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Shadow economy and tax revenue in Africa

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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 data-set covers the period 1999-2007. The main results reveal that the shadow economy has a significant and negative impact on 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.

JEL Code: H20, H11, H26

Keywords: shadow economy, tax revenues, effects, implications, Africa

1. Introduction

The preference for shadow economy area becomes a complex and destructive economic phenomenon, which has intensively monopolised the attention of economists in the last decade of years. Defined by Smith (1994, p. 18) as “the market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of GDP”, the shadow economy has been the main topic on G8 Summit agenda in June 2013.

There are many studies which investigate the shadow economy. The first one focuses on determinants of shadow economy, while the second one investigates its consequence in the economic and social environment.

Schneider (2005b) splits the determinants of shadow economy in two main groups. The first group includes the tax and social security burdens. The connection between shadow economy and taxation is intensively investigated by Schneider (2000) and Johnson et al. (1998). They find a significant influence of taxation on shadow economy, the variables heaving the same sign. Similar outputs obtain Kirchgässner (1984) in the case of Germany and Klovland (1984) for Norway and Sweden, respectively. The second group of investigations traits the intensity of regulation as potential explanatory factor for shadow economy and state that the political spectrum can affect formal and informal economic activities. Some contributions in this field offer researchers, such as: Levin and Satarov (2000), Bird et al. (2006) and Dreher and Schneider (2006).

The implications of shadow economy on economic and social environment are the second exploring direction of studies. According to this field, any extension of shadow economy lead to a decrease of official tax base, heaving the same impact direction on collect tax revenues. Moreover, these reduced tax receipts determine a low quality and quantity of public goods and services. On long term, the government need supplementary tax resources and raises the level of tax rates for firms and individuals in the official sector.

The aim of this paper is to analyze the effects of shadow economy on tax revenues, based on a panel-model approach. The data-set includes several countries from Africa and covers the period 1999-2007. The main results reveal that the shadow economy has a significant and negative impact on tax revenues. In other word, when the shadow economy tends to extend, the level of tax revenues decreases.

Unfortunately, there are few contributions on this topic. For example, Schneider (2005b) estimates the level of shadow economy in 110 countries, including developing, transition and developed OECD economies. Beside these predictions, the author states that the ”An increase in the size of the shadow economy can lead to reduced state revenues, which in turn reduces the quality and quantity of publicly provided goods and services. Ultimately, this can lead to an increase in tax rates for firms and individuals in the official sector,...” Schneider (2005, p. 602). Hence, if the shadow economy increases, tax revenues reduce on short term and increases on long term. Other studies have relevance on the public finance topic. For example, Nicolini (1998) performs and tests a simple monetary model to investigate the effects of tax evasion on the optimal inflation tax. Based on this approach, the inflation can be an indirect resort of taxing the shadow economy. Cavalcanti and Villamil (2004) study the optimal inflation tax in economies with structural imperfections in labour, commodity and currency markets. The main output of this analysis shows that when the structural imperfections exist, such as the informal sector, the optimal inflation tax is positive. In this case, the shadow economy is positively correlated with the taxes. Similar results offers Koreschkova (2006), employing a quantitative analysis of inflation as a tax on the underground economy. She finds that, at a given level shadow economy, in the case of US, the government finances its public expenditures using an optimal mix of the income tax rate and the inflation rate. If these

investigations follow a normative approach, Mazhar and Méon (2012), for the first time, tests empirically the size of the shadow economy increases under the influence of taxes and inflation. The sample includes developed and developing countries and covers the period 1999-2007. The authors find that the tax burden is negatively correlated with the size of the shadow economy, while the inflation and the size of the shadow economy have the same sign. Given this poor empirical literature in the area of shadow economy - tax nexus, the present paper extends the literature in the field by focusing on the shadow economy implications on tax revenues and finds new evidences regarding this connection. As the classical literature explores the influence of tax revenues on shadow economy, we investigate the reverse relationship direction, from shadow economy to tax revenues.

Our investigation is focused on the case of Africa. We choose this region because it includes developing countries, which are confronted with severe shadow economy phenomenon and low level of tax inputs. Even if the topic of shadow economy is prolific regarding the contributions for this geographical area (e.g. Tanzi, 1981; Leuthold, 1991; Stotsky and WoldeMariam, 1997; Ghura, 1998), neither one has been interested in the implications of shadow economy on tax revenues.

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

2. Methodology

The main hypothesis of this investigation claims that shadow economy has significant and positive impact on tax revenues share. In order to analyse this relationship we use the econometric tool. Two data-sets are used for the period 1999-2006: one which covers whole world, and another which includes African countries only.

As first step, using the first sample, we estimate the following basic empirical model:

$$Tax\ revenue_i = \beta_0 + \beta_1 Shadow\ economy_i + \delta Z_i + \mu_i, \quad (1)$$

where $Z = (z_1, \dots, z_k)$ is the vector of control variables, while μ_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 shadow economy and $\delta = (\delta_1, \delta_2, \dots, \delta_k)$ is the parameter vector for the control variables. The model is estimated using the ordinary least squares (OLS) and robust standard errors.

The second set of estimations, consider a transversal model approach, by entering the dummy variables, which capture geographical location (the continent). In this case, the model has the following form:

$$Tax\ revenue_i = \beta_0 + \beta_1 Shadow\ economy_i + \delta Z_i + \alpha Continental_i + \gamma Shadow * Continental_i + \mu_i \quad (2)$$

This estimation procedure integrates the regional dimension in order to understand the importance of the relationship between the two variables. We hypothesize that the effect of the informal economy can vary by region, which is captured by the interaction between the variable of interest and the continental dummy.

The further step of empirical analysis captures the specific effects of each nation through panel-model investigation, with this form:

$$Tax\ revenue_{i,t} = \beta_0 + \beta_1 Shadow\ economy_{i,t} + \delta Z_{i,t} + \mu_{i,t}, \quad (3)$$

where $i=1,2,\dots,N$ and $t=1,2,\dots,T$ indicate the country and year, respectively.

The homogeneity issue of panels is also treated. At this level, the regressions are performed with variables on African data only. At the same time, we also rewrite the equation introducing lagged of dependent variables. This leads to:

$$Tax\ revenue_{i,t} = \alpha Tax\ revenue_{i,t-1} + \beta X'_{i,t} + v_t + \mu_i + \varepsilon_{i,t}, \quad (4)$$

where α is the lagged-variable parameter, X is a vector of our control variables, including the informal economy, ε is the error term, v represents the fixed effect temporal, and μ_i is the fixed effect component.

In order to deal with this possible endogeneity issue and to control for the bias as result of using of lagged dependent variable, a generalized method of moments (GMM) model is performed. The first popular GMM approach belongs to Arellano-Bond (1991) and is as a follows:

$$\Delta Tax\ revenue_{i,t} = \alpha \Delta Tax\ revenue_{i,t-1} + \beta \Delta X'_{i,t} + \Delta v_t + \Delta \varepsilon_{i,t} \quad (5)$$

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 data-sets are used for analyse, covering the period 1999-2006: one which includes all world countries, and another which groups only the 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 sample in presented in Annexe 1.

The tax revenue is the dependent variable and represents the volume of tax revenues as percentage of GDP, being obtained from World Bank. This variable is regularly used as dependent variable in many studies, such as: Ghura (1998), Piancastelli (2001), Eltony (2001), Tanzi (1981), Leuthold, (1991), Stotsky and WoldeMariam (1997), Ghura (1998), and Bird et al. (2004). The shadow economy is used to measure the informal economy. The sources of data are the studies of Schneider (2010), whose theoretical bases are discussed including Schneider (2005a, 2005b, 2010). Using a cross-country panel analysis of 12 East-European countries, Davoodi and Gregorian (2007) capture the tax potential and efforts in Armenia. The authors suggest that size of shadow economy and institutional quality are two significant factors that affect tax effectiveness. Haque (2012) also finds a negative correlation between the informal economy and tax effort. For the first estimations, 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 ones).

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

The first group includes variables, such as: per capita GDP (log), share of agriculture in GDP, and share of imports in GDP, according to Gupta (2007). This data come from World Bank.

GDP per capita is a traditional indicator of economic development. Thus, it is expected that this indicator has a certain positive significant correlation with the tax performance. This hypothesis is plausible especially in virtue of the Wagner's law. 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 (e.g. Keen and Simone, 2004 and Rodrik, 1998). Lotz and Morss (1967) also find that per capita income and trade share are significant determinants of the tax share. This finding has been replicated by Piancastelli (2001), Chelliah et al. 9(1975), and Tait et al. (1979). 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 compile by Daniel Kaufmann, Art Kraay and Massimo Mastruzzi at 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. Several studies focus on the importance of institutional factors in determining of tax performance. For example, Bird et al. (2006) find factors, such as: corruption, rule of law, entry regulations play key roles. Corruption, voice and accountability also determine a positive significant impact on tax effort (Bird et al. 2008). On the same note, Besley and Person (2013) put in evidence the positive role of institutional quality in tax revenues collection.

Finally, we note only the variables that are returned most often in the literature are used for our estimates.

4. Econometric findings

Figure 1 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 correlation coefficient of 0.27, a strong statistically significant (at 1%).

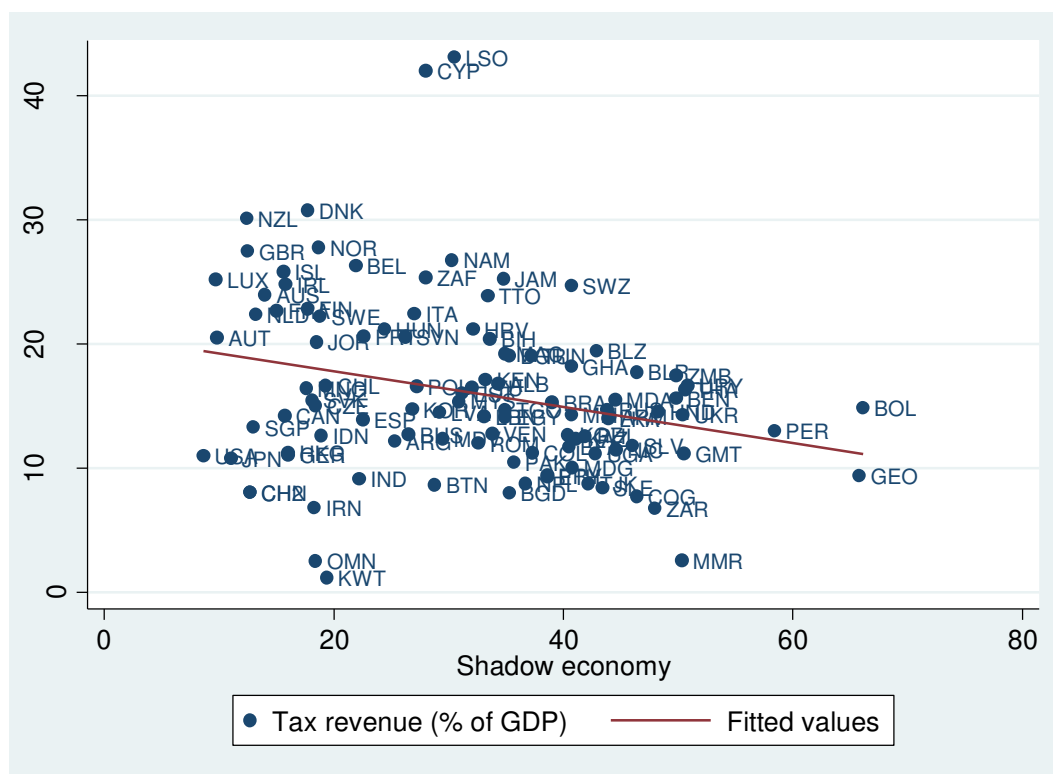


Figure 1. The correlation between tax revenues and shadow economy

In Figure 1, the tax revenues are plotted against shadow economy. It follows that countries with higher shadow economy enjoy weak mobilization of tax revenues. We also represent the fitted line for the simple regression model. The estimated coefficient for β is negative (-.145) and strongly significant (p-value = 0.000), indicating that high shadow economy reduces tax revenue.

It is worthwhile to test its solidity with an empirical assessment. This is the objective of the following table 1.

Table 1. Main results

Dependent variables: tax revenues as % of GDP.							
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
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)		
Europa						8.680 (5.392)	
Oceania							65.568*** (14.658)
Schadow *							
Africa							
Schadow *							
Americas							
Schadow *							
Asia							
Schadow *							
Europa							
Schadow *							
Oceania							
Cons	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: All regressions are estimated using White (1980) heteroskedasticity correction.

Table 1 shows the basic estimates of this work. In the first column, the results of the simple regression between the dependent variable and the dependent 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 relationship found in the model can be located in one or more such as areas.

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 size of the informal economy is detrimental to taxes. The model IV reveals that the dummy of America is also significant, but its crossing with the informal economy is not. The case of Asia is revealed in the fifth column and also changes the configuration of the previous results in the sense that the informal economy and import variables become significant. Moreover, the dummy of Asia has a negative and significant sign, while the crossing of dummy with the informal economy is significant but positively correlated with depended variable. The introduction of Europe generates non-conclusive results. On the contrary, the Oceania registers the same results as those found in Africa. The differences in findings between Africa, Asia and Oceania, require further consideration.

Indeed, in Tables 2, using the African sample, we consider both the problem of fixed effects for each country in its respective continent, but also the issue of endogeneity between the informal economy and tax revenues. Many studies have established that the taxation has important implication in the size of the informal economy (e.g. Schneider, 2000; and Johnson et al., 1998).

As a first step, we estimate the effect of the informal economy in a naive panel regression with fixed effect and random effect (models 1 and 3). We note that the obtained results confirm the previously one for Africa: the informal economy affects negatively the resulting revenues of taxes. We find that in the case of the random-effects model, the magnitude of the coefficient is almost double comparatively with the fixed effect.

Further, in the models 2 and 4, we introduce the control variables. All coefficients behave similarly regardless of the model chosen, but in the case of 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 negative sign in respect to the tax revenues.

Table 2. The main estimation results for Africa
Dependent Variable: Tax revenues as % of GDP.

Variable	Fixed Effects	Fixed Effects	Random effects	Random effects	Diff.-GMM	System GMM
Model	1	2	3	4	5	6
Shadow economy	-.384** (0.191)	-.049 (.367)	-.688*** (0.143)	-.351** (.169)	-3.127** (1.623)	-.301** (.135)
Import share		.116*** (.029)		.098*** (.026)	.024 (.041)	.0151 (.014)
Agriculture share		-.086 (.097)		-.149** (.083)	.140 (.121)	-.139** (.066)
Governance		.003 (.016)		.009 (.014)	-.001 (.019)	-.002 (.008)
Log_GDP_per_capita		.013 (.054)		.008 (.019)	-.358 (.265)	-.030** (.0136)
Tax_rev(-1)					-.012 (.231)	.841*** (.071)
Obs	158	154	158	154	100	124
N	29	28	29	28	22	24
Instruments					18	46
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: Standard errors in parentheses. *, **, ***: significance levels at 10%, 5% and 1% respectively. All regressions are estimated using constant term.

All these results have a problem in interpretation due to reverse causality of the majority of our variables. We deal with this issue performing the GMM-dynamic and GMM-system estimations (models 5 and 6). Two both GMM estimators reveal that the interest variable is significant and negatively correlated with tax revenues share. More precisely, the increase in the size of the informal economy reduces tax revenues in African countries. However, the Sargan-Hansen tests associated with our estimates validate the instruments of the model, at limit in the case of GMM-dynamic. Moreover, it may be noted that there is no second-order autocorrelation for both models. As noted, the GMM-system estimator is better is more powerful than the first difference because it gives biased results in small samples in presence of weak instruments.

Considering for our analysis this last estimator, the main findings show that the interest variable is significant and has negative sign. The same results reveal the import share and GDP per capita. If the first case confirms the main outputs in the literature, the second one has

a contrary sign. This can be the result of the extension of 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 determinants are not conclusive.

Concluding, the main results of our investigation show that, in the case of considered African countries, for the period 1999-2007, the shadow economy has a significant and negative impact of tax revenues share.

5. Conclusions

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

The policy implications of these outputs show that the Sub-Saharan African governments, in order to maximise the collected tax revenues, should better “control” the shadow economy phenomenon. This means that the primordial governmental objective is the reduction of shadow economy, through two channels. The first channel claims an improvement of 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.

All these policy coordinates will increase the tax base “visibility”, extending the tax base, with positive impact on tax revenues.

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Annexes 1. Summary statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Schadow 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 revenu	161	.1586098	.0988902	.0011668	.6101812