# Analysis of output and output volatility connectedness of Nigeria, USA, China and India: new empirical insights from the global financial crisis versus 2016 Nigerian recession

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## Abstract

**Purpose** – This paper aims to examine Nigeria's dynamic output and output volatility connectedness with USA, China and India using quarterly data from 1981Q1 to 2019Q4.

**Design/methodology/approach** – The study adopted the network approach of Diebold and Yilmaz (2014) and used the normalized generalized forecast error variance decomposition from an underlying vector error correction model to build connectedness measures.

**Findings** – The findings show that the global financial crisis (GFC) increased the connectedness index far more than the 2016 Nigeria economic recession. The moderate effect of the 2016 Nigeria economic recession on the connectedness index underscores the fact that Nigeria is a small, open economy with minimal capacity to spread output shock. For both real output and its volatility, the total connectedness index rose smoothly and systematically through time, thereby leaving the economies more connected in the long run.

**Originality/value** – To the best of the authors' knowledge, this paper is among the first to examine Nigeria's dynamic output and output volatility connectedness with the USA, China and India using new empirical insights from the GFC versus 2016 Nigerian recession. The study, therefore, concludes that the Nigerian economy should be diversified immediately as a hedge against future real output shocks, while the USA, China and India should maintain and sustain their current policy frameworks to remain less vulnerable to real output shocks.

**Keywords** Connectedness, Output volatility, Global financial crisis, Economic recession, VAR model

**Paper type** Research paper

## 1. Introduction

African economies are very prone and responsive to price fluctuations of primary commodity products since her economies depend majorly on the export of these primary

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products to the industrialized economies (Raddatz, 2008). In recent times, specifically in 2009, the Nigerian projected gross domestic product (GDP) growth rate was between 7% and 9%; this was not achieved as growth instead declined and hovered around 6%–4% (Omotor, 2011). Toward the end of December 2008, Nigerian exchange rate depreciated from N117/$1 to N135/$1. Interestingly, the growth decline and exchange rate depreciation are not unconnected with the period of global financial crisis (GFC), which to a large extent had a negative pressure on the world oil price and subsequently reduced growth outcomes. GFC corresponds to the era of global economic hardship and depression with origin from the United States (hereafter USA) due to the collapse of Lehman Brothers between the period of 2008 and 2009. As of July 2019, the exchange rate of Nigeria has worsened as it exchanges on average N358.45/$1 (National Bureau of Statistics, 2019). Spillovers wield enormous influence and dictate the conditions of real GDP, specifically in developing and emerging economies (Anaya *et al.*, 2017). However, Nigeria has no doubt witnessed some growth trend over the years though most of them are short-lived. In the 1990s, Nigeria economy grew from 0.86% in the early 1990s to 2.33% in 1999 (late 1990s). The millennium GDP growth stood at 7.06% and 5.96% for the periods 2005–2009 and 2010–2014, respectively, representing a downward trend. The periods of high growth (2005–2009) interestingly reflect the era of positive oil price shock. Between 2015 and 2016, the GDP growth falls further by 0.57%, a period that marked the economy's transition into recession (Adefabi and Rasaki, 2018; Orji *et al.*, 2022, 2023). This era depicts the worst growth rate in recent Nigeria economic history (Orji *et al.*, 2023), which interestingly corresponds to the time that the economy entered into recession, otherwise termed the "2016 Nigeria Economic Recession" in this paper.

The trade patterns among these economies (Nigeria, China, India and the USA) are particularly striking and of great interest. The trade volume between China and Nigeria has increased remarkably in recent times, especially with respect to crude oil and natural gas. Specifically, in 2016, Nigeria earned 401,353,439m United States Dollars (hereafter USD or US$) from crude oil sale to China [United Nations Commodity Trade (hereafter UN Comtrade), 2017 cited in Irshad *et al.*, 2017]. In 2018, the export value flow from Nigeria to China was about US$1.0bn against US$7.2bn in 2017; hence, China is the 16$^{th}$ largest export market for Nigeria. On the side of imports, China is the first largest import market for Nigeria, accounting for 19.4% (US$8.3bn) of Nigeria imports in 2018. Similarly, India is Nigeria's largest trade partner, and Nigeria, in the same vein, is India's largest trade partner in Africa. Year 2018 data on trade statistics shows that Nigeria total export to India stood at US$9.91bn, whereas its import from India stood at US$2.2bn with trade balance of US$7.7bn (UN Comtrade, 2019). These statistics reveal that on the global scene, India remains the largest export market and sixth largest import market for Nigeria. Furthermore, trade statistics also show that the export value from Nigeria to the USA declined from US$5.7bn in 2017 to US$3.8bn in 2018 which is about 33%, placing the USA as the sixth largest export market for Nigeria with 6.1% contribution of the total Nigeria export in 2018 (UN Comtrade, 2018). Earlier in 2017, the USA accounted for 12.76% of Nigeria total export value, placing it as the second largest export destination for Nigeria, just behind India (UN Comtrade, 2017). Similarly, between 2017 and 2018, Nigeria's import from the USA rose significantly from US $2.5bn to US$3.2bn, representing 28% increase. This, however, placed the USA as the fifth largest import market for Nigeria, contributing about 7.3% of Nigeria's total import in 2018. These trade statistics further demonstrate the degree of trade integration or synchronization among these economies, which demonstrates the rate at which globalization is breeding across the globe, thereby leaving economies more interlinked, including their policies (Nyakurukwa and Seetharam, 2023). Vivid description of the trade traffic among these