TAX EVASION AND ECONOMIC GROWTH IN SELECTED AFRICAN COUNTRIES, 1985-2010

William Bekoe

Abstract

Major tax reforms were undertaken in the 1980s with the aim of enhancing revenue mobilisation and laying the foundation for sustained economic growth. Yet African countries continue to experience low tax revenue, hence declining economic growth. The existence of tax evasion has been cited as the major hindering factor. However, empirical evidence on the severity of tax evasion and its impact on economic growth is not only inconclusive but also limited. This study, therefore examines the impact of tax evasion on economic growth and the direction of causality between them in seven African countries for the period 1985 to 2010. The study used panel data estimation techniques and conducted causality tests. The results indicated that tax evasion was the single most important factor that retarded economic growth, whereby a 10.0% increase in tax evasion reduced economic growth by about 7.1%. The results from causality tests indicated that four countries exhibited bi-directional causality, one demonstrated unidirectional relationship, from tax evasion to economic growth; while two showed unidirectional causality from economic growth to tax evasion. The study, therefore, recommends that governments should evolve perhaps towards monetisation of the economy and the evaluation of an optimal tax system for each country.

JEL Classification: H26, F43
Key words: Tax evasion, Economic growth, Panel data, African countries

INTRODUCTION

Large fiscal deficits have been a major challenge confronting a number of African countries over the past several years. Rapid expansion in expenditure and low revenue levels have been assigned as the primary cause of such fiscal imbalances. In recent periods however, endogenous growth models argue that growth can be enhanced by either reducing expenditure levels or raising revenue in order to reduce the fiscal

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4 Dr. William Bekoe is a Lecturer at Department of Economics, University of Ghana. The views expressed in this paper are personal to the author and does not represent the official position of his employer.

5 Nashashibi and Bazzoni (1994) provide an analysis of the trends in revenue and expenditure, as well economic performance in the region, during the period 1980 to 1981.
imbalances (Tanzi and Zee, 1997). As a result, many countries in the African sub-region including Ghana, Uganda, Nigeria, Kenya and many others have reduced expenditures to the minimum sustainable levels especially in health, education and infrastructure without any significant changes in their fiscal stance. Thus raising tax revenue to achieve fiscal sustainability has become the most feasible alternative. Moreover, in order to create the necessary environment that will “crowd in” the private sector to play their rightful roles to achieve desired growth levels, governments of African countries must invest in physical and human capital and institutional infrastructure. Tax revenue would be needed for such expenditures if inflationary financing and crowding out of the private sector is to be avoided (Hamada 1994). Thus mobilizing sufficient tax revenue is a sine qua non for achieving sustained economic growth.

Meanwhile, Nashashibi and Bazzoni (1994) observed that the existence of wide divergences between effective and statutory tax rates in many African countries indicates that there is scope for raising tax revenue without increasing tax rates by reinforcing tax and customs administrators, reducing tax exemptions and fighting fraud and corruption.

It was in the light of these developments, that the 1980s witnessed the implementation of major tax reform policies among several African countries within the framework of stabilization and structural adjustment programmes with the aim of laying a strong foundation for sustained economic growth. A key element of the programme was the restoration of fiscal discipline and the pursuit of a growth-oriented fiscal strategy. The fiscal adjustment involved not only a determined effort at expenditure control to reduce budget deficits, but also an increase in domestic resource mobilization through reforms in the tax systems. Though the reforms were taken at different times, by the mid-1990s several African countries including Ghana, Botswana, South Africa, Nigeria, Kenya and Cote d’Ivoire had undertaken comprehensive tax reforms thereby improving tax compliance through reductions in tax burdens and complexities in the tax systems as well as improvement in tax administration.

By the early 1980s the average ratio of total tax revenue to GDP for African countries with per capita income less than $360, was 11.1 percent and 14.8 percent for those countries whose per capita income exceeded $360 compared with the 31.2 percent for industrial countries. At the regional level, the Middle East and Asia exhibit tax ratios of between 14 and 15 percent (Burgess and Stern 1993). The reforms however led to an increase in the average tax revenue/GDP to 17.3% in the 1990s and to 20.5% for the period 2000 to 2010. This performance notwithstanding, tax revenue performance in

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6 Sine qua non means an indispensable and essential action, condition, or ingredient.

7 See Appendix A for trends in tax revenue for sample countries.
Africa is still low when compared with the average tax revenue / GDP of 33.8% for developed countries in the last decade. The existence of tax evasion in the tax system has been cited as the major hindering factor in the mobilization of adequate tax revenue and hence accounting for the decline in economic growth among several African countries (see Cabelle and Penades, 1997; Chen, 2003).

Tax evasion has the tendency of reducing the potential revenue generation capacity of a government and thereby constraining her expenditure outlays. Just like tax holidays and concessions, taxes avoided or evaded serve as an indirect public expenditure. Tax evasion also reduces the tax base and leads to the imposition of higher tax rates on individuals and businesses loyal to honouring their tax obligations. Tax evasion may further undermine the equity attribute of a tax system; where honest tax payers feel frustrated and are easily tempted to join the decision to evade.

The fundamental aim of the study is therefore, to assess the impact of tax evasion on economic growth in some selected African countries and to determine the direction of causality between tax evasion and economic growth. Providing answers to these questions will enable us find long-term solutions to maximizing growth in Africa through domestic resource mobilization.

The importance of the study stems from the fact that the relation between tax evasion and economic growth is not only scarce but also inconclusive. At the theoretical level, whereas Roubini and Sala-i- Martin (1995) and Lin and Yang (2001) argue for a positive relationship between tax evasion and economic growth. Cabelle and Penades (1997) and Chen (2003) have however suggested a negative association. Eichorn (2004) on the other hand argued that tax evasion has no impact on economic growth. Given that there are limited empirical studies on this relationship, the study attempts to unearth the relationship between tax evasion and economic growth empirically for some selected African countries. The use of panel data for analyzing the relationship between tax evasion and economic growth is an added advantage over most studies that use time series at least in two main respects: first, in the context of African countries data for a long period of time that enables the application of time series methods are not always available for a wide set of countries. Thus, resorting to panel data estimation methods help to circumvent the problem. Second, even when data is available for a long period, they may not show much variation over time in a given country so that their effect, though important in theory, may not be fully depicted by time series estimation methods in a single country regression. The effects of such variables can easily be picked up in panel data estimation by accounting for the cross-sectional variation of such variables.

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8 See Appendix B for trends in GDP growth rates among sample countries.
The rest of the study is organized as follows. Section II focuses on the overview of tax evasion in Africa. Section III reviews the relevant literature of the study whereas Section IV discusses the theoretical and methodological framework. Presentation and discussion of results is taken up in Section V. Section VI then concludes that study.

OVERVIEW OF TAX EVASION IN AFRICA

Conceptual Issues
Tax evasion is the general term used for efforts by tax payers to evade the payment of taxes by illegal means (Asher 2001). It has also been defined as the conscious attempt to under-declare a taxable activity. It usually entails a premeditated misrepresentation or concealment of the true state of one’s economic activity in order to reduce one’s tax liability and includes dishonest tax reporting such as under declaring income, profits or gains, or overstating of deductions. Tax evasion is thus illegal and a criminal offence punishable by fines or even imprisonment. Tax evasion may be distinguished from tax avoidance-the reorganization of economic activity, possibly at some cost, to lower tax payment. Tax avoidance is legal (Myles 1995).9

Who Evades tax?

Very few people like paying taxes but the hostility to taxation and the propensity to evade depend on cultures as well as economic incentive. Thus the success or failure of any taxation system depends on the level of voluntary compliance as well as on enforcement. For certain individuals evasion may be relatively passive in that there is little attempt by the government to impose the tax. Taxes are therefore evaded by individuals as well as corporate entities and take place in the administration of both direct and indirect taxes.

In order to enjoy the benefit of evading taxes, individuals engage in a myriad of tax evasion and avoidance activities and behaviours. The most prevalent ones are as follows10:

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9 See also “Evasion is illegal; avoidance is not”. Carter Commission Report (Report of the Royal Commission on Taxation, Queen’s Printer, Ottawa 1966), Volume 3, page 538

10 This section draws on “Tax Audit Techniques in Cash Based Economies” (2005) and “Strategies and Initiatives used by CATA member countries (2006) by The Commonwealth Association of Tax Administrators (CATA)
• Non-reporting/declaration of income.
• Under reporting of incomes.
• Misreporting of income
• Diversion of income
• Failure to register business

Just as in the case of individuals, non-filing of tax returns; non-declaring income/underreporting of income; and the over-claiming of expenses by businesses and corporation are the primary sources by which businesses and corporations evade tax in Africa. However, in addition to these behaviours, abuse of transfer pricing; promotion/participation in aggressive tax planning schemes; engaging in VAT fraud; and the abuse of thin capitalization and debt financing have also been regarded as contributing sources of tax evasion in Africa. Taken as a whole, the effects of evasion are impressive. Acharya (1985) estimated that, for developing countries, of the total income assessable for tax, the actual percentage declared was 53.3 percent in 1975 and 41.9 percent in 1980.

Both the self-employed and multinational corporations engage in tax evasion activities. Tax evasion by the self-employed usually takes the form of non-filling of returns and failure to keep records. Small to medium companies do register for tax purposes and file returns, but their most attractive method of evasion is underreporting of income and overstatement of deductions. This is done through accounting misleads and failure to keep adequate records. Multinational corporations on the other hand, tend to use more complicated methods to conceal and shift their tax base through intra-company transactions.

Tax evasion at the firm level takes several forms including:
• Keeping of two sets of accounts simultaneously with one account showing very low profits before tax;
• Failure to report fully and adequately on income and expenditure by either omitting items of income or claiming inflated deductions or expenses;

Rather than depend on declaration of income by small taxpayers and businesses, Musgrave (1969) and others suggest that presumptive-income and estimated-income approaches, where incomes and returns on capital are calculated independently, might be used instead.
• Refusal to take delivery of notices of assessment sent through the post. Such notices are sometimes returned with messages such as “Taxpayer not known”, or “Taxpayer ejected”;
• The use of false names or false documents;
• The inclusion of an overseas entity in a domestic transaction;
• The use of transactions that have no apparent commercial reality or relevance;
• Keeping of goods away from their registered places of business (sometimes in their homes) and distributing them to selected customers; and
• Attempts to reduce tax liabilities by splitting incomes amongst wives, children and other close relatives or associates.

Tax evasion is not limited to income taxes alone. Sales taxes and excises are evaded in many ways. A popular method is under invoicing. The problem seems to be particularly severe in the service sector, where clients are often presented with an option: a higher fee if tax is to be declared or a lower one if the transaction is to go unreported (Burgess and Stern 1993). The introduction of VAT systems, with their built-in incentives to seek correct invoicing of one's purchases, seems to contribute to a reduction of noncompliance in domestic indirect taxation (Tait 1988 and Goode 1990). Evasion of import or export duties (also called smuggling) remains a serious problem in many African countries. The procedures used vary and do not always require avoidance of customs officials but through under-declaration of goods, fake delivery papers and so on.

LITERATURE REVIEW

Theoretical Literature

In spite of the fact that growth theory is a popular field of economic research, models explicitly taking into account the possibility of tax evasion are quite rare. Roubini and Sala-i-Martin (1995) develop the first model, where government reacts to tax evasion as follows: in countries with perceived high incidence of tax evasion, government increases seigniorage by repressing the financial sector and increasing inflation rates. This government policy tends to reduce the amount of services that the financial sector provides to the economy; therefore the results are lower growth rates.

The study by Caballe and Panades (1997) follows by attempting to explain how tax compliance policy affects the rate of economic growth in a (discrete-time) overlapping generations model with identical individuals who possess logarithmic utility, where tax financed public goods are productive and completely rival. They found that the effect was generally ambiguous and depends on the importance of public inputs in the production process, because (if compliance is not perfect) stricter enforcement increases compliance, leading to two effects in opposite directions. On the one hand, a fall in
private saving may cause disposable income to fall and whereas a rise of public inputs leads to higher investment. Caballe and Panades (2007) extended their basic tax evasion model to a multi-period economy exhibiting sustained growth. In this study as individuals conceal part of their true income from the tax authority, they face the risk of being audited and hence of paying the corresponding fine. Taxes and fines together determine saving and the rate of capital accumulation of individuals. The study suggested that if the penalty imposed on tax evaders is proportional to the amount of evaded taxes, then the growth rate is decreasing in the tax rate. The relationship between growth and tax rate however was found to be non-monotonic when the penalty rate is imposed on the amount of evaded income.

The study by Lin and Yang (2001), however, adapted part of the growth model of Barro (1990) in a continuous-time endogenous growth model with tax evasion. If public goods have consumptive character only, Barro found that the growth rate is strictly decreasing in the tax rate. Lin and Yang (2001) show that for individuals with logarithmic preferences tax evasion may rather encourage economic growth because resources are diverted from the unproductive government sector to the productive private sector.

Chen (2003) investigates an endogenous growth model with public capital financed by an income tax which can be evaded. He investigates the optimum decision of saving and evasion in an environment without uncertainty assuming that individuals hold assets of enough firms so that auditing for a fraction of income is certain by the law of large numbers. Government optimizes the tax rate, auditing probability and fine rate given the consumer's evasion decision. In general these policies have ambiguous effects, but for realistic parameter constellations he found that growth declines with tax evasion.

The research by Eichorn (2004) examines an endogenous growth model, where individuals optimize consumption and tax evasion over time given the tax structure and tax compliance policy of the government. Applying methods of stochastic optimal control, the individual's problem is solved and the rate of economic growth is derived. Given the consumption and evasion decision government designs its tax policy. It is shown that a welfare maximizing government adjusts its tax rate upwards to ensure a sufficient provision of a public good. In effect, tax evasion has no impact on the growth rate.

Empirical Review

Hanousek and Palda (2007), in their study on Displacement Deadweight Loss from Tax Evasion, found that in the presence of the underground economy taxes give rise to a deadweight loss from displacement of efficient producers by inefficient producers. They considered an economy in which a producer faces two types of costs: the cost of production and taxes. If the ability to evade taxes is inversely proportional to the ability
to keep production costs low, high tax rates may cause inefficient producers to crowd out efficient producers. They estimated this deadweight loss from surveys of 426 Czech firms taken in 2004 and 2005. They further found that the deadweight loss due to this crowding out could be several times as large as the deadweight losses from discouraged consumption.

In another vein the study by Sookram and Watson (2005) had two main objectives. The first objective was to determine the extent of tax evasion in Trinidad and Tobago during the period 1960-2000. This was done using estimates of the hidden economy based on a variant of Tanzi’s monetary model. The second objective was to determine if, and to what extent, any relationship exists between certain key macroeconomic variables and the level of income tax evasion in Trinidad and Tobago. The bounds testing procedure to cointegration within an autoregressive distributive lag (ARDL) framework is used to address the issue. The study established a long-run relationship between tax evasion, per capita economic growth, imports, external debt, unemployment and inflation.

Cerqueti and Coppier (2009) explored tax revenues in a regime of widespread corruption in a growth model. They develop a Ramsey model of economic growth with rival but non-excludable public good which is financed by taxes which can be evaded via corrupt tax inspector. They show that the relationship between the tax rate and tax collection, in a dynamic framework, is not unique. The study revealed that growth rates - both of income and of tax revenues - decrease, as the tax rate increases but they differed in how the growth rate decreases as the tax rate increases among countries.

Mironov (2010) examines the effect of tax evasion on firm growth using a unique set of data that contains 236 million banking transactions of 1.7 million Russian firms over the period 2003 to 2004. The study estimated income diversion in Russia to be 11.3% to 3.1% of GDP, which corresponds to tax evasion of 4.6% to 5.8% of GDP respectively. The study developed a direct measure of tax evasion for 46,965 companies and finds that, on average; firms divert 5.7% (31.2%) of their revenue (assets) per year. The paper then documents a negative relation between tax evasion and firm growth. One standard deviation increase in tax evasion is associated with a 1.7%-2.0% (0.7%-0.9%) decrease in the growth of revenue (assets). Finally, the paper examines several factors that could explain this result and finds that tax evaders face restricted access to capital markets. One standard deviation in tax evasion corresponds to a 5.191-basis point increase in debt interest rate. Tax evaders also were found to experience a decline in productivity.

Fisman and Svensson (2000) study the relationship between bribe payments, taxes, and firm growth in Uganda for the period 1995-97. Using industry-location averages to circumvent the potential problem of endogeneity and to deal with issues of measurement error, they find that both the rate of taxation and the rate of bribery are negatively correlated with firm growth. For the full data set, a one percentage point increase in the bribery rate is associated with a three percentage point reduction in firm growth—an effect about three times that of taxation. Moreover, after excluding outliers, the authors
find that bribery has a much greater negative impact on growth, and taxation a considerably smaller one. This provides some validation of firm-level theories of which posit that corruption retards development even more than taxation does.

THEORETICAL FRAMEWORK AND METHODOLOGY

Following the Penades and Caballe (1997) and Chen (2003) approaches, the study constructs a dynamic general equilibrium model for explaining the relationship between economic growth and tax evasion. Tax evasion is introduced as part of the optimization problem of economic agents who choose how much tax to evade, depending on the probability of being caught and punished to maximize expected utility over time. For this study, the probability of getting caught and the fine rate are taken as being exogenous to taxpayers and collectors.

Let us consider an overlapping generations (OLG) economy populated by identical individuals living for two periods. A new generation is born in each period and there is no population growth. Generations are indexed by the period in which they are born. Individuals own a unit of labour when they are young (the first period of their lives) and this unit of labour is supplied inelastically to firms in exchange for a wage. Labour income is subjected to a proportional tax and the tax rate is \( \tau \in (0, 1) \). An individual of generation \( t \) declares a level \( x_t \) of labour income during the first period of life. Therefore, the amount of taxes paid voluntarily will be \( \tau x_t \). Since tax evasion is possible, \( x_t \) might be less than the real wage \( w_t \). With probability \( p \in (0, 1) \), individuals are subjected to investigation by the tax authority and if such an investigation takes place, the tax collecting agency detects the true labour income earned by the taxpayer. In such a situation, the taxpayer will have to pay a proportional penalty rate \( \pi > 1 \) on the amount of evaded taxes \( \tau(w_t - x_t) \). The specification of the tax evasion problem is thus the same as in Yitzhaki (1974) since the penalty is imposed on evaded taxes while Allingham and Sandmo (1972) assume instead that the penalty is imposed on undeclared income.

In the first period, young individuals work and receive their wages. Then they voluntarily declare the labour income they have earned and pay the corresponding taxes. Consumption in the first period of life then takes place. Let \( s_t \) denote the disposable income after an individual has consumed and paid the taxes on declared income. Then, the potential inspection occurs with probability \( p \). The effective saving of an agent who has not been audited is \( s_t \), while the saving of an audited agent will be \( s_t - \pi \tau(w_t - x_t) \). The gross rate of return on the amount effectively saved is \( R_{t+1} \).
Capital income will be consumed when individuals are old (that is, in the second period of life). An old individual does not have any other source of income and thus his consumption will be $R_{t+1}(s_t - \pi \tau (w_t - x_t))$ if he has been audited, or $R_{t+1}st$ if he has not. Since the inspection occurs after consumption has taken place, taxing the income of old agents is not enforceable and therefore, capital income is tax exempt.

**The Household**

The preferences of an agent of this household in time $t$ is represented by the time-additive Von Neumann-Morgenstern (V-N M) utility function

$$ u(c^1_t) + \delta E(u(\tilde{C}^2_{t+1})) $$

(1)

where:

- $C^1_t$ = Consumption in the individual’s first period of life (young consumption); and
- $\tilde{C}^2_{t+1}$ = Random consumption in the second period of life (old consumption).

The random variable $\tilde{C}^2_{t+1}$ takes two values, $C^2_{t+1}A$ and $C^2_{t+1}N$ which correspond to old consumption if the individual has been audited, and old consumption if he has not been audited, respectively. The parameter $\delta > 0$ is the discount factor.

**The firm**

Competitive firms in the economy produce a single good according to the following Cobb-Douglas gross production function

$$ Y_t = BK^\alpha_t \hat{L}^{1-\alpha}_t, \text{ with } B > 0, \alpha \in (0,1) $$

(2)

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12 A V-N M utility function is preferable because tax evasion is gamble activity; where the consumer can loose (if caught) or gain (if evasion is successful). A given that a V-N M utility function deals with consumer uncertainty it is deemed the most appropriate utility function for the theoretical framework.

13 See Appendix C for details on the general equilibrium problem between the household, the firm and the government.

14 This type of production function allows for extensions such as analyzing the impact of government’s investment expenditure on production as in Barro (1990).
where:

\[ Y_t = \text{Gross output}; \]
\[ K_t = \text{Private capital used by each firm}; \]
\[ \hat{L}_t = \text{Efficiency units of labour hired by each firm}. \]

**The Government**

Government finances the stock of public capital by means of both the proportional taxes on declared income and the penalty fees collected from the audited taxpayers in the preceding period. It is assumed that the government faces a proportional inspection cost \( c \) per unit of audited income. Hence, the budget constraint of the government is:

\[ g_{t+1} = (1 - \rho) \tau x_t + \rho (\tau x_t + \pi \tau (w_t + x_t)) - cpw_t \]

(3)

where:

\( (1 - \rho) \tau x_t \) = Taxes paid by non-audited taxpayers;
\( \rho (\tau x_t + \pi \tau (w_t + x_t)) \) = Taxes plus penalty fees paid by audited taxpayers; and
\( cpw_t \) = Cost associated with tax inspection.

**Model Specification**

By using equations (1) to (3) and by controlling for non-evasion factors that influence long run growth, the economic growth model can generally be specified as:

\[ y_{it} = \alpha + \lambda E_{it} + \beta X_{it} + \eta_i + \varepsilon_{it} \]

(4)

Where:

\( y_{it} \) = Growth rate of GDP in country \( i \) at time \( t \);
\( E_{it} \) = Levels of tax evasion in country \( i \) at time \( t \);
\( X_{it} \) = Set of control variables;
\( \eta_i \) = the unobserved country-specific effect; and
\( \varepsilon_{it} \) = The error term.

More specifically equation (4) can be presented as follows:
\[
\ln(y) = \alpha + \lambda \ln(TEGDP) + \beta_1 \ln(SAV) + B_2 \ln(IRS) + \beta_3 \ln(GGDP) + \\
\beta_4 \ln(HCP) + \beta_5 \ln(INF) + \beta_6 FDI + \eta_i + \epsilon_{it}
\]

(5)

Where:

- \( y \) = Growth rate of GDP,
- \( TEGDP \) = Extent of tax evasion in a given economy (measured by the monetary approach);
- \( SAV \) = Gross national savings as a percentage of GDP;
- \( IRS \) = Interest rate spread (measured as the difference between the deposit and lending rates);
- \( GGDP \) = Public sector investment as a percentage of GDP;
- \( HCP \) = Human capital (measured as educational attainment in terms of the average years of schooling for the total population over the age of 15 years);
- \( INF \) = Rate of change in consumer price index;
- \( FDI \) = Foreign Direct Investment;

**Estimation Techniques**

The study employed panel regression as the main estimation techniques. This is because we expected unobserved group heterogeneity in the cross-section of countries pooled in the study, hence we ruled out the use of simple Ordinary Leads Squares (OLS). In fact it is well known that with the presence of group heterogeneity simple OLS is inefficient. The panel data estimators comprised of fixed and random effects. The dynamic model was also estimated. The Granger and Johansen’s causality tests were carried out to establish the direction of causality between tax evasion and economic growth.

**Data Sources:**


The analysis of the impact of tax evasion on economic growth will cover the period 1985 to 2010. The reason for choosing this period is two fold: first, it corresponds to the period that most countries in the sub-region witnessed tax reforms and second, due to the availability of data. The seven countries selected for the study are: Botswana, Cote d’Ivoire, Egypt, Ghana, Kenya, Nigeria and South Africa. These countries were strategically selected on the basis of their tax revenue performance and GDP growth rates. Given that data on tax evasion is generally unavailable, we generated estimates for
tax evasion for the period 1975 to 2010 for each country using estimates of the hidden economy based on a variant of Tanzi’s (1983) monetary model. See Appendix D for illustration of how the model is used to estimate the tax evasion.

RESULTS AND DISCUSSION

Panel Regression Results

In line with the main objective of the study, the impact of tax evasion on economic growth among the selected African countries was assessed by estimating equation (5) using panel data regression. The results obtained from the panel regression is presented in Table 1.1 below.

The first column of Table 1 reports OLS estimates, which ignores potential endogeneity of the regressors as well as the possible presence of country-specific effects. The coefficients are, in general, very small and largely conform with theoretical expectations. As evident from the table only three variables, namely; national savings, interest rate spread and foreign direct investment were significant. It was therefore abandoned as the most appropriate estimating method. The second and third column report the fixed and random effects estimates whereas the fourth column reports the dynamic model (in which all the variables are in the first difference) which is based on the Arellano and Bond (1991) estimation procedure. In order to choose between the fixed effects and the random effects in estimating the level equations, the Hausman’s specification test was used. The results from the Hausman specification test indicate that the individual country-specific effects are uncorrelated with the explanatory variables. This suggests that the fixed effects model is preferable to the random effects model for the levels regression estimates. Hence for the levels estimates we only consider the results from the fixed effects estimates in the discussion of our findings. The results from the dynamic model further show that most of the variables (except national savings and the lag of GDP growth rate) were insignificant hence it was not worth discussing.

From the regression results, it is evident that the coefficient on variable called tax evasion (TEGDP) possessed the expected negative sign and statistically significant at 10 percent level. The negative coefficient implies that increases in the incidence of tax evasion discourage economic growth among our sampled countries. From the results, the coefficient of -0.0707 indicates that if tax evasion should rise by 1 unit, then economic growth will decline by 0.07 units. Roubini and Sala-i- Matin (1995) explained such a relationship. They argued that improvement in financial sector development encourages the efficiency of allocating savings to productive investment and therefore financial development has real effects on growth. In countries where the incidence of tax evasion is perceived to be high, the government will optimally choose to repress the financial sector in order to increase seigniorage taxation. Such a policy will then reduce
the efficiency of the financial sector, increase the costs of intermediation, reduce the amount of investment and thereby reduce the rate of economic growth. High tax rates will therefore be associated with high tax evasion, low economic growth and high inflation. Our finding is also in line with the conclusion by Lin and Yang (2001), who argued that public goods are not productive in themselves. Thus when tax rates are high resources are diverted through tax evasion from the unproductive public sector to the productive private sector to enhance economic growth.
Table 1: Panel Regression Results: GDP Growth Rate as Dependent Variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>OLS</th>
<th>Fixed Effect Model</th>
<th>Random effect Model</th>
<th>Dynamic Model</th>
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<td>(3.05)**</td>
<td>(2.05)**</td>
<td>(3.21)**</td>
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<td>(-2.59)**</td>
<td>(-0.29)</td>
<td>(-1.48)</td>
</tr>
<tr>
<td>GGDP</td>
<td>0.0672</td>
<td>0.0548</td>
<td>0.0672</td>
<td>0.0872</td>
</tr>
<tr>
<td></td>
<td>(0.95)</td>
<td>(0.81)</td>
<td>(0.95)</td>
<td>(1.28)</td>
</tr>
<tr>
<td>FDI</td>
<td>0.2755</td>
<td>0.2861</td>
<td>0.2755</td>
<td>0.1160</td>
</tr>
<tr>
<td></td>
<td>(1.89)***</td>
<td>(2.18)***</td>
<td>(1.89)***</td>
<td>(0.88)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of Observations</th>
<th>147</th>
<th>147</th>
<th>147</th>
<th>147</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.48</td>
<td>0.40</td>
<td>0.41</td>
<td>-----</td>
</tr>
<tr>
<td>F-Test</td>
<td>F(7,139) = 4.73 (0.0001)</td>
<td>F(7,133) = 3.44 (0.021)</td>
<td>Wald Chi2 (7) = 33.12(0.0000)</td>
<td>-----</td>
</tr>
<tr>
<td>Hausman Test</td>
<td>-----</td>
<td>Chi2 (7) = 156.46</td>
<td>-----</td>
<td>-----</td>
</tr>
</tbody>
</table>

Source: Computed

Note: Variables are expressed in log form and t-values are reported in parenthesis. The coefficients in the dynamic model are interpreted as growth elasticities. Both the Fixed Effects and Random Effects models are in levels. The dynamic model is based on the Arellano-Bond Estimation Procedure. * Significant at 1%, ** Significant at 5%, *** Significant at 10%,
The results further indicated the coefficient of the interest rate spread (IRS) variable is negative but insignificant. The reason behind this relationship can be easily ascertained; an increase in the interest rate spread has a very high possibility of raising the cost of capital and thereby reducing the returns from investment. The resultant effect is to discourage future investment and eventually causing economic growth to decline. Thus an increase in interest rate spread discourages economic growth. From the results, the coefficient of -0.0514 for IRS gives an indication that a unit increase in interest rate spread reduces economic growth by 0.05 units. Studies such as Giovannini (1985), Roubini and Sala-i- Matin (1995) support our finding.

As portrayed by the results, the coefficient of the variable named inflation (INF) is negative and statistically significant at 5 percent level. The implication is that higher rates of inflation adversely affect economic growth among our sampled African countries. This outcome is expected because productivity can only increase when the macroeconomic environment is stable and of which inflation remains an important determinant. In fact higher levels of inflation have a negative effect on economic growth since the expectation of rising prices along with rising cost of productive inputs creates uncertainties among producers. In the midst of such uncertainties, producers indulge in speculative activities in order to make quick profits instead of engaging in productive ventures. In terms of magnitude of relative effect, the results reveal that a 1 unit increase in inflation dampens economic growth by 0.05 units. The negative relationship found between inflation and economic growth is consistent with the findings by Fielding and Mizen (1997).

The results further reveal that the coefficient of the variable called national savings (SAV) is not only positive but also statistically significant at 5 percent level. The implication is that any policy that encourages gross national savings will have a strong impact on economic growth within the economy of our seven Africa countries. Higher saving rates provides a focus in the form of an institution or market for potential borrowers to access investment funds which eventually translate into higher levels of productivity. Thus increasing the saving rate enhances the possibility of financial institutions mobilizing and allocating resources effectively for economic growth to increase; all other things being equal. The results show that a 1 unit increase in saving will improve economic growth by 0.13 units as evident by the coefficient of 0.1342. This finding is consistent with those obtained by Maddison (1992), Bosworth (1993) and Carroll and Weil (1994).

For the variable called public investment and measured as government final consumption expenditure per GDP (GGDP), the results showed a coefficient which is positive in sign but statistically insignificant. The results suggest that increasing public investment supports economic growth in Africa and in particular the set of countries
used in the study. A country endowed with well developed public resources such as good road networks, well functioning communication networks and stable electricity for instance have the tendency of improving output per labour. The effect is to cause economic growth to increase. In terms of relative impact, the results show that a unit increase in public investment will induce growth on an average by a margin of 0.05 units. This finding is consistent with the results of Aschauer (1989) and Tanzi and Zee (1997).

The results also showed that the coefficient for the variable, human capital (HUM) is negative but significant. Usually an improvement in human capital through training and skill acquisition as well as proper health care provision enhances growth. Improving the quality of human capital makes labour to be more productive. The study however found the reverse. This result is counter intuitive.

Finally, the results pointed out a direct relationship between Foreign Direct Investment (FDI) and economic growth as expected. FDI indeed generate economic growth through the direct impact on trade and also by augmenting domestic capital and thereby stimulating the productivity of domestic investments. Through these two arguments the quantity and quality of factors of production as well as the transformation of the production processes are enhanced to stimulate economic growth. In terms of relative effect, the coefficient of 0.2865 indicates that economic growth will boom by 0.29 units, if there is a 1 unit increase in FDI. Our finding is consistent with studies such as Balasubramanyan et al., (1996); Borensztein et al., (1998), (1998) and Bengos and Sanchez-Robles (2003). The studies by Borensztein et al. and Glass and Saggi in particular argues that FDI has been important in explaining China’s economic growth.

**Causality Tests Results**

The reason for carrying out causality tests was to assess the causal relationships between tax evasion and economic growth. Two tests were carried out in this regard; the Granger Casualty tests and the Johansen Test. In carrying out the Granger Causality tests, we related the economic growth variable (GDP) with two tax evasion variables-tax rate represented by tax per GDP (TGDP) and individual income level represented by GDP per capita (GDPY). The results from the pair-wise Granger Causality test are presented Tables 2 and 3.

In Table 2 where the results of the pair-wise Granger Causality test between tax per GDP (TGDP) and economic growth (GDP) is shown, the null hypothesis is that: tax rate per GDP does not Granger Cause economic growth. The analysis shows that the tax rate per GDP does not Granger cause economic growth in Cote d’Ivoire and Egypt implying tax invasion causes economic growth. In the case of South Africa, economic growth causes tax evasion as the alternative hypothesis is rejected. No clear causation between tax evasion and growth was found for the rest of the countries namely...
Botswana, Ghana, Kenya and Nigeria. This does not however, imply that the tax evasion does not impact on economic growth in these countries, rather, causation may arise from other aspects of tax evasion other than the overall tax rate.

Regarding the relation between economic growth and individual income, the results from the pair-wise Granger Causality tests is presented in Table 3. The results indicate the rejection of the null hypothesis that individual income per capita does not Granger Cause economic growth in three countries, namely; Botswana, Cote d’Ivoire and Kenya. The implication is that for these countries, tax evasion causes economic growth. The results from the same table further indicate a bilateral causation between tax evasion and economic growth in Cote d’Ivoire. For the rest of the countries-Egypt, Ghana, Nigeria and South Africa no clear evidence of causation was found between tax evasion and economic growth.

Table 2: Granger Causality Results - TGDP and GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Null Hypothesis</th>
<th>F-Statistic</th>
<th>P-Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>H1:</td>
<td>0.07048</td>
<td>0.98918</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>H2:</td>
<td>2.25533</td>
<td>0.15224</td>
<td>No causality</td>
</tr>
<tr>
<td>Egypt</td>
<td>H1:</td>
<td>3.65417</td>
<td>0.0561**</td>
<td>TGDP→GDP</td>
</tr>
<tr>
<td></td>
<td>H2:</td>
<td>0.92259</td>
<td>0.49622</td>
<td></td>
</tr>
<tr>
<td>Cote d’Ivoire</td>
<td>H1:</td>
<td>4.46574</td>
<td>0.0344*</td>
<td>TGDP→GDP</td>
</tr>
<tr>
<td></td>
<td>H2:</td>
<td>0.98479</td>
<td>0.46763</td>
<td></td>
</tr>
<tr>
<td>Ghana</td>
<td>H1:</td>
<td>1.03675</td>
<td>0.44507</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>H2:</td>
<td>1.65254</td>
<td>0.25258</td>
<td>No causality</td>
</tr>
<tr>
<td>Kenya</td>
<td>H1:</td>
<td>2.54731</td>
<td>0.11390</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>H2:</td>
<td>0.49016</td>
<td>0.62265</td>
<td>No causality</td>
</tr>
<tr>
<td>Nigeria</td>
<td>H1:</td>
<td>1.68473</td>
<td>0.24553</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>H2:</td>
<td>0.56106</td>
<td>0.69782</td>
<td>No causality</td>
</tr>
<tr>
<td>South Africa</td>
<td>H1:</td>
<td>0.54596</td>
<td>0.59113</td>
<td>GDP→TGDP</td>
</tr>
<tr>
<td></td>
<td>H2:</td>
<td>3.65044</td>
<td>0.0524*</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computed by Author

Note: Null Hypothesis: H1: TGDP does not Granger cause GDP, and H2: GDP does not Granger cause TGDP. Where S → T means, variable S Granger Cause T.
Table 3: Granger Causality Test Results- GDPY and GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>Null Hypothesis</th>
<th>F-Statistic</th>
<th>P-Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botswana</td>
<td>$H_1$:</td>
<td>5.02592</td>
<td>0.02535*</td>
<td>GDPY → GDP</td>
</tr>
<tr>
<td></td>
<td>$H_2$:</td>
<td>0.90931</td>
<td>0.50256</td>
<td>GDP</td>
</tr>
<tr>
<td>Egypt</td>
<td>$H_1$:</td>
<td>0.75473</td>
<td>0.58234</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>$H_2$:</td>
<td>0.61864</td>
<td>0.66181</td>
<td>No causality</td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>$H_1$:</td>
<td>2.95823</td>
<td>0.0848**</td>
<td>GDPY → GDP</td>
</tr>
<tr>
<td></td>
<td>$H_2$:</td>
<td>6.15047</td>
<td>0.01211*</td>
<td>GDP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GDPY</td>
</tr>
<tr>
<td>Ghana</td>
<td>$H_1$:</td>
<td>1.15244</td>
<td>0.39891</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>$H_2$:</td>
<td>1.37814</td>
<td>0.32335</td>
<td>No causality</td>
</tr>
<tr>
<td>Kenya</td>
<td>$H_1$:</td>
<td>2.72980</td>
<td>0.0910**</td>
<td>GDPY → GDP</td>
</tr>
<tr>
<td></td>
<td>$H_2$:</td>
<td>0.66692</td>
<td>0.52886</td>
<td>GDP</td>
</tr>
<tr>
<td>Nigeria</td>
<td>$H_1$:</td>
<td>1.28170</td>
<td>0.35346</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>$H_2$:</td>
<td>1.10755</td>
<td>0.41617</td>
<td>No causality</td>
</tr>
<tr>
<td>South Africa</td>
<td>$H_1$:</td>
<td>2.52599</td>
<td>0.11570</td>
<td>No causality</td>
</tr>
<tr>
<td></td>
<td>$H_2$:</td>
<td>1.33251</td>
<td>0.29529</td>
<td>No causality</td>
</tr>
</tbody>
</table>

Source: Computed by author

Note: Null Hypothesis: $H_1$: GDPY does not Granger cause GDP, and $H_2$: GDP does not Granger cause GDPY. Where S → T means, variable S Granger Cause T.

In order to verify the results obtained from the pair-wise Granger Causality test reported above, we apply cointegration test following the approach by Johansen (1988) as an alternative way for testing causality. The results from the cointegration test indicated the possibility of bilateral causality between tax evasion and economic growth in Cote d'Ivoire given that a maximum of two cointegration vectors were found for this country as presented in Table 4. For Botswana, Egypt, Nigeria and South Africa the results indicated the existence of a single cointegrating vector. The existence of a single cointegrating vector therefore rules out the possibility of bilateral causation between tax evasion and economic growth. This implies that there is a unilateral causality between tax evasion and economic growth among these countries. However, the results for Ghana and Kenya indicated that there is no possibility of causality between tax evasion and economic growth as no cointegrating vectors were found. The results from the cointegration test is not significantly different from those obtained under the Granger Causality test.
Table 4: Results from Johansen Cointegration Test

<table>
<thead>
<tr>
<th>Country</th>
<th>Johansen’s Trace Statistics (TS) and 5% Critical Values (CV)</th>
<th>Null Hypothesis for the rank</th>
<th>Maximum number of cointegrating Vectors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R=0</td>
<td>r ≤ 1</td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>TS 19.49**</td>
<td>1.01</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CV 15.41</td>
<td>3.76</td>
<td></td>
</tr>
<tr>
<td>Cote d'Ivoire</td>
<td>TS 16.58**</td>
<td>6.66**</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>CV 15.41</td>
<td>3.76</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>TS 16.31**</td>
<td>2.89</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CV 15.41</td>
<td>3.76</td>
<td></td>
</tr>
<tr>
<td>Ghana</td>
<td>TS 5.87</td>
<td>1.03</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>CV 15.41</td>
<td>3.76</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>S 8.99</td>
<td>1.31</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>CV 15.41</td>
<td>3.76</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>TS 16.64**</td>
<td>0.66</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CV 15.41</td>
<td>3.76</td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>TS 18.60**</td>
<td>0.41</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CV 15.41</td>
<td>3.76</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computed

Note: where (**) means rejection of the null hypothesis at the 5% level of significance. Where TS stands for Trace Statistics and CV stands for Critical Value of the test.

Conclusion and Recommendation

In the early part of the 1980s, several African countries implemented tax reform policies within the framework of stabilization and structural adjustment programmes with the aim of laying a solid foundation for sustained economic growth. Nevertheless, they continue to experience low tax revenue and declining economic growth. The existence of tax evasion in the tax system has been cited as the major setback. In the light of this consideration, the study set out to examine the impact of tax evasion on economic growth and to determine the direction of causality between them. The study which was conducted for seven African countries covered the period 1985 to 2010. The effect of tax evasion on economic growth was analysed within the framework of an endogenous growth model with the use of panel regression technique. And in order to capture the direction of causality between tax evasion and economic growth among the selected African countries, causality and co-integration tests, based on Granger and Johansen’s procedure were carried out.
The findings from the study are summarized as follows: First, gross national savings is an important ingredient in promoting economic growth among the selected Africa countries. A country endowed with well developed public resources such as good roads network, well functioning communication networks and stable electricity to mention but a few, has the tendency of improving output per labour. Thirdly, results indicate that there is a trade off between interest rate spread and inflation on one hand and economic growth rate on the other. The results further indicate that there is a direct relationship between foreign direct investment and economic growth. The study identified tax evasion as the single most important hindrance to economic growth. Finally, the causality tests reveal that causality flows purely from tax evasion to economic growth in Cote d’Ivoire, Botswana, Kenya and Egypt. For Cote d’Ivoire the results further showed a bilateral causation between tax evasion and economic growth.

Consistent with the negative relationship between tax evasion and economic growth in the literature, tax evasion was found to impact negatively on economic growth in the selected African countries. Although an increase in direct tax revenue is vital for African countries because of their redistributive effects, any attempt to increase tax rates could give rise to tax evasion. Instead, broadening the tax base would be a better alternative. To supplement these efforts, official administration regarding the detection and discouraging of tax evasion should be improved. Tax reforms processes should be consolidated and integrated with other macroeconomic reforms. System loopholes and prevailing corruption among tax collection authorities cannot be neglected when dealing with the issues of evasion. These inefficiencies must be dealt with accordingly in order to curb the deadweight loses and to reduce the cost of being part of the reported economy.
REFERENCES


APPENDIX A

Trends in Tax Revenue in Selected African Countries (in percentage of GDP)

Source: Generated by Author

APPENDIX B

GDP Growth Rate for Selected African Countries, 1970-2010

Source: World Development Indicators
Appendix C

Details on the general equilibrium problem between the household, the firm and the government

The Household

The preferences of an agent of this household in time $t$ is represented by the time-additive Von Neumann-Morgenstern (V-N M) utility function

$$u(c_1^t) + \delta E(u(\tilde{C}_{t+1}^2))$$  \hspace{1cm} (1)

where:

$C_1^t$ = Consumption in the individual’s first period of life (young consumption): and

$\tilde{C}_{t+1}^2$ = Random consumption in the second period of life (old consumption).

The random variable $\tilde{C}_{t+1}^2$ takes two values, $C_{t+1}^{2A}$ and $C_{t+1}^{2N}$ which correspond to old consumption if the individual has been audited, and old consumption if he has not been audited, respectively. The parameter $\delta > 0$ is the discount factor.

Therefore, an individual of this generation $t$ chooses both the declared income $x_t \in [0, w_t]$ and the intended saving $s_t$ in order to solve the following program:

$$\text{Max}\{u(C_1^t) + (1 + \rho)\delta u(C_{t+1}^N) + \rho \delta (C_{t+1}^{2A})\}$$  \hspace{1cm} (2)

Subject to:

$$C_1^t = w_t - \tau w_t - s_t$$

$$C_{t+1}^{2N} = R_{t+1}s_t \text{ and}$$

$$C_{t+1}^{2A} = R_{t+1}(s_t - \pi \tau (w_t - x_t))$$

The solution to the individual’s optimization problem (2) is given by:

$15$ A V-N M utility function is preferable because tax evasion is gamble activity; where the consumer can lose (if caught) or gain (if evasion is successful). A given that a V-N M utility function deals with consumer uncertainty it is deemed the most appropriate utility function for the theoretical framework.
\[ x_t = Xw_t \text{ and } s_t = Sw_t \]

where:

\[
X = \frac{(1-\rho)\tau(1+\delta\pi) - (1-\rho\pi)(\rho\delta + \tau)}{\rho\tau(\pi-1)(1+\delta)} \tag{3}
\]

\[
S = \frac{\pi\delta(1-\rho)(1-\tau)}{(\pi-1)(1+\delta)} > 1; \quad \text{if} \ \rho \pi \geq 1 \tag{4}
\]

The following partial derivatives concerning the behaviour of the propensity to declare \( X \) and the propensity to save \( S \) for an interior solution are obtained from (3) and (4):

\[
\frac{\partial X}{\partial \rho} = \frac{\pi\delta(1-\tau)}{\tau(\pi-1)(1+\delta)} > 0
\]

\[
\frac{\partial X}{\partial \pi} = \frac{\delta(1-\rho)(1-\tau)}{(\pi-1)^2(1+\delta)} > 0
\]

\[
\frac{\partial S}{\partial \rho} = \frac{-\delta\pi(1-\tau)}{(\pi-1)(1+\delta)} < 0
\]

\[
\frac{\partial S}{\partial \pi} = \frac{\pi\delta(1-\tau)}{(\pi-1)^2(1+\delta)} > 0
\]  

Equation (5) indicates that reported income is increasing in both the probability to investigation \( \rho \) and the penalty rate \( \pi \). Since individual increases the income reported with \( \rho \) and \( \pi \), this immediately translates into a decrease of intended saving.

**The firm**

Competitive firms in the economy produce a single good according to the following Cobb-Douglas gross production function\(^{16}\):

\[^{16}\text{This type of production function allows for extensions such as analyzing the impact of government’s investment expenditure on production as in Barro (1990)\} \]
\[ Y_t = BK_t^\alpha \hat{L}_t^{1-\alpha}, \text{ with } B > 0, \alpha \in (0,1) \]  
where:

- \( Y_t \) = Gross output;
- \( K_t \) = Private capital used by each firm; and
- \( \hat{L}_t \) = Efficiency units of labour hired by each firm.

\( K_t \) is interpreted as a composite capital embodying both physical and human capital. Efficiency units of labour are proportional to both the number \( L_t \) of physical units of labour and the level \( g_t \) of capital supplied by the government per worker, that is;

\[ \hat{L}_t = DL_t g_t, \text{ with } D > 0. \]  

Thus, we are assuming that public capital increases proportionally the productivity of each worker as in Barro (1990). The services provided by public capital are assumed to be completely rival for the users so that it is the amount of public capital per capita and not the total amount that enters in the production function. It is further assumed that there are neither user charges nor additional congestion effects associated with public services. Public capital is thus a productive externality from firm’s point of view. Hence, the production function (6) can be re-written as:

\[ Y_t = AK_t^\alpha L_t^{1-\alpha} g_t, \]  

where \( A = BD^{1-\alpha} \). It is also assumed that both private and public capital fully depreciate after one period.

Taking \( g_t \) and normalizing the number of firms to one per worker, the optimal demands for private capital and workers by firms that satisfies first order conditions for profit maximization is given respectively as:

\[ w_t = A(1-\alpha)K_t^\alpha g_t^{1-\alpha}, \]  
and

\[ r_t = A\alpha K_t^{\alpha-1} g_t^{1-\alpha}. \]  

Likewise, equilibrium in the capital market implies that effective saving must be equal to the private capital installed in the next period,

\[ K_{t+1} = (1-p)s_t + \rho(s_t - \pi\tau(w_t - x_t)). \]
Given that in this economy a fraction $\rho$ of individuals is subjected to tax investigation, the first term on the right hand side (RHS) of (11) is the effective saving of the non-audited population whereas the second term is the effective saving of the audited population. Substituting $s_t$ and $x_t$ by their optimal values given in (2'), equation (11) becomes:

$$K_{t+1} = MW_t$$

(12)

where:

$$M = S - \rho \pi \tau (1 - X)$$

(13)

$M > 0$ since effective saving after inspection is strictly positive.

**The Government**

Government finances the stock of public capital by means of both the proportional taxes on declared income and the penalty fees collected from the audited taxpayers in the preceding period. It is assumed that the government faces a proportional inspection cost $c$ per unit of audited income. Hence, the budget constraint of the government is:

$$g_{t+1} = (1 - \rho) \tau x_t + \rho (\tau x_t + \pi \tau (w_t + x_t)) - cpw_t,$$

(14)

where:

$$(1 - \rho) \tau x_t = \text{Taxes paid by non-audited taxpayers;}$$

$$\rho (\tau x_t + \pi \tau (w_t + x_t)) = \text{Taxes plus penalty fees paid by audited taxpayers;}$$

and

$cpw_t = \text{Cost associated with tax inspection.}$

By substituting the equilibrium value of $x_t$ given in (2') into (14), we obtain:

$$g_{t+1} = Gw_t,$$

(15)

where

$$G = (1 - \rho \pi) \tau X + \rho \pi \tau - cp.$$  

(16)

By using (9), (12) and (16) the gross rate of economic growth is given as:

$$y = A(1 - \alpha)M^\alpha G^{1-\alpha}$$

(19)

The effects of changes in tax evasion (through tax enforcement parameters) on the rate of economic growth are determined by changes in $M$ and $G$ as seen from (19).
APPENDIX D

Estimates of Tax evasion were achieved by using estimates of the hidden economy based on a variant of Tanzi’s (1983) monetary model. This model also referred to as the currency demand approach, is a widely used approach for measuring the underground economy and hence tax evasion. This approach was first employed by Cagan (1958) to estimating the size of the underground economy for the United States over the period 1919 – 1955. Twenty years later, Gutmann (1977) and then Feige (1979) used the same approach but without any statistical procedures. Cagan’s approach was further adopted and developed by Tanzi (1980, 1983) to determine the size of the underground economy for the United States by estimating econometrically a currency demand function for the country over the period 1929 -1980.

The equation for the currency-M2 model based on Tanzi (1983) is represented as:

$$\ln\left(\frac{C}{M_2 t}\right) = \alpha + \beta_1 \ln(TGDP_t) + \beta_2 \ln(GDPY_t) + \beta_3 \ln(HGDP_t) + \beta_4 \ln(INF_t) + \beta_5 \ln(INT_t) + \beta_6 \ln(EDU_t) + \beta_7 \ln(URPOP_t) + \varepsilon_t$$ (1)

where:
- $C_{t}$ = Currency-M2 ratio,
- $TGDP_t$ = Total tax per GDP (to proxy changes in the size of the shadow economy),
- $GDPY_t$ = GDP per capita,
- $HGDP_t$ = Household final consumption expenditure per GDP,
- $INF_t$ = Inflation Rate (to capture the opportunity cost of holding cash)
- $INT_t$ = Interest rate (to capture the opportunity cost of holding cash)
- $EDU_t$ = Education level (measured as educational attainment in terms of the average years of schooling for the total population over the age of 15 years);
- $URPOP_t$ = Urbanization (measured as percentage of the population living in cities)
- $\varepsilon_t$ = Error term

By using the results from the estimated currency-M2 model, we then proceeded to find estimates for the size of underground economy and tax evasion through the following steps as applied in studies such as Tanzi (1980, 1983), Schneider (2007) and...
Schneider and Enste (2000, 2002). First we find the amount of illegal money in the economy, followed by legal money, then, velocity of money, the underground economy and finally tax evasion as follows:

Illegal Money (IM) = \[ \left( \frac{C}{M_2} \right)_t - \left( \frac{C}{M_2} \right)_{wt} \] * \( M_2 \) \]

(2)

where:

\[ \left( \frac{C}{M_2} \right)_t \] = the currency-M2 equation with the tax rate;

\[ \left( \frac{C}{M_2} \right)_{wt} \] = the currency-M2 equation without the tax rate;

\( M_2 \) = Broad definition of money (M1 plus time deposits)

Legal Money (LM) = \( M_1 - IM \) \]

(3)

where:

\( M_1 \) = Narrow Definition of money (currency plus demand deposits)

\( IM \) = Illegal money obtained from equation (2)

Velocity (V) = \[ \frac{\text{GNP}}{\text{LM}} \] \]

(4)

where:

\( \text{GNP} \) = Gross National Product

\( \text{LM} \) = Legal Money obtained from equation (3)

Underground Economy (UE) = IM * V \]

(5)

where:

\( IM \) = Illegal Money

\( V \) = Velocity of Money derived from equation (4)

Tax Evasion (TE) = UE * \[ \left( \frac{\text{Total Taxes}}{\text{GNP}} \right) \] \]

(6)

where:

\( UE \) = Underground Economy derived from equation (5)

\( \text{GNP} \) = Gross National Product