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Trade Liberalization and Industrial Growth in Nigeria

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Abstract
This study investigated the relation between trade liberalization and industrial growth in Nigeria. Adopted in the study is the human capital model of endogenous growth with modifications for trade liberalization within the Nigerian context. In the empirical investigation of the aggregate function of industrial output growth in Nigeria, co-integration and error correction estimation approaches were utilized. A unique co-integral relation between industrial production and the explanatory variables in the study is found. In order to determine the short-run dynamics around the equilibrium relationship, we estimated an error correction model [ECM]. The empirical findings in this study have it that there is a positive and significant correlation between trade liberalization and industrial growth in Nigeria, structural deregulation had positive impact industrial growth in Nigeria, Nigerian industries are labour intensive, industrial production responded negatively and insignificantly to capital formation in Nigeria, industrial growth is cumulative and self-sustaining in Nigeria. The result however does not provide evidence of significance of structural deregulation over the period of short-run analysis. The policy implications are simple. The results of the study suggest the need for government to embark on comprehensive implementation of trade liberalization policies in order to accelerate and sustain industrial growth in Nigeria. However, the implementation of trade liberalization polices should be done with a delay caution.
Keywords: trade liberalization, industrial growth, endogenous growth, cointegration, error correction

1. Introduction

Successive governments in Nigeria, since independence have been quite consistent, at least in theory, through an expression in annual budgets, in pursuance of an industrial policy that aims at ensuring economic growth and development. Beginning from the import substitution industrialization [ISI] policy of the immediate post independent era to the policy of the development of export-oriented industries in the 1980s, the momentum has not subsided at the policy development level. Despite the implementation of four development plans from 1962-1985, as well as rolling plans that came with the Structural Adjustment Programme [SAP] in 1986, through the 1990s, the industrial sector of the Nigeria economy has not been transformed to reflect the objective of the sector. It still requires a radical structural transformation from its current role of mere assembling of imported components to an integrated industry with the domestic economy as its base and propeller.

The critical role of the industrial sub-sector is predicated on the fact that it acts as an engine of growth by broadening the productive and export base of the economy, reducing unemployment and stemming rural-urban drift as well as helping to reduce poverty. Nigeria is an open economy. Accordingly, developments in international circles have profound implications on the path the country is going in terms of the development of her industrial sub-sector. It has been the goal of trading with countries to obtain improved and more secure access to markets abroad. This is intended to provide the country with the opportunity to explore economies of scale beyond the limit of the domestic market and facilitate access to foreign exchange with which to finance critical imports needed for development (Adenikinju 2002). It is true that trade and trade policies are important determinants of economic performance. International trade offers opportunities for greater specialization, increased capacity utilization and import of goods and services. Within the Nigerian context, there has been a considerable amount of discussion on the inter-relationship between trade policy reforms, economic performance and industrial growth.

A number of empirical studies have been carried out on the nexus between trade-growth. Several studies have shown that there is a positive relationship between openness and economic performance [World Bank (1991), Ahmed (1999) and Dutta and Ahmed (2000)]. Others have found no significant relationship (Helleiner 1986). In recent times, however, there appears to be lack of consensus of empirical studies on the relationship between trade liberalization and industrial output growth. Thus, interpretation of such regression coefficients in previous studies can now be considered inadequate for meaningful economic forecast. Besides, there is the problem of spurious regression estimates in the previous studies that needs to be empirically re-examined based on recent time series econometric analysis using Nigeria as a case study. Hence, we are set in this paper to determine the accurate correlation between trade liberalization and industrial growth in Nigeria. Additionally, we will empirically ascertain the impact of labour force and capital formation on industrial performance in Nigeria. In line with the stated objectives, we hypothesize that:

(a) There is no significant positive relationship between trade liberalization and industrial performance in

Nigeria.
(b) There is no significant positive relationship between labour force and industrial performance in Nigeria.
(c) There is no significant positive relationship between capital formation and industrial performance in Nigeria.
The paper is structured into five sections for ease of analysis. Following section one is the literature review in section two. Section three focuses on the theoretical framework and model specification while section four is dwells on presentation and analysis of results and section five contains the summary of empirical findings followed by policy recommendations and conclusion.

2. Literature Review
The recent move towards more open trade policies in developing countries, after decades of production, has sparked off lively debates. The proponents of trade liberalization argue that an open market policy will result to a permanent direct minimum increase in gross domestic product [GDP] in addition to the indirect benefits that accrue in the form of a reduced regressive tax burden and positive dynamic externalities (Odusola and Akilo 1995). Much of the controversy
relates to the macro analysis of trade-growth linkages. There are many arguments explaining why more open trade regimes lead to productivity improvements in the industrial sector. Perhaps the most basic is that returns to entrepreneurial effort increases as exposure to foreign competition rises (Martin and Page 1983, and Tybout 1992). A second argument is that increasing returns to scale imply lower costs per unit as output increases (Pack 1988 and Tybout 1992). The conventional views that trade liberalization is necessary and has positive effects for development and of the growth performance of the industrial sector constitute an increasing controversial issue.
According to Adenikinju and Olofin (2002), trade policy might affect industrial growth through several channels. First, a less protectionist trade regime increases scale efficiency by enlarging the domestic market which otherwise might be too small for the efficient production of goods that show increasing returns to scale. Second, a more liberal trade regime leads to increased competition from abroad forcing domestic firms to adopt more efficient technology to reduce inefficiency and waste. Thirdly, it is argued that a freer economy eases foreign exchange constraints faced by most developing countries and hence enables a country to import needed raw materials and capital goods. Finally, a more open economy results in a faster rate of technological progress. In particular, Grossman and Helpman (1991) argue that technological change can be influenced by a country's openness to trade. Openness to trade provides access to imported inputs, which embody new technology and increases the size of the market facing producers which in turn raises returns to innovation and affects a country's specialization in research intensive production. Thus, a country's openness leads to improvements in domestic technology, helps the production process become more efficient and culminates in productivity improvements.
Technological change has been the focus of the endogenous growth literature (Lucas 1988). Their works show how trade liberalization may raise growth rates in the long run by generating economics of scale, operating through research and development and knowledge spillover, human capital accumulation and learning by doing. Cline (1979) enumerates the classical benefits of a move towards free trade as including savings to consumers through lower prices that is an increased "consumer surplus" and the liberalization of domestic resources that were formally used inefficiently for use in more productive activities. In addition, to the static welfare benefits of free trade, Cline acknowledges the importance of economics of scale as export section increase its output, benefits accrue from a stimulus to investment as new export opportunities arises. There are additional benefits from increased domestic efficiency and technical changes provided by the new competition from abroad. Following the same line of reasoning, Haberller (1988) identified four key points in discussing the beneficial effect of international trade on participating developing countries. First, trade provides material means (capital goods, raw and semi-finished materials) indispensable for economic development. Secondly, and even more important, trade is the means and vehicle for the dissemination of technological knowledge, the transmission of ideas for the importation of know-how skills, managerial talents and entrepreneurship. Thirdly, trade is a vehicle for international movement of capital especially from the developed countries. Fourthly, free international trade is the best anti-monopoly policy and the best guarantee for the maintenance of a healthy degree of free competition.
According to IMF (2010), greater openness may accelerate technological innovations in industrial countries leading to more investment in product development. Trade liberalization has led to a massive expansion in the growth of world trade relative to world output, while the world output or GDP has expanded five-fold; the volume of world trade has grown sixteen times at an average compound rate of just over seven percent per annum (Soludo and Oji 2003). In some individual countries, notably in South-East Asia, the growth of exports has exceeded ten percent per annum (Oyejide 2003). Exports have tended to grow faster in countries with more liberal trade regimes, and these countries have experienced the fastest growth of GDP. The proponents of a free trade policiy regime predict gains in manufacturing productivity from outward looking trade policies. Outward

trade orientation brings about familiarity with new technologies, induces greater capacity utilization as well as scale benefit via production for export markets and brings about international competition. These in turn are expected to result in productivity improvements in the industrial sector.

Okamoto (1994) however found no clear evidence regarding the impact of trade liberalization as measured by effective rates of protection on TFP growth. The role of foreign direct investment policies was found to be significant. Kajiwara (1994) observes that for Philippines, even though the TFP growth rates in the manufacturing sector during the 1970s and 80s were negative there were improvements brought about by trade liberalization. Kim (2000) examines dynamic impact of trade liberalization on productivity, competition and scale efficiency and found that despite the positive impact, the productivity increase was not significant because the extent of trade liberalization was not substantial enough in Korea.

3. Trade Policy and Industrial Growth in Nigeria

The policy of trade liberalization was earlier advocated by Smith (1776) who has in the past posited that it is always safer to allow the economy to be propelled by an invisible hand, that is, the forces of competition motivated by industrial self-interest. Smith's (1776) argument for trade liberalization is based on the role which division of labour plays in economic growth. For example, expansion of international trade is an important method of widening the market and of promoting the division of labor while trade restrictions limit the size of the market, diminishes the scope for international specialization, and thus lowering domestic productivity. Smith's proposition found support from Ricardo (1817), who emphasized the role of "comparative advantage, market mechanism" and "competition" in the growth of the economy. According to the classical theory of international trade, "free trade is the best policy" and it leads to the optimization of world's resources through international division of labour. Indeed, these authors long viewed international trade as engine of economic growth and hence as engine of mutual economic gain among countries.

Any assessment of the impact of trade policy reforms on industrial growth requires an understanding of the notion of trade liberalization. The hypothesis on trade policy reforms includes several distinct concepts of "trade liberalization". It encompasses both openness and changes in trade orientation. Openness is an economy wide measure, whereas trade orientation is an industry specific measure [Pritchett (1996)]. For developing countries like Nigeria, a more open international trade system means greater opportunity to earn foreign exchange through exports since the availability of foreign exchange is imperative for the purchase of imported capital goods and raw materials necessary for rapid growth.

The trade policy reforms that have been adopted by the Nigerian government over the years include the partial abolition of import license scheme, granting of special tax incentives and tax holidays to enable local industries build up adequate funds for expansion and to encourage firms invest in economically disadvantaged areas, reduction of corporate income tax rate and introduction of tax-free dividends for foreign persons and to encourage local research and development. Other reforms include the promulgation of export incentives decree in which various incentives to enhance export promotion were stipulated, establishment of export credit guarantee and insurance scheme to assist Nigeria companies compete effectively in the international market, government grant of 140 percent tax relief to firms in respect of research and development of raw materials, export stimulation loan [ESL] scheme to provide for foreign producers that require imported inputs essential to the production of export products, opening of domiciliary account to keep firms' export earnings in foreign currencies, government institutional supports through the establishment of industrial development coordinating committee [IDCC], data bank, raw material research and development council [RMROC], project development agency [PRODA], federal institute of industrial research [FIIR], export processing zones [EPZs], Nigeria investment promotion council, simplification of industrial licensing, deregulation of the exchange market and devaluation of the naira.

4. Theoretical Framework and Empirical Model

A number of theoretical arguments linking trade liberalization with higher rate of industrial productivity growth can be put down. There is the argument of industrial output growth effects of scale benefits, industrial productivity growth effects of reduction in managerial slackness due to competition and industrial productivity growth effects of imported technology innovations (Krugman (1986). Rodrik (1995) has shown that a domestic firm's rate of technological 'catch-up' is positively related to the market share. The proposition is that the sectors that gain in productivity are exportable sectors and the import competing sectors have a non-positive impact as far as technological change is concerned. Accordingly, the integration of the world economy is seen as having important influence on the pace and direction of technical change. The theory of endogenous growth links trade openness with innovation and growth. Grossman and Helpman (1991) consider how trade and industrial policies affect the long-run rates of innovation and growth. The study adopted the endogenous growth framework of Lucas (1988) where output is generated via a production function of the form:

$GNG^{NRT} = q_0 CAK^{SOCK\,(q_1)}[HMC^{CAPK}\, LAB^{FOCK(1-\,q_1)}L]$

Where GNG^{NRT} is industrial output growth, CAK^{SOCK} is capital stock, HMC^{CAPK} is human capital stock in

Nigeria, LAB^{FOCK} is labour force. The study extends the Lucas's framework to factor in the relationship between trade liberalization and industrial output production within the Nigerian context. According to Adenikinju and Chette (1999), trade liberalization captures the spillover effect on industrial production. For example, the more opened the domestic economy is to integration with international industries, the more the growth of industries in the economy. Capital stock is expected to have strapping positive influence on industrial growth. Industrial output grows faster with a high level of human capital development as measured in terms of high level of educational attainment (Mankiw, Romer and Weil 1992). Labour force is better equipped to adapt to new technologies and management skills developed elsewhere. If the dummy variable is positive and significant, it means that the adoption of SAP had made industrial performance to be more efficient.

Using the endogenous growth framework of Lucas (1988) as a bench mark, a simple reduced form relationship is specified, which links industrial output production trade liberalization and a vector of other control variables namely, real exchange rate, labour force, capital formation, dummy variable and human capital stock. The model is thus specified:

$$GNG^{NRT} = F\ (CAK^{SOCK},\ LAB^{FOCK}\ ,\ HMC^{CAPK},\ EXR^{RATE},\ DMV^{DMMY},\ TRA^{LBZT}) \quad (4.1)$$

Where GNG^{NRT} is industrial output growth, CAK^{SOCK} is capital stock, LAB^{FOCK} is labor force, HMC^{CAPK} is human capital stock in Nigeria, EXR^{RATE} is the real exchange rate, DMV^{DMMY} is the dummy variable and TRA^{LBZT} is trade liberalization. The empirical equation is specified as follows:

$$\text{Log}[GNG^{NRT}] = q_0 + q_1\text{Log}[CAK^{SOCK}] + q_2\text{Log}[LAB^{FOCK}] + q_3\text{Log}[HMC^{CAPK}] + q_4\text{Log}[EXR^{RATE}] + \text{Log}[GNG^{NRT}] + q_5\text{Log}[DMV^{DMMY}] + q_6\text{Log}[TRA^{LBZT}] + U_t \quad (4.2)$$

The coefficients $[q_1, q_2, q_3, q_5, q_6]$ are the elasticity parameters. With the exemption of the exchange rate impact, all other impacts to be estimated are expected to be positive. The error-correction specification of the model may be represented as follows.

$$\Delta\text{Log}[GNG^{NRT}] = q_0 + q_1\Delta\text{Log}[CAK^{SOCK}] + q_2\Delta\text{Log}[LAB^{FOCK}] + q_3\Delta\text{Log}[HMC^{CAPK}] + q_4\Delta\text{Log}[EXR^{RATE}] + q_5\Delta\text{Log}[DMV^{DMMY}] + q_6\Delta\text{Log}[TRA^{LBZT}] + q_7ECM_{[t-1]} + U_t \quad (4.3)$$

Where Δ is the difference operator and $ECM_{[t-1]}$ is the error-correction term (Engle and Granger 1987). In general, the use of differencing has been found to reduce the possibility of spurious regression results (Plosser and Schwart 1978). In general, the use of differencing has been found to reduce the possibility of spurious regression results (Granger and Newbold 1979).

5. Methodology and Data

The parameters stability of the model might have been influenced by the oil boom in the 1970s, the devaluation of exchange rate in 1987, the liberalization of interest rate in 1987 and the policy shift from a fixed exchange rate regime to a floating exchange regime in October 1987. The data relating to the years 1970-2010 are used to test the structural break caused by all these events, using CUSUM and CUSMSQ test. First- differencing achieves stationarity of variables and thus reduces the possibility of spurious results. This in effect determines the robustness and consistency of estimated coefficients. The short run adjustment process is measured by the error correction term ECT. The error correction mechanism, in general, represents the "equilibrium error", which can be used to relate the short-run level of industrial production to the long-run level of production. If the ECT is between zero and negative unity, the adjustment to industrial production in the current period [t] is a fraction of the error in the previous period [t-1]. In this case, the ECT plays a crucial role in causing the level of industrial production to converge monotonically to its long run equilibrium path in relation to changes in the explanatory variables. In effect therefore, if the coefficient of the ECT is positive, industrial production will diverge between periods, while if the coefficient is negative, the ECT generates a dampened oscillation in the industrial sector about its equilibrium path. The Dickey-Fuller [DF] is used to confirm that our series are generated by first order autoregressive process [AR (1)]. The Dickey Fuller test is extended to allow for n-order autoregressive process [AR (n)] to generate the Augmented Dickey Fuller [ADF]. The stationarity test by Phillips-Peron is also utilized in the study. The Johansen (1988) and Johansen and Juselius (1990) co-integration techniques are adopted in testing the existence of long-run correlation in the study. The Generalized Method of Moments [GMM] is utilized in estimating the error correction model.

The data for this study have been obtained from the Central Bank of Nigeria [CBN] Statistical Bulletin and Annual Report and Statement of Accounts, and the Federal Office of Statistics [FOS] Annual Abstracts of Statistics. The time series of the variables of the model are used to examine the impact of trade liberalization on industrial performance. There are time series data on various measures of industrial performance in the CBN Statistical Bulletin. These include real, nominal values, and index of industrial production. We use annual values of gross real industrial output, as it is expected that the real values would reflect better the role of openness in

industrial growth. Industrial output growth is measured as the sum of manufacturing output, mining output and the output from electricity generation. Following Edwards (1992), Sachs and Warner (1995), the level of trade openness is measured as the ratio of imports plus exports to GDP. The dummy variable is used to capture the effect of policy shock and change in pattern and planning strategies during the Structural Adjustment Programme (SAP). In the estimated model, this variable is assigned the value of one during the SAP era and zero otherwise.

6. Analysis of Regression Results

6.1 Stationary and Co-integration Results

The results of the stationarity test are reported in Appendix A1. The ADF unit root test shows that all the variables are stationary at first difference using the trend and intercept test equation at a critical value of -3.259. Also, the Philips-Peron test shows that all the variables are first-difference stationary with a critical value of -3.637. Appendix A2 presents the co-integraiton results. It examines the joint movement of the variables in the long-run following the methodology of Johansen (1988) and Johansen and Juselius (1990). The estimation results provide evidence of statistical long run relationship between the natural logarithm of industrial production, capital stock, the Nigerian labor force, human capital stock, trade openness, real exchange rate, structural deregulation variable and trade liberalization. This is easily ascertained on the basis of the fact that the likelihood ratios and the max-eigen values all exceed the critical values at the 1 percent level of significance.

6.2 System Error Correction Results

With a significant t-statistics, there exist a significant positive correlation between trade liberalization and industrial growth in Nigeria. In the short run, a 10 per cent rise in trade liberalization lagged one, two and three periods stimulates industrial production by 1.55, 1.09 and 1.23 percent respectively. This indeed indicates that the process of trade liberalization is cumulative and self-sustaining. The industrial production responded negatively and insignificantly

to capital formation even after the third lag. By economic intuition, the real savings are not enormously available in Nigeria, credit and financial institutions are yet to mobilize adequate savings and to divert them in preferred channels and above all savings are until now not adequately utilized for investment in capital goods. Accordingly, the rate of capital formation by means of savings mobilization and investment that will increase the production capacity of the Nigerian industries is low. Therefore, per-capita income is low and the propensity to save is exceptionally low. In effect, the result implies that the Nigerian economy is not capital intensive. Industrial production correlates positively and significantly with industrial production at both the first and third lags. The elasticity of industrial growth with respect to the first and third lags of labor force in Nigeria is 1.02 and 1.39 respectively. In effect, the results indicate that the industrial growth effect of labour force has a delayed effect. The significant effect of the Nigerian labor force on industrial production is not far-fetched given that the Nigerian economy is labor intensive. It means that the industries should embark on labor intensive projects, since it has comparative advantage in it than capital intensive projects.

The coefficient of the dummy variable, which represents the policy shock of the period of structural adjustment is positive but insignificant. The result thus portrays the fact that structural deregulation had positive but insignificant impact on the growth of industrial production in Nigeria. With a coefficient of 0.23, it indicates that 10 percent increase in the policy shock associated with structural deregulation will induce 2.3 percent positive impact on industrial production in Nigeria. The insignificance of the structural deregulation could be pointing to the fact that during the era of structural adjustment in Nigeria, Nigerian industries were made to look inward for the source of raw materials. Industrial production lagged one period has a positive and significant relationship with its current index. A 10 percent rise in the previous level of industrial production will bring about a rise in the current level by 2.53 percent. This indeed indicates that industrial growth is cumulative and self-sustaining in Nigeria. Industrial output growth responded positively and significantly to real exchange rate over the period of analysis. A 10 percent rise in the real exchange rate will induce 2.9 percent devaluation of the naira vis-à-vis the US dollar rate of foreign exchange. This in turn facilitates the export of industrial production in Nigeria. The R-squared explains 89 percent of the systematic variations in industrial growth in Nigeria on account of the policy changes in capital stock, labor force, human capital stock, real exchange rate, structural deregulation and trade liberalization.

The F-statistic of 293 shows that all the variables jointly had a statistically significant impact on industrial production. The Durbin-Watson Statistic of 2.03 shows that there is no problem of serial correlation. Therefore, the GMM estimates can be relied upon for meaningful statistical inference. The ECM depicts the 89 percent adjustment speed of convergence to long run equilibrium value of industrial growth in Nigeria after policy shocks or changes in trade liberalization together with other explanatory variables in the study. The estimated error correction model will act rightly to correct any deviations from the long-run equilibrium of industrial production in Nigeria. In effect, when level of industrial production deviates from equilibrium, there will be a feedback mechanism of exactly 89 percent. The stability of estimated results is determined on the basis of the CUSUM and CUSUMSQ plots (see Appendix A4).

7. Conclusion

This study focussed mainly on the relation between trade liberalization and industrial growth in Nigeria. Adopted in the study is the human capital model of endogenous growth developed by Lucas (1988) with modifications for trade liberalization within the Nigerian context. In the empirical investigation of the aggregate function of industrial output growth in Nigeria, co-integration and error correction estimation approaches were utilized. A unique co-integral relation between industrial production and the explanatory variables in the study is found. In order to determine the short-run dynamics around the equilibrium relationship, we estimated an error correction model. The empirical findings in this study have it that there is a positive and significant relationship between trade liberalization and industrial growth in Nigeria; structural deregulation had positive impact industrial growth in Nigeria; Nigerian industries are labor intensive; industrial production responded negatively and insignificantly to capital formation in Nigeria; industrial growth is cumulative and self-sustaining in Nigeria, that is, there is a feedback mechanism in the level of industrial production even in the case of deviation from equilibrium and real exchange rate devaluation facilitates the export of industrial production in Nigeria. The results however does not provide evidence of significance of structural deregulation and of capital formation on industrial output growth in Nigeria over the period of short-run analysis.

The policy implications are simple. The results of the study suggest the need for government to embark on comprehensive trade liberalization policies in order to accelerate and sustain industrial growth in Nigeria. However, the implementation of trade liberalization polices should be done with a delay caution. This is because excessive liberalization of trade could be disadvantageous to industrial growth as it is capable of bringing into the domestic markets, imported new finished products that are indeed substandard, that is, fake products.

Government should embark on structural deregulation in the industrial sector of the Nigerian economy. Nigerian industries should embark on labor intensive projects since it has comparative advantage in it than capital intensive projects. There is need for the government to enhance the rate of capital formation by means of savings mobilization and investment that will stimulate the production capacity of the Nigerian industries. Exchange rate devaluation should be encouraged in Nigeria.

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Appendix A1: Unit Root Test Results

PANEL A: AUGMENTED DICKEY-FULLLER TEST RESULTS @ 5 PERCENT		
Variables	ADF Test Statistic*	Critical Value @ 5%
$\Delta Log[GNG^{NGRT}]$	-5.89 , I[1]	-3.259
$\Delta Log[CAK^{SOCK}]$	-4.53, I[1]	-3.259
$\Delta Log[LAB^{FOCK}]$	-5.75, I[1]	-3.259
$\Delta Log[HMC^{CAPK}]$	-5.29, I[1]	-3.259
$\Delta Log[EXR^{RATE}]$	-7.79, I[1]	-3.259
$\Delta Log[DMV^{DMMY}]$	-5.35, I[1]	-3.259
$\Delta Log[TRA^{LBZT}]$	-4.55, I[1]	-3.259
PANEL B: PHILIPS-PERRON TEST RESULTS @ 5 PERCENT		
Variables	PP Test Statistic*	Critical Value @ 5%
$\Delta Log[GNG^{NGRT}]$	-10.35, I[1]	-3.637
$\Delta Log[CAK^{SOCK}]$	-9.39, I[1]	-3.637
$\Delta Log[LAB^{FOCK}]$	-13.55, I[1]	-3.637
$\Delta Log[HMC^{CAPK}]$	-15.59, I[1]	-3.637
$\Delta Log[EXR^{RATE}]$	-9.39, I[1]	-3.637
$\Delta Log[DMV^{DMMY}]$	-15.35, I[1]	-3.637
$\Delta Log[TRA^{LBZT}]$	-22.59, I[1]	-3.637
NOTE: * indicates difference stationary series @ 5% for both the ADF and PP		

Appendix A2: Co-integration Test Results

Eigen Value	Likelihood Ratio	Max-eigen Value	1% Critical Value	No. of Co-integrating Equations
0.59	58.65*	57.35*	54.46	At most 1
0.53	35.53**	49.93**	33.65	At most 2
0.09	13.38***	33.75***	5.55	At most 3
*, **, *** denotes 1, 2, 3, co-integrating vectors at 1% significance level respectively.				

Appendix A3: System Error-Correction Results

Industrial Growth Model	**Generalized Method of Moments**	
Variables	**Coefficients**	T-Statistic
C	-0.02	-1.89
$\Delta Log[CAK^{SOCK}]_{[-1]}$	-0.29	-1.05
$\Delta Log[CAK^{SOCK}]_{[-2]}$	-0.02	-1.26
$\Delta Log[CAK^{SOCK}]_{[-3]}$	-0.05	-1.33
$\Delta Log[LAB^{FOCK}]$	1.02	5.99*
$\Delta Log[LAB^{FOCK}]_{[-3]}$	1.39	9.35*
$\Delta Log[HMC^{CAPK}]$	0.05	3.67**
$\Delta Log[GNG^{NGRT}]_{[-1]}$	2.53	13.67*
$\Delta Log[EXR^{RATE}]$	-0.29	-2.97***
$\Delta Log[DMV^{DMMY}]$	0.23	1.35
$\Delta Log[TRA^{LBZT}]$	1.55	5.53*
$\Delta Log[TRA^{LBZT}]_{[-1]}$	1.09	5.55*
$\Delta Log[TRA^{LBZT}]_{[-2]}$	1.23	3.29**
$ECM_{[-1]}$	-0.89	-5.98*
Model Diagnostic Results		
Measure	Statistic	Probability
R-Squared	0.89	0.00
Adjusted R-squared	0.85	0.00
F-Ratio	293	0.00
S.E. of Regression	0.02	0.00
Sum Square Residual	0.09	0.00
Log likelihood	3.05	0.00
Durbin-Watson Statistics	2.03	0.00
*, **, *** indicates statistical significance @ 1%, 5% , 10% respectively		

Appendix A4: Stability Results

Fig. A: CUSUM

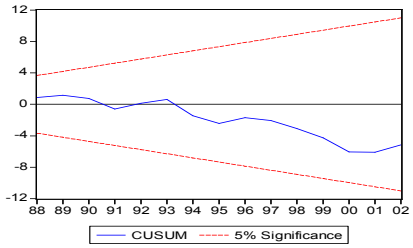

Fig. B: CUSUMSQ