

BANK, BORROW OR STEAL

Analysing the relationship between
Corruption and Inflation
in sub-Saharan Africa

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Abstract

The sub-Saharan African region is often considered the most corrupt in the world and has been characterised by macroeconomic instability; several countries have experienced out of control inflation in recent years. Corruption, defined as the abuse of public power for private gain discourages enterprise and investment, and encourages capital flight and rent-seeking; all of which increase the difficulty of raising tax revenue. The difficulty in collecting taxes can establish powerful motives for governments to turn to the printing presses in order to generate seigniorage, which in turn causes inflation.

The aim of this thesis is to determine whether corruption and inflation are correlated in thirty six countries in sub-Saharan Africa over the period 2001-2011. This will be achieved through econometric panel regression analysis and by theoretical analysis of the mechanisms by which the relationship occurs. Our findings demonstrate that corruption has a statistically significant reinforcing effect on inflation in sub-Saharan Africa. This is ostensibly due to the negative effects of corruption on the ability of governments to fund public expenditure thus creating motives for seigniorage which can in turn cause inflation.

Keywords: corruption, inflation, seigniorage, panel data, sub-Saharan Africa¹

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1.1 Introduction

This opening chapter introduces the topic and objective of the thesis, highlighting the relevance of the study. A delimitation and thesis outline follow.

Human development in sub-Saharan Africa has made huge leaps in recent years during the continent's slow and painful transition from warzone to an increasingly prosperous region. Booming economic growth has alleviated poverty in some countries and living standards have risen by 30% in the last decade. At the end of the Cold War there were only three democracies in sub-Saharan Africa, now the number stands at twenty five. Despite the varying legitimacy of these governments the development is positive; presently only four countries in the region lack multi-party constitutions. The varying shades of government bureaucracy and fast changing socioeconomic environment have put immense strain on underdeveloped institutions and their ability to regulate the economy. (The Economist, 2013a)

This study of corruption and inflation focuses on sub-Saharan Africa since the region is one of the world's most corrupt (Svensson, 2005), and further since several countries in the region have experienced very high- or hyperinflation during the reference period (World Bank, 2013). Political instability and war have taken their toll on the administrative capabilities and finances of the countries and many countries have underdeveloped government apparatuses as a result of fairly recent independence and nascent nation building. All these preceding factors make the region an interesting object for study. The future prosperity of the region will be dependent on a stable macroeconomy and reduced corruption that will provide conditions for a sustainable business environment and tax revenue growth. (The Economist, 2013c)

The relationship between inflation and corruption has been documented by various studies, giving both economic and political explanations for their relationship. This paper will attempt to empirically prove a correlation between these two phenomena and

highlight certain possible ways in which corruption affects inflation. Though the direction of the causal link is unclear, we have chosen to use inflation as the dependent variable in our analysis.

Regression analysis may prove a correlation between inflation and corruption; however it provides no insights into how they are connected or the direction of the causality. Using the political-economy approach it is possible to theorise about the relationship: one possible explanation is that corrupt governments actively allow inflation when pursuing motives to generate seigniorage: embezzlement fuelled deficits, difficulties in tax collection especially with regard to the parallel economy and corruption (and inflation) induced capital flight.

1.2 Objective

The objective of this thesis is to determine whether a relationship exists between corruption and inflation in sub-Saharan Africa. The aim of the paper is to analyse how corruption in public administration affects inflation through a number of mechanisms including discouragement of enterprise and investment, capital flight and rent-seeking, all of which add to difficulties in raising tax revenues and thus establish motives for seigniorage. There is a wealth of literature on the negative macroeconomic effects of corruption and of inflation, however the relationship has not been fully analysed in this region; we aim to contribute to economic literature by analysing the phenomenon in sub-Saharan Africa. It is especially relevant and timely to investigate this relationship at a time of booming economic growth in the region as a whole, which will best benefit the countries in question only when a stable macroeconomy and reduced corruption provide conditions for a sustainable business environment and tax revenue growth.

1.3 Delimitation

Our study sample includes thirty six countries in sub-Saharan Africa (see Table 1). The original sample of forty seven countries was revised downwards to thirty six due to a lack of available data in some countries that otherwise would have been in scope. The time period has been limited to eleven years (2001-2011) due to large gaps in data for earlier years. Many prior panel data studies in the field have analysed a shorter time period and a similar or smaller cross-section.

1.4 Thesis outline

This thesis is presented as follows: Section 2 presents a short background on the sub-Saharan African region. The following section presents previous studies and relevant theory. Section 4 describes our methodology and regression specification including explanations of our choice of variables. The empirical findings are presented in Section 5 and are succeeded by analysis of our results and a concluding section that summarises our findings.

2 Background

The regional situation with regard to corruption and inflation is presented briefly.

Sub-Saharan Africa is amongst the world's least developed regions, with the majority of countries ranked near the bottom of all development indices. Much of the region has been ravaged by war and has until recently been characterised by low economic growth (Economist, 2013c). However the region is currently experiencing amongst the fastest economic growth in the world amid a commodity boom (Economist, 2013a); the projected average growth for the entire sub-Saharan African region is 5.25% annually in 2012-13 (International Monetary Fund, 2012).

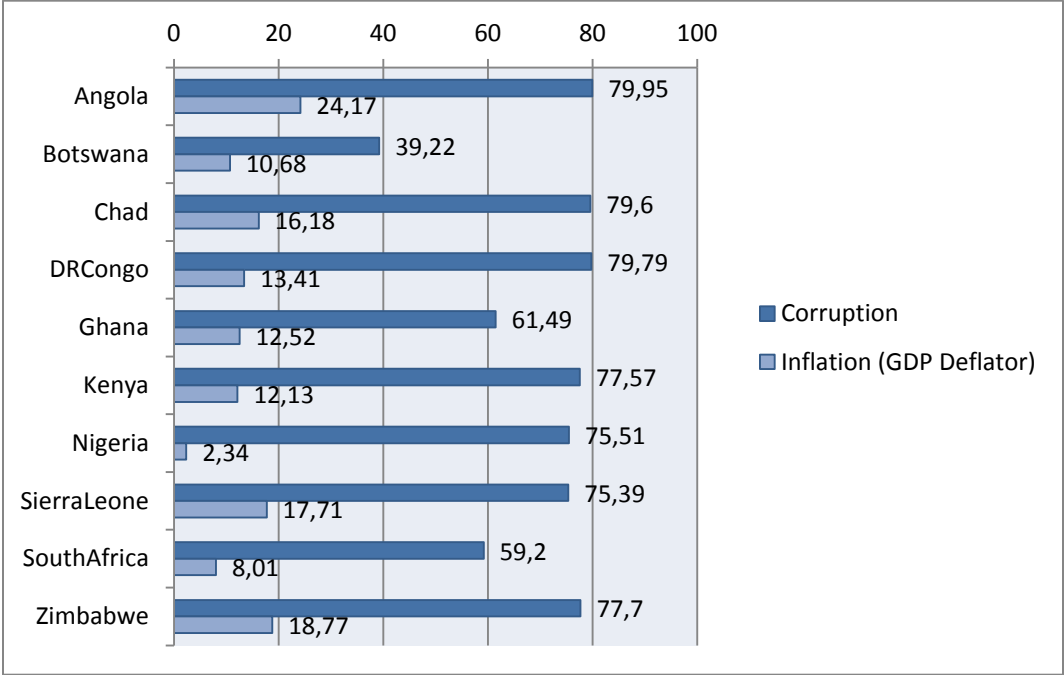
With weak state institutions and an inefficient judicial system moderating the society, the economies have become a nightmare for those aiming to operate businesses in the region (Economist, 2013c). Often referred to as the world's most corrupt region, sub-Saharan Africa is fraught with red-tape and rent-seeking government officials (Economist, 2013b). Entrepreneurs thinking of investing in sub-Saharan Africa are soon reminded why countries in the region are almost exclusively in the bottom third of the World Bank's "ease of doing business" index (Economist, 2013b) as a result FDI levels are very low in comparison with other regions. The mismanagement of government finances and the lack of transparency in all government activities have contributed to the creation of inhospitable financial environments and several countries have experienced hyperinflation in recent years (World Bank, 2013).

During the 1990s the sub-Saharan region experienced roughly thirty armed conflicts a year, this prevalence has since dropped, but there are still currently a dozen armed conflicts in the region. During the same period the number of successful coups fell by roughly 65%. Though this progress is positive, the legacy of these conflicts and coups is unsustainable governance (Economist, 2013d). Corruption is widespread and many leaders

are not afraid to raid state coffers in order to enrich themselves. Bribery is so ubiquitous that it has become part of daily life, and to some degree socially acceptable. Public services are not “public” without first paying the correct bribes, ingraining rent-seeking in societal norms (Economist, 2013c). In many sub-Saharan African countries, peasant farmers take refuge in subsistence production, which is economically sub-optimal, so as to avoid corruption causing a consequent decline in overall agricultural productivity and living standards (Svensson, 2005).

The graph below (Graph 1) provides an overview of the prevalence of inflation and corruption in a selection of sub-Saharan African countries. Botswana, with the lowest corruption also has relatively low inflation whereas Angola has both the highest corruption and inflation. However, Nigeria shows a different story with high corruption and very low inflation.

Graph 1: Corruption and Inflation (2011)



Source: Transparency International (2011)² and World Bank (2013)

² Note: inverted corruption scale

3 Literature review

The following chapter presents the theoretical framework used in this thesis. Firstly previous academic studies that have contributed to the paper are discussed; thereafter relevant economic theory on the subject is presented.

3.1 Previous Studies

Rose-Ackerman's (1975) research on corruption is the first extensive work in modern literature on the subject, and since publication has triggered extensive research into the costs and consequences of corruption in modern economies. Svensson (2005) further analyses the prevalence of corruption and seeks to understand its effects on the market structure; the analysis focuses on the effects of competition on corruption and also the possible positive relationship between corruption and economic growth due to a more flexible and less bureaucratic economy. Other studies (see Treisman, 1998; Ades and Di Tella, 1999 etc.) instead found that corruption increases in the face of weak political competition.

Drawing on work by Rose-Ackerman on the effects of corruption on the market structure, Braun and Di Tella (2000) investigate the correlation between corruption and inflation variance. They found that high inflation variance disrupts market price mechanisms thus increasing the ability to charge non-market prices. The corrupt can take advantage of the difficulty to ascertain price information in order to seek rents.

Blackburn and Powell (2011) found a correlation between inflation and corruption through theoretical modelling that attributed seigniorage, and thus inflation, to the growth-impeding aspects of corruption. Their theory inferred that corruption has a long-term negative impact on economic growth as a result of the deterrent effect of inflation on investment. Similarly Blackburn, Neanidis and Haque (2008) empirically proved how corruption increases the need for governments to rely on seigniorage financing, thereby increasing inflation. Their main thesis analysed the ways in which corruption negatively

impacts economic growth, primarily due to the misallocation of skills and resources from productive to unproductive sectors and activities, impediments to doing business and the undermining of property rights which in turn discourage innovation and investment, both domestic and FDI. Both of the Blackburn (2008; 2011) studies found, in contrast to Svensson (2005) that corruption has a strong negative impact on economic growth through impediments to business and misallocation of resources. The World Bank (1997, p.14-15) further refutes the theory that corruption is “efficiency enhancing”.

In the first systematic cross-country analysis of the relationship between corruption and inflation, Al-Mahrubi (2000) used a political economy approach to the determinants of inflation. He asserted that governments establish motives to create inflation through seigniorage due to the negative impact of corruption on tax revenue. The mechanism by which corruption affects tax revenue is: increased difficulties in tax collection, a growth in the parallel economy and a triggering of capital flight. This is further aggravated by increased deficits due to higher levels of public spending as a result of embezzlement. Al-Marhubi’s (2000) study concluded the existence of a significant correlation between inflation and corruption in forty five Latin American and Asian countries.

The negative correlation between corruption and the ability to generate tax revenue has been widely discussed (see Ghura, 1998; Tanzi and Davoodi, 2000; Imam and Jacobs, 2007) adding further weight to theories linking corruption and inflation tax. Samimi et al.’s (2012) research furthers this theory as they found a positive correlation between inflation tax and corruption, thus showing why seigniorage becomes an alternative source of funding as a result of the negative impact of corruption on the tax base. Their panel data regression model included Middle Eastern, North African and other developing countries.

Akça et al. (2012) discuss the difficulty in establishing causality between inflation and corruption, a theme picked up on in many studies. Though arguing a two way relationship, Akça et al. (2012) chose corruption as the dependent variable and analysed the ways in which inflation and indicators of governance affect it. The study showed a statistically significant correlation between inflation and corruption in all three reference groups:

underdeveloped, developing and developed countries. They concluded, in accordance with Samimi et al. (2012), that an increase in inflation brings about an increase in corruption which they attribute to government seigniorage motives as a result of reduced tax revenue and inefficient fund allocation. Inflation, in turn, causes deterioration in both investment climate and income distribution which further incentivises corruption.

Despite widespread research proclaiming and denouncing the negative macroeconomic consequences of both inflation and corruption, their effects on each other have not been fully understood. Al-Marhubi (2000), Akça et al. (2012) and Samimi et al. (2012) all emphasise the political-economy approach in highlighting the many ways in which corruption and inflation affect each other. All three studies use empirical evidence from a number of regions to further support the theory that countries often experience these twin ills in tandem. According to our research, previous studies have neglected to focus specifically on sub-Saharan Africa (though the Akça et al. (2012) study did include a few sub-Saharan African countries) and thus it is unproven whether the relationship between inflation and corruption holds for these countries in the same way.

3.2 Theoretical framework

3.2.1 Inflation

Friedman (1963) argues that inflation is purely a monetary phenomenon derived from an increase in money supply. Though private banks have some limited possibility of creating money, governments have a near-monopoly. Furthermore, printing money is a source of revenue to governments. At a fundamental level government expenditure can only be funded through taxes or borrowing, the printing of money must therefore be one of the two. To the extent that money printing does not raise prices it constitutes borrowing; the public issues zero interest loans to the government. However, when money printing raises the general price level it levies a so-called inflation tax on cash balances. (Friedman, 1963)

3.2.2 Optimal seigniorage

Schulze (2000) states that seigniorage is the ability for the money printing monopolist to generate revenue through the differential in the real and perceived value of fiat money. In effect the monopolist can exchange banknotes for real goods, given that the population is willing or forced to hold and use the currency (Schulze, 2000, p. 36-40). The theory of optimal seigniorage, as defined by Mankiw (1987), postulates that governments aim to reduce societal deadweight losses by using the optimal mix of revenue streams. One form of revenue is tax on output and the other seigniorage. The deadweight losses incurred by the inflationary effects of seigniorage are of two types: the first are direct costs, such as increased menu costs that affect firms as a result of changing nominal prices; the term is derived from the textbook example of businesses having to reprint menus. The second category is that of the costs associated with disruption and reduced efficiency in markets (Mankiw, 1987). Capital controls, or legislation that makes local currency the only legal tender, are examples of measures that increase the ability to use seigniorage (Schulze, 2000, p. 36-40).

3.2.3 Suppressed inflation

According to Friedman (1963) suppressed inflation occurs when the government “attempts to suppress the manifestations of the inflationary pressure by controlling prices, exchange rates, and other magnitudes” (p. 25). In its extreme, suppressed inflation leads to the establishment of a widespread underground economy where new forms of money are created and the economy regresses to a bartering system. Suppressed inflation can be harmful as it wipes out the price mechanism, which is widely credited with achieving the most efficient allocation of resources (p. 31). Businesses in such environments face difficulties such as excess supply and liquidity issues due to the economy’s inability to reach demand/supply equilibrium (Friedman, 1963). Mankiw (1987) notes that inflation tax may be the only way of taxing economic activity that takes place in the underground economy.

3.2.4 Corruption

Despite the non-existence of a universal definition, the World Bank (1997) suggests corruption be defined as “abuse of public office for private gain” (p. 8). According to Svensson (2005), corruption can be seen as a fee or a tax that creates disparity between the actual and perceived marginal product of capital. Corruption is however not a tax as it does not contribute to state coffers but causes higher transaction costs due to secrecy and uncertainty. Corruption in the public domain has consequences that reach beyond the misappropriation of public funds: the investment climate, market signals and social trust all suffer. Through corruption, market signals and thus the price mechanism central to market transfer become skewed: this increases transaction costs and creates incentives for black market trading as pricing becomes more opaque (Braun and Di Tella, 2000). Further costs caused by corruption are the social costs of inefficient allocation of “talent, technology and capital away from their socially most productive uses” (Svensson, 2005, p. 37). This affects business adversely as entrepreneurs reduce their investments or move to the parallel sector. Transaction costs associated with reduced social trust can have further negative effects on economic growth as they also discourage trade (Svensson, 2005).

The negative effects of corruption on the investment climate discourage all types of investment as corruption can lead to questionable property rights and increased monetary costs of bribes, red tape etc. (Svensson, 2005). This can in turn induce capital flight, both monetary and human as the business and social environment is deemed too risky for investment (Blackburn, Neanidis and Haque, 2008). Corruption also has detrimental effects on government finances due to the monetary costs of inflation, and the drain on the economy caused by corrupt officials' embezzlement (World Bank, 1997).

3.2.5 Mechanism linking corruption and inflation

All the effects listed above reduce economic output and the tax base. In accordance with the theory put forward by Al-Mahrubi (2000), corruption decreases the ability of governments to fund public activities; creating the need for alternative sources of funding. This could incentivise further corruption, or else seigniorage could become an attractive revenue source (Blackburn, Neanidis and Haque, 2008). Milton Friedman famously said that

inflation is the one form of taxation that can be imposed without legislation, which is why it is often the resort of governments experiencing difficulties in raising tax in conventional ways (Friedman, 1963, p. 16). Governments can avoid raising unpopular direct taxes and use seigniorage as an indirect inflation tax, in effect causing both the currency and the population's assets to depreciate (Akça et al., 2012).

Al-Mahrubi (2000) theorises that the relationship between corruption and inflation stems from motives for governments to create seigniorage in order to fund public expenditure. Corruption has manifest effects on the tax base; tax evasion and tax collection costs are likely to be higher in corrupt economies, furthermore the tendency for firms to go underground in order to avoid corruption incentivises usage of inflation tax. Economic growth, and investment, suffer as a result of corruption thus reducing the tax base and thereby government revenue. Finally, corruption contributes to inflation as it exacerbates financial deficits as a result of increased public expenditure. (Al-Mahrubi, 2000)

4 Methodology

This chapter presents a detailed description of how this study was conducted. Firstly, the sample of countries, data collection and empirical specification are presented. Secondly, we present a comprehensive explanation of all included variables and their relevance for the study. Lastly the econometric approach and method are thoroughly explained.

4.1 Methodological approach

4.1.1 Sample of countries

The thirty six countries included in our dataset are all from the sub-Saharan region of Africa (see Table 1); the original sample of forty seven was revised downwards due to lack of data.

Table 1: Sample of countries including income group as of 2011

Low income	Lower middle income	Upper middle income
Benin	Cameroon	Angola
Burkina Faso	Republic of Congo	Botswana
Burundi	Cote d'Ivoire	Gabon
Chad	Ghana	Mauritius
Democratic Rep of Congo	Lesotho	Namibia
Eritrea	Nigeria	Seychelles
Ethiopia	Senegal	South Africa
The Gambia	Sudan	
Kenya	Swaziland	
Madagascar	Zambia	
Malawi		
Mali		
Mozambique		
Niger		
Rwanda		
Sierra Leone		
Tanzania		
Uganda		
Zimbabwe		

Source: World Bank (2013)

4.1.2 Data collection

The data collected in this paper is classified as secondary data and was compiled by the World Bank and Transparency International as part of the World Development Indicators (WDI) and the Corruption Perception Index (CPI) respectively. The data series covers an eleven year period ranging from 2001 to 2011. Other secondary data used throughout this paper derives from Google Scholar, Elin@Lund (Lund University's electronic database) and Discovery Search (The University of Melbourne's electronic database).

4.1.3 Empirical specification

Our analysis will be constructed using a multiple regression model and specified as follows;

$$y_{it} = \beta_0 + u_i + e_t + \beta_1 * x_{1it} + \beta_2 * x_{2it} + \beta_3 * x_{3it} + \beta_4 * x_{4it} + \beta_5 * x_{5it} + \epsilon_{it}$$

$$INFLATION_{it} = \beta_0 + u_i + e_t + \beta_1 * CORRUPTION_{it} + \beta_2 * FDI/GDP_{it} + \beta_3 * OPENNESS_{it} + \beta_4 * GDPGROWTH_{it} + \beta_5 * GDP/CAPITA_{it} + \epsilon_{it}$$

The index, i , denotes the cross-sectional unit ranging from 1-36 for the different countries, t is the time period index (2001-2011) and y is the dependent variable, inflation. β_0 is the intercept and β_{1-5} denote the estimated coefficients for the independent variables, x_{1-5} . The independent variables are: Corruption, Openness, FDI (% of GDP), GDP growth and GDP/capita. The residual term is denoted, ϵ . Section 4.3.2 will explain the use of the fixed effects model which inserts dummies for period and cross section respectively; these are denoted e_t and u_i . Note that the time period dummy is dependent solely on the time index and the cross-section solely on the cross-sectional unit index.

We will be using the least squares estimator on a panel regression model with fixed effects, as described above. The model will be unbalanced due to gaps in the data; however we deemed this to be a better option than creating an artificially balanced dataset. The reason for this is that corruption and/or inflation may have contributed to the lack of data; therefore eliminating the unbalanced data would perhaps have caused a bias. Unbalanced data is not a problem in itself, yet has the potential to make it more difficult to reach significant results (Dougherty, 2011, p. 515).

4.2 Variables

4.2.1 Inflation

According to Burda and Wyplosz (2009) inflation can be defined as “the sustained increase in prices over longer periods of time, as measured by the rate of change in a price index” (p. 281). Inflation is a fairly new occurrence and was practically unheard of prior to the implementation of fiat money in the modern economic system (Burda and Wyplosz, 2009, p. 281). The variable used in this study is inflation as measured by the annual growth rate of the GDP implicit deflator; a World Bank development indicator. It shows the rate of price change in the domestic economy as a whole by calculating the ratio of GDP in current local currency to GDP in constant local currency (World Bank, 2013). The GDP deflator was chosen, in preference to the Consumer Price Index, as it is a less volatile measure and as it only measures domestic price-levels. In addition it facilitates cross country comparison as it is not bound to a country specific basket of goods and services.

4.2.2 Corruption

The most widely accepted definition of corruption is: the “abuse of public office for private gain” (World Bank, 1997, p. 8). Measuring levels of corruption is difficult as the phenomenon is expressed uniquely in various transactions; corruption is rooted in a country's political, bureaucratic and social institutions (World Bank, 1997, p. 8). However indices of corruption levels have been created through a series of surveys which use perceptions of corruption collected by reputable institutions. In this paper we will use the Transparency International (TI) “Corruption Perceptions Index”. TI compiles a composite index every year measuring the perceived corruption (CPI) in the public sector, and is the most widely used and respected corruption index. Countries are ranked between 0-100 with 0 representing a highly corrupt public sector and 100 a public sector free from corruption (Transparency International, 2013). The index scale has been inverted in order to produce more easily comprehensible results: a higher score represents a higher level of corruption and vice-versa.

4.2.3 FDI as a percentage of GDP

Foreign direct investment, “FDI (% of GDP)” is included as a variable as it is believed to act as an indicator of investment climate, and a proxy for both investor confidence - and to some degree corruption - in public administration. Investment is considered risky in the face of institutional inefficiency due to deficient or unenforceable property rights, underdeveloped judicial systems and uncertainty. We predict a negative correlation between inflation and FDI (% of GDP) as a result of the poor investment climate. Inflation is detrimental to capital as it acts as an inflation tax on cash balances. FDI (% of GDP) as an indicator of investor confidence and institutional efficiency is predicted to exhibit a negative relationship with inflation due to the supposed relationship between macroeconomic stability and low inflation. As FDI (% of GDP) acts as a proxy for corruption the correlation between inflation and FDI will provide further insights in to the relationship between inflation and corruption.

FDI is the net inflow of investment in an enterprise operating in a foreign economy. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments (World Bank, 2013). We calculated FDI’s share of GDP by dividing FDI (current US dollars) with GDP (current US dollars), and thereafter multiplying by 100. Data has been collected from the World Bank development indicators.

4.2.4 Openness

Openness, like FDI, acts as an indicator of ease of doing business and accessibility from and to external markets. The correlation between inflation and openness is predicted to be negative in so far as high inflation tends to make for a poor investment climate. However, openness also increases vulnerability to external markets through demand for domestic currency and reliance on foreign trade (Loayza and Raddatz, 2006). A country that is heavily reliant on imports could experience imported inflation due to rising price-levels abroad, or could experience deflationary effects due to capital outflow. A country with an export based economy sees substantial inflows of foreign currency and could experience inflation due to increased money supply (Friedman, 1963). For these reasons Openness could have a positive relationship with inflation. The actual correlation between Openness

and inflation is therefore difficult to predict; it is to be hoped that regression analysis will provide insights.

Openness is measured as the sum of the import and export percentages of GDP divided by 100. This data was compiled using the World Bank (2013) development indicators for the percentages of GDP that correspond to imports and exports. The Openness measure has the range 0-2, whereby 0 denotes no imports/exports and 2 denotes imports and exports equal to 100% of GDP respectively.

4.2.5 GDP/capita

GDP/capita is calculated by dividing GDP (in current US dollars) by the midyear population. "The GDP is the sum of gross value added by all resident producers in the economy plus any taxes and minus any subsidies not included in the value of the products" (World Bank, 2013). GDP/capita is included as a variable in this study to control for the countries' developmental levels, as inflation levels tend to vary with the country's stage of development. It also acts as a proxy for functioning institutions as these are often linked to wealth accumulation. The reason for using this proxy variable instead of some form of institutional index is to avoid multicollinearity with corruption and due to the inherent problems of indices based on perceptions (Bardhan, 1997).

4.2.6 GDP growth

GDP growth is defined as the annual percentage growth rate of GDP at market prices based on constant local currency while aggregates are based on constant 2000 US dollars (World Bank, 2013). GDP growth is included as a control variable that is expected to show a positive correlation with inflation. The two variables should grow at a fairly equal pace in a society characterised by a stable macroeconomy due to inflation expectations and rational wage demands (Friedman, 1977).

4.3 Econometrics

4.3.1 Panel data

The emergence of panel data in modern economics has enabled simultaneous analysis of time series and cross-sectional data. By enabling observation of the same units over several different time periods, analysis of certain economic phenomena has become much more accessible (Kennedy, 2003, p. 301). A typical trait of panel data is large numbers of cross-sectional units observed over a shorter period of time. In our paper we will study observations from thirty six sub-Saharan African countries over an eleven year period. Kennedy (2003) recognises that compiling panel data is very expensive, thus one could speculate that the frequent data-gaps in several sub-Saharan countries are due to budgetary restrictions on the data gathering institutions.

Panel data analysis has several advantages in comparison to traditional time-series and cross-sectional data analysis. Panel data has the ability to deal with heterogeneity in the unmeasured variables³ that determine the dependent variable, correcting them and thus creating an unbiased estimation of the omitted variables (Kennedy, 2003, p. 302). Panel data also creates more variability in the data set as more combinations are produced given the variation over time and variation of specific units, reducing issues of multicollinearity. As discussed in the previous paragraph panel data allows one to view the dynamics of the variables as it tracks a common sample of units over several years. It also has the ability to better address the analysis of dynamic adjustment, thus it reduces the need for long time series of data (Kennedy, 2003, p. 302).

4.3.2 Fixed versus random effects

The heterogeneity in the unmeasured variables in cross-sectional data has the tendency to require different intercepts for each country (Kennedy, 2003, p. 303). If this need is not satisfied it can cause the LS (least squares) estimator to become biased as the unmeasured variables are correlated with the explanatory variables. To tackle this problem two

³ For more information on micro units/unmeasured variables see Kennedy, (2003) "A Guide to Econometrics", p. 302.

methods have been suggested which aim to improve the estimation by modelling a different intercept for each cross-sectional unit.

The fixed effects model allows each country to have a different intercept by adding a dummy for each. The effect of the dummy on the estimation protects against the LS-bias discussed in the previous paragraph. This transformation creates what is commonly referred to as the fixed effect estimator and transforms the LS-estimator in order to produce the desired slope of estimates (Kennedy, 2003, p. 303). However the fixed effects model comes with drawbacks; introducing a substantial amount of dummies in the estimation reduces the degrees of freedom leaving only one degree (the intercept has no dummy), causing a loss in efficiency of the estimation. The transformation also eliminates all explanatory variables that do not vary within an individual (Kennedy, 2003, p. 304). This elimination is however only problematic with time-invariant variables such as gender, race etc.; as our model does not include any such variables this problem will not affect the outcome of the relevant calculations.

The random effects model, like the fixed effects model, allows different intercepts, but the model is designed to avoid the drawbacks of the fixed effects model. The model can be likened to drawing possible intercepts at random from a bowl of candidates; this causes them to be treated as if they were part of an error term. Kennedy (2003) states that as a result “we have a specification in which there is an overall intercept, a set of explanatory variables with coefficients of interest, and a composite error term” (p. 304). The random effects estimator thus makes part of the error term constant over the time period while other parts change for each period. However the random effects model also comes with drawbacks; there is a risk that the composite error term is correlated with the explanatory variables. Performing a Hausman test (see Table 2) will establish whether or not this is the case (Kennedy, 2003, p. 304).

4.3.3 Econometric considerations

In the analysis of panel data several problems must be guarded for in the regressions as the data may be affected by multicollinearity, autocorrelation and heteroskedasticity. Other factors that should be considered are the normal distribution of the residuals and the possible misspecification of the model as well as linearity issues. Several tests have been developed which test for the existence of the above mentioned phenomena. If proved to exist the model will not fulfil the Gauss-Markow assumption as it will not be BLUE (best linear unbiased estimator). If present, the above mentioned problems will reduce the efficiency of the least squares estimator (Westerlund, 2005).

Normal distribution of the residuals is needed for the estimator to be BLUE, however if the data set is large enough with large amounts of observations (N) and a small time period (t), the need to correct for normality in the residuals is not necessary. One method for normality adjustment is to create dummies which eradicate extreme values and outliers (Westerlund, 2005). Non-linearity in the model reduces the efficiency of the estimator and can therefore require re-specification. It is tested through graphical analysis or regression analysis with squared variables (Westerlund, 2005).

When testing for multicollinearity it is important to highlight the innate strengths of panel data. As explained in the previous section (4.3.1) panel data combines the variation across countries with the variation over time. This creates more variability, thereby reducing the risk of multicollinearity and creating a more efficient estimator (Kennedy, 2003). One way of examining the occurrence of multicollinearity is by studying the correlation between the explanatory variables (see Table 4); a rule of thumb is to address the problem of multicollinearity if the correlation exceeds 0.8, where 1.0 suggests a perfect correlation (Westerlund, 2005, p. 160).

When using time-series data it is common to encounter autocorrelation as data of this type tends to be correlated with its previous values (Westerlund, 2005, p. 185). The effects of autocorrelation cause the observations to lose independence as the covariance between the residuals is significantly different from 0. If autocorrelation is present, the effect on the LS-

estimator will be a loss of efficiency; the estimator is no longer BLUE. The variance-covariance-matrix will give incorrect results causing the estimator inference to be misleading (Westerlund, 2005, p. 185). To test for autocorrelation in our model we will use the Durbin-Watson test. The Durbin-Watson test is constructed using $2(1-p)$ where p is the correlation between the residuals. The range is between 4 and 0, the value 2 indicating no trace of autocorrelation; values close to 4 and 0 indicate autocorrelation (Westerlund, 2005).

Unit roots may affect the outcome of our regression if the stochastic process is non-stationary, causing the LS-estimator to lose efficiency. A high R^2 value in combination with a low Durbin-Watson statistic and high t-statistic values indicate the presence of unit roots (Kennedy, 2003).

Heteroskedasticity is a major concern if present in the LS-estimation. Much like autocorrelation, the impact of heteroskedasticity on the estimator is loss of efficiency. Thereby the estimator will not have the lowest variability (not BLUE) and the estimator inference will also be misleading, as the variance-covariance-matrix is incorrect (Westerlund, 2005, p. 173).

To correct for heteroskedasticity and autocorrelation one could create robustness through the Prais-Winsten approach; creating robustness in the standard errors by weighting the equation using panel corrected standard errors (PCSE) on the cross-section. PCSE was chosen as it is optimal for creating robustness when the cross-section is larger than the time period. PCSE improves the PLS (panel least squares) standard errors, thus correcting the standard errors with respect to panel heteroskedasticity and the possible correlation of the standard errors (Beck and Katz, 1995; 2004). Beck and Katz (1995) state that "PCSEs dominate OLS standard errors; when PCSEs are not necessary, they perform as well as the OLS standard errors, and when OLS standard errors perform poorly, PCSEs still perform well" (Beck and Katz, 1995, p. 641). Furthermore, the PCSE model performs better than the Huber-White formula in calculating robust standard errors as it estimates variation within clusters due to the recognition of a common variance structure within a cluster. In that way

PCSE utilises information that the Huber-White formula neglects in only measuring variation between clusters (Johnson, 2004).

Another pertinent problem is that of endogeneity; the direction of causality between the dependent and independent variables. Typically causality is tested by a Granger test (Dougherty, 2011) however this is not possible for panel data in the data program used (EViews 7.1).

4.3.4 Robustness tests

Robustness tests are performed to validate results obtained through our model. Ways to create robustness include inserting various dummies, using alternative measures of variables or creating an artificially balanced panel. Appropriate methods for this model include balancing the panel as the data is unbalanced to a great extent, and dividing the sample countries into different groups based on income level.

To create the balanced panel in order to test for robustness we entirely excluded countries that lacked any observation for any variable during our specified time period (2001-2011). This created a panel consisting of twelve countries⁴, thus eradicating two thirds of the cross-sectional observations in the original sample of thirty six (see Table 7); this balanced panel is representative of the income distribution in the original sample. The second robustness test constituted dividing the original thirty six country sample into groups based on income level as of year 2011 (see Table 8), as defined by the World Bank. One group consisted of lower income countries (53% of the sample), one group comprised of lower middle income countries (28%) and lastly a group of upper middle income countries (19%) (see Table 1 and Graph 4).

⁴ Botswana, Cameroon, Cote d'Ivoire, Ghana, Kenya, Malawi, Namibia, Nigeria, Senegal, South Africa, Zambia, Zimbabwe.

4.4 Research methodology

4.4.1 Reliability

In order for this research to be reliable, two considerations must be made. Firstly the data collected must derive from reliable sources and secondly the research process must be done in a consistent way. Our study utilises annual data from the World Bank and Transparency International from the time period 2001-2011. The research has been conducted in a clear, structured and consistent manner throughout the process, enabling replication of the study. All data was processed in Microsoft Excel 2007 and later imported into EViews 7.1 to conduct the intended regressions.

The study analyses the sub-Saharan region and data is therefore restricted to countries in this area. Similar studies have used the same approach with regard to data sources and achieved good results, further increasing the reliability of our data sample. The research and data processing has been conducted with precision and caution in order to limit calculation errors which may have had implications for the study.

4.4.2 Validity

The validity of the subject is of utmost importance and concerns the degree of “truth” in our research. If the study does not reflect reality the validity of the study is of concern. The validity of the results is a product of the data. The data used in this study is therefore highly associated with the topic and has been gathered through reliable channels and handled with precision. The validity in our analysis stems from an objective review of relevant economic theory and the implementation of these theories on our data. As this study has been conducted in line with previous studies, there is little reason to suspect validity issues in the analysis.

4.4.3 Source criticism

The sources used throughout this paper include old and new articles retrieved from Google Scholar, ELIN@Lund and Discovery Search. The publishing dates of the articles vary, with some articles having been published in the early 1960s while others have been published in recent years. By including old and new articles the subject gains a wider perspective as the older articles create a foundation of fundamental ideas on the subject, while recently published articles contribute with newer perspectives. However there is an inherent risk in using old articles as the ideas in the older articles could be outdated, this risk was reduced by choosing articles which had been referred to in more recent publications.

The origin of the data collected also has to be considered. If the sources were to provide incorrect information the results generated would be misleading. The data used in this study is considered reliable as the World Bank and Transparency International are well respected organisations and data from these sources have been used in several previous studies on the subject. The World Bank development indicators and the Corruption Perceptions Index are therefore deemed to be reliable. However it is worth noting that the Corruption Perceptions Index is built on perceptions, which has been proven to have significant drawbacks (Bardhan, 1997).

5 Empirical findings

This chapter presents the empirical findings and their statistical significance. The chapter commences with descriptive statistics regarding the econometric tests performed in the study. Thereafter, the main results of regression model are presented.

5.1 Descriptive statistics

The sample, after losses, consists of 337 observations from thirty six sub-Saharan countries. The model constructed fulfills the Gauss-Markov assumption and achieves a BLUE regression. It can therefore be stated that no estimator has lower variance, thus there is no alternative estimator that better carries out the regression.

Our regression analysis will be conducted with fixed effects on both the cross-section and period observations. By conducting a Hausman test (see Table 2) and a Likelihood ratio test for redundant fixed effects (see Table 3) it can be shown that fixed effects is the optimal choice for our model; the prerequisites for using random effects have not been fulfilled as it cannot be said that we are drawing observations at random. The dataset concerns observations from countries and our sample of countries consist entirely of sub-Saharan nations, thus it cannot be said that the sample has been drawn at random, due to the fact that the world consists of roughly 200 sovereign states; depending on definition. (Dougherty, 2011, p. 525)

Table 2: Hausman test of initial regression (Table 14)

	Chi-Squared Statistic	Chi-Squared. Degrees of Freedom	Prob.
<i>Cross-section random</i>	19.0272	5	0.0019
<i>Period random</i>	7.9652	5	0.1582

Table 3: Likelihood ratio test of initial regression (Table 14)

	Statistic	Degrees of Freedom	Prob.
<i>Cross-Section F</i>	4.0031	(35.286)	0.0000
<i>Cross-Section Chi-Square</i>	134.3619	35	0.0000
<i>Period F</i>	1.4560	(10.286)	0.1556
<i>Period Chi-Square</i>	16.7343	10	0.0805
<i>Cross-Section/Period F</i>	3.7067	(45.286)	0.0000
<i>Cross-Section/Period Chi-Squared</i>	154.8393	45	0.0000

When analysing the correlation in our dataset we conclude that none of our explanatory variables show signs of multicollinearity, as no value exceeds 0.8 (see Table 1). Another multicollinearity test is achieved by performing step-by-step regressions (see Tables 10-14) thus ascertaining if variables “poach” explanatory power from each other, an indication of multicollinearity. The Corruption variable experienced loss of explanatory power on the inclusion of the GDP/capita variable, which indicates collinearity. This was not unforeseen as GDP/capita to some extent acts as a proxy for institutional efficacy. As the correlation matrix refutes a correlation the possible multicollinearity was not seen to be an issue in our model.

Table 4: Correlation matrix

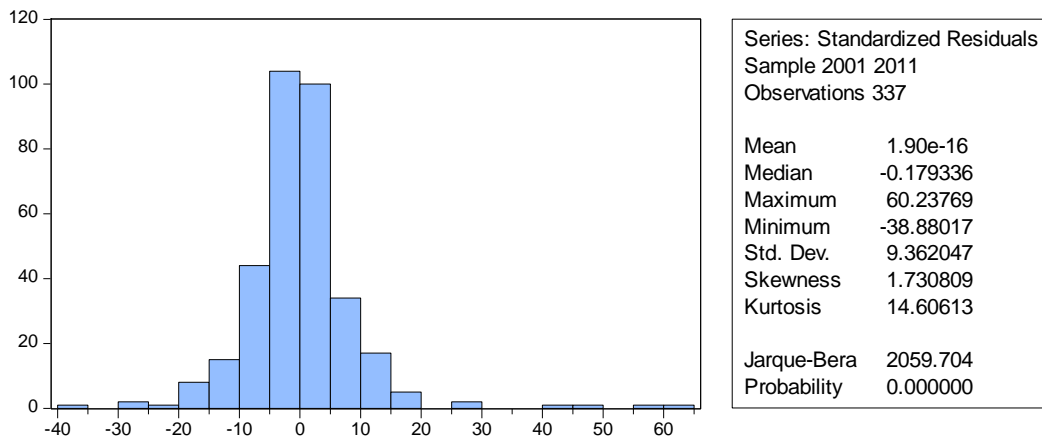
	Inflation	Corruption	(FDI/GDP)	Openness	GDP growth	GDP/capita
Inflation	1.0	0.093820	0.2244	0.159659	0.136920	-0.036577
Corruption		1.0	0,012841	-0.179036	0.060633	-0.602034
(FDI/GDP)			1.0	0.275144	0.122678	0,121607
Openness				1.0	0.010385	0.394646
GDP growth					1.0	-0.039160
GDP/capita						1.0

The Durbin-Watson statistic produced (1.7806) (see Table 9) indicates no signs of autocorrelation (positive or negative), and should therefore have no implications for the LS-estimate. The values obtained in our regression show no signs of unit roots as values of the above mentioned were within limits. Though contemporaneous correlation, autocorrelation and heteroskedasticity were not apparent in our model, we have chosen to

weight the model using PCSE weights on the cross-section according to the discussion in section 4.3.3.

The sample shows indications of normal distribution with a reasonably bell-shaped curve. Even though the residual distribution (see Graph 2) produced a high Jarque-Bera value, the value is considered low enough in relation to the number of observations in our sample. The level of probability further strengthens the assumption of normal distribution. We have thus determined that our sample is large enough to produce a normal distribution in the estimates, therefore the Gauss-Markov assumption of normal distribution holds.

Graph 2: Residual distribution of regression output in Table 15



An attempt to perform a regression with logarithmic values yielded unlikely results: despite calculating five year moving averages of all variables that assumed negative values (Inflation, GDP growth), many of the calculated averages were negative. It is not possible to calculate the logarithm of negative values thus many null values were generated, further unbalancing the dataset. After computing the squared values of all variables (except for corruption as it is already a somewhat abstract index) and performing regression analysis (see Table 5) with both level and squared variables, it would appear that the model suffers somewhat from non-linearity. This was however not apparent after graphical analysis (see Graph 5).

Table 5: Linearity test

Total panel observations:	337
Dependent variable:	Inflation
Independent variables:	Coefficient (S.E.)
β_0	8.4038 (7.2148)
<i>Corruption</i>	-0.0540 (0.0852)
<i>(FDI/GDP)</i>	-0.9371*** (0.2956)
<i>(FDI/GDP)²</i>	0.0708*** (0.0140)
<i>Openness</i>	13.1800* (7.2139)
<i>Openness²</i>	-4.3330 (3.9023)
<i>GDP growth</i>	0.3864** (0.1651)
<i>GDP growth²</i>	-0.0030 (0.0093)
<i>(GDP/capita)</i>	-0.0024** (0.0009)
<i>(GDP/capita)²</i>	1.95E-07* (8.59E-08)
Model R²	0.1603
Model Prob (F-statistic)	0.0000

Statistical Significance at ***1%, **5%, *10%

The relationship between inflation and corruption has been tested in a variety of studies (see Section 3.1) however the choice of dependent variable has varied. One could conclude: given the economic literature on the subject, that corruption and inflation affect one another and that no clear causal direction exists (see Table 6).

Table 6: Causality of Inflation and Corruption

Author(s)	Dependent variable	Independent variable
Al-Mahrubi (2000)	Inflation	Corruption
Akça et al. (2012)	Corruption	Inflation
Braun and Di Tella (2000)	Corruption	Inflation variability
Samimi et al. (2012)	Inflation	Corruption

We did not reach conclusive results when controlling for robustness in our results. In the balanced panel model (see Table 7) Corruption and (FDI/GDP) were both shown to be significant correlated with Inflation. The results of the income group robustness test (see Table 8) were inconclusive; different variables proved to be important determinants of Inflation depending on income level. The corollary of the robustness tests is that our model cannot be said to be fully robust thus implying a weakness in our model.

Table 7: Robustness test using balanced panel, fixed effects in period and cross-section and PCSE weights (cross-sectional)

Total panel observations:	132
Cross-section weights:	PCSE
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.5697* (0.2918)
<i>(FDI/GDP)</i>	-0.9165** (0.4512)
<i>Openness</i>	-1.3952 (12.8790)
<i>GDP/capita</i>	0.0008 (0.0012)
<i>GDP growth</i>	0.2020 (0.3035)
<i>B₀</i>	-27.1048 (20.8084)
Model R²	0.4860
Model Prob (F-Statistic)	0.0000
Effects specification:	Cross-section fixed Period fixed

Statistical significance at *** 1%, ** 5%, *10%

Table 8: Robustness test for income groups, fixed effects in period and cross-section and PCSE weights (cross-sectional)

Total panel observations:	170	98	69
Cross-section weights:	PCSE	PCSE	PCSE
Income group:	Low	Lower middle	Upper middle
Dependent Variable:	Inflation	Inflation	Inflation
Independent Variables:	Coefficient (S.E)	Coefficient (S.E)	Coefficient (S.E)
<i>Corruption</i>	0.2815 (0.1812)	0.5392* (0.3158)	0.2304 (0.4198)
<i>(FDI/GDP)</i>	-0.1587 (0.1561)	-0.5388 (0.4208)	2.0543*** (0.4388)
<i>Openness</i>	7.7577* (4.6115)	-19.4000 (15.3030)	28.9915 (25.7913)
<i>GDP/capita</i>	0.0278** (0.0131)	0.0023 (0.0060)	0.0036 (0.0034)
<i>GDP growth</i>	0.0761 (0.1560)	-0.2908 (0.5827)	-1.1135* (0.6166)
<i>B₀</i>	-27.5035* (15.8653)	-11.5104 (25.1123)	-55.3405 (48.5587)
Model R²	0.3747	0.5906	0.7177
Model Prob (F-Statistic)	0.0001	0.0000	0.0000
Effects specification:	Cross-section fixed	Cross-section fixed	Cross-section fixed
	Period fixed	Period fixed	Period fixed

Statistical significance at *** 1%, ** 5%, *10%

5.2 Results

Below we present the results of the regression performed in EViews 7.1 using Inflation as the dependent variable. The results below have been tested and corrected according to the discussion above (see Section 5.1). The table below (Table 9) shows the regression made using fixed effects in both period and cross-sections in the panel least squares model with PCSE cross-sectional weights, thus creating robust clustered standard errors.

Table 9: Regression output, fixed effects in period and cross-section and PCSE weights (cross-sectional)

Total panel observations:	337
Cross-section weights:	PCSE
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.3309** (0.1574)
<i>(FDI/GDP)</i>	0.5876** (0.2555)
<i>Openness</i>	7.3372 (5.7141)
<i>GDP/capita</i>	-0.0018 (0.0013)
<i>GDP growth</i>	-0.0832 (0.2141)
<i>B₀</i>	-17.7550 (12.7905)
Model R²	0.4237
Model Prob (F-Statistic)	0.0000
Durbin-Watson stat	1.7806
Effects specification:	Cross-section fixed Period fixed

Statistical significance at *** 1%, ** 5%, *10%

Corruption and (FDI/GDP) were both shown to be positively and significantly correlated with Inflation. Even though not significant, the GDP/capita and GDP growth coefficients were indicative of negative relationships with Inflation. Openness was not shown to be significantly correlated with Inflation however the coefficient suggests a positive relationship between the variables.

6 Analysis

This chapter interprets the findings from the previous chapter with regard to the theoretical framework. It therefore constitutes the main product of this study.

It is no coincidence that sub-Saharan Africa, a region fraught by conflict and instability, has not been the focus of much previous economic study. The reason for this is a grave lack of data concerning certain countries; statistical reporting seems to disappear in the face of conflict. This has had consequences for our study, forcing a smaller index of countries and a shorter timespan than otherwise planned. Furthermore the data that has been used is unbalanced which could affect the regressions' outcomes; the unbalanced data could cause a bias as the periods corresponding to the greatest instability and therefore highest corruption and/or inflation may be those that have been omitted. Friedman (1963) asserts that funding wars is one of the most common reasons for seigniorage (p. 9). In recent years as the region has become more stable, data has become more complete; this will enable more widely-based research in the future.

Though most data was collected from the World Bank and is thought to be reliable, the corruption data was taken from Transparency International's (TI) Corruption Perceptions Index (CPI). TI is a highly reputable organisation; however the index is built on perceptions, which traditionally adjust slowly to new developments. Policy changes aimed at addressing corruption can take many years to implement and be seen to have an effect, which could account for the low variation in the CPI data. The low variability in the CPI index could have had major implications for our study as we attempted to analyse the relationship between this variable and a highly fluctuating inflation index. To achieve further robustness other variables that also measure corruption could have been included; however that might have introduced multicollinearity into the model. Other such variables are hard to measure and quantify and were therefore omitted (see Bardhan, 1997;

Svensson, 2005). We would have liked to build other models using alternative measures of corruption however this was not possible due to insufficient data.

Corruption was shown to have a significant and positive effect on inflation. This result was predicted by theory and many previous studies; however there seems to be some heterogeneity that is not captured by the result. The mechanism by which the positive relationship occurs cannot be empirically proven however this paper hypothesises, in accordance with Al-Mahrubi's (2000) research, that corruption has many negative implications for the tax base, thus incentivising seigniorage as a government revenue stream. The positive coefficient obtained through regression analysis can be explained by theories that highlight how corruption erodes the tax base, and therefore makes an inflation tax more attractive. Al-Mahrubi (2000) highlights several ways in which corruption contributes to inflation due to tax base depletion. Simultaneous corruption and inflation bring about a negative spiral in which governments' costs surge, whereas revenue steadily decreases. Costs increase due to embezzlement, but also as a result of the monetary costs of inflation and increased import costs due to real currency depreciation (World Bank, 1997; Friedman, 1963; Burda and Wyplosz, 2009).

The results obtained through regression analysis give further weight to theoretical assumptions surrounding the relationship between inflation and corruption. Al-Mahrubi (2000) theorises that corruption incentivises black market activity. Friedman (1963) argues that inflation is always and everywhere a monetary phenomenon, however many attribute it to increased price-levels set by profit seeking firms, thus governments may try to suppress price-levels and inflation. An inability to openly charge market prices may tend to force firms into the parallel economy, however a large underground economy further shrinks the tax base creating further motives for seigniorage and, in turn, inflation. Furthermore inflation tax/seigniorage may be the only way to tax activity in the parallel economy (Mankiw, 1987). Corruption, too, creates motives for businesses to move to the parallel sector as a result of rising business costs (Svensson, 2005).

Robustness tests do not categorically strengthen the hypothesis of a positive correlation between inflation and corruption. As a result of colonial history and current political and social turbulence, countries in Africa have widely ranging institutional frameworks, or lack thereof. The corollary of this diversity within sub-Saharan Africa is that small reference groups are ill-equipped to provide broad truths. The variables shown to contribute to inflation differed distinctly between the different income groups in the robustness test.

Neither GDP/capita nor GDP growth showed to be significantly correlated with inflation therefore we cannot comment with certainty on their relationship. The variables are indicators of not only development level but also general state of governmental aptitude; both showed negative coefficients thus indicating that a less “well-functioning” government contributes to inflation. This is in line with Friedman’s (1963) theory that inflation is an attractive source of funding for governments lacking political legitimacy, this as inflation is the only tax that can be levied without legislation. Furthermore difficulties in raising tax revenue, perhaps exacerbated by low GDP levels, can be alleviated through seigniorage as money has no substitute; therefore no one can “escape” taxation (Friedman, 1963). This becomes an especially pertinent issue in unstable societies and economies that are served by weak or corrupt government institutions. The GDP/capita and GDP growth variables seemed to have acted as proxies for institutional efficiency, illustrating in accordance with work by Blackburn, Neanidis and Haque (2008) that corruption in the public sector increases the need for seigniorage financing. No index of institutional efficiency was included as this would probably have been collinear with corruption and the available data was in any case insufficient.

Regression analysis showed that FDI as a percentage of GDP has a statistically significant positive effect on inflation. This stands in contrast to Svensson’s (2005) hypothesis which states that the value of capital and other assets is eroded through inflation, deterring investment. Likewise he asserts that the social costs of corruption include the inefficient allocation of resources, including the disincentive for business investments causing capital flight and reduced FDI (Svensson, 2005). Our hypothesis that FDI acts as a proxy for investor confidence in the face of macroeconomic (in)stability due to inflation and other

factors cannot be proved. Despite the findings of our regression, a combination of corruption and inflation is very damaging to the investment climate as a result of inflation tax, diminishing value of capital, monetary costs of corruption and impediments to doing business such as red-tape and insufficient property rights (Svensson, 2005; Blackburn, Neanidis and Haque, 2008). Therefore a positive relationship must result from FDI being an indicator or proxy for some omitted variable. It is possible that a positive coefficient is indicative of increased foreign capital inflows causing inflation due to malfunctioning capital markets, or other unanticipated links.

Openness showed to have a positive though non-significant effect on inflation, the interpretation of this is unclear but presumably this variable's explanatory power as a measure of vulnerability to external markets was stronger than as a proxy for ease of doing business. Similarly, the variable FDI (% of GDP) might act as an indicator of volatile foreign capital markets and not investor confidence. Domestic institutions such as financial and labour markets could reduce the vulnerability to external shocks that openness causes (Loayza and Raddatz, 2006). We tentatively conclude that better functioning financial markets that e.g. absorb excess foreign currency would reduce the negative impact that seems to contribute to inflation.

7 Conclusions

This final chapter summarises our findings and makes suggestions for policy and future study.

7.1 Concluding remarks

The purpose of this thesis was to investigate the relationship between corruption and inflation in sub-Saharan Africa by means of an empirical study. We aimed to fill a gap in the economic literature by applying relevant theories to this specific region. With reference to previous research within the topic area, we were able to theorise about the relationship and reached statistically significant results through econometric regression analysis. The findings of Al-Marhubi's (2000) seminal research on the relationship between corruption and inflation have therefore been strengthened by our findings.

Our hypothesis was that corruption and inflation are positively correlated as the former creates motives for inflation-fuelling seigniorage. Our findings suggest that corruption exacts a large monetary penalty on an economy in the form of direct costs such as embezzlement but also through the tax base depletion caused by diminished investment and growing parallel markets. Governments are therefore forced to seek other sources of funding, with seigniorage as an attractive alternative source of revenue.

Inflation does seem to be affected adversely by institutional inefficiency as illustrated by the many control variables that act as proxies for governmental efficacy. Notably both (FDI/GDP) and Openness were shown to be positively correlated with inflation, indicating that vulnerability to the effects of foreign capital flows contributes to inflation as a result of underdeveloped financial regulation. Though statistically insignificant, both GDP/capita and GDP growth, telling indicators of development level and of a functioning economy (also with regard to tax revenue), were negatively correlated with inflation. One could further speculate that countries at a higher developmental level have less need to engage in seigniorage activities in order to fund government expenditure.

The causality of the relationship between inflation and corruption is unclear as has been demonstrated by the many previous studies within the field (see Table 6). It is however apparent that institutional effectiveness and a stable macroeconomy contribute to both inflation control and corruption control as they tend to create environments where governments can enforce laws, regulate markets and are able to effect credible inflation targeting.

The findings of this thesis are thus that corruption contributes positively to inflation in sub-Saharan Africa, possibly as it creates seigniorage motives for governments struggling to fund public expenditure as a result of the tax base eroding effects of both corruption and inflation. Further study is necessary to determine the mechanism linking corruption and inflation. Seigniorage is hard to measure, especially due the lack of institutional transparency in the government apparatus in the region studied. Due to the fast changing economic, political and institutional environment in the region, future studies will presumably be able to take advantage of greater data availability and reliability which will hopefully generate more conclusive results: in turn enabling policy prescriptions for combatting corruption and thus inflation.

The policy prescriptions resulting from this paper concern the need to create independent and accountable institutions, notably central banks with credible inflation targeting. These measures would contribute to a better business and investment climate thus promoting economic growth which increases tax revenue. Furthermore institutional development must take place in order to regulate financial and other markets hence reducing external vulnerability. Creating a functioning judicial system that eliminates corruption and guarantees property rights, would stimulate investment and promote growth.

7.2 Further studies

In order to gain further insights into the relationship between inflation and corruption more studies in this field will be necessary. Due to the unclear causality between the variables, study of the relationship using corruption as the dependent variable would be interesting. As more data becomes available as African countries develop, future studies will be able to take advantage of balanced data for a wider range of countries.

Analysis would benefit from the inclusion of alternate measures of corruption as this would achieve greater robustness in the results. The ability to measure seigniorage would have strengthened our hypothesis as our study was only able to make assumptions regarding the relationship between corruption and seigniorage. Furthermore an index measuring Central Bank independence could have given further insights into the relationship between inflation and corruption in the public domain.

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9 Appendix

Below we present the process leading to our final results, including residual distribution graphs and econometric tests. We also provide some background information about the region.

Table 10: Regression output: Inflation and Corruption

Total panel observations:	337
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.1141* (0.0662)
<i>B₀</i>	2.0505 (4.7228)
Model R²	0.0088
Model Prob (F-Statistic)	0.0855

Statistical Significance at ***1%, **5%, *10%

Table 11: Regression output: Inflation, Corruption and (FDI/GDP)

Total panel observations:	337
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.1107* (0.0646)
<i>(FDI/GDP)</i>	0.5303*** (0.1261)
<i>B₀</i>	-0.0001 (4.6351)
Model R²	0.0586
Model Prob (F-Statistic)	0.0000

Statistical significance at *** 1%, ** 5%, *10%

Table 12: Regression output: Inflation, Corruption, (FDI/GDP) and Openness

Total panel observations:	337
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.1392** (0.0654)
<i>(FDI/GDP)</i>	0.4456*** (0.1306)
<i>Openness</i>	4.6907** (2.0395)
B_0	-5.1973 (5.1301)
Model R²	0.0733
Model Prob (F-Statistic)	0.0000

Statistical significance at *** 1%, ** 5%, *10%

Table 13: Regression output: Inflation, Corruption, (FDI/GDP), Openness and GDP/capita

Total panel observations:	337
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.0889 (0.0809)
<i>(FDI/GDP)</i>	0.4547*** (0.1309)
<i>Openness</i>	5.4610** (2.1662)
<i>GDP/capita</i>	-0.0004 (0.0004)
B_0	-1.6197 (6.1509)
Model R²	0.0764
Model Prob (F-Statistic)	0.0000

Statistical significance at *** 1%, ** 5%, *10%

Table 14: Regression output: Inflation, Corruption, (FDI/GDP), Openness, GDP/capita and GDP growth – initial regression

Total panel observations:	337
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.08347 (0.0806)
<i>(FDI/GDP)</i>	0.4225*** (0.1313)
<i>Openness</i>	5.4863** (2.1564)
<i>GDP/capita</i>	-0.0004 (0.0003)
<i>GDP growth</i>	0.2843** (0.1414)
<i>B₀</i>	-2.4995 (6.1386)
Model R²	0.0876
Model Prob (F-Statistic)	0.0000

Statistical significance at *** 1%, ** 5%, *10%

Graph 3: Residual distribution of regression output in Table 14

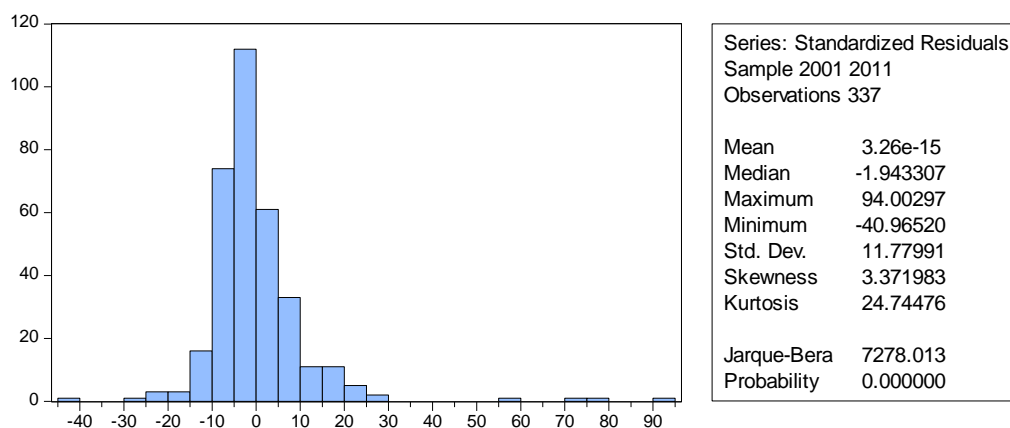
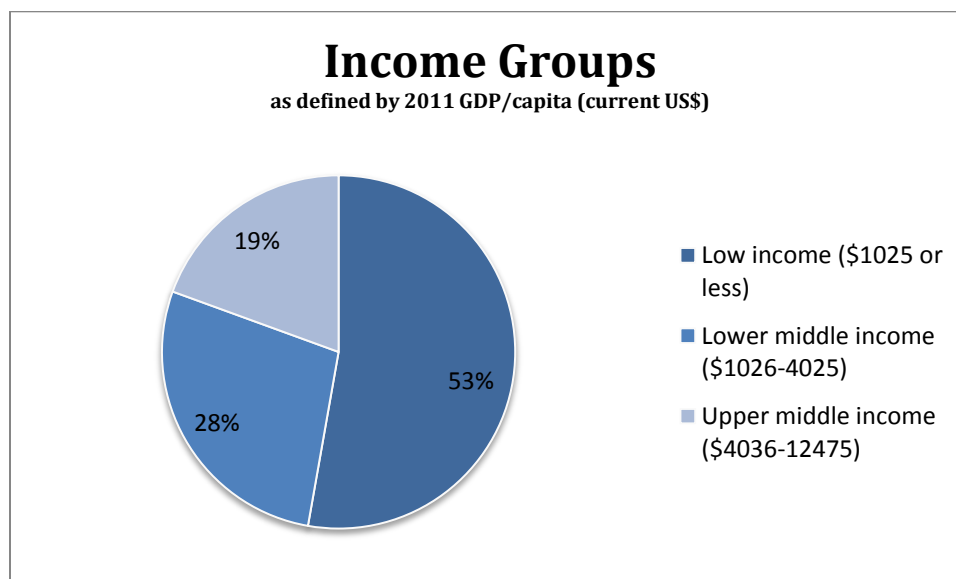


Table 15: Regression output, initial regression with fixed effects in period and cross-section

Total panel observations:	337
Dependent Variable:	Inflation
Independent Variables:	Coefficient (S.E)
<i>Corruption</i>	0.3309* (0.1894)
<i>(FDI/GDP)</i>	0.5876*** (0.1494)
<i>Openness</i>	7.3372 (5.0384)
<i>GDP/capita</i>	-0.0018* (0.0010)
<i>GDP growth</i>	-0.0832 (0.1527)
<i>B₀</i>	-17.7550 (14.0971)
Model R²	0.4237
Model Prob (F-Statistic)	0.0000
Durbin-Watson stat	1.7806
Effects specification:	Cross-section fixed
	Period fixed

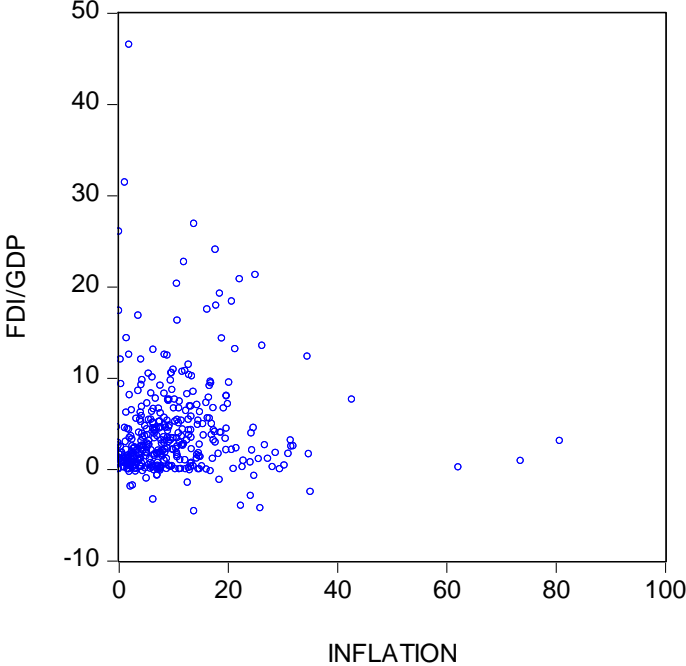
Statistical significance at *** 1%, ** 5%, *10%

Graph 4: Income groups



Source: World Bank (2013)

Graph 5: Graphical linearity test of (FDI/GDP) against Inflation



Source: World Bank (2013)