ESTIMATION OF TRADE ELASTICITIES IN NIGERIA: A TEST OF MARSHALL–LERNER CONDITION (1981–2010).

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ABSTRACT

This paper attempted testing whether the Marshall-Lerner condition (MLC) holds for Nigeria's bilateral trade with West African monetary zone countries. The two stage Least squares (2SLS) was adopted on annual time series data from 1981-2010. An econometric technique of co integration was used to establish the long-run behavior of the variables. The Augmented Dickey Fuller (ADF) test statistics was also applied to test for unit root. The result obtained shows that there is a long-run relationship between import, export, the dependent variables and exchange rate, the independent variables. The empirical result from the 2SLS shows that Sierra-Leone and The Gambia satisfied the M-L condition while Ghana did not. The research therefore recommends for a policy mix that will strengthen domestic and foreign income in external sector management. While devaluation of the naira be done with respect to countries that meet the M-L condition. This further suggests that income particularly those that did not meet the M-L Condition in order to improve trade balance. This is because increase in foreign countries income can also lead to improvement in Nigeria's trade balance by increase in imports from Nigeria, provided imports exhibit an inelastic demand.

Key Words: Trade, Elasticities, Exchange rate, Marshall Lerner Condition (MLC).

JEL Classification: F13, F31, F41, F51.

I INTRODUCTION

Economies the world over have become increasingly interdependent. While closer ties among nations have been partly driven by the rise in the movement of labor, services and capital-with the latter amid barriers to complete mobility-across national borders, it is trade in goods that is arguably at the core of economic relations among independent states (Bahmani-Oskooee and Brooks, 1999). The potential gains from commodity exchange have been well documented in the classic theories of international trade which emphasize, among other things, the benefits that accrue from comparative advantage and specialization (Krugman and Obstfeld, 2001).

Concerted efforts by nations at establishing both bilateral trade links and subsequent formation of regional trading blocs, such as North American Free Trade Agreement (NAFTA), Southern Common Market(MERCOSUR), Southern African Development Council (SADC), Gulf Co-operation Council of the Arab States (GCC) among others, are the upshot of this widely held view on the gains from trade. In Africa, the West African Monetary Zone (WAMZ) was formally launched in December 2000 with the key objective of promoting trade among The Gambia, Ghana, Guinea, Nigeria and Sierra Leone. However, considerable challenges arise especially in terms of macroeconomic policy stance within countries and the requisite coordination across them. For instance, the influence of

policymakers on the exchange rate may stir their interest towards gaining deeper insight into how the deployment of that influence would affect external sector aggregates in particular the trade balance (Himarios, 1985; Gupta-Kapoor and Ramakrishnan, 1999; Lal and Lowinger, 2001).

The Nigerian economy has experienced substantial structural changes since the country gained independence in 1960. The country has been battling with series of economic problems, most of which have defied conventional solutions. Evidence shows that there was rapid trade imbalance (deficit) in the federal government current account. The economy's high import dependence on raw materials and finished goods worsened the situation which marked the genesis of economic crisis in Nigeria. As a result of this, the government set up the National Economic Council (NEC) in 1983. The expert report on the state of the nation was that there was the necessity to restructure the economic base and system in Nigerian economy. Some of the problems are to correct external imbalance, domestic inflation, unemployment and the anomalous import content of the productive as well as the consumption activities given the low export content of the nation (Ogba, 2011).

The growing inability of the government to meet the payments for current import, capital and interest on short term loans necessitated a dialogue between the country and International Monetary Fund (IMF) for a support loan. Meanwhile, an adjustment policy through fiscal and monetary measures were adopted to check external imbalance, internal and external indebtedness and the problem of inflation. The worsening economic condition prompted the government to introduce Economic Stabilization Act in 1982 with minimal involvement of non-governmental institutions. The Act

comprised of a package of stringent policies and measures of demand management aimed at rationalizing overall expenditure pattern in order to restore fiscal balance within the domestic economy and the external sector. These include tightening of import controls, the imposition of exchange restrictions on current international transactions, substantial increase in custom tariffs, introduction of an advance import deposit scheme, and ceilings on total central bank foreign exchange disbursements. The government sought to reinforce the 1982 austerity measures by further tightening financial policies and introducing more administrative controls such as counter trade. This was aimed at reviving the economy through the provision of raw materials that were needed in industries, stopping further closure of industries, assisting in reducing the unemployment problems and minimize inflation Ogba (2011).

However, the continued inability of the government to finance external trade due to the continued worsening of the oil market coupled with the insistence of external creditors for payments to be effected on all transactions forced the country to go back to the world bank for assistance after rejecting the IMF loan. However, like the IMF, the World Bank loan was accompanied with its own requirements. The World Bank condition was as usual broadly stated in terms of its Structural Adjustment Programme (SAP) for the recipient country. The content of certain governmental parastatals and corporations, trade liberalization, reduction in government expenditure, removal of commodity price subsidization as well as allowing the market forces of demand and supply to determine the rate at which the naira is exchanged with other foreign currencies. This was hoped, would lead to a determination of the realistic value of the naira vis-à-vis foreign currencies and, in addition, ensure a more

optimal use of and allocation of foreign exchange to the various sectors of the economy that could be achieved through the import licensing policy. The policy of a market determined exchange rate for the naira was to improve the external imbalance by curtailing imports, boosting exports and enhance the inflow of foreign capital investment. The problem of external sector include the following among others: oil is the main source of government revenue, any fluctuations in oil revenue will inevitably be reflected in fluctuations in government revenue. The main problem of this research is the identification of the trade balance in Nigeria, and focus on the elasticity of demand of import and export.

II LITERATURE REVIEW

The general consensus in the international finance is that movements in the exchange rate have direct impacts on trade balance in the long-run. Specifically, evidence suggests that competitive currency devaluation leads to improvement of trade balance in the long- run.

There exist vast theoretical and empirical studies on developed economies on how the trade balance responds to adjustment in exchange rate (Rosenweiig and Knock; 1998, Rose and Yellen, 1989; Kim, 2001; Bahmani-Oskooee and Ratha, 2004). Also studies on developing countries to this effect have proliferated considerably (Bhmani-Oskooee, 1985; Upadhyaya and Dhakal, 1997; Senhadji, 1998; Rawlins and Praveen, 2000; Sinah, 2002; Musila and Newark, 2003; Naraya and Naraya, 2004 and Agbola, 2004).

The Elasticity Approach

This approach credited to Robinson (1947) and Meltzler (1948) and popularized by Kreuger (1983) posits that transactions under contract completed at the time of devaluation or depreciation may dominate a short-run change in trade balance causing it to deteriorate in the short-term. But in the long-run (as elasticity of exports and imports rise, the adjustment in export (increase) and import (fall) quantities may cause the demand for import to fall after substantial lags and subsequently results in an improvement in the trade balance of the country devaluing its currency-the J-curve effect. Empirical evidence on J-curve hypothesis is mixed. In this regard, this work will not venture into investigating and testing for the existence of J-Curve relationship in Nigeria, but however, will estimate the long-run effect of exchange rate depreciation on the country's balance of trade. Another aspect of the elasticity approach to exchange rate-trade balance relationship is the Marshall-Lerner (ML) condition, which this work is based on (Marshall, 1923; Lerner, 1944), cited by Ogbonna (2009). The theory that a devaluation of a domestic currency will improve current account balance is founded on a number of elasticity approach models, the most popular of which is the Marshall-Lerner condition. The condition states that for a country's balance of trade to benefit from a currency devaluation or depreciation, the summation of the price elasticities of imports and exports of the country devaluing its currency should be greater than unity. The model is:

ηxe + ηme > 1. ……..……...*1*

where: ηxe = elasticity of export . ηme = elasticity of import

If it is equal to unity, the balance of payments remains stable, if it is less than unity the balance of payments worsens, but if it is in excess of unity, the trade balance improves. The theory states that when a country devalues its currency, the domestic prices of its imports are raised and the foreign prices of its exports are reduced. These will work to reduce the domestic demand for imports and increase the external demand for the domestic exports to improve the trade balance. Empirical evidence shows that Marshall-Lerner condition is satisfied in majority of advanced economies, but it is a general consensus among economists that both demand and supply elasticity will be greater in the long-run than in the short-run.

III METHODOLOGY

This section is preoccupied with the methodology, formulation of models to capture the relationship between bilateral trade (import and export) and exchange rate. The elasticity model is tested to ascertain the validity of the M-L condition in Nigeria's bilateral trade with WAMZ countries (Riti, 2012)

The Marshall-Lerner Condition

The Marshall–Lerner condition has been cited as a technical reason why a reduction in value of a nation's currency need not immediately improve its balance of payments. The condition states that, for a currency devaluation to have a positive impact on trade balance, the sum of price elasticity of exports and imports (in absolute value) must be greater than 1.

As a devaluation of the exchange rate means a reduction in the price of exports, quantity demanded for these will increase. At the same time, price of imports will rise and their quantity demanded will

diminish. The net effect on the trade balance will depend on price elasticities. If goods exported are price elastic their quantity demanded will increase proportionately more than the decrease in price, and total export revenue will increase. Similarly, if goods imported are elastic, total import expenditure will decrease. Both will improve the trade balance.

Empirically, it has been found that goods tend to be inelastic in the short term, as it takes time to change consumption pattern. Thus, the Marshall–Lerner condition is not met, and a devaluation is likely to worsen the trade balance initially. In the long term, consumers will adjust to the new prices, and trade balance will improve.

Mathematical Derivation

Here, *e* is defined as the price of one unit of foreign currency in terms of the domestic currency. Using this definition, the trade balance denominated in domestic currency, with domestic and foreign prices normalized to one, is given by:

$Nx = X - eM$ ……...*2*

where X denotes exports, and M imports.

Differentiating with respect to e gives:

$$\frac{\partial Nx}{\partial e} = \frac{\partial x}{\partial e} - e\frac{\partial m}{\partial e} - m$$ ……3

Dividing through by X:

$$\frac{\partial Nx}{\partial e}\frac{1}{x} =$$

$$\frac{\partial x}{\partial e}\frac{1}{x} - \frac{e}{x}\frac{\partial m}{\partial e} - \frac{m}{x}$$……4

At equilibrium, $X = eM$. ……5

Therefore:

$$\frac{\partial Nx}{\partial e}\frac{1}{x} = \frac{\partial x}{\partial e}\frac{1}{x} - \frac{1}{m}\frac{\partial m}{\partial e} - \frac{m}{x} = 0 \quad \ldots\ldots 6$$

Multiplying through by e:

$$\frac{\partial Nx}{\partial e}\frac{e}{x} = \frac{\partial x}{\partial e}\frac{e}{x} - \frac{\partial m}{\partial e}\frac{e}{m} - 1 = 0 \quad \ldots\ldots 7$$

Since X = eM, eM/X becomes 1 from equation (1).

Which can be expressed as $\frac{\partial Nx}{\partial x}\frac{e}{x} = Лxe - Лme - 1 = 0$ ……..8

where η_{Xe} and η_{Me} are common notation for the elasticity of exports and imports with respect to the exchange rate respectively.

In order for a fall in the relative value of a country's currency (i.e. a rise in e using the above definition) to have a positive effect on that country's trade balance, the left hand side of the equation must be positive (i.e. for a rise in e to cause a rise in N_x)

Therefore:

ЛXe – Лme – 1 > 0 ……9

This can be written as:

ЛXe + IЛMeI > 1……..10

Equation (10) states that the sum of export and import in absolute terms should sum up to greater than unity.

TRADE MODEL

In order to test the Marshall-Lerner condition there is need to estimate the import and export demand-price elasticities. This requires specifying and estimating the demand equations. The choice of two models according to Goldstein and Khan (1985) may be competing or complementary models depending upon the focus of the research.

The demand equations for trade disaggregated on a bilateral basis are given below:

$M_i=f(Y_{NIG},REX_i)$……11

$X_i=f(Y_i,REX_i)$……12

Where:

Y_{NIG} is GDP for Nigeria

Y_i is GDP for the foreign country i; and

REXi is the real bilateral exchange rate measured as country is currency unit per naira.

M_i is real Nigerian imports from country i and

X_i is real Nigeria exports to country i.

The log linear representation of the import demand equation is as follows:

$LM_{i,t}= \alpha + \beta LY_{NIG} + \lambda LEXR_{i,t} + U_{i,t}$……13

It is expected that a real depreciation of the naira (i.e. a decline in $LEXR_i$ will cause a decrease in imports), therefore, $\lambda > 0$. Also, it is expected that the income elasticity, β, to be positive, implying an increase in Nigerian income increases Nigeria's imports. The export demand equation can be modeled in a similar fashion as follows:

$LX_{i,t} = \alpha_1 + \beta_1 LY_i + \lambda_1 LEXR_{i,t} + \varepsilon_{i,t}$……14

Here, it is expected that a real depreciation of the naira, LREXi decreasing, would cause an increase in exports; therefore, the price elasticity, $\lambda_1 < 0$. The income elasticity, β_I, should be positive implying an increase in foreign income increases foreign demand for Nigeria exports.

The M-L condition is applied to estimates import and export price elasticities. Specifically, the import price elasticity plus the

export price elasticity should sum to greater than unity (1). If this condition is met, depreciation will lead to an improvement in the trade balance in the long-run.

The complete macroeconomic models on bilateral basis to be adopted in this research are:

$$LM_{i,t} = \alpha + \beta LY_{NIGi,t} + \lambda LREX_{i,t} + U_t \quad \ldots\ldots 15$$

$$LX_{i,t} = \alpha_1 + \beta_1 LY_i + \lambda_1 LREX_{i,t} + \varepsilon_t \quad \ldots\ldots 16$$

3.3 ECONOMETRIC TESTS

3.3.1 Unit Root Test

Since the data for the analysis are time series data, there is the need for the data to undergo a unit root test. This is to ascertain the stationary of the data to avoid a spurious regression model. The Augmented Dickey Fuller (ADF) is applied and the result is shown below:

The ADF in tables 1.0 shows that most of the variables are integrated of order one [I(1)]. This is to say that most of the variables are individually non-stationary. However, a linear combination of the data is stationary. The ADF test-statistic in appendix ascertained to that.

3.3.2 Co integration

Since the data is subjected to unit root analysis and found that it is stationary, that is, it is I(0), then it implies that although they are individually I(1), that is, they have stochastic trends, their linear combination is I(0). In this case, the variables are co integrated. Two or more variables are co integrated if they have a long-term, or equilibrium terms (Gujarati and Sangeetha, 2007). A regression such as equation (15) and (16) are known as co integrating regression and

the slope parametersβ, β_1, λ, λ_1 are known as the co integrating parameters.

The results of the co integration indicate that all the models of import and export have one or more co integrating equation at 5% level of significance with the assumption of linear deterministic trend in the data except Ghana which has three co integrating equations at 5% significant level with the assumption of deterministic trend in the data. This is shown by the value of the co integrating likelihood ratio (LR) compared with 5% critical values (C.V). Hence, the variables are co integrated. See appendix.

3.3.3 Granger-Causality Test

The causal direction between the trade balance (import and export) and exchange rate is one of the main focus of our empirical investigation. Generally, the Granger causality test helps to determine the direction of causality between the variables. It is important to point out here that temporal precedence does not imply a cause and effect relationship, but establishing the order of the temporal procedure which can be very useful to understanding the nature of the relationship between trade balance, exchange rate and policy recommendations. The result of Granger-Causality test is given in the appendix.

The result of the granger causality test shows that most of the variables granger cause each other . The implication of this is that there could be bias in the estimation and the Ordinary Least Squares (OLS) gives inconsistent and biased estimates. However, the instrumental variable (IV) method or the Two Stage Least Squares

(2SLS) econometric technique is applied to minimize the error inherent in estimation (Koutsoyiannis, 1977).

Table 1 .0: Two Stage Least Squares Estimates of the ML-Condition

Country	**(ЛМе + ЛХе > 1) ML-Condition**
Ghana	0.08 + 0.36 = 0.44
Sierra-Leone	1.05 + 1.02 = 2.07*
The Gambia	1.87 + 1.07 = 2.94*

Note: *The asterisk indicates that the ML-Condition is met because the sum of the import and export demand elasticities is greater than unity*.

Table 1.0 above summarized the ML-Condition for Ghana, Sierra-Leone and the Gambia. Sierra-Leone and the Gambia satisfied the ML-condition with the sum of elasticities of 2.07, and 2.94 respectively. Ghana however, did not satisfy the ML-Condition with the sum of its elasticities 0.44. See appendix for the regression results.

All the constant values (intercepts) of imports of the different models are positive and statistically significant using both the standard error test and the T-statistic test at 5% level of significance. This is shown by low standard errors and high T-statistics. While the constant values (intercepts) of exports of the different models are statistically insignificant using both the standard error test and the T-statistic test at the 5% significant level. This is shown by the values of the standard errors greater than half of the parameter estimates.

The coefficients of LNigGDP arising from Nigeria's import show that they have inappropriate signs (negative) and are

statistically insignificant. This is shown by the values of their standard errors of the parameters greater than the half the values of their parameter estimates and low T-statistics.

The coefficients of other WAMZ's LGDPi arising from Nigeria's exports show that they all have the appropriate signs and are statistically significant. A 100% change in Ghana's income or GDP will lead to a 120% change in Nigeria's export in the positive direction. While a100% change in Sierra-Leone and Gambia's GDP will lead to a 137% and 118% change in Nigeria's export respectively in the positive direction. This is in line with the absorption approach which stresses income or GDP and expenditure (absorption) as a determinant of a nation's balance of payment.

All the import demand elasticities captured as the coefficients of exchange rates with respect to Nigeria's imports have the appropriate signs (negative) and are statistically significant. A unit decrease in the Nigerian naira exchange rate all things being equal will lead to a 0.36, 1.05 and 1.87 decrease in Nigeria's imports from Ghana, Sierra-Leone and The Gambia respectively. All the export demand elasticities captured as the coefficients of exchange rates with respect to Nigeria's exports have the appropriate signs (negative) and are statistically significant.

Those that satisfy the ML-Condition show that the sum of the import and export demand elasticities is greater than unity. Table 1.0 shows that Sierra-Leone and The Gambia satisfied the ML-Condition while Ghana did not because the sum of its import and export demand elasticity is less than unity.

The coefficients of determination (R^2) of the models indicate that Nigeria imports from Ghana, Sierra-Leone and The Gambia

show 21%, 54% and 70% variation in the dependent variable caused by the variations in the independent variables(GDP and EXR) respectively . The models for Nigeria's export indicates that Ghana, Sierra-Leone and The Gambia have 72%, 79% and 74% respectively variation in the dependent variable (LNigX) due to the joint variation in the independent variables (GDPand EXR) of Ghana, Sierra-Leone and the Gambia respectively .

On the overall significance of the regression equations, Nigeria's import from Ghana, Serra-Leone and Gambia show an F-statistic values of 3.65, 16.43 and 32.38 respectively greater than the F-tabulated value of 3.34 accepting the alternate hypothesis (H_1) that a coordinated devaluation of the naira improves trade between Nigeria and the other WAMZ countries. This suggests that depreciation can improve the bilateral trade balance between Nigeria and other WAMZ countries except Ghana.

IV. CONCLUSION

The study generally examines the trade balance (import and export) nexus borrowing from the Marshall-Lerner Condition (MLC) that the sum of import and export elasticities should be greater than unity for a devaluation/depreciation to have a positive impact on the trade balance. Other works on trade balance nexus were done on an aggregate basis. However, in an attempt to improve the estimates, it is critical to choose the appropriate level of aggregation for the estimation of these elasticities. The factors important in determining this level of aggregation include the policy maker's potential tools, data availability and econometric concerns. Therefore, it is clear that the bilateral approach in this research is superior given the objectives.

The results indicate that Nigeria satisfies the Marshall-Lerner Condition on a bilateral basis with Sierra-Leone and The Gambia except Ghana. Therefore, a depreciation/devaluation of the naira vis-à-vis the other two countries should improve Nigeria's bilateral trade. While depreciation of the naira cannot improve bilateral trade between Nigeria and Ghana.

There are several other important conclusions in this work. It confirms, on a bilateral basis, the disparity in income elasticities noted in the aggregate case. That is Nigerian import demand elasticity is larger than the export demand elasticity. In fact this is the probably a plausible explanation for the failure of the trade balance to improve after the naira started to fall in 1986 during the Structural Adjustment Period (SAP). This further suggests that policy should be focused on improving Nigeria and the foreign countries real income particularly those that did not meet the M-L Condition in order to improve trade balance. This is because increase in foreign countries income can also lead to improvement in Nigeria's trade balance by increase in imports from Nigeria, provided imports exhibit an inelastic demand.

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APPENDIX

Table 1.0: Augmented Dickey Fuller Unit root test Statistics

Variable	Intercept only	Intercept and Trend	Decision
Nigeria			
LGDP	-3.8079* I(0)	-3.8052** I(0)	I(0)
LNIGM	-2.8851*** I(1)	-4.5623* I(1)	I(1)
LNIGX	-3.7677* (1)	-3.8263** I(1)	I(1)
Ghana			
LGDP	-3.0646** I(1)	-3.3032***I(1)	I(1)
LREX	-3.5517**I(1ss)	-4.0474** I(1)	I(1)
Sierra-Leone			
LGDP	-4.8489* I(1)	-5.7702* I(1)	I(1)
LEXR	-3.3437**I(1)	-3.3352 ***I(1)	I(1)
The Gambia			
LGDP	-5.4918*I(1)	-5.4586* I (1)	I(1)
LEXR	-3.5154**I(1)	-3.4521***I(1)	I(1)

*, ** and ***, significant at 1%, 5%, and 10% respectively

Note: The order of integration appears in parenthesis.

Table 2.0: Johansen Co integration Test for Import

Series	Eigen value	Likelihood Ratio (LR	5% C.V	1% C.V	Hypothesized No. of CE(s)	Decision
Imports						
Nig-Gha	0.631342	63.20176	42.44	4.45	None**	3 CE(s) at
	0.500806	34.26309	25.32	30.45	At most 1**	5% level of
	0.385364	14.11504	12.25	16.26	At most 2**	significance
Nig-Sle	0.591651	45.01273	29.68	35.65	None**	2 CE(s) at
	0.439193	19.03937	15.41	20.04	At most 1*	5% level of
	0.075176	2.266399	3.76	6.65	At most 2	significance

Nig-Gam	0.596873	48.01200	42.44	48.45	None*	1 CE(s) at
	0.435495	21.66539	25.32	30.45	At most 1	5% level of
	0.160775	5.083031	12.25	16.26	At most 2	Significance

***(**)** denotes the rejection of the null hypothesis at 5% (1%) significance level.

Table 3.0: Johansen Co integration Test for Export

Series	**Eigen value**	**Likelihood Ratio (LR**	**5% C.V**	**1% C.V**	**Hypothesized No. of CE(s)**	**Decision**
Exports	**Eigen value**	**Likelihood Ratio (LR**	**5% C.V**	**1% C.V**	**Hypothesized No. of CE(s)**	**Decision**
Nig-Gha	0.378675	27.13271	24.31	29.75	None*	3 CE(s) at
	0.275643	13.33157	12.53	16.31	At most 1*	5% level of
	0.128238	3.979928	3.84	6.51	At most 2*	significance
Nig-Sle	0.437514	25.30682	24.31	29.75	None*	1 CE(s) at
	0.215871	8.620518	12.53	16.31	At most 1	5% level of
	0.052641	1.568251	3.84	6.51	At most 2	Significance
Nig-Gam	0.594657	38.90495	29.68	35.65	None*	1 CE(s) at
	0.340070	12.71732	15.41	20.04	At most 1	5% level of
	0.022646	0.664297	3.76	6.65	At most 2	Significance

***(**)** denotes the rejection of the null hypothesis at 5% (1%) significance level.

Table 3.0: Pair wise Granger Causality Tests

Null Hypothesis:	**F-Statistic**	**Probability**
LNIGGDP does not Granger Cause LNIGM	2.32339	0.13907
LNIGM does not Granger Cause LNIGGDP	0.36016	0.5534
LNIG_SLE_EXR01 does not Granger Cause LNIGM	7.31147	0.01171
LNIGM does not Granger Cause LNIG_SLE_EXR01	1.87808	0.18184
LNIG_GHA_EXR01 does not Granger Cause LNIGM	18.4565	0.00020
LNIGM does not Granger Cause LNIG_GHA_EXR01	1.18261	0.28644
LNIG_GAM_EXR01 does not Granger Cause LNIGM	10.1637	0.00361

LNIGM does not Granger Cause LNIG_GAM_EXR01	0.00663	0.93570
LSLEGDP does not Granger Cause LNIGX	0.01663	0.89834
LNIGX does not Granger Cause LSLEGDP	8.10623	0.00833
LGAMGDP does not Granger Cause LNIGX	3.41038	0.07578
LNIGX does not Granger Cause LGAMGDP	5.84984	0.02259
LGHAGDP does not Granger Cause LNIGX	7.87890	0.00917
LNIGX does not Granger Cause LGHAGDP	2.53394	0.12152
LNIG_GAM_EXR01 does not Granger Cause LNIGX	25.0582	3.00000
LNIGX does not Granger Cause LNIG_GAM_EXR01	0.02731	0.86996
LNIG_GHA_EXR01 does not Granger Cause LNIGX	8.62929	0.00669
LNIGX does not Granger Cause LNIG_GHA_EXR01	1.77196	0.19427
LNIG_SLE_EXR01 does not Granger Cause LNIGX	7.18316	0.01239
LNIGX does not Granger Cause LNIG_SLE_EXR01	1.98748	0.17002

Dependent Variable: LNIGM
Method: Two Stage Least Squares
Date: 04/01/12 Time: 08:58
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIGGDP	-2.17E-06	3.10E-06	-0.700157	0.4896
LNIG_GHA_EXR01	-0.358949	0.136575	-2.628227	0.0138
C	25.21480	0.726795	34.69314	0.0000
R-squared	0.206813	Mean dependent var		23.32215
Adjusted R-squared	0.150157	S.D. dependent var		0.794776
S.E. of regression	0.732680	Akaike info criterion		2.307550
Sum squared resid	15.03095	Schwarz criterion		2.446322
Log likelihood	-32.76702	F-statistic		3.650326
Durbin-Watson stat	0.226300	Prob(F-statistic)		0.039017

Dependent Variable: LNIGX

Method: Two StageLeast Squares
Date: 04/01/12 Time: 09:00
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGHAGDP	1.200471	0.176623	6.796799	0.0000
LNIG_GHA_EXR01	-0.079316	0.108988	-0.727748	0.4728
C	-3.403525	4.337304	-0.784710	0.4392

R-squared	0.716601	Mean dependent var	23.46570
Adjusted R-squared	0.696358	S.D. dependent var	0.908333s
S.E. of regression	0.500525	Akaike info criterion	1.545448
Sum squared resid	7.014712	Schwarz criterion	1.684221
Log likelihood	-20.95444	F-statistic	35.40031
Durbin-Watson stat	0.879381	Prob(F-statistic)	0.000000

Dependent Variable: LNIGM
Method: Two Stage Least Squares
Date: 04/01/12 Time: 09:08
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIGGDP	-3.13E-06	2.37E-06	-1.319255	0.1978
LNIG_SLE_EXR01	-1.049250	0.184911	-5.674354	0.0000
C	28.73214	0.956191	30.04854	0.0000

R-squared	0.540050	Mean dependent var	23.32215
Adjusted R-squared	0.507196	S.D. dependent var	0.794776
S.E. of regression	0.557933	Akaike info criterion	1.762609
Sum squared resid	8.716094	Schwarz criterion	1.901382
Log likelihood	-24.32045	F-statistic	16.43808
Durbin-Watson stat	0.278328	Prob(F-statistic)	0.000019

Dependent Variable: LNIGX

Method: Two Stage Least Squares
Date: 04/01/12 Time: 09:09
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LSLEGDP	1.373309	0.231417	5.934350	0.0000
LNIG_SLE_EXR01	-1.016991	0.144494	-7.038307	0.0000
C	0.265000	4.999912	0.053001	0.9581

R-squared	0.793049	Mean dependent var	23.46570
Adjusted R-squared	0.778267	S.D. dependent var	0.908333
S.E. of regression	0.427721	Akaike info criterion	1.231074
Sum squared resid	5.122464	Schwarz criterion	1.369847
Log likelihood	-16.08164	F-statistic	53.64887
Durbin-Watson stat	1.017585	Prob(F-statistic)	0.000000

Dependent Variable: LNIGM
Method: Two Stage Least Squares
Date: 04/03/12 Time: 04:57
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIGGDP	-9.77E-07	1.92E-06	-0.509949	0.6141
LNIG_GAM_EXR01	-1.874842	0.234842	-7.983421	0.0000
C	32.99573	1.212628	27.21011	0.0000

R-squared	0.698172	Mean dependent var	23.32215
Adjusted R-squared	0.676613	S.D. dependent var	0.794776
S.E. of regression	0.451967	Akaike info criterion	1.341349
Sum squared resid	5.719671	Schwarz criterion	1.480122
Log likelihood	-17.79092	F-statistic	32.38399
Durbin-Watson stat	0.435037	Prob(F-statistic)	0.000000

Dependent Variable: LNIGX
Method: Two Stage Least Squares
Date: 04/03/12 Time: 04:59
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LGAMGDP	1.184732	0.321468	3.685381	0.0010
LNIG_GAM_EXR01	-1.070491	0.357905	-2.990987	0.0057
C	5.623533	7.767910	0.723944	0.4751

R-squared	0.737285	Mean dependent var	23.46570
Adjusted R-squared	0.718520	S.D. dependent var	0.908333
S.E. of regression	0.481913	Akaike info criterion	1.469661
Sum squared resid	6.502735	Schwarz criterion	1.608434
Log likelihood	-19.77974	F-statistic	39.28972
Durbin-Watson stat	1.081795	Prob(F-statistic)	0.000000