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**Article**

## Growth co-movements between Nigeria and its industrialized trade partners: Does the decoupling hypothesis hold for Nigeria?

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# GROWTH CO-MOVEMENTS BETWEEN NIGERIA AND ITS INDUSTRIALIZED TRADE PARTNERS: DOES THE DECOUPLING HYPOTHESIS HOLD FOR NIGERIA?

Adesola Ibiroñke<sup>1</sup>

## Abstract

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*Are there still significant common macroeconomic fluctuations between Nigeria and its industrial trade partners, even with the increased growth performance and resilience of emerging market and developing economies to developments originating from advanced economies in recent years? This paper answers this question by empirically exploring oil-related growth fluctuations between Nigeria and its two main (industrial) trade partners, namely the US and the Euro Area. This involves testing for Nigeria a relatively new hypothesis in the literature dealing with the subject in question, namely the decoupling hypothesis. The main finding is that the decoupling hypothesis does not hold for Nigeria, as there is a statistically significant degree of growth fluctuations between the country and its two industrial trade partners. Key policy implications of this finding are: (i) Trade links between Nigeria and its industrial counterparts constitute a significant source of macroeconomic risk for the former, as fluctuations imply uncertainty and risk. (ii) Apart from adopting shock-absorbing macroeconomic policies, diversifying trade away from industrial trade partners and increasing regional trade such as trade within the West African Monetary Zone (WAMZ), may be an effective policy through which Nigeria can limit vulnerability to fluctuations originating from industrial trade partners.*

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**Keywords:** Economic Integration; Macroeconomic Aspects of International Trade and Finance; Open Economy Macroeconomics; International Linkages to Development; Africa

**JEL Codes:** F15; F4; F41; O19; O55-

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## INTRODUCTION

The decoupling hypothesis is a relatively new “theory” having policy implications.<sup>2</sup> The hypothesis involves testing whether the business cycles of the emerging market and developing economies (EMDEs) are no longer tightly linked to the business cycles of the advanced economies (ADs), because in recent years there is evidence of stronger growth performance of the EMDEs over the ADs, and resilience of the former to developments in the latter (see for example, IMF, 2012). Traditionally the performance of the EMDEs largely depended on the performance of the ADs (Lewis, 1992; Kose, 2008). The decoupling hypothesis has been tested in the literature for individual EMDEs (e.g. Jayaram et al., 2009; Obiora, 2009), selected EMDE regions (e.g. Willett et al., 2011; Kim et al., 2011), and for the whole group of the EMDEs (e.g. Economic and Financial Affairs, 2011; Dervis, 2012).

Generally, international business-cycle linkages are caused by trade and financial linkages between countries. But trade has been identified as the dominant source of international transmission of business cycles (Baxter and Kouparitsas, 2005). This is consistent with the findings of Kose and Raymond (2001) that trade shocks are the dominant source of fluctuations in aggregate output in typical African economies, because the countries have the common feature of large dependence on trade involving primary commodities as exports and intermediate inputs and capital goods as imports.

Against the forgoing explanations, the objective of this paper is to empirically investigate whether or not there are still significant growth fluctuations between Nigeria and its industrial trade partners, by testing the decoupling hypothesis for Nigeria with reference to its two main trade partners, namely the Euro Area and the US. The main trade partners are identified through the examination of the trade shares of Nigeria’s trade partners in a trade share matrix involving the country and 33 other nations, which are important countries in the global economy in that they account for 90% of global output (Dees et al., 2007).

Since Nigeria is a major oil exporting country, oil price has a strong role to play in the transmission of business cycles into the economy. Generally, oil has a high level of globalization, making it to play a strong role in the transmission of business cycles between countries. Therefore, the analysis of this paper primarily involves a dynamic factor model (DFM) having an oil-related feature.

This paper is particularly relevant in the decoupling literature, as there is little empirical work on the decoupling hypothesis focusing on African countries. The outstanding economic performances within the Asian region in recent years have made most studies on the hypothesis to focus on the countries of the region (e.g. Kim et al., 2011; He and Liao, 2011; and Fidrmuc and Korhonen, 2010) at the expense of other developing regions.

Overall, the results of the paper show a statistically significant degree of common growth fluctuations between Nigeria, US and Euro Area, due to a common oil-related unobserved factor. This finding is found to be robust in a covariate model. Therefore, the decoupling hypothesis does not hold for Nigeria. According to the traditional small open-economy literature, the large and developed economies (i.e. US and Euro Area) are the source of the common fluctuations between the three economies in question (US, Euro Area and Nigeria), as small open economies such as Nigeria are too small to influence large economies (see Fleming, 1962; Mundell, 1963; Dornbusch, 1976).

The results have policy implications. First, the trade links between Nigeria and its advanced trade partners form a significant source of macroeconomic risk for the former, as fluctuations point to uncertainty and risk. Macroeconomic performance is hindered when there is uncertainty because

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<sup>2</sup> *Studies on the hypothesis came into the literature about a decade ago, as shown in Table 2. The work of Kose et al. (2008) is perhaps one of the well-known studies on the subject.*

economic agents delay decisions (i.e. decisions on investment, consumption, production, etc) when there is uncertainty, which consequently affects the overall welfare of the economy (Ebrahim et al., 2014).

Second, although Nigeria has adopted shock-absorbing macroeconomic policies (e.g. the oil-price-based fiscal rule) in recent years to protect itself from externally generated fluctuations, due to lessons learnt from shocks such as the debt crisis of the early 1980s, the country may, however, need to diversify trade away from the ADs. As such, regional trade, such as trade within the West African Monetary Zone (WAMZ) will increase, thus, limiting susceptibility to developments in the ADs. Findings of this paper reveal that the US and the Euro Area both account for about 63 percent of Nigeria's trade, suggesting that the latter economy will be influenced largely by developments in the two developed economies, since trade is a strong source of international transmission of business cycles as noted earlier.

The remaining part of the paper is organized as follows: Stylized empirical discussions on the decoupling hypothesis are done in section 2. Section 3 presents the methodology; the empirical results are presented in section 4 and discussed in section 5. Concluding remarks are given in section 6.

## THE DECOUPLING HYPOTHESIS: STYLIZED EMPIRICAL DISCUSSIONS

The decoupling of the EMDEs from the ADs has two forms, namely real decoupling and financial decoupling. Real decoupling concerns the desynchronization of the business cycles of the countries of the two economic groups in question, which can be measured through “real” variables such as GDP and trade flows, while financial decoupling requires insignificant financial spillovers or the absence of financial contagion between the economies of the two groups, which can be measured through financial variables such as stock prices and interest rates (Cutrini and Galeazzi, 2012). This paper addresses real decoupling.

Kose and Prasad (2010) provide excellent discussions of global growth trends involving the EMDEs and ADs. As shown by these authors, the contributions of the ADs to global growth followed a decreasing trend over the Bretton Woods (1960-1972), pre-globalization (1973-1985), and globalization (1986-2009) periods, in contrast to the shares of the EMDEs which had an increasing trend over these periods, as indicated in Table 1. This table also shows that these trends continued in the most recent years (2008-2009) of the sample.

**Table 1: Distribution of Global GDP (Measured in Percentages)**

Group	1960-1972	1973-1985	1986-2009	2008-2009
Advanced Economies	80.30	73.21	65.71	56.98
Emerging Market Economies	16.60	22.86	30.69	39.06
Other Developing Economies	3.09	3.93	3.60	3.95
US	32.64	27.08	25.88	23.58
Japan	7.77	9.40	9.06	7.03
G-7	70.19	61.19	55.29	47.46
EU-15	34.41	31.10	25.74	21.77
Major Emerging Market Economies	6.30	9.04	15.09	22.57

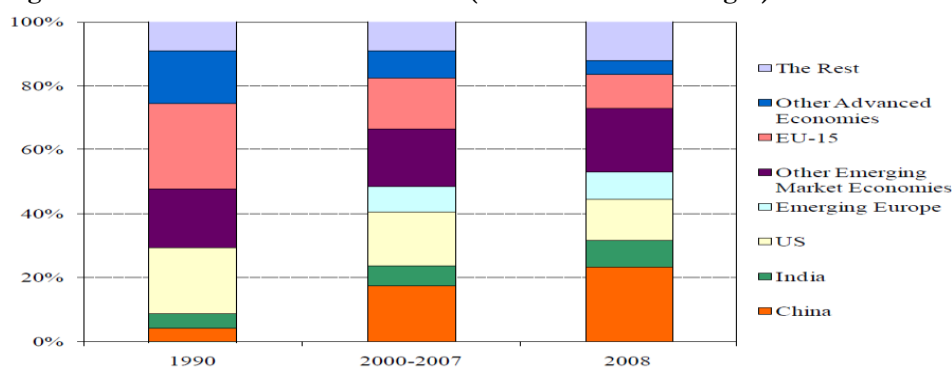
**Notes:** The values are the shares of GDP in total world GDP calculated by using PPP exchange rates. EU-15 Netherlands, Portugal, Spain, Sweden and UK, while the major emerging markets include Brazil, China and India.

**Source:** Kose and Prasad (2010).

As revealed in Table 1, three emerging markets, namely Brazil, China, and India have exceptional contributions to the increased growth performance of the EMDEs, with China having the strongest share among the three outstanding countries, as indicated in Figure 1 below.<sup>3</sup>

Kose and Prasad (2010) also note the dominant contributions of the US in the trade and financial linkages of the EMDEs, which together with the strategic role of the US among other advanced economies shown in Table 1 and Figure 1; imply that testing the decoupling hypothesis requires examining the impact of the US.

**Figure 1: Contributions to World Growth (Measured in Percentages)**



**Note:** The values are measured in PPP exchange rates. Countries considered separately are not included in the economic groups to which they belong.

**Source:** Kose and Prasad (2010).

Apart from the definition of decoupling involving business-cycles desynchronization or disconnection, the concept of decoupling may also be defined in terms of the relative shares of country-specific, regional, and global factors in the economic performance of the EMDEs (Kose et al., 2008); and the

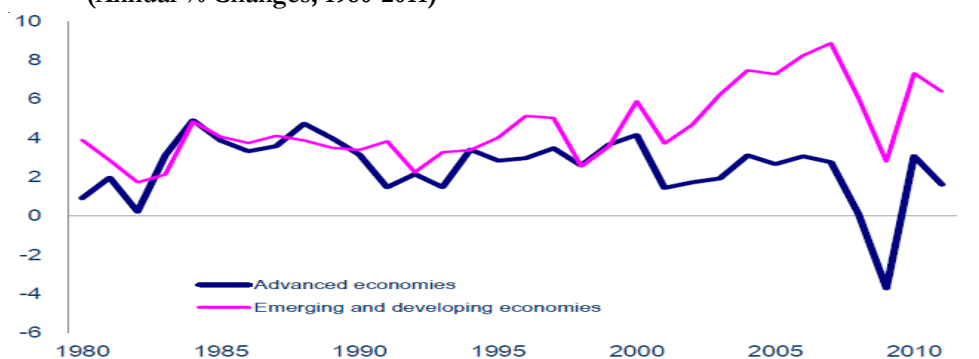
<sup>3</sup> The three economies are part of the group of large developing countries tagged the BRICs in the literature, which has been observed to have outstanding growth. In fact, it has been predicted that the growth of BRICs would overtake the growth of the G6 (US, Japan, UK, Germany, France, and Italy) by 2050 (see Bell, 2011; Wilson and Purushothaman, 2003).

degree of resilience of the EMDEs to shocks from the ADs (Pesce, 2014). Increases in the relative contributions of country-specific and regional factors in the economic performance at the expense of the share of global factors and a rise in the degree of resilience point to decoupling. In this paper, we measure decoupling based on the definition involving desynchronization, by examining the correlation or comovements of the considered variables.

Studies on real decoupling may be categorized into two main classes. The first class of studies are conducted from the perspective of the aggregate growth performance of the EMDEs, looking for evidence of convergence and divergence with the growth of ADs (see for examples, Economic and Financial Affairs, 2011; Dervis, 2012). The main finding of the studies in this class shows that the increasing aggregate growth performance of the EMDEs over their industrial counterparts in recent years is a consequence of the divergence of the long-run aggregate growth trends of the two groups and not due to the short-run cyclical components of growth. This evidence of business-cycle comovements between the two groups contradicts the decoupling hypothesis.

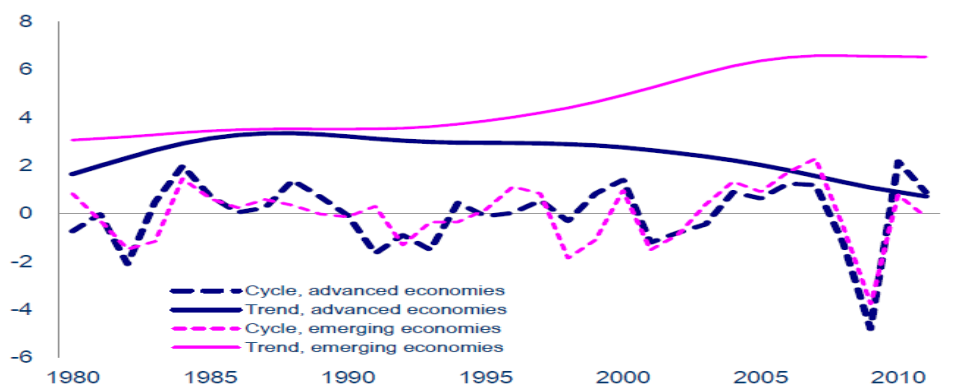
Dervis (2012) agrees with this argument writing that: “Growth in emerging market and developing economies is less dependent on advanced economies over the long run, but in the short run they dance together.” Figure 2 shows the overall growth performance of the two economic groups without decomposition into cycles and trends, while Figure 3 displays the convergence and divergence of the cycles and the trends respectively.

**Figure 2: Real GDP Growth in Emerging Market and Developing and Advanced Economies (Annual % Changes; 1980-2011)**



*Source: Economic and Financial Affairs, 2011.*

**Figure 3: Cycles and Trends of Annual GDP Growth Rates in Emerging and Advanced Economies (1980-2011)**



**Note:** Trends are in % of annual growth rates and cycles in % of trend.

**Source:** *Economic and Financial Affairs*, 2011.

The studies of the second class focus on investigating whether individual EMDEs or EMDE regions have been decoupling from the ADs, particularly the US. Unlike the studies of the first class which employ aggregate variables, the studies of the second class use variables relating to individual countries and regions. Besides, unlike the studies of the first class, the studies of the second class have mixed findings. Some of the findings show that no decoupling has taken place (for examples, Willett et al., 2011; Wälti, 2009; Lam and Yetman, 2013; Wyrobek and Stańczyk, 2013; Jayaram et al., 2009; and Obiora, 2009). Other findings provide evidence of the desynchronization of the business cycles of certain EMDE countries and regions from the business cycles of the ADs (for examples, Park and Shin, 2009; He and Liao, 2011; and Kose et al., 2008).

The differences in the findings of the two classes of studies suggest that the increasing growth performance of the EMDEs in recent years may be a concomitant of varying contributions of the economies to their gross growth. While some of them like China, Brazil and India may be growing largely, others may be experiencing lower growth rates due to growth slowdown factors. This implies that there may be varying shares of country-specific, regional, and global factors in the economic performance of these countries. Besides, they may have varying level of resilience to shocks from the ADs. This necessitates case-by-case empirical studies in dealing with the decoupling hypothesis.

At this point we present the review of the methods adopted in analysing decoupling in the literature. Cutrini and Galeazzi (2012) presents a review of the econometric techniques employed in the empirical literature to analyse decoupling, together with the authors, countries, data frequencies, periods, and findings associated with the techniques. The findings are mixed as indicated earlier: some show the evidence of decoupling, while some do not. As shown in Table 2 below, examples of econometrics techniques touched on by Cutrini and Galeazzi (2012) in their review are dynamic factor model, synchronicity measure, dynamic correlations, and panel VAR, which all have the ability to measure comovements.

**Table 2: A Summary of Empirical Studies on Decoupling**

	Methods	Period (frequency)	Countries	Is the decoupling hypothesis verified?
Kose <i>et al.</i> (2008)	Dynamic factor model based on GDP growth rates	1960-2005 (annual)	106 countries classified as advanced, emerging and other developing	Yes. Mild support to decoupling.
Wälti (2009)	Synchronicity measure developed by Mink <i>et al.</i> (2007)	1980-2007 (annual)	8 Asian countries, 9 Latin American countries and 13 Eastern European countries	No. Decoupling is a myth
Willett <i>et al.</i> (2011)	Correlations of GDP growth and deviation from GDP growth trend	1960-2008 (annual)	BRICs	No, even China and India were not able to insulate from the Global Recession
Fidrmuc and Korhonen (2010)	Dynamic correlations of GDP growth rates (Croux <i>et al.</i> , 2001)	1992-2008 (quarterly)	Emerging Asia vs. OECD countries (focus on China and India)	Yes. However the comovements have generally increased as a result of the global financial crisis
Kim <i>et al.</i> (2011)	Panel VAR (correlation of GDP growth rates)	1990-2008 (quarterly)	Emerging Asian economies vs. G6 (Canada, France, Germany, Italy, United Kingdom, and United States)	No. Bidirectional interdependences
Park and Shin (2009)	Cyclical measures of output for the three blocs based on growth rate of real output of each group	1990-2006 (quarterly)	3 economic blocs: the U.S., the EU and Emerging Asia	Yes. Decoupling of emerging Asia before the global financial crisis
He and Liao (2011)	Multi-level structural factor model based on GDP growth rates	1981-2008 (quarterly)	9 Asian countries: Hong Kong, China, Indonesia, South Korea, Malaysia, Philippine, Singapore, Taiwan, Thailand	Yes. Asian decoupling can be explained in terms of common productivity shocks

**Source:** *Cutrini and Galeazzi (2012).*

The comovement of a group of economic series points to the existence of a common feature of the series caused by common components like cycles and trends. The common feature implies the reduction of the larger series to a more parsimonious and likely more informative form, which can be captured through models such as cointegration models, dynamic factor models, etc (Vahid and Engle, 1993; Centoni and Cubadda, 2011).

## METHODOLOGY

### The Data

The data used in the study are on the GDPs of Nigeria, the US, and the Euro Area; oil price, oil price cycles, and oil price trend; and trade flows between Nigeria and 33 countries, discussed further in the next section. The oil price cycles and oil price trend are generated from the oil price through the Hodrick Prescott (HP) filter.



Table 3 presents the summary of the information on the data:

**Table 3: The Data of the Study**

Variable	Source of Data	Form of Data
Trade Flows	Data for the mentioned 33 countries are from the Global VAR (GVAR) database (GVAR Toolbox 1.1, <a href="http://www.cfap.jbs.cam.ac.uk/research/gvartoolbox">www.cfap.jbs.cam.ac.uk/research/gvartoolbox</a> ), while Nigerian data were obtained from the IMF Direction of Trade Statistics, 2014 Edition.	Annual (2006-2008)
Euro Area real GDP	Global VAR database (GVAR Toolbox 1.1)	Quarterly (1979Q2-2009Q4)
USA real GDP	GVAR database (GVAR Toolbox 1.1)	Quarterly (1979Q2-2009Q4)
Nigeria's real GDP	Obtained in annual form from the May 2014 Edition of the International Financial Statistics and converted to quarterly form through interpolation and extrapolation.	Quarterly (1979Q2-2009Q4)
Oil Price	GVAR database (GVAR Toolbox 1.1)	Quarterly (1979Q2-2009Q4)
Oil price trend	HP Filter applied to oil price of GVAR database	Quarterly (1979Q2-2009Q4)

### Methodology/Econometric Framework

The methodology framework used, starts with the computation of a trade share matrix based on trade flows between Nigeria and 33 countries from 2006 to 2008. The 33 countries are adopted from the GVAR model introduced by Dees et al. (2007). As indicated earlier, the authors note that the 33 countries account for 90 percent of global output, implying that they constitute a good representation of the global economy. Table 4 presents the countries of the trade share matrix.

Table 4: Nigeria and the other 33 Countries of the Trade Share Matrix

Euro Area	Other Countries
Germany	Argentina
France	Australia
Italy	Brazil
Spain	Canada
Netherlands	China
Belgium	Chile
Austria	India
Finland	Indonesia
	Japan
	Korea
	Malaysia
	Mexico
	Norway
	New Zealand
	Peru
	Philippines
	South Africa
	Saudi Arabia
	Singapore
	Sweden
	Switzerland
	Thailand
	Turkey
	United Kingdom
	USA
	Nigeria

Based on the findings from the trade weights and the earlier mentioned role of oil in the international transmission of business cycles, we focus on oil price and the real GDPs of Nigeria, the US, and the Euro Area in our econometric estimations, which include unit root tests, cointegration tests, DMF, a covariate model employed for the robustness check of the DFM, and estimation of statistics showing the nature of the relationship between the oil price and the unobserved factor obtained from the DFM. Cointegration is employed to analyse the long-run relationship between the three GDPs and the oil price. This is to serve as the initial analysis of comovements. Thereafter, the DFM, our main technique, is estimated for further comovement analysis, after which the covariate model is employed for the robustness check of the DFM. The techniques are discussed below.

### Unit Root Tests

We employ the unit root test techniques of the GVAR software. The software undertakes unit-root testing using the Augmented Dickey- Fuller (ADF) and the weighted symmetric ADF-type (WF) approaches.

Basically, the WF approach is based on a modification of the ADF model. Dees et al. (2007) argue that the WF perform better than the ADF, as shown in the influential unit-root works of Leybourne et al. (2005) and Pantula et al. (1994).

### Cointegration Tests

We use Johansen (1991, 1995) technique to test for the existence of cointegration between the oil price and the three GDPs under consideration. The Johansen cointegration approach is based on maximum likelihood estimation, with two different likelihood ratio tests, namely the trace and the maximum eigenvalue tests.

A major advantage of the Johansen approach is that in a dataset containing two or more series it can estimate more than one cointegrating relationship. This helps in giving theory-consistent interpretations of the cointegration results, since the cointegration relationships usually have theoretical meanings.

### Dynamic Factor Model

As Kose et al. (2008) explained, the DFM is able to produce results that common alternative techniques of analysing comovements like static correlation may not produce. According to the authors, “the DFM is in fact a decomposition of the entire joint spectral density matrix of the data.”

We model our DFM based on the conjecture that a latent oil-related factor drives the comovements between the real GDPs of Nigeria, the Euro Area, and the US. The factor has oil-related exogenous covariates, which are the trend and the cycles of the oil price obtained through the Hodrick-Prescott (HP) filter. The covariates are employed with the belief that they will help to capture the business-cycle linkages between Nigeria and the two industrial trade partners, since the former is a major oil exporter and oil is a highly globalized commodity.

Therefore, in our DFM the three considered real GDPs denoted by *niggdg*, *eurogdg*, and *usagdg* for Nigeria, the Euro Area, and the US respectively, are linear functions of the unobserved factor, which in

turn is a function of oil price trend and oil price cycles denoted by *oiltrend* and *oilcycle* respectively and a second-order autoregressive process, as shown in the equations below:

$$y_{it} = A f_t + u_{it} \quad (1)$$

$$f_t = B z_t + \Pi_1 f_{t-1} + \Pi_2 f_{t-2} + v_t \quad (2)$$

where  $y_{it}$  is a  $k \times 1$  vector of *niggdgdp*, *eurogdgdp*, and *usagdp*

$A = k \times n_f$  matrix of parameters which are the factor loadings

$f_t = n_f \times 1$  vector of unobserved factors, which is a column vector because we have only one factor

$u_{it} = k \times 1$  vector of disturbances

$B = n_f \times n_z$  matrix of parameters

$z_t = n_z \times 1$  vector of *oiltrend* and *oilcycle*

$\Pi_i = n_f \times n_f$  matrix of autocorrelated parameters for  $i \in \{1, 2, 3\}$

$v_t = n_f \times 1$  vector of disturbances

Equation 1 can be written more explicitly for the three GDPs under consideration as follows:

$$D\ln(eurogdgdp)_t = A_1 f_t + u_{1t} \quad (3)$$

$$D\ln(niggdgdp)_t = A_2 f_t + u_{2t} \quad (4)$$

$$D\ln(usagdp)_t = A_3 f_t + u_{3t} \quad (5)$$

As noted earlier, the oil price cycles and oil price trend used in our DFM are obtained from the oil price through the Hodrick-Prescott (HP) filter procedure.

### Covariate Model: Robust Check of the Dynamic Factor Model

We undertake a robust check of the DFM with the predicted series of the unobserved factor in a covariate model where the Nigerian GDP is regressed in turn against the unobserved factor, the lagged terms of the GDPs of the US and the Euro Area, and the lagged terms of the Nigerian GDP. As indicated by Stock and Watson (2010), the predicted factor of a DFM can be employed for post-estimation regressions of various purposes.

The covariate model consists of three equations. In the first equation, the Nigerian GDP is regressed against the predicted unobserved factor, which acts as a standardized variable across the three GDPs, since it captures their co-movement. In the other two equations, the lagged forms of the GDPs are included accordingly as covariates, since the GDPs have individual localized independence and can change the results of the first equation. The first equation is:

$$Dln(nigggdp)_t = \gamma_0 + \gamma_1 f_t + u_t \quad (6)$$

where  $nigggdp_t$  = Nigeria's real GDP

$f_t$  = unobserved factor

$u_t$  = error term

The second equation of the model extends the first equation by including twelve lags each of the real GDPs of the Euro Area and the US as covariates, making the model to have lagged covariates:

$$Dln(nigggdp)_t = \pi_0 + \pi_1 f_t + \pi_2 Dln(eurogdp)_{t-1} \dots \pi_{13} Dln(eurogdp)_{t-12} + \pi_{14} Dln(usagdp)_{t-1} \dots \pi_{25} Dln(usagdp)_{t-12} + v_t \quad (7)$$

where  $eurogdp_t$  = the real GDP of the Euro Area

$usagdp_t$  = the real GDP of USA

$v_t$  = error term

The third equation of the model extends the second equation by also including twelve lags of the Nigerian GDP as covariates, making the model to have an autoregressive feature:

$$Dln(nigggdp)_t = \pi_0 + \pi_1 f_t + \pi_2 Dln(eurogdp)_{t-1} \dots \pi_{13} Dln(eurogdp)_{t-12} + \pi_{14} Dln(usagdp)_{t-1} \dots \pi_{25} Dln(usagdp)_{t-12} + \pi_{26} Dln(nigggdp)_{t-1} \dots + \pi_{37} Dln(nigggdp)_{t-12} + z_t \quad (8)$$

where  $z_t$  = error term

The chosen number of lags (i.e. twelve) of the covariates is based on empirical discretion. The number of lags should be sufficient to capture the dynamics of the business cycles of the economies.

### Oil-Price-Factor Relationship: Evidence from Statistics

Together with the above robust check, statistics showing the nature of the relationship between the oil price and the estimated unobserved factor are also estimated. This is done to confirm the relationship between the two variables shown in the results of the DFM, which will further reveal the level of success of the estimated DFM.

The statistics estimated capture vital statistical characteristics like volatility, correlation, and covariance.

## EMPIRICAL RESULTS

### Trade Shares (2006-2008)

According to Table 5 below, the US and the Euro Area have dominant shares in Nigeria's trade, accounting for about 38 percent and 25 percent respectively, indicating the central role of the two industrial economies in the transmission of international business cycles into Nigeria.<sup>1</sup>

Apart from the US and the Euro Area that accounts for about 63% shares of Nigeria's trade, no other industrial trade partner has two-digit share. This thus, necessitates focusing on the two economies in examining the decoupling hypothesis for Nigeria.

**Table 5: Trade Shares of Trade Partners in Nigeria' Trade (2006-2008)**

Economy	Trade Share with Nigeria
Argentina	0.27%
Australia	0.04%
Brazil	7.67%
Canada	0.85%
China	5.89%
Chile	0.30%
Euro	25.11%
India	9.07%
Indonesia	0.51%
Japan	2.05%
Korea	2.72%
Malaysia	0.15%
Mexico	0.34%
Nigeria	0
Norway	0.16%
New Zealand	0.17%
Peru	0.24%
Philippines	0.01%
South Africa	0.36%
Saudi Arabia	0.06%
Singapore	0.36%
Sweden	0.51%
Switzerland	0.63%
Thailand	0.64%
Turkey	0.67%
United kingdom	3.33%
USA	37.91%

### Unit Root Tests Results

As shown in Table 6, both the ADF (Augmented Dickey-Fuller) and WS (weighted symmetric ADF) approaches indicate that the three GDPs and the oil price are stationary after first differencing, reflecting that the variables are all  $I(1)$ . As indicated earlier, the WS technique has stronger relative performance

power over the ADF method, suggesting that the  $I(1)$  status of the variables is proven to be valid by the similar results of the methods of varying strength of performance.

**Table 6: Unit Root Tests for Real Output and Global Oil Price at the 5% Significance Level**

Specification	Test	Critical Value	Euro Output	Nigeria Output	US Output	Oil Price
With trend	ADF	-3.45	-0.83	-1.36	-2.28	-1.46
With trend	WS	-3.24	-1.18	-1.71	-2.45	-1.28
No trend	ADF	-2.89	-1.28	-1.34	-0.83	-0.69
No trend	WS	-2.55	0.87	0.40	1.23	-1.00
First Difference	ADF	-2.89	-3.71	-4.19	-5.00	-6.38
First Difference	WS	-2.55	-3.90	-4.22	-4.74	-6.49

**Notes:** Based on the prompting for options by the GVAR software regarding the unit root tests, we choose the Akaike Information Criteria (AIC) for the lag order selection and 4 as the maximum lag order, since our data are in quarterly form.

### Cointegration Tests Results

Table 7 presents the VAR lag selection criteria statistics for the cointegration tests. We employ the Akaike's Information Criterion (AIC), the Hannan and Quinn Information Criterion (HQIC), and the Schwarz's Bayesian Information Criterion (SBIC) in selecting the optimum VAR lag for the cointegration, using the levels forms of the considered variables, which are the oil price and the three GDPs under consideration. As shown in Table 7, the optimum number of lags chosen by the three information criteria is 2.

Based on the finding on the optimal lag, we proceed to undertake the cointegration test, using one lag of each of the differenced variables. The cointegration results for the trace and maximum eigenvalue statistics are presented in Tables 8 and 9.

**Table 7: VAR Lag Selection Criteria of Cointegration Test**

Lag	AIC	HQIC	SBIC
0	-6.70	-6.67	-6.61
1	-22.54	-22.35	-22.07
2	-23.54*	-23.20*	-22.70*
3	-23.54	-23.04	-22.32
4	-23.35	-22.70	-21.76

**Table 8: Trace Test of Johansen Cointegration** (Number of Lags = 1)

With Constant				With Trend		
$H_0$	Trace Statistic	5% Critical Value	1% Critical Value	Trace Statistic	5% Critical Value	1% Critical Value
$r \leq 0$	81.52	47.21	54.46	89.51	54.64	61.21
$r \leq 1$	34.90***	29.68	35.65	36.94***	34.55	40.49
$r \leq 2$	11.46**	15.41	20.04	15.25**	18.17	23.46
$r \leq 3$	2.26	3.76	6.65	3.94	3.74	6.40

**Notes:**  $r$  represents the maximum rank of cointegration, while \*\*\* and \*\* denote the rejection of the null hypothesis at 1% and 5% levels respectively.

**Table 9: Maximum Eigenvalue Test of Johansen Cointegration** (Number of Lags = 1)

With Constant				With Trend		
$H_0$	Maximum Eigenvalue Statistic	5% Critical Value	1% Critical Value	Maximum Eigenvalue Statistic	5% Critical Value	1% Critical Value
$r = 0$	46.62	27.07	32.24	52.57	30.33	35.68
$r = 1$	23.44***	20.97	25.52	21.69***;**	23.78	28.83
$r = 2$	9.20**	14.07	18.63	11.31	16.87	21.47
$r = 3$	2.26	3.76	6.65	3.94	3.74	6.40

**Note:**  $r$  represents the maximum rank of cointegration, while \*\*\* and \*\* denote the rejection of the null hypothesis at 1% and 5% levels respectively.

Table 8 indicates that for the trace test (both with constant and trend), we have at least 1 cointegration equation and 2 cointegrating equations at the 1% and 5% levels respectively. According to Table 9, for the maximum eigenvalue test (with constant) we have exactly one cointegrating equation and exactly 2 cointegrating equations at the 1% and 5% levels respectively. On the other hand, the maximum eigenvalue test (with trend) shows that we have exactly one cointegrating equation at both the 1% and 5% levels.



These findings suggest the existence of long-run relationships, working together with short-run dynamics, between the three GDPs and the oil price, due to the error correction properties of the VECM of the Johansen approach. This gives the initial evidence of some form of comovement between the four variables, making it plausible to employ the DFM, whose results are presented next, for further analysis.

### Dynamic Factor Model

As noted earlier, the DFM is the main econometric technique of this paper. The results of the model capture the coefficients of the oil-related exogenous variables; the coefficients of the lagged terms of the unobserved factor; and the factor loadings relating to each of the considered dependent variables. Table 10 below presents the results.

**Table 10: Dynamic Factor Model: Comovements between the Real GDPs of Nigeria, the Euro Area, and the US**

Wald chi2 (7) = 5567.83				
Prob > chi2 = 0.00				
	Coef.	Std. Err.	Z	P> z
f f				
L1	1.50***	0.20	7.38	0.00
L2	-0.58***	0.19	-3.11	0.002
oilcycle	-1.84**	0.84	-2.2	0.03
oiltrend	0.13**	0.06	2.35	0.02
Dln(niggdgdp) f	0.001**	0.001	2.35	0.02
Dln(usagdp)f	0.001**	0.001	2.11	0.04
Dln(eurogdgdp)f	0.001**	0.0004	2.14	0.03

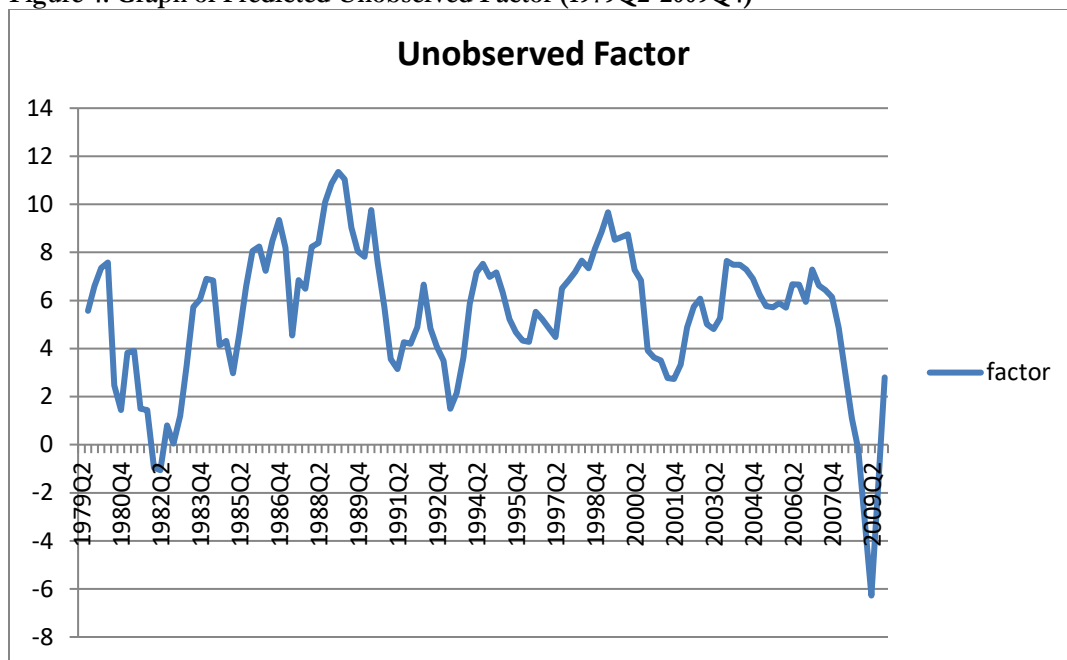
**Note:** \*\*\*, \*\*, and \* denote statistical significance at 1%, 5%, and 10% levels of significance respectively.

As shown in table 10, the unobserved factor denoted by f has statistically significant negative and positive autoregressive parameters impact on it. The oil price trend and oil price cycles also have statistically significant positive and negative effects respectively on the unobserved factor. The oil price cycles are the frequent short-term fluctuations of the oil price, while the oil price trend points to the long-term component of the price with infrequent variations.

The unobserved factor represents the comovements of the GDP series of the three economies considered. As noted before, comovement statistically means a “common move” in a set of series captured through a more parsimonious and likely more informative series or structure (Vahid and Engle, 1993; Centoni and Cubadda, 2011). For the three GDPs under consideration, the common component causing comovement may relate to shocks associated with the three series, as shown by the graph of

the common unobserved factor, which captures global recessions of the early 1980s and the late 2000s, as shown in Figure 4 below.<sup>4</sup>

**Figure 4: Graph of Predicted Unobserved Factor (1979Q2-2009Q4)**



*Source: Author*

Therefore, the high negative impact (-1.84) of the oil cycles on the factor is largely due to the fact that oil price spikes are usually associated with global growth slowdowns and sometimes recessions, with the oil-importing industrial economies, particularly the US, playing a leading role in the cross-country transmissions of the growth difficulties (see Kose et al., 2003; Roubini and Setser, 2004; Hamilton, 2009; Tapia, 2013). The studies show that oil price increases have a role to play in each of the post-73 global recessions, but not all such shocks caused a recession.

Specifically, the recessions of the early 1980s and the late 2000s that are shown as part of the comovement between the three countries under consideration were not solely consequences of oil price shocks, but oil price increases played significant roles in them. The recession of the early 1980s was largely caused by a restrictive monetary policy in the US, which led to a recession in the country and an eventual global recession, but the oil price spike that was associated with the Iranian revolution of 1979 had a role to play in the downturn. On the other hand, the US housing bubble was a primary causative factor of the recession of the late 2000s, but as Hamilton (2009) indicates, the oil price increases of 2007-2008 played a role in the downturn.

<sup>4</sup> Adding the GDPs of more countries in the analysis may enable the graph to reveal more recessions within the data span of the study, apart from those of early 1980s and late 2000s. The recession of the early 1980s was experienced by both advanced and developing countries, with the latter group of countries experiencing a debt crisis; while the recession of the late 2000s involved a financial crisis originating from the US and transmitted to Europe and the rest of the world in turn, with advanced and developing economies significantly affected.

Furthermore, as shown by the factor loading, the correlation between the unobserved factor and each of the GDPs of Nigeria, the US, and the Euro Area is statistically significant, with a value of 0.001, reflecting that the impact of the factor on each of the three GDPs is about 0.1 percent. The three GDPs therefore move together based on about the same impact of the common factor on them.

Finally, the Wald test results in the table are for all the parameters of the table. The null hypothesis for the test is that all the parameters are zero, and as the results show, the null hypothesis is rejected. This means that the considered coefficients are jointly statistically significant.

### Covariate Model

The covariate model is employed to check the robustness of the DFM, as mentioned before. The results of the covariate model captures the three equations of the model indicated earlier as shown in Table 11. The first equation of the covariate model involves regressing the Nigerian GDP against the unobserved factor, which is a regressor acting as a standardised variable across the three GDPs under consideration, as distinct from the GDPs themselves, which have individual localized independence, as noted earlier. Localized independence is one of the key features of covariates, justifying the use of the lagged terms of the three GDPs as covariates.

As shown in Panel A of Table 11, the unobserved factor has a statistically significant positive impact of about 0.10 percent on the Nigerian GDP, which is consistent with the positive correlation between the factor and the GDP in the DFM results of Table 10. However, as shown in Panel B of Table 11, the positive impact of the factor on the Nigerian GDP increases to about 0.20 percent when the lagged terms of the GDPs of the US and the Euro Area are added as exogenous covariates, because of the comovement between the three GDPs due to the factor.

Panel B also shows that the added covariates have varying individual effects on the Nigerian GDP. Over a three-year period (i.e. twelve quarters), the lagged terms of the US GDP have three negative and one positive statistically significant impact and a negative net-impact (i.e. positive-negative impacts) on the Nigerian GDP. On the other hand, the lagged terms of the GDP of the Euro Area have two statistically significant positive impact and hence a positive overall impact over the same time horizon. These effects suggest the relative roles of the US and the Euro Area as oil importers in the manifestation of the resource curse in Nigeria. If there are no policies preventing the resource curse, the growth of the US as a large oil importer may lead to a statistically significant increase of the oil price and a fall in the growth rate of Nigeria, due to the manifestation of the curse in the latter. On the other hand, the growth of the Euro Area as a smaller oil importer may cause a rise in the oil price that is not statistically significant. The resource curse effect may not manifest when the oil price increase is not statistically significant.

Table 11: Covariate Model

		Panel A: Equation 1 of Model (without lagged covariates)		Panel B: Equation 2 of Model (with lagged covariates)		Panel C: Equation 3 of Model (with lagged covariates and autoregressive feature )	
Dependent Variable: Dln(niggdp)		Coefficient	P-value (P>t)	Coefficient	P-value (P>t)	Coefficient	P-value (P>t)
factor		.001***	0.000	.002***	0.000	.0003	0.47
Dln(usagdp)	L1.			-.41**	0.004	-.15	0.17
	L2.			-.31**	0.02	-.06	0.53
	L3.			-.01	0.83	.17*	0.07
	L4.			.077	0.55	.06	0.50
	L5.			.22*	0.06	.13	0.13
	L6.			.15	0.17	.02	0.77
	L7.			.15	0.18	.15*	0.06
	L8.			.10	0.359	-.004	0.97
	L9.			-.01	0.964	-.07	0.39
	L10.			-.06	0.597	.01	0.88
	L11.			.05	0.631	.15*	0.05
	L12.			-.18*	0.097	-.11	0.18
Dln(eurogdp)	L1.			-.20	0.226	.05	0.65
	L2.			.04	0.777	.03	0.75
	L3.			.01	0.962	-.13	0.20
	L4.			-.18	0.261	-.17	0.11
	L5.			-.06	0.688	.05	0.65
	L6.			-.07	0.641	.07	0.54
	L7.			.35**	0.028	.23**	0.04
	L8.			.26	0.106	-.06	0.62
	L9.			.26*	0.096	.09	0.39
	L10.			.19	0.235	.03	0.78

	L11.			.25	0.110	.22**	0.04
	L12.			.14	0.364	-.10	0.35
Dln(niggdp)	L1.					.81***	0.00
	L2.					-.08	0.56
	L3.					.04	0.77
	L4.					-.48***	0.00
	L5.					.46***	0.001
	L6.					-.05	0.72
	L7.					.03	0.84
	L8.					-.37***	0.004
	L9.					.33**	0.01
	L10.					.04	0.76
	L11.					-.07	0.60
	L12.					.10	0.29
Constant		.001	0.44	-.01***	0.001	-.004*	0.07
F		13.30***		5.01***		11.32***	
Prob > F		0.0004		0.00		0.00	
R-squared		0.10		0.60		0.85	

**Notes:** \*\*\*, \*\*, and \* denote statistical significance at 1%, 5%, and 10% levels of significance respectively.

Panel C shows that the impact of the unobserved factor on the Nigerian GDP becomes statistically insignificant, when the lagged terms of Nigerian GDP are added as additional covariates. This further confirms the comovement between the three GDPs under consideration, due to the factor. Because the factor is the cause of the comovement, the factor's impact on the Nigerian GDP should become insignificant when the lags of the three GDPs are present as regressors. These findings show the robustness of the factor and the DFM.

Furthermore, the inclusion of the lagged terms of the Nigerian GDP as covariates changes the impact of the US GDP, which now only has positive statistically significant impact on the former GDP, with three of such impacts existing within the three-year horizon. However, the positive impact of the GDP of the Euro Area is maintained, after the inclusion of the Nigerian covariates. The impact of the lagged terms of the Nigerian GDP over the three-year horizon are both positive and negative, with three positive and negative impacts respectively and a positive net impact. The overall impact of the Nigerian covariates are also higher than the impacts of the US and Euro Area covariates, with the statistically

significant impact of the former covariates being about five times greater than those of the latter ones. This may be due to the greater role of domestic shocks over oil shocks in Nigeria.<sup>5</sup>

Finally, as indicated before, the unobserved factor has a high inverse relationship with oil price cycles, which is the component of the price with frequent variations (i.e. volatility). This means that the earlier indicated fluctuating nature of the factor is inversely associated with oil price volatility, implying that the statistical insignificance of the factor in Panel C alludes to low impact of oil price volatility. Since oil price volatility is one of the causes of the resource curse (Sala-i-Martin and Subramanian, 2003), that the US GDP has only statistically significant positive impact on the Nigerian GDP in Panel C may point to the fact that low oil price volatility limits the resource curse in Nigeria, bearing in mind that an increase in the US GDP may lead to a reduction in the rate of change of the Nigerian GDP due to the resource curse effect, as mentioned earlier.

## **THE RELATIONSHIP BETWEEN THE OIL PRICE AND THE UNOBSERVED FACTOR**

### **Statistical Evidence**

In addition to the robust check of the DFM undertaken through the covariate model, in this section we provide statistical evidence in Table 12 on the relationship between the oil price and the unobserved factor. The statistics shown in the table, particularly the correlation and covariance, are consistent with the inverse relationship between the oil cycles and the unobserved factor in the DFM results.

As indicated in Table 12, the correlation and covariance between the oil price and the unobserved factor are -0.39 and -0.60 respectively. These values clearly show that the variables tend to move in opposite directions, which is mainly due to the slowdowns and recessions caused by oil price spikes, as mentioned earlier. As shown in the table, the fluctuation or volatility of the price of oil, by say a standard deviation of 0.53 will cause a larger degree of fluctuation in the unobserved factor by a standard deviation of 2.91. This suggests that oil price spikes will cause growth downturns having sizes that are larger than the sizes of the oil shocks in the concerned economies, due to the unobserved factor, which is consistent with the negative covariance and correlation values.

Conceptually, covariance measures the degree to which two variables change together, which is statistically measured by the product of the two variables, after they are deviated from their means. But the value of covariance may be difficult to interpret, if the units in which the considered variables are measured are different. This limitation is overcome in the formula of correlation, which is covariance divided by the standard deviations of the considered variables, because the numerator and the denominator of the formula are in the same units.

**Table 12: Statistics on the Relationship between Oil Price and Unobserved Factor**

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<sup>5</sup> *In a working paper of the author on the relative impacts of external (oil-related) and domestic shocks on Nigeria, the results show that the latter shocks have stronger impact.*

	<b>ln(Oil)</b>	<b>Unobserved Factor</b>
Mean	3.30	5.41
Std. Dev.	0.53	2.91
Min	2.41	-6.28
Max	4.81	11.35
<b>Correlation</b>		
ln(Oil)	1	-0.39
<b>Covariance</b>		
ln(Oil)	0.28	-0.60
Unobserved Factor	-0.60	8.45

### DISCUSSION OF FINDINGS

The results of tables 5-12 show that the decoupling hypothesis does not hold for Nigeria, regardless of the form of analysis (cointegration, dynamic comovement technique or covariate modelling). This is perhaps not surprising given the role of oil price in the business-cycle linkages between Nigeria and its considered industrial trade partners.

The finding that decoupling hypothesis does not hold for Nigeria, is consistent with other studies of the literature regarding the decoupling of the EMDEs from their industrial counterparts. Such studies focus on individual EMDEs (e.g. Jayaram et al., 2009; Wyrobek and Stańczyk, 2013); regions consisting of selected EMDEs (e.g. Cutrini and Galeazzi, 2012; Lam and Yetman, 2013); and the aggregate of all EMDEs (e.g. Economic and Financial Affairs, 2011; Dervis, 2012).

The results of this paper are also consistent with the findings of Obiora (2009), who focuses on Nigeria in his study of decoupling. The work of the author is similar to our study not only with respect to the country focused on, but also in terms of the external countries considered, the channels of international linkages examined, and the role of oil in the linkages. The author identifies the US as the largest trade partner of Nigeria, and the European Union as the second largest partner, based on Direction of Trade data, with the European Union consisting five countries (i.e. Spain, France, Germany, the Netherlands, and Italy) of the eight countries forming the Euro Area in our study.

Regarding the channels of international linkages, the author examines the relative roles of trade channel, financial channel, and the channel of commodity prices in the transmission of international spillovers from trade partners to Nigeria. Oil has a strong role in the spillovers, because it accounts for a large share of the trade channel. Besides, oil price is part of the prices constituting the commodity prices channel. Concerning the overall findings, the author finds that the decoupling hypothesis does not hold for Nigeria, based on the dominance of the trade and commodity prices channels relative to the financial channel, with the US playing a leading role in the transmission of the spillovers. Generally, the trade and financial linkages between the EMDEs and their industrial counterparts constitute a major factor that may not make the former economies to decouple from the latter ones.

Our results have vital policy implications. First, the common fluctuations between Nigeria and its two industrial trade partners discovered through the DFM, points to uncertainty and risk in the former

economy caused by trade links with the large economies, as fluctuations indicate the existence of volatility and shocks (i.e. extreme manifestations of volatility). Basically, this challenge hinders welfare in the economy, because economic agents delay the decisions to consume, save, invest and produce, among others, when uncertainty and risk exist in the economy (Ebrahim et al., 2014). This finding suggests that trade links with developed economies constitute a major source of risk and uncertainty which needs to be dealt with in Nigeria, by strengthening domestic demand.

Second, in addition to shock-absorbing policies (e.g. the oil-price-based fiscal rule introduced in Nigeria in 2004), which the country has introduced because of previous experiences on externally generated crises, the nation also needs to adopt policies aimed at diversifying trade away from industrial trade partners in order to limit their influence in international transmissions of business cycles, as trade is the strongest channel of such transmissions (Baxter and Kouparitsas, 2005). Such diversification may increase Nigeria's regional trade, such as trade within the WAMZ and the ECOWAS region.

### CONCLUSION

This paper tests the decoupling hypothesis for Nigeria, by exploring the comovements between the real GDPs of the country and its two main (industrial) trade partners, namely the US and the Euro Area. The aim is to examine fluctuations between Nigeria and its industrial trade partners, in order to examine its policy implications in the Nigerian economy.

The results show that the decoupling hypothesis does not hold for Nigeria, as a significant level of fluctuations still exists between the country and its industrial trade partners. The policy implications of such fluctuations for Nigeria are that they point to risk and uncertainty and the need to diversify trade away from industrial economies and increase regional trade such as trade within WAMZ, in order to limit the influence of the industrial economies.

Finally, it is worth noting that since our analysis on decoupling in this paper focuses mainly on real decoupling, which involves dealing with real GDP, it would be useful to examine financial decoupling in future research, based on the increasing role of the financial channel in cross-country interlinkages. This involves investigating the existence of cross-country financial contagion; the relative roles of country-specific and global financial factors in the financial sectors of countries, among others.

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