Estimating the underground economy andtax evasion in Ghana

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ABSTRACT

This paper has attempted to provide estimates of the size of the underground economy and estimated tax evasion in Ghana from 1990 to 2010 which have received little consideration. The Stock-Watson DOLS estimate for currency demand was employed. Our estimates suggest that underground economy is quite large accounting for about 48% of the official economy on the average. These results are consistent with the stylised fact about the Ghanaian economy, in particular the large number of persons employed in small business and trading versus the number of tax returns filed on an annual basis and also claiming to have incomes way below taxable levels. The estimated evaded tax ranges from 4% to about 14% of the official economy and higher budgetary supports and loans contracted in a year. The implication is that any success made in reducing such leakages may have positive effect on fiscal and monetary policy.

Introduction

The underground economy and tax evasion have been a source of grave worry in Ghana, not only to the economists but also to the political leaders, policy-makers, nongovernmental organizations, and the press are taking a active interest in the size of the underground economy and tax evasion in Ghana. These are evidenced by the recent revelation at the Tema Port, Osei Kojokrom Border by investigative journalist Anas Aremeyew Anas and concerns raised by the President of Ghana, John Evans Atta Mills during his visit to the Domestic Tax Division of National Revenue Authority on 4th February, 2011. These concerns arise from the continually decrease in tax base and low tax elasticity and buoyancy, and the resulting mounting fiscal deficit. Regrettably, it is very difficult to get accurate information about the size of the underground economy and the lost taxes. The challenge the national tax systems confront is the problem of taxing underground economic activities which has been referred to in the literature (see Georgiou,2007) variously as "informal economic activities"; "unrecorded economy"; "shadow economy", Secondary Economy", Unobserved Sector of the Economy", "Fourth Sector of the Economy", "Hidden Economy", "Irregular Economy", "Black Economy", "Cash Economy", "Clandestine Economy", "Covert Economy", "Dual Economy", "Grey Economy", "Illegal Economy", "Illegitimate Economy", "Invisible Economy", "Informal Economy", "Other Economy", "Unofficial Economy", "Subterranean Economy", "Parallel Economy", "Twilight Economy" etc. According to Iqbal, Qureshi and Mahmood (1998), the term is generally meant that the economy which-goes unrecorded in official statistics though the definition of the term differs depending on the objective and the approach used in the literature. The present study used the term "Underground Economy" as such activities as illegal drugs dealing, smuggling, prostitution, money laundering, unlicensed money lending, illegal gambling, and other illegal activities (Amir, Masron, and Ibrahim, 2009; Smith, 1994) and legal practices like income generated through legitimate cash-based or non cash-based activities such as online trade (Zhuge, et al., 2009) and bartering services (Schneider and

Enste, 2000). The rationale is that it may be difficult to separate felonious and drug money from legal transactions obscured from tax authorities. The study employs currency demand function which follows Pickhardt and Sarda (2006) specification to estimate the size of underground economy and tax evasion in Ghana. The study contributes to the literature by estimating the size of underground economy and does not rely on the assumption of equal velocity of money in official and unofficial economy. The study believes that such assumption is misleading because the characteristics of the two economies are different and would hardly have same velocity of money.

These results are consistent with the stylised fact about the Ghanaian economy, in particular the large number of persons employed in small business and trading versus the number of tax returns filed on an annual basis and also claiming to have incomes way below taxable levels. The consequence is high tax evasion ranging from 4% to about 14% of the official economy The rest of the paper is as follows: literature review as section 2, model and estimation technique in section 3. The section 4 presents the data and empirical results and concluded in section 5.

Literature Review

There is a vast literature present on underground, concerning different aspects of the underground economy including but not limited to why underground economy exist and methods of estimating the size of underground economy. A glance at the literature highlight and support factors such as tax burden, regulations (such as entry barriers, for example, such as licensing costs for certain types of business), regulations in the labour market, lack of rule of law, low personal income in the official economy, unemployment, corruption etc (see Weiss, 1987; Choi & Thum, 2005; McMillan, 2006; Schneider 2008) as reasons why underground economy exist.

The methods of determining the size of underground economy is torn between direct and indirect approaches. Direct approaches include surveys and tax auditing. The survey method seems to give a very detailed picture of the undergroud economy subject to interviewees willingness to

disclose the fact of their illegal activity. Tax auditing requires auditing conducted by tax collection authorities, and gives very detailed information on underground activities. However, the method is only applicable to taxable activities.

The indirect approaches are mostly macroeconomic and use various economic and other indicators, which contain information regarding the development of shadow economies over time. These includes a number of methods dealing with discrepancy between national expenditures and income statistics, transaction approach which states that there is a constant relationship between official GDP and the volume of money, currency demand approach, Multiple Indicators Multiple Causes (MIMC) and the Electricity consumption Method (for discussion of each of the available approach and their limitations, (see Feige and Urban 2008; Hassan,2011). Though, like other methods currency demand approach has its own criticism, it has been widely used in estimating the size of underground economy in the literature especially Giles (1999) improved version of Tanzi (1983) model. The underlying assumption of this approach is that shadow transactions are conducted in cash (to avoid leaving traces, history such as for example when wiring money through bank or printing receipt at cash desk -using cash gives anonymity). The strong side of this method is availability of data, currency amount is well documented, and the regression is elegant.

Model and Estimation Technique

As it has been agued, this study employs currency demand model which follows Pickhardt and Sarda (2006) specification to estimate the size of the underground economy and consequently the tax evasion potential.

The currency demand equation in this model is specified in log-linear terms:

$$\log\left(M_t\right) = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 P_t + \alpha_3 IR_t + \alpha_4 T_t + \varepsilon_t \quad (1)$$

where is M_t currency demand, Y_t is observed legal income in terms of national product,

P_t is inflation rate, IR_t is nominal interest rate, T_t is a measure of fiscal pressure, α_i

$[i = 0,1....4]$ are parameters to be estimated and ε_t is an error term. Subscript denotes time of observation.

When logarithms are reversed in (1), following is obtained:

$$M_t = Y_t^{\alpha_1} e^{(\alpha_2 P_t + \alpha_3 IR_t + \alpha_4 T_t + \varepsilon_t)} \quad (2)$$

Assume that tax burden affects currency demand related to underground economy, then currency demand related to total income, Y_t ,observed and , Y_t^U ,unobserved if there are no taxes is(i.e. set tax burden to zero):

$$M_t = (Y_t + Y_t^U)^{\alpha} e^{(\alpha_2 P_t + \alpha_3 IR_t + \varepsilon_t)} \quad (3)$$

Then, rearranging (4) ratio of unobserved to observed income (2) in terms of national product is obtained:

$$\frac{Y_t^U}{Y_t} = e^{\left(\alpha_4 . \frac{T_t}{\alpha_1}\right)} - 1 \approx \alpha_4 . \frac{T_t}{\alpha_1} \quad (4)$$

Note: Using Taylor series expansion

$$e^{\left(\alpha_4 . \frac{T_t}{\alpha_1}\right)} = \sum_{n=0}^{\infty} \frac{(\alpha_4 \frac{T_t}{\alpha_1})^n}{n!} \approx 1 + \frac{\alpha_4 T_t}{\alpha_1} \text{ as } \frac{\alpha_4 T_t}{\alpha_1} \to 0 \text{ and } n \to \infty$$

From equation (4), the unobserved /underground economy can be estimated using

$$Y_t^U \approx \alpha_4 . \frac{T_t}{\alpha_1} Y_t \quad (5)$$

It is worth noted that only estimates of α_4 and α_1 are required to estimate of shadow economy in that period.

The advantage of this model is that it does not require existing observation of shadow economy and does not assume same velocity of cash circulation in observed and hidden economy

Finally, level of tax evasion is obtained by multiplying the size of underground economy to the ratio of tax-to- GDP

Tax Evation $= Y_t^U T_t \quad (6)$

Estimation technique

The goal of this paper is to estimate the underground economy of Ghana through currency demand function. This follows current time series econometric practice in recognising that classical regression properties hold only for cases where variables are stationary (integrated of order 0), that by contrast most economic variables are integrated of order 1 or higher (and hence do not satisfy these assumptions), but that where error correction mechanisms or long run relationships exists, certain combinations of I(1) variables are likely to be I(0) and hence amenable to OLS estimation.

Where this is so, the variables are said to be cointegrated and OLS estimates of such cointegrated variables may be superconsistent in the sense of collapsing to their true values more quickly than if the variables had been stationary.

The first step is to determine the degree of integration of the individual series under investigation. Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests are performed on each series to determine their order of integration.

Results from unit root tests on all the variables involve in the study indicate that all the variables are of I(1)[1]. The implication is that alternative approach other than OLS should be used. The present study employs Stock and Watson (1993) Dynamic Ordinary Least Square (DOLS).

This method improves on OLS by coping with small sample and dynamic sources of bias. The Johansen method, being a full information technique, is exposed to the problem that parameter estimates in one equation are affected by any misspecification in other equations (Al-Azam and Hawdson, 1999)

The Stock Watson method is, by contrast, a robust single equation approach which corrects for regressor endogeneity by augmenting with leads and lags of first differences of the regressors, and for serially correlated errors by a GLS procedure. In addition it has the same asymptotic optimality properties as the Johansen distribution.

We model the demand for Currency in Ghana as

$$\log\left(M_t\right) = \alpha_0 + \alpha_1 \log Y_t + \alpha_2 P_t + \alpha_3 IR_t + \alpha_4 T_t + \sum_{i=-m}^{m} \alpha_5 \Delta \log Y_{t-i} + \sum_{i=-n}^{n} \alpha_6 \Delta P_{t-i} + \sum_{i=-m}^{m} \alpha_7 \Delta IR_{t-i} + \sum_{i=-l}^{l} \alpha_8 \Delta T_{t-i} + \varepsilon_t$$

$$(7)$$

Where
m, n and *l* are the lengths of leads and lags of the regressors

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[1] The unit root tests is available upon request.

Data and Empirical Results
Data

The analysis in this paper is based on annual time series that start from 1990 to 2010. Table 1 below details how each variable of study is measured and the corresponding data source.

Table 1: Variables Definition, Measurement and Source

Variable	Definition	Measurement	Source
M	Currency demand	M1	WDI
Y	Observed Legal income	GDP at current prices in Local currency	IMF-IFS
P	Inflation Rate	Percentage change in CPI	IMF-IFS
IR	Nominal Interest Rate	T-bill rate	IMF-IFS
T	Tax rate	Tax revenue as percentage of GDP	WDI

The possibility of cointegration between the variables of I(1) included in the models is examined by estimating the cointegrating regression initially by OLS. The approach is adopted over Johansen approach due to the small sample nature of this study. The ADF test of the residuals clearly indicates cointegration (see table 2). The cumulative Sum of Recursive Residual *CUSM (fig 1)* and the cumulative Sum of Squares of Recursive Residual *CUSUMSQ (fig2)* tests conducted to investigate the stability of the model parameters indicate that the mode stable.

Table 2: OLS Estimate of Currency Demand

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y	1.078415	0.030466	35.39781	0.0000
P	-0.000164	0.004460	-0.036720	0.9712
IR	-0.002065	0.005825	-0.354533	0.7276
T	0.058210	0.017052	3.413719	0.0036
C	-4.385590	0.699560	-6.269073	0.0000

Diagnostic Tests

$R^2 = 0.991$ 　　　　　　　　　　　Serial Correlation
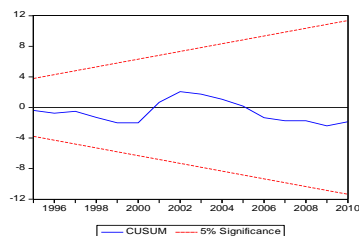
$\chi^2(2) = 2.721(0.2565)$

$DW = 1.987$ 　　Normality $\chi^2(2) = 3.682(0.1587)$
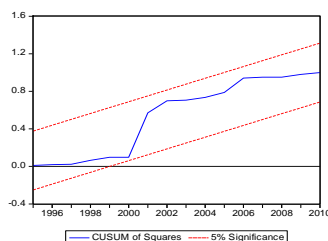
$ADF(1) = 3.09(0.043)$ 　　　Heteroscedasticity

$\chi^2(1) = 0.875(0.5067)$

Figure 1:Plot of Cumulative Sum of Recursive Residuals

Figure 2:Plot of Cumulative Sum of squares of Recursive Residuals

The study proceed to estimate the long run relationship using the DOLS specified in equation (7). The Stock-Watson DOLS estimates for currency demand appear in Table3.The currency demand equations were estimated including up to i=±2 leads and lags, the insignificant lags and leads were dropped. Table 3 shows the result of DOLS estimate of currency demand in Ghana. The parameters of interest have the expected sign and are highly significant at 5% level. The GDP elasticity is 2.07 while that of tax is found to be 0.067 indicating that increase in tax rate in terms of tax evasion effect results in more use of currency. The DOLS for the currency demand is robust to various departures from standard regression assumptions in terms of residual correlation, hetroscedasticity, and non-normality of residuals. The regression results that are shown in Table 3 are remarkably good. The adjusted R^2 is very high and this indicates that the model is capable of explaining most of the explanatory power in the dependent variable over the period. The Durbin Watson statistics and all diagnostic tests results are also at satisfactory levels.Stability tests conducted by plotting *CUSM* and *CUSMSQ* where they both suggest that estimated models are stable over the sample period see figures 3 and4.

Table 3: Stock-Watson Dynamic OLS estimates of Currency demand

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y	2.072246	0.043523	24.63637	0.0000
P	-0.000808	0.007818	-0.103350	0.9197
IR	-0.001044	0.009672	-0.107961	0.9162
T	0.067742	0.024980	2.711885	0.0219
C	-4.431635	0.950132	-4.664231	0.0009
ΔY	0.700303	0.300766	2.32839816	0.0497
ΔP	0.030220	0.00551	5.4845735	0.0171
ΔIR	-0.080044	0.009881	-8.140775230	0.0013

Diagnostic Tests

$R^2 = 0.992$ 　　　　　　　　　　　Serial Correlation

$\chi^2(2) = 2.512(0.2565)$

$DW = 2.01$ 　　Normality $\chi^2(2) = 5.347(0.0696)$
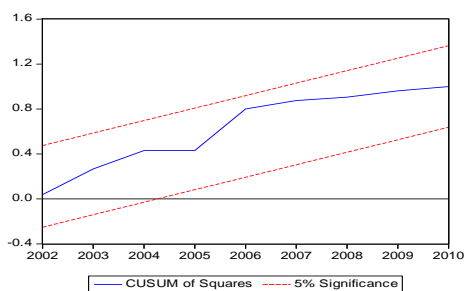
Adj. $R^2 = 0.986$ 　　　　　　Heteroscedasticity

$\chi^2(1) = 0.975(0.6167)$

Figure 3:Plot of Cumulative Sum of Recursive Residuals
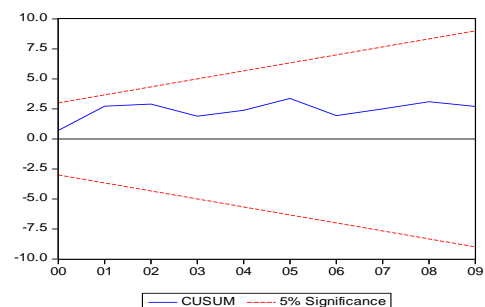
**Figure 4:Plot of Cumulative Sum of squares of Recursive Residuals**

The significant of the coefficients of tax and observed GDP variables give way to estimate the sizes of unobserved GDP (Underground economy) and tax evasion in Ghana from 1990 to2010 using equations (5) and (6) respectively. Column (3) of Table 4 shows the estimated values of underground economy while column (4) of the same table presents the unobserved economy as percentage of the observed economy. The results indicate that the underground economy is very high in Ghana and ranges between GHS69.070 million in 1990 and GHS 15.667 Billion in 2010. In terms of percentages of the underground economy to recorded economy, it spans between low of 36% and high of 72% and averaged 48%. The estimated underground/recorded ratio seems to be little higher than what is recorded in Schneider, Buehn and Montenegro (2010) who recorded an average of 40.7% of official economy from 1999 to 2007. The difference may be as a result of differences in the methodology but at least it has been established that the size of underground economy is above 40% of the recorded economy in Ghana.

Figure 5 shows the trends of the underground economy against the recorded economy. It clear from the figure 5 that as the official economy or recorded economy expands so does the underground economy.

The columns 5 and 6 of Table 4 show the evaded tax based on the estimated underground economy and tax evaded-official economy ratio. The results reveal huge tax potential lost as result of underground economy. The value of estimated tax evasion in monetary term ranges between GHS7.597 Million in 1990 and GHS2.66 Billion in 2010. This is not surprising because Ghana's economy has huge informal sector whose activities are difficult to track coupled with perceived high level of corruption.

Figure 5: Trends of Estimated Underground and Official economies
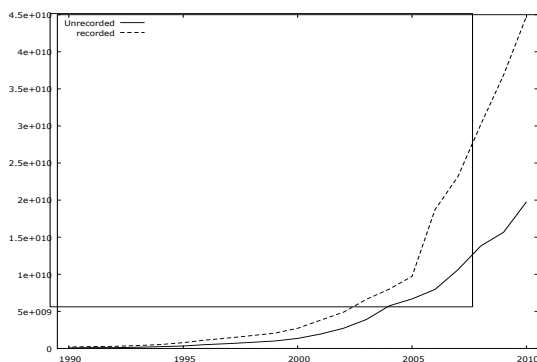
Table 4: Size of Undergroud Economy and Tax Evasion

year	Tax Revenue (% of GDP) (1)	Official GDP (Current LCU) (2)	Unobserved GDP (LCU) (3)	Unobserved GDP (% of Observed GDP) (4)	Tax Evasion (5)	Tax Evasion (% of Observed GDP) (6)
1990	11.00	192,079,135	69,070,019.87	0.36	7,597,702.19	4.0
1991	13.00	242,752,946	103,163,143.22	0.42	13,411,208.62	5.5
1992	11.00	280,287,511	100,789,000.09	0.36	11,086,790.01	4.0
1993	13.00	387,210,000	164,553,309.63	0.42	21,391,930.25	5.5
1994	14.00	520,500,000	238,213,008.49	0.46	33,349,821.19	6.4
1995	13.00	775,170,000	329,425,348.06	0.42	42,825,295.25	5.5
1996	14.00	1,133,870,000	518,929,075.78	0.46	72,650,070.61	6.4
1997	14.20	1,411,340,000	655,143,896.42	0.46	93,030,433.29	6.6
1998	14.54	1,729,600,000	822,265,595.17	0.48	119,580,910.84	6.9
1999	14.89	2,057,980,000	1,001,445,993.30	0.49	149,072,389.29	7.2
2000	15.23	2,715,250,000	1,351,716,737.87	0.50	205,847,148.94	7.6
2001	15.57	3,807,070,000	1,937,920,802.39	0.51	301,761,953.51	7.9
2002	17.00	4,886,200,000	2,715,419,079.97	0.56	461,621,243.60	9.4
2003	18.00	6,615,770,000	3,892,867,373.91	0.59	700,716,127.30	10.6
2004	22.00	7,988,791,000	5,745,402,311.45	0.72	1,263,988,508.52	15.8
2005	21.00	9,726,080,000	6,676,884,085.46	0.69	1,402,145,657.95	14.4
2006	13.00	18,705,016,801	7,949,103,642.01	0.42	1,033,383,473.46	5.5
2007	14.00	23,154,531,583	10,596,946,452.76	0.46	1,483,572,503.39	6.4
2008	14.00	30,178,631,206	13,811,609,090.91	0.46	1,933,625,272.73	6.4
2009	13.00	36,867,361,098	15,667,586,802.68	0.42	2,036,786,284.35	5.5
2010	13.50	44,798,730,492	19,770,432,956.97	0.44	2,669,008,449.19	6.0

Conclusion

This paper has attempted to provide estimates of the size of the underground economy and estimated tax evasion in Ghana from 1990 to 2010. The Stock-Watson DOLS estimate for currency demand was employed. The results shows bigger underground economy between 1990 and 2010 averaged 48% of the official or recorded economy together with high estimated evaded tax. The study argues that the huge underground economy may be as result of huge size of informal sector which are difficult to track.

The result showing estimated evaded taxes lend credence to aid irrelevant claims. For example, the 2009 and 2010 estimated tax evasion alone is more than the much debated Chinese $3billion (GHS1.67/$) loan to be drawn down on the two tranches (US1.5 billion each) under the Master Facility Agreement (MFA) in five (5) years to Ghana. It is surprising that the commitments put in securing such loans over the years have not been put in building our institution to reduce tax revenue leakages. The study recommends that efforts should be

made to lower the size of the underground economy and tax leakages.

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