Economics Bulletin

Volume 34, Issue 1

Shadow economy and tax revenue in Africa

Oasis Kodila-Tedika
University of Kinshasa

Mihai Mutascu
LEO (Laboratoire d''Economie d''Orléans) - UMR7322, and West University of Timisoara

Abstract

The paper explores the effects of shadow economy on tax revenues, in the case of several African countries, based on a panel-model approach. The dataset covers the period 1999-2007. The main results reveal that the change in shadow economy has a significant and negative impact on change in tax revenues. In other word, when the shadow economy tends to extend, the level of tax revenues decreases. These outputs show that the African governments, in order to maximise the collected tax revenues, should better "control" the shadow economy phenomenon.

The authors would like to thank the anonymous referees for their valuable comments and suggestions on this paper. The authors are fully responsible for any remaining shortcomings.
Citation: Oasis Kodila-Tedika and Mihai Mutascu, (2014) "Shadow economy and tax revenue in Africa", *Economics Bulletin*, Vol. 34 No. 1 pp. 469-479.
Contact: Oasis Kodila-Tedika - oasiskodila@yahoo.fr, Mihai Mutascu - mihai.mutascu@gmail.com.
Submitted: November 18, 2013. **Published:** March 06, 2014.

1. Introduction

The preference of firms and individuals to have a shadow economy has become a complex and destructive economic phenomenon. This phenomenon has intensively monopolised the attention of economists in the recent decade. Many studies investigate shadow economy; some of them focus on determinants of shadow economy, while others investigate its consequences for the economic and social environment.

Schneider (2005a) points out two main areas of study on the determinants of shadow economy. The first area considers tax and social security burdens as key factors of shadow economy (e.g., Schneider, 2000; Johnson et al., 1998; Kirchgässner, 1984; Klovland, 1984; Friedman et al., 1999), while the second area explores regulations - the number and quality of laws - as the major explanatory determinants for a shadow economy (e.g., Johnson et al., 1998; Friedman et al., 1999; Levin and Satarov, 2000; Bird et al., 2006; Dreher and Schneider, 2010).

The second direction of research flips the coin and looks at shadow economy as the determinant of the economic and social environment. Any extension of a shadow economy leads to a decrease of official tax base and tax inputs, reducing the quality and quantity of public goods and services. For the long term, governments need supplementary tax resources and must raise the level of tax rates for firms and individuals in the official sector. The literature reveals consistent contributions on this topic, with different results (e.g., Schneider, 2005a; Nicolini, 1998; Kaufmann and Kaliberda, 1996; De Cavalcanti and Villamil, 2003; Koreschkova, 2006; Mazhar and Méon, 2012; Davoodi and Gregorian, 2007; Haque, 2012).

The aim of this paper, using a panel-model approach, is to analyze the effects of shadow economy on tax revenues. The dataset includes several African countries and covers the period 1999-2007. We choose this region because it includes developing countries, which are confronted with a severe shadow economy phenomenon and a low level of tax inputs. For example, in the year 2005, Sub-Saharan Africa had the highest mean level of a shadow economy (Table 1, in the Appendix). In these countries, according to Singh et al. (2012), the shadow economy and the weak institutions generate many problems for policymaking. The shadow economy is estimated by Schneider et al. (2010, 2012) and measures, based on "dynamic multiple - indicators multiple - causes" (DYMIMIC) approach, the size and development of shadow economy as percentage of GDP. DYMIMIC method is relied on the statistical theory of unobserved variables, which follows multiple causes and indicators of the measured phenomenon. The main used indicators are tax burden of direct and indirect taxation, tax burden of regulation and tax morality. The intensity of shadow economy is higher, as the percentage of GDP is higher.

Even if the topic of taxation is prolific for the African area (e.g. Tanzi, 1981; Leuthold, 1991; Stotsky and WoldeMariam, 1997; Ghura, 1998), no work thus far has investigated the shadow economy and its implications on tax revenues. Moreover, most research has been focused on Sub-Saharan African countries. The present paper better illustrates several contributions for the literature in the field of the shadow economy-tax revenue nexus in African countries, including also the Sub-Saharan area. Furthermore, while the classical literature explores the influence of tax revenues on shadow economy, we investigate the reverse relationship direction, the influence of shadow economy on tax revenues. In addition, this paper extends the literature on taxation in African countries other than those already extensively studied. Finally, this paper finds new evidence regarding the connection between shadow economy and tax ratio.

The rest of the paper is structured as follows: Section 2 illustrates the methodology. Section 3 describes the data and Section 4 illustrates the main results. Section 5 concludes.

2. Methodology

The main hypothesis of this investigation claims that a shadow economy has significant and positive impact on the tax revenue ratio. In order to analyse this relationship, we use an econometric tool and two datasets for the period 1999-2007: one which covers the whole world, and another which includes African countries only.[1] The first sample allows us only to understand the importance of the connection between the two considered variables, while the second one represents the support for our African analysis.
As first step, using the first sample, we estimate the following basic empirical model:

$$\tau_i = \beta_0 + \beta_1 \psi_i + \delta Z_i + \varepsilon_i, \quad (1)$$

where τ is the tax ratio (the tax revenues as percentage of GDP), ψ denotes the shadow economy (the level of shadow economy as percentage of GDP), i=1,2... captures the country index, $Z = (z_1,\ldots z_k)$ is the vector of control variables, and ε_i represents the error term that is assumed to be normally and independently distributed. β_0 is the intercept, β_1 captures the effect of a shadow economy and $\delta=(\delta_1, \delta_2,.. \delta_n)$ is the parameter vector for n control variables. The model is estimated by using the ordinary least squares (OLS) and robust standard errors.
Using the same first sample, the second set of estimations reveals a transversal model approach, which is captured by the interaction between the variable of interest and the continental dummies (1 if the country is in Africa, Americas, Asia, Europe or Oceania, and 0 if not), in order to demonstrate that the shadow economy can vary by continent.
The further empirical analysis step used the second sample, which includes only African countries, and is oriented to the specific effects of each nation through panel-model investigation, with this form:

$$\tau_{i,t} = \beta_0 + \beta_1 \psi_{i,t} + \delta Z_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where t=1,2,…T indicates the year.
The homogeneity issue of panels is also verified. On the other hand, we rewrite the equation introducing lagged of dependent variables. This leads to:

$$\tau_{i,t} = \theta \tau_{i,t-1} + \beta_1 \psi_{i,t} + \delta Z_{i,t} + \nu_t + \mu_i + \varepsilon_{i,t}, \quad (3)$$

where θ is the lagged-variable parameter, ε is the error term, υ represents the time specific effect, and μ illustrates the countries fixed-effect component.
In order to deal with a potential endogeneity, especially arising from the reverse causality of the pair "tax ratio - shadow economy", an IV model (Instrumental Variables regression, also known as Two-Stage Least-Squares estimator) is performed. Unfortunately, in this case, the issue of disturbance heteroskedasticity requires further investigation. According to Baum et al. (2003), "if heteroskedasticity is present, the GMM estimator is more efficient than the simple IV estimator, whereas if heteroskedasticity is not present, the GMM estimator is no worse asymptotically than the IV estimator" (p. 11). In the case of the IV model, the heteroskedasticity can be evidenced by following the Pagan-Hall general test for heteroskedasticity. Further, two types of generalized method of moments (GMM) models are performed for fixing the heteroskedasticity issue, when one or more regressors are

[1] The full list of countries in this dataset is found in Section 3.

endogenous, and controlling the bias is generated by use of the lagged dependent variable. Roodman (2009) highlights several advantages of GMM estimators, such as: "1) "small *T*, large *N*" panels, meaning few time periods and many individuals; 2) a linear functional relationship; 3) one left-hand-side variable that is dynamic, depending on its own past realizations; 4) independent variables that are not strictly exogenous, meaning they are correlated with past and possibly current realizations of the error; 5) fixed individual effects; and 6) heteroskedasticity and autocorrelation within individuals but not across them" (p. 86). The first popular GMM approach belongs to Arellano and Bond (1991) and is as a follows:

$$\Delta\tau_{i,t} = \theta\Delta\tau_{i,t-1} + \beta_1\Delta\psi_{i,t} + \delta\Delta Z_{i,t} + \Delta\nu_t + \Delta\varepsilon_{i,t}. \quad (4)$$

The dynamic GMM estimator cannot reach the best estimations, as the lagged levels of the regressors are poor instruments for the first-differenced regressors. As a consequence, Blundell and Bond (1998) developed an augmented GMM new version, named GMM-system. This kind of technique follows the levels of variables, as in equation (3), in order to explore two equations: one differenced and one in levels. The Sargan test is employed to check the validity of the considered instruments. AR(1) and AR(2) processes in the first differences tests are performed to detect the presence of autocorrelations.

3. Data

Two datasets are used to analyse and cover the period 1999-2007: one which includes all world countries, and another one which groups several African countries (i.e., Algeria, Benin, Botswana, Burkina Faso, Cape Verde, Congo Dem. Rep., Congo, Rep., Egypt, Arab Rep., Ethiopia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Mali, Morocco, Namibia, Niger, Nigeria, Sierra Leone, Togo, Tunisia, Uganda, and Zambia). The descriptive statistics of the sample are presented in Table 2, in the Appendix. The tax ratio is the dependent variable and represents the volume of tax revenues as a percentage of GDP, and was obtained from the World Bank. The shadow economy is the independent interest variable, and is estimated by following the DYMIMIC approach. It measures the level of shadow economy as a percentage of GDP. The sources of data are the studies of Schneider et al. (2010), with its theoretical base in Schneider (2005a, 2005b). For the first estimations, with the world sample, we also consider the geographical location. In this case, the dummy variables are used for continents instead of the regional classification of countries (value 1 for considered continent, and 0 for the rest).

In order to isolate the effect of the interest variable, we include several structural and institutional quality control determinants.

The first group of control factors includes variables, such as: per capita GDP (log), share of agriculture in GDP, and share of imports in GDP, according to Gupta (2007). These data come from the World Bank. GDP per capita is a traditional indicator of economic development and it is expected to have a positive significant impact on tax performance. The sectorial composition is also an important element of taxation. In Africa, for example, the agricultural sector consists of agriculture substance, but the mining sector may be useful to generate significant tax revenues to the economy if these areas attract large companies. Chelliah (1971) identifies as explanatory variables for the tax share: the mining share, the non-mineral export ratio and the agriculture share. If the mining share has a positive impact on tax revenues, the agricultural share has a negative one. At the same time, many studies emphasize the role of openness on the income tax. Tanzi (1992) states that half of the variation in the tax ratio is explained by per capita income, import share, agriculture share and foreign debt share. The import share is positively correlated with the tax ratio.

The second group of control determinants is related to institutional quality environment. The measures of institutional quality come from the dataset compiled by the World Bank. This sample aggregates indicators of six broad dimensions of governance: Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. These six aggregate indicators are based on 30 underlying data sources reporting the perceptions of governance of a large number of survey respondents and expert assessments worldwide. We use the average of these measures of institutional quality. Besley and Persson (2013) put into evidence the positive role of institutional quality in tax revenues collection.
Finally, we note that only the variables that are used most often in the literature are used for our estimates.

4. Econometric findings

Figure 1, in the Appendix, presents the scatter plot between tax revenues as percentage of GDP (y-axis), and shadow economy (x-axis) for the countries included in our first sample. The output clearly suggests the evidence of a negative relationship between these two variables, with a correlation coefficient of 0.27, and is strongly statistically significant (at 1%). In Figure 1, the tax revenues are plotted against the shadow economy. It follows that countries with a higher shadow economy enjoy weak mobilization of tax revenues. The solid line represents the simple regression model. The estimated coefficient for β is negative (-.145) and is strongly significant (p-value = 0.000), indicating that high shadow economy reduces tax revenue.
It is worthwhile to test the correlation's solidity with an empirical assessment, as can be seen in Table 3, in the Appendix. The table shows the basic estimates of this work. In the first column, the results of the simple regression between the dependent variable and the independent variable reinforce the output of Figure 1. In the second column, we control for other variables to minimize the bias of omission. We realize that the variable of interest is no longer significant, and indeed, none of the variables appears significant in this regression. In the next specifications, we consider different continents, assuming that the relationships we find in the model can be located in one or more continents.
In this case, in the third column, the dummy for Africa, has a significant and positive coefficient. The crossing of the dummy to the variable of interest is also significant with a negative sign. This means that in Africa, the larger the shadow economy, the more detrimental it is to taxes. The differences in findings between Africa, Asia and Oceania, require further consideration.
Indeed, in Table 4, in the Appendix, using the African sample, we consider both the problem of fixed effects for each country in its respective continent, and also the issue of endogeneity between the shadow economy and tax revenues. Many studies have established that taxation has important implication in the size of a shadow economy (e.g., Schneider, 2000; Johnson et al., 1998). As a first step, we estimate the effect of the shadow economy in a naive panel regression with fixed effect and random effect (models 1 and 3). We note that the obtained results confirm the one previously obtained for Africa: the shadow economy negatively affects the resulting revenues of taxes. We find that in the case of the random-effects model, the magnitude of the coefficient is almost double compared with the fixed effect.
Further, in models 2 and 4, we introduce the control variables. All coefficients behave similarly regardless of the model chosen, but in the case of the fixed-effects model 2, only the import share is significant, while the interest determinant is not conclusive. However, in the random-effects model, these two variables are statistically different from zero. The agriculture share also becomes significant, with a negative sign in respect to the tax revenues.

All these results have a problem in interpretation due to reverse causality of the majority of our variables. Model 5 fixes this aspect by using a TSLS approach, but is inconsistent due to the evidence of heteroskedasticity, as Pagan-Hall general test statistic reveals. We deal with this new issue by performing the GMM-dynamic and GMM-system estimations (models 6 and 7). The instruments are the lagged values of endogenous regressors. Both GMM estimators reveal that the interest variable is significant and negatively correlated with the tax revenues share. More precisely, the increase in the size of the shadow economy reduces tax revenues in African countries. However, the Sargan-Hansen tests associated with our estimates validate the instruments of the model, at the limit, in the case of the GMM-dynamic. Moreover, we note that there is no second-order autocorrelation for either model. As noted, the GMM-system estimator is better than the first-difference estimator because it gives biased results in small samples in the presence of weak instruments. Even so, for our case, according to Roodman (2009), the GMM-dynamic model 6 is more appropriate than the GMM-system model 7, as the number of instruments (18) of this model is less than the cross-sections (22). Unfortunately, in the case of model 7, the number of instruments (46) exceeds the number of cross-sections (24).

Considering the GMM-dynamic model 6 for our analysis, the main findings show that the change in interest independent variable is significant and has a negative sign. The same results reveal the variation of import share and GDP per capita. If the first case confirms the main results in the literature, the second one has a contrary sign. This can be the result of the extension of the tax base (i.e., the GDP per capita is the main tax base for tax revenues), without any legal tax ratio modification. The rest of the determinants are not conclusive. The main results of our investigation show that, in the case of the considered African countries, for the period 1999-2007, the change in shadow economy has a significant and negative impact on the change in tax revenue ratio. Our results confirm the results of Kaufmann and Kaliberda (1996), Schneider (2005a), Koreschkova (2006), Davoodi and Gregorian (2007), Mazhar and Méon (2012), and Haque (2012), reinforcing the evidence for a negative connection between shadow economy and tax rate.

5. Conclusions

Shadow economy represents a complex and destructive phenomenon for the whole world, especially for developing countries. Investigating several economies from Sub-Saharan Africa by using a panel-model approach, for the period 1999-2007, we find that change in shadow economy has a significant influence on the change in tax revenues, the variation of variables being negatively correlated. More precisely, any extension of shadow economy determines a decrease of tax revenue ratio. In this case, the diminution of tax inputs is the result of the compression of the tax base and has two main explanations. The first explanation reveals that the tax base decreases as the effect of tax evasion increases (i.e., the taxpayers are officially registered but do not declare the tax base), while the second explanation argues that the reduction of the tax base has origins in the extension of unofficial economy (i.e., the taxpayers do not exist officially, with individuals and companies "operating" directly in the "black" economic area).

The policy implications of these results show that African governments, in order to maximise the collected tax revenues, should better "control" the shadow economy phenomenon. This means that the primary governmental objective should be the reduction of shadow economy through two channels. The first channel would be an improvement of the laws regarding the prevention and punishment of tax evasion, in parallel with a severe tax controls. The second channel assumes corrective tax measures in order to stimulate the individuals and companies to pass from "black economy" to the official zone.

These policies will increase the tax base "visibility", extending the tax base, with positive impacts on tax revenues.

References

Arellano, M. and S. Bond (1991) "Some tests of specifcation for panel data: Monte Carlo evidence and an application to employment equations," *Review of Economic Studies* **58**, 277-297.

Baum, C., M. Schaffer and S. Stillman (2003) "Instrumental variables and GMM: Estimation and testing," *The Stata Journal* **3**, 1-31.

Besley, T.J. and T. Persson (2013) "Taxation and Development," CEPR Discussion Papers 9307, C.E.P.R. Discussion Papers.

Bird, R., J. Martinez-Vazquez and B. Torgler (2006) "Societal institutions and tax effort in developing countries," in J. Alm, J. Martinez-Vazquez, & M. Rider (Eds.) *The challenges of tax reform in the global economy* (pp. 283–338). New York: Springer.

Blundell, R. and S. Bond (1998) "Initial conditions and moment restrictions in dynamic panel data models," *Journal of Econometrics* **87**, 111-143.

Chelliah, R.J. (1971) "Trends in Taxation in Developing Countries," *Staff Papers, International Monetary Fund* **18**, 254–0331.

Davoodi, H. and D.A. Gregorian (2007) "Tax Potential vs. Tax Effort: A Cross- Country Analysis of Armenia's Stubbornly Low Tax Collection," Working Paper No WP/07/106, IMF.

De Cavalcanti, T.V., and A.P. Villamil (2003) "Optimal inflation tax and structural reform," *Macroeconomic Dynamics* **7(3)**, 333-362.

Dreher, A. and F. Schneider (2010) "Corruption and the shadow economy: an empirical Analysis," *Public Choice* **144**, 215–238.

Friedman, E., S. Johnson, D. Kaufmann and P. Zoido-Lobaton (1999) "Dodging the grabbing hand: the determinants of unofficial activity in 69 countries," World Bank Discussion Paper. Washington, DC: The World Bank.

Ghura, D. (1998) "Tax Revenue in Sub-Saharan Africa: Effects of Economic Policies and Corruption," IMF Working Paper 98/135 (Washington: International Monetary Fund).

Gupta, A.S. (2007) "Determinants of Tax Revenue Efforts in Developing Countries," IMF Working Paper 07/184.

Haque, A. (2012) "Determinants of low tax efforts of developing countries," mimeo**.**

Johnson, S., D. Kaufmann and P. Zoido-Lobaton (1998) "Regulatory discretion and the unofficial economy," *The American Economic Review* **88**, 387- 392.

Kaufmann, D. and A. Kaliberda (1996) "Integrating the unofficial economy into the dynamics of post-socialist economies: a framework of analysis and evidence," in B. Kaminski (Ed.), Economic transition in the newly independent states. Armonk, NY: M. E. Sharpe Press.

Kirchgässner, G. (1984) "Verfahrenzur Erfassung des in der Schattenwirtschafterarbeiteten Sozialprodukts," *Allgemeines Statistisches Archiv* **68**, 378-405.

Klovland, J. (1984) "Tax evasion and the demand for currency in Norway and Sweden: is there a hidden relationship?" *Scandinavian Journal of Economics* **86**, 423-439.

Koreshkova, A.T. (2006) "A quantitative analysis of inflation as a tax on the underground economy," *Journal of Monetary Economics* **53(4)**, 773-96.

Leuthold, J.H. (1991) "Tax Shares in Developing Countries: A Panel Study," *Journal of Development Economics* **35**, 173–185.

Levin, M. and G. Satarov (2000) "Corruption and institutions in Russia," *European Journal of Political Economy* **16**, 113–132.

Mazhar, U. and P-G. Méon (2012) "Taxing the unobservable: The impact of the shadow economy on inflation and tax revenue," Working Papers CEB, No 12-023.

Nicolini, J.P. (1998) "Tax Evasion and the Optimal Inflation Tax," *Journal of Development Economics* **55(1)**, 215-232.

Roodman, D. (2009) "How to do xtabond2: An introduction to difference and system GMM in Stata" *The Stata Journal* **9**, 86-136.

Singh, A., A. Jain-Chandra and A. Mohommad (2012) "Out of Shadow," *Finance & Development* June, 42-45.

Schneider, F. (2005a) "Shadow Economies Around the World: What Do We Really Know?" *European Journal of Political Economy* **21**, 598-642.

Schneider, F. (2005b) "Shadow Economies of 145 Countries All Over the World: What Do We Really Know?" CREMA Working Paper 2006-01, Basel, Center for Research in Economics, Management and the Arts.

Schneider, F. (2000) "The increase of the size of the shadow economy of 18 OECD-Countries: some preliminary explanations," Paper presented at the Annual Public Choice Meeting, Charleston, SC.

Schneider, F. (2012) "The Shadow Economy and Work in the Shadow: What Do We (Not) Know?" Discussion Paper, IZA DP No. 6423.

Schneider, F., A. Buehn and C.E. Montenegro (2010) "Shadow economies all over the world: new estimates for 162 countries from 1999 to 2007," Policy Research Working Paper Series 5356, The World Bank.

Stotsky, J.G. and A. WoldeMariam (1997) "Tax Effort in Sub-Saharan Africa," IMF WorkingPaper 97/107 (Washington: International Monetary Fund).

Tanzi, V. (1992) "Structural Factors and Tax Revenue in Developing Countries: A Decade of evidence. In Open Economies: Structural Adjustment and Agriculture," ed. By Ian Goldin and L. Alan Winters, Cambridge University Press, pp. 267-281.

Tanzi, V. (1981) "A Statistical Evaluation of Taxation in Sub-Saharan Africa," *Taxation in Sub-Saharan Africa* (International Monetary Fund, 1981).

Appendix

Table 1. Shadow economy in the world in 2005 (percentage of GDP)

Region	Mean	Median	Min.	Max.	Standard deviation
East Asia and Pacific	17.5	12.7	12.7	50.6	10.6
Europe and Central Asia	36.4	32.6	18.1	65.8	8.4
Latin America and the Caribbean	34.7	33.8	19.3	66.1	7.9
Middle East and North Africa	27.3	32.5	18.3	37.2	7.7
High Income OECD	13.4	11	8.5	28	5.7
Other High Income	20.8	19.4	12.4	33.4	4.9
South Asia	25.1	22.2	22.2	43.9	5.9
Sub-Saharan Africa	37.6	33.2	18.4	61.8	11.7

Source: Schneider et al. (2010) cited by Schneider (2012).

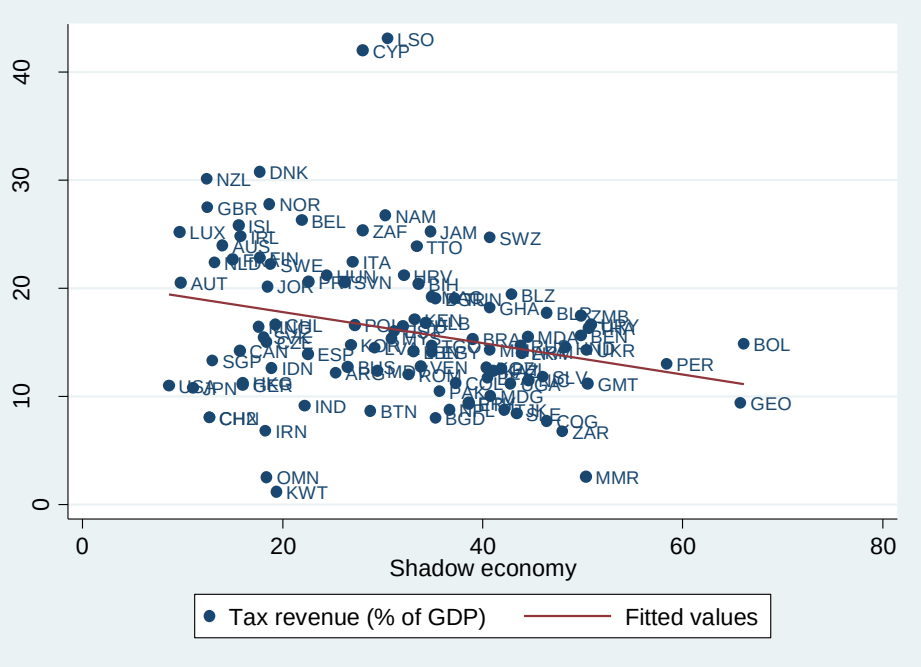

Figure 1. The correlation between tax revenue ratio and shadow economy

Table 2. Summary statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Shadow economy	382	.4025445	.0680624	.219	.59
Log GDP per capita	387	7.337708	.9864477	5.512981	10.268
Import share	378	.4192161	.202291	.1456259	1.427436
Agriculture share	367	.2710156	.1665489	.0181917	.8007458
Governance	387	-.5976752	.5621785	-1.89954	1.249669
Tax revenues	161	.1586098	.0988902	.011668	.6101812

Table 3. Main results of world estimations

Dependent variables: tax revenues as % of GDP.							
	(a)	(b)	(c)	(d)	(e)	(f)	(g)
Shadow economy	-.145*** (.046)	-.080 (.079)	-.023 (.069)	-.091 (.096)	-.269* (.155)	-.042 (.0766)	-.059 (.076)
Log GDP per capita		.860 (2.109)	2.432 (1.477)	.837 (2.197)	-1.109 (2.637)	-.384 (2.411)	.491 (2.136)
Import share		.079 (.057)	.063 (.047)	.073 (.060)	.080** (.040)	.072 (.055)	.088 (.058)
Agriculture share		-.071 (.142)	-.059 (.108)	-.085 (.168)	-.140 (.157)	-.117 (.154)	-.095 (.143)
Governance		-.165 (.946)	-.244 (.930)	-.175 (.961)	.029 (.692)	.092 (.870)	-.514 (.945)
Africa			35.9136** (16.588)				
Americas				-6.564** (3.300)			
Asia					-14.728** (6.760)		
Europe						8.680 (5.392)	
Oceania							65.568*** (14.658)
Shadow * Africa			-.777* (.424)				
Shadow * Americas				.142 (.091)			
Shadow * Asia					.319* (.184)		
Shadow * Europe						-.213 (.143)	
Shadow * Oceania							-4.191*** (1.042)
Constant	20.692*** (1.853)	8.749 (21.301)	-7.586 (15.072)	9.984 (22.153)	34.572 (29.059)	18.558 (23.219)	11.033 (21.392)
R^2	0.0712	0.2245	0.3309	0.2390	0.3661	0.2695	0.2762
Obs	104	69	69	69	69	69	69

Note:
(1) Standard errors in parentheses. *, **, ***: significance levels at 10%, 5% and 1% respectively.
(2) All regressions are estimated using white heteroskedasticity correction.

Table 4. The main estimation results for Africa

Dependent Variable: Tax revenues as % of GDP.

Variable	Fixed Effects	Fixed Effects	Random effects	Random effects	TSLS	Diff.-GMM	System GMM
Model	1	2	3	4	5	6	7
Shadow economy	-.384**	-.049	-.688***	-.351**	-.757***	-3.127**	-.301**
	(0.191)	(.367)	(0.143)	(.169)	(.102)	(1.623)	(.135)
Import share		.116***		.098***	.108***	.024	.0151
		(.029)		(.026)	(.023)	(.041)	(.014)
Agriculture share		-.086		-.149**	-.373**	.140	-.139**
		(.097)		(.083)	(.063)	(.121)	(.066)
Governance		.003		.009	.002	-.001	-.002
		(.016)		(.014)	(.013)	(.019)	(.008)
Log_GDP_per_capita		.013		.008	-.035**	-.358	-.030**
		(.054)		(.019)	(.011)	(.265)	(.0136)
Constant	.313***	.071	.427***	.239	.773***		.392**
	(0.976)	(.524)	(.058)	(.188)	(.015)		(.164)
Tax_rev(-1)						-.012	.841***
						(.231)	(.071)
Obs	158	154	158	154	140	100	124
N	29	28	29	28		22	24
Instruments					3	18	46
Pagan-Hall general test statistic for heteroskedasticity					.793 (P-value = 0.025)		
AR(1) Pr > z						0.829	0.000
AR(2) Pr > z						0.110	0.329
Sargan test (Prob> chi2)						0.067	0.230

Note:
(1) Standard errors in parentheses. *, **, ***: significance levels at 10%, 5% and 1% respectively.
(2) TSLS denotes "Two-Stage Least-Squares".