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# National Stock Exchanges (NSE) and National Economic Development: A vector autoregressive modelling approach with data from thirty (30) Sub-Saharan countries (2000-2013)

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**Abstract:** Using both Vector Auto Regression (VAR) and Pooled Least Squares Regression (PLSR) analysis, this paper demonstrated the contributions of a formidable National Stock Exchange (NSE) to national economic development, especially in war-affected and disaster-stricken economies in the Sub-Saharan Africa (SSA). A panel data for thirty (30) SSA economies (1981-2012), comprising of selected macroeconomic variables viz: “Gross Domestic Product (LY\_GDP), Economy-wide Stock Capitalization (LY\_CAPITA) and Economy-Wide Stock Monetization (LY\_MONET)” was used to resolve the question “Does a formidable NSE enhance national economic development?”. Whilst the VAR was used to demonstrated co-movement within the short and long-run dependence, the PLSR technique evaluated structural dynamics amongst the variables; Economy-Wide Stock Capitalization (LY\_CAPITA), Economy-wide Stock Monetization (LY\_MONET) and Economic Growth (LY\_GDP). The changes in GDP was proxied national economic development, whilst, the changes in Economy-Wide Stock Capitalization (LY\_CAPITA) and Economy-Wide Stock Monetization (LY\_MONET) surrogated NSE activities. Both the VAR and PLSR affirmed a positive relationship between economic growth (LY\_GDP) and the variables Nation-wide Market Capitalization (LY\_CAPITA) and Economy-Wide Stock Monetization (LY\_MONET). We therefore imply that, Nation-Wide Market Capitalization (LY\_CAPITA) and Economy-Wide Monetization (LY\_MONET) contributes to national economic development. Hence, we recommend that the “State” as the frontier pusher in any economy to initiate policies that would identify and promote investors’ base, strengthened regulations, and monitors NSEs development within these economies.

**Keywords:** National Exchange, Economy-Wide Stock Market Capitalization, Economy-Wide Monetization and National Economic Development, Pooled Least Squares Regression (PLSR) and Vector Auto Regression (VAR).

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## 1. Introduction

The cyclical nature and the destruction of wars, diseases and other natural disasters in many SSA economies had created a desperate need to search for alternative means for sustainable capital accumulation, particularly, in the domestic economy. This domestic capital will then be used to invest into projects, which could eventually contribute positively to the

post-disaster draw-downs on economic expansion and overall national economic development. A formidable NSE is proposed as one amongst the many national institutions that can very quickly, directly and/or indirectly, contribute to the quest to boast post-war national economic development in these economies. The 'State' in these war-turned economies

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<sup>1</sup> The "State" here implies the permanent nature of the country rather than Government, which comes and go - Government are transitory. This therefore stressed the need for permanent institutions in the state.

must assist in establishing (where they are non-existent) and/or promote (in cases, where they already existed<sup>1</sup>) a formidable NSE to create a sustained avenue for the accumulation of capital to support national economic development. NSEs in these economies would perform many important functions including the following:

- provide an effective mechanism for the transfer and reallocation of funds into investment purposes;
- facilitate companies' access to a large number of local and foreign investors;
- widening of the variety of financial instruments available to savers and investors; and sometimes, even Government;
- increase the diversity of payment system and means of compensation within the financial system;
- provide markets signals on current and future market trends in the entire financial sector;
- serve as a convenient conduit through which monetary and other important economic policy targets could be channeled in order to enhance macroeconomic stability and effective financial intermediation; and
- provide financial market data needed for policy analysis, decision making and bench-marking prices on existing domestic debt instruments with the domestic financial markets.

Over the last 40-50 year, nearly 20 African countries, most of which are in South of the Sahara (SSA) have experienced at least one episode of war and/or some form(s) of natural disasters. These episodes had reversed national economic development and ushered in hardship. Many literatures have been written about the effects of such wars and/ or disease stricken episodes on these economies without mentioning specific national institutions that would kick-start sustainable economic development from within. This paper discussed the contribution of a formidable NSE to the national economic development and expounded on the rationale for the "State" in these economies to establish and/or push the advancement of a formidable NSE in their development agenda. The rest of the paper is organized as follows: Section Two (II) discussed the problem and theoretical framework linking formidable NSE and national economic development. Section Three (III) explored the rationale on "Why" the state must take a proactive role in the establishment and/or development of a formidable NSE within its domestic economies. Section Four (IV) is empirical work, including econometric application, interpretation of results and Section Five (V) concludes and suggested few policy actions.

## 2. Statement of the Problem of the Paper

Today, countries in the SSA can boast of only twelve (12)

Stock Exchanges (SE)<sup>2</sup> operating either as a national entity or integrated with some regional or internationally acclaimed exchange. The Nigerian Stock Exchange is the oldest Exchange in the Sub-Region, established in 1960 with great support from the "State". Many others were established in the same-like manner, drawing huge financial and other support from the state. By the year 2013, many countries in the region had either proposed to establish a NSE or get affiliated to a regional or International Stock Exchange (ISE). In spite of this effort to grow national exchanges in these economies, their impacts are not heavily felt in the domestic financial system.

**Table 1.** Selected Exchanges in Sub-Saharan Africa, Years of Establishment and Total Listed companies as at mid June 2011

COUNTRY	Year(s) of establishment	No. of Listed Companies as at End June 2011
Ghana	1998	28
Sierra Leone	2007	1
Nigeria	1978	39
Kenya	1960	223
Botswana	1989	44
Malawi	1998	8
Gambia	1984	81
Mauritius	1992	40
Mozambique	1992	na
Namibia	1992	na
Swaziland	1990	10
Tunisia	1998	11
Uganda	1997	14
Zambia	1994	16
Cameroon	2001	2

Source: [http://devdata.worldbank.org/AAG/lbr\\_aag.pdf](http://devdata.worldbank.org/AAG/lbr_aag.pdf)\*WAMZ West African Monetary Zone

The number of registered companies with these exchanges is small and discouraging. The fact however, is that, NSEs are difficult to grow and develop without the state's explicit interventions, especially in war-battered and/or disaster grappled economies. NSEs need to be frog-leaped by the "State" and given its rightful position in the domestic financial system in the economy. Table 1 above showed the disappointing picture of Capitalization and/or Monetization of some of the NSEs relative to their years of establishment and operations in these economies. Apart from Kenya, none is yet able to register more than 100 companies ever since its inception.

### 2.1. Literature Review & Theoretical Framework

In theory, the link between NSEs and national economic development is indirect and sometimes difficult to explain. Aamir (2014) et.al and Fatemeh (2014) et.al in their various publications emphasized the important role of stock market activities on economic growth in India, Pakistan, Malaysia, Singapore and Iran respectively.

1. In certain cases, NSE exist but it is marred with serious bottlenecks that constraint its growth and effectiveness. The state must take a proactive step to grow and maintain NSEs activities in the domestic financial environment.

2. As at end December 2013, the Sub-Region can boast of only 12 notable National Stock Exchanges. Some of which are active whilst others are less active in the domestic economy

Singh (1977) argued that NSEs increases the quantity and quality of investment in the domestic economy. However, NSEs can boost savings and heightened the urge on business entities, individuals, private and public institutions to save and invest within the limit of their earnings. This indirectly boosts national economic development.

Levine and Zervos, 1998, argued that a formidable NSE within the economy can facilitate the emergence of a variety of financial instruments with varying investors' taste. In particular, formidable NSEs in poor and war/diseased-ravaged economies could represent a reliable and formal avenue for companies to raise capital at lower costs for the expansion of current and future investment. In this respect, formidable NSEs will complement the banking system, providing alternative financing sources necessary for small and/or large capital investment.

In general, a formidable NSE in war-turned economies generate and disseminate very reliable information and data to be used by existing business entities as well as "would be investors" at very low cost, thereby serving as a revealer of prices which is of great help in making timely business decisions. Formidable NSEs therefore reduces the costs of acquiring information and thereby positively affecting the profits of investors/brokers and overall investment turnover in the economy. Beincivenga and Smith, 1991 posted that NSEs in post-war economies ensures a constant flow of liquidity at

all times and, hence, provide the opportunity for initial investors to access savings easily, quickly and cheaply in an organized manner. This in effect, improves allocation of capital and enhancing prospect for long-term

### 3. Why Must the State Promote the Growth and Development of Formidable NSEs.

The classicalists envisage the evolution of a formidable NSE through a process that is lead by a group of wealthy and dedicated individuals and/or financial brokers or businesses interested in the development of a formidable NSE within the economy. However, the above logic implied two things:- firstly, such group of entrepreneurs must exist and, secondly, they must generate an unending interest in the operations of a formidable NSE. In the developed economies, such groups of investors emerged quickly and easily to operate an NSE with little or no support from the "State". In contrast, such group of entrepreneurs is not easily found in many of the SSA economies. This is because the macroeconomic conditions as well as the existing financial systems in these economies are underdeveloped. Hence, the envisaged classicalist logic of self-evolution of a formidable NSE cannot be realized without "State" intervention.

*Table 2. Macroeconomic Selected Comparison (WAMZ Area Year 2008).*

Macro-Variables (WAMZ AREA YEAR 2008)	S/Leone	Gambia	Guinea	Ghana	Nigeria	Senegal	Liberia	WAMZ Average
GDP Average Annual Growth	4.70	4.60	4.50	9.50	4.40	3.20	7.10	5.43
Gross Capital formation	1.00	14.60	13.20	13.30	0.00	3.50	0.00	9.12
Gross Capital formation/GDP	14.70	25.10	4.50	35.90	0.00	18.20	20.10	19.75
Gross Domestic Saving/GDP	1.00	6.20	10.20	2.90	0.00	7.70	-121.50	15.58
Gross National Saving/GDP	1.70	10.20	0.00	9.80	0.00	18.20	-126.80	17.38
Household Final Consumption Expenditure	8.30	0.00	3.60	9.90	0.00	82.30	202.30	61.28
General Government Consumption Expenditure	12.50	0.00	8.90	7.90	0.00	10.00	172.60	42.38

Source: [http://devdata.worldbank.org/AAG/Ibr\\_aag.pdf](http://devdata.worldbank.org/AAG/Ibr_aag.pdf)\*WAMZ West African Monetary Zone

Table 2 above outlined an appalling macroeconomic outlook within the WAMZ economies in the SSA region. Apart from Ghana and Nigeria, which has some encouraging macroeconomic prospects, all other WAMZ member countries displayed unfavourable macrocosmic environment when compared to other regions where NSEs have evolved and operated smoothly. In particular, post-war-affected economies like Sierra Leone, Liberia etc showed a comparably poor macroeconomic performance to support the classical logic of self-evolution of a formidable NSE within these economies. Hence, the "State" must be seen to promote the development of a formidable NSE mainly because of the two (2) main arguments:- Firstly, most post-war economies do not have wealthy-private and/or institutional business entities that are willing to autonomously promote the growth and development of formidable NSEs in the domestic economies. Even when they are available, they are constrained by the bitter experiences of war and other disasters on their profitability.

Secondly, the resources needed to support initial research and development activities of NSEs and other related activities are limited, given the weak level of financial market development in these economies. We therefore argue that the "State" must view NSE as a national institution that should support overall national development.

### 4. Econometric Application

To demonstrate that NSEs can be a very important source of national economic development in the Sub-Saharan African, we employed Vector Auto Regressive (VAR) and the Least Squares Pooled Multiple Regression Model to both long and short-term co-movement as well as dependence amongst Economic Growth, Nation-Wide Stock Exchange Capitalisation (LY\_CAPITA) and Monetisation (LY\_MONET).

**4.1. Data Collection and Description**

The data (panel data) for 30 Sub-Saharan countries were picked from both the International Finance Statistics (IFS) and World Development Indicators (WDI). National Stock Exchange activities were represented by Nation-Wide Capitalisation (Y\_CAPITA) and Monetisation (Y\_MONET) whilst, changes in the National economic Development was represented by Gross Domestic Product (LY\_GDP).

**4.2. The Vector Auto Regression Model (VAR)**

Empirically, the unstructured VAR was utilised in investigating both short and long-run relationship co-movement amongst the NSE proxies i.e. Nation-Wide Capitalization (LY\_CAPITA) and Economy-Wide Monetization (LY\_MONET) and Gross Domestic Product

The VAR of order P model can be schematically

$$\Delta LY\_GDP_t = \beta_0 + \beta_{1t} \Delta LY\_CAPITA_t + \beta_{2t} \Delta LY\_MONET_{2t} + \epsilon_t \tag{1}$$

A three-variable VAR model was adopted as shown below:

$$LY\_GDP_t = LY\_GDP_{t-1} + LY\_CAPITA_t + LY\_MONE_t \tag{2}$$

$$LY\_CAPITA_t = LY\_GDP_{t-1} + LY\_CAPITA_{t-1} + LY\_MONET_t \tag{3}$$

$$LY\_MONET_t = LY\_GDP_{t-1} + LY\_CAPITA_{t-1} + LY\_MONET_{t-1} \tag{4}$$

Where Y\_GDP is Gross Domestic Product  
 LY\_CAPITA is Nation-Wide Capital Formation  
 LY\_MONET is Economy-Wide Monetization  
 Assuming that errors are i(id), and apriori, we assumed

$$\beta_{ii} > 0, \beta_{it} > 0, \beta_{it} > 0$$

We further evaluate structural dynamics amongst these variables using Pooled Least Squares Modeling Techniques. We studied the panel data regression output with -No Intercept, Common Constant and Fixed Effects. The Pooled Multiple equation is expressed as:

The above multiple econometric regression representation postulates that a change in the growth of the Gross Domestic Product (LY\_GDP) is a function of the Nation-Wide Capitalization and Monetization. A-priori, we assumed a positive relationship between LY\_GDP and that of LY\_CAPITA and LY\_MONET.

**4.3. Empirical Results-Diagnosis and Interpretation**

We started empirically to address the question of stationarity and co integration. The Augmented Dickey Fuller (ADF) and the Johansson tests based on the maximum likelihood procedure was used to make our judgment. This was followed by several diagnostic tests before estimating of the VAR model and (P LSR) outputs. The Granger Causality test was utilized in order to determine if a particular variable predicted one another. The VAR output was analyzed mainly using impulse response function and variance decomposition.

The results and implication for each tests is outline below:

**4.4. Unit Root, Tests Co-integration, Granger Causality**

To examine the existence of stochastic non-stationary on the given series, the order of integration of individual time series were sought through the unit root test. Important results on the Unit Roots test are shown in the Panel A (Attached in the Appendix). The results showed that all of the variables are stationary at the level; except for the variable (LY\_MONET), which was stationery at first difference. We therefore differenced it once before applying the Ordinary Least Squares (OLS) modeling techniques and analysis going forward.

The summary of the Johansson test with all other criteria is shown in Panel B (Attached in Appendix). The results confirmed long-run relationship amongst the variables:- LY\_GDP and LY\_CAPITA, LY\_MONET.

The Granger Causality tests were done to examine whether the variables predicted each other. Table 3 below summarized the Granger-Causality results for the four variables. As the probability values associated with the F-statistics were zero, we therefore concluded that Stock Exchange Capitalization and Nation-Wide Monetization co-predicted GDP in the Sub-Region.

The reduced form VAR is shown in Panel C (Attached in Appendix). In all the instances, the long-run relationship between economic growths and the Nation-Wide Market Capitalization (LY\_CAPITA) and Monetization (LY\_MONET) are significant.

Judging from the coefficients of both the current and lagged Stock Market and the national economic development variables showed some level of positive correlation amongst the variables under consideration.

Further, all of the variables proved significant against our 95% level of confidence. The high R<sup>2</sup> (93.52 %) in the Recursive form was indicative good fit in the VAR methodology as oppose to the panel modeling with lower R<sup>2</sup>( less than 40 % in all the cases ).

*Table 3. Pair wise Granger Causality Tests. Null*

Hypothesis	Obs	F-Statistic	Probability
LY_CAPITA does not Granger Cause LY_GDP	718	0.3329	0.8559
LY_GDP does not Granger Cause LY_CAPITA		0.8874	0.4710
			0.47098
LY_MONET does not Granger Cause LY_GDP	723	0.3492	0.8446
LY_GDP does not Granger Cause LY_MONET		0.0954	0.9839
		0.0954	0.9902
LY_MONET does not Granger Cause LY_CAPITA	726	0.0734	0.9902
LY_CAPITA does not Granger Cause LY_MONET		0.8700	0.4815

Source: Authors using Eviews 3.1, student's version

#### 4.5. The Impulse Response Function (IRF) and VDCF

The impulse response function is shown in Panel D (Attached in Appendix). The long-term co-movement amongst co-integrated variables in a VAR is captured through its impulse responses. This implicitly tells us what happens to a particular variable when the error changes by one unit while other variables are held constant.

The first-row showed the effect of an unexpected one-percentage point increase in LY\_GDP on all three variables. The second row depicts the effect of an unexpected one-percentage point rise in market Capitalization (LY\_CAPITA) on the all the three other variables. Finally, the third row gave the same, in respect of the Nation-Wide Monetization (LY\_MONET) with the other two variables. We can see clearly that all of the variables are co-integrated and at most, any disturbances will return to zero at least after the 5<sup>th</sup> period. This is indicative of strong causal relationship and /or co-movement within these variables in the long-run. We can therefore conclude that, there is enormous evidence in support of our hypothesis that the stock market operative variables:- (LY\_CAPITA) and (LY\_MONET) are positively related with national economic development variable (LY\_GDP) within these economies.

The variance proportions the errors of prediction of each variable due to each of the of the system disturbances during 10 periods. It reveals the forecast error in each variable that can be attributed to innovations in other variables over the years in 10 periods. The forecast error variances of all the variables in the system are all due to their own innovations.

The variance decomposition of LY\_GDP indicates that over 50% of the innovation of LY\_DGP is due to its own shocks in the last year or the 1st 5 years.

The PLSR regression outputs for the three (3) instances shown in Panel E (Attached in Appendix) showed that changes in the economic growth is positively related to higher changes in the Nation-Wide Capitalization (LY\_CAPITA) and Nation-Wide Monetization (LY\_MONET) in these regions. In terms of significance, all of the variables showed evidenced of significance within a confidence interval of 5% in our analysis. Although the R<sup>2</sup> is low (slightly over 30 per cent), we have confidence in the robustness and stability of our models. We therefore concluded that our hypothesis that activities generated by a formidable National Stock Exchange (NSE) in these economy will pull up overall economic growth.

## 5. Conclusions and Recommendations

The contributions of NSE to national economic development (LY\_GDP) have been discussed for far too long in the academic debate, without empirical evidence, particularly for post-war and disaster affected SSA economies. The findings in this paper chronicled Nation-Wide

Capitalisation (LY\_CAPITA) and Monetisation (LY\_MONET) to have a positive effect on Gross Domestic Product (LY\_GDP) and, thus, giving credence to much of the literature and discuss in support of NSEs's positive contribution to national development. Hence, the evolution and development of such institution must be given an exceptional 'need status' by the state in its development aspirations. The state must commit some reasonable financial resources to frog-leap the initial activities that would facilitate the growth and development of a formidable NSE in these economies. Few areas of policy intervention by the state are a part of the conclusion of the article. In general, the state should establish a unit/body to specifically carry out the following activities;

#### (I). Identify Institutional Investors

In most of these economies, the institutional investors base are quiet small and inactive. As such, most of these economies lack committed institutional investors that are willing and/or are able to undertake investment ventures to kick start NSEs. Government's involvement in the above direction will push market satisfaction and help smooth the yield curve into a much more satisfactory.

#### (ii). Strengthen Regulation and Surveillance

Regulation and Supervision of the financial system plays a great role in determining both stability and quality of services provided by the NSE within the economy. Government must be seen involved in making regulation and supervision strategies aimed at protecting investors from potential opportunistic behaviour of insiders within and/or outside the financial System. This will bring assurances to would-be investors' terms of confidence and protection.

#### (iii). Encourage Foreign Direct Participation

The state has to be in the front in making the environment ripe for private capital flows through encouraging foreign direct investment, remittances and portfolio investment. These are necessary criteria that would make a formidable NSE within these economies. Many analysts, including Asiedu (2006) had emphasised the need for most African countries to do more to attract capital flows especially portfolio flows. Thus the state must promote capital flows and foreign investor's participation big time.

#### (iv). Build a Sustained Educational Outreach Program on the NSE's activities on the economy.

The state must initiate the promotion and sustenance of information and outreach program for the operations of the NSE at the very start of its inception. This will provide public knowledge about the functioning of the NSEs in the domestic market and thereby, promoting its development and thereby contribute to national development directly or indirectly. Regular and intensive discussion programs on what goes on in the NSE will go a long way to educating the public about the role of the NSE within the capital market architecture of the country.

## Appendix A

### Augmented Dicky Fular & Philip Perron Test On The Variables *Ly\_Gdp*, *Ly\_Capita*, *Ly\_Monet*

Augmented Dicky Fular Unit Root Test on (LY_GDP) Test at Level and Intercept				Philip Perron Unit Root Test on (LY_GDP) Test at Level and Intercept			
ADF Test Statistic	-4.17844	1% Critical Value*	-3.4420	PP Test Statistic	-3.963147	1% Critical Value*	-3.4419
		5% Critical Value	-2.8659			5% Critical Value	-2.8659
		10% Critical Value	-2.5691			10% Critical Value	-2.5691
Augmented Dicky Fular Unit Root Test on (LY_GDP) Test at 1st Difference and Intercept				Philip Perron Unit Root Test on (LY_GDP) Test at 1st Difference and Intercept			
ADF Test Statistic	-13.46581	1% Critical Value*	-3.4420	PP Test Statistic	-26.9272	1% Critical Value*	-3.4419
		5% Critical Value	-2.8659			5% Critical Value	-2.8659
		10% Critical Value	-2.5691			10% Critical Value	-2.5691
Augmented Dicky Fular Unit Root Test on (LY_CAPITA) Test at Level and Intercept				Philip Perron Unit Root Test on (LY_GDP) Test at Level and Intercept			
ADF Test Statistic	-5.916391	1% Critical Value*	-3.4419	PP Test Statistic	-6.314542	1% Critical Value*	-3.4418
		5% Critical Value	-2.8659			5% Critical Value	-2.8659
		10% Critical Value	-2.5691			10% Critical Value	-2.5691
Augmented Dicky Fular Unit Root Test on (LY_CAPITA) Test at 1st Difference and Intercept				Philip Perron Unit Root Test on (LY_GDP) Test at 1st Difference and Intercept			
ADF Test Statistic	-13.7060	1% Critical Value*	-3.4420	PP Test Statistic	-28.81075	1% Critical Value*	-3.4419
		5% Critical Value	-2.8659			5% Critical Value	-2.8659
		10% Critical Value	-2.5691			10% Critical Value	-2.5691
Augmented Dicky Fular Unit Root Test on (LY_MONET) Test at Level and Intercept				Philip Perron Unit Root Test on (LY_GDP) Test at 1st Difference and Intercept			
ADF Test Statistic	-3.146996	1% Critical Value*	-3.4419	PP Test Statistic	-3.226444	1% Critical Value*	-3.4418
		5% Critical Value	-2.8659			5% Critical Value	-2.8658
		10% Critical Value	-2.5691			10% Critical Value	-2.5691
Augmented Dicky Fular Unit Root Test on (LY_MONET) Test at 1st Difference and Intercept				Philip Perron Unit Root Test on (LY_) MONET at 1st Difference and Intercept			
ADF Test Statistic	-11.80645	1% Critical Value*	-3.4419	PP Test Statistic	-27.15741	1% Critical Value*	-3.4418
		5% Critical Value	-2.8659			5% Critical Value	-2.8659
		10% Critical Value	-2.5691			10% Critical Value	-2.5691

Source: Authors' using Eviews 3.1, Student's version

## Panel B

### Johanson Test: Summary

Data Trend	None	None	Linear	Linear	Quadratic
Rank or	No Intercept	Intercept	Intercept	Intercept	Intercept
No. of Ccs	No Trend	No Trend	No Trend	Trend	Trend
Log Likelihood by Model and Rank					
0	-2487.2160	-2487.2160	-2487.216	-2487.216	-2487.134
1	-2465.0830	-2462.7170	-2462.699	-2462.699	-2462.637
2	-2456.9610	-2453.076	-2453.072	-2449.83	-2449.815
3	-2456.8340	2447.051	2447.051	-2443.623	-2443.623
Akaike Information Criteria by Model and Rank					

Data Trend	None	None	Linear	Linear	Quadratic
0	7.0579	7.0579	7.0663	7.0663	7.0745
1	7.0128	7.0090	7.0145	7.0173	7.0228
2	7.0069	7.0016	7.0044	7.0009	7.0037
3	7.0233	7.0043	7.0043	7.0031	7.0031
Schwarz Criteria by Model and Rank					
0	7.2882	7.2882	7.3157	7.3157	7.3431
1	7.2814	7.2840	7.3023	7.3115	7.3297
2	7.3138	7.3214	7.3305	7.3398	7.349
3	7.3686	7.3688	7.3688	7.3868	7.3868
L.R. Test	Rank =2	Rank=3	Rank=3	Rank=3	Rank=3

Date: 10/24/10

Time: 20:28

Sample: 1 735 Included observation: 715

Series: LY\_GDP LY\_CAPITA LY\_MONET

Lags interval: 1 to 4

Source: Authors' using Eviews 3.1, student's version

## Panel C

### Recursive Var

VARIABLE(S)	LY_GDP	LY_CAPITA	LY_MONET
LY_GDP (-1)	0.9587 -0.0374 -25.6084	0.0000 0.0000 -4.9579	0.0000 0.0000 -1.6159
LY_GDP(-2)	-0.0172 -0.0373 (-0.46196)	0.0000 0.0000 (-4.96871)	0.0000 0.0000 (-1.47273)
LY_CAPITA (-1)	-0.4807 -0.0582 (-8.25737)	0.0000 0.0000 (-4.41535)	0.0000 0.0000 (-5.41901)
LY_CAPITA (-2)	0.0254 -0.0459 -0.5544	0.0000 0.0000 -3.6454	0.0000 0.0000 -4.2109
LY_MONET (-1)	0.7596 -0.1624 (-4.67873)	0.0000 0.0000 (-25.2422)	0.0000 0.0000 (-23.1058)
LY_MONET (-2)	0.0199 -0.1178 (-0.16858)	0.0000 0.0000 -12.2731	0.0000 0.0000 -8.3479
C	-0.0727 -0.3113 (-0.23346)	0.0000 0.0000 -0.3746	0.0000 0.0000 (-1.55859)
LY_CAPITA	0.5413 -0.0412 -13.1422	1.0000 0.0000 -8.7E+14	0.0000 0.0000 -2.7855
LY_MONET	0.7956 -0.1139 -6.9850	0.0000 0.0000 -23.0669	1.0000 0.0000 -3.8000E+14
R-squared	0.9352	1.0000	1.0000
Adj. R-squared	0.9345	1.0000	1.0000
Sum sq. resids	923.9761	0.0000	0.0000
S.E. equation	1.1368	0.0000	0.0000
F-statistic	1290.111	4.8700E+29	3.0500E+29
Log likelihood	-1115.601		
Akaike AIC	3.1066		
Schwarz SC	3.1636		
Mean dependent	12.1181	7.3497	9.7250
S.D. dependent	4.4413	2.3196	1.5195
Determinant Residual Covariance		0.0000	
Log likelihood		42993.19	
Akaike Information Criteria		-118.6911	
Schwarz Criteria		-118.5202	

Date: 10/24/14 Time: 20:47

Sample (adjusted): 3 735

Included observations: 724

Excluded observations: 9 after adjusting endpoints

Excluded observations: 9 after adjusting endpoints

Standard errors &amp; t-statistics in parentheses

## Panel D

### Variance Decomposition of Variables:-Tabular Representation Variance Decomposition of LY\_GDP:

Period	S.E.	LY_GDP	LY_CAPITA	LY_MONET
1	1.1297	100.0000	0.0000	0.0000
2	1.5650	100.0000	0.0000	0.0000
3	1.8675	100.0000	0.0000	0.0000
4	2.0990	100.0000	0.0000	0.0000
5	2.2843	100.0000	0.0000	0.0000
6	2.4364	100.0000	0.0000	0.0000
7	2.5635	100.0000	0.0000	0.0000
8	2.6708	100.0000	0.0000	0.0000
9	2.7623	100.0000	0.0000	0.0000
10	2.8407	100.0000	0.0000	0.0000
Variance Decomposition of LY_CAPITA:				
Period	S.E.	LY_GDP	LY_CAPITA	LY_MONET
1	0.0000	0.0000	100.0000	0.0000
2	0.0000	3.3306	96.6694	0.0000
3	0.0000	3.3354	96.6646	0.0000
4	0.0000	3.3448	96.6552	0.0000
5	0.0000	3.3533	96.6468	0.0000
6	0.0000	3.3607	96.6393	0.0000
7	0.0000	3.3673	96.6327	0.0000
8	0.0000	3.3732	96.6268	0.0000
9	0.0000	3.3783	96.6217	0.0000
10	0.0000	3.3829	96.6171	0.0000
Variance Decomposition of LY_MONET:				
Period	S.E.	LY_GDP	LY_CAPITA	LY_MONET
1	0.0000	0.0002	93.7889	6.2109
2	0.0000	0.3649	93.4469	6.1883
3	0.0000	0.3658	93.4459	6.1882
4	0.0000	0.3662	93.4456	6.1882
5	0.0000	0.3666	93.4453	6.1882
6	0.0000	0.3669	93.4450	6.1881
7	0.0000	0.3671	93.4448	6.1881
8	0.0000	0.3673	93.4445	6.1881
9	0.0000	0.3676	93.4443	6.1881
10	0.0000	0.3677	93.4442	6.1881

Ordering: LY\_GDP LY\_CAPITA LY\_MONET  
Source: Authors' using Eviews 3.1' student's version

## Panel E

Pooled Least's Squares Regression Outputs-No Intercept				
Variables	Coefficient	Std. Error	t-statistic	Prob.
LY_CAPITA (1)	0.4567	0.0546	8.3694	0.0000
D (LY_MONET)	0.1649	0.2040	0.8084	0.4189
LY_CAPITA (1)	0.6445	0.0553	11.6482	0.0000
LY_MONET(1)	0.4205	0.0243	17.2979	0.0000
R-squared	0.3788	Mean dependent var		12.1691
Adjusted R-squared	0.3780	S.D. dependent var		4.5158
S.E. of regression	3.5615	Sum squared resid		27689.2500
F-statistic	443.8119	Durbin-Watson stat		0.1919
Prob (F-statistic)	0.0000			
Pooled Regression Outputs - Fixed Effects				
Variables	Coefficient	Std. Error	t-statistic	Prob.
C	-2.1746	0.5279	-4.1192	0.0000
LY_CAPITA (1)	0.4941	0.0551	8.9637	0.0000
D (LY_MONET)	0.0587	0.2049	0.2865	0.7746
LY_CAPITA (-1)	0.6679	0.0554	12.0516	0.0000
LY_MONET(1)	0.5928	0.0483	12.2637	0.0000
R-squared	0.3836	Mean dependent var		
Adjusted R-squared	0.3825	S.D. dependent var		
S.E. of regression	3.5485	Sum squared resid		

Pooled Least's Squares Regression Outputs-No Intercept				
Variables	Coefficient	Std. Error	t-statistic	Prob.
F-statistic	339.5356	Durbin-Watson stat		
Prob (F-statistic)	0.0000			
Pooled Regression Ourput-Random Effects				
Variables	Coefficient	Std. Error	t-statistic	Prob.
LY_CAPITA (1)	0.4941	0.0552	8.9596	0.0000
D (LY_MONET)	0.0587	0.2050	0.2863	0.7747
LY_CAPITA (-1)	0.6679	0.0554	12.0461	0.0000
LY_MONET(1)	0.5928	0.0484	12.2581	0.0000
Fixed Effects				
LY_GDP--C	-2.1746			
LY_CAPITA--C	-2.1746			
LY_MONET--C	-2.1746			
R-squared	0.3836	Mean dependent var		12.1691
Adjusted R-squared	0.3819	S.D. dependent var		4.515766
S.E. of regression	3.550138	Sum squared resid		27475.59
F-statistic	452.2991	Durbin-Watson stat		0.2024
Prob (F-statistic)	0.0000			

Dependent Variable: LY\_GDP

Method: Pooled Least Squares

Date: 10/24/10 Time: 21:34

Sample (adjusted): 2 734

Included observations: 729 after adjusting endpoints

Total panel (balanced) observations 2187

Source: Authors' using Eviews 3.1, student's version

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