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TOTAL FACTOR PRODUCTIVITY AND MANUFACTURED EXPORT IN NIGERIA

Abstract:

This study investigates the relationship between total factor productivity and manufactured export in Nigeria between 1973 and 2009. The study made use of time series data and adopted vector autoregressive (VAR) Model with its forecast error variance decomposition (FEVD) in investigating shock transmission among TFP and manufactured export. The study also estimates TFP in Nigeria using non-parametric approach. The empirical finding in the study revealed that TFP in Nigeria had been low and unstable, indicating a situation of poor and unstable technological growth in Nigeria. The study also found that both manufactured export and import of capital goods exhibited positive relationship with TFP in Nigeria. The findings also showed the existence of bi-directional causality between Total factor productivity and manufactured export in Nigeria. The paper recommended that government should improve technological efficiency i.e. TFP and import of capital goods in order to experience improvement in Nigeria manufactured export, government should also take drastic step in improving the growth of per capita output .

Keywords:

Total Factor Productivity and Manufactured Export

JEL Classification: A10

I. INTRODUCTION.

Orubu (1988) and Iyoha (1995) contend that export expansion leads to growth through the stimulation of technical change and investment or by demand spill over into other sectors of the economy. This means that export expansion accelerates the growth process which can lead to the diversification of the economy.

Nigeria export sector is characterized by the dominant of a single export commodity since 1960. Initially, Nigerian economy was dominated by agricultural commodity exports between 1960s and 1970s before the situation changed in the mid-1970s when crude oil became the main export product of the country. Douglas and Jike (2005) described several factors militating against the performance of non-oil export which include low international demand for primary commodity export, ineffective marketing strategies, and slow pace of diversifying the non-oil export base from primary products to manufactures.

Various measures have been taken by successive governments in Nigeria which led to introduction of various reforms in the country. The major objective of these reforms was the diversification and restructuring of the productive base of the economy with a view to enhancing efficiency and reducing its dependence on oil exports. The Structural Adjustment Programme (SAP) as a reform strategy, introduced in 1986 to bail the country out of its numerous challenges had favourable effect on agriculture but a negative effect on manufacturing. The relative contribution of manufacturing production to GDP showed that SAP, indeed, triggered a shrinking growth of the manufacturing sector which contributed 8.7% to GDP in 1986. However, with the adoption of SAP, the manufacturing sector's relative share in output began to fall and reached a 5.29% in 1989 and fell further to 4.96% in 1990s. Despite these reform strategies, oil export is still expanding while the non-oil export is yet to improve appreciably. The exports of crude oil constitute about 96% of the total exports, (Okon, 2004). This shows that the reforms are not capable of diversifying the Nigerian economy which would have boosted manufacturing export to pave way for sustaining economic development.

World Bank (1993) opined that the promotion of exports had been a significant source of rapid productivity change through greater access to best practice technologies. This shows the need for the explicit assessment of the relationship between exports and technological progress represented by growth in the total factor productivity.

There are extensive debates on the relationship between openness and productivity growth using developed countries' aggregate economy-wide data, but few works have been done as regards causal link between export and productivity in developing economies. In fact, partial productivity measures used in most of the previous studies carried out have long been criticized for their incomplete picture of performance thereby causing misleading analysis.

Another missing gap in this area is that many empirical works on Nigerian economy such as Alao (2010) and Akinlo (2006) did not estimate Total Factor Productivity (TFP) in Nigeria to ascertain the technology efficiency of Nigeria. Those that estimated TFP in Nigeria like Ogunleye and Ayeni (2008) only estimated TFP in Nigerian manufacturing sector and this might not capture technology sufficiency of the whole economy.

The broad objective of this study is to investigate the relationship between productivity and manufactured export in Nigeria. However, the specific objectives of the study are to:

i. estimate Total Factor Productivity (TFP) in Nigeria.
ii. investigate the existence of causal relationship between TFP and manufactured export in Nigeria and determine the direction of causality.
iii. examine shock transmission between TFP and manufactured export in Nigeria.

In achieving these, the remaining part of the paper is organized thus: the next section provides a brief literature review. This is followed by an outline of methodology and estimation technique, the next section contains results and discussion. The conclusion and policy recommendation end the paper.

II LITERATURE REVIEW

Productivity measures the relationship between the quantity of goods and services produced and the quantity of resources (inputs) used in the production. Atkinson, Banker, Kaplan and Young (1995) described productivity as a ratio of output to input and this was supported by Screyer (2001) who said that “productivity is commonly defined as a ratio of a volume of output to a volume of input used”. Productivity can be said to be the amount of output produced by each unit of input.

Olaoye (1985) observed that productivity as a concept can assume two dimensions: namely partial productivity and total factor productivity (TFP) otherwise known as Multifactor Productivity. Partial productivity could either be labour or capital productivity. This can be measured at the national level, industry or factory level. When the definition of productivity is related to any given factor input e.g., when output is associated to per man-hour or per unit of labour is called labour productivity. This only measures how the output per unit has changed over time, ignoring the contributions from other factor inputs.

NECA (1991) observes that it is more common in productivity studies to see emphasis placed on labour productivity. Labour productivity translates to what is known as human productivity because it is the type of productivity that directly affects the purchasing power of the people. Partial productivity measures have been criticized for their incomplete picture of performance. It must be appreciated that the definition of productivity partially is purely to satisfy the demand of theoretical curiosity.

Total Factor Productivity (TFP) is defined as the relationship between output produced and an index of composite inputs; meaning the sum of all the inputs of basic resources notably labour, capital goods and natural resources. The general understanding of Total Factor Productivity (TFP) is that it is measured by an index of outputs, or as the shift in the production function (Hans and Dick 2000). These two approaches are identical when the production function is defined on continuous time and production is assumed to be efficient.

The new endogenous growth models establish the links between long-run growth and technological progress, as well as providing a framework in which trade can permanently increase the rate of growth in the host country through technology transfer, diffusion, and spillover effects. Romer (1993) points out that one benefit that trade brings is access to new ideas. According to him, it is spillover from research efforts by a firm that leads to the creation of new knowledge by other firm. In other words, new research technology by a firm spillover instantly across the entire economy i.e. knowledge gained from export trade will spill over to the entire economy. Moreover, the firm investing in research technology will not be exclusive beneficiary of the increase in knowledge. The other firms or countries participating also make use of the new knowledge and increase their production. Thus the production of goods from increase knowledge displays increasing returns. New knowledge is the ultimate determinant of productivity which is determined by knowledge gained from export.

Liman and Miller (2004) examined cross country pattern of economic growth by estimating a stochastic frontier production function for 80 developed and developing countries and decomposing output change into factor accumulation, total factor productivity and production efficiency improvement. They also incorporate the quality of inputs in analyzing output growth, where the productivity of labour depends on its average level of education. They discovered that developing countries face the challenge of acquiring and absorbing foreign technology and that productivity growth depends on making the best use of the imported technology. Their result shows that the share of TFP growth is high in East and South Asia where TFP growth contributes to 34.1 and 61.9 percent of total output growth respectively. In the West, TFP growth explains 12.5 percent of total output growth. In Latin America and Africa, the contributions of TFP to total output growth are negative being –1.4 percent for Latin America and –19.3 for Africa respectively.

Kaloyan (2005) examined how TFP measurement enables determination of the contribution of supply-side production inputs to economic growth. He discovered that it is difficult to construct a production function with stable parameter because there are typical developments of capital and labour during periods of economic growth, as well as due to the lack of sufficiently long and dependable data series. To him, the dynamics of total factor productivity growth are the main determinant of economic growth in Bulgaria. The low and unstable values of TFP in the years proceeding 1997 determine the unstable development of the gross domestic product in Bulgaria. With

the introduction of reform, there was a corresponding increase in the rates of growth of total factor productivity. Therefore, he concluded that total factor productivity development is the main driving force of economic growth.

Akinlo (2006) examined the effects of macroeconomic factors on total factor productivity in 34 sub-Sahara African countries for the period 1980 - 2002. The study made use of pooled time series and cross sectional data in its analysis. The study revealed that external debt, inflation rate, agriculture value-added as percentage of GDP, lending rate and local price deviation from purchasing power parity are significantly negatively related to total factor productivity. However, human capital, export-GDP ratio, credit to private sector as percentage of GDP, foreign direct investment as percentage of GDP, manufacturing value-added as a share of GDP and liquid liabilities as percentage of GDP have significant positive effect on total factor productivity. The study concluded that policies that reduce population growth rate and debt; facilitate greater openness, sound macroeconomic fundamentals, price stability, financial deepening and greater private participation would lead to higher total factor productivity in Sub-Saharan region.

Idris (2007) analyzed and discussed the factors that determine TFP growth in Malaysia during 1971 – 2004. Data Envelopment Analysis (DEA) approach was used to estimate the changes in the production frontier. He used Malinquist Production index to decomposed total productivity into technical change and technical efficiency change. He discovered that TFP growth of the Malaysian economy for the entire test period had not been encouraging due to negative contribution from technical efficiency. His result reveals that the Malaysian economy was able to cause shifts in its own frontier due to innovation. He concluded that the economy needs an enhancement of its productivity-based catching-up capability, specifically the effective use of human capital in the labour market, increase the number of skilled workers to operate a more sophisticated technology and the adoption of the new technology.

Liao and Liu (2007) examined empirically the inter play between exports and productivity growth for eight East Asian economies in a multivariate framework by applying bound test and modified world test. They discovered that very limited studies have been conducted on the causal links between exports and productivity growth in Asian economies despite increased interest in the relationship between trade and macroeconomic performance in developing economies. The work avoided the limitation of bivariate systems by switching to a multivariate. The result of their study shows that the export-led TFP growth in Korea and Singapore, while the productivity-led export growth appear to be likely in China, Hong Kong, Indonesia, Philippines and Malaysia. There is bi-directional causality in Korea, Singapore and Taiwan, implying that exports and productivity growth have reinforced each other while causality is unidirectional, running from productivity to exports, for China, Hong Kong, Indonesia, Malaysia and Philipines. Both long-run and short-run causal link exists in Hong Kong, where as only long-run causality is found in the remaining four economies. The

conclusion of Liao and Liu provides little support for the export led growth hypothesis. In contrast, productivity is found significant in explaining the future path of exports, confirming the productivity-led hypothesis.

Ogunleye and Ayeni (2008) investigate the link between trade and productivity growth for the Nigerian economy with special attention to export-productivity nexus in the manufacturing sector. They used Engle Granger static procedure of co-integration technique and error correction model in analyzing the data covering the period 1970 - 2003. The study employed multivariate frame work by adding set of control variables which include import growth, rate of foreign income, relative income and capacity utilization. The study revealed that there is bi-directional causality between Export and total factor productivity and this provide support for a link between export growth and productivity growth. They concluded that Nigerian should look inward rather than outward, to promote and develop manufacturing sector towards increasing production, not only for domestic consumption but for export since it is clear that increased productivity can increase export growth.

Alao (2010) empirically investigates the macroeconomic factors on manufacturing performance in Nigeria using co-integration and error correction model (ECM). He used set of variables such as rate of growth of gross domestic product, interest rate spread, banks' Credit to the Manufacturing sub-sector, inflation rate, foreign direct investment, exchange rate, quantity of graduates, structural adjustment dummy and crisis dummy. He concluded that long run equilibrium relationship exist between productivity and manufacturing sub-sector.

Liao and Liu (2007) in their empirical analysis confirmed that there is bi – directional causality running from productivity to export in Korea, Singapore and Taiwan while there is uni-directional causality running from productivity to export in China, Hong Kong, Indonesia, Malaysia and Philippines. They also established that long run and short run causality exist only in Hong Kong while China, Indonesia, Malaysia and Philippines have long run causality implying that short run causality does not exist in the four countries. Their empirical works were restricted to East Asian countries without considering African countries.

In Nigeria, Ogunleye and Ayeni (2008) using Engle Granger static procedure confirmed that there is bi – directional causality between export and productivity in the manufacturing sector of Nigerian economy using data spanning from 1970 – 2003. Also, Alao (2010) made use of Engle Granger static procedure in establishing the long run relationship between productivity and manufacturing performance. As both works employed Engle Granger static procedure of Co-integration and Error Correction model, they could only examine the direction of causality without investigating shocks transmission between the variables which can be effectively analyzed by Vector Auto Regressive (VAR) model. Based on the estimation technique they employed, they could not examine the shocks transmission between export and productivity in

manufacturing sector of Nigerian economy which is imperative in ascertaining the sensitivity of these variables between one another. In addition, both works failed to estimate total factor productivity for the whole Nigerian economy to ascertain the technological efficiency of Nigeria.

In view of the above, this study is aimed at filling these gaps by examining shocks transmission between Total Factor Productivity (TFP) and manufactured export in Nigeria using vector Auto – regressive (VAR) model. This technique has been recognized by Gujarat and Sangeetha (2007) as the best method for examining shocks transmission among variables in order to confirm the sensitivity of these variables.

III METHODOLOGY

(a) Model Specification and Estimation Technique.

With reference of the causal objective of this study and based on the literature review, with special reference to Liao and Liu (2007), the model for this study is specified thus:

$TFP_t = f(EXP_t, MCG_t)$

This can be explicitly written as: $TFP_t = \alpha_0 + \alpha_1 EXP_t + \alpha_2 MCG_t + U_t$

Where α_0, α_1, and α_2 are parameters to be estimated.

Where:

TFP = Total factor productivity.

EXP = Manufactured Export.

MCG = Import of capital goods, which represents the control variable.

U_t = Error term.

This study obtains TFP estimates by a direct calculation of equation bellow:

$$TFP = \frac{\Delta Y}{Y} - 0.35\frac{\Delta K}{K}$$

The estimated TFP is computed for each year by using time series data on $\frac{\Delta Y}{Y} and \frac{\Delta k}{k}$.

A positive relationship is expected between the Total Factor Productivity and manufactured export in Nigeria so also that of Import of capital goods. This can be symbolically shown as: $\alpha_1 > 0$ and $\alpha_2 > 0$.

This paper made use of Augmented Dickey-Fuller (ADF) to ascertain the degree of stationary of variables employed in this study. This study adopted pairwise granger causality to test the causal relationship between the variables. It also adopted impulse response and Forecast Error Variance Decomposition of the Vector Autoregressive (VAR) Model. The study employed these techniques so as to estimate shock transmission among TFP and manufactured export.

(b) **Sources of Data**

This study relied on secondary data. Therefore, secondary data was collected on National output, gross capital formation and population which were used for total factor productivity computation. Also, data on manufacturing export and import of capital goods were collected from various issues of the CBN statistical bulletin

(IV) ESTIMATION AND RESULT ANALYSIS

Total Factor Productivity.

This study estimated Total Factor Productivity (TFP) by direct calculation of $\Delta Y/Y - 0.35\Delta K/K$. The estimated TFP was computed for each year using time series data from Nigeria. The result of the estimated TFP for the period 1973 to 2009 is presented in form of a Line graph in figure 1 below.

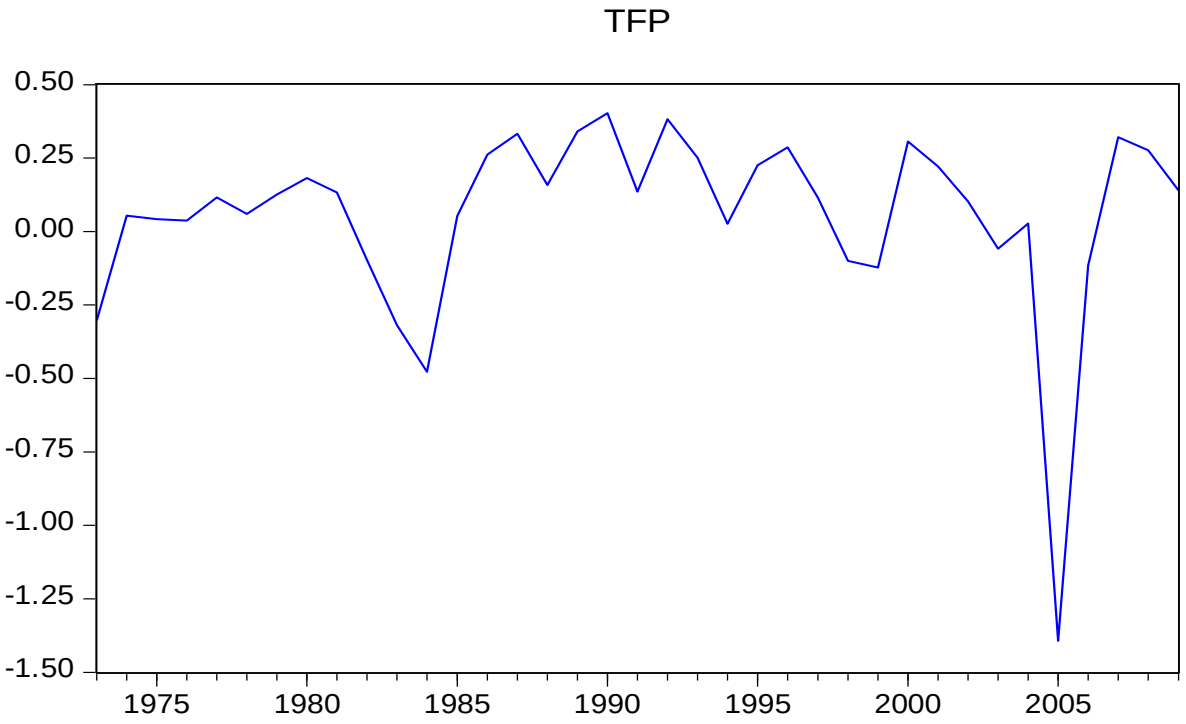

Figure 1: Line Graph of TFP Trend.

A cursory look at figure 1 shows that TFP in Nigeria had been unstable over the years. It rose a bit from negative values between 1974 and 1981 after which it falls backward, reaching zero value and then negative. The negative value recorded for TFP should be expected if the per capita output growth (Δy/y) is lower than the growth in physical capital stock per person (Δk/k).

Between 1985 and 1999, TFP recorded an upward surge; it later fluctuated between 2000 and 2002 after which a negative drift was recorded. TFP pulled up again in 2006 and tend to maintain an upward increase. It is to be noted that, the TFP is a measure of the rate of technological progress. Thus, we may interpret the fluctuation trend in TFP in Nigeria as a situation of poor and unstable technological growth in the Country. This is in agreement with the work of some researchers such as: Kaloyan (2005), Liman and Miller (2004) and Idris (2007) that TFP growth of developing economy has not been encouraging due to unstable and negative contribution from technical efficiency.

The Time series properties of the variable.

The result in Table 1 showed that manufactured export (MEX) and import of capital good (MCG) are made stationary at first difference and second difference respectively while the total factor productivity (TFP) is stationary at its level. The implication of this result is simple, since the three variables are not integrated of the same order; a condition for co integration is not met. On the basis of this unit root result, the best alternative as suggested by Gujarat and Sangeetha (2007) is to resort to the short-run

dynamic estimation using the Vector Auto Regression (VAR) technique since a long-run equilibrium relationship is not achievable. This justifies the use of VAR for the analysis in this study.

Table 1: Augmented Dickey-Fuller unit root test.

	Level		First Difference		Second Difference		Order of integration
Variable	ADF Statistics	5% critical value	ADF Statistics	5% critical value	ADF Statistics	5% critical value	
MEX	3.1274	-2.9458	-3.8806	-2.9484			I (1)
MCG	4.4951	-2.9458	1.0699	-2.9484	-4.0427	-2.9604	I(2)
TFP	-4.4172	-2.9458					I(0)

Source: computed from data (2012).

Causality Test Analysis

The causality test result as shown in table 2, indicate a bi-directional causality between MCG and MEX. The direction of causality runs from MCG to MEX and vice visa. The finding agrees with the a priori expectation that when MCG is directed to productive channels in an economy, MEX tend to increase.

The result further confirmed that TFP does not granger cause MEX and vice visa. This position is in line with Joachim (2005) who claimed that export does not necessarily improve productivity, but contrary to Liao and Liu (2007) who confirmed that causality is unidirectional, running from productivity to exports in some selected countries in East Asian.

In the same vein, this study established that long run causality does not exist between TFP and MCG. This is contrary to the a priori expectation of the study. Therefore, the finding implies that MEX fail to determine TFP in Nigeria but actually influence MCG to some extent since a causal link was established between MEX and MCG in the study.

Table 2: Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
MCG does not Granger Cause EPT	36	7.87212	0.0084
EPT does not Granger Cause MCG		9.91220	0.0035
TFP does not Granger Cause EPT	36	0.29420	0.5912
EPT does not Granger Cause TFP		0.03442	0.8540
TFP does not Granger Cause MCG	36	0.04167	0.8395
MCG does not Granger Cause TFP		0.02063	0.8867

Source: computed from data (2012).

Impulse Response Analysis among Variables.

The results of impulse- response function in Table 3 and figure 2 below revealed that TFP responds poorly to shocks in manufactured exports and import of capital goods. This shows that technological change in Nigeria has not significantly improved upon the manufactured export in the country because of the poor state of technology in the industrial sector. It was also revealed that a standard deviation shock in manufactured export and import of capital goods is volatile and positive which indicates that import of capital goods has greater impact on manufactured export vice - versa. This result is supported by Hashin (1998) and Idris (2007) they concluded that TFP plays a very minimal role and that capital was a major determinant of output or productivity growth of the manufacturing sector.

Table 3: **Impulse Response Result**

Response of MEX:			
Period	MEX	TFP	MCG
1	5388.567	0.000000	0.000000
	(644.057)	(0.00000)	(0.00000)
2	4298.423	-913.1539	269.9139
	(1127.77)	(788.313)	(1166.81)
3	2375.549	-431.5919	1769.534
	(1267.64)	(1057.92)	(1022.45)
4	1567.749	758.1413	3417.213
	(1377.37)	(1198.68)	(1105.94)
5	2372.980	1432.274	4580.006
	(1508.75)	(1179.74)	(1180.68)
6	4137.601	1174.456	4779.428

	(1738.10)	(1228.31)	(1346.23)
7	5774.733	678.0287	5173.776
	(2035.24)	(1448.26)	(1430.08)
8	6835.591	600.2686	6184.390
	(2404.01)	(1725.56)	(1690.60)
9	7733.504	1121.331	8163.679
	(2926.65)	(2132.62)	(2093.24)
10	9181.942	1811.932	10438.04
	(3587.10)	(2547.99)	(2723.73)

Response of TFP:

Period	MEX	TFP	MCG
1	-0.015537	0.198993	0.000000
	(0.03369)	(0.02378)	(0.00000)
2	0.011317	0.152975	0.232639
	(0.05970)	(0.05210)	(0.05138)
3	0.122137	-0.068772	-0.207371
	(0.07250)	(0.06142)	(0.06693)
4	0.093092	-0.095210	-0.024442
	(0.07039)	(0.06541)	(0.10313)
5	-0.026093	-0.079808	-0.175641
	(0.06092)	(0.06108)	(0.09684)
6	-0.118603	0.044280	0.111838
	(0.07063)	(0.06355)	(0.10721)
7	-0.099846	0.042298	-0.056701
	(0.07301)	(0.07060)	(0.13079)
8	-0.038051	0.034771	0.052620
	(0.06140)	(0.05686)	(0.13044)
9	-0.000703	-0.044188	-0.160638
	(0.06693)	(0.06131)	(0.12848)
10	-0.033273	-0.036640	-0.045246
	(0.05866)	(0.05800)	(0.14606)

Response of MCG:

Period	MEX	TFP	MCG
1	24444.71	18999.93	68551.93
	(12374.1)	(11807.8)	(8193.52)
2	43521.54	4504.578	14077.72
	(14988.3)	(11149.7)	(16368.0)
3	53849.97	8062.466	67876.33
	(19490.9)	(17194.5)	(18487.4)
4	61055.93	752.1150	33588.55
	(21625.8)	(15097.4)	(23811.5)

5	66799.58	14705.39	94484.86
	(28192.5)	(21715.8)	(25346.7)
6	81789.91	14472.72	77344.17
	(31118.6)	(20188.0)	(33714.1)
7	103617.4	24278.20	132786.6
	(39291.0)	(28953.8)	(34067.7)
8	132638.3	20385.18	124695.0
	(46494.3)	(32291.8)	(43286.5)
9	163283.9	28741.55	183854.9
	(59456.5)	(44130.0)	(47863.3)
10	199585.6	30680.84	198339.7
	(72491.9)	(50152.5)	(60719.5)

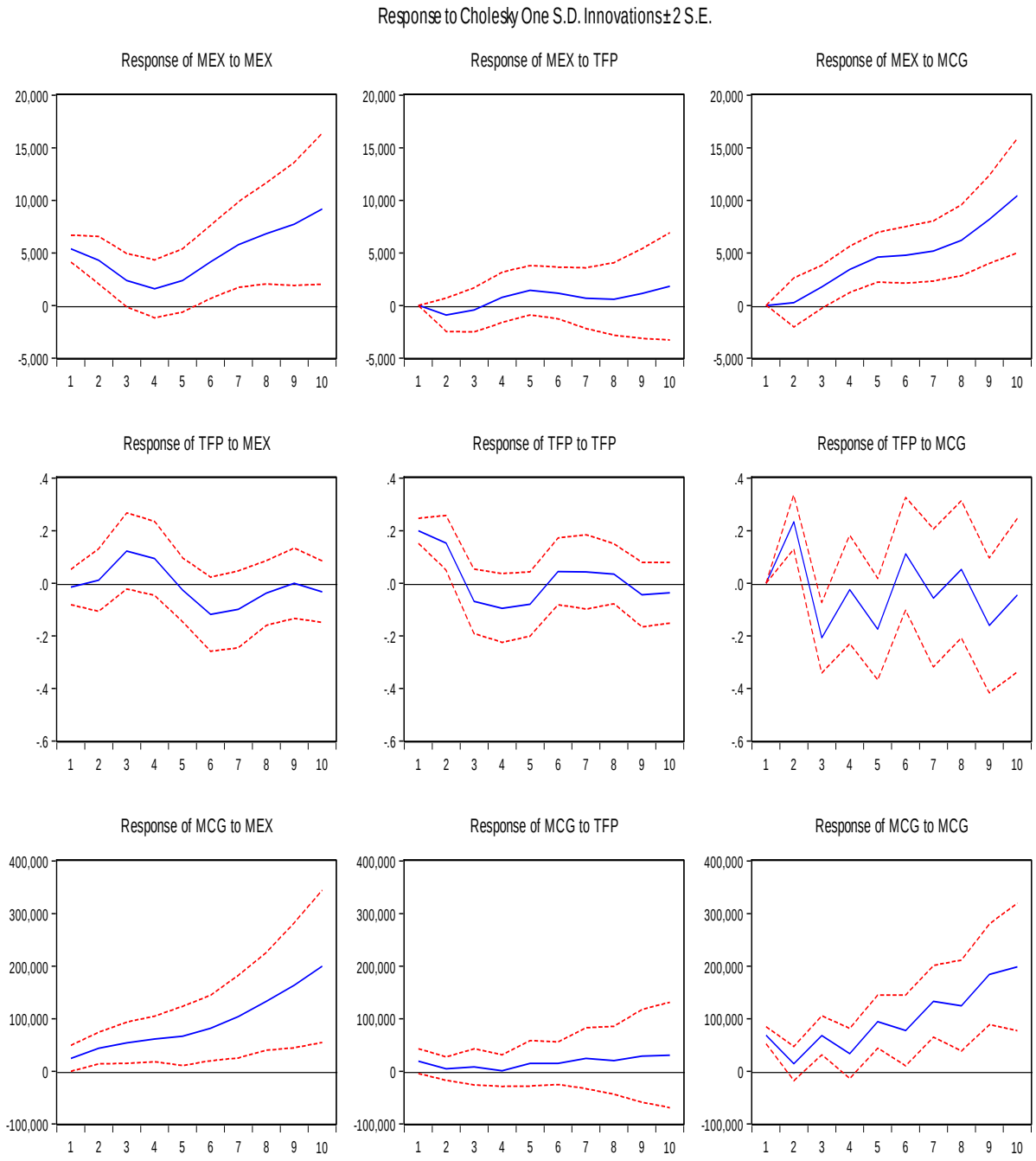

Figure 2: Impulse Response Function

The Forecast Error Variance Decomposition Analysis

The result in figure 3 provides complementary information on the dynamic behaviour of the three variables (MEX, TFP, and MCG) in the system. This analysis decomposes the forecast variance into the contributions by each of the different shocks. It shows the proportion of forecast error variance forecast of MEX, TFP and MCG, that is attributing to its own innovation or shock and to shocks in the other endogenous variables. The variance decomposition result revealed that the greater shocks received by manufactured export is the feedback shock from its own lag and latter gives way to shocks from import of capital goods. This implies that decline in import of

capital goods contributes to the poor growth rate of manufactured export.

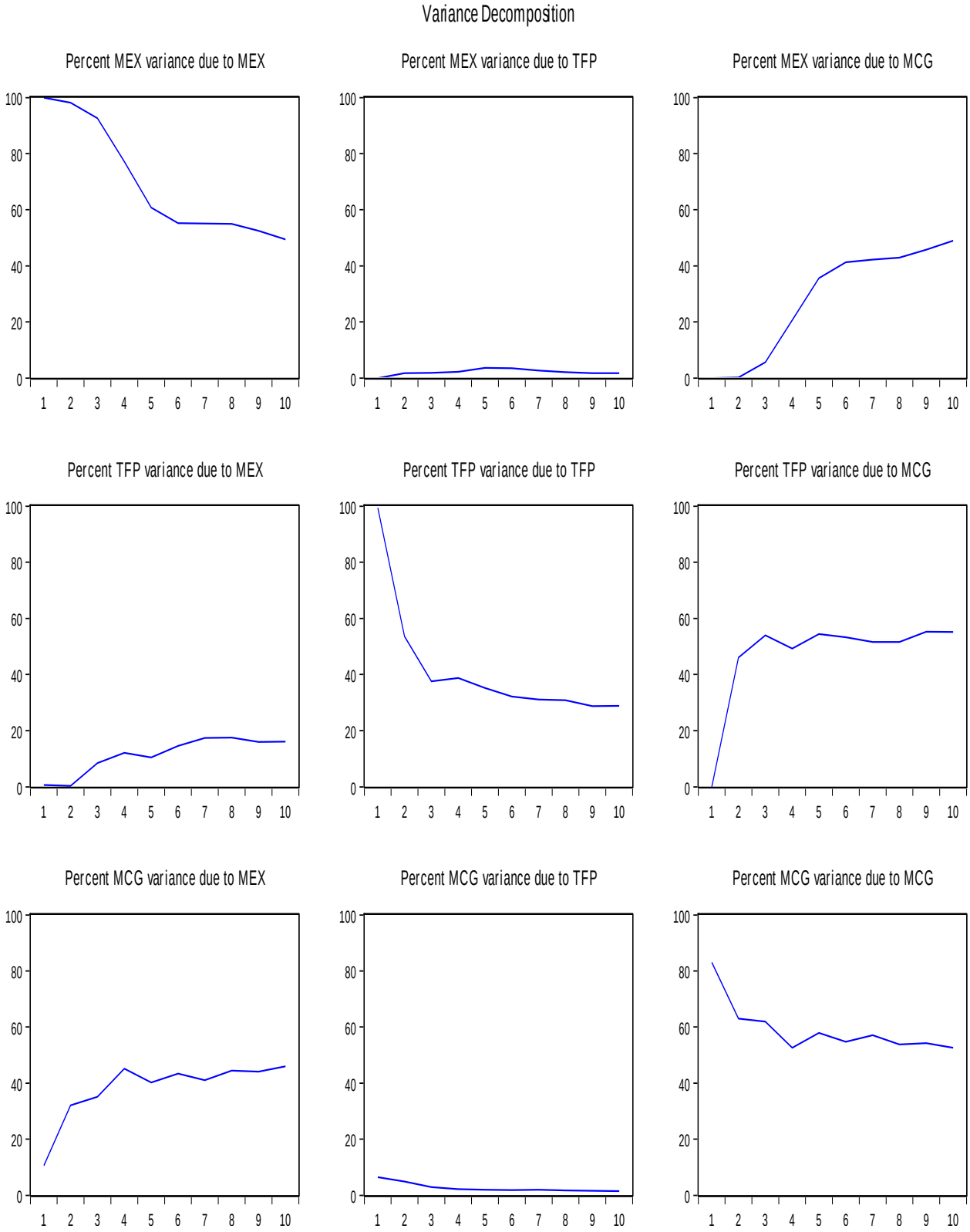

Figure 3: Forecast Error Variance Decomposition

(V) DISCUSSION OF FINDINGS

The result of this study revealed fluctuation in the trend of TFP in Nigeria as shown in figure 1. This implies that Nigerian economy is operating with poor and unstable technological growth. This is in agreement with the work of Kaloyan (2005), Liman and Miller (2004) and Idris (2007) found that TFP growth of developing economy has not been encouraging due to unstable and negative contribution from technical efficiency.

The result of the study also showed that there is bi-directional causal link between manufactured export and import of capital goods in Nigeria as revealed in Table 2. The position agreed with the a priori expectation of the study.

In another dimension, the result of impulse- response function in Table 3 and figure 2 revealed that TFP responds poorly to shocks in manufactured exports and import of capital goods. This shows that technological change in Nigeria has not significantly improved manufactured export in the country because of the poor state of technology in industrial sector. It was also revealed that a standard deviation shock in manufactured export and import of capital goods is volatile and positive which indicates that import of capital goods has greater impact on manufactured export vice - versa. This result is supported by Maison and Arshard (1992), Hashin (1998) and Idris (2007) who concluded that TFP plays a very minimal role and that capital was a major determinant of output or productivity growth in the manufacturing sector.

Furthermore, the result of variance decomposition shown in figure 3 revealed that the greater shocks received by manufactured export is the feedback shock from its own lag and latter gives way to shocks from import of capital goods. This implies that decline in import of capital goods contributes to the poor growth rate of manufactured export.

(VI) CONCLUSION AND POLICY RECOMMENDATIONS

From the findings of the study, it was concluded that there exist causal relationship between MEX and MCG in Nigeria in the period under review as a bi-directional relationship exist between them. Thus, MEX in the period have a measure of effectiveness in causing some form of MCG. Based on the findings, we recommend as follows:

i. For Nigeria to have a stable technological growth, drastic step should be taken in improving the growth of her per capita output.

ii. There should be appropriate policy-mix to ensure that both MEX and MCG activities are not mitigated by conflicting macroeconomic policies in Nigeria.

iii. A concerted effort should be directed toward productive channels of MEX in the Nigeria economy so as to increase MCG.

iv. It is finally suggested that for Nigeria to experience improvement in her manufactured export, it is imperative for her to improve import of capital goods.

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