African Review of Economics and Finance | ISSN 2042-1478 | Volume 9 | Issue 2 | December 2017

Taxable capacity and effort of Ghana's value-added tax

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Abstract

Value-added tax (VAT) has not only brought dynamism in Ghana's revenue mobilisation landscape but also occupies a centre stage in the country's fiscal consolidation efforts. Interestingly, the VAT regime has undergone a number of discretionary reforms in a bid to generate as much revenue as possible for its fiscal mandate. However, the trends show that VAT's contribution to total tax revenue has consistently remained below 30 percent over the past one and a half decades. Could it be that the scope for further VAT revenue expansion is reaching its limit? This study uses the regression approach to estimate and examine the taxable capacity and collection efforts of Ghana's VAT. The paper discovers that the VAT regime is characterised by both periods of underexploited and overexploited taxable capacities. However, on the whole, there appears to be little scope for further revenue expansion, given the existing base. The study, therefore, argues that the recent over concentration on VAT may endanger the country's quest for fiscal adequacy. Consequently, an appropriate tax mix is highly recommended.

JEL classification: H20; H25; E62; 017.

Keywords: Tax effort; Tax capacity; VAT; Tax collection; Shadow economy.

1. Introduction

Ghana has experienced persistent budget deficit since 1992 (except in 1994 and 1995) (Alagidede, Baah-Boateng, & Nketiah-Amposah, 2013). The deterioration in the fiscal stance of the economy is largely blamed on the rapid expansion in the public expenditure coupled with weak non-oil tax revenue collection (Amo-Yartey, 2014). Given the dwindling aid and capital flows to developing countries since the 2008 economic crises (Alcorta & Nixson, 2011), and the international aid agenda to gradually reduce the amount of aid to developing countries after 2015 (Mascagni *et al*., 2014), the need to increase domestic revenues has become even more pressing.

In 1998, Ghana successfully re-introduced value-added tax (VAT) as part of the fiscal reforms to boost revenue mobilisation, to reduce the mounting pressure from increased expenditure demands and excessive borrowing. This was a major component of the then ongoing IMF's Enhanced Structural Adjustment Facility (ESAF) for developing countries. Specifically, the ESAF emphasised a tax reform to be centered on a broad-based consumption tax, notably a VAT, as a means to foster macroeconomic stability through improved tax revenue (World Bank, 1991; IMF, 1998). The adoption of VAT in Ghana was also in line with a key recommendation of a major study on the revenue productivity of the country's tax system. According to the study, the major option available for raising additional revenue in Ghana was the introduction of VAT to replace the existing sales tax (Kusi, 1998 p.47).

Indeed, VAT has not only brought some dynamism in the revenue mobilisation landscape but also has come to occupy a centre stage in the country's fiscal consolidation efforts. For instance, prior to the VAT implementation, taxes on international trade constituted the major component of tax revenue in Ghana, with an average share in total tax revenue of 38.8 percent (1980-93) and 32.1 percent (from 1996 to 1998). This was followed by taxes on domestic goods and services which contributed about 28.5 percent and 24.4 percent respectively. The least was taxes on income and property contributing 21.3 percent in 1980-93 and 27.5 percent in 1996-98 (Osei, 2005). Currently, VAT makes the highest contribution to total tax revenue compared to other tax components. Over the period 2001 – 2014, the contribution of VAT to total tax revenue was approximately 28.0 percent. This is about 17 times that of self-employed tax (1.58 percent) and twice of PAYE (14.1 percent). Import duties, which comes

next after VAT, contributes about 17.76 percent to total tax revenue, followed by company tax (16.46 percent) and PAYE (14.1 percent)[1].

Interestingly, Ghana's VAT has undergone a number of discretionary reforms in a bid to generate as much revenue as possible for its fiscal mandate. The key discretionary changes include the re-classification of the exempt and zero-rated items, revision of thresholds levels and upward revisions in rates. For example, in the year 1999, the VAT rate was increased from 10 percent to 12.5 percent with the 2.5 percent earmarked for the Ghana Education Trust Fund (GETFund)[2]. In the year 2003, the rate was further increased to 15 percent. This time, the additional 2.5 percent was earmarked for the National Health Insurance Scheme (NHIS) (Osei, 2000; Osei & Quartey, 2005; Prichard, 2009). Finally, in 2013, it was increased to 17.5 percent and again the additional 2.5 percent earmarked for infrastructure development. Clearly, this shows the indispensability of VAT in the success of the two key social sectors – education and health, but at the same time, it reveals the dire desire to generate increasing amount of revenue from the VAT regime.

However, as espoused by Laffer (1981)(through his famous Laffer curve), increasing tax rate initially increases tax revenue, but a further increase in the rate leads to a fall in tax revenues. This implies that there is a limit to the amount of revenue that can be raised from a given tax regime. Supply-side economists, Baye & Parker (1981), in a theoretical extension of the Laffer framework, show that increasing consumption tax rate has unambiguous negative tax revenue effects. Furthermore, according to Musgrave (1987), tax revenues in developing countries are determined not only by what could be extracted from the state's economy but also by the commitment of the government to tax its resources. In the spirit of the Laffer and Musgrave's tradition, the recent tax literature argues that a country's tax revenue is intrinsically linked to its taxable capacity (Cnossen, 2015; Le, Moreno-Dodson, & Bayraktar, 2012; International Monetary Fund,1995). Thus, undeniably, efforts to draw more revenue from a tax system without recourse to the available capacity could be damaging, as taxpayers will be compelled to increase tax evasion and tax avoidance thereby reducing tax revenue.

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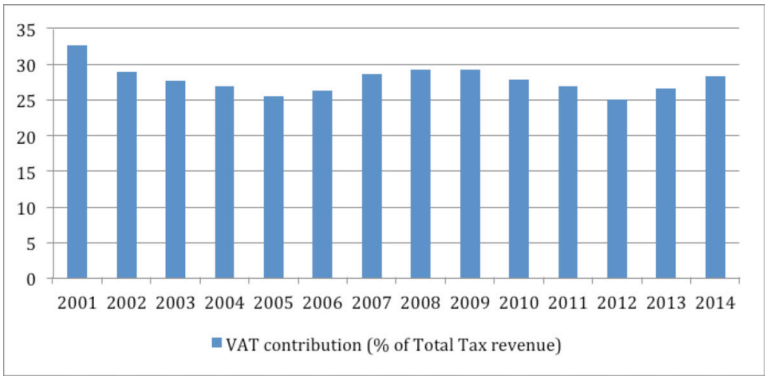
[1] Figures are computed from data used for this study. Sources of data are described in section 3.4 of this paper.

[2] GETFund was primarily set up to fund infrastructure and human capacity development of Ghana's public tertiary institutions. Its scope has been widened over time.

Ghana's VAT has a heavy fiscal mandate which demands an increasing amount of VAT revenue. However, despite the various discretionary measures undertaken to improve VAT revenues, the trends shows that VAT's contribution to total tax revenue has consistently remained below 30 percent over more than a decade (see Figure 1).

Figure 1: Trends in VAT Contribution to Total Tax Revenue



Source: Author (based on the compiled data for this study. See section 3.4 for sources of data).

The concern, therefore, is that the much-celebrated VAT may either be reaching the limit of its taxable capacity or the collection effort to convert the available capacity into actual revenue is low. However, so far, no known study is found to provide a detailed examination of the issue. As a key contribution, this paper estimates and explicitly examines the trends in taxable capacity and collection efforts of VAT in Ghana. The paper examines the trends in VAT capacity and efforts in the context of the country's macroeconomic and institutional environment. Moreover, the study goes further to disaggregate the VAT into domestic and external (import) VAT thereby offering a deeper understanding of the evolution of the performance of each component.

2. Literature review

2.1. Conceptual issues: taxable capacity and tax efforts

Taxable capacity is defined as the potential tax revenue obtained, taking into account a country's specific macroeconomic, demographic, and institutional features while tax effort is the ratio of actual tax collection and taxable capacity (Le, Moreno-Dodson, & Bayraktar, 2012). The measurement of taxable capacity and efforts has varied over the years. Traditionally, GDP has been used as a measure of taxable capacity. The justification is that GDP gives the limit to

the amount of tax revenue obtainable. However, using GDP is inappropriate because not all taxes are linked explicitly to income and its distribution (Stotsky, WoldeMariam, & IMF, 1997). For example, import duties and VAT are based on final consumption. Moreover, GDP fails to take into account the specific differences in countries' economic structures, institutional arrangements, and demographic trends, hence making it inappropriate for inter-country comparisons (Le, Moreno-Dodson, & Bayraktar, 2012; Chelliah, Baas, & Kelly, 1975). Consequently, Tait, Gratz, & Eichengreen (1979) and Bahl (1971) adopt the average tax system approach. This approach calculates average effective tax rates and then applies them to a standard set of tax bases. The ratio of the actual yield to the standard tax yield is consequently used as tax efforts index. However, the key limitation is that it fails to control for factors other than the determinants of tax revenues. The estimation of the taxable capacity involves only the tax bases.

The use of regression has, therefore, become a dominant approach in estimating taxable capacity and tax effort in recent times (see Le, Moreno-Dodson, & Bayraktar, 2012; Le, Moreno-Dodson, & Rojchaichaninthorn, 2008; Gupta, 2007 and Stotsky & WoldeMariam,1997). Its key strength is that in addition to the relevant tax bases, this approach takes into consideration the determinants of tax revenues in estimating taxable capacity. The first step in applying this approach is to regress the tax revenue share on the tax base and other factors that determine a country's ability to collect tax revenue. The second step is to predict the taxable capacity from the estimated regression. The tax effort is then obtained by dividing the predicted tax by actual tax. If tax effort equals 1, it means that there is little scope for further revenue increase. If it is greater than unity, it means the country has over utilized its available tax capacity. If it is less than unity, it means that there is still an untapped tax capacity.

A second variant of the regression is the stochastic frontier approach (SFA) developed by Aigner, Lovell, Knox, & Schmidt (1977). The SFA is analogous to the production function in that it expresses the maximum tax revenue obtainable from a given set of inputs. These inputs are the tax base and other tax determinants. The SFA predicts and measures tax inefficiency by estimating the difference between the actual revenue and the maximum revenue (see Greene 2008; Pessino & Fenochietto, 2010; and Fenochietto & Pessino, 2013 for a detailed description of the stochastic frontier method).

2.2. Empirical studies

Stotsky & WoldeMariam (1997) estimate a panel of 43 African countries covering 1990-1995. Ghana's average tax effort is 1.121 and 1.315[3] (when agriculture share of GDP is included in the specification). Agriculture share of GDP and mining share GDP are both statistically significant and negatively related to tax-GDP ratio. Gupta (2007) also examines a panel of 105 developing countries, including Ghana, over the period 1980-2004. The results of their study show that Ghana has a tax effort ratio of 0.73 (with the GDP specification) and 0.97 (when agriculture share of GDP is included in the model), suggesting that the country failed to exploit fully its tax potential. The study, therefore, classifies Ghana as a low tax performing country.

Le, Moreno-Dodson, and Rojchaichaninthorn (2008) cover 104 countries during 1994-2003, using the regression method. The study finds Ghana's predicted (taxable) capacity and tax effort ratio to be 14.20 and 1.29 respectively. Ghana's status is then described by the study as high effort but low tax collection country. The study finds higher institutional quality and corruption to have a positive and a negative effect on revenue capacity respectively. Le, Moreno-Dodson, & Bayraktar (2012) cover a sample of 110 developing and developed countries for the period 1994-2009. They find Ghana's tax effort to be 1.30, indicating overexploitation of available taxable capacity. Similarly to the previous study, the study, therefore, describes Ghana as high effort but low tax collection country.

In a stochastic frontier analysis of 96 countries, Pessino & Fenochietto (2010) find Ghana's taxable capacity and tax effort ratio to be 24.6 per cent of GDP and 91.2 percent (0.91) respectively. Unlike the previous study, their results show that Ghana is a low effort country suggesting that there still exists additional scope for improved tax revenue. Inflation and corruption are identified to be the major setback to Ghana's tax collection effort. In a follow-up study, Fenochietto & Pessino (2013) examine 113 countries in a panel regression framework. The results, therefore widely confirm the previous results that Ghana is low taxable capacity and low tax effort country. The study attributes the low taxable capacity to large level of tax exemptions, high inflation, high tax rates, and corruption.

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[3] We computed average values from the ratios reported by Stotsky & WoldeMariam (1997). The reported effort ratios from 1990 - 1995 were 1.028 (1.182), 1.0672(1.338), 0.952(1.134), 1.162(1.319), 1.292(1.485) and 1.22(1.432). Note: values in parenthesis were for the agriculture share specification.

Recently, Ndiaye & Korsu (2014) examine ECOWAS countries for the period 2000–2010. Ghana's tax effort ratios for direct tax, indirect tax, trade tax, total tax (excluding resource tax) and total tax (including natural resource) are given as 0.82, 0.86, 0.36, 0.75 and 0.78 respectively. The results suggest that Ghana's tax effort is low. The study blames the low tax performance on large agricultural share of GDP.

On a whole, an important observation made about the above studies is the conspicuous absence of the effect of shadow economy in the analyses. Meanwhile, a number of studies find shadow economy to have a negative effect on tax performance (Kodila-Tadika & Mutascu, 2013; Davoodi & Grigorian, 2007; Alm & Torgler, 2006; Bird *et al*., 2004). However, these studies did not consider Ghana. Moreover, the studies that considered Ghana, unfortunately, failed to pay attention to VAT.

Admittedly, studies on VAT revenue performance abound; however, they primarily focus on determinants of VAT collection efficiency based on VAT efficiency and C-efficiency. None has yet been found that specifically considers VAT taxable capacity and effort. In terms of determinants, Keen (2013) finds standard VAT rate and the share of consumption in GDP to have positive effect on VAT collection efficiency. de Mello (2009) in a differential game of VAT also finds VAT rate, share of tax administrative costs and regulatory quality, rule of law and government effectiveness as key determinants of VAT revenue collection. Aizenman & Jinjarak (2008) on their part find durability of political regime, ease and fluidity of political participation, GDP per capita, urbanization and trade openness as positive determinants VAT collection efficiency. Agriculture share of GDP is, however, found to reduce the VAT collection efficiency. Furthermore, Legeida & Sologoub (2003) finds positive influence of VAT rate and tax base on VAT revenue collection. These findings are also confirmed by Bogetic & Hassan, (1993), Gillis, Shoup, & Sicat (1990) and Kay & Davis (1990). However, as pointed out earlier, here again, the studies ignore shadow economy.

3. Conceptual framework

The conceptualization of tax capacity is informed by Aizenman & Jinjarak (2008)'s extension of the theoretical model of Cukierman, Edwards, & Tabellini (1992). The central idea of the model is that inefficiency in a tax system reflects a lower investment in tax capacity, which in turn leads to lower probability of auditing and lower evasion penalty. This, therefore, reduces the amount of tax

collected at a given statutory VAT rate. The model further posits that structural factors that increase the ease of tax evasion tend to reduce the equilibrium tax collection.

The model is set up as follows: The economy is represented by two budget constraints: the government [equation (1)] and the private sector [equation (2)].

$$g_t + f_t \leq \tau_t^A 1-\theta) + s_t \tag{1}$$

$$c_t \leq 1 - \tau_{\#}^A - s_t - \delta(\tau_t) - \gamma(s_t) \tag{2}$$

where, g_t and f_t denotes two public goods that compete for government expenditure. The variable c_t is per capita private consumption; s_t and $\tau^A{}_t$ respectively denote the amount of "seigniorage" and actual VAT collected by the government at time *t*, while τ_t is the statutory VAT rate. Seigniorage is assumed to entail no administrative cost but VAT entails enforcement and administrative cost. A fraction θ_t of the VAT revenue is invested in collecting and enforcing VAT compliance. Thus, θ_t denotes VAT capacity investment and is a rough measure of the efficiency of the VAT system. Therefore, the lower the value of θ, the more inefficient is the tax system. Both seigniorage and VAT are assumed to impose a convex deadweight loss on the private sector equal to $y(s_t)$ and $\delta(\tau_t)$ respectively, such that $\delta'(\cdot) > 0$, $\delta''(\cdot) > 0$, $y'(\cdot) > 0$ and $y''(\cdot) > 0$.

3.1. The agent's problem

A key feature of VAT administration is that firms (retail and wholesale) collect VAT revenue on behalf of the government. The firms are supposed to keep records of all purchases and sales and pay VAT on net sales of VAT goods and services. However, these firms may choose to under-report sales (hence pay lower VAT) if they do not expect to be audited by tax authorities or receive less penalty in case of default. Let *p* be the probability that the tax authority will audit firm and ϕ be the penalty rate associated with default if found paying $r \hat{<} r$. The total penalty of default is expressed as quadratic $\frac{1}{2}\phi_t[\tau_t - \hat{\tau}]^2$ Thus, the default firm makes a total after-default payment to the tune of $\tau_t + \frac{1}{2}\phi_t[\tau_t - \hat{\tau}_t]^2$.

The representative agent has a utility $U(c_t)$, where c_t is the private consumption and is made up of $c_{t,a} = 1 - \{\hat{\tau}_t + \frac{1}{2}\phi[\hat{\tau}_t - \tau_t]^2\} - s_t - \delta(\hat{\tau}_t) - \gamma(s_t)$, when audited; and $c_{t,n} = 1 - \tau_t - s_t - \delta(\hat{\tau}_t) - \gamma(s_t)$ when not audited. The agent, therefore, seeks to maximize expected utility from actual VAT payments in the form

$$\underset{\tau_t^A}{Max}\left[p_t U(c_{t,a}) + (1-p)U(c_{t,n})\right] \tag{3}$$

Optimizing equation (3) subject to (2), the agent submits VAT payment expressed as, $\tau_t^A = \tau_t - \frac{1-p_t}{p_t\phi_t}(1-\lambda)$ (4)

where, λ is the risk premium adjusted such that $\lambda = \frac{U'(c_{t,a}) - U'(c_{t,n})}{U'(c_{t,a})} > 0$ and $U'(c_t)$ is the marginal utility associated with consumption c_t. The risk premium term λ measures the percentage gap of the marginal utilities between the audit and no audit cases. The resultant expected tax payment is

$$E[\tau_t^A] = \tau_t - \frac{1}{2}\frac{(1-p_t)^2}{p_t\phi_t}(1-\lambda^2) \quad (5)$$

Higher degree of risk aversion increases the utility cost of being audited thereby increasing the expected VAT payment. It can be verified that $\lambda \cong \frac{c_{t,n}-c_{t,a}}{c_{t,a}} - \frac{U''(c_{t,a})}{U'(c_{t,a})}$. Therefore, λ is negligible when $\frac{c_{t,n}-c_{t,a}}{c_{t,a}}$ is small. This is the case when tax gap between the increases in tax payment associated with audit, is small relative to total consumption. Hence, the risk adjustment term, λ can be approximated to zero and therefore be ignored. With economy being populated with a large number of atomistic agents, the authorities consider the idiosyncratic risk associated with tax evasion to be diversified away in the macro budget constraints (1) and (2). Hence the actual VAT revenue r^A_t becomes the expected tax payment of the atomistic agent as expressed in (6)

$$\tau_t^A = \tau_t - \frac{1}{2}\frac{(1-p_t)^2}{p_t\phi_t}(1-\lambda^2) \cong \tau_t - \frac{1}{2}\frac{(1-p_t)^2}{p_t\phi_t} \quad (6)$$

Equation (6) shows that the expected tax payment (the revenue performance of the tax system) is positively related to the standard rate τ_t, the probability of an audit p_t and the penalty rate ϕ. The private agent views p_t and ϕ_t as exogenous. However, the policy maker determines these variables through the investment in tax capacity, θ as well as other structural factors (ST) in the economy. Thus,

$$p_t = p_t(\theta_{t-1}; ST)\ ;\ p' > 0, p'' < 0 \quad (7)$$

$$\phi_t = \phi_t(\theta_{t-1}; ST)\ ;\ \phi' > 0, \phi'' < 0 \quad (8)$$

where, ST is the vector of structural factors which affect the cost of tax collection.

4. Methodology and data sources

4.1. Empirical model specification and estimation strategy

Following from equations (6), (7) and (8), VAT revenue is modeled as a function of standard rate, tax investments and structural factors as:

$$V_{it}^S = f(\tau_t, \theta_t, ST) \quad (9)$$

This study departs from the Aizenman & Jinjarak (2008)'s model by going beyond the traditional approach of modeling directly tax auditing and penalty rate. It can be argued that the presence of higher shadow economy undoubtedly increases the cost of VAT investment. Davoodi and Gregorian (2007) and Kodila-Tadika & Mutascu (2013) argue that growing shadow economy renders most taxpayers officially nonexistent, making it extremely difficult, if not impossible, to track VAT sales. Under such circumstances, tax authorities are compelled to increase tax investment. Thus, in this study, shadow economy proxies for the cost of tax collection and investment in tax capacity because larger shadow economy increases the cost of auditing and investment in tax capacity. These, therefore, lead to a reduction in the efficiency (hence capacity) of the tax system. Following the empirical literature, inflation is included as a proxy for macroeconomic environment. Moreover, as in tax models, the tax base is captured as a key determinant of tax revenue. The baseline empirical model is, thus, specified as:

$$V_{it}^{S} = \alpha_{it} + \beta_{it} \ln B_{it} + \delta_{it} StdR_{t} + \pi_{it} Infl_{t} + \gamma Shadow_{t} + \upsilon_{it} \quad , \quad i = 3 \tag{10}$$

where, α_{it} is the constant , $V_{it}^{S} = \frac{R_{it}}{B_{it}}$ is the VAT share of the i^{th} VAT component at time t. The variable R_{it} is actual VAT revenue of component i, at time t InB_{it} is the proxy base for i^{th} VAT component at time t, *StdR* is the effective VAT rate, *Infl* is the rate of inflation (in percentages) and In*Shadow* is the shadow economy at time t.

The baseline equation (10) is estimated separately for the three measures of VAT: total VAT revenue, domestic VAT revenue and Import VAT revenue. VAT-to-total consumption ratio is used as the dependent variable for total VAT estimation. Import VAT share (import VAT divided by total import) is the dependent variable for the import VAT estimation, while Domestic VAT share (domestic VAT revenue divided by household final consumption) is used for domestic VAT estimation. Total consumption is used as the base for total VAT estimation, household final consumption for domestic VAT and import for import VAT estimations. The rate of inflation is captured by the change in CPI. Studies that recognize the importance of shadow economy in tax revenue performance try to proxy it by agriculture share of GDP. However, Schneider & Buehn (2016) and Buehn & Schneider (2012) argue that one indicator cannot adequately represent shadow economy because it cannot be observed. As a departure from previous studies, we estimate the size of the shadow economy for the period under study and then use it for the estimation. Following Buehn

& Schneider (2012), we estimate shadow economy using the MIMIC (Multiple Indicators Multiple Causes) model.

The MIMIC model is a type of structural equation model (SEM) developed by Frey & Weck-Hannerman (1984). It models an unobserved (latent) variable in terms of a set of observed variables by using the covariance information of the latter. The structure of the MIMIC models are specified in (11) and (12):

$$\eta = \psi' X + \zeta, \qquad X' = (x_1, x_2, ..., x_q)\ ;\ \ \psi' = (\psi_1, \psi_2, ..., \psi_q) \tag{11}$$

$$y = \sigma\eta + \varepsilon\ ; \qquad y' = (y_1, y_2, ..., y_p) \tag{12}$$

Equation (11) expresses the structural equation linking the unobserved variable (η) to a vector of exogenous causal factors, X. The parameter ψ ' describes the relationships between the latent variable and causal factors. Equation (12) shows the measurement (factor analytical) model that links the latent variable to its indicators. The variable y' is a vector of several variables that reflect the latent variable and ε is a *p-vector* of white noise disturbances (See Schneider, Buehn, & Montenegro, 2010; Schneider & Buehn, , 2016; Del'Anno ,2003; Giles and Tedds, 2002 for a detailed treatment and derivation of the MIMIC model).

Following Schneider & Buehn (2016), Buehn & Schneider (2012) and Dell'Anno (2007) we estimate the shadow economy using tax burden, government consumption and GDP as causal variables (see also Schneider & Enste, 2000; Feld & Schneider, 2010) while currency in circulation (measured by M0) and ratio of agriculture to GDP are used as indicators. The key advantage of the MIMIC approach over the widely used currency demand approach is that it explicitly considers multiple causes of the existence and growth of the shadow economy as well as the multiple effects of the shadow economy over time (For a detailed criticism of the transaction approach see Frey & Pommerehne, 1984 and Tanzi ,1986).

4.2. Potential biases and diagnostic tests

Non-stationary time series data can produce spurious results. For this reason, it is often necessary to carry out unit root and cointegration tests. The Augmented Dickey Fuller (ADF) unit root test is therefore used to test for the stationarity in the variables. Secondly, the presence of heteroskedasticity and/or autocorrelation could bias the regression results. In the presence of heteroskedasticity, the OLS estimators, although unbiased and consistent, no longer have minimum variance. The inflated variance can lead to the type-1 or type-2 error. Similarly,

presence of autocorrelation makes OLS estimators no longer efficient, leading to inflated F-statistic and underestimated level of statistical significance. The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity and Breusch-Godfrey test for autocorrelation are therefore performed on each model. Those found to have both heteroskedasticity and autocorrelation are re-estimated by Newey-West estimators, while models found to have autocorrelation are re-estimated using Prais-Winsten estimators. The third issue is multicollinearity. Its presence inflates the variance, causing test statistic to be small. Under this circumstance, there is a high probability of rejecting a null hypothesis when it should have been accepted (type I error). It also leads to the over estimation of the R2. To ascertain this, a matrix correlation is run for all the explanatory variables. Finally, as post-estimation test, the Linktest is performed to ascertain the appropriateness of the model specification. In addition, the residuals of the estimated regressions are also tested for unit root. The results are considered spurious if there is the presence of unit root in the regression residuals.

4.3. Data and sources

The study uses quarterly data from first quarter of 2000 to fourth quarter of 2014. VAT revenue data is sourced from the Ghana Revenue Authority, Bank of Ghana (BoG) annual and quarterly reports as well as the various national budgets. Quarterly data on GDP from 2006 to 2014 is from Ghana Statistical Service (GSS) website. GDP series from 2000 to 2005 and that of value of imports are however compiled from various annual, quarterly and monthly reports by the GSS, the Bank of Ghana (BoG), and Ministry of Trade and Industry. Following Ferede (2013), and taking into account the rebasing of Ghana's national accounts in 2006[4], the GDP deflator is used to transform the data into real values to avoid distortion by different movements in sector specific price levels. Inflation data is also sourced from the Ghana Statistical Service quarterly CPI bulletins and annual reports. The data for shadow economy is obtained from the MIMIC estimates described in the methodology section.

[4] In 2010, the national account was rebased. The base year was therefore moved from 1993 to 2006. The rebasing resulted in about 60.3 percent increase in GDP figures for 2006 from the 1993 therefore pushing Ghana into the lower middle income economy (Ghana Statistical Service(GSS) & Government of Ghana, 2010).

5. Results and discussions

5.1. Results from pre-estimations and post-estimation Tests

The MIMIC results show that on the average the size of the shadow economy is 40.23 percent of GDP (2000-2014). This compares favourably with a World Bank study, Schneider *et al*. (2010) who obtains 41.1 percent for the period 1999-2005. The quarterly and annual figures for shadow economy are presented in Appendix A1.

The pre-estimation ADF test results are presented in Table A2 in the Appendix. The results show that, with the exception of real GDP, the absolute values of the test statistics are greater than the absolute values of the critical values at 5 percent. This implies that all the variables, with the exception of real GDP, are stationary in levels. Thus, they are integrated of order zero (i.e. I(0)). Real GDP, however, becomes stationary after first difference (i.e. I(1)). Moreover, a correlation matrix involving explanatory variables (as presented in Table A3 in Appendix) shows that multicollinearity does not appear to be a problem.

Furthermore, the post-estimation ADF test conducted on the residuals fail to accept the null of unit root, as the test statistics are found to be greater than the critical values at 5 percent (see Table A4 in the appendix). This indicates that the results obtained are not spurious. Finally, Linktest for model specification is performed after estimations to indicate the appropriateness of the specifications (see Table A5 in the appendix). Column 1 is the Linktest for total VAT model, column 2 for domestic VAT and column 3 for the import VAT model. Column 1 shows that the *hat* has an explanatory power i.e. significant at 1 percent. However, the *hat square* is not significant, implying no explanatory power. This means that an inclusion of additional variables will not necessarily improve the model, therefore, suggesting that the number of variables used in the estimations is enough to produce reliable results. Similar observations are made for columns 2 and 3.

5.2. VAT revenue determinants

Table 1 presents empirical results for the taxable capacity. Column (1) shows the results for total VAT while columns (2) and (3) show that of Domestic VAT and Import VAT respectively. In line with expectation, the study confirms VAT rate, size of shadow economy, inflation rate and VAT bases as the key determinants of the VAT revenues hence taxable capacity. All the variables have the expected signs.

Table 1: Determinants of VAT Capacity

VARIABLES	(1) Total VAT	(2) Domestic VAT	(3) Import VAT
lnTotal Cons	0.0699***		
	(0.0196)		
VAT rate	0.00268***	0.003***	0.00440**
	(0.000990)	(0.000463)	(0.00180)
lnShadowEcon	-0.0670**	-0.0446**	-0.167**
	(0.0304)	(0.0170)	(0.0699)
lnRealGDP	0.0478**		-0.0146
	(0.0192)		(0.0115)
lnRealHHcons		0.00606***	
		(0.00164)	
lnImprts			0.0135***
			(0.00255)
Inflation	-0.011***	-.0001**	.00052**
	(0.002)	(.000048)	(.0002)
Constant	-0.0718***	-0.0754***	-0.0873***
	(0.0105)	(0.00401)	(0.0251)
Observations	59	59	59
R-squared	0.885	N/A	N/A
ADF test (residual)	-5.241***	-6.576***	-4.624***

Notes: (Newey-West) standard errors in parentheses (for Models 2 and 3)
*** p<0.01, ** p<0.05, * p<0.1
ADF critical values: -3.569 (1%), -2.924 (5%)

Specifically, the study finds that shadow economy reduces total VAT revenue by 0.07 percent (Column 1), domestic VAT revenue share by 0.04 percent (column 2) and import VAT share by 0.2 percent (Column 3). This is in line with Bird, *et al*. (2004); Davoodi and Gregorian (2007) and Kodila-Tadika & Mutascu (2013). Shadow economy makes it extremely difficult to track VAT sales. Secondly, even some of the officially registered taxpayers fail to declare the right tax liability. This is a common practice among retail and wholesale outlets (VAT collection points) in Africa. They refuse to use the VAT invoice in transactions thereby reducing VAT revenue.

VAT standard rate is found to influence both domestic VAT and import VAT shares positively, albeit the effect is minimal. This finding contrasts that of de Mello (2009) and Agha & Haughton (1996). However, two reasons can be adduced to explain this positive effect. First, Ghana's tax regime is generally characterised with generous exemptions, which are noted to have been grossly abused (Government of Ghana, 2004; 2006). Direct tax and VAT exemptions in 2012 alone amounted to US$ 876 million. This represents about 67 percent of all exemptions (Government of Ghana/Ministry of Finance, 2012). In the face of generous tax exemptions, it is argued that tax authorities usually tend to increase tax rates in an attempt to compensate for the repressive revenue effect of the shrinking tax base (Gillis, Shoup, & Sicat, 1990; Kay & Davis, 1990 and Bogetic & Hassan, 1993). Indeed, in 2014, it was acknowledged that the increase in the VAT rates was a key factor contributing to the strong growth in Ghana's VAT revenues in 2014 over that of 2013 (Government of Ghana, 2014). Although the statement applies to just one year, it attests to the fact that increase in VAT rate indeed contributes to increased VAT revenues in Ghana. Second, according to Friedman *et al*. (2000), the tax rate has two potentially offsetting effects: it creates incentives for non-compliance through the discouragement of business formality, but also allows the government to raise revenue to finance law and order, which encourages compliance. Therefore, if the effect of the latter is stronger than that of the former, VAT rate will have positive revenue effect.

Inflation is found to have a negative effect on domestic VAT but a positive effect on import VAT. The negative sign supports the recent empirical findings of Fenochietto & Pessino (2013) and Fenochietto & Pessino (2010). Intuitively, a higher rate of inflation reduces buying power of consumers and investing capacity of investors hence exerts a repressive effect on tax revenues. Moreover, theoretically, Tanzi (1977; 2000) show that when there are a longer tax revenue collection lag and high level of inflation, the positive impact of the "fiscal drag" on tax revenue is overwhelmed by the negative impact of the revenue collection lag[5]. In Ghana, firms are given up to three months to file their VAT returns. For example, VAT collections for the month of October 2016 are due on 31st January 2017. However, the recent emphasis by the Ghana Revenue Authority (GRA) on penalties for defaulting firms (Public Agenda, 2017) seems to suggest the existence of longer than expected collection lags. This could be more prevalent among domestic VAT firms where automation of revenue collection is not widespread. Unlike domestic VAT, import VAT revenues are collected almost

[5] This situation is termed as "the Tanzi Effect" in the tax literature (Tanzi, 2000).

instantly at the ports hence the collection lags may be very short (if any). This probably explains why the sign is positive (Tanzi, 2000).

5.3. Trends in actual VAT share, VAT capacity and VAT effort

Table 2 reports the trends in actual VAT shares, capacity and effort index. The effort index is calculated by dividing actual VAT by the predicted VAT share. A tax effort of above 1 (high tax effort) implies that the tax base was well utilized to increase revenues. It also suggests that the country collected VAT revenues beyond the capacity of its base. A tax effort below 1 (low tax effort), on the other hand, implies a failure to harness the available potential of VAT revenues. Finally, a tax effort equal to 1 implies that the country was able to raise the maximum possible VAT revenue given the economic characteristics of the economy. For the sake of brevity, we concentrate on the annual values of the disaggregated components of VAT (see Table A6 in the appendix for quarterly estimations).

Table 2: Actual VAT Share, VAT Capacity and Efforts Ratios

	Domestic VAT			**Import VAT**		
(I) Year	(II) Actual (% Base)	(III) Capacity (% Base)	(IV) Effort Ratio (II/III)	(V) Actual (% Base)	(VI) Capacity (% Base)	(VII) Effort Ratio (V/VI)
2000	0.42	0.61	0.71	3.29	4.88	0.76
2001	0.58	0.52	1.14	5.15	4.78	1.08
2002	0.72	0.64	1.11	5.43	4.94	1.1
2003	0.98	1.27	0.77	6.49	5.95	1.09
2004	1.3	1.32	0.98	6.05	6.25	0.97
2005	1.53	1.37	1.11	5.88	6.3	0.93
2006	1.61	1.58	1.02	5.69	6.39	0.9
2007	1.9	1.64	1.16	6.34	6.86	0.92
2008	1.74	1.84	0.95	7.11	6.98	1.02
2009	1.87	1.92	0.97	8.18	7.06	1.16
2010	2.08	2.09	0.99	7.91	7.31	1.08
2011	2.13	2.19	0.97	7.67	8.03	0.96
2012	2.37	2.3	1.03	6.97	8.22	0.85
2013	2.19	2.5	0.88	8.29	8.15	1.02
2014	2.86	2.52	1.14	9.22	8.31	1.11
R2 (Act & ER)			0.3			0.57
2000-2014 (Average)	1.62	1.62	1.00	6.64	6.69	0.99

Source: Computed by author, based on regression results

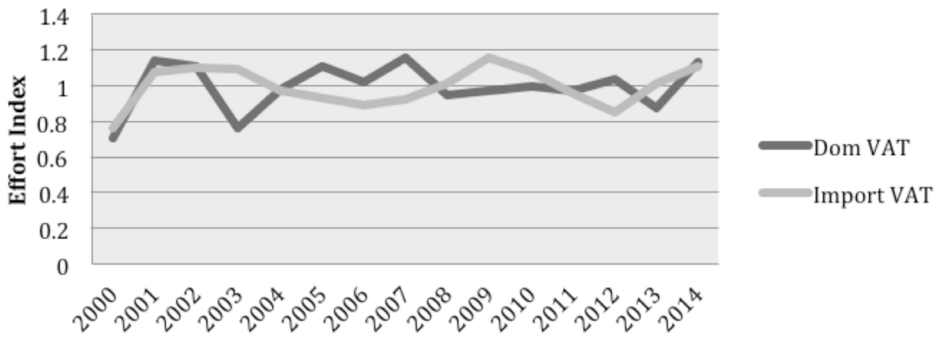
The average taxable capacity, effort index and actual shares are given in the last row while the correlation coefficients between actual VAT share and effort index are presented on the last but one row. The average taxable capacity for domestic VAT is 1.62 percent of the tax base and actual share is 1.62 percent of the base, thus giving an effort index of 1. Actual import VAT share, on the other hand, is 6.64 percent of tax base and the estimated potential is 6.69 percent of tax base. Columns II, III, V and VI show that VAT taxable capacity and actual collection have improved over the years for both domestic VAT and import VAT and hence for total VAT. We classified a year as a low collection year if its actual share is less than the average share effort. We find that from the year 2000 to 2006, domestic VAT regime is characterised by low collection and low capacity. However, from 2008-2014, the regime records higher than average actual collection and capacity. Similarly, import VAT records low actual share and capacity from the year 2000 to 2007, but higher share and potential from 2008-2014.

The observed positive trend may reflect the spillover effects from both the gradual improvement in tax administration and national growth. Notable among the administrative improvements is the harmonization of all the three revenue agencies in 2010 under one authority, the Ghana Revenue Authority (GRA). Moreover, In 2003, the GRA decided to install automation procedure of import clearance at Ghana's major ports and harbours. The automation systems consist of the Ghana Community Network (GCNet) and the Ghana Customs Management Systems (GCMS). These platforms not only provide a fully integrated computerized system for the management of Customs declarations and related activities but also enable the sharing of data with all the parties involved in the processing of trade document and Customs clearances. Vasudevan (2007) posits that automating tax administration has the benefits of reducing the compliance and administration cost and therefore, increases effectiveness in revenue collection. This is especially the situation observed about import VAT in Ghana.

The results further show that Ghana's VAT is characterised by periods of both underexploited and overexploited revenue potentials. Under exploitation occurs when actual VAT share falls below potential VAT (i.e. effort index of less than unity) while overexploitation occurs when actual share exceeds potential share giving an effort index of greater than unity. Figure 2 shows the trends in the effort indices for both domestic VAT and import VAT. Irregular trends

are observed in effort indices of both components of VAT. This suggests that the country is unable to sustain the periods of high efforts as such periods are usually followed by low effort periods. For instance, domestic VAT effort index increases from 0.71 in 2000 to 1.14 in 2001. This high effort index, however, could not be sustained as it declines rapidly and drastically to 0.77 in 2003.

Figure 2: Trends in VAT Effort Index



Source: Constructed by author based on estimated regression values

Moreover, after recovering and peaking at 1.16 in 2007, it again declines to 0.88 in 2013. This fall is driven strongly by a decline in the actual collection from 2.37 percent of household consumption in 2012 to 2.19 percent in 2013. A similar trend is observed for Import VAT. Effort index increases from 0.76 in 2000 to 1.1 in 2002. However, it could not be sustained as it declines thereafter till reaching 0.92 in 2007. Finally, having attained a peak of 1.16 in 2009, it then declines to 0.85 in 2012. The observed unstable trends in the effort indices of both components are driven mostly by the instability and consistent declines in the growth of actual VAT collection. This leaves much to be desired. This situation does not only undermine sound revenue planning and forecasting but also makes it extremely difficult to achieve a sustainable national policy balance.

However, interestingly, it is found that about fifty percent of the period of the VAT operation in Ghana is characterised by low effort (efforts index is less than 1)(see Table 3).

Table 3: Classification of Low and High VAT Effort Years

Domestic VAT		**Import VAT**	
Low Effort Years	High Effort Years	Low Effort Years	High Effort Years
2000	2001	2000	2001
2003	2002	2004	2002
2004	2005	2005	2003
2008	2006	2006	2008
2009	2007	2007	2009
2010	2012	2011	2010
2011	2014	2012	2013
2013			2014

Specifically, low domestic VAT effort index is recorded in 8 of the 15 years (i.e. 53 percent). Similarly, for import VAT, low effort index is recorded in 28 out of the 60 quarters. This suggests that in almost half of the operational period of the VAT, actual VAT revenues collected are lower than the available capacity offered by the tax base. However, it should be emphasised that these gaps are very small. As can be observed in Table 1, over the 15-year period, the average actual domestic VAT share equals its capacity (1.62) thus yielding an effort of 1 while that of import VAT is 0.99. This suggests that from a bird's eye view, there is little scope for further VAT revenue exploitation. Intuitively, with a fixed tax base, there is a limit to the extent to which additional tax revenue can be generated. This finding does not seem to be in line with the low tax effort discovered by aggregate tax efforts studies such as Ndiaye & Korsu (2014), Fenochietto & Pessino (2013). However, it is imperative to indicate that, those studies considered aggregate tax revenue, comprising revenues from all the various tax categories. In such a situation, it is possible for the cumulative effect of low taxable efforts in all the other tax components to overwhelm the high effort of VAT.

Furthermore, the study finds that low and high effort years vary across domestic and import VAT, albeit there exists overlapping years. The years 2003, 2008, 2009, 2010 and 2013 are low effort years for Domestic VAT but high effort years for import VAT. A critical examination of those years reveals some common characteristics: high inflation, agriculture driven growth, slow growth in manufacturing and services, severe energy crises and volatile foreign exchange rate. For instance, headline inflation ranged from 29.4 percent to 23.6 in 2003 and was about 18.4 percent in 2008. However, it increased from 8.8

per cent in December 2012 to 13.5 per cent in December 2013 (Bank of Ghana, 2003; 2008; 2009; 2010; 2013). These may have weakened the pace of domestic economic activities (thus, perhaps giving way for high import volumes) and consumer sentiments. Consequently, this may have provided an incentive for domestic VAT avoidance and evasion. Furthermore, as explained earlier, in the context of revenue collection lags, the real value of tax revenue falls with an increase in inflation. The combination of these factors may have contributed to the reduction in actual domestic VAT shares and thus the lower effort ratios.

The years 2005, 2006, 2007 and 2012, are high effort years for domestic VAT but are low effort years for import VAT. Three key features of these years are sustained economic growth, low inflation rate, and industry and services sectors driven economy. These developments may have favoured VAT payments and collections (Bank of Ghana, 2005; 2006; 2007; 2012). Furthermore, the years 2000, 2004 and 2011 are low effort years for both domestic and import VAT. The economy of Ghana suffered its worst growth performance in 2000. Real GDP growth slumped to 3.7 percent, the lowest in about a decade. In addition, the rate of inflation increased drastically, the cost of borrowing skyrocketed while the local cedi depreciated greatly. These undesirable macroeconomic factors led to substantial reductions in production and consumption (OECD/AfDB, 2002) and may have negatively affected people's willingness and ability to pay VAT. In 2004 and 2011, the economy posted impressive growth performances: 5.8 percent in 2004 and 14.4 (7.7 percent non-oil) in 2011. However, in 2004, the growth was driven largely by agriculture sector (OECD/AfDB, 2004)(Bank of Ghana, 2010). In view of the twin-problem of this sector- generous tax exemption and zero rating, and large shadow economy - it is not surprising to find that the growth did not reflect in high VAT collection index revenue.

The years 2001, 2002 and 2014 are high effort years for both domestic and import VAT. These years coincide with enhanced tax administration. In 2001, the then VAT Service embarked on massive public education to conscientise the public to insist on their VAT invoices. Also, businesses that should have registered for VAT by law but had failed to do so were covered. Finally, VAT registered firms, especially in the hotel and restaurant industry and the retail sector, which had been selective in charging the tax, in contravention of the VAT Act were dealt with (Ministry of Finance, 2003). These measures, no doubt, led to the improved collection for both domestic and import VAT.

Finally, a positive but weak correlation is observed between VAT efforts and VAT actual collections. The estimated correlation coefficients are 0.30 and 0.57

for domestic VAT and import VAT respectively. In line with the findings of Stotsky & WoldeMariam(1997) and Chelliah, Baas, & Kelly (1975), the positive correlation suggests that higher collection tends to be positively associated with higher tax effort. However, the association is considered to be very weak. This may reflect the negative impact of the shadow economy. In the presence of large shadow economy, higher tax efforts may but yield just little gains.

6. Conclusion and recommendation

This paper set out to estimate and examine the trends in taxable capacity and collection efforts of Ghana's VAT. The empirical findings reveal evidence of irregular trends in Ghana's VAT effort. Thus, VAT collection effort indices exhibit unpredictable trends over the years indicating that there are periods of underexploited and overexploited VAT taxable capacities. However, the study discovers that almost 50 percent of the operation of VAT is characterised by low efforts (actual VAT share falls below the potential share). This is more prevalent for domestic VAT than import VAT as domestic VAT records more low effort years relative to import VAT. This suggests that the taxable capacity of the latter is more utilized than that of the former, probably due to high efficiency in its administration following the installation of the port clearing automation system. The study further finds a weak positive relationship between VAT revenue collection effort and actual VAT share. This is believed to be a reflection of the undermining effect of shadow economy on VAT revenue performance. On a whole, the results show that on the average Ghana's VAT appears to have little scope for further revenue expansion. Consequently, any attempt to further generate revenue through, for example, increase in VAT rate may have negative ramifications for VAT revenues.

The measures taken by Ghana's fiscal Authorities, especially GRA to reduce VAT evasion and fraud are highly commendable. Key among these efforts are the automation process, the registration of firms, and the revision of threshold, especially to rope in firms in the informal sector. Obviously, these have the potential of improving revenues mobilisation, especially for domestic VAT which records relatively more low effort years.

In view of the observed limited scope for VAT revenue expansion, the study argues that the recent over concentration on VAT as the panacea for the country's revenue challenges may endanger the country's quest for fiscal adequacy. As observed from the empirical literature, Ghana's aggregate tax effort is generally low, implying that the taxable capacity of some of the tax components (other

than VAT) are not fully exploited. It is, therefore, recommended that equal attention should be paid to the development of all the other tax components especially such as property taxes and gift taxes that possess great potentials for domestic revenue mobilisation. Relying on a number of tax handles provides an opportunity to spread the risk as other tax may offset the negative effects of others. An appropriate tax mix is therefore critical for tax revenue improvement, stability and adequacy.

Biographical Notes

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Acknowledgements

I am grateful to the three anonymous referees for the excellent comments and suggestions. I am also highly indebted to the African Economic Research Consortium (AERC) for providing funding for my PhD programme. This paper is a chapter in my PhD dissertation. I am grateful to my supervisors Prof. N. Osoro and Dr. E. Luvanda. I also acknowledge the useful comments from my PhD advanced seminar discussant, Dr. J.K. Mduma.

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Appendix

TABLE A1: QUARTERLY SIZE OF SHADOW ECONOMY (2000-2014)

YRS/QTR	Shadow Econ Size	Yrs/Qtrs	Shadow Econ Size	Quarters	Shadow Econ Size
2000 1	32.22	2005 1	37.66	2010 1	41.96
2000 2	31.65	2005 2	37.94	2010 2	41.45
2000 3	31.97	2005 3	37.97	2010 3	42.70
2000 4	31.35	2005 4	38.46	2010 4	43.62
2001 1	31.46	2006 1	36.94	2011 1	46.39
2001 2	31.29	2006 2	37.16	2011 2	46.68
2001 3	31.82	2006 3	37.97	2011 3	47.25
2001 4	32.72	2006 4	38.60	2011 4	47.93
2002 1	32.99	2007 1	38.19	2012 1	48.11
2002 2	33.20	2007 2	38.62	2012 2	49.22
2002 3	33.59	2007 3	39.49	2012 3	50.01
2002 4	33.78	2007 4	40.56	2012 4	51.13
2003 1	34.20	2008 1	39.68	2013 1	48.94
2003 2	33.92	2008 2	39.36	2013 2	49.53
2003 3	34.27	2008 3	40.80	2013 3	49.63
2003 4	34.59	2008 4	41.23	2013 4	50.57
2004 1	35.43	2009 1	40.88	2014 1	50.19
2004 2	35.68	2009 2	41.24	2014 2	50.58
2004 3	35.96	2009 3	41.84	2014 3	51.20
2004 4	36.52	2009 4	42.25	2014 4	51.73
Average (2000-2014)	40.24				

Source: Computed by Author, based on Model 4

Table A2: ADF Unit Root Test

Variable	In levels	1diff
Total VAT share	-4.45***	
Dom VAT share	-5.794***	
Import VAT share	-4.729 ***	
Total consumption	-3.737**	
Shadow Economy	-3.692**	
VAT rate	-4.45***	
Real GDP	-3.246	-9.101***
Agric-GDP ratio	-7.752***	
CIC	-4.881***	
Real HH Cons	-3.538**	
Imports	-4.582***	

Notes: Critical Values: 1% (-4.13) , 5%(-3.491
All tests included trend

Table A3: Correlation Matrix for Models

	Tot cons	VATrat	ShadEco	Infl.	HH cons	Imports
Tot cons	1.000					
VAT rate	0.125	1.000				
Shad Eco	0.64	0.106	1.000			
Infl	-0.185	-0.514	-0.149	1.000		
HH cons	0.21	0.542	0.128	-0.610	1.000	
Imports	0.153	0.662	0.096	-0.675	0.972	1.000

Table A4: ADF Tests Results for Regression Residuals

	(1) Tot. VAT	(2) Dom. VAT	(3) Import VAT
Test statistics	-5.241***	-6.576***	-4.624***
Critical Value (1%)	-3.569	-3.569	-3.569
Critical Value (5%)	-2.924	-2.924	-2.924
Mackinnon approx. p-value	0.0000	0.0000	0.0001

*** p<0.01, ** p<0.05, * p<0.1

Table A5: Linktest Results

	(1) Tot. VAT	(2) Dom. VAT	(3) Import VAT
hat	1.11867***	1.0441***	1.0794
	(0.2357)	(0.235)	(1.1238)
hat Square	-1.6774	-1. 4472	-0.6017
	(3.2794)	(8.5154)	(8. 6075)
Constant	-0.00185	-0.00027	-0.00253
	(0.00403)	(0.00132)	(0.03602)
Observations	59	59	59

Table A6: Quarterly VAT Share, Potential and Effort Ratio from 2000-2014

Domestic VAT				Import VAT I			Domestic VAT				Import VAT		
QTR/ Year	Act	Pot.	Eff	Act	Pot.	Eff	QTR/ YR	Act	Pot	Effort	Actual	Pot	Effort
2000 2	0.34	0.69	0.49	2.99	4.76	0.63	2008 1	1.68	1.90	0.88	6.25	6.76	0.92
2000 3	0.44	0.53	0.83	4.68	5.01	0.93	2008 2	2.09	1.76	1.19	6.45	6.79	0.95
2000 4	0.49	0.61	0.80	3.55	4.88	0.73	2008 3	1.55	1.78	0.87	7.51	7.15	1.05
2001 1	0.59	0.51	1.17	4.74	4.68	1.01	2008 4	1.64	1.92	0.86	8.25	7.20	1.15
2001 2	0.55	0.58	0.96	5.04	4.49	1.12	2009 1	1.85	1.89	0.98	8.10	6.96	1.16
2001 3	0.57	0.50	1.14	5.34	4.88	1.09	2009 2	1.75	1.85	0.94	7.93	7.03	1.13
2001 4	0.62	0.48	1.29	5.50	5.08	1.08	2009 3	1.71	1.96	0.87	7.79	7.12	1.09
2002 1	0.65	0.63	1.03	5.42	4.78	1.14	2009 4	2.17	1.97	1.10	8.89	7.12	1.25
2002 2	0.73	0.66	1.11	5.55	4.82	1.15	2010 1	1.80	2.14	0.84	7.15	7.00	1.02
2002 3	0.70	0.64	1.10	5.21	5.13	1.02	2010 2	2.55	2.05	1.24	7.03	7.12	0.99
2002 4	0.78	0.65	1.20	5.55	5.04	1.10	2010 3	1.95	2.05	0.95	8.25	7.45	1.11
2003 1	0.94	1.27	0.74	5.88	6.25	0.94	2010 4	2.00	2.13	0.94	9.19	7.66	1.20
2003 2	0.92	1.33	0.70	6.08	5.76	1.05	2011 1	2.05	1.96	1.04	7.60	8.62	0.88
2003 3	1.04	1.25	0.83	7.34	5.83	1.26	2011 2	2.45	2.22	1.10	7.17	7.70	0.93
2003 4	1.00	1.25	0.80	6.67	5.95	1.12	2000 3	2.07	2.27	0.91	7.49	7.86	0.95
2004 1	1.22	1.25	0.98	6.30	6.23	1.01	2011 4	1.94	2.32	0.84	8.42	7.94	1.06
2004 2	1.29	1.35	0.95	5.71	6.21	0.92	2012 1	2.78	2.26	1.23	7.37	7.99	0.92
2004 3	1.38	1.36	1.02	6.71	6.18	1.09	2012 2	2.43	2.21	1.10	7.06	8.20	0.86
2004 4	1.32	1.33	0.99	5.49	6.37	0.86	2001 3	2.14	2.33	0.92	6.65	8.26	0.80
2005 1	1.29	1.28	1.01	6.08	6.65	0.92	2012 4	2.13	2.40	0.89	6.80	8.43	0.81
2005 2	1.45	1.40	1.03	5.89	6.17	0.96	2013 1	2.38	2.59	0.92	7.64	7.56	1.01
2005 3	1.57	1.44	1.09	5.68	6.15	0.92	2013 2	2.29	2.43	0.94	7.37	8.23	0.90
2005 4	1.80	1.37	1.31	5.85	6.23	0.94	2013 3	2.06	2.50	0.82	8.75	8.29	1.06
2006 1	1.76	1.68	1.05	5.55	5.50	1.01	2013 4	2.02	2.48	0.82	9.41	8.52	1.10
2006 2	1.82	1.49	1.22	5.25	6.47	0.81	2014 1	2.77	2.51	1.10	9.26	8.16	1.13
2006 3	1.34	1.55	0.86	5.64	6.71	0.84	2014 2	2.98	2.49	1.20	8.80	8.26	1.07
2006 4	1.54	1.59	0.97	6.34	6.87	0.92	2014 3	2.94	2.50	1.17	9.76	8.37	1.17
2007 1	1.97	1.62	1.22	5.82	6.63	0.88	2014 4	2.78	2.58	1.07	9.06	8.45	1.07
2007 2	1.99	1.55	1.29	6.02	6.70	0.90							
2007 3	1.53	1.68	0.91	6.27	6.97	0.90							
2007 4	2.11	1.73	1.22	7.23	7.14	1.01							

Source: Computed by author
Notes: Act = actual VAT revenue Pot = potential VAT revenue Eff = VAT effort