The Underground Economy and GDP Estimation in Developing Countries

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ABSTRACT

The estimation of gross domestic product (GDP) in most developing countries portrays a lot of meaning; most often it is very low. This could be true or false. The existence of underground economy in this economies tend to undermine the estimation of GDP in developing economies, because the size of such economy is large, hence the actual figure if gross domestic product in these countries is hardly a true reflection of the picture. An underground economy is given various names and meaning, depending on the context it is employed. The economy is described as a market based production of goods and services whether legal or illegal that escapes detection in the official estimate of gross domestic product (GDP).The objective of the study is to show that the size of underground economy is correlated to GDP figure. Using the technique of ANCOVA, the result from the study shows that the coefficients are not positively related, but statistically significant in explaining the variation in the dependent variable. This is showing that the underground economy can contribute significantly to the growth of the economy, therefore policies should be designed and strengthen to include their activities in the economy.

INTRODUCTION

All economic activities whether in the developed or developing economy are expected to pass through the conventional processes of gross domestic product (GDP) computation. However, a large chunk of these activities do take place or are not included in the computation, as such the value of GDP at any point in time is hardly a reflect of the true picture of the economy, particularly in the developing countries. Although, these activities are not formally reported in the computation of gross domestic product (GDP), they

nevertheless use real resources, and satisfy real wants and needs. The term "underground economy" is synonymous with the terms like the "Shadow, Informal, Black or Parallel, and Hidden economy". They are employed to mean the same, however depends within the context they are used. The western scholars would prefer to use the term to connote negative behaviour and present an ugly picture of what is happening in the less developed world as being "bad". The terms shall be used in this work interchangeably to mean the same. Although, there are the bad and the good aspect of the concept, the concern of the study is the good aspect that is expected to contribute the computation of gross domestic product (GDP).But because of the institutional lapses; they are excluded in the computation.

The Shadow economic activities may include production employment and exchange, etc.but are not reported to government authorities for the purposes of tax. These activities constitute a large and growing part of all activities throughout the world; they are by nature difficult to be measured with precision. Attempts have been made to estimate their magnitude, and to relate those magnitudes to tax rates and other determinants, (Schneider, 2006).Underground economy exists even in the 21st century, and has been investigated on various studies (Giles, 1999 2002; Bajada and Schneider 2005; Schneider, 2005, 2007, and 20010).

While the global economy is grinding to a standstill, the underground economy is thriving rapidly in developing countries like Nigeria. The concern here is not to demonstrate the assertion that they exist, and are growing like wild wind. But the appropriate question rather to pounder is that 'Is it the fault of the operators of this economy, or that of the weaknesses of laws and institutional framework that developing countries operate that continue to provide a favourable breeding ground for this system to multiply unabated. The objective of this paper is to demonstrate and show that the expected contributions of this economy to GDP calculation would have been higher in developing economy if activities in the underground economy were to be included in the computation. In addition, to suggest various measures of incorporating them into the official process of national income calculation, by way of adjustment and re-enactment of the various statutory laws and the institutional framework of most of these economies.

This paper is organise as follows, immediately after the introduction above, is section II, which is titled literature review and theoretical framework. Section III discusses the size of underground economy in developing economies in relation GDP estimation. Section 3 will be the methodology and estimation procedure of the work, while section four summarise and conclude the work.

Literature review and theoretical framework

Park, (2005), simply described an underground economy as "no –market economic activities that include home production. The illegal market activities, prohibited production and distribution of proscribed substances,

illegal market activities but are kept hidden for reasons such as tax evasion. Enste, and Schneider (2002) viewed it as not only illegal activities but also unreported income from the production of legal goods and services, either for monetary or barter transactions. Hence, the shadow economy comprise of all economic activities that would generally be taxable, were they reported to the tax authority. From the foregoing, the economy has two sides, the legal and the illegal part. From the legal point of view, it would be said that since the economy uses real resources for the satisfaction of consumer wants, their operation are in itself legal. However, if viewed from the illegal angle, the inability of the tax authorities to capture their contribution in the computation of national income activities becomes illegal, therefore, a drain on the national income.

To further buttress the legal angle of the underground economy, Chrystal and Lipsey (1999), opined that the transaction that occur in the underground economy are perfectly legal in themselves. The only illegality is such that transactions are not reported for tax purposes. One example of this, is a carpenter who repairs a leaking roof of a house and takes payment in cash or kind in order to avoid taxation, because such transactions goes unreported and are therefore omitted from Gross Domestic Product(GDP).

Park, (2005) enumerated the following factors as the likely causes of underground economy. These are:

1. High tax rate and social insecurity condition.
2. Increased regulation
3. Forced reduction of weekly working hours or the counterpart part of it as "casual workers" in developing countries.
4. Early retirement
5. Unemployment
6. Decline of civic virtue and loyalty towards public institutions

The above can be said to be the predisposes factors for the growth and severity of this type of economy in most developing countries like Nigeria, because a close scrutiny of the factors indicates that all of them are various challenges responsible for the growth of this type of economy in Nigeria.

Basically, three methods are widely used in the estimation of the size of the underground economy. They are:

1. Direct approach
2. The indirect approach
3. Model approach

The direct or micro approach employs survey and sample based procedure on voluntary responses from interviewers, or tax auditing and compliance method. The indirect or the indicator approach mostly uses macro economic data and other indicators that contain information about the development over time of the hidden economy. The indicators may include:

1. Discrepancy between national expenditure and income statistics.
2. Discrepancy between official and actual labour force
3. Physical input (electricity consumption method).

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The model approach explicitly considers multiple causes and multiple indicators of the underground economy.

Theoretical framework

By the definition, the underground economy cannot be directly observed, as such; its size can only be estimated. Ene and Stefanescu, (2011), suggest the use of structural model, or mimic model. Generally the structural equation model requires evidence of statistical relationships that occur between a latent variable (unobserved), and several observed variables. The Mimic approach allows several indicators variables and several causal variables in forming structural relationships to explain the latent variable, within this context; our latent variable is the size of the underground economy. The method is taken from the psychometrics sciences, and was applied in the field of economic, (as a latent variable model by Zelner, 1970; and Goldberger, 1972).Mimic model is a structural model that treats the size of the underground economy as "a latent unobserved variable "that links a collection of observable indicators –reflecting changes in the underground economy size with causal observed variables considered to be driving forces behind the underground economy activities, given the appropriate data and indicators, estimates can be achieved by the b standard econometric procedures.

Size of underground ecdonomy in developing countries

Estimating the size of economy with precision is often a difficult task, because those engage in these activities ensure that they avoid detection, but policymakers and government administrators need information about how many people are active in the shadow economy, how often the underground activities occur, and the size of these activities, to serve as guide to make appropriate decisions on resource allocation. the table below shows the size of the underground economy as a percentage of GDP.

Table 1: Shadow economy as a percentage of gdp in developing countries **(1998-2000).**

Counry group	Percentage of GDP
Developing countries	**34-44**
Transition economies	**21-30**
OECD	**14-16**

SOURCE: Adopted in ENE AND SCHNEIDER, (2000).

Table 2: Average size of underground economy for developing and OECD countries in percentage of official GDP.

COUNTRIES/YEAR	1992/2000	2000/2001	2002/2003
Africa (developing economy)	33.9	37.4	41.2
Central and South America (developing).	34.2	37.7	41.5
Asia(developing economy)	20.9	23.4	26.3
Transition countries	31.5	32.6	33.4
Highly developed OECD countries	13.2	15.7	16.8

Source: Adopted in Ene and Schneider, (2000).

According to a survey conducted in 1998-99 in Africa, Nigeria and Egypt had the largest Shadow economies having an equivalent of 77%, and 69% of GDP respectively.(Ene,and Schneider 20020.With reference to Nigeria, we expect that the size of underground economy will be greater than 77%,because the factors that have given rise to underground economy has rather worsen than before. But suffice it to say that we used that as our benchmark measurement for of the size of the underground economy in Nigeria, although it might amount to either an under or over statement, it does not matter the precision of the measurement, because our ultimate objectives is not to gauge the size, but rather to show whether the estimated size of the underground economy interact with the other determinants of this economy. The size of the economy has grown tremendously over time in Nigeria largely as a result of causative factors that seem to be endemic now than before, these factors are:

1. The gross decay and indiscipline in the civic attitude of Nigerian to the laws of the land
2. Pervasive poverty because of failed policies
3. High unemployment rate
4. Mass and early retirement of the work force
5. A growing element of regulation in some segment of the economy.
   The entire factors above are very active and operational in Nigeria and the size of the economy is said to be growing unabated.

METHODOLOGY

The study uses annual time series data obtained from the various publication of Central Bank of Nigeria (CBN), and National Bureau of Statistics (NBS), and any other statutory sources for its analysis. From the insight gained in the exposition of the "MIMIC MODEL" and the variables identified therein, the methodology for this study shall follow the same line of reasoning, therefore

a standard econometric procedures is applied. (Giles, 1999).the econometric technique to be used is the ANCOVA technique to examine the interaction between the size of the underground economy, and other determinant in Nigeria. This is to see the dynamic nature of this economy.

When both qualitative and quantitative variables are employed as regressors in a model, the model is term as an ANCOVA MODEL. Thereafter a standard OLS procedure shall be used to obtain the estimators of the parameters.

The variables

The variables to be used for the analysis are
1.   The latent variable
2.   Gross Domestic Product (GDP).
3.   Unemployment rate
4.   Regulation.
The first three variables above are the quantitative variables because their rate can be quantify over time, while the last variable is qualitative in nature because is cannot be quantified, hence it include as a dummy variable.

Definition of variable and notations

 The latent variabe (LV): This is the unobserved variable, and will be used as a proxy for the size of underground the economy. In the case of Nigeria, we shall derive from the Nigeria's gross domestic product using the proportion of underground economy as a percentage of official GDP in developing countries. This variable is considered as the dependent variable.

Gross domestic product (GDP: This stands for gross domestic product representing the value of goods and services produced in the economy by resident of the country. The data is already computed, and are available as a secondary data.

Unemployment (UNEM): The statistic of those that are not gainfully employed and thus have on source of income. This variable is one of the main determinants of the growth of the underground economy. In other words unemployment level provides a ground for this type of economy to strive. Data on this variable already existed in the form a secondary data or sources.

Regulation (RGN): This variable captures government policy. The underground economy tends to breed very well in an economy that is regulated, and that is whether the economy is protected or liberalised. Following the scope of this study, 1980-2010, the period is a concomitant of regulated and unregulated policies. The variable is included as a **DUMMY**, to incorporate the periods. The coding is zero (0), for regulated   economy,

and one (1) for liberalised economy. For the period of our study we shall consider Military regime as regulated and Democratic Government as a liberalised economy. It can be argued that Structural Adjustment Problem, (SAP) is a liberal policy, but for the fact that it operated under the Military regime was not completely   liberalised.

The model

The functional equation will be the size of underground economy as a function of GDP, Unemployment, and Regulation. Adopting a letter representation as follows

LV = f (GDP, UNEMP, RGN)..1
The explicit equation of equation 1 will be stated in econometric form as

LV = β_0 +β_1 (GDPt) +β_2 (UNEMP$_t$) +β_3 (RGN$_t$)......................2
To avoid proliferation effect, due to differences in the unit of measurement, equation 2 will be stated in a logarithm form.

LogLV = β_O + $\beta_1$log (GDP) +$\beta_2$log (UNEMP) +β_3 (DUMM)................3

Parameters estimation

The ordinary least square (OLS) will be used to obtain a long run relationship among the cointegrating variables. The choice of **(OLS)** as noted Koutsoyiannis (2001) is based on the following merits.
I.   The parameter estimate obtained by ordinary least square have some optimal properties;
II.   The computational procedure of **OLS** is fairly simple as compared with other economic techniques and the data requirement are not excessive
III.   The **OLS** has been used in most empirical work in economics and other related field with a fairly satisfactory results,
IV.   With the advent of computer based econometrics soft ware (e.g E-views, Rats and Cats).the computation procedure of OLS is not only simple, but has added to the robustness of the results there from.
V.   **OLS** is said to be an essential component of most econometric of most other econometric techniques.
In estimating the model, we proceed by recognizing that macroeconomic time series data may often times exhibit the empirical characteristics of non-stationarity. That is they contain unit root. And since the residuals of non-stationary time series are correlated with their lagged values, a standard assumption of the ordinary least square (OLS) theory (that is the assumption of the absence of auto correlated disturbances) term is violated. The consequence of this is that the parameter estimates obtained by estimating such models using the OLS technique are biased and inefficient(Engle and

Granger,1987).A major implication of this is that policies formulated and implemented using such models are rendered impotent.

In the light of the foregoing, the estimation of the models in this study shall proceed in three stages. In the first stage, we test the various series for the existence of unit root.

Next, we conduct cointegration test, which involves testing the residuals obtained from estimating the model for unit root. The third will be the estimation of the parameters by OLS technique.

Unit root tests

Testing for the existence of unit root is a key preoccupation in the study of time series models and cointegration. (Iyoha,and Ekanem,2002).The importance of testing for unit root, became generally accepted by Granger Newbold (1974), that regression equations between two non stationary series could lead to a Spurious or meaningless results. That is the regression could give a "goodness of fit "judging by the usual goodness of fit statistics, when in fact the series are almost independent. It has also been shown that only relationships specified between stationary time series variables can be meaningful. (Brooks, 2002).However, most time series data are stationary only after first or second differencing. Maddalla (1992) has offered an interesting perspective and interpretation on the testing of unit roots. According to him, testing for unit root is a formulation of the Box-Jenkins methods of differencing the time series after a visual inspection of the correlograms.

The most commonly accepted method for testing unit root is by the use of the Augmented Dickey Fuller test. The Augmented Dickey Fuller (ADF) is considered superior to dickey fuller (DF) test because it adjusts appropriately for the occurrence of serial correlations. (Iyoha and Ekanem, 2002).The ADF test is usually the test of Null hypothesis that a series (Y_t) is non-stationary by calculating statistics for $\boldsymbol{\beta}=0$ in the following equation.

$$\Delta Y = \boldsymbol{\alpha} + \boldsymbol{\beta} Y_{t-1} + \boldsymbol{\gamma}_t + \sum \boldsymbol{\delta} t \Delta Y_{t-1} + \boldsymbol{\epsilon}_t \dots\dots\dots\dots\dots 4$$
Where $Y = Y_{t-1}, Y_{t-k} = Y_{t-k-1},$ and $K=123\dots\dots n.$

$\boldsymbol{\alpha}, \boldsymbol{\beta}, \boldsymbol{\gamma}$, and $\boldsymbol{\delta}$ are the parameters to be estimated and $\boldsymbol{\epsilon}_1$ is the white noise error term (Mukhtar and Zakaria,2008).If the value of ADF is less than the critical value at the conventional significance level(usually at five percent level),the series Yt is said not to be stationary and vice versa. If the Yt is stationary at first difference, i.e. $\boldsymbol{\Delta Y} = (\boldsymbol{Y_t - Y_{t-1}}) \boldsymbol{I(0)},$ by repeating the above procedure. If the difference of the series ($\boldsymbol{\Delta}$Y) is stationary, then the series (Yt) may be concluded as intergraded of the order one. I.e. $\boldsymbol{Y_t \sim I(0)}.$ Once such is established, then the model can then be check for cointegration. The table below shows the result of the unit root test for the series in this work.

Table 3: Result of unit root test.

Series	Trend/intercept	Adf	Critical value	Order of intergration
GDP	Trend and intercept	-6.481	-3.587**	I(0)
LV	Intercept only	-5.953	-3.689***	I(0)
UNEMP	Intercept only	-2.890	-2.621*	I(0)

Source: Author's computation**. (* @ 10%. **@ 5%, ***@ 1%.**

Cointegration technique

Cointegration technique has been widely acknowledged in empirical economics since their introduction over two decades ago. (Brooks, 2002).following Vera-Martin (1999),cointegration is the most appropriate technique to establish the behavior of economic time series for the following reasons; Cointegration solves the issue of whether to use the variables in their levels, or at first difference to estimate the result.
1. Cointegration brings together short and long run information in modelling the data through specification of an error correction model (ECM).
2. Cointegration solves the spurious regression associated with trending time series.
    Thus, cointegration arises out of the need to integrate short run dynamics with long run equilibrium between economic variables. Because attempting to achieve stationary when differencing will result in the loss of valuable information about the long run equilibrium relationship between the variables.
Thus, cointegration arises out of the need to integrate short run dynamics with long run equilibrium between economic variables. Because attempting to achieve stationary when differencing will result in the loss of valuable information about the long run equilibrium relationship between the variables. As reported in table three above that all the series are integrated of the order I (O), we can proceed to investigate about their long run relationship by conducting a cointegration test. The result is presented below in table four.

Table 4: The Johansen cointegration test.

Hypothesis No of CE(s) (Null)	Eigen-Value	Trace Statistic	Max-Eigen-value Test.	0.05% Critical Value	Remark
r = 0	0.805168	95.02634	47.43293	47.85613	Rejected
r<=1	0.740640	47.59341	39.13662	29.797	Rejected
r<=2	0.211808	8.456788	6.902383	15.490	Accepted

Source: Author's computation.Eview.7.

The result from both the Trace and the Maximum Eigenvalue test shows that there are two cointegration equations in the system. The summary of the cointegration test under alternative trend assumption in that the data reveals that the null of at most two cointegrating equations cannot be rejected. Thus there exist a long run relationship between the underground economy represented by the Latent variables and its determinant in the model. This position is further being reinforce by the results of the correlation matrix, and the ordinary least square as shown in the table below

Table 5: Correlation Matrixes.

	DUMMY	GDP	LV	UNEMP
DUMMY	1.000000	0.149408	0.377424	0.060365
GDP	0.149408	1.000000	0.565727	0.654681
LV	0.377424	0.565727	1.000000	0.442877
UNEMP	0.060365	0.654681	0.442877	1.000000

As evidenced from the table above, there exist a correlation between the underground economy represented by the latent variable (LV), and it determinants. For instance, there is a strong correlation between the latent variable (LV) and GDP of about 56%.,and 44% with unemployment, both are positive.

TABLE 6: OLS result of the model **.**

Variable	Coefficient	t-statistic	Prob -value	Remark
Intercept (C)	-946.0	-0.477	0.636	Not Significant
GDP	0.486	2.163	0.039**	Significant
UNEMP	3636.0	2.056	0.049**	Significant
DUMMY	179	0.756	0.456	Not Significient

Sourcs: Computation by the Author **5% level of significance
$R^2 = 0.42$; Adj $R^2 = 0.35$; DW $= 0.35$
Prob(F-Statistic)   0.0018

DISCUSSION

As indicated above, the ordinary least square (OLS) was employed using our underground economy proxy by Latent variable as our dependent variable, and the other determinant as regressors. The lesson to be derived from the result is that the overall performance of the variables is impressive as shown by the F-statistic, which is significant. However on the individual variable beginning with intercept, though not significant, but the sign satisfied our expectation, because it shows that underground economy can only exist when the identified determinants are at play, the negative sign shows that if our regressors sum-up to zero, the underground economy will be negative.

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The GDP variable is positively related to the dependent variable signifying that as the formal economy is booming, it also provided the breeding ground for the informal one to strive, not only that, the variable is also significant in explaining the variation in the dependent variable. Unemployment variable also satisfy our theoretical expectation, because the sign is positive indicating that the higher the rate of unemployment, the higher the existence of underground economy. The variable is statistically significant at 5% critical level. The Dummy variable is positive but not significant. The overall impact of the independent on the dependent variable shows that only 35% after adjusting to degree of freedom the variation in dependent variable can be explained by the independent variable. The weak result of our adjuster R-square is possible because of the nature and the paucity of the data adopted for the study.

Diagnostic test on the model
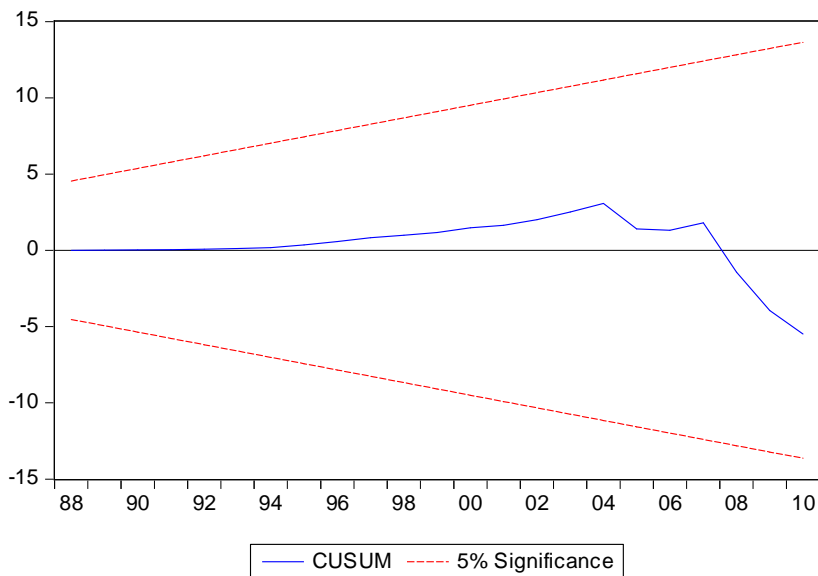
The CUSUM test was carried out on the model to see the stability of the model, as evidenced by the diagram above, the model is stable over time because the CUSUM line is within the bound at 5% level of significance.

SUMMARY AND CONCLUSION

This study examined underground economy in Nigeria with the aim of showing how the system aid in the under estimation and or over-estimation of the country's gross domestic product. The data adopted span from 1980-2010, and using Ancova technique,(i.e. incorporating both qualitative and quantitative data) in the analysis, the estimate of the parameters was obtained using the ordinary least square (OLS). In conclusion, since there are two segments of this type of economy-the evil, and the good side, and also noting that two-third of the earnings of this economy is spent on the formal economy, the good aspect of the economy be incorporated as formal system by re-enacting   and strengthening the basic institutions which include the various legal framework that would recognise their existence, so that it will serve as another avenue of contributing to the gross domestic product, particularly where the incidence of this type of economy is perceived to be endemic.

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