ACTA UNIVERSITATIS AGRICULTURAE ET SILVICULTURAE MENDELIANAE BRUNENSIS

Volume 63 222 Number 6, 2015
http://dx.doi.org/10.11118/actaun201563062043

UNOFFICIAL ECONOMY ESTIMATION BY THE MIMIC MODEL: THE CASE OF KENYA, NAMIBIA, GHANA AND NIGERIA

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Abstract

NCHOR DENNIS, ADAMEC VÁCLAV. 2015. Unofficial Economy Estimation by the MIMIC Model: the Case of Kenya, Namibia, Ghana and Nigeria. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis,* 63(6): 2043–2049.

This study investigates the size and trend of the underground economies in selected African countries. Underground economies are present in all countries, but they are endemic in developing economies. Their presence is not necessarily bad for the economies, in which they prevail. It could however cause huge losses to government revenue and could also constitute serious violation of Labor regulations. The study uses the Multiple Indicators and Multiple Causes model (MIMIC), a variant of Simultaneous Equations Model (SEM). It involves two sets of variables: the observed variables and the indicator variables. The former include size of government, indirect tax rates, total tax rates, business regulation, interest rate on deposits, unemployment rate, quality of public services, and GDP per capita. The indicator variables were Labor participation rate in the official economy, the amount of cash held outside the banking system and growth in GDP per capita. This study found the average level of underground economies in Kenya, Namibia, Ghana and Nigeria as 33.7%, 29.1%, 36% and 47%, respectively. The estimated results show that the causes of shadow economic activities vary among the countries. The data was obtained from the World Bank country indicators and the International Financial Statistics.

Keywords: underground economy, SEM model, trend, revenues, tax evasion, underground

INTRODUCTION

Underground economic activities are present in all economies of the world especially in developing countries. Though their presence may not necessarily be bad for the economies in which they prevail, they account for numerous economic and social problems such as environmental hazards, losses to state revenue, violation of labor regulations etc. The positive aspect of such activities is that, they provide additional opportunities for employment and extra income to the impoverished population. Such activities are also regarded in some quarters as shadow economic activities, hidden activities, black market activities to mention but a few. Their definition remains largely controversial but this study adopts the definition by Schneider *et al.* (2009) where underground economic activities are defined as market based production activities, which are deliberately hidden from the official system. Such activities occur as a result of individuals and companies avoiding payment of taxes, social security contributions and compliance with labor market standards. In other words, such activities are in principal legal, however, remain unreported to the authorities with the purpose of tax evasion, noncompliance with regulations or avoidance of official bureaucracy.

Numerous definitions of the underground economy were previously formulated in the literature (Ogbuabor and Malaolu, 2013; Schneider *et al.*, 2009; Oduh *et al.*, 2008). The relationship of the underground economy with the official economy still remains incomprehensively described, although some authors claim that rising official economy weakens underground economic activities, as both compete for the same resources (Ogbuabor and Malaolu, 2013).

The study seeks to estimate the underground economies of Kenya, Namibia, Ghana and Nigeria. The objective is to determine the actual sizes and trends in underground activities and to investigate the similarities or otherwise of the causal factors of such activities in these four countries. The choice of those countries is based on the fact that, they have similar economic structures as their economies are largely agrarian and most exports are raw materials which either include agricultural products or solid minerals.

The chosen countries are also from the different regional economic bodies of Africa which will ensure comparison of similarities and contrasts. Ghana and Nigeria are both power houses in the Economic Community of West African States (ECOWAS). Kenya has a strong economy in the East African Community (EAC) and Namibia a member of the Southern African Development Community (SADC) boasting of one of the most stable macroeconomic developments in the region. All four countries boast of oil resource discoveries though Kenya and Namibia are new in this area.

Ghana has a Gross Domestic Product (GDP) per capita at purchasing power parity in 2011 constant US dollars of about $3952, Nigeria $5607, Kenya $2776 and Namibia $9506 according to the World Development Indicators (WDI, 2014). 44.7% of the labor force in Ghana is into agriculture, 70% in Nigeria, 75% in Kenya and 70% in Namibia (WDI, 2014).

The business regulatory environment in these countries is usually not conducive for the formation and operation of businesses as it involves several procedures and takes couple of months. Their labor markets are also underdeveloped coupled with fragile financial market systems. These and other similarities make it easy for comparison of the underground economies in these countries.

The study employed the Multiple Indicators and Multiple Causes (MIMIC) model. This model uses two sets of variables: the observed variables and the indicator variables. The observed variables describe the causal factors of underground economic activities. These include but not limited to: the level of GDP per capita, general level of taxation and social security payments, size of government consumption, extent of business regulation, quality of public services, unemployment rate and corruption index. The indicator variables determine the presence of an underground economy and they include: labor participation in the official system, the amount of cash held outside the banking system and growth in GDP per capita. A booming underground economy is indicated by low participation of a country's labor force in the official system and large quantum of cash outside the banking system. The vice versa is true ceteris paribus. The underground economy therefore has a negative relationship with labor participation in the official system, a positive relationship with cash held outside the banking system and a negative relationship with growth in GDP per capita. The next chapter focuses on the data and the methods used for this study.

DATA AND METHODS

The objective of this study is to estimate the size and trend of the underground economies of four African countries (Kenya, Namibia, Ghana and Nigeria) and to provide insights into the main causes of such activities in each of the countries. This was achieved using the MIMIC model. Estimation of the MIMIC model and the follow-up diagnostics were completed with STATA software version 12 (StataCorp, 2011). Yearly time series analysed in this study were received from the World Bank country indicators and from the International Financial Statistics.

In the past, numerous approaches have been considered to estimate the underground economy. Out of many, the Currency Demand approach (Ariyo and Bekoe, 2011; Faal, 2003) and the Multiple Indicators and Multiple Causes model (MIMIC) (Schneider and Enste, 2000; Schneider *et al.*, 2009) were the most favoured.

The Multiple Indicators and Multiple Causes Model

The Multiple Indicators and Multiple Causes model (MIMIC) is a variant of the Simultaneous Equations Model (SEM). It has two parts: the structural equation model and the measurement model. The first component estimates the relationship between the causal variables and the latent variable, which represents the underground economy. The following equation (1) shows the relationship between individual causal variables and shadow economic activities in each specific country.

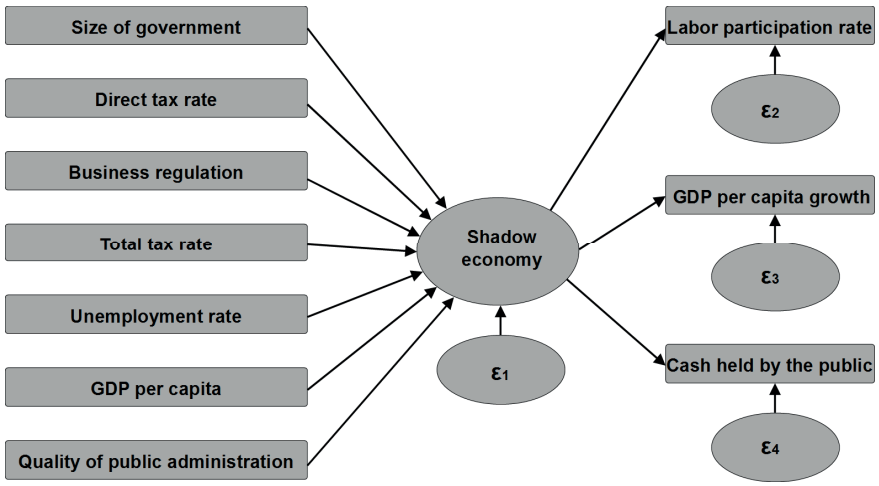
$$\eta_t = \alpha_1 X_{1t} + \alpha_2 X_{2t} + \alpha_3 X_{3t} + \alpha_4 X_{4t} + \alpha_5 X_{5t} + \alpha_6 X_{6t} + \\ + \alpha_7 X_{7t} + \varepsilon_t. \quad (1)$$

In the structural equation model (1), is the latent variable (underground economy) and α_1, α_2, …, α_7 are the model coefficients. Symbols X_1, X_2, …, X_7 denote exogenous causal regressors determining the size of the latent variable. The latent variable is directly unobserved, but estimated from the MIMIC model.

The measurement model on the other hand, estimates the impact of the underground economy on each indicator variable. It is given by equation (2).

$$y_t = \beta\eta_t + \varepsilon_t, \quad (2)$$

where $y_t = (y_1, y_2, \ldots, y_n)$ is a $(1 \times n)$ vector of the indicator variables, β represents the regression coefficients and ε_t is a $(1 \times n)$ vector of errors satisfying white noise.



1: *General structure of the MIMIC model*

MIMIC Index

First, for each country, the MIMIC model is correctly specified and its parameters are subsequently estimated by the method of Maximum Likelihood (ML). The general structure of the MIMIC model is illustrated in Fig. 1. The causal and indicator variables provided, may slightly differ among models for specific countries. During the diagnostic stage the analysts verified parameter significance (α = 0.10) and ensured that the SEM model met the criteria of good fit (StataCorp, 2011). Later the parameter estimates were used to predict the latent variable (underground economy) and to calculate the MIMIC index [%] from it (Schneider *et al*., 2009).

$$\hat{\eta}_t = 100 \frac{\tilde{\eta}_t}{\tilde{\eta}_{1990}} \eta^*_{1990} . \qquad (3)$$

In equation (3), $\hat{\eta}_t$ is the calculated MIMIC index at time *t*; it estimates the underground economy as a percentage of the official economy; $\tilde{\eta}_t$ is the estimated value of the latent variable at time *t;* $\tilde{\eta}_{1990}$ is the estimate of the underground economy in the base year 1990 and η^*_{1990} is the exogenous estimate of the underground economies in 1990. Exogenous underground economy is the exterior estimate, i.e. base value of the underground economies in 1990, derived for each country as the average size of the underground economy from several previous studies. The structure of the MIMIC model is given in Fig. 1.

RESULTS

Tab. I provides a summary of the detailed Structural Equation Model results for each of the countries. The summarized results show the model's significant coefficients and z statistics. Though some of the causal factors are common to all four countries others differ. The underground economy in Kenya is caused by the size of government, GDP per capita, the rate of unemployment and the deposit interest rate. In Namibia, it is caused by the size of government, the level of unemployment and the level of GDP per capita. Ghana's underground economy is caused by the size of government, the unemployment rate, direct taxes and total taxes. In Nigeria, it is caused by the size of government, unemployment, quality of public services, business regulation and total taxes.

A percentage point increase in the size of government causes an increase in the underground economies in Kenya and Nigeria by 0.27% and 0.05% respectively, but decreases the underground economies in Namibia and Ghana by 0.71% and 0.31% respectively. A percentage point increase in the rate of unemployment causes underground economic activities in Kenya to increase by 8.16%, Namibia by 0.08%, Ghana by 0.17% and Nigeria by 0.04%. A dollar increase in GDP per capita only increases underground economic activities in Kenya and Namibia by 0.03% and 0.001% respectively.

The deposit interest rate is only a significant cause of underground economic activities in Kenya. Increasing deposit interest rates by a percentage point increases underground economic activities in Kenya by 0.15%.

The quality of public sector services and business regulation are only statistically significant in Nigeria. A unit improvement in the quality of public services leads to 0.81% decrease in underground economic activities and a unit intensification of the business regulatory environment leads to more underground economic activities by 0.39%.

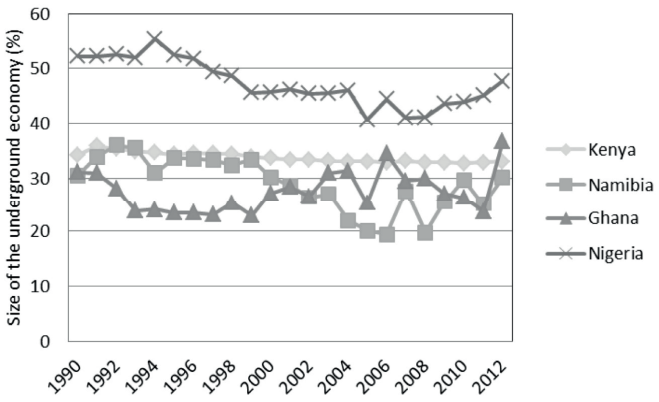
Total taxes influence underground economic activities in Ghana and Nigeria. A percentage point increase in the total tax rate leads to growth in underground economic activities by 0.40% in Ghana and 0.20% in Nigeria. Direct taxes are only statistically significant in the case of Ghana where underground economic activities increase by 0.21% for every percentage point increase in direct tax rate (see Tab. I for the results).

I: *MIMIC model equations, estimate (z-statistics in parenthesis)*

STRUCTURAL PART	Kenya	Namibia	Ghana	Nigeria
Underground economy				
Size of government	0.27(1.19)	–0.71(–3.00)	–0.31(–2.41)	0.05(2.82)
Unemployment rate	8.16(3.29)	0.08(1.65)	0.17(3.38)	0.04(4.40)
Direct tax rate			0.21(3.22)	
GDP per capita	0.025(1.66)	0.001(1.85)		
Deposit Interest rate	0.154(3.90)			
Quality of public service				–0.81(–4.14)
Business regulation				0.39(2.12)
Total Taxes			0.40(3.34)	0.20(2.33)
MEASUREMENT PART				
1. Labor force participation				
Underground economy	1 (constrained)	2.31(1.89)	1(constrained)	1 (constrained)
Constant	–29.16(–0.87)	58.80(18.13)	64.33(14.49)	49.03(15.81)
Size of government	–0.36(–2.68)	1.11(1.58)		
Unemployment			–0.10(–2.57)	
2. Money ratio				
Underground economy	–0.05(–10.30)	0.04(2.58)		
Constant	5.20(3.21)	0.87(5.29)		
Deposit interest rate				
3. GDP per capita growth				
Underground economy		1 (constrained)		–16.96(–2.34)
Constant		19.34(3.16)		129.8 (1.76)
Unemployment rate		–0.30(–2.01)		

II: *Quality of fit indicators for the estimated MIMIC models*

Country	RMSEA	Pclose	CFI	SRMR	Overall R^2
Kenya	0.04	0.37	1.00	0.01	0.98
Namibia	< 0.01	0.52	1.00	0.05	0.99
Ghana	< 0.01	0.55	1.00	0.02	0.88
Nigeria	< 0.01	0.75	1.00	0.03	0.90



2: *Trend of the informal economy*

Model quality checks were carried out using the Residual Mean Standard Error of Approximation (RMSEA), Comparative Fit Index (CFI), Standardized Root Mean Squared Residual (SRMR) and the Coefficient of Determination or the overall R-square. Pclose indicator provides the probability that, RMSEA ≤ 0.05. The results (see Tab. II) show that, the model satisfies the goodness of fit statistics. See Hu and Bentler (1999), Kenny, Kaniskan and McCoach (2014), MacCallum,

Browne and Sugawara (1996) for further readings on simultaneous equation model fit indices.

Fig. 2 shows the size and development of the underground economy in each of the countries studied. Kenya, Namibia and Ghana have relatively similar levels of underground activities as compared to Nigeria though the trend differs. The underground economy in Kenya is fairly steady with gradual and marginal decline. It currently stands at about 33% at the end of 2012. The underground economy in Ghana shows a steady decline from 1990 to 2000. The period beyond 2011 saw an increase in underground economic activities which could largely be attributed to the new oil sector activities. By 2012, underground economic activities in Ghana were about 37% of official GDP. Namibia's underground economy is seen to react to the period of economic crises in 2007. It decreased between 1990 and 2006 after which a cyclical movement is observed. The underground economy of Namibia as at the end of 2012 was about 30%. Nigeria has a relatively high percentage of underground economic activities but generally declining over the last decades. Their economy reacted to the global economic crises in 2007 with a rise in such activities. As at the end of 2012, Nigeria's underground economy stood at 48% of official GDP.

Consequences

Underground economies result in the inefficient functioning of the goods and labor markets due to the fact that, prices of factors of production and goods and services cannot be monitored. State revenue is also largely affected as a result of the decision by businesses to work outside the official system. The study results show that, on the average, Kenya, Namibia, Ghana and Nigeria lose 19%, 10.5%, 15% and 28% of tax revenue as a percentage of official GDP respectively due to the presence of underground economic activities.

Corruption increases as a result of the hidden nature of these activities. Any activity that is not registered increases the tendency for malpractices. It affects policy making as the national accounts aggregates are not reliable. With such high percentage of production not accounted for in the estimation of GDP, estimates of a country's national accounts become less credible and could lead to wrong policy formulation. Environmental hazards also mostly result from these underground activities due to the absence of regulation.

On the positive side these activities create value added that is spent on the official economy. They help bridge the income distribution gap as people with low incomes undertake such activities to supplement their low earnings. For countries with high unemployment rates and lack of social welfare systems, these underground activities help reduce the adverse effects of unemployment as long as the activities are legal.

Recommendations

Increasing the size of government increases the underground economies in Kenya and Nigeria. Both countries have average sizes of government of about 16% and 10% of GDP respectively and therefore have to reduce the size of their governments. The study however acknowledges that further research is required to ascertain the optimum size of government conducive for controlling shadow economic activities in these countries

Increasing the size of government in both Namibia and Ghana reduces the level of underground economic activities. It is therefore recommended that the size of government increases in priority areas in these two countries.

The rate of unemployment is a significant cause of underground activities in all four countries. The magnitude of effect however differs for each country. Several factors account for the growing unemployment rate in these countries and this problem remains chronic globally but an enabling environment could be created for high private sector participation in the formal sector which will help reduce the level of unemployment.

GDP per capita plays a significant role in determining whether individuals participate in shadow economic activities or not. High level of GDP per capita tends to guarantee quality standard of living and reduces the incentive to participate in shadow economic activities. These countries understudy have reasonable levels of GDP per capita coupled with strong annual growth. The issue is however about equitable distribution. Given that this condition is met, there will be welfare improvement which will reduce the incentive to participate in underground economic activities for livelihood.

In other cases, higher GDP per capita can rather lead to an increase in underground economic activities. This generally occurs with the issue of corruption and unequal distribution of resources. In such a case, there is the need for identification and scrutinization of complex or unusually large individual and business transactions. In addition, organizations both state and private, should be required to declare appropriately the earnings of employees and to take measures to make employees aware of the laws relating to the laundering of money.

DISCUSSION AND CONCLUSION

The study applied the Multiple Indicators and Multiple Causes model. This model received its name from Jöreskog and Goldberger (1975), although it had previously been discussed by Zellner (1970) and Hauser and Goldberger (1971).

A wide range of variables were considered as causal factors of underground economies in each of the countries studied. They include: the size of government, direct taxes, total taxes, GDP per capita, unemployment rate, business regulation, the quality of public sector services, total tax rate, social security contributions and the deposit interest rates. Corruption which remains one important determinant of shadow economic activities could not be added due to data unavailability. Labor force participation in the official system, growth in GDP per capita and currency in the hands of the public were significant indicators of the presence of shadow economic activities.

The results of this study are compared with similar studies by various authors. This study found the average level of underground economies in Kenya, Namibia, Ghana and Nigeria as 33.7%, 29.1%, 36%% and 47% respectively. This is compared with the averages derived by Schneider *et al*. (2009) for the year 2006 as 34.5%, 30.5%, 42.3% and 56.2%, respectively. The size of government and the level of unemployment are unique causes in all four countries. Total taxes cause underground economic activities in Ghana and Nigeria. Direct taxes are only statistically significant in the case of Ghana. GDP per capita is only statistically significant in Kenya and Namibia. The deposit interest rate only causes such activities in Kenya. Business regulation and the quality of public sector services are unique causes in Nigeria.

The study by Schneider *et al*. (2009) showed that the rate of unemployment and the level of GDP per capita were influential in the size of underground economies of developing and transition countries. In their analysis of 88 developing countries, the size of government, direct taxes, fiscal freedom and the level of GDP per capita proved to be the main causes of shadow economic activities. Labor force participation rate, growth in GDP per capita and currency held by the public were statistically significant indicators for all categories of countries studied.

The relationship between the rate of unemployment and the underground economy is seen by most authors in this area to be ambiguous, for example, Tanzi (1999). Heterogeneous workers compose the labor force of hidden economy; one part of those is classified as unemployed because they are components of the official labor force, the other part of hidden workers is composed of retired people, illegal immigrants, minors or housewives, who are not part of the official work force. Furthermore, there are people, who have at the same time an official and unofficial job (Tanzi, 1999). It therefore often happens that official rate of unemployment is less correlated with the underground economy but in this study the two were correlated for all four countries.

Most often self-employment activities are synonymous with developing countries and such activities if registered are counted as formal employment. The improper regulation of such self-employment activities could however lead to growing underground economic activities.

According to Bordignon and Zanardi (1997), the springing up of small firms and growing self-employment activities distinguish the character of shadow economic activities in Italy from other economies in Western Europe. The higher the rate of self-employed the larger is the underground economy, ceteris paribus.

Acknowledgement

The authors appreciate kind support from the Internal Grant Agency (IGA) of Mendel University in Brno [No. 35/2014].

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