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**Article**

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## **Determinants of Tax Evasion in Ghana: 1970-2010**

**Betty Annan<sup>1</sup>, William Bekoe<sup>2</sup> and Edward Nketiah-Amponsah<sup>3</sup>**

### **Abstract**

*This paper investigates the factors that determine tax evasion in Ghana using time series data covering the period 1970-2010. Employing the currency demand approach, we obtained the estimates of the shadow economy and the level of tax evasion for the entire period. Using the bounds test technique of cointegration we found that the variables included in our ARDL model are bounded together. The short-run model indicates that per capita income, the average tax rate, age and inflation were positively and significantly associated with tax evasion while gender showed an inverse and significant relationship with tax evasion. The error correction term was negative, statistically significant and suggests that 45 per cent of the deviation from equilibrium tax evasion is corrected each year. In addition, the Granger causality test indicates that tax and inflation rates aid in predicting future levels of tax evasion in Ghana. The paper further discusses the policy implications of the findings.*

**Keywords:** tax evasion, bounds testing, error correction, granger causality, Ghana

**JEL Classification:** H26; H41; O23

### **1. Introduction**

Taxation plays an important role in economic development by sustaining the existence of the state and financing both social programmes and infrastructure investment. It also aids in the allocation of resources, redistribution of income, and correction of negative externalities as well as protection of domestic industries by restricting imports. The provision of public services and infrastructure financed by tax revenue is a key factor for economic growth and development. Yet, many developing countries fail to generate the requisite tax revenue to finance their public expenditures (Fuest and Riedel, 2009; Adamopoulos, 2010).

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Like many developing countries, Ghana depends heavily on taxes to generate the much needed revenue for development. Hence, in an attempt to reduce the complexity of the tax system in order to enhance efficiency, minimize the underground economy, discourage tax evasion and generate sufficient revenue, Ghana's tax system has undergone several structural reforms since the past three decades. In 1983, the initial tax reform measure of the fiscal adjustment programme was designed largely to restore the tax base which had been battered by the constant over-valuation of the domestic currency. This measure was expected to broaden the tax net, lower the tax burden on economic agents and reduce tax evasion. The reform also included the strengthening of production incentives with the introduction of an Investment Code (PNDC Law 116, 1985) and a new Minerals Law (Minerals Commission Law, 1986). This code identified four sectors-tourism, manufacturing, construction and building and agriculture as targeted sectors of investment. The code also provided a wide range of tax incentives and benefits to foreign and domestic investors with enterprises engaging in activities in any of the four areas. The introduction of the Value Added Tax in 1995, which cut across a wide range of commodities, was expected to minimize changes in the behaviour of economic agents.

The administrative reform of 1985 also focused on measures to enhance the efficiency of the tax administration and improve upon the equity of the tax system. A major component of this reform was the conversion of the Internal Revenue Service (IRS) and Customs, Excise and Preventive Service (CEPS) into the Ghana Revenue Authority, an autonomous corporate body with new organizational structures (GRA) in 2009. Its objective is to strengthen the role of the revenue institutions in achieving increased revenue collection and changing the structure of the tax system to make it more efficient and equitable. In 2007, the tax administration management information system was computerized and a unique identification number assigned to taxpayers for easy tracking by tax collectors. In addition, there has been gradual reduction of tax rates and elimination of multiple tax rates to reduce the distortions that arise from such tax systems. The introduction of the e-government project in November 2011 is aimed at linking Ghana Revenue Authority (GRA) to the Registrar General's Department (RGD) electronically to ensure GRA has access to the database of registered businesses for easy tracking and collection of tax payments.

In spite of the several fiscal reforms implemented to minimize tax burden and discourage activities of the underground economy, tax evasion continues to be a problem in Ghana. The presence of a large shadow economy implies activities which are liable to tax payments are hidden from the tax authorities and the related tax revenues are not collected. Tax evasion<sup>1</sup> thus reduces government revenue, increases the taxes that compliant taxpayers face and often reduces the public services that citizens receive. It also causes distortions in the economy which influence policy makers to make misinformed decisions. Hence, this

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<sup>1</sup> Tax evasion is a situation where individuals or business entities decide not to fully honour their tax obligations through non-declaration or under declaration of taxable economic activities. It is an illegal act and it's also different from tax avoidance. Tax avoidance takes place when a tax payer makes use of the available loopholes and ambiguities in the tax system to lower his tax burden, but does not violate the tax law.

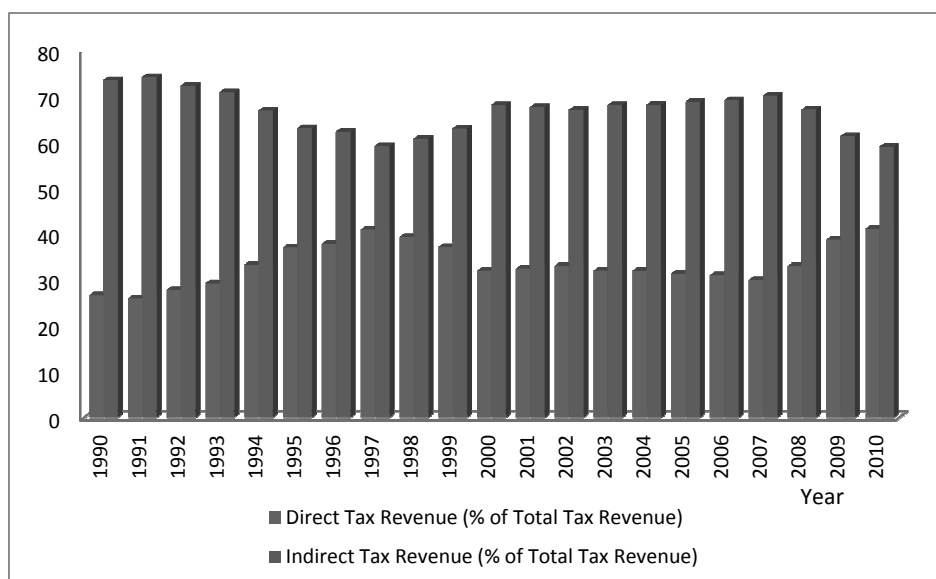
paper seeks to primarily identify the determinants of tax evasion in Ghana for the period 1970-2010.

The significance of the study is predicated upon the fact that a clear understanding of the extent of tax revenue left uncollected and the factors accounting for its existence is necessary for effective policy formulation and implementation in order to minimize tax evasion. Findings from this study is also expected to complement the body of existing literature on the subject matter especially on developing economies since most empirical studies on the determinants of tax evasion focus on developed economies (Clotfelter, 1983; Klovland, 1984; Crane and Nourzad, 1986; Trehub and Krasnikova, 2005; Richardson, 2006, 2008 and Schneider et al., 2008) with a limited number focused on developing countries<sup>2</sup>.

### 1.1 Tax Revenue Performance (1990-2010)

The implementation of the Economic Recovery Programme (ERP) in 1983 rejuvenated several sectors of the economy from their deteriorating states. In fact, the tax revenue to GDP ratio in 1989 was almost three times what was realized in 1983 (Mishra, 2011). Figures 1 and 2 respectively show the trend of direct and indirect tax contributions to tax revenue and importantly, the share of tax revenue in GDP over the 1990-2010 periods.

**Figure 1: Contributions of Direct and Indirect Taxes to Tax Revenue (1990-2010)**



**Source:** Ghana Revenue Authority and author's computation

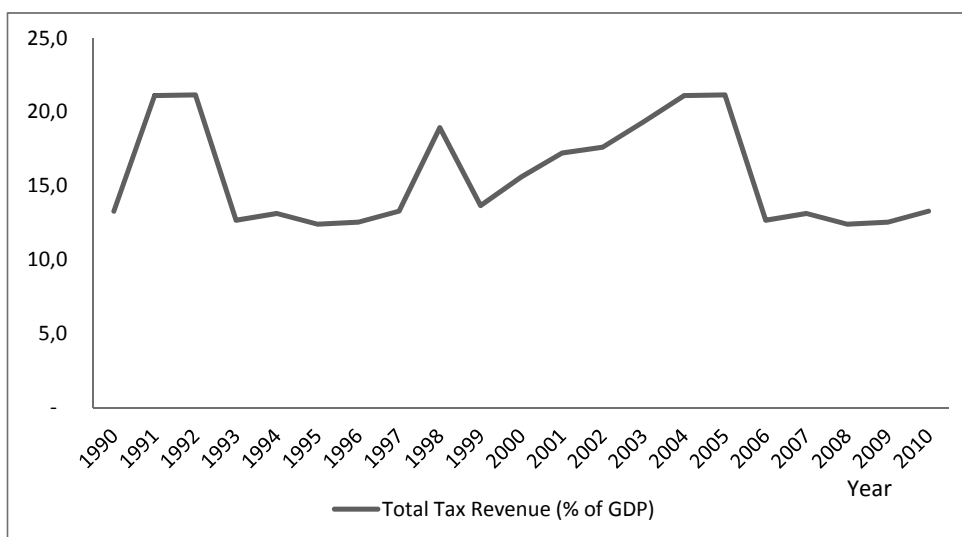
<sup>2</sup> The empirical studies conducted in Africa to examine the determinants of tax evasion include studies such as Ghura (1998), Faal (2003) and, Sookram and Watson (2005).

Figure 1 indicates that, indirect taxes contributed almost two-thirds of the tax revenue mobilized. This result could be attributed the relatively larger tax base of indirect taxes. Direct tax revenue relative to total tax revenue rose from 26.6 per cent in 1990 to 41.1 per cent in 2010, averaging 33.4 per cent for the period. In the same period, the share of indirect taxes in total tax revenue declined from 73.4 per cent to 58.9 per cent. Moreover, tax revenue to GDP rose from 12.5 per cent in 1990 to 13.3 per cent in 2010 and with an average of 16.5 per cent for the period.

In 1992, the then PNDC government (now the NDC) for the first time contested elections under the new constitution of the Fourth Republic. Uncertain of its victory, the government raised its spending from 19 per cent of GDP in 1991 to 25 per cent in 1992 (Leite et al., 2000; Farajova, 2011; Eyasi and Rahimi, 2012). With a roughly flat revenue ratio, a large deterioration in the budget occurred. A deficit equivalent to over 5 per cent of GDP was experienced in 1992 (Killick, 2010, Georgantopoulos and Tsamis, 2012). The excessive spending pattern of the government repeated itself in 1996 as it was also an election year. Attempts made to restore fiscal discipline were unable to rectify what had become the government’s constant penchant to spend well in excess of its revenue.

In order to finance the deficits, government resorted to domestic borrowing. Given the narrowness of the domestic financial markets at that period, this resulted in crowding-out of private domestic investors engaged in production, exports and imports. Tax receipts from indirect taxes declined from 72.2 per cent of total tax revenue in 1992 to 62.9 per cent in 1999 (Figure 1). Within the same period, direct tax revenue relative to total tax revenue experienced a gradual increase that could be attributed to changes in the tax rate structure. The increase in total tax revenue to GDP ratio from 11 per cent in 1992 to 23.5 per cent in 1995 was as a result of the rise in revenue from direct taxes.

**Figure 2: Tax Revenue as a percentage of GDP (1990-2010)**



**Source:** Ghana Revenue Authority and author’s calculation

In 2000, the government offered what they termed an “entrepreneur-led pattern of economic development”. The whole machinery of the government was aimed at supporting both domestic and foreign investors in Ghana to increase their production and improve their competitiveness. An important feature of this policy was a swift rise in credit to the private sector, both in absolute and relative terms. Another significant aspect of the improved investment environment was a marked strengthening of macroeconomic conditions such as the decline in the fiscal deficit from 10 per cent of GDP in 2000 to 7 per cent in 2007 (Feridun and Sissoko, 2011). Furthermore, the ratio of indirect tax revenue to total tax revenue increased from 62.9 per cent in 1999 to 70.1 per cent in 2007 (Figure 1). Direct taxes share in tax revenue increased in 2008 to 33 per cent and further to 41.1 per cent in 2010. Over the same period, the contribution of indirect taxes to tax revenue declined from 67.03 per cent to 58.9 per cent. This decline could be attributed to the introduction of the communication services tax which is levied on communication service users, with imported communication devices being exempt from the tax (Diakomihalis, 2012).

The rest of this paper is organized as follows: section 2 focuses on the theoretical and empirical literature whereas section 3 deals with the methodology and model for the study. Section 4 is devoted to the presentation and discussion of the empirical results. The conclusion and policy recommendations are presented in section 5.

## **2. Literature Review**

In a paper prepared for the International Economic Association Workshop on Economic Theory, Mirrles (1971) suggests tax evasion as a topic for theoretical investigation. This provides Allingham and Sandmo (1972) with the motivation to review income tax evasion in their article “Income Tax Evasion: A Theoretical Analysis”. The objective of that paper was to analyze the decision to evade or not to evade by a taxpayer and the extent to which taxes are evaded by intentional underreporting. The behaviour of the taxpayer was assumed to conform to the Von Neumann-Morgenstern axioms for behaviour under uncertainty. In general, the models suggest that tax evasion is increasing in tax rate but decreasing in detection risk and penalty levels. However, the relationship between the amount of income reported and the actual income of the taxpayer is ambiguous. The approach on the one hand, is based on Becker’s (1968) study on economics of criminal activity. On the other hand, it relates to the work by Arrow (1970), analyzing the optimal portfolio and insurance policies in economics of uncertainty<sup>3</sup>.

Yitzhaki (1974) presents another version of the model of tax evasion. In his model, the fine paid by a taxpayer caught evading is levied on the amount of tax payments evaded rather than on the amount of undeclared income. In analysing the relationship between the four variables of interest in the model and the fraction of actual income reported, the comparative static results show a positive relation between both the probability of detection, the penalty rate and the amount of income reported. Considering the tax rate and the actual

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<sup>3</sup> See also Dritsakis, and Gkanas (2009)

income, Yitzhaki resolves the ambiguities present in the previous model<sup>4</sup>. By making use of the assumption of decreasing absolute risk aversion, he arrives at a clear-cut hypothesis on the effect of the two parameters on the fraction of income reported. The author further explains that higher tax rates will lead to higher income declaration, thus a reduction in tax evasion. This result highly contradicts the general belief that high tax rates stimulate tax evasion (Adreoni, Erard and Feinstein, 1998).

A number of empirical studies have also been conducted to ascertain the determinants of tax evasion. While some authors focus on economic factors others also use non-economic factors such as demographic and behavioural factors to explain the phenomenon.

Tanzi (1983) was the first to econometrically estimate a currency demand function for the United States for the period 1929 to 1980 as way of formally estimating the shadow economy and hence tax evasion. His approach suggests that within the shadow economy, transactions are mainly conducted with cash payments, in order not to leave behind any evident for monetary authorities to trace. An increase in the size of the shadow economy therefore indicates an increase in the demand for currency. Other studies that employ Tanzi's currency demand equation include Klovland (1984), Hersoug (1983) and Sookram and Watson (2005).

Adopting Tobit, OLS, Random and Fixed effects techniques to estimate the tax evasion model, Trehub and Krasnikova (2005) reveal that the estimated coefficients for the variable capturing the size of the household is positive and statistically significant in all four estimation techniques. The explanation is that members of a large household tend to be more risk-averse than those of small households. Secondly, the result for the Tobit estimation alone indicates a significant and positive relationship between gender and tax evasion. Trehub and Krasnikova suggest that women in Russia are more likely to evade taxes than their male counterparts. Considering the relationship between income source and tax evasion, incomes from both government and rent exhibit a significant and negative relationship with tax evasion. The authors confirm the belief that households with incomes from government sources have less incentive to underreport their incomes. Finally, testing the effect of income and the personal income tax reform on the level of underreporting, the study shows that for all four estimation techniques, the estimated coefficients of income is statistically significant and positive.

Hofstede (1980) segregates culture into four dimensions (power distance, uncertainty avoidance, masculinity and individualism) and develops a country-based ranking for each dimension. Employing Hofstede's dimension of culture, Tsakumis et al. (2007) investigate the relation between national cultural dimensions and tax evasion for 50 countries. The authors adopt estimates of the shadow economy and measure tax evasion as a ratio of the size of a country's shadow economy to its GDP. Controlling for economic development, the OLS estimation results show a positive and significant relation between uncertainty-avoidance and tax evasion. The estimated coefficients for both individualism and masculinity give a positive and significant effect on tax evasion. In contrast, power distance shows

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<sup>4</sup> Tax evasion model by Allingham and Sandmo (1972)

a significant and negative relation with tax evasion. The authors conclude that at higher levels of uncertainty avoidance and power distance, and lower levels of individualism and masculinity, tax evasion is on a higher scale across countries.

Schneider et al. (2008) analysed the long-run characteristics of tax rates and tax evasion in Italy over the period 1980-2004. Defining two different tax rates, they realise that the effective tax burden (revenue-net GDP ratio) is higher than the apparent tax burden (revenue-GDP ratio). Also, the difference between the two tax rates is a fixed value around 11 per cent but with short-run exogenous disturbances. Schneider et al. (2008) further explain that taxpayers always implement plans targetted at sustaining the equilibrium gap. Secondly, adopting cointegration technique, it was found that the apparent tax rate and tax evasion Granger-cause each other with a percentage change in the apparent tax rate increasing tax evasion by 0.48 per cent whereas an increase in the latter pushes the former up by 0.3 per cent. The authors conclude that in the long-run the apparent tax rate emerges as the determinant of tax evasion.

Extending the international tax evasion model by Tsakumis et al. (2007) by including legal, political and religious variables, Richardson (2008) tests the relationship between culture and tax evasion across 47 selected countries. Obtaining average data for the years 2002-2004 for both the dependent and independent variables from the Global competitiveness Report and controlling for economic development, the OLS regression results show that at higher levels of uncertainty avoidance, the level of tax evasion is higher across countries. In addition, the lower the level of religiosity, legal enforcement, trust in government and individualism, the higher the level of tax evasion.

### **3. Methodology and Model**

#### **3.1 Model Specification and Variable Description**

The seminal theoretical models, which are the basis for most of modern tax evasion models, were first derived by Allingham and Sadmo (1972), Srinivasan (1993) and another version by Yitzhaki (1974). These models study the behaviour of the taxpayer within the Von Neumann-Morgenstern axioms for behaviour under uncertainty. They are based on Baker's (1969) economic approach to crime. Following from Yitzhaki's model and the other works such as Clotfelter (1983) and Tanzi (1993) the empirical model to be estimated is presented as:

$$\ln TE_t = \alpha_0 + \alpha_1 \ln Ir_t + \alpha_2 \ln rPCY_t + \alpha_3 \ln ATR_t + \alpha_4 \ln AGE_t + \alpha_5 \ln GEND_t + \alpha_6 \ln INF_t + \mu_t \quad (1)$$

The dependent variable *TE* represents the level of tax evasion for each period of the study. *Ir* is interest on bank deposits. The coefficient of the *Ir* variable captures the effect of a change in deposit interest rate on the amount of currency held for transactions by individuals. We therefore expect a negative relationship between *Ir* and *TE*. The



variable  $rPCY$  is the real per capita income. It is used as a proxy for the level of economic development. Per capita income is expected to be negatively related to the level of tax evasion. The coefficient of  $ATR$  illustrates the effect of changes in the average tax rate on the level of tax evasion. The average tax rate is computed as a share of total tax revenue in GDP for each period. It is expected to exhibit a positive relationship with the dependent variable.

$AGE$  denotes the age of taxpayers and measured as the proportion of the population between 15 and 64 years<sup>5</sup>. This age interval represents younger taxpayers and we anticipate a positive relation between  $AGE$  and  $TE$ . The gender of a taxpayer is represented by the variable  $GEND$  where  $GEND$  is measured as the proportion of the population that is female. We expect a negative association between  $GEND$  and the level of tax evasion.  $INF$  represents the rate of inflation for the period of the study.  $INF$  is measured as the change in consumer price index. The coefficient of  $INF$  demonstrates the relationship between inflation and tax evasion which is expected to be positive.  $\ln$  is the natural logarithm of the respective variables. The dependent and independent variables are logarithmized to ease the interpretation of the coefficients as elasticities.

### 3.2 Technique of Analysis

The study employed time series data for the analysis. One problem often associated with time series data is non-stationarity. The use of non-stationary variables is likely to give misleading results. This study therefore begins its estimation process by first testing for unit roots. The Phillip- Peron (PP) test proposed by Phillips and Peron (1988) is employed for the unit root test. The PP test has an advantage over the Augmented Dickey Fuller test as it gives robust estimates when the series are serially correlated and also suffer from time-dependent heteroscedasticity. The Granger causality test based on the Granger (1969) procedure was also employed to detect causal relationships among the variables.

The bounds testing approach developed by Pesaran, Shin and Smith (2001) is used to test for the presence of a long-run relationship among the variables in this study. The bounds testing approach employs Autoregressive Distributed Lag (ARDL)<sup>6</sup> models. The use of this approach is based on several considerations. First, ARDL models generate consistent estimates of long-run coefficients that are asymptotically normal, regardless of whether the variables are purely  $I(0)$ , purely  $I(1)$  or mutually cointegrated (Pesaran et al., 2001). In general, the technique provides unbiased estimates of the long-run model and valid  $t$ -statistics even in situations when the variables are endogenous. Moreover, ARDL models are suitable for small sample sizes, unlike the Johansen cointegration technique which in the same situation would result in considerable loss of degrees of freedom.

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<sup>5</sup> In the empirical literature individuals age 65 and above represent older taxpayers. See Richardson (2006)

<sup>6</sup> See Nikopour (2003); Arby et al. (2010); Dell' Anno and Halicioglu (2010); Adriana AnaMaria, and Ion (2010) as other studies that used ARDL to estimate the shadow economy

To carry out the bounds test procedure, equation (1) is modeled as a conditional ARDL-error correction model stated below:

$$\begin{aligned} \Delta \ln TE_t = & \alpha_0 + \sum_{i=1}^p b_i \Delta \ln TE_{t-i} + \sum_{i=0}^p c_i \Delta \ln Ir_{t-i} + \sum_{i=0}^p d_i \Delta \ln rPCY_{t-i} + \sum_{i=0}^p e_i \Delta \ln ATR_{t-i} + \\ & + \sum_{i=0}^p f_i \Delta \ln AGE_{t-i} + \sum_{i=0}^p g_i \Delta \ln GEND_{t-i} + \sum_{i=0}^p h_i \Delta \ln INF_{t-i} + U_t + \\ & \phi_1 \ln TE_{t-1} + \phi_2 \ln Ir_{t-1} + \phi_3 \ln rPCY_{t-1} + \phi_4 \ln ATR_{t-1} + \phi_5 \ln AGE_{t-1} + \phi_6 \ln GEND_{t-1} + \\ & + \phi_7 \ln INF_{t-1} + \varepsilon_t \end{aligned} \quad (2)$$

Where,  $\Delta$  denotes the first difference operator,  $\alpha_0$  is the drift parameter and  $\varepsilon_t$  is the white noise error term. To determine the existence of cointegration, we first estimate the first differenced components of the above equation using ordinary least squares (OLS). The Schwartz Bayesian Criterion (SBC) is employed to select the optimum number of lags. We then ascertain the long-run relationship by restricting the coefficients of the lagged level variables to zero. The null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration among the variables.

That is;

$$\begin{aligned} H_0 : & \phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5 = \phi_6 = \phi_7 = 0 \\ H_1 : & \phi_1 \neq \phi_2 \neq \phi_3 \neq \phi_4 \neq \phi_5 \neq \phi_6 \neq \phi_7 \neq 0 \end{aligned}$$

The null hypothesis is tested against the alternative by means of an F-test with an asymptotic non-standard distribution. Considering the ARDL approach, two asymptotic critical value bounds provide a test for cointegration when the independent variables are  $I(d)$  with  $0 < d < 1$  (Pesaran and Smith, 1995). The lower bound on the one hand, assumes that all the regressors are  $I(0)$  and the upper bound on the other hand, assumes that they are  $I(1)$ . If the F-statistic computed lies above the critical upper bound value, we reject the null hypothesis regardless of the cointegration rank of the variables, indicating cointegration among the variables. However, if the computed F-statistic lies below the lower critical bound value, we fail to reject the null hypothesis of no cointegration relationship among the variables, implying the absence of long-run relationship. No conclusive decision is made when the F- statistic falls within the critical bound values. The critical values developed by Pesaran et al. (2001) are based on simulated large sample size. Therefore, this study uses the critical values developed by Narayan (2004), since it is more appropriate for small samples.

Once we establish that the variables are cointegrated, we proceed to estimate the long-run ARDL model in order to obtain the long-run coefficients and their asymptotic standard errors. The estimated model is as follows:

$$\ln TE_t = \alpha_0 + \sum_{i=1}^{n_1} \beta_i \ln TE_{t-i} + \sum_{i=0}^{n_2} \gamma_i \ln Ir_{t-i} + \sum_{i=0}^{n_3} \sigma_i \ln rPCY_{t-i} + \sum_{i=0}^{n_4} \varepsilon_i \ln ATR_{t-i} + \sum_{i=0}^{n_5} \phi_i \ln AGE_{t-i} + \sum_{i=0}^{n_6} \lambda_i \ln GEND_{t-i} + \sum_{i=0}^{n_7} \theta_i \ln INF_{t-i} + \mu_t \quad (3)$$

This is followed by the estimation of the short-run elasticities of the variables with the error correction representation of the ARDL model. By employing the error correction of the ARDL, we determine the speed of adjustment to equilibrium. The existence of long-run relationship among the variables necessitates the estimation of the unrestricted ARDL-error correction represented as:

$$\Delta \ln TE_t = a_0 + \sum_{i=1}^{n_1-1} b_i \Delta \ln TE_{t-i} + \sum_{i=0}^{n_2-1} c_i \Delta \ln Ir_{t-i} + \sum_{i=0}^{n_3-1} d_i \Delta \ln rPCY_{t-i} + \sum_{i=0}^{n_4-1} e_i \Delta \ln ATR_{t-i} + \sum_{i=0}^{n_5-1} f_i \Delta \ln AGE_{t-i} + \sum_{i=0}^{n_6-1} g_i \Delta \ln GEND_{t-i} + \sum_{i=0}^{n_7-1} h_i \Delta \ln INF_{t-i} + \lambda ECM + \mu_t \quad (4)$$

*ECM* is the error correction term and its coefficient ( $\lambda$ ) is the speed of adjustment to the long-run following a shock to the system. It is expected to be negative and statistically significant so as to confirm the existence of cointegration among the variables in the model.

The reliability of the goodness of fit of the model is also determined by conducting the diagnostic and stability tests of the model. The diagnostic test takes care of heteroscedasticity, autocorrelation, normality and the functional form that are linked to the model. According to Pesaran and Pesaran (1997) the CUSUM and CUSUMSQ are employed in performing parameter stability tests.

### 3.3 Data Type and Sources

Annual time series data covering the period 1970-2010 is employed for the study. The dataset is obtained from a wide range of sources. Information on the currency in circulation is obtained from the Bank of Ghana and International Monetary Fund's International Financial Statistics (IFS) year books (1996, 2004 and 2010). Also, data on AGE, GEND, RPCY and INF are from the World Bank Development Indicators. Likewise, tax revenue values are obtained from the Ghana Revenue Authority. Given that data on tax evasion is generally unavailable, the study generated estimates for tax evasion for the period 1970 to 2010 by first estimating the size of the shadow economy based on Tanzi's (1983) monetary model (See Appendix for the illustration of how the model is used to estimate the tax evasion).

#### 4. Discussion of Results

We proceed with our estimation by testing for the presence of unit roots in all the variables used in our ARDL model. Even though ARDL cointegration technique does not require pre-testing of the variables for unit root, this test is conducted to ensure that the variables are not integrated of order greater than one. Employing the Phillip-Perron test for unit root, we initially examined all the variables to verify whether they were stationary at levels. For the variables that were not, we first differenced them to assess whether they would be stationary or not. In both estimations, we tested the null hypothesis (presence of unit root) against the alternative hypothesis (see Appendix II for discussion on unit root test results).

Prior to testing the presence of a long-run relationship among the variables, it is important that we determine the lag length of the ARDL model. Pesaran and Shin (1999) suggest a maximum lag length of 2 for annual data in the bounds testing approach to cointegration, so given that the ARDL model uses annual data, we include a lag length of 2. After establishing the lag length, we compare the *F*-statistic computed within the unrestricted error correction framework of the bounds test with the lower and upper critical values developed by Narayan (2004). The *F*-statistic tests the joint null hypothesis that the coefficients of the lagged levels are zero, that is, there is no long-run relationship among the variables. The result of the bounds test for the presence of a long-run relationship is presented in Table 1.

**Table 1: Bounds Test for the presence of Cointegration**

Critical Value Bounds of the F-statistics ( Unrestricted Intercept and no Trend)					
90% Level		95% Level		99% Level	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
2.442	3.400	2.907	3.982	3.983	5.448
Calculated F-statistics: 4.537**					

**Source:** Narayan (2004), \*\* indicates 5 per cent significance level

From Table 1, the calculated *F*-statistic of 4.537 lies above the upper critical bound of the 5 per cent significance level of 3.982. This implies that the null hypothesis of no cointegration among the variables of our ARDL model is rejected at the 5 per cent significance level. This result suggests that there exists a long-run relationship among tax evasion and the explanatory variables of the model, and these explanatory variables can be treated as “long-run forcing” variables for the explanation of tax evasion in Ghana. Establishing this relationship, we further estimate our ARDL model to determine the long-run relationship and short-run dynamics.

We estimate the impact of the explanatory variables on tax evasion in the long-run. Table 2 presents the results of the long-run estimate based on the Schwartz Bayesian

Criterion (SBC). The diagnostic test section of Table 2 illustrates that the selected ARDL (0, 0, 1, 0, 1, 0, 1) passes the standard diagnostic test of; serial correlation, functional form, normality and heteroscedasticity.

Table 2 also shows that all the explanatory variables with the exception of deposit interest rate (*Ir*) are significant. Although insignificant, *Ir* bears the expected negative signage. The insignificance of *IR* runs contrary to the results of studies such as Tanzi (1983) and Klovland (1984). Both studies found deposit rate of interest to be negative and significantly related to tax evasion in United States, Norway and Sweden respectively. Our result suggests that, any change in the deposit interest rate of financial assets does not affect the opportunity cost of holding cash. Probably, most Ghanaians find the gains from bank deposits to be relatively low compared to the gains realised when the same amount is engaged in transactions outside the banking sector.

**Table 2: Long-run Estimates based on SBC-ARDL (0, 0, 1, 0, 1, 0, 1)**

**Dependent variable is LTE**

Variable	Coefficient	Standard error	T-Ratio [Prob]
LnIr	-0.0083106	0.0065587	-1.2671 [0.216]
LnrPCY	-2.1981***	0.72691	-3.0239 [0.005]
LnATR	0.024170***	0.0027577	8.7646 [0.000]
LnAGE	0.0038589***	0.0010185	3.7887 [0.001]
LnGEND	-0.22619***	0.030465	-7.4246 [0.000]
INF	0.0078579***	0.0016802	4.6767 [0.000]
C	0.13525	0.024188	5.5918 [0.000]
<b>Diagnostic test</b>			
<b>Test Statistics</b>	<b>LM Version</b>		<b>F Version</b>
Serial Correlation	CHSQ (1) = 0.64525 [0.422]		F (1, 26) = 0.44911 [0.509]
Functional Form	CHSQ (1) = 0.29032 [0.590]		F (1, 26) = 0.20017 [0.658]
Normality	CHSQ (2) = 0.73096 [0.694]		Not applicable
Heteroscedasticity	CHSQ (1) = 0.026570 [0.871]		F (1, 36) = 0.02518 [0.875]

**Source:** Authors' calculation using Microfit 4.1. \*\*\*: Significant at 1%; \*\*: Significant at 5%

The rest of the discussion focuses on the significant predictors of tax evasion (Table 2). As expected, per capita income is (*rPCY*) inversely related to tax evasion. This finding is consistent with that of Tanzi (1983) for the United States and Sookram and Watson (2005) for Trinidad and Tobago among others. The estimated coefficient for *rPCY* suggests that a one per cent increase in the real per capita income of economic agents will cause tax evasion to reduce by 2.20 per cent, all other factors remaining the same. One possible explanation for the inverse relationship is that economic development involves the development of various institutions (such as the domestic revenue mobilisation institutions) and sectors of the economy. Therefore, improving domestic revenue mobilisation institutions leads to higher capacity to collect taxes, resulting in a fall in the level of tax evasion. Also, an improvement in the revenue mobilisation institutions in Ghana will increase their ability to detect potential tax evaders and reduce future tax evasion. Another explanation is that at low incomes, economic units have a high tendency of engaging in several jobs but report incomes on only one job causing a rise in the level of tax evaded. On the other hand, high per capita income may reduce the tendency of economic agents holding other jobs and underreporting their incomes.

The average tax rate (*ATR*) exhibits a positive relationship with tax evasion. Further, it shows that a one per cent rise in the average tax rate causes tax evasion to rise by 0.02 per cent, all other things being the same. This result could be due to the fact that, at constant income, increases in tax rates reduce the disposable income of taxpayers, motivating them to secure other jobs in the shadow economy in order not to report earned income and evade tax liabilities. Clotfelter (1983), Trehub and Krasnikova (2005), Schneider et al. (2008) had similar results in their studies where the average tax rate was found to exhibit a positive and significant impact on tax evasion.

The literature on the direction of the impact of inflation on tax evasion is inconclusive. Crane and Nourzad (1986) observe a positive and statistically significant relationship between inflation and tax evasion in the long-run. On the other hand, Klovland (1984) finds that in Sweden there exists a negative and statistically significant relation between inflation and tax evasion at equilibrium. In addition, Sookram and Watson (2005) find a negative and statistically significant link between inflation and tax evasion in Trinidad and Tobago.

With regard to inflation (*INF*) and tax evasion, our results suggest a positive relationship. Further, the estimated coefficient of *INF* shows that a one per cent increase in inflation rate will increase tax evasion by 0.008 per cent, holding other factors constant. The possible reason accounting for this result is that the wage structure of the formal sector in the economy is not inflation indexed. Therefore, higher inflation affects the after-tax income of taxpayers and reduces their disposable income. In order to maintain a consistent consumption pattern, most taxpayers participate in activities of the hidden economy to earn extra incomes which are unrealised by the tax authorities.

Concerning the demographic variables, age (*AGE*) and gender (*GEND*), we observed that at equilibrium, the age variable influences tax evasion positively. Also, the estimated coefficient of *AGE* suggests that as the proportion of the population between 15-64 years of age increases by one per cent, the level of tax evasion also increases by 0.004 per cent, all

other determinants treated as constant. The result suggests that younger taxpayers in Ghana are more risk-seeking and less sensitive to sanctions. Though Richardson (2006) found the impact of age to be insignificant on tax evasion, both Clotfelter (1983) and Feinstein (1991) observed that older taxpayers were more tax compliant.

Finally, we found a negative relationship between gender and tax evasion. The result shows that, a one per cent increase in the proportion of the population which is female results in 0.23 per cent decrease in tax evasion in Ghana in the long run. This negative relationship suggests that women in Ghana are more likely to be tax compliant. In contrast, Trehub and Kransikova (2005) found that women in Russia are more likely to evade tax liabilities.

The evidence that the variables in our model are cointegrated provides support for the use of an error correction model (ECM) so as to examine the short-run dynamics. The results of the short-run dynamics associated with the ARDL (0, 0, 1, 0, 1, 0, 1) are illustrated in Table 3. The error correction term has a coefficient of -0.4505 which is statistically significant at the 1 per cent level. This helps to reinforce the findings of a long run relationship among the variables in the model. The magnitude of the coefficient of the error correction term signifies that 45 per cent of deviations from the equilibrium level of tax evasion is corrected each year. Furthermore, an R-squared of 0.79 suggests that the explanatory variables included in our model explain 79 per cent of the level of tax evasion. The remaining 21 per cent is accounted for by variables excluded in our tax evasion model and which are accounted for by the error term.

Table 3 shows that all the explanatory variables with the exception of deposit interest rate are statistically significant in the short run. Interestingly, the signs associated with each of the explanatory variables are consistent with the long run results discussed earlier. However, the magnitudes of the estimated coefficients differ from that of the long-run estimates.

**Table 3: Short-run Dynamic Results ARDL (0, 0, 1, 0, 1, 0, 1)**

**Dependent variable is LTE**

Variable	Coefficient	Standard Error	T-Ratio [Prob]
dLnIr	-0.0083106	0.0065587	-1.2671 [0.215]
dLnPCY	-0.29821***	0.079104	-3.7699 [0.001]
dLnATR	0.024170***	0.0027577	8.7646 [0.000]
dLnAGE	0.12366***	0.033056	3.7409 [0.001]
dLnGEND	-0.0030919**	0.0011715	-2.6393 [0.015]
dINF	0.0037150***	0.0011066	3.3572 [0.002]
C	0.40014	0.2084	1.9169 [0.068]
ECM(-1)	-0.45048	0.9582	-4.7013 [0.000]

$$ecm = LTE + 0.0083106IR + 2.1981LRPCY - 0.024170ATR - 0.0038589LAGE + .22619LGEND - 0.0078579INF - 0.13525C$$

R-Squared	.79490	R-Bar-Squared	0.71893
S.E. of Regression	0.15256	F-stat. F( 8, 29)	13.0800 [0.000]
Mean of Dependent Variable	-0.016029	S.D. of Dependent Variable	0.28776
Residual Sum of Squares	0.62840	Equation Log-likelihood	24.1213
Akaike Info. Creterion	13.0213	Schwarz Bayesian Criterion	4.0146
DW-statistics	2.2260		

**Source:** Results obtained using Microfit Version 4.1

The real per capita income variable (*rPCY*) exhibits a negative and statistically significant effect on tax evasion. The estimated coefficient associated with *rPCY* shows that in the short-run, a one per cent rise in the real per capita income reduces the level of tax evasion in Ghana by 0.30 per cent (Table 3). Moreover, short-run changes in both average tax rate and the rate of inflation are statistically significant and have positive impacts on the level of tax evasion. As the average tax rate and the rate of inflation increase by one per cent, tax evasion increases by 0.02 and 0.004 percent respectively.

Table 3 further shows that age (*AGE*) has a positive and statistically significant influence on tax evasion at the 1 per cent significance level in the short run. The results above demonstrate that a 1 per cent rise in the proportion of the population between 15-64 years of age results in 0.12 per cent increase in tax evasion. Gender (*GEND*) also exhibits a negative and statistically significant relation with tax evasion, suggesting that a percentage increase (decrease) in proportion of the population that is female will decrease (increase) the level of tax evasion in the short-run.

#### **4.1 Granger Causality Test Results**

The causal relationship between tax evasion (*LTE*), the average tax rate (*ATR*) and rate of inflation (*INF*) are reported in Table 4. The result shows that average tax rate Granger- causes tax evasion. Moreover, the result shows a unidirectional relationship between average tax rate and tax evasion for the period under consideration. The result also suggests that not only do past values of tax evasion aid in predicting its future values but tax rate variable is also important in predicting future values of tax evasion. In addition, we observed a weak unidirectional relationship between the inflation rate and tax evasion (significant at 10%). The result implies that inflation rate is a vital variable which aids in predicting future levels of tax evasion. The results confirm our earlier claim that both the tax variable and the inflation rate influence tax evasion in Ghana.



**Table 4: Pairwise Granger Causality Test Results**

Null hypothesis	F-Statistics	Probability	Comment
LnATR does not Granger Cause LnTE	3.74992	0.03442	Null rejected
LnTE does not Granger Cause LnATR	1.20853	0.31114	Null not rejected
INF does not Granger Cause LnTE	2.52358	0.09684	Null rejected
LnTE does not Granger Cause INF	0.62425	0.54169	Null not rejected

**Source:** Author's computation using EViews 5.

## 5. Conclusion and Recommendations

This paper sought to identify the factors that contribute to the extent of tax evasion in Ghana, using time series data covering the period 1970-2010. Employing the currency demand approach, we obtained the estimates of the shadow economy and the level of tax evasion for the entire period. We then adopted the bounds testing technique to cointegration to ascertain the determinants of tax evasion. First, the variables in the study were tested for stationarity using the Philips-Perron test.

The econometric evidence suggests that the variables included in our ARDL model are bounded together. The results based on the long run estimates show that average tax rate, age and inflation rate have positive and statistically significant impact on tax evasion. Conversely, real per capita income and gender do exert negative and statistically significant effect on tax evasion. Besides, deposit interest rate though carried the correct signage, had an insignificant effect on tax evasion in the long run. The short run estimates were consistent with the long run estimates. However, there were differences in the magnitudes and levels of significance of the estimates. The error correction term was negative, statistically significant and shows that 45 per cent of the deviation from equilibrium tax evasion is corrected each year. Our empirical finding based on the Granger causality test suggests that the tax rate and inflation rate aid in predicting future levels of tax evasion in Ghana.

The study found that an increase in the tax variable raises the level of tax evasion in Ghana for the period under review. On this note, we recommend that the tax authorities should widen the tax base to include as much items and individuals as possible and slightly reduce the tax rates in a manner that the net effect on tax revenue will be an increase. This will serve to reduce the level of tax evasion.

Additionally, we observed a positive relationship between the rate of inflation and tax evasion such that an increase in the inflation rate will lead to a rise in tax evasion in Ghana. Hence, we propose that the current effort by the Bank of Ghana to maintain single digit inflation should not be relented on in addition to identifying the optimal level of inflation in the economy.

Given that the proportion of younger taxpayers in the population increases tax evasion, we propose that tax authorities should pay keen attention to younger taxpayers.

This will include ascertaining the average income level of a representative young taxpayer. In line with the results obtained earlier that an increase in the female population leads to a reduction of tax evasion in Ghana, we similarly recommend that the tax authorities should focus less on female tax payers but channel a greater proportion of their resource in monitoring male tax payers.

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## Appendices

### Appendix I: Estimating Tax Evasion

The monetary approach<sup>7</sup> to measuring the size of the shadow economy and tax evasion<sup>8</sup> has become the most popular approach. This approach, also known as the currency demand approach was initiated by Cagan (1958) and further developed by Tanzi (1980). The approach assumes that shadow transactions are conducted in cash payments to leave no observable traces for the authorities. In order to hide the source of income from tax authorities, economic agents in the shadow economy are more likely to use cash. In this sense, a rise in the currency ratio, *ceteris paribus*, could represent an increase in the shadow economy. Tanzi (1983) assumes that the currency demand approach is based on a correlation between the demand for currency and the tax pressures such that, the shadow economy is nonexistent when taxes are zero. He further states that the difference between the estimated currency (with taxes) and the estimated currency (under the assumption of zero taxes) produces an estimation of currency in the shadow economy.

Empirical studies such as Tanzi (1983), Klovland (1984), Faal (2003) and Bekoe (2010) have identified certain key factors that influence the level of currency holding by the public at any period. Employing a number of these determinants of currency ratio, we develop and estimate a currency demand equation in order to determine the size of the shadow economy and tax evasion. Employing an Ordinary Least Squares (OLS) technique, we estimate a currency demand equation of the form:

$$\ln\left(\frac{C}{M2}\right)_t = \beta_0 + \beta_1 \ln ATR_t + \beta_2 \ln Ir_t + \beta_3 \ln rPCY_t + \beta_4 \ln(EDU_t) + \beta_5 \ln(URPOP_t) + \varepsilon_t \quad (\text{A.1})$$

Where:

$\frac{C}{M2}$  = Currency- M2 ratio

$ATR$  = Tax variable

$Ir$  = Interest rate

$rPCY$  = real per capita income

$EDU_t$  = Education level (measured as educational attainment in terms of the average years of schooling for the total population over the age of 15 years);

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<sup>7</sup> In spite of its popularity the method has been strongly criticized from different angles (see Cardi and Passerini, 2001; Thomas, 1999, and Breusch, 2005 and 2005b) but these have been amply addressed by other authors (See Schneider and Enste, 2000 and Schneider, 2002). A recent adjustment to the monetary method has been argued by Ahumada et al. (2007, 2008). The authors propose that the monetary method only produces consistent estimates if the income elasticity of demand for currency is unitary and suggested different ways for estimation if the elasticity were otherwise. They re-estimated the shadow economy for Argentina, Bolivia, Australia, Norway and Tanzania and had different results from previous studies.

<sup>8</sup> Results on tax evasion estimates not presented to avoid inundation of pages in this paper

$URPOP_t$  = Urbanization (measured as percentage of the population living in cities)

$\varepsilon_t$  = Error term

Ln = Natural Logarithm

By using the results from the estimated currency-M2 model, we then proceed 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:

$$\text{Illegal Money (IM)} = \left( \left( \frac{C}{M2} \right)_t - \left( \frac{C}{M2} \right)_{wt} \right) * M2 \quad (\text{A.2})$$

where:

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

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

$M2$  = Broad definition of money (M1 plus time deposits)

$$\text{Legal Money (LM)} = M1 - IM \quad (\text{A.3})$$

where:

$M1$  = Narrow Definition of money (currency plus demand deposits)

$IM$  = Illegal money obtained from equation (A.2)

$$\text{Velocity (V)} = \frac{GNP}{LM} \quad (\text{A.4})$$

where:

$GNP$  = Gross National Product

$LM$  = Legal Money obtained from equation (A.3)

$$\text{Underground Economy (UE)} = IM * V \quad (\text{A.5})$$

where:

$IM$  = Illegal Money

$V$  = Velocity of Money derived from equation A.(4)

$$\text{Tax Evasion (TE)} = UE * \left( \frac{\text{Total Taxes}}{GNP} \right) \quad (\text{A.6})$$

where:

$UE$  = Underground Economy derived from equation (A.5)

$GNP$  = Gross National Product

## Appendix II: Discussion of Unit Root Results

The Mackinnon (1996) critical values were used in making a conclusion as to rejecting or failing to reject the null hypothesis. Whenever the absolute value of the calculated statistics is greater (lesser) than the critical value, we reject (fail to reject) the null hypothesis and conclude that the variable is stationary (non-stationary). Tables A1 and A2 present the results of the unit root test at level and first difference respectively.

**Table A1: Unit Root Test Results at Levels**

Variable	PP Statistics	PP critical	P-Value
LnTE	-2.161829	-3.194611	0.4970
LnIr	-1.854855	-3.194611	0.6589
LnrPCY	-0.593834	-3.194611	0.9740
LnATR	-2.146621	-3.194611	0.5051
LnAGE	-5.473174	-4.205004	0.0003
LnGEND	-4.017102	-3.526609	0.0160
INF	-4.730021	-4.205004	0.0025

**Source:** Author's computation using EViews 5.

From the Table A1, we realised that *LnAGE*, *LnGEND* and *INF* have the absolute values of their PP statistics being greater than their critical values and also with significant probability values. We therefore reject the null hypothesis and conclude that these three variables are stationary at levels or integrated of order zero.

Table A2 on the other hand, presents results of variables that were not stationary at levels and had to be differenced. After differencing, the following variables; *LnTE*, *LnIr*, *LnrPCY* and *LnATR* exhibit PP statistics greater than their critical values in absolute terms and also show probability values which are significant at 1 per cent level. We reject the null hypothesis and conclude that *LnTE*, *LnIr*, *LnrPCY* and *LnATR* are stationary at first difference or integrated of order one.

**Table A2: Unit Root Test Results at First Difference**

Variable	PP Statistics	PP Critical	P-Value
LnTE	-7.105130	-4.211868	0.0000
LnIR	-5.704630	-4.211868	0.0002
LnRPCY	-6.809942	-4.211868	0.0000
LnATR	-5.895970	-4.211868	0.0001

**Source:** Author's computation using EViews 5.



Combining the results in Tables A1 and A2, the order of integration of the variables used in the study are shown in the Table A3:

**Table A3: Order of Integration of Variables**

Variable	Order of Integration
LTE	I(1)
IR	I(1)
LRPCY	I(1)
ATR	I(1)
LAGE	I(0)
LGEND	I(0)
INF	I(0)

**Source:** Author's compilation

### **Appendix III: Diagnostic and Stability Test Results**

It is evident from Table 2 that our ARDL (0, 0, 1, 0, 1, 0, 1) model passes the standard diagnostic test<sup>9</sup>. However, it is important to investigate whether the above long and short run relationships established in the study are stable for the entire period of the study. For this purpose, we test for parameter stability which is based on the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) test proposed by Brown, Durbin and Evans (1975). On the one hand, the CUSUM test employs the cumulative sum of recursive residuals based on the first “n” observations, updated recursively and plotted against break point. The CUSUMSQ on the other hand, uses the squared recursive residuals and follows the above procedure. In instances where both the CUSUM and CUSUMSQ stay within the 5 percent critical bound, the null hypothesis that all coefficients are stable cannot be rejected. The result clearly indicate that both CUSUM and CUSUMSQ plots lie within the 5 percent critical bound therefore, providing a confirmation that over the entire period of the study, the parameters of the model do not suffer from any structural instability<sup>10</sup>.

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<sup>9</sup> That is the test for serial correlation, functional form, normality and heteroscedasticity.

<sup>10</sup> Result of the stability test is not presented to avoid inundation of pages in this paper