

International Journal of Applied Research and Technology
ISSN 2277-0585

Publication details, including instructions for authors and subscription information:

<http://www.esxpublishers.com>

Effects of Export, Import and Inflation on Output Expansion.

Olorunpomi, O. T.¹, Job, O.² and Adeyemo, A. K.²

¹Nigeria Police Academy, Kano State, Nigeria.

²University of Ilorin, Kwara State, Nigeria.

Available online: August 31, 2016.

To cite this article:

Olorunpomi, O. T., Job, O. and Adeyemo, A. K. (2016). Effects of Export, Import and Inflation on Output Expansion. *International Journal of Applied Research and Technology*. 5(8): 44 – 52.

PLEASE SCROLL DOWN FOR ARTICLE

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan, sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instruction, formulae and analysis should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Effects of Export, Import and Inflation on Output Expansion.

Olorunpomi, O. T.¹, Job, O.² and Adeyemo, A. K.²

¹Nigeria Police Academy, Kano State, Nigeria.

²University of Ilorin, Kwara State, Nigeria.

(Received: 26 August 2016 / Accepted: 05 August 2016 / Published: 31 August 2016).

Abstract

This paper defines the family of VARs with block exogeneity to reconnoiter the effects of export and import of goods and services, inflation on output expansion within a multivariate cointegration and error correction structure in Nigeria, over the period 1960-2014. The investigation showed that the indicators are I(1) and moderate correlation was observed amongst the indicators; but any correlation with LINF is negative. LP and LEXPGS are block recursive in time series sense at 0.5138 and 0.4232 levels of significance respectively. LP is not influenced by LIMGS, LEXPGS and LINF. Unidirectional causality was detected from LP and LEXPGS to LIMGS and from LIMGS and LEXPGS to LINF. Normalized cointegration coefficients showed that LIMGS and LINF contributed negatively to LP, while LEXPGS contributed positively to LP in the long-run. The static forecasts from our VECM subsequently recover and tracked the trends reasonably well for the periods considered. Our assessment supports the export-led expansion hypothesis which suggests opening native markets to foreign competition in exchange for market access in other countries. Nigeria's over dependence on crude oil export is treacherous because crude oil is a deteriorating benefit with proven fallback which would eventually become exhausted and the impulses of the oil market has resulted in a significant decline in the paychecks because of the exogenously determined price of crude oil. Thus, promoting non-oil export products will bring about a reduction of the nation's level of dependence on crude oil export.

Keywords: Block exogeneity, I(1), Export-led Output expansion, VECM.

For corresponding author:

E-mail: info@esxpublishers.com

Subject: 0716-0229.

© 2016 Exxon Publishers. All rights reserved.

Introduction

Objectives of macro-economic policies among others include, control of the level of inflation, maintenance of healthy balance of payment; economic growth and development. The social and economic effects of inflation are such that after certain level, the negative effects will outweigh the benefits and unless controlled at that point, the effects may be disastrous. It causes reduction in level of savings and has tendency to rid money of virtually all functions. Moreover, it can turn a country into a dumping ground as exported goods become expensive relative to prices of commodities in other countries, making the country a bad place to buy from but a good place to sell and this have significant impact on foreign exchange earnings and on the balance of payment condition. As population continues to increase, it is important that commensurate growth be recorded in output if the population will not outgrow resources bringing about some corruptions. It is also essential that a country continues to develop through increases in its productive capacity and capital formation beyond rate of population growth so that the welfare of citizens can improve. The state of trading relationship of a country with the rest of the world should be of supreme interest. If a country is importing more than she is exporting, the net trading result is negative and the implication is that the country becomes debtor nation in the same manner as an individual consistently spends more than his income, and goods that have little impact on the domestic economy will dominate the hard-earned foreign exchange. If domestic prices are hard, home-made goods would be more expensive relative to those in other countries. Export price increase will bring about increase in quantity supplied, and as import price falls, a corresponding increase in quantity demanded will materialize. If imports are higher in value than exports, the balance represents a deficit or unfavorable balance and must have been financed through increase in foreign debt, sales of foreign assets or depletion of reserves. Excess of exports over imports will conversely represent a surplus or favourable balance and must have added to the foreign reserves or been used to repay foreign debt. Thus, the country may need to promote exports by reducing export duties, encouraging production of export goods, looking for more markets for export goods, and may need to control import by using policies inform of import quota, ban and prohibition, and economic integration (Afolabi, 1998).

Nigeria is a middle income, mixed economy and emerging markets, with expanding financial service, communications, technology, and entertainment sectors. It is ranked as the 21st largest economy in the world in terms of purchasing power parity. It is the largest economy in Africa; its re-emergent, though currently underperforming manufacturing sector is the third largest on the continent, and produces a large proportion of goods and services for the West Africa sub region. Nigeria recently changed its economic analysis to account for rapidly growing contributors to its GDP, such as telecommunications, banking, and its film industry (The Economist, 2014). Over the last few decades as discovered by Kumapayi, et al. 2012, high inflation in Nigeria has caused yield on investment to decline while government policies objectives have been adversely affected as the real size of its budget shrinks with rising inflation which has hampered economic growth. Omotosho, et al. 2013 mentioned that high inflation volatility in Nigeria are associated with periods of specific government policy change, shocks to food prices and lack of coordination between monetary and fiscal policies. A nation could accelerate the rate of economic growth by promoting exports of goods and services. The relationship between export and economic growth was an important issue among economists and many researchers tried to investigate this relationship. There are four possible propositions on a relationship between export and economic growth. Export-led growth (ELG), growth-driven export (GDE), feedback relationship between export and economic growth, and finally it is possible that there is no relationship. Some of the researchers found unidirectional causality and some of them found bidirectional causality and of course some of them could not found any evidence. The dominant focus of this paper uses family of VARs with block exogeneity Wald tests in order to explore the long-run causal effects of exports, imports and inflation on output expansion and to authenticate the export-led expansion hypothesis within a multivariate cointegration and error correction structure in Nigeria, over the period 1960-2014.

Materials and Methods

Sims, 1980, Engle, et al. 1987, Johansen, 1988 and Lutkepohl, 1991, 2011 mentioned that a VAR model can be used for economic analysis because they describe the joint generation mechanism of the variables involved. Vector indicates that more than one variable will be predicted, while; Auto-regression indicates that variables will be regressed on their own past values. Thus, a set of regressions is run (simultaneously) with the same length for each variable. Let GDP per capita be represented by P_{1t} , proxy for returns implying output expansion; earnings implying imports of goods and services be represented by $IMGS_{2t}$, earnings implying exports of goods and services be represented by $EXPGS_{3t}$, and earnings implying consumer price index be represented by INF_{4t} proxy for inflation. It reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

For a set of n time series variables, $y_t = (P_{1t}, IMGS_{2t}, EXPGS_{3t}, INF_{4t})'$ where, y_t is an $(n \times 1)$ vector of random variables that follows a p^{th} order Gaussian VAR if, for all t ($t=1,2,\dots,T$). If the solution of the p^{th} order VAR has a root $\Phi(L) = 1$; then either some or all of the variables in y_t are integrated of order one, i.e. $I(1)$. It might be the case, that cointegration between the variables does exist. This instance can then be better analyzed in the context of a VECM. The vector error correction model (VECM) writes Δy_t as a function of lagged levels y_{t-1} and lagged Δy_t :

$$\Delta y_t = \pi y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + \varepsilon_t \quad (1)$$

ϕ_i 's are matrix coefficients for $i=1, \dots, p$; $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, \dots, \varepsilon_{nt})'$ is $(n \times 1)$ unobservable zero mean independent white noise process with time variant positive definite covariance matrix $E(\varepsilon_t \varepsilon_t') = \Sigma_\varepsilon$; $\pi = -(I_n - \phi_1 - \phi_2 - \dots - \phi_p)$ contains the cumulative long-run impact, i.e., the cointegrating relation. $\Gamma_j = -(\phi_{j+1} + \dots + \phi_p)$ for $i=1, \dots, p-1$; measures transitory effects, i.e., the short-run parameters. (Hamilton, 1994, Hayashi, 2000).

Block Exogeneity

Jarocinski, et al. 2011 defined the family of VARs with block exogeneity and cast the choice of variables in a VAR as the choice of one model from this family is widely discussed form of causality in the econometrics literature. Let y_t denote the vector consisting of all N variables in the dataset. Consider a partition of y_t into three sub vectors, $y_t = \{y_i, y_j, y_k\}$, where y_i denotes N_1 variables of interest and y_j denotes N_2 , y_k denotes N_3 remaining variables. Let Ω denote a family of models such that: (i) each model in the family Ω is a VAR with N variables represented by y_t with zero, one, or more block exogeneity restrictions, and (ii) in each model in the family Ω , the variables represented by y_i are in the first block of that model. Suppose that $N=3$ and $N_1=1$, i.e. the dataset contains three variables and there is one variable of interest (Dufour, et al. 1998):

$$\begin{bmatrix} y_{it} \\ y_{jt} \\ y_{kt} \end{bmatrix} = \gamma + \begin{bmatrix} D_{ii}(L) & D_{ij}(L) & D_{ik}(L) \\ D_{ji}(L) & D_{jj}(L) & D_{jk}(L) \\ D_{ki}(L) & D_{kj}(L) & D_{kk}(L) \end{bmatrix} \begin{bmatrix} y_{i,t-1} \\ y_{j,t-1} \\ y_{k,t-1} \end{bmatrix} + e_t \quad (2)$$

We think of y_i as the variable of interest and think of y_j and y_k as the remaining variables. We study the following queries: In addition to y_i , should we include in the VAR, y_j and y_k , only y_j , only y_k or neither y_j nor y_k . We sort four interpretations about these questions. First, "including y_j and y_k in addition to y_i ", means estimating the unrestricted VAR given in equation (2). "Including only y_j in addition to y_i " means estimating the VAR given in equation (2) with the restriction $D_{ik}(L) = D_{jk}(L) = 0$; i.e., with the restriction that y_i and y_j are block exogenous to y_k . "Including only y_k in addition to y_i " means estimating that VAR with the restriction $D_{ij}(L) = D_{kj}(L) = 0$, i.e. with the restriction that y_i and y_k are block exogenous to y_j . "Including neither y_j nor y_k in addition to y_i " means estimating that VAR with the restriction $D_{ij}(L) = D_{ik}(L) = 0$, i.e., with the restriction that y_i is block exogenous to y_j and y_k . In particular, one could be concerned that modeling the interaction between the remaining variables matters for the result of the block exogeneity tests deliberated so far. Our approach to modeling the interaction between the remaining variables is to consider block exogeneity restrictions among the remaining variables. This approach leads us to consider two additional models: (i) the VAR given in equation (12) with the restriction $D_{ij}(L) = D_{ik}(L) = D_{jk}(L) = 0$, i.e. with the restriction that y_i is block exogenous to y_{ji} and y_{jj} and y_{ji} is block-exogenous to y_{jj} , and (ii) the VAR given in equation (12) with the restriction $D_{ij}(L) = D_{ik}(L) = D_{kj}(L) = 0$, i.e. with the restriction that y_i is block exogenous to y_{ji} and y_{jj} and y_{jj} is block-exogenous to y_{ji} . Note that with either of those two restrictions, the decision is "include neither y_{ji} nor y_{jj} in addition to y_i " (Granger, 1969 and Lutkepohl, 1993).

Johansen Cointegration Test

Johansen, 1988 explained that if the solution of equation (1) has a root $\Phi(L) = 1$; then either some or all of the variables in y_t are integrated of order one, i.e., $I(1)$. It might be the case, that cointegration between the variables does exist. This instance can then be better analyzed in the context of a VECM. If y_t is cointegrated then the VAR representation is not the most suitable representation for analysis because the cointegrating relations are not explicitly apparent. The linear

combinations of a VAR model will have zero expected values and finite variances, so that not only will zero be the expected value of these terms but will also be meaningful in that there will be a non-trivial probability of being “close” to it (Judge, et al. 1985 Engle, et al. 1987, and Hendry, 1986). The cointegration test here is based on the following general model:

$$y_t = D_t + x_t \quad (3)$$

Where, y_t is a K -dimensional vector of observable variables, D_t is a deterministic term, e.g., $D_t = \mu_0 + \mu_1 t$ may be a linear trend term, and x_t is a VAR (p) process with vector error correction model (VECM) representation (equation 1); but here, ε_t is a vector white noise process with $\varepsilon_t \sim (0, \Sigma_\varepsilon)$. The rank of π is the cointegrating rank of x_t and hence of y_t . Therefore, the Johansen trace tests check the pair of hypotheses:

$$H_0(r_0): \text{rank}(\pi) = r_0 \quad \text{Vs} \quad H_A(r_0): \text{rank}(\pi) > r_0, \quad r_0 = 0, \dots, k-1 \quad (4)$$

Decision rule

Accept $H_0(r_0)$ (cointegration relationship) if t-statistic is greater than asymptotic critical value or if the p-value is less than the level of significance; otherwise reject the null hypothesis and accept the alternative hypothesis, H_A (no cointegration relationship) if t-statistic is less than asymptotic critical value or if the p-value is greater than the level of significance.

We used Eviews to invoke model summaries and standardized coefficients of the regression. The data were sourced from the Central Bank of Nigeria publications and those of the World Bank, over the period 1960 – 2014.

Results and Discussion

Table 1 for the multiple-series unit root tests revealed that the indicators are integrated of order 1, $I(1)$. The correlation matrix of Table 2 revealed a moderate correlation amongst the indicators and any correlation with LINP is negative; but LIMGS showed a negative correlation with LP and a positive correlation with LEXPGS. A moderate positive correlation of about 38% between LP and LEXPGS is understood as empirical evidence in favour of the export-led growth hypothesis. Table 3 for VAR Granger Causality and block exogeneity Wald tests include three parts. The first part reports the result of testing whether we can exclude each variable out of the equation of LP. Likewise, the next part reports the result of testing whether we can exclude each variable out of the equation of LIMGS. Similarly, the next part reports the result of testing whether we can exclude each variable out of the equation of LEXPGS. The last part reports the result of testing whether we can exclude each variable out of the equation of LINP. Each part of Table 3 includes three columns. The first column lists the variables which will be excluded from the equation. The next columns are the value of χ^2 degrees of freedom and p-value. The last row in each part of Table 4 reports the joint statistics of the variables excluded from the equation. The test divulges that, LP and LEXPGS are block recursive in time series sense at 0.5138 and 0.4232 levels of significance respectively for the joint statistics; while LIMGS and LINP are not block recursive at 0.0006 and 0.0008 levels of significance respectively for the joint statistics. This exposed that LP and LEXPGS are not jointly influenced by other variables. We cannot exclude LIMGS, LEXPGS and LINP out of the equation of LP at 0.4791, 0.4535 and 0.3969 levels of significance respectively. This suggests that LP is not influenced by LIMGS, LEXPGS and LINP. The test also provides evidence that we cannot exclude LINP out of the equation of LIMGS at a 0.8101 level of significance. This put forward that LIMGS is not influenced by LINP; but LP and LEXPGS are Granger cause for LIMGS at 0.0186 and 0.0976 levels of significance. Thus, unidirectional causality was detected from LP and LEXPGS to LIMGS. Furthermore, we cannot exclude LP, LIMGS and LINP out of the equation of LEXPGS at 0.7114, 0.7211 and 0.3037 levels of significance respectively. This advocates that LEXPGS is not influenced by LP, LIMGS and LINP. Lastly, we cannot exclude LP out of the equation of LINP at a 0.4250 level of significance. This recommends that LINP is not influenced by LP; but LIMGS and LEXPGS are Granger cause for LINP at 0.0229 and 0.0025 levels of significance. Thus, unidirectional causality was identified from LIMGS and LEXPGS to LINP.

Johansen cointegration test for the number of cointegration relationship as presented in Table 4 revealed that one cointegration relationship exists among the variables. The estimates of the coefficients are statistically significant since their t-values are greater than 0.05 level of significance. Diagnostic tests executed in Tables 5 and 6 inferred that there are no serial correlations in the residuals and the residuals of our VEC(2) model are normally distributed. According to normalized cointegrating equation, LIMGS and LINP contributed negatively to LP, while LEXPGS contributed positive to LP in the long-run. Moreover, the negative effect of LIMGS has been larger than LINP. These implied that the four variables are causally related in one direction. Assuming that all the constant terms and the short-run adjustment dynamics of VECM are equal to zero, the normalized cointegrating equation gives the error correction term as:

$$\Delta y_t = \pi y_{t-1} + \varepsilon_t \quad (5)$$

Taking expectations of equation (2) we've: $E(\Delta y_t) = E(\pi y_{t-1}) + E(\varepsilon_t) \Rightarrow 0 = \pi y_{t-1}$

$$\Delta LP_t = -4.70L\Delta LIMGS_{2t} + 4.41L\Delta LEXPGS_{3t} - 0.30L\Delta CPI_{4t} \quad (6)$$

Figure 1 revealed that the forecasts from our VECM subsequently recover and tracked the trends reasonably well from 1960-2014.

Conclusion and Recommendations

Our exploration supports the export-led expansion hypothesis which suggests opening domestic markets to foreign competition in exchange for market access in other countries. This strategy pursues to find forte in the world economy for a certain type of export. Industries producing this export may receive governmental subsidies and better access to the local markets. By implementing this strategy, countries hope to gain enough hard currency to import commodities manufactured more cheaply somewhere else (Goldstein, et. al 2008). According to CBN Governor noted on November 17, 2015; Nigeria's major export commodity which accounts for more than 80% of our income is crude oil export and what is supposed to be the non-oil export. Adenugba, 2013 pointed out that Nigeria's over dependence on crude oil export is dangerous for two reasons one being because crude oil is a deteriorating asset with proven fallback which would eventually become exhausted and secondly, the impulses of the oil market has resulted in a significant decline in the paychecks because of the exogenously determined price of crude oil. Consequently, promoting non-oil export products will bring about a reduction of the nation's level of dependence on crude oil export. Diversification from oil to non-oil exports in Nigeria as stated by Nigeria Export Promotion Council (NEPC) include, increase the foreign exchange earnings thereby assisting the financing of other economic sectors; create employment and reduce unemployment problems; improve the living standard of the people in the exporting country; it may bring about increase in sales and profits to firms that export their products; a reduction in production cost brought about by mass production for export; business expansion as a result of export marketing; finally, recognition and reputation of firms may also be enhanced when quality, quantity, and reliability of the firm are considerably improved as the firm successfully engages in export marketing.

References

- Adenugba, A.A. and Dipo, S.O. (2013). "Non-Oil Export in the Economic Growth of Nigeria: A Study of Agricultural and Mineral Resources". *Journal of Educational and Social Research*. Vol. 3(2), pp. 403-418.
- Afolabi, L. (1998). *Monetary Economics*, Revised Edition. PERRY BARR LTD., Lagos, Nigeria.
- Dickey, D.A. and Fuller, W.A. (1979). "Distribution of the Estimators for Autoregressive Time Series with a Unit Root". *Journal of the American Statistical Association*, 74, pp. 427-431.
- Engle, R.F. and Granger, C.W.J. (1987). "Cointegration and Error-Correction: Representation, Estimation and Testing". *Econometrica*, Vol. 55, pp. 251-276.
- Fisher, R. A. (1932). *Statistical Methods for Research Workers*, 4th Edition, Edinburgh, Oliver & Boyd.
- Goldstein, J.S. and J.C. Pevehouse (2008). *International Relations*, 8th Edition, Pearson Longman, New York.
- Granger, C.W.J. (1969). "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods". *Econometrica*, Vol.37, pp. 424-438.
- Hamilton, J. D. (1994). *Time Series Analysis*, Princeton University Press; Princeton, N.J.
- Hayashi, F. (2000). *Econometrics*. Princeton University Press; Princeton, N.J.
- Hendry, D. F. (1986). "Econometric Modeling with Cointegrated Variables: An Overview". *Oxford Bulletin of Economics and Statistics*, pp. 201-212.
- Im, K. S., Pesaran, M. and Shin, Y. (2003). "Testing for Unit Roots in Heterogeneous Panels". *Journal of Econometrics* 115, pp. 53-74.
- Jarocinski, M. and Mackowiak, B. (2011). "Choice of Variables in Vector Autoregressions". European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany.
- Johansen, S. (1988). "Statistical analysis of Cointegrated vectors". *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231-254.
- Judge, G.G., Griffiths, W.E., Hill, R.C., Lutkepohl, H. and T.C. Lee (1985). *The Theory and Practice of Econometrics*, 2nd edition, J.Wiley & Sons, INC, NY.
- Kumapayi, A.A, Nana, J.U and Ohwofasa, O.B. (2012). "Impact of Inflation on Monetary Policy and Economic Development in Nigeria, 1980-2010: Evidence from Empirical Data". *Asian Journal of Empirical Research*. Vol.2, no.2, pp. 28-39.
- Levin, A., Lin, F. and Chu, C. (2002). "Unit Root Tests in Panel Data: Asymptotic and Finite-Sample Properties". *Journal of Econometrics* 108, pp. 1-24.
- Lutkepohl, H. (1991). *Introduction to Multiple Time Series Analysis*. Berlin: Springer- Verlag.
- Lutkepohl, H. (1993). "Testing for causation between two variables in higher dimensional VAR models, in H. Schneeweiss and k.f. Zimmermann (eds.)". *Studies in Applied Econometrics*, Heidelberg: Physica-Verlag, pp. 75-91.
- Lutkepohl, H. (2011). "Vector Autoregressive Models". EUI Working Paper, Eco 2011/30; Department of Economics; European University Institute, Florence Italy.
- Maddala, G. S. and S. Wu (1999). "A Comparative Study of Unit Root Tests with Panel Data and A new Simple Test". *Oxford Bulletin of Economics and Statistics*, Special Issue (1999) 0305-9049.
- Omotosho, B.S. and Doguwa, S.I. (2013). "Understanding the Dynamics of Inflation Volatility in Nigeria: A GARCH Perspective". *CBN Journal of Applied Statistics*. Vol.3, no.2, pp. 51-74.
- Sims, C. (1980). "Macroeconomics and Reality". *Econometrica*, Vol. 48, pp. 1-48.
- The Economist (2014). *Africa's New Number One*. Printed Edition. (<http://www.economist.com/news/leaders/21600685>).

Tables

Table 1: Multiple-series unit root tests

Null: Assumes common unit root process					
Method	Statistic	P-value	Sect. Obs.		
Levin, et al. 2002	0.38458	0.6497	4	215	
Null: Assumes individual unit root process					
Im, et al. 2003	1.23795	0.8921	4	215	
Fisher-ADF(Maddala, et al. 1999)	5.63385	0.6882	4	215	
Fisher-PP(Maddala, et al. 1999)	6.20373	0.6244	4	216	

Table 2: Correlation matrix

	LP	LIMGS	LEXPGS	LINF
LP	1.000000	-0.186290	0.383001	-0.112603
LIMGS	-0.186290	1.000000	0.254641	-0.053508
LEXPGS	0.383001	0.254641	1.000000	-0.224775
LINF	-0.112603	-0.053508	-0.224775	1.000000

Table 3: VAR granger causality and block exogeneity wald tests

Dependent Variable	Excluded	χ^2 Statistics		df
LP	LIMGS	2.78	3	0.4791
	LEXPGS	2.62	3	0.4535
	LINF	2.97	3	0.3969
	ALL VALUES TAKEN TOGETHER	8.20	9	0.5138
LIMGS	LIMGS	9.99	3	0.0186
	LEXPGS	6.31	3	0.0976
	LINF	0.96	3	0.8101
	ALL VALUES TAKEN TOGETHER	29.23	9	0.0006
LEXPGS	LIMGS	1.38	3	0.7114
	LEXPGS	1.33	3	0.7211
	LINF	3.63	3	0.3037
	ALL VALUES TAKEN TOGETHER	9.15	9	0.4232
LINF	LIMGS	2.79	3	0.4250
	LEXPGS	9.54	3	0.0229
	LINF	14.31	3	0.0025
	ALL VALUES TAKEN TOGETHER	28.61	9	0.0008

Table 4: Johansen cointegration tests

Trace Method for Unrestricted Cointegration Rank Test				
Hypothesized no. of CE(s)	Eigenvalue	Trace Stat.	0.05 Critical Value	P-value
None*	0.390549	45.36719	40.17493	0.0138
At most 1	0.250024	19.61694	24.27596	0.1731
At most 2	0.083409	4.655834	11.22480	0.6163
At most 3	0.002439	0.129906	4.129906	0.7690
Maximum Eigenvalue Method for Unrestricted Cointegration Rank Test				
Hypothesized no. of CE(s)	Eigenvalue	Max-EigenStat.	0.05 Critical Value	P-value
None*	0.390549	25.75025	24.15921	0.0302
At most 1	0.250024	14.96111	17.70730	0.1271
At most 2	0.083409	4.528857	11.22480	0.5461
At most 3	0.002439	0.126978	4.129906	0.7690
Normalized cointegrating coefficients, Log likelihood: 248.5669 (standard error in parentheses and t-ratios in brackets)				
LP	LIMGS	LEXP GS	LINF	
1.000000	4.700868 (0.96825) [4.85499]	-4.413870 (1.05342) [-4.19003]	0.297817 (0.17749) [1.67789]	

Table 5: Serial Correlation LM Tests for VEC (2) Residuals

Lags	LM-Stat	Prob.
1	16.50400	0.4184
2	11.71084	0.7636
3	17.66496	0.3439
4	14.35785	0.5721
5	20.35393	0.2047
6	14.71218	0.5458
7	24.01799	0.0891
8	11.71613	0.7633
9	14.00398	0.5984

Table 6: Normality Tests for VEC (2) Residuals

Component	Skewness	χ^2 Statistics	df	P-value
1	-0.233820	0.473821	1	0.4912
2	-0.046224	0.018517	1	0.8918
3	0.469067	1.906870	1	0.1673
4	-0.296356	0.761164	1	0.3830
Joint		3.160373	4	0.5314
Component	Kurtosis	χ^2 Statistics	df	P-value
1	2.741247	0.145065	1	0.7033
2	2.417604	0.734900	1	0.3913
3	2.994584	6.36E-05	1	0.9936
4	4.270711	3.498531	1	0.0614
Joint		4.378559	4	0.3572
Component	Jarque-Bera	df	P-value	
1	0.618886	2	0.7339	
2	0.753418	2	0.6861	
3	1.906933	2	0.3854	
4	4.259694	2	0.1189	
Joint	7.538932	8	0.4798	

Figure

Figure 1: One-step ahead forecasts

