2004) in a survey of empirical literature on the informal sector in Latin America provides evidence of voluntary entrepreneurial entry into the informal sector. For example, resignation from the formal labour market may be attributed to the need for higher incomes and greater independence that is associated with informal entrepreneurship or self employment. Maloney (2004) using a microsurvey data from Mexico shows that over 60% of the respondents attributed their entry into informal entrepreneurship from the formal labour market to the need for greater independence and higher incomes. Similarly, using survey data from Argentina and Brazil, Maloney (2004) finds that 80% of the self-employed and over 62% of the self-employed men respectively did not want to switch jobs. The Maloney (2004) argument for voluntary informality can be seen as a complement rather than a substitute to the view that corruption exacerbates the size of the informal sector.

#### **4.1.2 Corruption, informal sector and income inequality**

One of the avenues through which income inequality can be increased is through corruption. For instance Blackburn and Forgues-Puccio (2007) using a dynamic general equilibrium model, show that corruption has the potential to increase income inequality. This is through bureaucrats colluding with tax payers to evade taxes thereby reducing the effectiveness of the government's redistributive policy. In support of the preceding theoretical result,

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<sup>9</sup>Loayza (1996), Johnson, Kaufmann and Shleifer (1997), Johnson, Kaufmann and Zoido-Lobaton (1998) and Schneider and Enste (2000).

empirical investigations by Gupta et al. (2002) and Gyimah-Brepong et al. (2006) posit that there is a robust positive relationship between corruption and income inequality. Specifically, a standard deviation fall in the corruption index results in a 4.4 points increase in the Gini coefficient (Gupta et al. 2002). Decreasing the level of corruption by one standard deviation is associated with a reduction in income inequality (as measured by Gini coefficient) by 0.05, 0.14, 0.25, and 0.33 among OECD, Asian, African and Latin American Economies respectively (Gyimah-Brepong et al. 2006). The positive relationship between corruption and income inequality may be attributed to corruption reducing the effectiveness of social programmes through either outright theft of funds or altering the composition of social programs to the benefit of the rich while at the same time being disadvantageous to the poor, (Andres and Ramlogan-Dobson, 2011).

However, Chong and Calderon (2000) show evidence of an inverted-U relationship between corruption and income inequality with an inflection point at the ICRG index of 4.34. Of the 62 countries in the sample, only 26 were above the inflection point and these were mainly developed economies. However, Latin American and Sub Saharan African economies were predominantly below the inflection point, implying a positive link between corruption and income inequality in these economies. In addition, the preceding empirical result is suggestive of a potential trade-off between institutional reform and income inequality in developing countries (Chong and Calderon, 2000).

Consistent with Chong and Calderon (2000), Andres and Ramlogan-Dobson (2011), Dobson and Ramlogan-Dobson (2010) and Dobson and Ramlogan-Dobson (2012a) show evidence of a trade-off between corruption and income inequality in Latin America. Dobson and Ramlogan-Dobson (2012a) show that in Latin America an increase in corruption<sup>10</sup> (using the ICRG measure of corruption) is associated with 1.714 reduction in the Gini coefficient<sup>11</sup>. The trade-off between corruption and income inequality is attributed to the increase in the cost of doing business as informal firms are cajoled to operate

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<sup>10</sup>Or a reduction in institutional quality is associated with a reduction in income inequality.

<sup>11</sup>A reduction in institutional quality is associated with a reduction in income inequality

formally as countries undertake institutional reforms. The informal economy typically employs persons who by virtue of; personal attributes, corruption, high tax burdens and bureaucratic rigidities can not partake in the formal economy. Institutional reforms would imply agents being cajoled to pay taxes and make social security contributions among others. However, agents in the informal sector could potentially find it difficult to adjust to the new institutional framework leading to business closure, unemployment and increased income inequality.

One of the arguments that has been put forward to account for the trade-off between income inequality and corruption is the size of the informal sector in a given economy. When the size of the informal sector is low (high) income inequality is increasing (decreasing) in corruption. For example, Dobson and Ramlogan-Dobson (2012a) show that where the informal economy is 12(45) percent of GDP, the marginal impact of corruption on income inequality is approximately 2.8 (-0.78). Similarly using a sample of South East Asian countries, Kar and Saha (2012) show that when the informal economy as a proportion of GDP is 10(70) percent, the effect of corruption on income inequality is positive (negative). Dobson and Ramlogan-Dobson (2012b) using a sample of developed and developing country data show that the coefficient on the interaction term between corruption and the size of the informal sector is negative. Implying that the size of the informal sector mitigates the effect of corruption on income inequality. Specifically, using the ICRG corruption index the marginal effect of corruption on income inequality is positive but declines as the size of the informal sector increases. However, when the size of the informal sector is at least 20 to 22 percent of GDP, the marginal impact of corruption on income inequality is negative and increasing<sup>12</sup>. Among only developing countries, the marginal effect of corruption on income inequality is positive and decreasing up to the point when the size of the informal economy is 37 percent of the GDP where the relationship turns negative and increasing when the size of the informal economy is

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<sup>12</sup>Similar results are attained using the TI corruption index although the threshold level of informality beyond which the informal sector mitigates the extent to which corruption negatively affects income inequality is when the informal sector is 18 to 19 as a percentage of GDP.

higher (Dobson and Ramlogan-Dobson, 2012a). Kar and Saha (2012) show that among South East Asian countries, the threshold level beyond which the informal economy mitigates the effect of corruption on income inequality is when the informal economy as a share of GDP is between 10 to 20 percent. Hence, there is evidence that the existence of the informal sector may mitigate the extent to which corruption affects income inequality.

In the midst of bureaucratic rigidities negating entry into the formal sector, economic growth (income inequality) could potentially be low (high). However, the entrepreneurial choice of entry into the informal sector potentially mitigates the extent to which both income inequality and economic growth are compromised. With regard to economic growth, Sarte (2000) suggests that the crowding out of agents into the informal sector as a result of bureaucratic entry barriers into the formal sector, implies that agents that would have otherwise escaped the high costs of informality for the formal sector in a free entry and exit institutional environment would instead be caught up in informality. Under such circumstances, economic growth would be compromised in comparison to when there is free entry and exit into the formal economy. However, even though economic growth is lower, it is at least greater than that without the informal sector given corruption.

While Sarte (2000) avails a theoretical account for the relevance of the informal sector to economic growth in a corruption ridden environment, to the best of our knowledge none has been done for income inequality. As such this paper is a theoretical macroeconomic attempt to show how the informal sector dampens the effect of corruption on income inequality.

The following subsection positions the aforementioned research issue within the existing related literature.

### **Related Literature**

This paper falls in the same bracket as Sarte (2000), with the common ground being that informality is not entirely bad particularly in an environment of corruption. Sarte (2000) argues that the existence of the informal sector reduces the impact of corruption on economic activities. Along the same

line, this paper posits that the existence of the informal sector mitigates the extent of income inequality attributed to corruption. Therefore, the two papers conclude that informality allows for a second best in economies that exhibit widespread corruption.

This paper is also related to Banerjee and Newman (1993). They show that given inherited wealth, credit market rigidities account for household occupational decisions. In the end, household occupational decisions account for an economy's institutional structure thus affecting its economic development path. The analytical framework adopted shows that poor households have a preference for employment in the formal labour market as opposed to self-employment and entrepreneurship. Consequently, an economy's long term equilibrium can be characterised by either a high or low level of economic development. The point of convergence is that household endowment and credit market rigidities drive occupational decisions. We differ from Banerjee and Newman (1993) in that we introduce corruption as a direct fixed cost in formal entrepreneurial decisions. The reduced profitability of formal entrepreneurship due to bribe payment compromises the preference for formal entrepreneurship in favour of informal entrepreneurship. Furthermore, we proceed and analyse the income inequality dynamics of the economy given corruption and available occupational choices.

The following section presents the model environment within which the linkage between corruption, informality and income inequality is analysed.

## **4.2 The Model**

### **4.2.1 The basic framework**

Consider a small open economy characterised by a constant population of two period lived overlapping generations of agents. Agents are divided between households and bureaucrats. For simplicity the total population of households in each period is assumed to be equal to 1. All households are assumed to be identical except for an initial inequality in endowments. We assume that in  $t = 0$  households are given an initial endowment that is uniformly

distributed between 0 and  $\bar{b}$  with probability density function:  $f(b_0) = \frac{1}{\bar{b}}$ . Based on this initial endowment and subsequent bequests from parents in the following periods, households make occupational choices between formal entrepreneurship, informal entrepreneurship and subsistence livelihood. The choice of occupation depends on the kind of technology a household's bequest or endowment can afford and the existing credit market constraints. Formal entrepreneurship involves employing a high yielding but costly capital investment. Informal entrepreneurship involves employing a low yielding rudimentary technology. The paper characterises the occupational choice behaviour of households in an economy with and without corruption. The paper attempts to explore the relevance of the informal sector in mitigating the extent of income inequality. In the economy with corruption, the effect of corruption is to enhance credit market rigidities. Corruption-induced credit market rigidities increases (decreases) household participation in informal (formal) entrepreneurship. The household's choice of entry into informal entrepreneurship as opposed to subsistence livelihood given corruption-induced credit market rigidities mitigates the effect of corruption on income inequality. Otherwise, the household's occupational choice and the subsequent investment is made in period  $t$  yielding a net income  $y_{t+1}$  upon which claims are settled, consumption  $c_{t+1}$  and bequests  $b_{t+1}$  are consequently effected.

In the model, we do not explicitly explore the behaviour of bureaucrats and the bribe determination process other than state that they exchange formal investment licences for bribes. Emphasis is laid on the income dynamics of households given their occupational choices in an environment with and without corruption. In what follows we present a full characterisation of the model environment.

A household's occupational decision is undertaken in order to maximise his lifetime utility  $U_t$  subject to period  $t + 1$  net income which is spent on consumption and bequests in period  $t + 1$  that is;

$$MaxU_t = c_{t+1}^\alpha b_{t+1}^{(1-\alpha)} \quad (4.1)$$

s.t

$$y_{t+1} = c_{t+1} + b_{t+1} \tag{4.2}$$

As in Galor and Zeira (1993) our specification of the household's lifetime utility is to simplify the algebra and ensure focused tractability of the household's behaviour. Also, the household's lifetime utility is increasing in the size of the bequest extended to their offspring as opposed to the utility their offspring receives from the bequest. The underlying assumption is that even poor parents would desire to save more in an attempt to secure the future livelihoods of their offsprings implying that they actually care about the utility of their offsprings<sup>13</sup>.

The optimisation problem yields:  $c_{t+1} = \alpha y_{t+1}$ ;  $b_{t+1} = (1 - \alpha) y_{t+1}$ ; and  $U_t = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} y_{t+1}$ . The optimal solution,  $b_{t+1} = (1 - \alpha) y_{t+1}$  implies that period  $t + 1$  bequest to an offspring is increasing in the household's net income. While, the optimal solution,  $c_{t+1} = \alpha y_{t+1}$  implies that period  $t + 1$  consumption is increasing in a household's net income. Clearly  $U_t(y_{t+1})$  implies that occupations with higher net incomes yield higher utility levels and will be strictly preferred.

### **4.2.2 Occupational choice and inequality in the economy without both corruption and informality**

As the benchmark model, this chapter first explores an economy which is composed of formal entrepreneurial and subsistence households. The motivation is to explore the income dynamics of such an economy. Thereafter informal entrepreneurs are introduced in order to study the effect of informality on income dynamics.

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<sup>13</sup>The key results of our analysis would not change even if we replace the size of bequests with the actual utility that offsprings attain from the bequest.

## Formal sector entrepreneurship

Recall that a household receives a bequest,  $b_t$  upon which he makes an occupational choice. Entry into formal entrepreneurship involves acquisition of an investment license from a bureaucrat at zero price. Also, a household requires a non-divisible capital investment,  $K$ . Formal entrepreneurship yields  $\Lambda$  gross return. To yield the gross return  $\Lambda$ , a formal entrepreneur will borrow an amount equal to the difference between the investment cost,  $K$  and bequest received,  $b_t$ . We assume that a formal entrepreneur access' a loan from a financial intermediary at a competitive market rate of interest  $r$ . The financial intermediary's claim on the formal entrepreneur's gross income amounts to  $[K - b_t](1 + r)$ . As such, the formal entrepreneur's net payoff is the difference between the gross return and the financial intermediary's claim on an entrepreneur's gross income,  $[K - b_t](1 + r)$  that is<sup>14</sup>;

$$y_{t+1}^F = \Lambda - [K - b_t](1 + r) \quad (4.3)$$

Following Banerjee and Newman (1993) and Blackburn and Wang (2009), we allow for the possibility of an entrepreneur renegeing loan repayment. We assume that upon a borrower defaulting, the lender establishes an inefficient monitoring technology to recoup as much income as possible from the borrower. Inefficiency in the monitoring technology implies that a proportion  $\delta\Lambda$  of the defaulting borrower's gross income is recouped by the financial intermediary. A borrower chooses to renege the loan contract if the net income from loan default,  $[1 - \delta]\Lambda$  is greater than the net income upon commitment to the loan contract, equation (4.3). Implying that the formal entrepreneur will choose to renege loan payment if the difference between the investment cost,  $K$  and the discounted financial intermediary's return upon the formal entrepreneur defaulting,  $\frac{\delta\Lambda}{(1+r)}$  is greater or equal to the formal entrepreneur's bequest level,  $b_t$ , that is;

$$K - \frac{\delta\Lambda}{(1+r)} \geq b_t \quad (4.4)$$

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<sup>14</sup>Parameter restrictions imply that  $\Lambda - [K - b_t](1 + r) > 0$

From the formal entrepreneur's default decision rule, equation (4.4) we can derive the incentive compatible condition that rules out the possibility of an entrepreneur defaulting, that is;

$$b_t = K - \frac{\delta\Lambda}{(1+r)} = \omega \quad (4.5)$$

From equation (4.5), the incentive compatible condition is increasing in the cost of capital investment,  $K$  and inversely related to the discounted financial intermediary return upon the formal entrepreneur defaulting. The incentive compatible condition implies that only households with bequest level  $b_t > \omega$  access formal entrepreneurial investment credit. Therefore credit market rigidities restrict formal entrepreneurship to households with bequest level  $b_t > \omega$ .

Following our assumptions that in period  $t = 0$  households are given an initial bequest (endowment) that is uniformly distributed between 0 and  $\bar{b}$  with probability density function:  $f(b_0) = \frac{1}{\bar{b}}$  and that in each period there is a constant population normalised to 1, means that we can calculate the proportion of the population that will participate in all the sectors of the economy. For instance with reference to figure (4.1), the fraction of households that engage in formal entrepreneurship is  $1 - \frac{\omega}{\bar{b}}$ .

Note that formal entrepreneurship yields a net payoff given by equation (4.3). Substituting for the net payoff in the solution of the household's maximisation problem,  $U_t = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} y_{t+1}$  the lifetime utility of a formal entrepreneur is given by,

$$U_t^F = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} [\Lambda - [K - b_t] (1 + r)] \quad (4.6)$$

### **Subsistence livelihood**

The financial intermediary's mitigation against credit default risk implies that households with bequest level  $b_t < \omega$  are credit constrained and as such can not engage in formal entrepreneurship. This is consistent with empirical evidence in which Paulson and Townsend (2004) using the socio-economic and institutional survey data from the Central and Northeast regions of Thai-

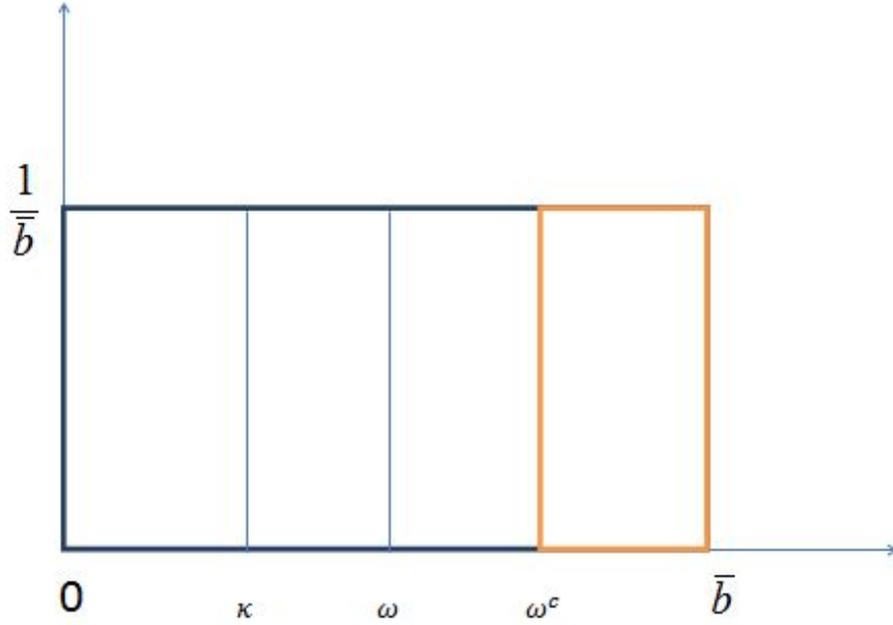


Figure 4.1: Distribution of initial bequest

land show that entrepreneurial activities depend on the existing financial constraints. In this case, households without access to the financial market, engage in subsistence livelihood. From figure (4.1), the fraction of subsistence livelihood households is equal to  $\frac{1}{b}\omega$ .

Subsistence livelihood is characterised by zero capital investment, entirely risk free and yields a gross revenue  $\sigma > 0$ . We assume that the gross return to subsistence livelihood is strictly less than the gross return to formal entrepreneurship that is,  $\sigma < \Lambda$ . Therefore, credit constrained households earn a net income given by;

$$y_{t+1}^S = (1 + r) b_t + \sigma \quad (4.7)$$

From the subsistence household's net income, equation (4.7) and the solution of the household's maximisation problem,  $U_t = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} y_{t+1}$  we can express the lifetime utility of a subsistence household as;

$$U_t^S = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} [(1 + r) b_t + \sigma] \quad (4.8)$$

Comparing equations (4.3) and (4.7), since formal entrepreneurship involves the use of a high yielding technology as opposed to subsistence livelihood such that  $\Lambda > \sigma$ , it follows that formal entrepreneurial income,  $y_{t+1}^F$  is greater than subsistence livelihood income,  $y_{t+1}^S$  by a magnitude  $[\Lambda - K(1+r)] - \sigma > 0$ . This is consistent with empirical evidence in which Paulson and Townsend (2004) show that the annual income of entrepreneurial households is twice greater than that of non-entrepreneurial households besides being wealthier.

Recall that from the optimal solution of a household's utility optimisation problem, the household's utility is increasing in occupational income that is,  $U_t(y_{t+1}^i)$  where  $i = F, S, I$  representing formal entrepreneurship, subsistence livelihood and informal entrepreneurship respectively. Therefore, for  $y_{t+1}^F > y_{t+1}^S$  it follows that  $U_t^F > U_t^S$ .

### **Dynamics of income distribution in the economy without informality**

Following the optimal solutions to the household's lifetime utility maximisation problem, the evolution of lineage income across generations is given by,  $b_{t+1} = (1 - \alpha)y_{t+1}$ . Substituting for the household's net income, we attain the following lineage wealth transition equations

$$b_{t+1} = \begin{cases} (1 - \alpha)[(1 + r)b_t + \sigma] & \dots \text{ if } 0 \leq b_t \leq \omega \\ (1 - \alpha)[\Lambda - [K - b_t](1 + r)] & \dots \text{ if } b_t > \omega \end{cases} \quad (4.9)$$

From the lineage wealth transition equations above, we are able to establish the long run income patterns of households given their initial bequest levels and subsequent occupational choices. To that end, we graphically characterise the transition equations as seen in figure (4.2)<sup>15</sup>. The 45 degree line is a locus of points corresponding to the steady state bequest levels such that

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<sup>15</sup>For the economy without corruption and informality, the figure (4.2) is drawn under the conditions that in the steady state,  $b^S < \omega$ , and  $b^F > \omega$ . These conditions are adopted for their plausibility and intuition.

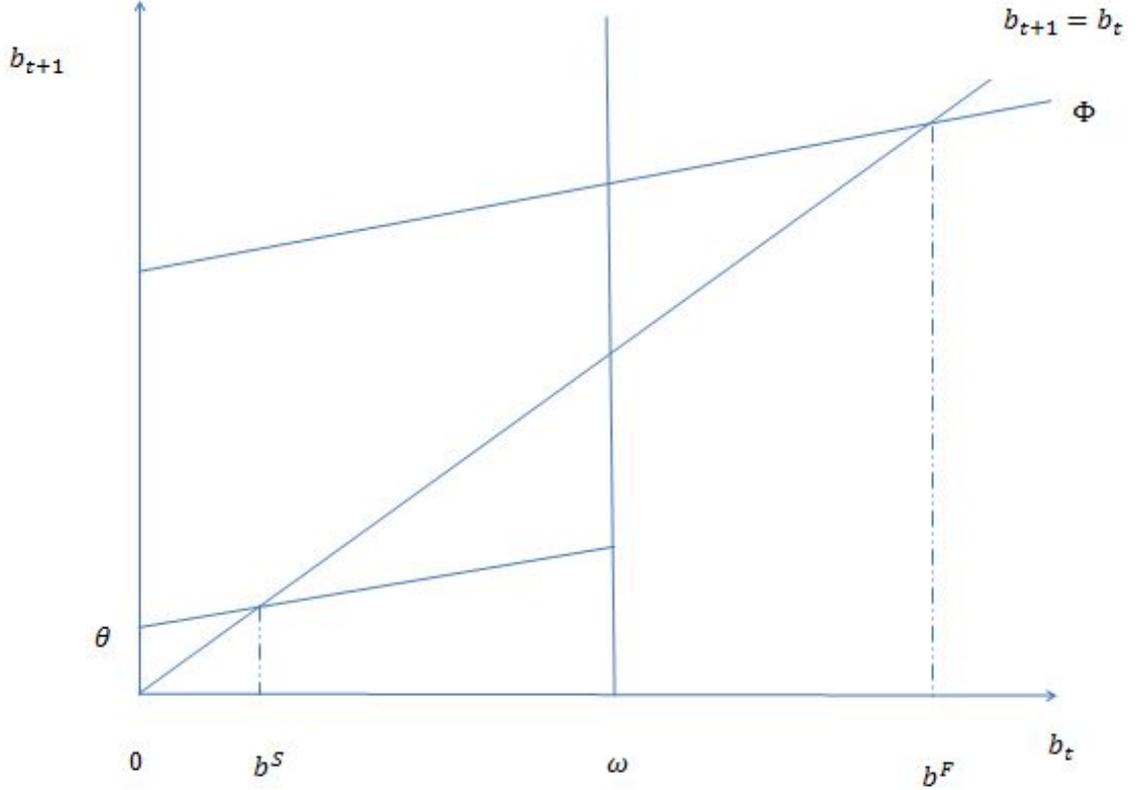


Figure 4.2: Income distribution in the economy without both corruption and informality

$b_{t+1} = b_t = b$ . Households in the bequest interval  $0 < b_t < \omega$  are subsistence households. Their transition equation is represented by the transition curve  $\theta$  with a slope  $0 < (1 - \alpha)(1 + r) < 1$ . The condition  $0 < (1 - \alpha)(1 + r) < 1$  is adopted to ensure stability of equilibrium bequest levels. Therefore, assuming steady state equilibrium such that  $b_{t+1} = b_t = b$ , the steady state level of bequest  $[b^S]$  among workers is given as,

$$b^S = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] \sigma \quad (4.10)$$

Households with an initial bequest level  $b_t > \omega$  engage in formal entrepreneurship. The long run income of formal entrepreneurs evolve along the tran-

sition curve  $\Phi$  with the intercept and slope given by  $[1 - \alpha] [\Lambda - (1 + r) K] > 0$  and  $0 < (1 - \alpha)(1 + r) < 1$  respectively. Assuming a steady state equilibrium such that  $b_{t+1} = b_t = b$ , the steady state level of bequest  $[b^F]$  among formal entrepreneurs is given as,

$$b^F = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] [\Lambda - (1 + r) K] \quad (4.11)$$

From equation (4.11), the steady state bequest,  $b^F$  is a function of the formal entrepreneur's steady state income that is,  $b^F [y^F]$ . Where  $b^{F'} [y^F] > 0$  implying that an increase (decrease) in the formal entrepreneurial steady income results in an outward (inward) shift of the steady state bequest,  $b^F$ .

From figure (4.2), households who are characterised by bequests such that  $b_t < \omega$  persistently engage in subsistence livelihood. While those that have bequests such that  $b_t > \omega$  persistently engage in formal entrepreneurship. Since the income that accrues to formal entrepreneurship is greater than the income that accrues to subsistence livelihood, at any point in time the economy is characterised by the relatively high income formal entrepreneurial households and relatively low income working households. Such economy has the potential to experience a high level of inequality.

### 4.2.3 Occupational choice and inequality in the economy with informality but without corruption

#### Informal entrepreneurship

The financial intermediary's mitigation against credit default risk implies that households with bequest level  $b_t < \omega$  are credit constrained. In the economy without informal entrepreneurship, such households engage in subsistence livelihood. We noted however, that under such a model environment income inequality could be relatively high. Would introducing informal entrepreneurship reduces the extent of income inequality?

Assume that informal entrepreneurship involves employing low yielding technology costing,  $\kappa$  and yielding output,  $\Omega$ . Informal entrepreneurial output,  $\Omega$  is less than the level of output in formal entrepreneurship,  $\Lambda$  although

greater the gross return to subsistence livelihood,  $\sigma$ . Households can only undertake informal entrepreneurship if their bequest level  $b_t \geq \kappa$ . Therefore households with an initial wealth such that  $\kappa \leq b_t \leq \omega$  engage in informal entrepreneurship. From figure (4.1), the fraction of informal entrepreneurial households amounts to  $\frac{1}{b}[\omega - \kappa]$ . While the fraction of formal entrepreneurial households remains unchanged, that of subsistence livelihood households reduces from  $\frac{1}{b}\omega$  to  $\frac{1}{b}\kappa$ .

The net payoff to informal entrepreneurship is the difference between the sum of the gross return to investment and the cost of informal sector investment,  $\Omega + (1 + r)(b_t - \kappa)$ , that is;

$$y_{t+1}^I = \Omega + (1 + r)(b_t - \kappa) \quad (4.12)$$

Following the optimal solution  $U_t = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} y_{t+1}$ , the informal entrepreneur's lifetime utility is given by,

$$U_t^I = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} [\Omega + (1 + r)(b_t - \kappa)] \quad (4.13)$$

Introduction of informal entrepreneurship implies that households with an initial wealth such that  $\kappa > b_t$  engage in subsistence livelihood yielding a net income given by equation (4.7) while households with a bequest such that  $\omega < b_t$  engage in formal entrepreneurship yielding a net income given by equation (4.3).

Comparing the income that accrues to both formal and informal entrepreneurs, parameter restrictions<sup>16</sup> imply that formal entrepreneurs earn more than informal entrepreneurs by a magnitude  $\Lambda - (\Omega + (1 + r)[K + \kappa]) > 0$ . Also parameter restrictions imply that informal entrepreneurial income is greater than subsistence livelihood income by a magnitude  $\Omega - [\sigma + (1 + r)\kappa] > 0$ . From the optimal solution of a household's optimisation problem, the household's lifetime utility is increasing in occupational income. Therefore, for  $y_{t+1}^F > y_{t+1}^I > y_{t+1}^S$  and given that a household's lifetime utility is in-

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<sup>16</sup>Since the formal entrepreneurship involves use of high yielding technology as opposed to the low yielding rudimentary technology in the informal sector, it must be the case that  $\Lambda > \Omega$ .

creasing in the occupational income, it follows that the lifetime utility that accrues to a formal entrepreneur,  $U_t^F$  is greater than the lifetime utility from informal entrepreneurship,  $U_t^I$  while  $U_t^I$  is greater than the lifetime utility that accrues to subsistence livelihood,  $U_t^S$ .

### **Dynamics of income distribution with informality but without corruption**

Following the optimal solutions to the household's lifetime utility maximisation problem, the evolution of lineage income across generations is given by,  $b_{t+1} = (1 - \alpha) y_{t+1}$ . Substituting for the household's net income, we attain the following lineage wealth transition equations

$$b_{t+1} = \begin{cases} (1 - \alpha) [(1 + r) b_t + \sigma] \dots \text{if } 0 \leq b_t < \kappa \\ (1 - \alpha) [\Omega + (1 + r) (b_t - \kappa)] \dots \text{if } \kappa \leq b_t \leq \omega \\ (1 - \alpha) [\Lambda - [K - b_t] (1 + r)] \dots \text{if } b_t > \omega \end{cases} \quad (4.14)$$

From the lineage wealth transition equations above, we are able to establish the long run income patterns of the households given their initial bequest levels and subsequent occupational choices in the economy characterised by no-corruption and with an informal sector. To that end, we graphically characterise the transition equations as in figure (4.3)<sup>17</sup>. Households in the bequest interval  $0 \leq b_t < \kappa$  engage in subsistence livelihood and their long run wealth evolves along the transition curve  $\theta$  with a corresponding intercept and slope given by  $(1 - \alpha) \sigma$  and  $0 < (1 - \alpha) (1 + r) < 1$  respectively. The condition  $0 < (1 - \alpha) (1 + r) < 1$  is adopted to ensure stability of the equilibrium bequest levels. The optimal solution,  $b_{t+1} = (1 - \alpha) y_{t+1}$  implies that a household's transition path of long run wealth shifts with changes in net income. However, since the introduction of informal entrepreneurship does not affect the net income for subsistence households, the long run wealth

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<sup>17</sup>For the economy without corruption but with informality, figure (4.3) is drawn under the conditions that in the steady state,  $b^S < \kappa$ ,  $\kappa < b^I < \omega$ , and  $b^F > \omega$ . These conditions are adopted for their plausibility and intuition.

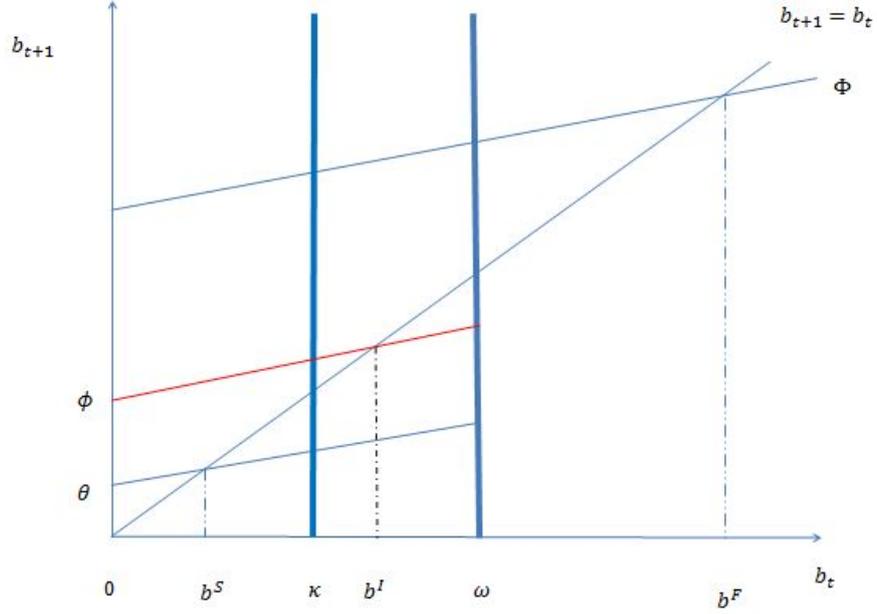


Figure 4.3: Income distribution in the economy with informality but without corruption

of these households evolves along the same path as that of subsistence households in the economy without informal entrepreneurship. Correspondingly, assuming steady state equilibrium such that  $b_{t+1} = b_t = b$ , the steady state bequest level of subsistence households remains unchanged and is given as,

$$b^S = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] \sigma$$

For households with the initial bequest level in the interval  $\kappa \leq b_t \leq \omega$ , they engage in informal entrepreneurship. Their transition equation is captured by the transition path  $\phi$  with the intercept and slope given by  $[1 - \alpha](\Omega - (1 + r)\kappa) > 0$  and  $0 < (1 - \alpha)(1 + r) < 1$  respectively. Since the income that accrues to informal entrepreneurs, equation (4.12) is greater than the income that accrues to subsistence households, equation (4.7) it follows that the transition path  $\phi$  is higher than the transition path  $\theta$ . Recall that households in the bequest interval  $\kappa \leq b_t \leq \omega$  were initially engaging

in subsistence livelihood with a corresponding transition path  $\theta$ . However, their choice of entry into informal entrepreneurship enhances their income from equation (4.7) to equation (4.12). Substituting for the informal entrepreneur's net income in the optimal solution  $b_{t+1} = (1 - \alpha) y_{t+1}$ , the long run wealth of informal entrepreneurs evolves along the transition path  $\phi$ . The effect of informal entrepreneurship is therefore to enhance the long run evolution of income among households that opt out of subsistence livelihood for informal entrepreneurship.

Assuming steady state equilibrium such that  $b_{t+1} = b_t = b$ , the steady state level of bequest among informal entrepreneurs  $[b^I]$  is given as,

$$b^I = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] (\Omega - (1 + r) \kappa) \quad (4.15)$$

Households with an initial bequest level  $b_t > \omega$  engage in formal entrepreneurship. The transition equation of these households is captured by the transition curve  $\Phi$  which is characterised by the intercept and slope  $[1 - \alpha] (\Lambda - (1 + r) K) > 0$  and  $0 < (1 - \alpha)(1 + r) < 1$  respectively. Since in our model informal entrepreneurship does not affect formal entrepreneurship, the income to formal entrepreneurship remains unchanged. Correspondingly, from the optimal solution,  $b_{t+1} = (1 - \alpha) y_{t+1}$  and as seen in figure (4.3), the long run wealth of formal entrepreneurial households still evolves along the transition path  $\Phi$ . Assuming steady state equilibrium such that  $b_{t+1} = b_t = b$ , the steady state level of bequest  $[b^F]$  among formal entrepreneurs given informal entrepreneurship is,

$$b^F = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] (\Lambda - (1 + r) K) \quad (4.16)$$

Evidently, the economy with informal entrepreneurship has three income brackets: relatively high income, middle income and relatively low income households corresponding with formal entrepreneurs, informal entrepreneurs and subsistence households respectively. As is evident from figure (4.3) and in comparison to figure (4.2), the economy with an informal sector is seen to exhibit a more varied distribution of income. Unlike the economy with-

out an informal economy, the economy with an informal sector reduces the divergence between the relatively high income group (formal entrepreneurs) and households in the bequest interval  $\kappa \leq b_t \leq \omega$  that choose to engage in informal entrepreneurship which yields a higher income than subsistence livelihood. Most importantly though is that the introduction of informal entrepreneurship increases the income of the fraction of households that decide to undertake informal entrepreneurship as opposed to engaging in subsistence livelihood. As such the existence of the informal sector has the potential to reduce the extent of income inequality in the economy without corruption.

#### **4.2.4 Occupational choice and inequality in the economy with both corruption and informality**

In this section, an attempt is made to accommodate a typical developing country situation where entry into the formal sector involves bureaucratic rigidities and consequently bribe payments ( $B$ ). We also consider an environment where informal entrepreneurship is already in the economy. The objective is to understand how corruption interacts with income distribution. We also seek to explore whether the informal sector has a role to play in the interaction between corruption and income inequality.

##### **Formal sector entrepreneurship**

With corruption, the total loan requirement for formal entrepreneurship increases by the amount of the bribe, that is;  $B + K - b_t$ . Regarding interest rates on loans, there is a consensus that interest rates are positively related with the quality of institutional framework in a country not to mention the level of corruption. For instance, Ciocchini et al. (2003) shows that decreasing corruption from the level prevalent in China or Ukraine to that in Jamaica leads to a reduction in spreads by about one-fifth. Also, Qian and Stahan (2007) show that stronger creditor protection is associated with lower interest rates and longer credit maturities. For instance a loan to a Mexican (British) firm where the credit rights are weak (stronger) attracts a maturity which is 40% shorter than that of its British counterpart. There-

fore, where collateral is relatively ineffective (for example in an environment of increased risk of government expropriation), financial institutions opt for loans with a shorter maturity implying higher interest rates. Furthermore, an improvement in the creditor rights by one standard deviation implies a 10% increase in loan maturity (which also implies lower interest rates). In a theoretical investigation, Blackburn and Wang (2009) show that corruption endogenously increases interest rates as a result of the uncertainty regarding the profitability of formal entrepreneurship which increases the likelihood of entrepreneurs reporting bankruptcy. While the preceding arguments avail empirical and theoretical accounts of a positive relationship between interest rates and corruption as we shall see later, the objective of this paper can be reasonably explored without necessarily tampering with interest rates.

Note that since bribe payment is captured as an additional fixed cost, therefore formal entrepreneurial income with corruption,  $y_{t+1}^{F/C}$  is given by,<sup>18</sup>

$$y_{t+1}^{F/C} = \Lambda - (B + K - b_t)(1 + r) \quad (4.17)$$

Like in the corruption free economy, we assume that in the event an entrepreneur declares bankruptcy, the financial intermediary would seek to wind-up the entrepreneur in an attempt to minimise its losses. However, inefficiency in the monitoring technology restricts the financial intermediary to recovering only a proportion  $\delta\Lambda$  of an entrepreneur's gross income. An entrepreneur will default if the loss in gross income from loan default is less than the loan repayment upon commitment to the loan contract,  $-\delta\Lambda > -(B + K - b_t)(1 + r)$ . From the preceding loan default rule, the incentive compatible condition which mitigates loan default is given by,

$$b_t = [B + K] - \frac{\delta\Lambda}{(1 + r)} = \omega^c \quad (4.18)$$

From equation (4.18),  $\omega^c$  defines the bequest threshold level above (below) which a household is corruption-induced credit unconstrained (constrained). Evidently,  $\omega^c$  is increasing in bribe payment. Note however that corruption

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<sup>18</sup>Similarly, parameter restrictions imply that  $\Lambda - (B + K - b_t)(1 + r) > 0$  otherwise formal entrepreneurship would not be feasible.

has both direct and indirect effects. The direct effect is permeated through bribe payments. While the indirect effect is channelled through the positive relationship between corruption and interest rates. In this paper, we capture the direct effect of corruption in the sense that the bequest threshold level above (below) which a household is corruption-induced credit unconstrained (constrained) increases by the amount of bribe payment.

Given corruption-induced credit market imperfection, formal entrepreneurship is restricted to households with bequest levels  $b_t > \omega^c$ . From figure (4.1), the fraction of formal entrepreneurial households given corruption amounts to  $1 - \frac{1}{b}\omega^c$ . These credit unconstrained households have an income level given by equation (4.17). From equation (4.17) and the household's lifetime utility maximisation solution,  $U_t = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} y_{t+1}$  the lifetime utility of a household in formal entrepreneurship given corruption is,

$$U_t^{F/C} = \alpha^\alpha (1 - \alpha)^{(1-\alpha)} [\Lambda - [B + K - b_t] (1 + r)] \quad (4.19)$$

A comparison of the income between formal entrepreneurship without corruption,  $y_{t+1}^F$  and formal entrepreneurship with corruption,  $y_{t+1}^{F/C}$ ,  $y_{t+1}^F$  is greater than  $y_{t+1}^{F/C}$ . This is because while both sets of entrepreneurs use the same quality of capital and thus incur the same capital cost, formal entrepreneurs in the economy with corruption incur an additional cost associated with bribe payment. Therefore  $y_{t+1}^F > y_{t+1}^{F/C}$  by a proportion  $B(1+r) > 0$  which captures that part of would be capital investment spent on bribe payment and yet the entrepreneur has to pay it back to the financial intermediary with an interest  $(1+r)$ . Since the household's lifetime utility is increasing in the household's income, it follows that the lifetime utility from formal entrepreneurship in the economy without corruption,  $U_t^F$  is greater than the lifetime utility from formal entrepreneurship in the economy with corruption,  $U_t^{F/C}$ .  $U_t^F > U_t^{F/C}$  by a proportion  $\alpha^\alpha (1 - \alpha)^{(1-\alpha)} [B(1+r)]$ .

### **Informal sector entrepreneurship**

The choice of entry into the informal sector remains the same since none of the households is required to purchase bureaucratic investment licences as

such no bribe payments are involved. However, households in the bequest interval  $\omega \leq b_t \leq \omega^c$  are now corruption-induced credit constrained and have to choose between informal entrepreneurship and subsistence livelihood. Following our parameter restrictions, since the net income to informal entrepreneurship,  $y_{t+1}^I$  is greater than the net income to subsistence livelihood  $y_{t+1}^S$ , it follows that the lifetime utility from informal entrepreneurship,  $U_t^I$  is greater than the lifetime utility from subsistence livelihood,  $U_t^S$ . Therefore, households in the bequest interval  $b_t \in [\omega, \omega^c]$  strictly prefer informal entrepreneurship as opposed to subsistence livelihood. Thus, the ultimate effect of corruption induced-credit market rigidities is to increase the size of informal entrepreneurship or the bequest interval within which households prefer to undertake informal entrepreneurship from  $\kappa \leq b_t \leq \omega$  to  $\kappa \leq b_t \leq \omega^c$ . In terms of figure (4.1), the fraction of informal entrepreneurial households increases from  $\frac{1}{b}[\omega - \kappa]$  to  $\frac{1}{b}[\omega^c - \kappa]$ . This result is supported by Johnson et al. (1998) and Friedman et al. (2000) empirical investigations where they established that the size of the informal economy has a significantly robust positive relationship with the level of corruption.

While entrepreneurs with bequest levels  $b_t > \omega^c$  might choose to go informal as an escape route from bureaucratic corruption in the formal sector, however the inability to fully exploit their entrepreneurial potential would water down incentives to go informal. This is because: 1) The gross return from formal entrepreneurship,  $\Lambda$  is greater than the gross return from informal entrepreneurship,  $\Omega$ ; 2) From 1) the lifetime utility from formal entrepreneurship,  $U_t^{F/C}$  is greater than the lifetime utility from informal entrepreneurship,  $U_t^I$  by a proportion  $\alpha^\alpha (1 - \alpha)^{(1-\alpha)}(\Lambda - \Omega + (1 + r)[B + K]) > 0$ . 3) If  $\Lambda < \Omega$  then most likely the technology being employed by the informal entrepreneur could be conspicuous hence increasing the likelihood of bureaucratic attention. Thus, households with bequest level  $b_t > \omega^c$  have a strict preference for formal entrepreneurship as opposed to informal entrepreneurship even in the midst of corruption.

## Subsistence livelihood

Since households in the subsistence sector do not interact with bureaucrats, the net income and lifetime utility among subsistence households remains the same as that in the economy without corruption that is  $y_{t+1}^S = (1+r)b_t + \sigma$  and  $U_t^S = \alpha^\alpha (1-\alpha)^{(1-\alpha)} [(1+r)b_t + \sigma]$  respectively.

## Dynamics of income distribution in the economy with corruption and informality

Following the optimal solutions to the household's lifetime utility maximisation problem, the evolution of lineage income across generations is given by  $b_{t+1} = (1-\alpha)y_{t+1}$ . We can thus attain the following lineage wealth transition equations

$$b_{t+1} = \begin{cases} (1-\alpha)[(1+r)b_t + \sigma] \dots & \text{if } b_t < \kappa \\ (1-\alpha)[\Omega + (1+r)(b_t - \kappa)] \dots & \text{if } \kappa \leq b_t \leq \omega^c \\ (1-\alpha)[\Lambda - [B + K - b_t](1+r)] \dots & \text{if } \omega^c < b_t \end{cases} \quad (4.20)$$

Using the transition equations, we can graphically characterise the income dynamics of households given their initial incomes and subsequent occupational choices as is seen in figure (4.4)<sup>19</sup>. The lineage wealth of subsistence households is represented by the transition curve with its steady state equilibrium being established at  $b^S = \left[ \frac{1-\alpha}{(1-(1-\alpha)(1+r))} \right] \sigma$ .  $b^S$  is left unchanged because subsistence households do not interact with bureaucrats as opposed to households in formal entrepreneurship as such their net income remains unchanged.

The lineage wealth of informal entrepreneurs is represented by the transition path  $\theta$  with the intercept represented by  $[1-\alpha](\Omega - (1+r)\kappa) > 0$ . This transition path however now includes households in the bequest interval  $\omega \leq b_t \leq \omega^c$ . These households were initially formal entrepreneurs however because of corruption-induced credit market rigidities they are crowded out

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<sup>19</sup>For the economy with corruption and informality, the figure (4.4) is drawn under the conditions that in the steady state,  $b^S < \kappa$ ,  $\kappa < b^I < \omega^c$ , and  $b^{F/C} > \omega^c$ . These conditions are adopted for their plausibility and intuition.

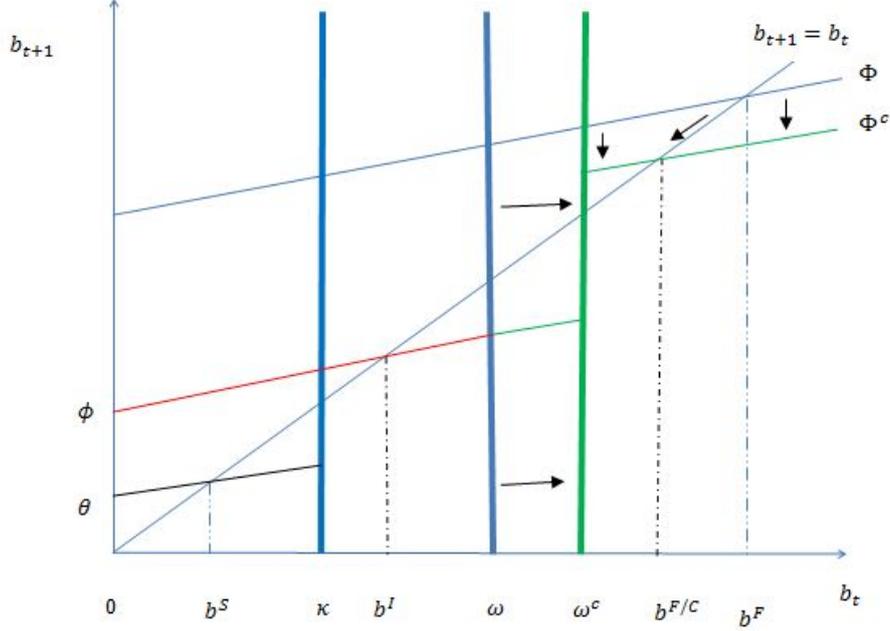


Figure 4.4: Income distribution in the economy with both corruption and informality

of the formal sector for informal entrepreneurship. Following our parameter restrictions, informal entrepreneurial income, equation (4.12) is less than formal entrepreneurial income in the economy with corruption, equation (4.17). Therefore, from the optimal solution,  $b_{t+1} = (1 - \alpha) y_{t+1}$ , it follows that households in the bequest interval  $\omega < b_t < \omega^c$  experience a shift downwards in the bequest schedule from  $\Phi$  to  $\theta$ . Where the bequest schedule  $\Phi(\theta)$  is associated with formal entrepreneurs in the economy without corruption (informal entrepreneurs in the economy with or without corruption). Overall, the steady state bequest  $b^I < \omega^c$  for households in the informal sector remains the same as that in the economy with an informal sector but without corruption, that is;

$$b^I = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] \Omega \quad (4.21)$$

With regard to households that remain in the formal sector, their bequest

transition path is represented by  $\Phi^c$  with an intercept at  $(1 - \alpha) [\Lambda - [B + K] (1 + r)]$ . Note that corruption has two effects in the formal sector: 1) It increases the bequest threshold upon which one can access credit from  $\omega$  to  $\omega^c$ . Implying that households in the wealth interval  $\omega < b_t < \omega^c$  who in the economy without corruption were engaged in formal entrepreneurship are now credit constrained. These households inevitably undertake informal entrepreneurship; 2) Bribe payment shifts the transition path of formal entrepreneurs downwards from the transition path  $\Phi$  to the transition path  $\Phi^c$ . Recall that the first effect arises from corruption increasing the cost of investing which reduces the return to formal entrepreneurship. The reduction in returns to formal entrepreneurship increases the likelihood of credit default. Financial intermediaries react by increasing the threshold level of collateral above which one can acquire credit. The high threshold level of collateral constrains some households from formal entrepreneurship. In our model, households in the bequest interval  $\omega < b_t < \omega^c$  are frozen out of formal entrepreneurship. With regard to the second effect, recall that the optimal solution,  $b_{t+1} = (1 - \alpha) y_{t+1}$  implies that a household's transition path of long run wealth shifts with changes in net income. Since corruption reduces the formal entrepreneurial net income from equation (4.3) to equation (4.17) and as seen in figure (4.4), the transition path of formal entrepreneurs shifts downwards from  $\Phi$  to transition path  $\Phi^c$ . The downward shift in the transition path of the long run wealth of formal entrepreneurs is by the amount of bribe plus interest paid on the bribe<sup>20</sup>,  $(1 + r) B$ .

Assuming that in equilibrium  $b_{t+1} = b_t = b$ , the corresponding steady state bequest level of formal sector entrepreneurship shifts inwards from  $b^F$  to  $b^{F/C} > \omega^c$ , where;

$$b^{F/C} = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] (\Lambda - (1 + r) [B + K]) \quad (4.22)$$

and that  $b^F > b^{F/C}$ . Since the bequest level determines how much one can borrow to finance private investment, the lower steady state bequest level

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<sup>20</sup>This is because part of the money borrowed from financial intermediaries is used to pay bribes to bureaucrats

$b^{F/C}$  as a result of corruption implies that the level of economic activities in the economy is lower. This is because, the lower steady state bequest level  $b^{F/C}$  implies a lower level of collateral at the disposal of households. Therefore the credit accessible to entrepreneurs in the steady state is equally lower as compared to when the economy is at steady state bequest level  $b^F$ . Thus, the level of economic activities is lower with corruption than without corruption.

Like the economy without corruption but with informal entrepreneurship, the economy with corruption-induced credit market rigidities has three income brackets; relatively high income, middle income and relatively low income households corresponding with; formal entrepreneurial, informal entrepreneurial, and subsisting households respectively. However with corruption, the occupational choice of households and their subsequent long run wealth dynamics are hinged on both the initial wealth distribution and the extent of corruption-induced credit market rigidities. Furthermore, the effect of corruption is to increase (decrease) in the fraction of middle income informal (relatively high income formal) entrepreneurial households while leaving the fraction of subsistence households unchanged. Under such circumstances, an increase in corruption could potentially be associated with a reduction in inequality.

#### **4.2.5 Occupational choice and inequality in the economy with corruption but without informality**

##### **Formal entrepreneurship**

Like in the economy with both formal and informal entrepreneurship, the effect of corruption in the economy without informal entrepreneurship is to increase the cost of credit. With corruption, formal entrepreneurs pay an amount  $B$  as a bribe to bureaucrats to have their business' registered or access public services. Therefore the cost of formal entrepreneurship increases by the amount of the Bribe that is,  $B + K - b_t$ . Implying that the net return to formal entrepreneurship is given by;

$$y_{t+1}^{F_{NI}/C} = \Lambda - (B + K - b_t)(1 + r) \quad (4.23)$$

In terms of credit access, like in the economy with formal and informal entrepreneurship given corruption, the effect of corruption in the economy without informal entrepreneurship is to increase the bequest threshold level above which a household can access credit from  $\omega$  to  $\omega^c$ . Implying that only households with the bequest level such that  $b_t > \omega^c$  can undertake formal entrepreneurship. While households in the bequest interval  $\omega \leq b_t \leq \omega^c$  are deemed to be corruption-induced credit constrained and as such can not engage in formal entrepreneurship. Consequent from figure (4.1), the fraction of formal entrepreneurial households decreases from  $1 - \frac{\omega}{b}$  to  $1 - \frac{\omega^c}{b}$ .

Unlike the economy with both formal and informal entrepreneurship where households that were corruption-induced credit constrained undertake informal entrepreneurship, in the economy without informal entrepreneurship, households that are corruption-induced credit constrained undertake subsistence livelihood.

### **Subsistence livelihood**

The financial intermediary's mitigation against credit default risk ensures that households with a bequest level  $b_t < \omega^c$  are crowded out of the financial market and engage in subsistence livelihood. Compared to the economy with both corruption and informality, the effect of corruption in the economy without informality is that the bequest interval within which households engage in subsistence livelihood increases by  $\omega \leq b_t \leq \omega^c$ . Implying that unlike in the economy with both corruption and informality where corruption-induced credit constrained households engage in informal entrepreneurship, in the economy with corruption and without informality corruption-induced credit constrained households engage in subsistence livelihood. From figure (4.1), the fraction of subsistence livelihood households increases from  $\frac{\omega}{b}$  to  $\frac{\omega^c}{b}$ .

Like in the economy with or without both corruption and informality, since subsistence households do not require investment licenses from bureaucrats, they do not pay any bribes. Therefore the net income and lifetime util-

ity among subsistence households remains the same as that in the economy with or without both corruption and informality that is  $y_{t+1}^S = (1+r)b_t + \sigma$  and  $U_t^S = \alpha^\alpha (1-\alpha)^{(1-\alpha)} [(1+r)b_t + \sigma]$  respectively.

The corresponding lifetime utility of subsistence households is  $U_t^S = \alpha^\alpha (1-\alpha)^{(1-\alpha)} [(1+r)b_t + \sigma]$ . Comparing the income that accrues to formal entrepreneurship and subsistence livelihood in the economy with corruption but without informality, the parameter restrictions imply that households are strictly better off engaging formal entrepreneurship as opposed to subsistence livelihood by a magnitude  $(\Lambda - \sigma) - (B + K)(1+r) > 0$ . Correspondingly in the economy with corruption, the lifetime utility from formal entrepreneurship is strictly greater than the lifetime utility from subsistence livelihood since the household's lifetime utility is increasing in their occupational income that is  $U_t^{FINC} > U_t^S$ .

### **Dynamics of income distribution in the economy with corruption but without informality**

Following the optimal solutions, the lineage wealth transition equation for households that engage in formal entrepreneurship can be derived from  $b_{t+1} = (1-\alpha)y_{t+1}^{FNI/C}$ . While that of households that engage in subsistence livelihood it can be derived from  $b_{t+1} = (1-\alpha)y_{t+1}^S$ . Substituting for both  $y_{t+1}^{FNI/C}$  and  $y_{t+1}^S$  yields the following transition equations;

$$b_{t+1} = \begin{cases} (1-\alpha)[\sigma + (1+r)b_t] & \dots \text{ if } b_t \leq \omega^c \\ (1-\alpha)[\Lambda - [B + K - b_t](1+r)] & \dots \text{ if } \omega^c < b_t \end{cases} \quad (4.24)$$

Using the lineage wealth transition equations, we can establish the long run income patterns of households given their occupational choices and initial bequests. With regard to households in the subsistence sector, assuming that in the steady state  $b_{t+1} = b_t = b$  their steady state bequest level is given as;

$$b^S = \left[ \frac{1-\alpha}{(1-(1-\alpha)(1+r))} \right] \sigma \quad (4.25)$$

To ensure the stability of  $b^S < \omega^c$ , we assume that  $0 < (1-\alpha)(1+r) < 1$ .

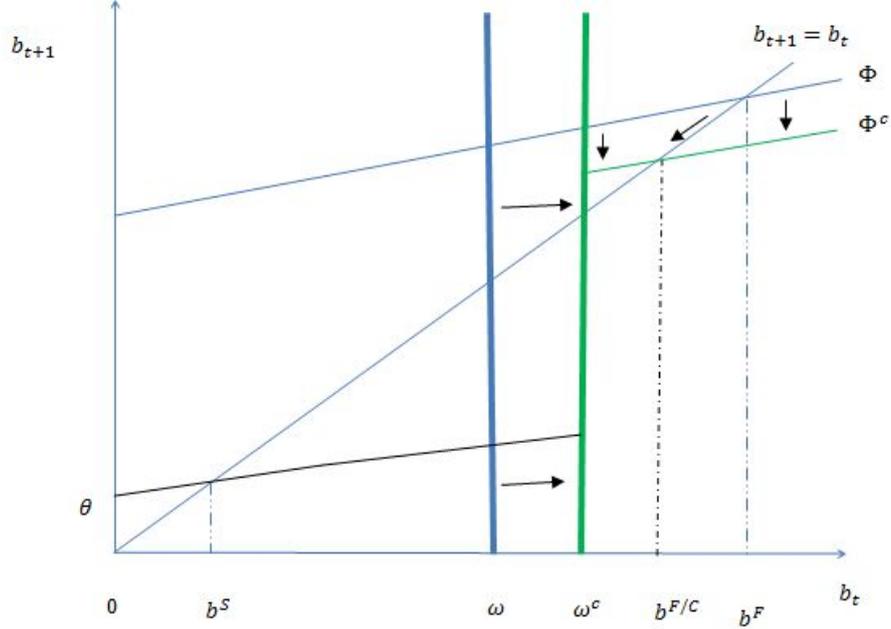


Figure 4.5: Income distribution in the economy with corruption but without informality

In light of households that engage in formal entrepreneurship, these households evolve along the transition path  $\Phi^c$  with the intercept given by  $1 - \alpha [\Lambda - [B + K] (1 + r)]$ . Assuming that in the steady state  $b_{t+1} = b_t = b$  their steady state bequest level is given as;

$$b^{F_{INC}} = \left[ \frac{1 - \alpha}{(1 - (1 - \alpha)(1 + r))} \right] [\Lambda - [B + K] (1 + r)] \quad (4.26)$$

Clearly, in both economies with or without informal entrepreneurship, the effect of corruption is to reduce to formal entrepreneurship by a fraction  $B(1 + r)$ . As such the steady state bequest levels in both economies are such that  $b^{F_{INC}} = b^{F/C} > \omega^c$  as is shown in figure (4.5)<sup>21</sup>.

In terms of income distribution, corruption introduces credit market rigidi-

<sup>21</sup>For the economy with corruption and without informality, the figure (4.5) is drawn under the conditions that in the steady state,  $b^S < \omega^c$ , and  $b^F > \omega^c$ . These conditions are adopted for their plausibility and intuition.

ties leading to contraction in formal entrepreneurship. In the absence of informal entrepreneurs the corruption-induced credit constrained households engage in subsistence livelihood. As such the long run income distribution is such that there exists relatively high income households and relatively low income households who engage in formal entrepreneurship and subsistence livelihood respectively. Entry into the subsistence sector of corruption-induced credit constrained households suggests that inequality could potentially increase. This is because more households are engaging in the relatively low income subsistence occupation with a reducing fraction of the relatively high income formal entrepreneurial households.

In comparison to the economy with informality, entry into the informal entrepreneurship of corruption-induced credit constrained households reduces the extent of income inequality attributed to corruption. This is because informal entrepreneurship yields a relatively higher level of income than subsistence livelihood. As such the economy is characterised by an increase in the fraction of middle income informal entrepreneurial households, a decrease in the fraction of relatively high income formal entrepreneurial households while the fraction of subsistence households remains unchanged in an environment of corruption. Under such circumstances, corruption may not result in an increase in inequality.

In the following subsection, we undertake a numerical analysis to highlight the role that the informal sector plays in mitigating the impact of corruption on income inequality.

#### **4.2.6 Numerical analysis**

In this numerical analysis we seek to emphasise the role of the informal sector in mitigating the effect of corruption on income inequality. We explore different combinations of an economy with formal entrepreneurs, informal entrepreneurs and subsistence livelihood households, in an environment with and without corruption. We also explore an economy with formal entrepreneurial and subsistence livelihood households in an environment with or without corruption. The benchmark scenario looks at an economy with a uniform

<b>Parameter</b>	<b>Value</b>
$r$	0.05
$\delta$	0.7
$K$	140,000
$\Omega$	30,000
$\Lambda$	190,000
$\kappa$	1,500
$\sigma$	3,687.5

Table 4.1: Parameter Values

distribution of initial wealth from 0 to 20,000. As a robustness check we vary the distributions of household initial wealth and compare the findings with those in the benchmark scenario. We also account for the effect of difference in net income between formal and informal entrepreneurial households by varying the net income that accrues to informal entrepreneurial households. We equally compare the results to the findings in the benchmark scenario. Otherwise the numerical analysis assumes a population of 100 households.

Regarding the model parameter values, Wojciech and Lupton (2007) show that households with a bequest motive on average spend 25% less on consumption expenditure. The numerical exercise therefore assumes that households spend  $\alpha = 25\%$  of their net income on bequest motive. With regard to the amount of bribe payable, we allude to a study by Rand and Tarp (2007) in which they show that on average firms in Vietnam spend 0.55 percent of firm revenue on bribe payment,  $B = 0.0055\Lambda$ . Otherwise, the other parameter values as seen in table (4.1) are chosen so as to ensure that: 1) the net income that accrues to formal entrepreneurship is always greater than the net income that accrues to informal entrepreneurship; 2) the net income that accrues to informal entrepreneurship is always greater than the net income that accrues to subsistence livelihood; and 3) credit market constraints with or without corruption hold. Table (4.1) below is a list of parameter values used;

Substituting for the parameter values in equations (4.3), (4.17), and (4.23) we get  $y_{t+1}^F = 58,305.08$ ,  $y_{t+1}^{F/C} = 56,817$ , and  $y_{t+1}^{FNI/C} = 56,817$  respectively. Substituting for the parameter values in equations (4.12) and (4.7)

we get  $y_{t+1}^I = 38,542.4$  and  $y_{t+1}^S = 5,000$  respectively. Substituting for the parameter values in equations (4.5) and (4.18) we get  $\omega = 13,333.33$  and  $\omega^c = 14,378$  respectively. Substituting for the parameter values in equations (4.11), (4.22), (4.15), and (4.10) we get  $b^F = 14,576.27$ ,  $b^{F/C} = 14,204.32$ ,  $b^I = 9,635.6$ , and  $b^S = 1,250$  respectively.

The distribution of income among households is measured using the Gini coefficient. The Gini coefficient ranges from 0 to 1. Where 0 represents an economy with perfect equality that is all households have the same level of income or wealth. While 1 represents an economy with perfect inequality that is one person owns all the economy's wealth while others have zero wealth. Therefore as the Gini coefficient approaches 1 the higher is the level of inequality in an economy. While as the Gini coefficient approaches 0 the lower is the level of inequality in an economy. In this numerical exercise, we use Matlab to calculate the Gini coefficient<sup>22</sup>.

**Benchmark scenario** Consider an economy characterised by a uniform distribution of initial wealth from 0 to 20,000 such that in an environment without both corruption and informality, credit market rigidities imply that 67% and 33% of the household population engages in subsistence livelihood and formal entrepreneurship respectively in  $t = 0$ . These proportions remain the same in the long run were bequests converge to single values for formal and subsistence livelihood. In light of figure (4.2), subsistence livelihood (formal entrepreneurial) households are households who have an initial bequest level such that  $b_t \leq \omega$  ( $b_t > \omega$ ). Given the net income of 5,000 and 58,305.08 to subsistence livelihood and formal entrepreneurial households respectively, the Gini coefficient for such an economy is 0.3853. Such a Gini coefficient implies a relatively low level of income inequality.

Introducing corruption, corruption-induced credit market rigidities imply that the fraction of subsistence livelihood households increases to 72% of the household population while that of formal entrepreneurial households reduces to 28% of the household population. This is consistent with figure (4.5) where

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<sup>22</sup>We make use of the Matlab codes developed by Lengwiler (2010) to calculate the Gini coefficient. See Appendix A

we show that the effect of corruption is to increase (decrease) the bequest interval within which households participate in subsistence livelihood (formal entrepreneurship) by  $\omega \leq b_t \leq \omega^c$ . Besides corruption leads to a reduction in formal entrepreneurial income from 58,305.08 to 56,817. The corresponding Gini coefficient for such an economy is 0.4332 which also signals a relatively low level of income inequality. In comparison to the economy without both corruption and informality, the Gini coefficient is higher in the economy with corruption but without informality by 0.0479. This implies that corruption leads to an increase in income inequality in an economy without informality. The higher level of inequality in the economy with corruption but without informality is because corruption leads to an increase (decrease) in household participation in the low income subsistence livelihood (high income formal entrepreneurship). Consequently, the economy has more relatively low income households and less relatively high income households hence a higher level of inequality.

In the economy without corruption but with informality, credit market rigidities imply that 33% of the household population engages in formal entrepreneurship. With regard to figure (4.3) formal entrepreneurial households encompasses households with an initial bequest level  $b_t > \omega$ . Given the entry cost into informal entrepreneurship, the fraction of informal entrepreneurial and subsistence livelihood households is 59% and 8% of the household population respectively. In light of figure (4.3) informal entrepreneurial and subsistence livelihood households includes households whose initial bequest is such that  $\kappa \leq b_t \leq \omega$  and  $b_t < \kappa$  respectively. Formal entrepreneurial, informal entrepreneurial and subsistence livelihood households earn 58,305.08, 38,542.4 and 5,000 respectively. Note that informal entrepreneurial households were initially earning 5,000 in an economy without informality; however, their entry into informal entrepreneurship as opposed to subsistence livelihood yields a net income 38,542.4. Given the household occupational choices and their corresponding income, the corresponding Gini coefficient is 0.1044. This Gini coefficient implies a relatively low level of income inequality.

In an environment with both corruption and informality however, the

effect of corruption is to increase the fraction of households that engage in informality to 64% of the household population. At the same time, corruption reduces the fraction of formal entrepreneurial households to 28% of the household population. In light of figure (4.4) the increase (decrease) in household participation in informality (formal entrepreneurship) is equivalent to the households in the bequest interval  $\omega \leq b_t \leq \omega^c$ . Otherwise the fraction of subsistence livelihood households remains unchanged at 8% of the household population. In an economy with both corruption and informality, formal entrepreneurial, informal entrepreneurial and subsistence livelihood households earn 56,817, 38,542.4 and  $y_{t+1}^S = 5,000$  respectively. The corresponding Gini coefficient of this economy is 0.1019 which signals a relatively low level of income inequality.

Comparing the economy with both corruption and informality to the economy with informality but without corruption, the Gini coefficient in the economy with both corruption and informality is lower than that of the economy with informality but without corruption by 0.0025. This implies that as more households engage in informality due to corruption-induced credit market rigidities, income inequality reduces.

It is worth noting that in the economy without informality introducing corruption leads to an increase in income inequality. However, in the economy with informality, introducing corruption is associated with a reduction in income inequality. Specifically, in comparison to the economy with corruption but without informality the Gini coefficient in the economy with both corruption and informality is lower than that of the economy with corruption but without informality by a magnitude 0.3313. This is because in the economy with corruption and without informality households who are corruption-induced credit constrained choose relatively low income subsistence livelihood. Therefore as more corruption-induced credit constrained households engage in subsistence income inequality is likely to increase. While in the economy with both corruption and informality, households who are corruption-induced credit constrained choose middle income informal entrepreneurship over relatively income subsistence livelihood. As such as more corruption-induced credit constrained households choose mid-

dle income informal entrepreneurship as opposed to the relatively low income subsistence livelihood income inequality is likely to be reduced. Thus the informal sector has the potential to mitigate the effect of corruption on income inequality.

### **Robustness checks**

**Case 1** Consider a uniform distribution of initial wealth from 0 to 40,000 such that in the economy without both corruption and informality the fraction of formal entrepreneurial and subsistence livelihood households is 67% and 33% of the population of households respectively. With regard to figure (4.2) formal entrepreneurial (subsistence livelihood) households encompasses all households whose initial wealth level is such that  $b_t > \omega$  ( $b_t \leq \omega$ ). Given the household occupational choices and their corresponding net incomes, the economy's Gini coefficient is 0.1005 which implies a relatively low level of income inequality.

If we introduce corruption in the economy without informality, corruption-induced credit market rigidities imply that the fraction of formal entrepreneurial households reduces to 64% of the household population. While the fraction of subsistence livelihood households increases to 36% of the household population. Indeed, as is shown in figure (4.5) corruption leads to an increase (decrease) in the bequest interval within which households participate in subsistence livelihood (formal entrepreneurship) by  $\omega \leq b_t \leq \omega^c$ . Correspondingly, the Gini coefficient in this economy is 0.1187 which also implies a relatively low level of income inequality.

Comparing the economy with corruption but without informality to the economy without both corruption and informality, the Gini coefficient in former is higher than that of the latter by a magnitude 0.0182. This implies that corruption leads to an increase in income inequality in an economy without informality. The increase in income inequality is because corruption leads to an increase (decrease) in household participation in the relatively low income subsistence livelihood (relatively high income formal entrepreneurship).

In an economy with informal entrepreneurship but without corruption,

credit market rigidities imply that the fraction of formal entrepreneurial households is 67% of the household population. This corresponds to households with an initial bequest level such that  $b_t > \omega$  in figure (4.3). Entry costs into informal entrepreneurship imply that the fraction of informal entrepreneurial and subsistence livelihood households is 29% and 4% of the household population respectively. As is seen in figure (4.3), informal entrepreneurial and subsistence livelihood households correspond to households with the initial bequest level such that  $\kappa \leq b_t \leq \omega$  and  $b_t < \kappa$  respectively. Given the household occupational choices and their corresponding income, the Gini coefficient in the economy without corruption but with informality is 0.0360 which signals a relatively low level of income inequality.

Introducing corruption in the economy with informal entrepreneurship, corruption-induced credit market rigidities imply that the fraction of formal entrepreneurial households reduces to 64% of the household population while that of informal entrepreneurial households increases to 32% of the household population. In terms of figure (4.4), the increase (decrease) in household participation in informal (formal) entrepreneurship is given by the fraction of households in the bequest interval  $\omega \leq b_t \leq \omega^c$ . The fraction of subsistence households remains unchanged at 4% of the household population. From the household occupational choices and their corresponding income, the Gini coefficient in the economy with both corruption and informal entrepreneurship is 0.0397 which implies a low level of income inequality. However, the Gini coefficient is greater than that of the economy without corruption but with informality by magnitude 0.0037.

Compared to the economy with a uniform distribution of initial wealth from 0 to 20,000, both economies have relatively low income inequality levels in an environment characterised by both corruption and informality. However, in the economy characterised by a uniform distribution of initial wealth from 0 to 40,000 the Gini coefficient is higher where there is both corruption and informality than where there is informality but without corruption. While in the economy characterised by a uniform distribution of initial wealth from 0 to 20,000, the Gini coefficient is lower where there is both corruption and informality than where there is informality but without corruption. This

inconsistence in income inequality implications perhaps suggests that the size of the informal sector may have to be significantly large so as to guarantee informality reducing the effect of corruption on income inequality.

Even then, the level of inequality is lower where there is both corruption and informality than where there is corruption but without informality in both the economy with a uniform distribution of initial wealth from 0 to 20,000 and that with a uniform distribution of initial wealth from 0 to 40,000. Indeed, the Gini coefficient in the economy with both corruption and informality is less than that of the economy with corruption but without informality by a magnitude 0.0790 in the economy characterised by a uniform distribution of initial wealth from 0 to 40,000. While in the economy characterised by the uniform distribution of initial wealth from 0 to 20,000 in an environment of both corruption and informality, the Gini coefficient is less than that of the economy scenario with corruption but without informality by a magnitude 0.3313. Thus, in both distributions of initial wealth the informal sector has the ability to mitigate the effect of corruption on income inequality.

Furthermore, in the economy with a uniform distribution of initial wealth from 0 to 20,000 and the economy with a uniform distribution of initial wealth from 0 to 40,000, corruption is seen to increase income inequality in the absence of informality.

**Case 2** Consider a uniform distribution of initial bequests from 0 to 15,000. In an economy without both corruption and informality, the fraction of formal entrepreneurial and subsistence livelihood households is 11% and 89% of the household population respectively. As is seen in figure (4.2) formal entrepreneurial (subsistence livelihood) households includes all households whose initial wealth level is such that  $b_t > \omega$  ( $b_t \leq \omega$ ). Given the household occupational choices and their corresponding income, the Gini coefficient in the economy without both corruption and informality is 0.5457 which implies a relatively high level of income inequality.

In an environment with corruption but without informality, the fraction of households engaging in subsistence livelihood increases to 96% of the house-

hold population. However, the fraction of formal entrepreneurial households decreases to 4% of the household population. With respect to figure (4.5), the increase (decrease) in subsistence livelihood (formal entrepreneurship) as a result of corruption-induced credit market rigidities corresponds to households in the bequest interval  $\omega \leq b_t \leq \omega^c$ . From the household occupational choices and their corresponding income, the Gini coefficient in the economy with corruption but without informality is 0.4122. This Gini coefficient corresponds to a relatively low level of income inequality.

In comparison to the economy without both corruption and informality, the Gini coefficient in the economy with corruption but without informality is higher by a magnitude -0.1335 implying that corruption leads to a reduction in income inequality. The reduction in the Gini coefficient and therefore income inequality could be attributed to the fact close to the entire household population (specifically 96% of the household population) engages in subsistence livelihood. Note that while income inequality is still relatively high given corruption it still reduces as the proportion of subsistence households approaches 100%.

In an economy without corruption but with informality, the fraction of formal entrepreneurial, informal entrepreneurial and subsistence livelihood households is 11%, 79% and 10% of the population of households respectively. With regard to figure (4.3), formal entrepreneurial, informal entrepreneurial and subsistence livelihood households correspond to households with the initial bequest level such that  $b_t > \omega$ ,  $\kappa \leq b_t \leq \omega$  and  $b_t < \kappa$  respectively. Given the household occupational choices and their corresponding income the Gini coefficient for the economy without corruption but with informal entrepreneurship is 0.0851 which implies a low level of income inequality.

In an environment with both corruption and informality however, the effect of corruption is to increase informal entrepreneurship to 86% of the household population while reducing the fraction of formal entrepreneurship to 4% of the household population. From figure (4.4), the decrease (increase) in household participation in formal (informal) entrepreneurship is given by the fraction of households in the bequest interval  $\omega \leq b_t \leq \omega^c$ . Otherwise the fraction of subsistence households remains unchanged and is 10% of the

household population. The Gini coefficient in this economy is 0.0423 which signals a low level of income inequality. In comparison to the economy without corruption but with informality, the Gini coefficient is lower by 0.0428 implying that as more households engage in informality as a result of corruption, income inequality reduces.

Furthermore, the Gini coefficient in the economy with both corruption and informality is lower than that of the economy with corruption but without informality by a magnitude 0.3699. Such a relatively high discrepancy in the Gini coefficient suggests that the informal sector may have the potential to mitigate the effect of corruption on income inequality.

It is note worth that in both the economy with a uniform distribution of initial wealth from 0 to 15,000 and the economy with a uniform distribution of initial wealth from 0 to 20,000, we can conclude that the informal sector has the potential to mitigate the effect of corruption on income inequality. Recall that in the economy with a uniform distribution of initial wealth from 0 to 15,000, the Gini coefficient when the economy is characterised by corruption but without informality is greater than the Gini coefficient when economy is characterised by both corruption and informality by a magnitude 0.3699. While in the economy characterised a uniform distribution of initial wealth from 0 to 20,000, the Gini coefficient is greater where there is corruption but without informality than where there is both corruption and informality by a magnitude 0.3313. In both economies therefore, informal sector mitigates the effect of corruption on income inequality.

**Case 3** In this robustness check, consider an economy where the discrepancy between formal and informal entrepreneurial net income is relatively large by letting the revenue to informal entrepreneurship equal 9,000. The corresponding net income to informal entrepreneurship is 6,864.4. Otherwise, we assume a uniform distribution of initial wealth from 0 to 20,000 such that in the economy without both corruption and informal entrepreneurship the fraction of formal entrepreneurial and subsistence livelihood households is 33% and 67% of the household population respectively. With regard to figure (4.2) formal entrepreneurial (subsistence livelihood) households corresponds

to households whose initial wealth level is such that  $b_t > \omega$  ( $b_t \leq \omega$ ). From the household occupational choices and their corresponding income, the Gini coefficient for the economy without both corruption and informality is 0.3853 which implies a relatively low level of income inequality.

Introducing corruption but without informality, the economy is characterised by a reduction in formal entrepreneurship to 28% of the household population. While the fraction of subsistence households increases to 72% of the household population. In relation to figure (4.5), the decrease (increase) in formal entrepreneurship (subsistence livelihood) as a result of corruption-induced credit market rigidities corresponds to households in the bequest interval  $\omega \leq b_t \leq \omega^c$ . In terms of income inequality, the economy with corruption but without informality is associated with a Gini coefficient of 0.4332 which implies a relatively low level of income inequality. When compared to the economy without corruption, the Gini coefficient in this economy is higher than that of the economy without corruption by a magnitude 0.05. Thus corruption leads to an increase in income inequality.

With regard to the economy without corruption but with informality, the size of formal, informal and subsistence sectors is 33%, 59% and 8% of the household population respectively. In terms of figure (4.3), formal entrepreneurial, informal entrepreneurial and subsistence livelihood households correspond to households with the initial bequest level such that  $b_t > \omega$ ,  $\kappa \leq b_t \leq \omega$  and  $b_t < \kappa$  respectively. Correspondingly, the economy's Gini coefficient is 0.3634 which signals a relatively low level of income inequality. Introducing corruption, the size of formal, informal and subsistence sectors is 28%, 64% and 8% of the household population respectively. Clearly, corruption leads to an increase (decrease) in informal (formal) entrepreneurship. With regard to figure (4.4), the increase (decrease) in household participation in informal (formal) entrepreneurship is given by the fraction of households in the bequest interval  $\omega \leq b_t \leq \omega^c$ . Correspondingly, the economy's Gini coefficient is 0.4051 which implies a relatively low level of income inequality. Note that the Gini coefficient in the economy with both corruption and informality is greater than that of the economy without corruption but with informality by a magnitude 0.04. This implies that entry into the informal

sector of corruption-induced credit constrained households may not necessarily result in a reduction in income inequality.

Recall that in the benchmark scenario informal entrepreneurs earn a net income 38,542.4 and that the Gini coefficient in the economy with both corruption and informality is less than that of the economy with informality but without corruption by a magnitude 0.0025. Suggesting therefore that as more households engage in informal entrepreneurship as a result of corruption-induced credit market rigidities, income inequality reduces. The preceding conclusion is however inconsistent with the economy where the net income to informal entrepreneurship is 6,864.4. Recall that in economy where the net income to informal entrepreneurship is 6,864.4, the Gini coefficient in an environment of both corruption and informality is greater than that where there is informality but without corruption by a magnitude 0.04. This robustness check perhaps suggests that the ability for the informal sector to mitigate the impact of corruption on income inequality also depends on the discrepancy between formal and informal entrepreneurial net incomes. The higher is the discrepancy, the lower is the likelihood that the informal sector would mitigate the effect of corruption on income inequality.

However, in both the economy where informal entrepreneurs earn a net income 38,542.4 and that where informal entrepreneurs earn a net income 6,864.4, a comparison of an environment with both corruption and informality to that with corruption but without informality shows that informality has the potential to mitigate the effect of corruption on income inequality. Specifically, in the economy where informal entrepreneurs earn a net income 38,542.4, the Gini coefficient when the economy is characterised by both corruption and informality is less than the Gini coefficient when economy is characterised by corruption but without informality by a magnitude 0.3313. While in the economy where informal entrepreneurs earn a net income 6,864.4, the Gini coefficient in an environment with both corruption and informality is less than that where there is corruption but without informality by a magnitude 0.0281. Therefore notwithstanding the size of discrepancy between formal and informal entrepreneurial income, entry into informal entrepreneurship as opposed to subsistence livelihood of corruption-induced

credit constrained households is seen to mitigate the effect of corruption on income inequality.

#### 4.2.7 Discussion

In the economy without an informal sector, corruption may lead to an increase in income inequality. However, in an economy with informality whether income inequality increases or not in the presence of corruption depends on: 1) the size of the discrepancy between the net income of formal and informal entrepreneurs; and 2) the size of the informal sector.

Recall that in the benchmark numerical example we noted that entry into the informal entrepreneurship as opposed to subsistence livelihood of corruption-induced credit constrained households results in a reduction in income inequality. However, in Case 3 we allowed for a larger discrepancy between formal and informal entrepreneurial incomes. As a consequence in Case 3, income inequality was higher in the economy with both corruption and informality as compared to the economy with corruption but without informality. Therefore, when there is a larger discrepancy between formal and informal entrepreneurial income, entry into the informal sector as a result of corruption may not guarantee a reduction in income inequality.

Note that Gupta et al. (2002) and Gyimah-Brepong et al. (2006) avail empirical support for corruption leading to an increase in income inequality. Gyimah-Brepong et al. (2006) argue that if corruption is reduced by one standard deviation, income inequality could reduce by 0.05, 0.14, 0.25, and 0.33 among OECD, Asian, African and Latin American Economies respectively. In light of our model, the Gupta et al. (2002) and Gyimah-Brepong et al. (2006) empirical investigations seem to relate with the economy scenario where households engage in subsistence livelihood as a result of corruption-induced credit market rigidities leading to low incomes compared to households that remain in formal entrepreneurship and earn high incomes. Also the Gupta et al. (2002) and Gyimah-Brepong et al. (2006) empirical investigation relates with our model in as far as there is a significant discrepancy between formal and informal occupational income. Indeed, in Case 3 of our

numerical exercise, as more households engage in informal entrepreneurship as a result of corruption, income inequality is shown to increase irrespective of the size of the informal sector.

From the numerical analysis apart from Case 3, the effect of corruption is to increase household participation in informal entrepreneurship and that income inequality is lower in an economy with both corruption and informality than the economy without informality but with corruption. Since the effect of corruption in the economy with informality is to increase household participation in informal entrepreneurship while leaving subsistence livelihood unchanged in doing so income inequality is also reduced. Note that Dobson and Ramlogan-Dobson (2012a), Dobson and Ramlogan-Dobson (2012b), and Kar and Saha (2012) avail empirical evidence in which they show that as the size of the informal sector increases, the effect of corruption on income inequality is mitigated. This empirical evidence relates with our numerical analysis in particular with respect to the benchmark scenario and Cases 1 and 2. Note that in the benchmark scenario and Cases 1 and 2, the discrepancy between formal and informal income is relatively small as compared to Case 3. Hence in these cases, it follows that given corruption, income inequality decreases as the size of the informal sector increases.

It has been argued that income inequality retard economic development in developing countries. Specifically, Barro (2000) argues that income inequality is seen to negatively (positively) interact with economic growth in economies with per capita GDP below US\$ 2,070<sup>23</sup> (GDP above US\$ 2,070). Also, Easterly (2007) shows evidence of a causal relationship between income inequality and development outcomes. Inequality as measured by both the Gini Coefficient and the share of income accruing to the top quintile is associated with a lower level of per capita income, inadequate and improper institutional structures, and low levels of educational attainment. A standard deviation increase in income inequality would lead to 1.1, 1.0, and 1.3 standard deviation reduction in per capita income, institutional quality and schooling attainment respectively. Introducing an IV<sup>24</sup> in the model, the re-

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<sup>23</sup>1985 U.S. Dollars

<sup>24</sup>Agriculture endowments (that is the relative abundance of land suitable for wheat

relationship is even more robust perhaps suggesting the OLS understates the interaction between income inequality and development outcomes. Furthermore, even after controlling for ethnic fractionalisation, tropical location or better still regional dummies and legal origin the negative effect of income inequality on development outcomes is still robust<sup>25</sup>.

In light of the theoretical literature, under imperfect credit market conditions and fixed costs related to individual investments poor households are crowded out of high yielding capital investments thereby leading to lower productivity in the economy (Galor and Zeira 1993; Banerjee and Newman 1993; Galor and Moav 2006; and Galor, Moav and Vollrath 2006). Furthermore, political economy models argue that in the midst of high income inequality levels<sup>26</sup> there is a likelihood of the income poor (median voter) agitating for income distributive policies such as public education, progressive tax systems, and direct income transfers among others. However, such policies are distortionary to economic growth as they compromise the investment potential in physical and human capital. This is because such private investments are hinged on the ability of individuals to rightly recoup the returns to their investments. As such, redistributive policies are argued to deter the process of economic growth (Person and Tabellini 1994; and Alesina and Rodrik 1994). The models on social-political unrest argue that income inequality is a catalyst for social and political instability. That as opposed to engaging in productive activities the poor might waste time in planning for criminal activities. Furthermore, the income and asset rich might as well redirect investable resources into building defence mechanisms at the expense of productivity enhancing investment. Also, because of the potential of political upheavals income inequality thus increases property rights insecurity hence deterring private investment (Alesina and Perotti 1996; Bourguignon and Verdier 2000; and Gradstein 2007).

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as opposed to sugarcane) as an instrument for income inequality. This has an added advantage of reducing the potential of measurement error in inequality Easterly (2007).

<sup>25</sup>This is in contrast to what Forbes (2000) argues that "...many estimates of a significant negative effect of inequality are not robust. When any sort of sensitivity analysis is performed, such as additional explanatory variables or regional dummies are included, the coefficient on inequality becomes insignificant (although it remains negative)."

<sup>26</sup>Particularly in democracies

The preceding empirical and theoretical investigations show that income inequality retards economic development. Consistent with empirical evidence, this paper offers a theoretical macroeconomic explanation for the potential existence of low income inequality in an environment of corruption with the informal sector playing a mitigating role. Therefore, the informal sector can be argued to mitigate the distortionary effect of income inequality on economic growth and economic development in an economy with widespread corruption. Hence the informal sector offers a window of hope.

### 4.3 Conclusions

This paper sought to characterise the relevance of the informal sector in reducing the extent of income inequality in a corruption riddled economy. In our model, the effect of corruption was shown to increase the cost of borrowing to the extent that a certain proportion of households are crowded out of formal entrepreneurship. However, a household's entry into the informal sector as opposed to subsistence livelihood reduces the potential of income inequality increasing. Following Barro (2000) and Easterly (2007), this result potentially implies that the extent of decrease in economic growth, per capital income and educational attainment are mitigated.

While this paper highlights that the informal sector reduces the extent of income inequality in a corruption riddled economy, however, it is possible that poverty levels could increase. This is because the informal sector involves the use of low income yielding technology, therefore the larger its size, the more likely household incomes are bound to low hence perpetuating poverty. However, without the informal sector households would be condemned to a lower income occupation for instance subsistence livelihood which potentially worsens an economy's inequality and poverty levels. Therefore, while the informal sector is not ideal, it at least reduces the extent of income reduction and thus poverty increase in an environment of corruption.

Furthermore, because activities in the informal economy are underground, they compromise the ability of governments to collect tax revenue and consequently finance public service provision. As Friedman et al. (2000) point

out, the inability to provide efficient public services reduces incentives to pay taxes thereby propagating a corruption-informality trap. Since formal entrepreneurial firms typically pay taxes unlike informal firms, the government's inability to mobilise revenue would be exacerbated. Thus, policy makers would have an incentive to reduce the size of the informal economy. In an environment of corruption which typically depicts many developing economies the trade-off from such a policy initiative would be an increase in income inequality as households will end up receiving a potentially inferior wage income or being idle. Since income inequality retards economic development, policy measures to decrease the size of the informal economy should ensure that safety nets are in place to facilitate a smooth transition of informal entrepreneurs into the formal economy .

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# Chapter 5

## Corruption, Fiscal Consolidation, and Economic Development in a model with Public Sector Inefficiency

### 5.1 Introduction

The public sector in any economy provides services that are deemed socially beneficial to its citizens and yet privately expensive to deliver. Such public services include infrastructure, education, health, and the rule of law. The delivery of public services typically involves the interaction between government (politicians), bureaucrats and citizens. The government mobilises citizens to pay taxes in return for public services. Using tax collections, the government hires bureaucrats to deliver public services. Delegation of authority and imperfect monitoring generates the principle-agent problem between government (principal) and bureaucrats (agent). This potentially breeds corruption tendencies among bureaucrats. Corruption could involve bureaucrats using less effort (shirking) or siphoning off public funds leading to the delivery poor quality public services.

The 2004 World Bank Development Report shows that in many develop-

ing countries where public services are accessible, they are characterised by low technical quality, dysfunctionality and inability to match the needs of the largely diverse public. Such features of public services could be attributed to corruption. For instance, Holmberg and Rothstein (2010) find that the existence of high corruption negatively impinges the quality of water delivery in developing economies.

Since tax payers perceive taxes as the price for quality public services, the provision of poor quality public services could be perceived as vitiation of the social contract between government and tax payers. Vitiating the social contract could incentivise tax payers to engage in tax evasion. Indeed, Hanousek and Palda (2004), Torgler (2005), Frey and Torgler (2007) and Alm and McClellan (2012) avail empirical observations in which they show that the tax payer's willingness to pay tax is inversely related with the quality of public services.

The development of incentives to evade tax breeds uncertainty in the government's revenue stream which potentially increases the likelihood of fiscal deficits. Fiscal deficits are among others associated with: 1) rising debt to GDP ratio which potentially compromises future fiscal sustainability and thus the welfare of future generations; and 2) the potential rise in inflationary pressure and volatility especially in economies with less independent central banks (Agnello and Sousa 2009). Under prudent macroeconomic management, a government would seek to overcome the potential occurrence of a fiscal deficit through undertaking fiscal policy adjustments.

In an attempt to undertake fiscal policy adjustments, this paper shows that the existence of corruption-induced tax evasion reduces the government's ability to increase revenue collection through increasing the tax payable. An increase in tax payable becomes counterproductive as it increases tax evasion which further reduces the government's revenue stream potentially aggravating the fiscal deficit. Consequently, the government inevitably has to cut back the quantity of public services delivered to attain a balanced budget. The preceding intuition is consistent with empirical evidence. For instance, with reference to the Greek economy, Katsios (2006) and Matsaganis and Leventi (2013) show that the lack of success in the government's stabilisa-

tion and management of the economy could potentially be explained by tax evasion. The low income tax collections is partly attributed to tax evasion offsets the benefits attained from other fiscal policies such as pension cuts and public sector pay cuts among others, Matsaganis and Leventi (2013). Indeed, Greece's fiscal deficit could have been dealt with by 2007 had it been able to improve its direct tax revenue collection from 7.9% as a percentage of GDP to the average European Union average of 13.4%, Mehir et al. (2010).

Furthermore, empirical evidence highlights that corruption through constraining the maintenance of public infrastructure reduces the quality of public services leading to low economic development (Tanzi and Davoodi, 1997). Consistent with the preceding empirical evidence, this paper theoretically highlights that bureaucratic corruption through reducing the quality of public services compromises the economic development potential of an economy. The preceding analytical result is consistent with the analytical implication in Blackburn et al. (2011). However, we propose an extension to Blackburn et al. (2011) by introducing within their framework corruption-induced tax evasion.

Under conditions of corruption-induced tax evasion, we show that: 1) the government's revenue stream is compromised; and 2) raising tax payable so as to increase tax revenue collections to finance public services and ensure a fiscal balance is counterproductive. Hence, the government is forced to cut back the quantity of public services so as to attain a balanced budget. A reduction in the quantity of public services reduces factor productivity which compromises the growth and economic development potential of the economy. Furthermore, where the reduction in the quantity of public services and thus the loot available to bureaucrats is associated with an increased incidence of corruption then the quality of public services is further compromised as bureaucrats would under such circumstances increasingly prefer to be dishonest. The reduced quality of public services further compromises factor productivity leading to low growth and economic development of potential of the economy. We therefore highlight the double-tragedy effect of corruption since it potentially leads to a reduction in the quality and quantity of public services both combining to reduce an economy's growth and

economic development potential and perhaps perpetuating a poverty trap. However, where cutting back the quantity of public services is associated with a reduced incidence of corruption then bureaucrats increasingly prefer to behave honestly. Under such conditions, there is a likelihood that factor productivity could increase potentially offsetting the factor productivity reducing effect of cutting back the quantity of public services. The increased factor productivity could propagate an increase in the growth and economic development potential of an economy.

In the next section we explore the literature in an attempt to position the research issue(s) within the context of the existing literature, section 2 presents the model and the subsequent analysis upon which one can draw intuition about the interaction between corruption and tax evasion and finally section 3 captures the conclusions from the study.

### **5.1.1 Review of literature**

#### **Public service delivery**

Public service provision is important in an economy because it justifies the existence of the public sector. Public service delivery may involve financing, regulation and information dissemination. Financing may involve facilitating infrastructure investments such as construction of schools, roads, railways, courts of law, airports, bridges, and hospitals. At the same time infrastructure has to be serviced with teaching materials and teachers in schools; doctors, drugs, nurses and ambulances in hospitals; and also roads have to be maintained to ensure durability and less risks to lives of road users. Regulation may involve streamlining the behaviour of actors in an economy for instance environmental regulation may guide industrialists on how to deal with industrial waste, a Land Act may guide individuals on ownership and the use of land, a Bankruptcy Act may guide individuals on the rights of a debtor and a lender and so many more. Information dissemination may involve sharing information with the public about the benefits of say having every child immunised and attending school. Otherwise, the country could be at a risk of non-scientific distortionary information about immunisation

and education which could be costly to livelihoods.

The delivery of public services involves government (politicians), bureaucrats and citizens. Government has monopoly over the collection of taxes from citizens with the promise that public services will be delivered. Citizens in a way perceive tax as the price for public services. Implicitly there is a social contract between government and citizens in which the latter pays taxes while the former ensures the delivery of public services. Using tax revenue, government hires bureaucrats to deliver public services to citizens. Bureaucrats are persons engaged in the day to day running of government, hospitals, schools and other public services.

Typically high quality public services are associated with high educational attainment, low mortality rates, high sustained levels of economic growth, access to safe water, and increased network of paved roads. Such indicators imply that where public services are of high quality, a country should be on the path to a higher level of economic development. However, inherent in the public service delivery mechanism is the principle-agent problem which implies that the government cannot fully monitor the actions of bureaucrats. As such the actions of bureaucrats might not necessarily result in high quality public service delivery. One of the implications is that high public spending might not necessarily guarantee that a country would enhance its economic development potential. For instance Devarajan et al. (1996) in a cross-country empirical study highlight that the level of public expenditure in capital, education, transport and communication, and health are inversely related to economic growth in developing economies as compared to developed economies. They argue that this could be because of existing distortions in developing economies which are attributed to actual physical public expenditure being greater than the desired level. However given a general lack of adequate education, health, and transport and telecommunications infrastructure in developing countries, it is inconceivable that public spending on such items is inversely related to economic growth.

Given that Devarajan et al. (1996) consider the levels of public expenditure as the amount the government allocates to education, health, capital, transport and telecommunications sectors, public sector spending leakages

imply that actual spending could be less than the budgetary allocations. For example Ablo and Reinnikka (1998) undertook an empirical study in Uganda which involved tracking public expenditure from the centre to primary schools. The study revealed that save for salary and wage allocations, more than 70 percent of the budgetary allocations was never received by the schools but rather spent on activities unrelated to primary education. Furthermore the 2004 World Bank's Development Report reports that at least 30 percent of the drugs allocated to public health facilities were diverted to private use in Cameroon, Tanzania and Uganda. Under such circumstances it is not surprising that public spending is inversely related to economic growth.

Furthermore, bureaucratic corruption may lead to an increase in the quantity of public services while compromising the quality of public services. This is because delivering new public services increases the likelihood of a higher bureaucratic loot as compared to say maintaining existing public services. In a cross-country empirical study, Tanzi and Davoodi (1997) argue that bureaucratic corruption compromises incentives to maintain public infrastructure or services while increasing the quantity of public services. In addition, Holmberg and Rothstein (2010) highlight that high public investment only acts as one of the ingredients to enhance the quality of public services. Where the quality of institutions is low (where corruption levels are high) high levels of public investment could potentially result in low quality public services. Using quality of water as a measure of the quality of public services, Holmberg and Rothstein (2010) argue that high corruption levels or low levels of institutional quality offset the potential increase in the quality of public services resulting from increased public investment especially in developing economies.

The preceding discussion unambiguously shows that corruption affects the quality of public services available to citizens. The existence of poor quality public services may drive individuals to seek for services from among others the private sector by-passing the nearest public service point. Akin and Hutchison (1999) show evidence of both rich and poor individuals in Sri Lanka by-passing public facilities where user fees for health care is zero for private care which is costly both in terms of healthcare and transport. By-

passing free health care at public facilities signals that individuals perceive the public health care to be of inferior quality as compared to the private health care. The chosen facilities are among others well stocked with drugs and in good condition which are signals of high quality health care. In addition Leonard et al. (2003) show that households in Iringa region of Tanzania are revealed to be aware of the degree of their illness and the relative qualities of the respective health facilities implying that they choose to bypass a health facility when the quality of health services is low irrespective of distance. Specifically patients choose health centres where: 1) consultations and prescriptions are of high quality; and 2) physicians are of a reasonable number besides being knowledgeable.

The by-passing behaviour by citizens of public services offers evidence that they are aware of the expected quality of public services. Since the social contract between government and citizens involves the promise to deliver public services by the latter and payment of taxes by the former, inadequacies in the quality of public services might not only lead to by-passing of public facilities but also incentivise tax evasion tendencies. Hanousek and Palda (2004) in an empirical study of Eastern European transition countries argue that the willingness to evade taxes increases the more citizens are very unsatisfied with public services. On a five point scale of the quality of public services, movement from the second lowest to the lowest belief about the quality of public services leads to a 13 percent increase in tax evasion. Torgler (2005) and Frey and Torgler (2007) show that the tax payer's willingness to pay tax is increasing in the trust they have for their public officials. This result is premised on the notion that the tax payer's willingness to pay tax is high if they believe that the government can ably and credibly deliver positive returns on taxes. For instance a unit increase in the tax payer's confidence about the judicial system increases the willingness to pay tax by 3 percent (Frey and Torgler 2007). Also Alm and McClellan (2012) show that a poorly functional legal system is associated with less willingness to pay taxes or low tax morale among firms

As such this paper characterises tax evasion as an outcome of the collapse of the social contract between tax payers and government. The failure of

government to avail quality public services due to bureaucratic corruption acts as an incentive for tax payers to evade tax.

The following subsection captures a review of literature regarding incentives to evade tax in an attempt to position this study in the context of the existing literature on incentives to evade tax.

### **Understanding the incentive to evade tax**

Pioneering work on tax evasion is attributed to Allingham and Sandmo (1972) who perceived tax evasion as a portfolio decision undertaken by a tax payer. They argue that tax evasion is inversely related with the penalty and detection rates. Furthermore, a potential reduction in tax revenue as a result of a decrease in the detection rate could be mitigated by an increase in the penalty rate. Hence both the penalty and detection rates are policy substitutes. Thus to enhance tax compliance a policy maker could consider adjusting penalty and detection rates.

Motivated by empirical findings that: 1) some citizens prefer to be honest even when tax evasion is profitable; 2) tax evasion increases with tax rate; and 3) the degree of evasion depends on an individual's perception of the level of evasion in a society, Gordon (1989) argues that such predictions are not easily reflected in the Allingham and Sandmo (1972) and Yitzhaki (1974) portfolio choice models of tax evasion. Rather Gordon (1989) augments the portfolio choice model with individual morality such that the agent's utility incorporates both his degree of honesty and consumption. Gordon (1989) thus shows that even when it is economically viable to evade, some agents might decide to be honest because of both private and social stigma. Like in the Allingham and Sandmo (1972) model both detection and penalty rates are policy tools that government could use in the Gordon (1989) model to minimise tax evasion. The only difference is that both the detection and penalty rates as policy tools are relevant to agents whose moral costs are low such that they find tax evasion attractive. Ultimately with moral costs, the extent of tax evasion given detection and penalty rules should be lower in the Gordon (1989) model as compared to the Allingham and

Sandmo (1972) model. Furthermore, Gordon (1989) incorporates endogenous reputation costs implying that individuals are more likely to engage in tax evasion the more they are aware that others are evading.

The likelihood of being audited and detected upon one evading income tax are the key drivers of tax compliance in the portfolio choice model of tax evasion. This approach to understanding tax evasion has been criticised on the grounds that the proportion of the income tax returns subjected to tax audit is quite often less than one percent of all the tax returns in a number of countries. Also penalties upon detection are hardly imposed besides the fines being less than the actual amount of tax evaded. Furthermore the civil penalties upon detection are even smaller. Under such circumstances tax payers would be rationally justified to evade tax. Such criticism to the portfolio choice model of tax evasion have led to the growth of the behavioural model of tax evasion.

With regard to the behavioural model of tax evasion, Feld and Frey (2002) argue that the existence of the morale to pay tax under such circumstances is attributed to the implicit contract between the tax payer and tax authorities (government). The sustainability of the implicit contract is contingent upon tax authorities respecting the citizens besides putting in place mechanisms that deter evasion. Besides, Frey (1997) argues that deeply rooted citizenry participation in national decision making through popular referendum and initiative accounts for the variation in the levels of tax evasion across districts in Switzerland. As such Switzerland can be characterised by at least two socially stable equilibriums. One of the equilibrium is characterised by high tax morale and thus high tax payments due to greater civic virtue while the other is associated with low tax morale and high tax evasion. The latter equilibrium is associated with greater direct popular participation in constitutional matters and thus citizen trust in the government unlike the former hence variations in the tax morale.

Following the developments in the tax evasion literature, on the one hand tax evasion is a portfolio choice implying that public policy should be aimed at enhancing detection and penalty rates to curb tax evasion. On the other hand tax evasion is a result of the loss of civic virtue implying that tax payers

do not trust the government. In this paper an attempt is made to bridge both the portfolio and behavioural choice models implying that tax evasion becomes a portfolio choice when tax payers are unsatisfied with the quality of public services as a result of bureaucratic corruption.

Tax payers perceive tax as the price paid for quality public goods. However upon vitiating the social contract by way of bureaucrats siphoning off public funds and thus delivering poor quality public services, tax payers develop incentives to evade taxes. Unambiguously, empirical evidence shows that the lower is the perception of tax payers about the quality of public services the higher is their incentive to engage in tax evasion, (Hanousek and Palda 2004; Torgler 2005; Frey and Torgler 2007; Alm and McClellan 2012).

This paper therefore augments the portfolio choice to evade tax with a breach in the social contract between the government and tax payers where the former delivers poor quality goods and the latter develops incentives to equally negate the social contract through evading tax.

### **Corruption, quality of public services, tax evasion and public finance**

Macroeconomic interest in fiscal deficits is relevant because fiscal deficits are associated with: 1) rising debt to GDP ratio which potentially compromises future fiscal sustainability and thus the welfare of future generations; and 2) the potential raise in inflationary pressure and volatility especially in economies with less independent central banks (Agnello and Sousa 2009). Prudent macroeconomic management would therefore expect a government to undertake fiscal consolidation so as to deal with fiscal deficits. However, fiscal consolidation is not straight forward because of: 1) the existence of strategic interaction among leaders implying that the current government may accumulate debt while limiting the fiscal options of their successor, (Persson and Svensson, 1989; Tabellini and Alesina, 1990); and 2) as argued by Alesina and Drazen (1991) disagreements on the mechanisms to be adopted on how to spread the costs of reducing the deficit causes delays in deficit reduction as each political group attempts to outmuscle the other.

Specifically, Persson and Svensson (1989) using a microeconomic approach show that the current leadership has influence over the policy choice of its successor if it has control over a state variable that is pertinent in its successor's objective function. Using debt as a state variable the current government could accumulate debt (implying large deficits) with the objective of constraining the spending options of its potentially more expansionary successor as opposed to when it would remain in power. Also, Tabellini and Alesina (1990) using a microeconomic approach show that the persistence of fiscal deficits could be accounted for by the inability of the current voters to bind the choice of future voters. This is because the future majority voter could have different preferences from the current majority voter. As a result, the current majority voter has an incentive to choose a debt policy that could potentially be suboptimal *ex ante* for the economy. Consequently the economy could experience either fiscal surplus or fiscal deficit. However, Tabellini and Alesina (1990) argue that the social choice of fiscal deficits is increasingly likely over a reasonable number of individual utility functions even though it is generally known to be socially suboptimal. Hence the existence of strategic interaction among leaders accounts for the difficulty in attaining fiscal consolidation.

Furthermore, Alesina and Drazen (1991) in a game theoretic approach attribute delayed fiscal consolidation to the war of attrition. That a political disagreement among different socio-economic groups on the mechanisms to be adopted on how to spread the costs of reducing the deficit causes delays in deficit reduction as each socio-economic group attempts to outmuscle the other. That fiscal consolidation is attained only after some of the socio-economic groups withdraw their demands and thus allow the victorious socio-economic group(s) to allocate the burden of fiscal consolidation.

This paper however makes a contribution to the macroeconomic literature on fiscal consolidation using the Dynamic General Equilibrium approach to characterise corruption as a potential cause of cumbersomeness in fiscal consolidation. The study shows that by bureaucratic corruption reducing the quality of public services, it incentivises tax payers to evade tax payment. Corruption-induced tax evasion propagates fiscal deficit. The existence of

corruption-induced tax evasion implies that efforts by government to alleviate the potential fiscal deficit by raising more revenue through increasing the tax payable might be counterproductive. This is because attempts to raise the tax payable could potentially incentivise more taxable households to evade. Therefore the existence of corruption-induced tax evasion incapacitates the ability of government to use tax policy to eliminate the fiscal deficit. Consistent with the preceding intuition and with reference to Greece, Katsios (2006) shows that the lack of success in the government's stabilisation and management of the economy can potentially be explained by tax evasion as it cannot tap into the underground economy. Also, Matsaganis and Leventi (2013) show that the Greek government's effort to restructure the personal income tax and at the same time introducing solidarity contributions and emergency taxes in order to cure the fiscal instability was partly weakened by tax evasion. The lower income tax collections partly offset the benefits attained from other fiscal policies such as pension cuts and public sector pay cuts among others (Matsaganis and Leventi, 2013). Bravely, Mehir et al. (2010) argue that if Greece was able to improve its direct tax revenue collection from 7.9% as a percentage of GDP to the average European Union average of 13.4% as a percentage of GDP, the fiscal deficit would have been history by 2007. To therefore attain the primary surplus eliminating tax evasion is of paramount importance (Mehir et al. 2010).

In conclusion, this paper theoretically attempts to use bureaucratic corruption to explain the existence of fiscal deficits through corruption-induced tax evasion and to highlight the ineffectiveness of tax policy to address a potential fiscal deficit given corruption-induced tax evasion.

### **Corruption, quality of public services, tax evasion and economic development**

One of the implications of poor quality public services is that productivity in such an economy is compromised hindering economic development. Tanzi and Davoodi (1997) in a cross-country empirical study show that corruption while increasing the quantity of public investment, it however decreases

the quality of public investment. Using the total paved roads that are in good condition, losses in electricity supply as a proportion of total electricity supply, losses in water supply, faults in the telecommunication network and the proportion of railway diesel engines that are in good working condition as proxies for quality of public services, Tanzi and Davoodi (1997) argue that the maintenance of existing public services is decreasing in the level of corruption. Holmberg and Rothstein (2010) in an empirical study of the interaction between the quality of government and quality of water show that the amount of money and quality of government are instrumental in explaining the quality of water accessible to households. In their analysis, Holmberg and Rothstein (2010) show that the interaction term between the quality of government and GDP per capita among developing economies is negative and significant. Thus while money is important in service delivery however the quality of government is equally necessary. Note that since the control of corruption index is implicitly a measure of quality of government we can thus infer that the existence of high corruption negatively impinges the quality of water delivery in developing economies. Therefore as government expenditure is bound to increase as a result of increased public investment the economy's growth rate is compromised since corruption does not allow for maintenance of public infrastructure hence reducing productivity (Tanzi and Davoodi, 1997).

Consistent with the preceding empirical evidence, Rajkumar and Swaroop (2008) in a cross sectional empirical study show that where the levels of corruption are low, a percentage increase in the ratio of public health spending to GDP is associated with 0.32 percent decrease in the child mortality rate. The decrease in child mortality ensures that an economy's flow of labourforce is maintained or increased. Also given low levels of corruption, a percentage increase in education spending as a proportion of GDP is associated with 0.70 percent drop in primary school failure rate (Rajkumar and Swaroop, 2008). The reduction in the school failure rate potentially increases an economy's quality of labourforce. Since both the quality and size of labourforce are a key ingredient of an economy's productivity, therefore high public spending on public services in an environment of low corruption could translate into

higher levels of economic growth and economic development.

In light of the aforementioned empirical findings, this study attempts to avail a theoretical macroeconomic explanation that accounts for the effect of bureaucratic corruption on public service delivery and economic development. The analytical framework is similar to Blackburn et al. (2011) who highlight that bureaucratic corruption through reducing the quality of public services compromises the economic development of an economy. This paper however augments the Blackburn et al. (2011) analysis with corruption-induced tax evasion the effect of which is to worsen the ability of government to finance and supply public services. Therefore while corruption directly affects the quality of public services thus inhibiting economic development (a result consistent with Blackburn et al. 2011) the introduction of corruption-induced tax evasion and its contraction of public revenue flow reduces the quantity of public services delivered. The reduction in the quantity of public services further reduces factor productivity and an economy's economic development potential. Therefore this paper avails a theoretical macroeconomic explanation for the deleterious effect of corruption on economic development by combining the effect of corruption on the quality and quantity of public services respectively.

## 5.2 Model

Consider an economy characterised by a constant population of overlapping generations of two-period lived agents belonging to dynastic families. Agents work in the first period (when they are young) and save all the proceeds for consumption in the second period (when they are old). In each period the economy is composed of  $M$  number of households and  $N < M$  number of bureaucrats. Households have heterogenous skills and inelastically supply their labour in the production of a final consumption good. In return, households earn a competitive wage  $w_t$ . Bureaucrats are endowed with one unit of labour which they supply inelastically to government in return for a competitive wage  $w_t$ . Bureaucrats engage in the procurement of public services and collection of taxes. There is a proportion  $\mu$  and  $1 - \mu$  of corrupt and

non-corrupt bureaucrats respectively. Corruption means that a bureaucrat delivers poor quality public services while quoting prices for high quality public services. Taxable households perceive tax as the price for quality public services. As such, they observe the quality of public services and decide whether or not to pay taxes. Poor quality public services propagate corruption-induced tax evasion which compromises the government revenue stream. The government inevitably undertakes fiscal policy adjustments to sustain a balanced budget. The model shows that corruption-induced tax evasion weakens the use of tax policy as fiscal adjustment tool. Rather the government cuts back the quantity of public services to attain a balanced budget. Cutting back the quantity of public services results in two conflicting outcomes. On one hand, it is deleterious to factor productivity and thus retards an economy's development potential. On the other hand, it reduces the loot available to corrupt bureaucrats and thus disincentivises potentially corrupt bureaucrats to engage in corruption hence propagating an economy's transition to a higher level of economic development.

The following is a full description of the model.

### 5.2.1 Firms

Firms choose capital  $k_t$  and labour  $x_t$  given the rental rate of capital and wages respectively to produce a single consumption good  $Y_t$ . The single consumption good is assumed to be the numeraire. It is produced using the constant returns to scale production technology<sup>1</sup>

$$Y_t = A [x_t K_t]^\alpha k_t^{1-\alpha} G^\beta \quad (5.1)$$

Where  $K_t$  which is the aggregate capital stock captures the externality associated with technology embodied.  $G$  is the aggregate quality of public services. Like in other growth models such as Barro (1990) and Blackburn et al. (2011),  $G$  is a cooperant factor that enhances the productivity of both labour and capital. The production level of the consumption good is

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<sup>1</sup>The production function is assumed to be; twice differentiable, characterised by positive marginal products and diminishing marginal rate of substitution.

increasing in the quality of the public services, capital, and labour employed.

The firm's profit maximisation decision ensures that the rental rate of capital,  $r_t = [1 - \alpha] A [x_t K_t]^\alpha k_t^{-\alpha} G^\beta$  and the wage,  $w_t = \alpha A x_t^{\alpha-1} K_t^\alpha k_t^{1-\alpha} G^\beta$ . In equilibrium  $K_t = k_t$  which combined with a constant population implies that the rate of return on capital is constant and is given as;  $r = [1 - \alpha] A x^\alpha G^\beta$ . Equally, wages are given by;  $w_t = \alpha A x^{\alpha-1} k_t G^\beta$  implying that the return to labour is increasing in both capital employed and the quality of public services.

## 5.2.2 Household

Households are identified by their labour endowments. There is a proportion  $\delta_l \in (0, 1)$  of low ( $l$ ) endowed households in terms of labour, that is;  $\lambda_l$ .  $1 - \delta_l$  is the proportion of highly ( $h$ ) endowed households in terms of labour, that is;  $\lambda_h > \lambda_l$ . The total labour supply to firms is thus;  $x = [(1 - \delta_l) \lambda_h + \delta_l \lambda_l] M$ . Note that the differences in household labour endowment imply differences in income. Specifically, a household [ $H$ ] with a labour endowment level  $j$  ( $= l, h$ ) earns  $\lambda_j w_t$  wage income. Consider an economy where households with labour endowment  $\lambda_l$  are exempted from tax payment. However, households with labour endowment  $\lambda_h$  are obliged to pay a lump sum tax [ $\tau_t$ ]. Assume that each household receives a bequest  $b_t$  from their parents when young. Therefore for non-taxable households their income [ $I_t^l$ ] is a sum of wage income and bequest,  $I_t^l = \lambda_l w_t + b_t$ . However, for taxable households their income [ $I_t^h$ ] is a sum of wage income and bequest less the lump sum tax payable [ $\tau_t$ ],  $I_t^h = \lambda_h w_t + b_t - \tau_t$ . As shall be seen in subsection (5.2.5), taxable households have a choice to make whether or not to evade tax payment. The incentive to evade will be driven by the quality of public goods and individual specific cost of shame  $\eta_i$  that the household incurs when detected upon evading tax. The shame cost  $\eta_i$  is uniformly distributed across taxable households. Otherwise the household's disposable income is saved and rented out to firms at a rate of return  $r$ .

The household's income is spent on consumption at old age and bequest to the young  $b_{t+1}$ . Therefore his expected lifetime utility function is of the

form  $u_t^H = [1 + r] I_t^j - b_{t+1} + v [b_{t+1}]$ . The difference between the household's saving and bequest to his offspring reflects the utility attained from consumption at old age. The assumption of consumption at old age implies that the household's consumption at a young age is implied by that of his parents. Incorporation of bequests in the household's lifetime utility function is aimed at ensuring a non-degenerate steady state equilibrium that is typical of a linear capital accumulation path. The term  $v [b_{t+1}]$  is the utility which accrues to the household upon bequeathing to their offspring. The underlying assumptions about  $v [b_{t+1}]$  is that: 1)  $v' [b_{t+1}] > 0$  and  $v'' [b_{t+1}] < 0$  implying the strict concavity of  $v [b_{t+1}]$ ; and 2)  $\lim_{b_{t+1} \rightarrow \infty} v' [b_{t+1}] = 0$  and  $\lim_{b_{t+1} \rightarrow 0} v' [b_{t+1}] = \infty$  implying that  $v [b_{t+1}]$  is bound by the inada conditions. Optimisation of the household's utility function yields  $v' [b_{t+1}] = 1$ . Thus the bequest level  $b$  is the same across households and constant across generations. From the firm's optimisation problem, the constant rental rate of capital implies that the household's expected lifetime utility is fully determined once his income is established.

### 5.2.3 Government

The government hires  $N$  number of bureaucrats to implement public policy through the purchase of public services and tax collection<sup>2</sup>. Bureaucrats are tasked to provide  $\left[\frac{g}{N}\right] N$  amount of public services. Specifically each bureaucrat delivers  $g/N$  quantity of public services. A bureaucrat  $[B]$  is endowed with one unit of labour which he supplies inelastically to earn a competitive wage<sup>3</sup>  $w_t$ . For simplicity, the bureaucrat's wage is not subjected to tax. Depending on whether a bureaucrat is corrupt or not, his/her income is saved and consumed at old age<sup>4</sup>. The bureaucrat's expected lifetime utility is  $u_t^B = [1 + r] I_t^B$ . The bureaucrat's lifetime utility assumes no bequest to

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<sup>2</sup>Tax collection could equally be subjected to bureaucratic corruption; however, for purposes of our analysis we restrict corruption to only the procurement of public services.

<sup>3</sup>As in Blackburn et al., (2011), the assumption of bureaucrats earning a competitive wage is aimed at making the public sector an equally attractive source of employment.

<sup>4</sup>As shall be shown later, detected corrupt bureaucrats lose their wage income and thus have no savings. As shall be shown later, illegal income is kept out of the capital market to avoid detection by government.

his off-spring. From the firm's optimisation problem, the constant rental rate of capital implies that the bureaucrat's expected lifetime utility is fully determined once his income is established.

Public services are either of good or bad quality. Bureaucrats have discretion on the choice of public service quality. The government employs an inefficient monitoring technology to follow up on the behaviour of bureaucrats. There is a probability  $s$  and  $1-s$  of detecting and not detecting corrupt bureaucrats respectively. Note that the cost of a high quality public service is an identically and independently distributed random variable taking 1 unit of output with a probability  $q$  and  $\phi > 1$  units of output with a probability  $1-q$ . High quality public services yield 1 unit of productive service such that the value of public service is given by  $\{1/\phi, 1\}$ . Poor quality goods cost  $\theta < 1$  units of output with certainty and yield  $\gamma < 1$  units of productive service. The value of a poor quality public good is assumed to be strictly less than that of the costly high quality public good that is  $\{\gamma/\theta < 1/\phi\}$ . Furthermore, the government is assumed to be unaware of the price of the respective qualities of public services. However, it has strict preference for high quality public services and  $(\frac{g}{N}) N$  quantity of public services. The strict preference for high quality public services and the lack of information about the cost (quality) of the specific public services creates an information gap which propagates grounds for corruption. Bureaucrats could potentially have an incentive to procure poor quality public services while quoting the price that accrues to high quality public services. The effect of bureaucratic corruption is to increase the cost of public service delivery while at the sametime compromising the aggregate quality of public services.

Consider an economy in which there is a proportion  $\mu$  and  $1-\mu$  of corrupt and non-corrupt bureaucrats respectively. A non-corrupt bureaucrat procures  $\frac{g}{N}$  units of high quality public goods at their true cost of  $\frac{g}{N}$  with a probability  $q$  or  $\phi(\frac{g}{N})$  with a probability  $1-q$ . These bureaucrats deliver  $[1-\mu](\frac{g}{N}) N$  quality of public services. Corrupt bureaucrats engage in the procurement of poor quality public services while quoting the price for high quality public services. With probability  $1-s$ , a non-detected corrupt bureaucrat procures  $\frac{g}{N}$  units of low quality public goods at a cost of  $\theta(\frac{g}{N})$

however he falsely reports the cost as  $\phi\left(\frac{g}{N}\right)$ . An undetected corrupt bureaucrat walks away with an amount  $(\phi - \theta)\left(\frac{g}{N}\right)$  of corrupt income besides his wage. Undetected corrupt bureaucrats deliver  $\mu[1 - s]\gamma\left(\frac{g}{N}\right)N$  quality of public services. With probability  $s$ , a corrupt bureaucrat is detected and while forfeiting their wages, the government is equally able to redeem  $\frac{g}{N}$  units of high quality public goods at their true cost of  $\frac{g}{N}$  or  $\phi\left(\frac{g}{N}\right)$ . As such the quality of public goods from unsuccessful corrupt bureaucrats is  $\mu s\left(\frac{g}{N}\right)N$ .

Following the preceding description of the procurement of public services, the expected aggregate quality of public services in a corrupt economy is given by

$$[1 - \mu + \mu[1 - s]\gamma + \mu s]g = G \quad (5.2)$$

Without corruption, the quality of public services would be such that  $g = G$ . With corruption however,  $1 - \mu + \mu[1 - s]\gamma + \mu s < 1$ . Since  $[1 - \mu + \mu[1 - s]\gamma + \mu s]g < g$  implies that the aggregate quality of public services is lower with corruption than without corruption. In support of our intuition that corruption compromises the quality of public goods, Tanzi and Davoodi (1997) empirically show that countries with high levels of corruption are associated with lower quality public infrastructure. Specifically, an increase in corruption leads to a reduction in the quality of paved roads and an increase in electricity outages. In the same respect, Holmberg and Rothstein (2010) in an empirical study of the interaction between the quality of government and quality of water show that the amount of money and quality of government are instrumental in explaining the quality of water accessible to households. Since the control of corruption is one of the measures of quality of government we can thus infer that the existence of high corruption negatively impinges the quality of water delivery in developing economies. Thus corruption affects the quality of public services.

#### 5.2.4 Bureaucratic incentive to be corrupt

The presence of bureaucratic corruption and the likelihood of being caught introduce uncertainty in bureaucratic income. With certainty a non-corrupt bureaucrat earns a wage  $w_t$  and his final wealth is  $(1 + r)w_t$ . However, a

corrupt bureaucrat's income shall depend on whether he is caught engaging in corruption or not. A corrupt bureaucrat earns  $w_t + [\phi - \theta] \frac{g}{N}$  with a probability  $[1 - s]$  of not being detected. Otherwise if caught with a probability  $s$ , a corrupt bureaucrat's income is 0<sup>5</sup>. Correspondingly, the expected final wealth of a corrupt bureaucrat is  $[1 - s] [(1 + r) w_t + [\phi - \theta] \frac{g}{N}]$ .

The penalty of zero income when caught in corrupt activities implies that a bureaucrat will have an incentive to engage in corruption if his expected final wealth with corruption  $[1 - s] [(1 + r) w_t + [\phi - \theta] \frac{g}{N}]$  is greater than his final wealth without engaging in corruption, that is,

$$\frac{[1 - s]}{s} [\phi - \theta] \frac{g}{N} > (1 + r) w_t \equiv h(k_t) \quad (5.3)$$

Like in Blackburn (2011), the individual bureaucrat's incentive to engage in corruption depends on the features of the economy that is interest rate and wage rate. Implying that at lower wages or interest rate, bureaucrats would increasingly prefer to engage in corruption. Indeed, Besley and McLaren (1993) in a theoretical attempt to understand wage incentives argue that low wages incentivise dishonest individuals to seek for employment in the public sector. Empirical investigations by Goel and Nelson (1998), Di Tella and Schargrodsky (2003) and Van Rijckegem and Weder (2001) generally agree that corruption and wages are inversely related. From equation (5.3), there is a threshold level of wage  $\omega$  below and above which corruption is feasible and infeasible respectively to a bureaucrat, that is,

$$\frac{[1 - s]}{s(1 + r)} [\phi - \theta] \frac{g}{N} = \omega \quad (5.4)$$

From equation (5.3), we can substitute for wage rate,  $w_t = \alpha Ax^{\alpha-1} k_t G^\beta$  so as to be able to relate an individual bureaucrat's decision to engage in corruption with the level of capital (economic development) in the economy, that is;

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<sup>5</sup>Being caught in a corrupt activity implies that not only does the bureaucrat lose his wage as a penalty but he is forced to hand in his illegal income.

$$[1 - s] \left[ (1 + r) \alpha A x^{\alpha-1} G^\beta k_t + [\phi - \theta] \frac{g}{N} \right] > (1 + r) \alpha A x^{\alpha-1} G^\beta k_t \quad (5.5)$$

From equation (5.5), we can define the critical level of capital,  $k_1^c$

$$k_1^c = \frac{1}{\alpha A x^{\alpha-1}} \frac{[1 - s]}{s(1 + r)} \left[ (\phi - \theta) \frac{g^{1-\beta}}{N} \right] \quad (5.6)$$

Equation (5.6) implies that for  $k_t < k_1^c$ , each corruptible bureaucrat prefers to engage in corruption regardless of whether other corruptible bureaucrats engage in corruption or not. This implies that there is a unique equilibrium in which all corruptible bureaucrats are corrupt.

Note that the effect of bureaucratic corruption is to reduce the quality of public services. The decrease in the quality of public services reduces factor productivity implying a decrease in wages from  $w_t = \alpha A x^{\alpha-1} k_t G^\beta$  to  $\widehat{w}_t = \alpha A x^{\alpha-1} k_t [[1 - \mu + \mu[1 - s]\gamma + \mu s]g]^\beta$  and interest rate from  $r = [1 - \alpha] A x^\alpha G^\beta$  to  $\widehat{r} = [1 - \alpha] A x^\alpha [[1 - \mu + \mu[1 - s]\gamma + \mu s]g]^\beta$ . Therefore, the decision to engage in corruption given that other corruptible bureaucrats are corrupt is given by,

$$\frac{[1 - s]}{s} [\phi - \theta] \frac{g}{N} > (1 + \widehat{r}) \widehat{w}_t \equiv \widehat{h}(k_t) \quad (5.7)$$

Substituting for  $\widehat{w}_t$  and  $\widehat{r}$  in equation (5.7) we can define a critical level of capital  $k_2^c$  given by<sup>6</sup>,

$$k_2^c = \frac{1}{\alpha A x^{\alpha-1} \Gamma} \frac{[1 - s]}{s(1 + \widehat{r})} \left[ (\phi - \theta) \frac{[\Gamma g]^{1-\beta}}{N} \right] \quad (5.8)$$

Note that since wages in the economy with corruption are lower than those in the economy without corruption, it follows that the function  $h(k_t)$  has a steeper slope than the function  $\widehat{h}(k_t)$ . It also follows that the critical level of capital  $k_1^c$  is lower than the critical level of capital  $k_2^c$ . Therefore,  $k_2^c$  defines a critical level of capital such that for  $k_t > k_2^c$ , each corruptible bureaucrat prefers not to engage in corruption regardless of how other cor-

<sup>6</sup>Where  $\Gamma$  is equal to  $1 - \mu + \mu[1 - s]\gamma + \mu s$

ruptible bureaucrats behave. This implies that there is a unique equilibrium in which all corruptible bureaucrats prefer not to engage in corruption.

From the critical levels of capital  $k_1^c$  and  $k_2^c$ , it follows that for  $k_1^c < k_t < k_2^c$ , each corruptible bureaucrat prefers to engage in corruption or be honest. The decision to engage in corruption or behave honestly depends on the incidence of corruption. That is whether other corruptible bureaucrats are corrupt or honest. Where all corruptible bureaucrats are corrupt is an equilibrium since none of them has an incentive to behave otherwise. While where all corruptible bureaucrats are honest is an equilibrium since none of them has an incentive to behave otherwise. Hence for  $k_1^c < k_t < k_2^c$ , there are multiple equilibria in which all corruptible bureaucrats prefer to engage in corruption or behave honestly.

### 5.2.5 Household incentive to evade tax

In this paper, taxable households have the ability to observe the quality of public services<sup>7</sup>. When the quality of the public service is good a taxable household voluntarily complies with tax payment. Otherwise bad quality public services incentivise a taxable household to consider evading tax payment. Figure (5.1) represents a taxable household's decision path following his observation of the quality of public services. In stage one the taxable household observes the quality of public services. The public service is either of good quality or bad quality. The taxable household fulfills his tax obligation in the event that the public service is of good quality. This is consistent with the behavioural choice argument in which a taxable household feels morally obliged to fulfill his tax obligation when he is satisfied with the quality of public services (Feld and Frey, 2002). Unambiguously, empirical evidence shows that a taxable household's fulfillment of his tax obligation is increasing the higher is the quality of public services (Alm and McClellan,

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<sup>7</sup>This assumption is supported by Akin and Hutchison (1999) and Leonard et al. (2003) who show empirical evidence of individuals irrespective of their income and potential user-fees by-passing the nearest public health care service point in Sri Lanka and Tanzania respectively. The individuals sought after health service points that were perceived to offer high quality health care.

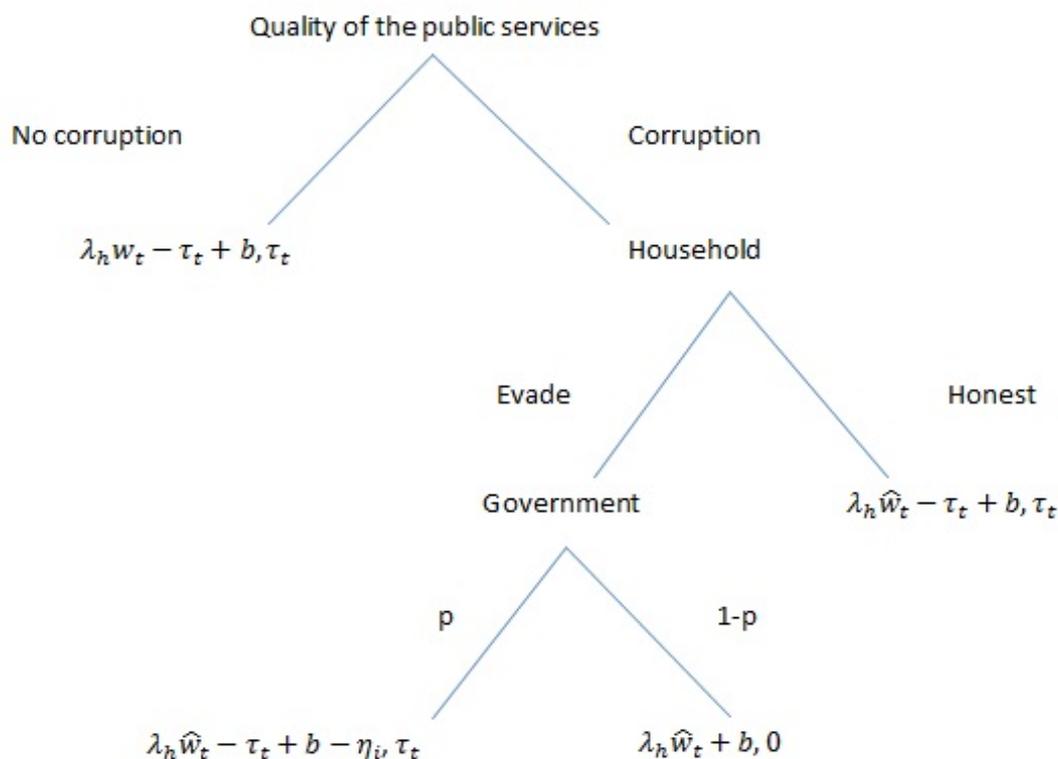


Figure 5.1: Taxable household's decision tree

2012; Frey and Torgler, 2007; Hanousek and Palda, 2004; and Torgler, 2005). Therefore, given high quality public services and that a taxable household fulfills his tax obligation, the payoff to the taxable household is  $\lambda_h w_t - \tau_t + b$  while that to the government is  $\tau_t$ .

When the public service is of bad quality we proceed to stage two. At this point, the taxable household's decision to fulfill his tax obligation is both a portfolio and behavioural choice. It is a portfolio choice in the sense that the decision will depend on the probability  $p$  of being detected<sup>8</sup> and the shame cost<sup>9</sup>  $\eta_i$ . It is a behavioural choice because his decision to engage in tax evasion is driven by the poor quality of public services<sup>10</sup>. Note that

<sup>8</sup>Allingham and Sandmo (1972) and Yitzhaki (1974)

<sup>9</sup>Gordon (1989)

<sup>10</sup>In essence the taxable household feels like he has no moral obligation to fulfil his tax

the taxable household will either behave honestly or will evade and then we proceed to stage three. When the taxable household behaves honestly<sup>11</sup> given that the quality of public services is bad his payoff is  $\lambda_h \widehat{w}_t - \tau_t + b$  while that of the government is  $\tau_t$ . Otherwise we proceed to stage three, where the government using its imperfect monitoring technology can detect a tax evading taxable household with a probability  $p$  or fail to detect with a probability  $1-p$ . When the tax evading taxable household is caught, he meets his tax liability and also incurs a cost  $\eta_i$  of shame. The taxable household's payoff when caught is  $\lambda_h \widehat{w}_t - \tau_t + b - \eta_i$  while that of the government is  $\tau_t$ . When the taxable household is not detected however, his payoff is  $\lambda_h \widehat{w}_t + b$  while that of the government is zero<sup>12</sup>.

Correspondingly, the taxable households expected utility if he engages in tax evasion given poor quality public services as a result of corruption is,  $(1+r)[\lambda_h \widehat{w}_t - \tau_t p + b] - \eta_i p - b + v[b]$ . While his expected utility if he voluntarily fulfills his tax obligation given poor quality public services as a result of corruption is,  $(1+r)[\lambda_h \widehat{w}_t - \tau_t p + b] - b + v[b]$ . The taxable household will choose to evade tax if his expected utility from engaging in tax evasion is greater than the expected utility from fulfilling his tax obligation given corruption that is,

$$(1+r)[\lambda_h \widehat{w}_t - \tau_t p + b] - \eta_i p - b + v[b] > (1+r)[\lambda_h \widehat{w}_t - \tau_t p + b] - b + v[b] \quad (5.9)$$

Collecting like terms, the taxable household will evade if his expected tax obligation given that the government has failed to provide high quality public services, Feld and Frey (2002)

<sup>11</sup>We can think of this non-tax evading taxable household as having a higher social cost  $\eta_i$  since he chooses to fulfil his tax obligation even when the quality of public services is bad. Gordon (1989) argues that even when its reasonable to evade some agents might still behave honestly because of private and social stigma.

<sup>12</sup>Note that it is possible for the decision tree to continue to stage four where caught tax evading taxable households could engage in a bribe bargaining process with bureaucrats to avoid being reprimanded. Adding stage four would however only serve to complicate the analysis yet without it we can ably show that corruption-induced tax evasion negates the use of tax policy to attain fiscal stability besides potentially worsening the economic development potential of an economy.

saving is greater or equal to the cost of shame when caught that is

$$\frac{(1+r)(1-p)\tau_t}{p} \geq \eta_i \quad (5.10)$$

From equation (5.10), one can derive a threshold shame cost  $\eta^* = \frac{(1+r)(1-p)\tau_t}{p}$ . As such taxable households with a shame cost less than  $\eta^*$  will prefer to evade tax. However, taxable households with a shame cost greater than  $\eta^*$  will prefer to be tax honest. Since  $\eta_i \sim [0, \eta]$  implies that  $\frac{\eta^*}{\eta} = \sigma$  is the fraction of taxable households that prefer to evade tax given the poor quality of public services<sup>13</sup>. From figure (5.2) below, the fraction of tax evading taxable households is the area of the rectangle  $0\eta^*a\frac{1}{\eta}$ . Because the threshold shame cost,  $\eta^* = \frac{(1-p)(1+r)\tau_t}{p}$  therefore the proportion of taxable households that evade tax is a function of the lump sum tax, the incidence of corruption<sup>14</sup>, and the probability of detection that is  $\sigma [\tau_t, p, r]$ . Clearly, an increase in the lump sum tax  $\tau_t$  leads to an outward shift of the threshold shame cost from  $\eta^*$  to  $\eta^{**}$ . The increase in proportion of tax evading taxable households is  $\frac{\eta^{**}-\eta^*}{\eta}$ . Thus, the proportion of tax evading taxable households is increasing in the lump sum tax  $\tau_t$ .

## 5.2.6 Distribution of household saving

The distribution of household savings will depend on whether or not households: 1) engage in tax evasion given the quality of public services; and 2) are detected upon engaging in tax evasion. Without corruption, the economy is said to be characterised by high quality public services and that taxable households have no incentive to evade taxes. As such the aggregate saving of taxable households is  $(1 - \delta_l) M [\lambda_h w_t - \tau_t + b]$ . While the aggregate savings of non-taxable households is  $\delta_l M [\lambda_l w_t + b]$ . Therefore, the aggregate household saving in the non-corrupt economy is the sum of the aggregate saving of taxable and non-taxable households, that is,  $xw_t - (1 - \delta_l) M \tau_t + Mb$

<sup>13</sup>Conversely the proportion of households that prefer not to evade taxes,  $1 - \sigma = \frac{\eta - \eta^*}{\eta}$

<sup>14</sup>This is because the interest rate depends on quality of public services,  $G$  which in turn depend on the incidence of corruption in the economy.

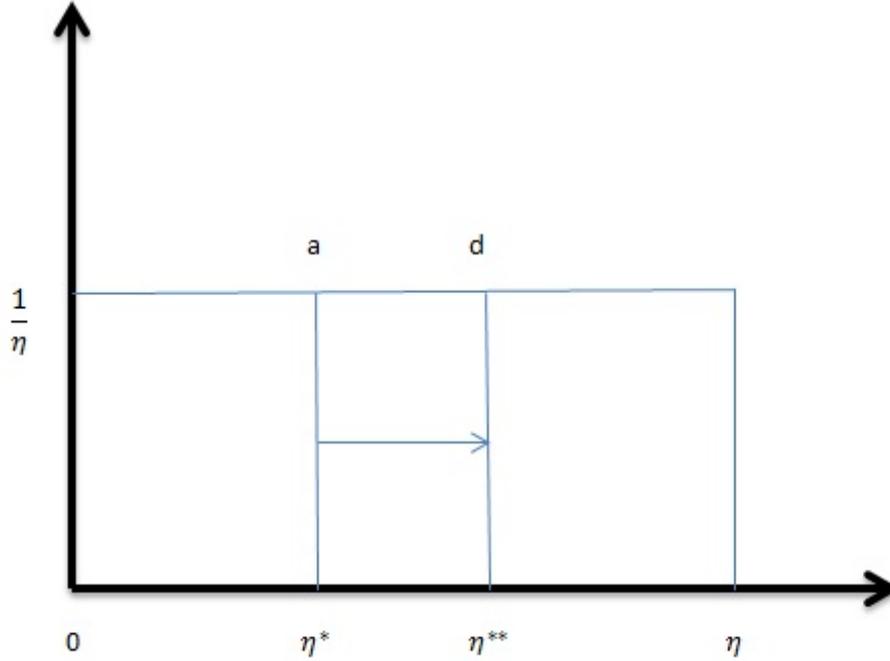


Figure 5.2: Distribution of the social cost borne out of tax evasion

With corruption however, the quality of public services is compromised such that taxable households are incentivised to engage in tax evasion. There is a proportion  $[1 - \sigma]$  of tax honest taxable households whose aggregate saving is  $[1 - \sigma] (1 - \delta_l) M [\lambda_h \hat{w}_t - \tau_t + b]$ . There is a proportion  $\sigma$  of tax evading households who successfully evade tax without detection with a probability  $[1 - p]$ . Correspondingly their aggregate income is  $\sigma (1 - \delta_l) M [\lambda_h \hat{w}_t + b] [1 - p]$ . There is a proportion  $\sigma$  of tax evading households who are detected with a probability  $p$  and are forced to meet their tax obligation. Their aggregate saving is  $\sigma (1 - \delta_l) M [\lambda_h \hat{w}_t - \tau_t + b] p$ . The aggregate savings of non-taxable households will amount to  $\delta_l M [\lambda_l \hat{w}_t + b]$ . Therefore, the aggregating savings of all households with corruption-induced tax evasion amounts to  $x \hat{w}_t + Mb - (1 - \delta_l) [(1 - \sigma) + \sigma p] M \tau_t$ .

If however taxable households choose not to evade taxes ( $\sigma = 0$ ) given bureaucratic corruption, their aggregate saving would be given as

$(1 - \delta_l) M [\lambda_h \widehat{w}_t - \tau_t + b]$ . While the savings of non-taxable households would be  $\delta_l M [\lambda_l \widehat{w}_t + b]$ . The aggregate household saving in this economy will amount to  $x \widehat{w}_t - (1 - \delta_l) M \tau_t + Mb$ .

### 5.2.7 Distribution of the bureaucratic saving

In a corruption free economy, the aggregate saving of bureaucrats is the total wage income earned by bureaucrats,  $Nw_t$ . With corruption however, the saving that accrues to bureaucrats depends on whether: 1) they engage in corruption or not? 2) if they engage in corruption are they detected or not? The aggregate income of non-corrupt bureaucrats in a corrupt economy is  $(1 - \mu) N \widehat{w}_t$ . The aggregate income that accrues to undetected corrupt bureaucrats is  $(1 - s) \mu N \widehat{w}_t + (1 - s) \mu (\phi - \theta) g$ . Detected corrupt bureaucrats incur a loss in aggregate saving of magnitude  $s \mu N \widehat{w}_t$ . Therefore,  $N \widehat{w}_t [1 - 2s\mu] + \mu [1 - s] [\phi - \theta] g$  is the aggregate saving of bureaucrats in the corrupt economy.

Recall that each bureaucrat has 1 unit of labour therefore his saving should amount to his wage income. Therefore, any income greater than his wage income could attract suspicion and perhaps detection by government. In that regard, like in Blackburn et al. (2011) we assume that bureaucrats keep their illegal income away from the capital market so as to avoid being detected.  $N \widehat{w}_t [1 - 2s\mu]$  is therefore the aggregate saving from bureaucrats available to firms for borrowing from the capital market.

### 5.2.8 Equilibrium

Following the assumption that consumption is undertaken in period two, the net period one income that accrues to households and bureaucrats is the supply side of the credit market or aggregate saving in the economy. From the characterisation of period one net income that accrues to households and bureaucrats, the aggregate saving in the economy is given by the sum of all period one net income across households and bureaucrats. The demand for capital is from entrepreneurs and it is equal to capital stock in period  $t + 1$ .

Capital market equilibrium will be such that the capital stock in period  $t + 1$  is equal to period  $t$  aggregate savings of households and bureaucrats.

In an economy without corruption, the existence of high quality public services ensures that households have no incentive to tax evade. Subsequently the economy's capital accumulation path is,

$$k_{t+1} = xw_t - (1 - \delta_l) M\tau_t + Mb + Nw_t \quad (5.11)$$

With bureaucratic corruption and corruption-induced tax evasion however, the capital market equilibrium implies that the economy's capital accumulation equation can be represented as,

$$k_{t+1}^T = x\hat{w}_t + Mb - \Pi + N\hat{w}_t [1 - 2s\mu] \quad (5.12)$$

Where,  $\Pi = (1 - \delta_l) [(1 - \sigma) + \sigma p] M\tau_t$  is the expected tax payment, and  $N\hat{w}_t [1 - 2s\mu]$  is the expected saving from bureaucrats. From equation (5.12), tax payment reduces the size of capital stock in period  $t + 1$ . Note that with tax evasion, households are able to retain a proportion  $(1 - p) \sigma (1 - \delta_l) M\tau_t$  which is transformed into capital investment next period. One could argue that the act of evasion deters would be capital ending in the hands of corrupt bureaucrats. The downside with the act of tax evasion is that it further compromises productivity by constraining the flow of revenue necessary to finance productivity enhancing public services. Furthermore, since corrupt bureaucrats attempt to avoid detection, the amount of bureaucratic theft  $\mu [1 - s] [\phi - \theta] g$  is withheld from the capital market. Implying a loss to private capital accumulation. Also, because corruption dwarfs productivity, wages are such that  $\hat{w}_t < w_t$  therefore  $x\hat{w}_t + N\hat{w}_t [1 - 2s\mu] < xw_t + Nw_t$ . Thus, the loss in labour productivity and the deadweight loss in capital  $\mu [1 - s] [\phi - \theta] g$  imply that the economy without corruption is strictly superior when compared to the one characterised by corruption-induced tax evasion.

Without tax evasion however, with the economy still characterised by

theft of public funds the capital accumulation equation is given by

$$k_{t+1}^{NT} = x\widehat{w}_t - (1 - \delta_l) M\tau + Mb + N\widehat{w}_t [1 - 2s\mu] \quad (5.13)$$

Similarly, the loss in productivity and the deadweight loss in capital imply that the economy without corruption is strictly superior to the one characterised with corruption but without corruption-induced tax evasion.

The capital market equilibrium equations (5.11), (5.12), and (5.13) enables us understand how corruption impacts the development process of an economy. However, we have to incorporate how corruption and tax evasion interact to affect public finance in order to understand the develop process implications of corruption-induced tax evasion.

### 5.2.9 Public finance

The government seeks to provide public services financed by taxes collected from taxable households while maintaining a balanced budget. Recall that bureaucrats are tasked to procure public services while taxable households are expected to voluntarily remit their tax obligations. In the economy without corruption, revenue collection amounts to the lump sum tax payable by all taxable households,  $(1 - \delta_l) \tau_t M$ .

With corruption however, non-tax evading taxable households voluntarily remit  $[1 - \sigma] (1 - \delta_l) \tau_t M$  amount of tax revenue. The government is also able to collect  $p\sigma (1 - \delta_l) \tau_t M$  from detected tax evading taxable households. There is a tax revenue loss of  $\sigma (1 - \delta_l) (1 - p) \tau_t M$  attributed to tax evading households that are not detected. There is a proportion  $\mu s N$  of corrupt bureaucrats caught plundering government resources. These bureaucrats forfeit their wages amounting to  $\mu s N \widehat{w}_t$ . Therefore the total revenue collected by government given corruption-induced tax evasion amounts to

$$(1 - \delta_l) [(1 - \sigma) + \sigma p] \tau_t M + \mu s N \widehat{w}_t \quad (5.14)$$

Where the first term in equation (5.14) is the revenue collection from non-tax evading households and detected tax evading households while the

second term captures fines collected from detected corrupt bureaucrats.

With regard to government expenditure, it includes both purchases of public services by bureaucrats and the wage bill for bureaucrats. In the economy without corruption the total government expenditure amounts to;

$$[q + (1 - q) \phi] g + Nw_t \quad (5.15)$$

The first term in equation (5.15) captures the government spending on public services while the second is the government spending on wages to bureaucrats.

In light of the economy characterised by corruption, spending by non-corrupt bureaucrats is  $(1 - \mu) [q + (1 - q) \phi] g$ . Spending by detected corrupt bureaucrats amounts to  $\mu s [q + (1 - q) \phi] g$ . Spending by undetected corrupt bureaucrats amounts to  $\phi (1 - s) \mu g$ . Wage payments amount to the sum of wages paid to non-corrupt and undetected corrupt bureaucrats less withheld wages from detected corrupt bureaucrats that is  $N\hat{w}_t - \mu s N\hat{w}_t$ . Therefore the total government spending is given by;

$$[(q + (1 - q) \phi) ((1 - \mu) + s\mu) + \phi (1 - s) \mu] g + N\hat{w}_t - \mu s N\hat{w}_t \quad (5.16)$$

## 5.3 Corruption, tax evasion, and government fiscal position

### 5.3.1 Economy without corruption

Since the government seeks to run a balanced budget, total tax collection should equal total government expenditure. Since taxes are assumed to be lump sum in nature, the total revenue collection without corruption would amount to the lump sum tax payable by all taxable households, that is;  $(1 - \delta_l) \tau_t M$ . Government expenditure would amount to what government pays towards wages and procurement of public services, that is;  $[(q + (1 - q) \phi)] g + Nw_t$ . Therefore, a balanced budget would require that,

$$(1 - \delta_l) \tau_t M = [(q + (1 - q) \phi)] g + Nw_t \quad (5.17)$$

**Proposition 1** *In a non-corrupt economy, a lump sum tax increase, improves the government's revenue collection*

**Proof.** Given a positive shock  $\Theta$  in government expenditure, such that at the lump sum tax  $\tau_t$ , revenue is less than public expenditure, that is;  $(1 - \delta_l) \tau_t M < [(q + (1 - q) \phi)] g + Nw_t + \Theta$ , the government can re-stabilise its fiscal position by increasing the tax payable  $\tau_t$ . For  $\tau_t < \tau'_t < \lambda_h w_t$  then we can have  $(1 - \delta_l) \tau'_t M = [(q + (1 - q) \phi)] g + Nw_t + \Theta$ . Besides, the derivative of tax revenue  $(1 - \delta_l) \tau_t M$  with respect to  $\tau_t = (1 - \delta_l) M > 0$  ■

$\lambda_h w_t - \tau'_t > 0$  implies that at the new tax payable,  $\tau'_t > \tau_t$ , the taxable household still maintains a positive disposable income. The positive disposable income ensures positive taxable household savings and thus capital available to firms for investment in period  $t + 1$ . Besides,  $\lambda_h w_t - \tau'_t > 0$  also ensures positive consumption in period  $t + 1$ . Therefore, in a non-corrupt economy, for as long as a taxable household can maintain a positive disposable income, the government can adjust the tax payable to re-stabilise the budget given a positive shock in expenditure.

Otherwise from equation (5.17), we can establish the amount of tax collected by the government in a non-corrupt economy, that is;

$$\tau_t M = \frac{[(q + (1 - q) \phi)] g + Nw_t}{(1 - \delta_l)} \quad (5.18)$$

### 5.3.2 Economy with corruption

#### Economy with corruption-induced tax evasion

Corruption results in the cost of public services being inflated by  $[\mu q(\phi - 1)(1 - s)]g^{15}$  and a reduction in the wage bill<sup>16</sup>. It is possible that total government expenditure with corruption is higher or lower than that of the economy without corruption. Of interest to this paper is however, when government expenditure is higher and the corresponding tax policy implications. Given that the amount of revenue  $(1 - \delta_l)\tau_t M^{17}$  (government revenue without corruption-induced tax evasion) is unattainable due to corruption-induced tax evasion, for the government to supply  $(\frac{g}{N})N$  quantity of public services would attract a fiscal deficit. The difference between the tax revenue of the corruption free economy,  $(1 - \delta_l)\tau_t M$  and the revenue collection in the economy with corruption-induced tax evasion,  $(1 - \delta_l)[(1 - \sigma) + \sigma p]\tau_t M + \mu s N \hat{w}_t$  enables us to arrive at the revenue shortfall,

$$(1 - \delta_l)\tau_t M [\sigma(1 - p)] - \mu s N \hat{w}_t \quad (5.19)$$

Recall that  $[\sigma(1 - p)]$  is the fraction of undetected tax evaders; therefore, the first term in the fiscal deficit equation captures the amount of tax the government loses as a result of corruption-induced tax evasion. The second term captures withheld wages from detected corrupt bureaucrats. The fiscal deficit is therefore the difference between taxes lost due to corruption-induced tax evasion and withheld wages from detected corrupt bureaucrats.

The characterisation of the fiscal deficit implies that the size of the fiscal deficit is increasing in corruption-induced tax evasion. The effect of

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<sup>15</sup>The proportion of government spending on public services that is inflated is attained as the difference between spending on public services in the economy without corruption with that of the economy with corruption. The effect of corruption inflating the cost of public services while compromising the quality of public services is empirically accounted for by Tanzi and Davoodi (1997).

<sup>16</sup>The reduction in the wage bill is because of the withheld wages from detected corrupt bureaucrats and also because corruption leads to a reduction in the competitive wage payable to bureaucrats.

<sup>17</sup>The government could ideally be perceived to budget for  $(1 - \delta_l)\tau_t M$  amount of revenue

corruption-induced tax evasion is to compromise the government revenue stream. Implying that at the given level of government expenditure the fiscal deficit is apparent. In a cross-country empirical study, Tanzi and Davoodi (1997) reveal that corruption through increasing the likelihood of tax evasion and improper tax exemptions is inversely related to government revenue. They argue that a reduction in government revenue is associated with unsatisfactory public service delivery which would further propagate incentives to evade taxes.

The fall in tax revenue collection and the inevitability of public expenditure on public services implies that the government must undertake fiscal policy adjustment not only to legitimise its existence by maintaining the supply of public services but also to ensure a balanced budget. As alluded to by Agnello and Sousa (2009), a fiscal deficit has the potential of increasing: 1) the debt to GDP ratio which compromises future welfare because of the possibility of future fiscal unsustainability; and 2) inflationary pressure and volatility especially in economies with less independent central banks. Prudent macroeconomic management would thus call for the government to undertake fiscal consolidation. The government might consider: 1) imposing a higher lump sum tax; 2) debt financing or 3) the government could reduce the quantity of public services supplied so as to re-establish a balanced budget.

In this paper the concern is on how increasing the lump sum tax payable by households fails to stabilise the fiscal position of the government besides worsening the government's ability to provide public services.

From our specification about tax evasion, the fraction of taxable households that seek to evade taxes is a function of the lump sum tax payable and the probability of the tax evader being detected,  $\sigma(\tau_t, p, r)$ . Assuming a fixed probability of detection we have  $\sigma(\tau_t) = \frac{(1-p)(1+r)\tau_t}{p\eta}$ . It is straightforward to see that the fraction of taxable households that engage in tax evasion is increasing in the lump sum tax. The interesting question is, "what is the impact of an increase in the tax rate on tax revenue?".

The characterisation of the fraction of taxable households that choose to evade tax implies that increasing the lump sum tax incentivises more

taxable households to engage in tax evasion. From figure (5.2), we can see that the effect of a tax increase is to shift the threshold level below which tax evasion is deemed socially acceptable outwards from  $\eta^*$  to  $\eta^{**}$ . Implying an increase in taxable household tax evaders by a proportion  $\frac{\eta^{**}-\eta^*}{\eta}$ . The positive relationship between corruption-induced tax evasion and lump sum tax leads us to the following proposition.

**Proposition 2** *In an economy with corruption-induced tax evasion, a lump sum tax increase, worsens the government's revenue collection.*

**Proof.** Government revenue collection in the corrupt economy is,  $(1 - \delta_l) [(1 - \sigma) + \sigma p] \tau_t M + \mu s N \widehat{w}_t$ . Which can also be expressed as  $(1 - \delta_l) [(1 - \sigma(\tau_t)) + \sigma(\tau_t) p] \tau_t M + \mu s N \widehat{w}_t$ . Differentiating government revenue with respect to lump sum tax,  $\tau_t$  results in

$(1 - \delta_l) M [\tau_t (-\sigma'_{\tau_t}(\tau_t) + p\sigma'_{\tau_t}(\tau_t)) + ((1 - \sigma(\tau_t)) + p\sigma(\tau_t))] < 0$ . Equating this result to zero we can derive an optimal lump sum tax  $\tau^* = \frac{((1-\sigma(\tau_t))+p\sigma(\tau_t))}{-(-\sigma'_{\tau_t}(\tau_t)+p\sigma'_{\tau_t}(\tau_t))}$  and twice differentiating revenue with respect to the lump sum tax yields  $-2(1 - \delta_l) M [(1 - p) \sigma'_{\tau_t}(\tau_t)] < 0$ . ■

From the proof, one can infer that if the lump sum tax is  $\tau^* = \frac{p\eta}{2(1-p)^2(1+r)}$ <sup>18</sup>, and that the government is experiencing a revenue shortage attributed to corruption-induced tax evasion, it cannot increase the lump sum tax payable to raise more revenue. Recall that  $\eta^* = \frac{(1-p)(1+r)\tau^*}{p}$  such that for any  $\tau > \tau^*$  implies an outward shift of the threshold level below which tax evasion is morally feasible. An outward shift of  $\eta^*$  implies an increase in the proportion of tax evaders,  $\sigma(\tau^*)$  hence a reduction in tax revenue collection. In essence, corruption-induced tax evasion is characterised with a Laffer curve feature.

In a non-corrupt economy however, for as long as the taxable household's wage income less taxes is positive,  $\lambda_h w_t - \tau'_t > 0$  such that  $k_{t+1} > 0$  then an increase in government expenditure can be financed by an increase in the lump sum tax payable by the taxable households so as to maintain a

<sup>18</sup>Where the explicit value of  $\tau^*$  is attained by substituting for  $\sigma(\tau_t)$  and  $\sigma'_{\tau_t}(\tau_t)$  in the equation  $\tau^* = \frac{((1-\sigma(\tau_t))+p\sigma(\tau_t))}{-(-\sigma'_{\tau_t}(\tau_t)+p\sigma'_{\tau_t}(\tau_t))}$

balanced budget. This paper therefore argues that, while the government in a non-corrupt economy can increase taxes to accommodate expenditure shocks, a tax rate increase in an economy with corruption-induced tax evasion is counterproductive. As increasing the tax rate leads to an increase in tax evasion hence incapacitating the ability of the government to use tax policy to eliminate the fiscal deficit. The preceding analysis is consistent with empirical evidence; for instance, with reference to Greece, the inability of its government to alleviate fiscal instability is partly attributed to tax evasion which is one of the residuals of corruption (Katsios 2006; Mehir et al. 2010; and Matsaganis and Leventi, 2013).

Since the government cannot increase revenue collections through raising the lump sum tax payable in an environment of corruption-induced tax evasion, therefore the expenditure given by equation (5.16) is associated with the deficit,  $(1 - \delta_l) \tau_t M [\sigma (1 - p)] - \mu s N \widehat{w}_t$ . Because of the reduction in revenue collection due to corruption-induced tax evasion and the government inability to raise the lump sum tax per taxable household implies that the quantity of public services will have to be reduced. Thus as opposed to supplying  $g$  quantity of public services,  $\widehat{g} < g$  is the quantity of public services supplied as to attain a balanced budget,

$$(1 - \delta_l) [(1 - \sigma) + \sigma p] \tau_t M + \mu s N \widehat{w}_t = [\Delta + \phi (1 - s) \mu] \widehat{g} + N \widehat{w}_t - \mu s N \widehat{w}_t \quad (5.20)$$

Where,  $\Delta = [(q + (1 - q) \phi) ((1 - \mu) + s\mu)]$ . Following the reduction in the quantity of public services delivered, the re-established balanced budget can be used to attain  $\tau_t M$ , that is,

$$\tau_t M = \frac{[\Delta + \phi (1 - s) \mu] \widehat{g} + (1 - 2\mu s) N \widehat{w}_t}{(1 - \delta_l) [(1 - \sigma) + \sigma p]} \quad (5.21)$$

### **Economy without corruption-induced tax evasion**

Ounce again the government is assumed to run a balanced budget. Recall that government expenditure in the corrupt economy is given by equation

(5.16). Tax revenue is a sum of tax collections from taxable households,  $(1 - \delta_l) \tau_t M$  and withheld wages from detected corrupt bureaucrats,  $\mu s N \widehat{w}_t$ , that is,  $(1 - \delta_l) \tau_t M + \mu s N \widehat{w}_t$ . Equating the total revenue to government expenditure implies,

$$(1 - \delta_l) \tau_t M = [\Delta + \phi(1 - s) \mu] g + (1 - 2\mu s) N \widehat{w}_t \quad (5.22)$$

**Proposition 3** *In a corrupt economy without corruption-induced tax evasion, a lump sum tax increase, improves the government's revenue collection.*

**Proof.** Like in the economy without corruption, given a positive shock  $\Upsilon$  in government expenditure such that at the lump sum tax  $\tau_t$ , revenue is less than public expenditure, that is;  $(1 - \delta_l) \tau_t M < [\Delta + \phi(1 - s) \mu] g + (1 - 2\mu s) N \widehat{w}_t + \Upsilon$ , the government can re-stabilise its fiscal position by increasing the tax payable  $\tau_t$ . For  $\tau_t < \tau'_t < \lambda_h \widehat{w}_t$  then we can have  $(1 - \delta_l) \tau'_t M = [\Delta + \phi(1 - s) \mu] g + (1 - 2\mu s) N \widehat{w}_t + \Upsilon$ . Besides, the derivative of tax revenue  $(1 - \delta_l) \tau_t M$  with respect to  $\tau_t = (1 - \delta_l) M > 0$  ■

$\lambda_h \widehat{w}_t - \tau'_t > 0$  implies that at the new tax payable,  $\tau'_t > \tau_t$ , the taxable household still maintains a positive disposable income. The positive disposable income ensures positive taxable household savings and thus capital available to firms for investment in period  $t + 1$ . Besides,  $\lambda_h \widehat{w}_t - \tau'_t > 0$  also ensures positive consumption in period  $t + 1$ . Therefore, in a corrupt economy but without tax evasion, for as long as the taxable household can maintain a positive disposable income, the government can adjust the lump sum tax payable to re-stabilise the budget given a positive shock in expenditure. Though not explicitly highlighted, this kind of adjustment of the lump sum tax payable  $\tau_t$  is what ensures the maintenance of a balanced budget in the corrupt economy presented in Blackburn et al. (2011).

In conclusion, corruption-induced tax evasion leads to a public revenue shortfall. The revenue shortfall creates a fiscal deficit. However, because increasing the lump sum tax payable is counterproductive given corruption-induced tax evasion, the government inevitably has to cut back the quantity of public services so as to re-establish a balanced budget. Note that while

cutting back the quantity of public services and therefore government expenditure could restore the budget balance, such efforts could be easily wasted for as long as bureaucratic corruption is still existent. As alluded to earlier, bureaucratic corruption could once again induce tax evasion implying further budget cuts a situation that is quite precarious given the importance of public services in enabling productivity in the economy. Hence while fiscal adjustments such as cutting back government expenditure could restore a balanced budget, the biggest fiscal gain would be attained if bureaucratic corruption is mitigated.

## 5.4 Corruption, tax evasion, and development

This section accounts for how corruption and tax evasion interact to affect the development process with the aide of the figure (5.3). We show that through compromising the quality and quantity of public services, corruption propagates low labour productivity and savings in the economy. Since savings translate into capital and thus affecting the growth of an economy, therefore the low savings under a corrupt regime compromises an economy's economic development potential.

### 5.4.1 Economy without corruption

From equation (5.8) which explains a bureaucrat's incentive to be corrupt, one can distinguish between a corrupt and non-corrupt economy. Specifically, an economy with the capital stock  $k_2^c < k_t$  is said to be a corruption free economy. The capital accumulation path for such an economy corresponds to equation (5.11). Using equation (5.18) to substitute for  $\tau_t M$  in equation (5.11) implies that,

$$k_{t+1} = xw_t + Mb - [(q + (1 - q)\phi)]g \quad (5.23)$$

Where  $xw_t$  is the aggregate wage income for households,  $Mb$  is the aggregate bequests for households, while  $[(q + (1 - q)\phi)]g$  captures aggregate government spending. Substituting for  $w_t$  in equation (5.23), results in a linear

transition path for capital,  $T_1(k_t)$ ,

$$k_{t+1} = Mb - [(q + (1 - q)\phi)]g + \psi k_t = T_1(k_t) \quad (5.24)$$

The transition path for capital,  $T_1(k_t)$  is characterised by a positive slope,  $\psi = \alpha Ax^\alpha g^\beta$  and an intercept,  $\varphi = Mb - [(q + (1 - q)\phi)]g$ . Assuming a steady state such that  $k_{t+1} = k_t = k$ , and collecting like terms the steady state level of capital  $k$  for the corruption free economy is,

$$k = \frac{Mb - [(q + (1 - q)\phi)]g}{1 - \alpha Ax^\alpha g^\beta} \quad (5.25)$$

The transition path of the high capital economy  $T_1(k_t)$  has a steady state at  $k$  where  $k > k_2^c$ . To guarantee  $k > 0$ , parameter values are such that  $1 - \alpha Ax^\alpha g^\beta > 0$  besides  $Mb - [(q + (1 - q)\phi)]g > 0$ .

## 5.4.2 Economy with corruption

### Economy without corruption-induced tax evasion

For  $k_1^c > k_t$ , such an economy is characterised by corruption. Regarding the economy without corruption-induced tax evasion, its capital accumulation path is given by equation (5.13). Using equation (5.22) to substitute for  $(1 - \delta_l)\tau_t M$  in equation (5.13), the corresponding capital accumulation path of the economy without corruption-induced tax evasion is,

$$k_{t+1}^{NT} = x\hat{w}_t + Mb - [\Delta + \delta[1 - s]\theta]g \quad (5.26)$$

Substituting for  $\hat{w}_t = \alpha Ax^{\alpha-1} [[1 - \mu + \mu[1 - s]\gamma + \mu s]g]^\beta \hat{k}_t$ , results in a transition equation for the corrupt economy without corruption-induced tax evasion given by equation (5.27). Where,  $\Delta = [(q + (1 - q)\phi)((1 - \mu) + s\mu)]$  and  $\Theta = \alpha Ax^\alpha [[1 - \mu + \mu[1 - s]\gamma + \mu s]g]^\beta$ .

$$k_{t+1}^{NT} = \Theta \hat{k}_t + Mb - [\Delta + \mu[1 - s]\theta]g = T_2(k_t) \quad (5.27)$$

The slope of the transition equation  $T_2(k_t)$  is  $\Theta$  while its intercept is  $\Omega = Mb - [\Delta + \mu[1 - s]\theta]g$ . Since the index of quality  $[1 - \mu + \mu[1 - s]\gamma + \mu s]$

is less than one, it follows that  $\alpha Ax^\alpha [[1 - \mu + \mu [1 - s] \gamma + \mu s] g]^\beta < \alpha Ax^\alpha g^\beta$  and that the transition path  $T_2(k_t)$  is flatter than the transition path  $T_1(k_t)$  as is represented in figure (5.3). Assuming a steady state such that  $k_{t+1}^{NT} = \widehat{k}_t = k$ , and collecting like terms the resulting steady state level of capital  $k^{NT}$  of the corrupt economy without corruption-induced tax evasion as seen below,

$$k^{NT} = \frac{Mb - [\Delta + \mu [1 - s] \theta] g}{1 - \Theta} \quad (5.28)$$

To guarantee  $k^{NT} > 0$ , parameter values are such that  $1 - \Theta > 0$  besides  $Mb - [\Delta + \mu [1 - s] \theta] g > 0$ .

### **Economy with corruption-induced tax evasion**

Regarding the corrupt economy with corruption-induced tax evasion, its capital accumulation path is represented by equation (5.12). Note however that because stabilisation of the government budget in this economy inevitably involves cutting back the quantity of public services from  $g$  to  $\widehat{g}$ , this implies that both poor quality and fewer quantity of public services combine to reduce productivity. Therefore the level of wages in the corrupt economy but without tax evasion,  $\widehat{w}_t = \alpha Ax^{\alpha-1} [[1 - \mu + \mu [1 - s] \gamma + \mu s] g]^\beta \widehat{k}_t$  is greater than that of the corrupt economy with corruption-induced tax evasion,  $\widetilde{w}_t = \alpha Ax^{\alpha-1} [[1 - \mu + \mu [1 - s] \gamma + \mu s] \widehat{g}]^\beta \widetilde{k}_t$ . Using equation (5.21) to substitute for  $\tau_t M$  in equation (5.12), the corresponding capital accumulation path of the economy with corruption-induced tax evasion is given by equation (5.29);

$$k_{t+1}^T = x\widetilde{w}_t + Mb - [\Delta + \mu [1 - s] \theta] \widehat{g} \quad (5.29)$$

Substituting for  $\widetilde{w}_t = \alpha Ax^{\alpha-1} [[1 - \mu + \mu [1 - s] \gamma + \mu s] \widehat{g}]^\beta \widetilde{k}_t$  in equation (5.29), results in an explicit linear capital accumulation path  $T_3(k_t)$  for the economy characterised by corruption-induced tax evasion, that is;

$$k_{t+1}^T = \Phi + \widehat{\Theta} \widetilde{k}_t = T_3(k_t) \quad (5.30)$$

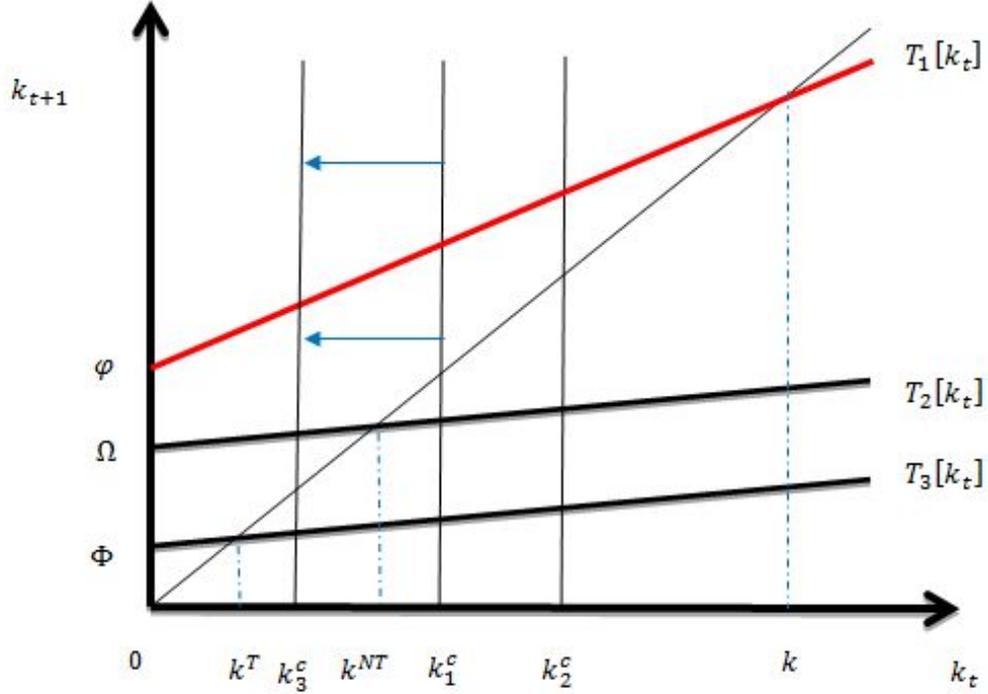


Figure 5.3: Economic Development

Where  $\hat{\Theta} = \alpha A x^\alpha [[1 - \mu + \mu [1 - s] \gamma + \mu s] \hat{g}]^\beta$  is the slope of  $T_3(k_t)$  while its intercept is  $\Phi = Mb - [\Delta + \mu [1 - s] \theta] \hat{g}$ . Since the index of quality  $[1 - \mu + \mu [1 - s] \gamma + \mu s] < 1$ , it follows that  $\hat{\Theta} < \alpha A x^\alpha g^\beta$ , implying that as seen from figure (5.3) the slope of the capital transition path of the economy with corruption-induced tax evasion,  $T_3(k_t)$  is flatter than that of the transition path of the economy without corruption  $T_1(k_t)$ . However, since both  $g$  and  $\hat{g}$  are levels and that  $g > \hat{g}$ , it follows that both  $T_2(k_t)$  and  $T_3(k_t)$  have similar slopes.

With regard to whether  $T_2(k_t) > T_3(k_t)$  or  $T_2(k_t) < T_3(k_t)$ , fiscal adjustment in the corrupt economy without corruption-induced tax evasion leaves the quantity of public services unchanged at  $g$ , while in the corrupt economy with corruption-induced tax evasion  $g$  is reduced to  $\hat{g}$ . Therefore, while the aggregate quality of public services is compromised

in both economies due to corruption, however labour productivity  $\widehat{w}_t = \alpha A x^{\alpha-1} [[1 - \mu + \mu [1 - s] \gamma + \mu s] g]^\beta \widehat{k}_t$  in the corrupt economy without corruption-induced tax evasion is greater than that in the corrupt economy with corruption-induced tax evasion,  $\widetilde{w}_t = \alpha A x^{\alpha-1} [[1 - \mu + \mu [1 - s] \gamma + \mu s] \widehat{g}]^\beta \widetilde{k}_t$  since  $g > \widehat{g}$ . Furthermore, corruption-induced tax evasion implies that the loss in private capital attributed to tax payments by taxable households to finance government expenditure  $[\Delta + \mu [1 - s] \theta] \widehat{g}$  is lower than that in the corrupt economy without corruption-induced tax evasion,  $[\Delta + \mu [1 - s] \theta] g$ . However, since both the quantity and quality of public services drive productivity, the effect of corruption-induced tax evasion facilitates a double tragedy as the economy ends up with both compromised quality and lower quantity of public services. Thus, the aggregate loss in productivity potentially overshadows savings from tax evasion. The transition path of the economy with corruption-induced tax evasion is thus lower than that of the economy with corruption but without corruption-induced tax evasion,  $T_3(k_t) < T_2(k_t)$  as represented in figure (5.3).

Assuming that in the steady state  $k_{t+1} = k_t = k$ , the resulting state steady state capital accumulation with corruption-induced tax evasion is,

$$k^T = \frac{Mb - [\Delta + \mu [1 - s] \theta] \widehat{g}}{1 - \widehat{\Theta}} \quad (5.31)$$

To guarantee  $k^T > 0$ , parameter values are such that  $1 - \widehat{\Theta} > 0$  besides  $Mb - [\Delta + \mu [1 - s] \theta] \widehat{g} > 0$ .

### 5.4.3 Discussion

$k_1^c$  is the threshold level of capital below which an economy is characterised as having a low level of economic development. Since for  $k < k_1^c$ , irrespective of whether a corrupt economy is associated with corruption-induced tax evasion or not such an economy is characterised by a low level of economic development. While an economy such that  $k > k_2^c$  is associated with a high level of economic development. Since  $k_1^c$  is also the threshold level below which corruptible bureaucrats prefer to engage in corruption regardless of how other

such bureaucrats behave, this implies that both bureaucratic malfeasance and low levels of economic development are self-reinforcing. Similarly, for  $k > k_2^c$  corruptible bureaucrats are sensitive to engaging in bureaucratic corruption and thus prefer to be honest. Hence for  $k > k_2^c$  implies that both high levels of economic development and low levels of bureaucratic malfeasance are self-reinforcing. For  $k_1^c < k < k_2^c$  such an economy can be either on the high economic development path or low economic development path. A high incidence of corruption implies that corruptible bureaucrats could increasingly prefer to engage to in corruption and as such the economy could potentially be on the lower economic development path. However, a lower incidence of corruption implies that corruptible bureaucrats could increasingly prefer to be honest and as such the economy could potentially be on the higher economic development path.

In this paper, the effect of bureaucratic corruption is to reduce the quality of public services. Lower quality public services reduce both capital and labour productivity. The reduction in labour productivity implies a lower level of both savings and supply of capital to the capital market. Thus a lower level of capital stock in a corrupt economy than in a non-corrupt economy. As seen in the preceding analysis,  $T_2(k_t) < T_1(k_t)$  that is the transition path of capital in the economy without corruption is strictly higher than that of the economy with corruption. This intuition is similar to that in Blackburn et al. (2011). This paper builds on Blackburn et al. (2011) by arguing that the lower quality of public services as a result of bureaucratic corruption incentivises taxable households to evade taxes. The effect of corruption-induced tax evasion is to reduce the government's revenue stream. Since the analysis is based on a government running a balanced budget coupled with the inability of government to raise the lump sum tax payable, the reduction in government revenue inevitably implies a fall in the quantity of public services (austerity measure). The reduction in the quantity of public services further reduces labour and capital productivity. Hence the level of savings and thus capital stock is further compromised thus  $T_3(k_t) < T_2(k_t) < T_1(k_t)$ . Correspondingly in equilibrium,  $k^T < k^{NT} < k$ . Therefore, by capturing the effects of corruption-induced tax evasion this paper attempts to

proportionately account for the deleterious effect of bureaucratic corruption on economic development.

With regard to enabling a country's transition from underdevelopment to a higher level of economic development, this paper re-echoes the argument that reducing the size of government could potentially be one of remedies to adopt. Differentiating equation (5.6) with respect to  $g$  results in  $\frac{[1-\beta]}{\alpha Ax^{\alpha-1}} \frac{[1-s]}{s(1+r)} \left[ (\phi - \theta) \frac{g^{-\beta}}{N} \right] > 0$ , that is  $k_1^c$  is positively related to the changes in  $g$ . Implying that the critical level of capital below which engaging in bureaucratic corruption is a unique equilibria decreases upon cutting back  $g$ . Depending on the size of decrease in  $g$ , if  $g$  is reduced such that  $k_1^c$  decreases to  $k_3^c$ , then it is no longer optimal for a corruptible bureaucrat to engage in corruption irrespective of how other bureaucrats behave in the capital stock interval  $k_3^c < k_t < k_2^c$ . Rather the decision to engage in corruption depends on the incidence of corruption in the capital stock interval  $k_3^c < k_t < k_2^c$ . Lowering  $g$  other factors held constant reduces the loot available to corrupt bureaucrats and thus disincentivising bureaucrats from engaging in corruption. If the reduction in  $g$  is followed by a significant proportion of corruptible bureaucrats preferring to be honest then the level of corruption in the economy will be lower since behaving honestly will be the optimal choice. The increased preference for corruptible bureaucrats to behave honestly could lead to an increase in factor productivity. Increased factor productivity could potentially result in increased economic growth and thus potentially propagating an economy's transition to a higher economic development path. For instance in light of figure (5.3), since  $k_3^c < k^{NT}$ , under conditions of less incidence of corruption, the economy with corruption but without corruption-induced tax evasion could potentially transit to a higher economic development path,  $T_1(k_t)$  and thus a higher steady state level of capital  $k$ . This result supports the typical argument that reducing the size of government is one of the ways to alleviate corruption, (Tanzi, 1998); however, it equally depends on the incidence of corruption following the cutting back of government expenditure. However, if cutting back  $g$  leaves the incidence of corruption still high, then bureaucrats could increasingly prefer to remain corrupt. This could result in lower factor productivity leading

to compromised economic growth and the possibility of perpetuating the economy's transition along a low economic development path. Under such circumstances, the steady state of the economy with corruption but without corruption-induced tax evasion could potentially lie in the region  $k_3^c > k^{NT}$  thus the economy could potentially be trapped in poverty.

From the preceding analysis, cutting back government expenditure has two conflicting outcomes: on one hand, through reducing the quantity of public services it reduces productivity and growth thereby perpetuating underdevelopment; and on the other hand it could reduce bureaucratic incentive to engage in corruption especially when the incidence of corruption is low which could potentially propagate an economy's transition from a lower economic development path to a higher economic development path. Which effect is dominant depends on the incidence of corruption and therefore how bureaucrats respond to cutting back government expenditure. If cutting back government expenditure induces more bureaucrats to behave honestly this implies that the productivity enhancement from high quality public services could offset the productivity reduction from the lower quantity of public services leading to enhanced growth. As such, the economy could potentially transit from a lower economic development path to a higher economic development path. In essence, high quality public service delivery leads to enhanced factor productivity which acts as the link between fiscal policy and economic development. Baldacci et al. (2004) show empirical evidence of expansionary fiscal contractions (through reducing government spending) in developing economies resulting in increased factor productivity and growth. Therefore, the increase in productivity from the reduction in the bureaucratic incentive to engage in corruption dominates the productivity reducing effect of the decrease in government expenditure only if the incidence of corruption is lower. However, where the incidence of corruption is high, the economy could potentially experience a double tragedy as both poor quality and lower quantity of public services compromise the economy's growth and thus increase the economy's potential to transit on a lower economic development path increasing the likelihood of a poverty trap.

## 5.5 Conclusion

The contribution of this study is to theoretically highlight how corruption distorts the choice of fiscal policy and economic development process through the tax evasion channel. Through reducing the quality of public services bureaucratic corruption incentivises agents to evade taxes. As such the government's revenue basket is compromised such that public deficit becomes inevitable. Since the analytical environment is based on a balanced budget, the government has to either increase taxes as to cover the revenue gap or reduce the quantity of public services. In the analysis, increasing the lump sum tax is not optimal as it further propagates tax evasion hence inhibiting the government's ability to raise more revenue. The government is left with the difficult decision of cutting back the quantity of public services. This analysis is consistent with empirical evidence which shows that the inability of the Greek government to tap into direct income tax as a result of corruption-induced tax evasion has compromised its ability to stabilise the economy's fiscal position (Dreher et al. 2009; Katsios 2006; Matsaganis and Leventi, 2013; and Mehir et al. 2010).

The paper highlights the importance of enhancing public sector efficiency with regard to ensuring the delivery of quality public services. Improving institutional quality and governance is instrumental in enhancing the tax payer's willingness to fulfill his tax obligation (Togler and Schneider, 2007 and 2009). Therefore while enhancing detection and penalty rates will deter evasion, for as long as households perceive the quality of public services to be poor then tax evasion will persist. As noted earlier, public service delivery is associated with agency problems to the extent that the government (principle) cannot fully monitor the behaviour of bureaucrats. Under such circumstances corrupt bureaucrats seize the opportunity to siphon off public funds while delivering poor quality public services. Therefore, the onus is on governments in developing economies to ensure an institutional environment that commits bureaucrats to quality public service delivery.

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# Chapter 6

## Conclusion

This thesis sought to explain how the size of the economy and corruption interact to affect innovation and growth, the trade-off between corruption and income inequality using the informal sector as a driver of the relationship and how poor quality public service delivery as a result of corruption induces tax evasion may lead to tax policy impotency and perpetuity of underdevelopment. The analyses that we presented are based on microeconomic foundations within a dynamic general equilibrium framework resulting in three distinct but related essays.

The first essay which is captured in chapter two discusses the interaction between corruption and economic growth given an economy's size. The essay was designed to try to answer the following questions. Does the size of the economy matter in the interaction between corruption, innovation and growth? Does the existence of multiple bribe payments affect the impact of the size of the economy on corruption? In the model corruption involves bureaucrats seeking for bribes from owners of Research and Development firms in return for permits to innovate. Without a permit to innovate, an entrepreneur cannot undertake Research and Development implying that he cannot innovate and produce an intermediate good necessary for the production in the final goods sector. The bribe is determined through a Nash bargaining mechanism. Corruption is associated with multiple bribe payments when for a given public service an entrepreneur engages in multiple bribe negotia-

tions with corrupt bureaucrats leading to bribes being paid more than ounce. Consistent with empirical evidence, the essay shows that indeed the size of the economy mitigates the effect of corruption on innovation and growth. However, when corruption is characterised by multiple bribe payments, both innovation and growth are compromised irrespective of the economy's size. The essay implies that: 1) a large sized economy in which corruption is characterised by a one-off bribe payment (multiple bribe payments) could experience a high (low) level of innovation and growth; 2) a large (small) sized corrupt economy is bound to experience a high (low) level of innovation and growth; 3) Innovation and growth are higher in a non-corrupt than in a corrupt economy.

The second essay which is captured in chapter three analyses the interaction between corruption, income inequality and the informal sector. The essay sought to answer the following questions. Is there a trade-off between corruption and income inequality? What role does the informal sector play in the interaction between corruption and income inequality? The analysis involves a household making an occupational choice between formal entrepreneurship, informal entrepreneurship and subsistence livelihood. The formal entrepreneurship involves a bribe payment to a bureaucrat in return for an investment permit. The effect of bribe payment is to increase credit market rigidities in such a way that the threshold level of wealth above which a household can access credit is increased. Implying that there exists a wealth interval associated with households who are legible to access credit in an environment of no corruption but become credit constrained given corruption. Consistent with empirical evidence, the essay shows that corruption-induced credit constrained households choose informal entrepreneurship as opposed subsistence livelihood. As a result, the effect of corruption-induced credit market constraints is to increase (decrease) the size of informal (formal) entrepreneurship while leaving the size of subsistence livelihood households unchanged. The choice of entry into informal entrepreneurship by credit constrained households reduces the extent of income inequality increase as compared to a situation where households have no option but engage in subsistence livelihood. Thus, our results may suggest that the existence of the

informal sector accounts for the trade-off between corruption and income inequality.

The third essay which is captured in chapter four of the thesis explains the interaction between corruption, fiscal consolidation and economic development. The essay sought to answer the following questions. What is the link between corruption, tax evasion and fiscal consolidation? Is there a link between corruption, tax evasion and economic development? Corruption in this essay involves bureaucrats delivering poor quality public services while quoting prices for high quality public services. Taxable households are assumed to be able to observe the quality of public services and perceive taxes as the price for quality public services. Poor quality public services as a result of corruption create incentives to evade taxes. The effect of corruption-induced tax evasion is to reduce the flow of revenue to public coffers. The government in this framework seeks to run a balanced budget, with corruption-induced tax evasion however, a fiscal deficit is apparent. The analysis shows that corruption-induced tax evasion: 1) makes increasing the tax payable to eliminate the fiscal deficit counterproductive; 2) restricts the government to cutting back the quantity of public services hence reducing public expenditure so as to ensure fiscal stability; and 3) through inducing the government to cut back the quantity of public services, it worsens productivity and increases bureaucratic incentives to engage in corruption. The essay shows that under conditions of low corruption incidence following the cutting of back of government expenditure, there is a likelihood of an economy breaking the poverty trap and transiting to a higher economic development path. The essay also shows the presence of multiple equilibrium where high (low) institutional quality is associated with high (low) economic development.

The essays emphasise the deleterious effect of bureaucratic corruption on economic development. More importantly though is that bureaucratic corruption and economic development are self-reinforcing implying the likelihood of poverty traps. Unless institutional mechanisms are put in place to alleviate bureaucratic corruption, an economy is bound to be trapped in underdevelopment. The second essay however implies that institutional mechanisms to fight corruption while well-intentioned, they might increase

income inequality as they could be at the expense of informal sector activities. Therefore mechanisms to enhance an economy's institutional framework should equally ensure that safety nets are in place to facilitate the smooth transition of households to the formal economy.

Across the three essays, the incentive to engage in bureaucratic corruption depends on the probability of a bureaucrat being caught and the subsequent penalty. The probability of being caught reflects: 1) the norms and values of a society since corruption is likely to flourish (frowned upon) in a more (less) corrupt society; 2) degree of press freedom since it signals the ability of the media to investigate and report bureaucratic behavior; and 3) judicial freedom as it allows for commissions of inquiry and police to undertake investigations without undue influence from public officials. In an economy characterised by high norms and values, press freedom and judicial freedom, the likelihood of a corrupt bureaucrat being detected is likely to be high. This implies that a bureaucrat could potentially be hesitant to engage in corruption and the reverse is true. However, the decision to engage in corruption also depends on the wages bureaucrats earn. Lower wages imply an increased incentive to engage in corruption. This is because even if the probability of being detected is high, for as long as bureaucratic wages are low, it implies that the expected benefit from a corrupt act could easily outweigh the expected penalty (which in this thesis is the loss in wages). Therefore, strengthening a country's institutions and paying fair and legitimate wages should simultaneously be employed if bureaucratic corruption is to be alleviated.

# Appendix A

## Appendix

### Matlab code

Below is the code that I employed in calculating the Gini coefficients.

% pop is a vector of population sizes of the different households given their occupational choices.

% val is a vector of net income that accrues to households given their occupational choices

%The vectors pop and val equal dimensions with strictly positive outcomes.

% g is the Gini coefficient.

% check arguments

```
assert(nargin >= 2, 'gini expects at least two arguments.')
```

```
if nargin < 3
```

```
makeplot = false;
```

```
end
```

```
assert(numel(pop) == numel(val), ...
```

```
'gini expects two equally long vectors (%d ~= %d).', ...
```

```
size(pop,1),size(val,1))
```

```
pop = [0;pop(:)]; val = [0;val(:)]; % pre-append a zero
```

```
isok = all(~isnan([pop,val]')); % filter out NaNs
```

```
if sum(isok) < 2
```

```
warning('gini:lacking_data','not enough data');
```

```

g = NaN; l = NaN(1,4);
return;
end
pop = pop(isok); val = val(isok);
assert(all(pop>=0) && all(val>=0), ...
'gini expects nonnegative vectors (neg elements in pop = %d, in val =
%d).', ...
sum(pop<0),sum(val<0))
% process input
z = val .* pop;
[~,ord] = sort(val);
pop = pop(ord); z = z(ord);
pop = cumsum(pop); z = cumsum(z);
relpop = pop/pop(end); relz = z/z(end);
% Gini coefficient
% We compute the area below the Lorentz curve. We do this by
% computing the average of the left and right Riemann-like sums.
% (I say Riemann-'like' because we evaluate not on a uniform grid, but
% on the points given by the pop data).
%
% These are the two Rieman-like sums:
% leftsum = sum(relz(1:end-1) .* diff(relpop));
% rightsum = sum(relz(2:end) .* diff(relpop));
% The Gini coefficient is one minus twice the average of leftsum and
% rightsum. We can put all of this into one line.
g = 1 - sum((relz(1:end-1)+relz(2:end)) .* diff(relpop));

```