Spillover Effect of US Unconventional Monetary Policy on Nigerian Economy

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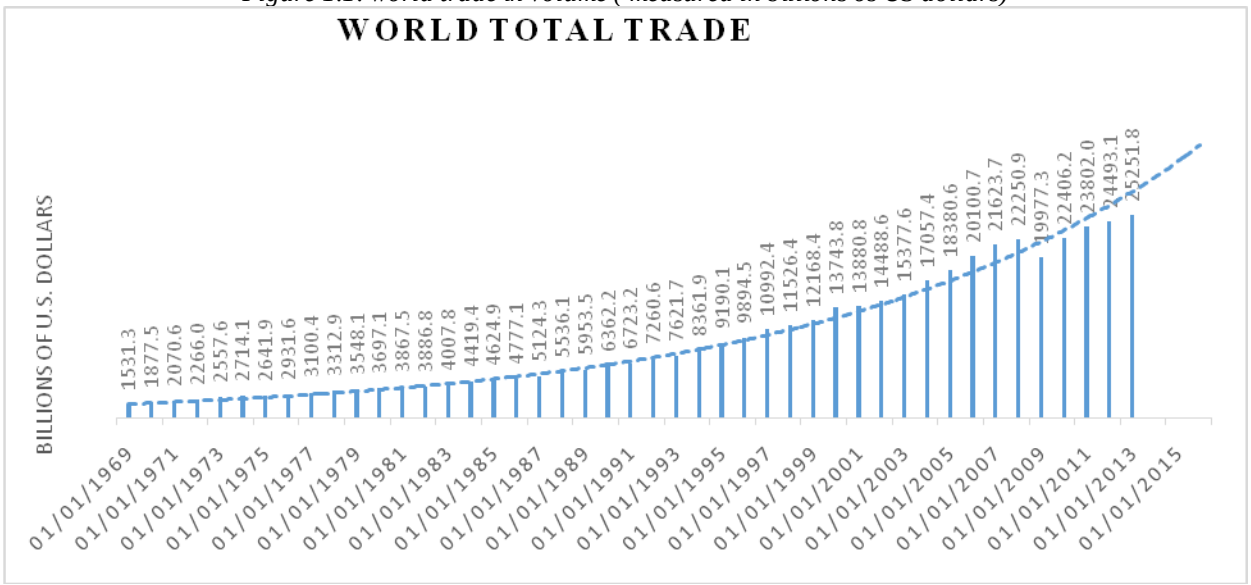
Abstract: *Since the late 2000 when the US launched its unconventional monetary policy arsenals such as Quantitative Easing (QE), Targetted Assets Purchase (TAP) and Forward Guidance in response to the great recession, arguments have subsisted in the literature on whether such actions could have spillover effects on small open economies. In this paper, we investigated the spillover effect of US uncoventional Monetary Policy (UMP) on Nigerian economy. We fed monthly US monetary policy proxies assummed to be weakly exogenous and monthly Nigerian data spanning from 2006:M1 to 2015:M12 into a Bayesian VARX model. The Impulse Response Function was also estimated. The major finding of this study is that US UMP exerts beggar-thy-neighbour effect on Nigerian economy. That is, the US UMP depresses growth, export and external reserves in Nigeria. The major transmission channel is found to be trade channel. Also, the inflow of hot money has led the policy makers to respond to excess liquidity by raising the policy rate. This procyclicality has rather encouraged more inflow of hot money and has discouraged investmnet. We therefore recommend that to effectively insulate Nigerian economy from beggar-thy-neighbour effects of US UMP, she must follow sound macroeconomic and macroprudential policies that would allow herto minimize systemic risk arising from US UMPand as well build buffers. Nigerian policy makers need to make concerted effort to make export more competitive by focusing on export promotion and import substitution strategies.*

Keywords: *Unconventional Monetary Policy (UMP), Spillover effect, beggar-thy neighbour, Bayesian VARX*

I.INTRODUCTION

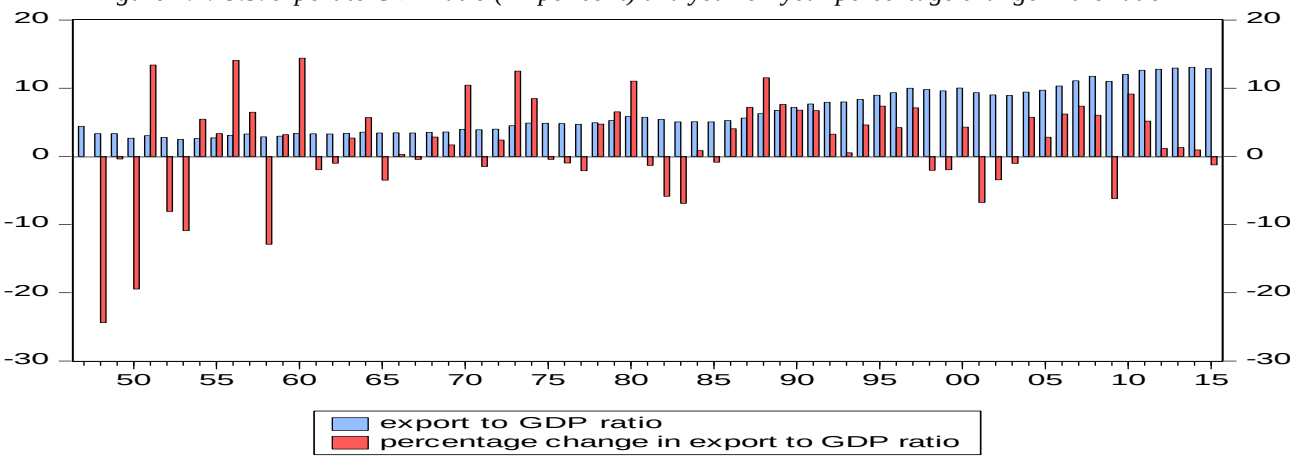
Over the past five decades, the global economy has experienced deepening of financial linkages as well as dramatic trade and economic integration. As shown in figure 1.1, total world trade has increased from US$ 1877.5 billion in 1970 to US$ 25251.8 billion in 2015, indicating 1245 *per cent* increase. Also, the ratio of U.S. export to GDP has more than trippled having increased by more than 200 *per cent*between 1970 and 2015. Andersen, Bollersl, Diebold & Vega (2007) also noted that the U.S. has maintained a leading role in cross-boarder finance. Thus, in a progressively integrating world economy and financial system, cross-border spillover may be inevitable.

Figure 1.1: world trade in volume (measured in billions os US dollars)



Source: Graph Generated by the Authors from Data obtained from Federal Reserves Bank of St. Louis

Figure 1.2: U.S. export to GDP ratio (in per cent) and year-on-year percentage change in the ratio



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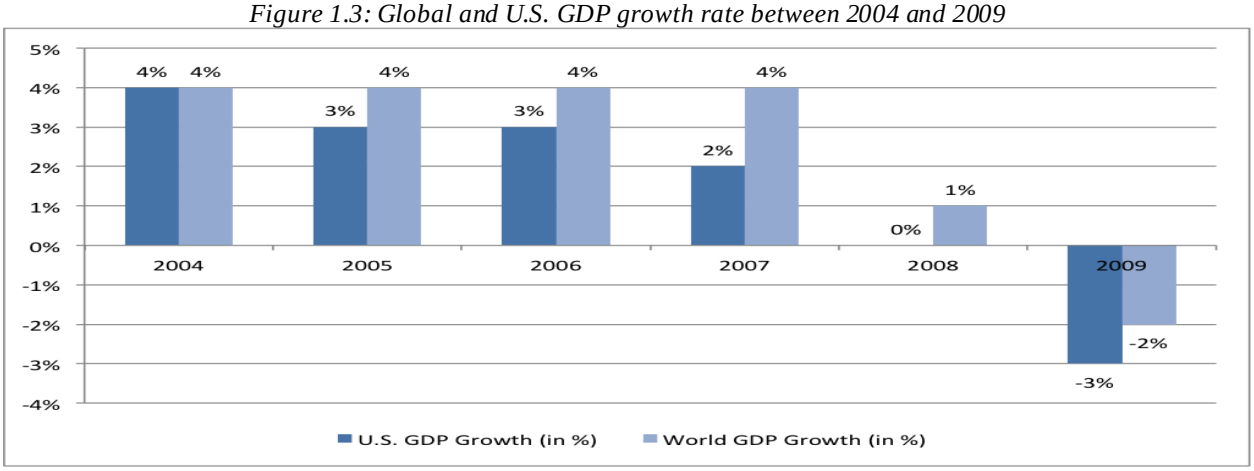
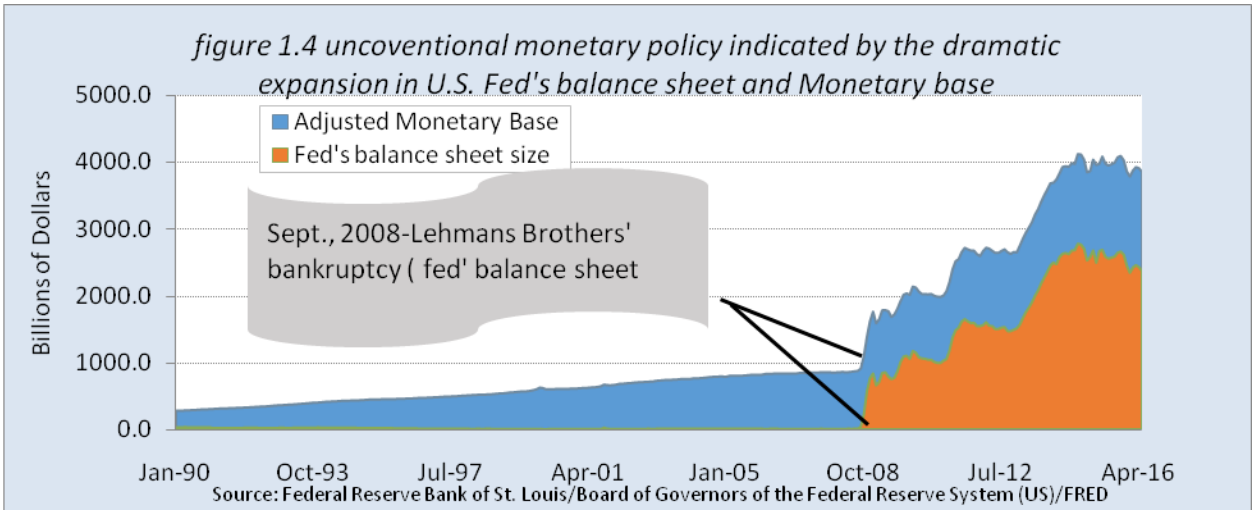
An example of the consequences of this increased interconnectedness is the recent outcome of the Global Financial Crisis, which originated in the US and rapidly spread to other countries. It brought down with it the investment banks, insurance companies, commercial banks, mortgage lenders, and a number of companies who relied on credit. Furthermore, the contagious downturn spread to major economies across the globe that had dabbled in the American real estate sector, wiping out over 30% of the value of a number of major economies. The result was a widespread slowdown in growth, in the U.S., and in the world as shown in figure 1.3

Figure 1.3: Global and U.S. GDP growth rate between 2004 and 2009



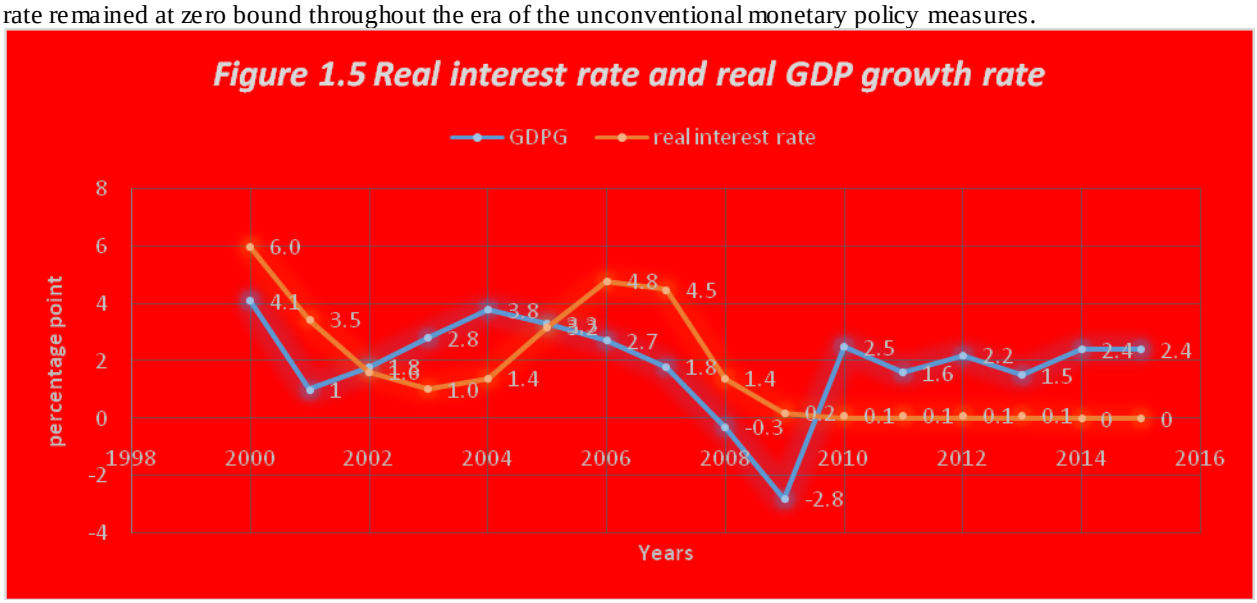
Source: Graph Generated by the Authors from Data obtained from Federal Reserves Bank of St. Louis

In response to the economic meltdown, the U.S federal reserve, having exhausted its convetional monetary policy arsenals (such that the nominal interest rates were close to zero) resorted tounconventional monetary policy. Some of the unconventional monetary policies adopted by the U.S. federal reserves include Targeted Assets Purchase(TAP), Quantitative Easing (QE) and Forward Guidance (FG). For example, following the collapse of Lehman Brothers in september, 2008, the Fed initiated immediate provision of credit to key markets and intermediaries (an example of TAP). This was followed by a rapid expansion of Fed's balance sheet (an example of QE) that started in November 2008. Between November, 2008 and February, 2009, Fed had purchased $100 billion and $500 billion of agency debt and mortgage-backed securities respectively. In March, 2009 Fed bought another $850 billion worth of mortgage-backed securities and debt. This amount reached a peak of $2.1 trillion in June 2010. This marked the end of the first phase of QE usually called QE1. The second phase which involved another bond buying program was announced by the Feds chairman, Benarke in November, 2010. This involved buying $600 billion worth of longer-dated treasuries by mid 2011 (Conerly, 2012; Federal Reserve, 2008; Annalyn, 2010).



By September, 2012 the Federal Open Market Committee (FOMC), the Federal Reserve decided to launch a new $40 billion per month, open-ended bond purchasing program of agency mortgage-backed securities. This was called QE3. Still maintaining the federal funds rate at near zero, the FOMC, on 12 December 2012, announced an increase in the amount of open-ended purchases from $40 billion to $85 billion per month (Abdulmalik, 2015; Annalyn, 2010; Federal Reserve, 2008).

The non-standard monetary policy measures are adjudged circumstantially appropriate, at least from the stand point of the U.S. economy. The U.S. economy responded almost immediately to the Fed's actions. More jobs were generated in the private sector, business confidence was relatively boosted and economic growth jumped from its all time low of -3% in 2009 to over 2% from 2010 to current period as shown in figure 1.5. Meanwhile interest rate remained at zero bound throughout the era of the unconventional monetary policy measures.



Source: Graph Generated by the Authors from Data obtained from Federal Reserves Bank of St. Louis

But the worry is: can the unconventional monetary policy measures in the U.S. be of any significant effect in Nigeria. That is, is the Nigerian economy drivien by monetary conditions in the U.S.? If yes, do the Nigerian policy makers factor such effects into their policy design. Of course, theoretical models show that policy decisions in large economies spillover into smaller open economies through various channels such asportfolio balance channel, exchange rate channel, trade channel, signalling channel among others. For example, portfolio balance modeldescribes the interaction between foreign interest rate, the bond market, risk perceptions exchange rate, output and monetary stimulus. Furthermore, the basic Mundell–Fleming-Dornbush (MFD) model predicts that unconventional monetary policy in a large economy can have both negative and positive effects on other economies. While exchange rate depreciation in the effect-transmitting economy tends to worsen the trade balance in the effect-

recipient economy, increased demand in the effect-transmitting economy tends to lead to increase in the net export in the effect-recipient economy.

The overall effect on the effect-recipient economy depends on the country characteristics, shock absorption mechanism and policy responses. Thus, there is, unarguably, a need to understand and incorporate into our policy decision-making the anticipated effects of monetary policies from advanced economies such as the U.S. This need becomes more pressing given the dearth of empirical research on the spillover effect of U.S. monetary policy on the Nigerian economy. As at the time of this research, no such empirical work exist to the best of the knowledge of the researchers. This makes this work timely and expedient. In order to assess the potential challenge in adjusting to changes in global financing conditions this study intends to quantify the potential impact of U.S. unconventional monetary policy on the Nigerian economy. The rest of the paper is arranged as follows. Section two discusses the theoretical frmework, section 3 discusses econometric procedures and outcomes while section 4 discusses the policy implications of the findings.

II. THEORETICAL FRAMEWORK

The workhorse open-economy macroeconomic model for predicting cross-border policy spillover has been the mundel-Flemming Model (MFM). The Mundell-Fleming Model (1969) describes the workings of an economy open to international trade in both goods and financial assets. According to Hinkle and Montiel (1999) and Kawai (2015), MFM provides a framework for monetary and fiscal policy analysis using the Keynesian IS-LM model. According to the MFM framework, the domestic economic conditions depends not only on domestic economic fundamentals (summarised by the IS-LM) but also on foreign economies' economic activities. Thus, given that there is unrestricted trans-border trade and capital flow, the MFM suggest a *'prema facie'* evidence of cross-country spillover effects.

Now, let's consider a two-country (say, U.S. and Nigeria) Mundell-Fleming model. Suppose the U. S. implements expansionary monetary policy which increases money supply and lowers the interest rate. The MFM predicts two effects on the U.S. economy. First, monetary expansion in the U.S. leads to output expansion and currency depreciation in the U.S. This is expected to have two compensating or offsetting effects on the Nigerian output level. Currency depreciation in the U.S. will make the U.S. export more competitive Nigeria's. This will lead to decline in Nigeria's net export and worsening of its current account as well as decline in output. In summary, monetary easing should lower the home interest rate relative to foreign rates and depreciate the home currency. This, in turn, boosts the home trade balance, and thus home GDP, while lowering the trade balances and GDP of the country's trading partners. This is a pure expenditure-shifting effect- that is, it shifts expenditures from foreign countries to the home country. Such an effect is a key feature of the Mundell-Fleming model of international monetary policy interactions, and created the intellectual rationale for the view that monetary policy easing exerted "beggar-thy-neighbour" effects on foreign economies. This is popularly known as the exchange rate channel. (see Sun, 2011; Beckmann, Belke & Dreger, 2015).

However, output expansion in the U.S. will lead to rise in U.S. imports which translates to increase in Nigerian exports. But, there is no *a priori* prediction of which impact will dominate. If the U.S. currency depreciation impact dominates, the overall impact of U.S. monetary easing in Nigeria will be negative-output decline and current accounts crises. On the other hand, if the U.S. output expansion effect dominates, the overall impact of U.S. monetary expansion in Nigeria will be positive-increase in GDP and improved current accounts. This suggests that the magnitude of the spillover effect will depend on both policy-initiating and effect-recipient country characteristics. For example, if the U.S. adopts fixed exchange rate regime, the predicted currency depreciation may not occur-overall effect in Nigeria will be positive, and vice versa. Again, if Nigeria do not have excess capacity or that its export supply is inelastic, the overall impact will be negative.

Second, the MFM predicts that monetary expansion in the U.S. could lead to cross-country capital flow and switching of portfolio balances between the U.S. and Nigeria (*remember that we are using standard two country model of the MFM*). To understand the portfolio balance effect of international monetary policy spillover, let us assume that there two financial assets-money and bonds. Money is the medium of exchange and pays no interest while bonds refers to all assets except money such as equity and debts and pays nominal interest rate. Hamilton & Wu (2012) noted that portfolio channel is a central channel through which monetary easing affects cross-country capital flow. Since QE involves the substitution of longer-duration assets for safe long-term government bonds, which in turn reduces the available stock of privately-held risky assets, unmet risk appetite will thus be met by increasing demand for other risky investments (see Gagnon., Raskin, Remache & Sack, 2011; Lim, Mohapatra & Stocker, 2014).

Portfolio balance model assumes that assets denominated in different currencies are not perfectly substitutable. This implies that although perfect capital mobility (CIP) holds, perfect capital substitutability does not. In other words, returns on bonds, when expressed in a common currency, might differ due to a risk premium (Frankel, 1984). Thus, we would expect the portfolio balance channel to be expressed both in terms of heightened demand for temporal (longer duration) and spatial (developing country) assets, which comes about as investors rebalance their portfolios.

Following from Frankel (1984) and Dooley and Isard (1982), let's assume that there are *n* investors who invest in government debts dominated only in their local currency such that:

$$\frac{D_t}{S_t D_t^*} = \psi(i_t - i_t^* - E_t \Delta s_{t+1}) \qquad 2.1$$

where D and D* are net supplies of domestic and foreign debt-bonds and $i_t - i_t^* - E_t \Delta s_{t+1}$ is the exchange risk premium on domestic currency or the deviation from uncovered interest parity. Also, the holdings of domestic bonds, relative to foreign currency denominated bonds, are a positive function ψ of the exchange risk premium. The above model predicts that if the central bank were to purchase domestic bonds, this would reduce the stock of bonds held by the private sector. Assuming the functional form for relative bond demand is linear exponential in ψ, then after rearrangement, equation (2.1) becomes:

$$s_t = \psi_0 + \psi_1(i_t - i_t^* - E_t \Delta s_{t+1}) + d_t - d_t^* \qquad 2.2$$

But since the term in the parentheses is unobservable, estimating equation (2.2) is pretty difficult. Now, suppose the expected inflation is zero then (2.2) becomes:

$$s_t = \psi_0 + \psi_1(i_t - i_t^*)) + d_t - d_t^* \quad 2.3$$

Notice that the equation indicates that as *d** increases, *s* falls (appreciates): as the stock of foreign assets held by home rises, the exchange rate appreciates. The impact of central bank purchases of bonds has ambiguous effects, as it removes bonds from the private sector, reducing *d*. In equation (2.2), that implies an appreciation of the exchange rate, counter to intuition regarding monetary easing through assets purchase through quantitative easing (QE) or Large-scale assets purchases (LSAPs). The portfolio balance channel implies that central bank bond purchases will affect the term premium in long-term interest rates due to imperfect substitutability between securities of different maturities or asset classes. Market segmentation implies that the amount and maturity structure of outstanding government securities, which is affected by QE or LSAPs, determine risk premia in long-term interest rates. Portfolio balance models suggest that investors have downward sloping demand for specific types of risk (e.g., duration risk) and therefore a reduction in the supply of an asset should reduce the required expected return on that asset and assets whose returns covary positively with it. Intuitively, if the QE or LSAP raises U.S. bond prices, then investors will tend to substitute toward the now relatively underpriced debt of similar quality (domestic or international), driving up the price of that debt. This substitution will affect all securities whose returns covary positively with the purchased asset (Bauer & Rudebusch, 2013; Woodford, 2012; D'Amico, English, Lopez-Salido & Nelson November, 2012; Bauer and Nelly, 2013).

In summary, when monetary policy is eased, it lowers longer-term yields and raises other asset prices in the home country (the U.S.); this leads, through portfolio balance effects among financially interconnected economies (such as Nigeria), to capital flows to (and lower yields and higher asset prices in) foreign economies (such as Nigeria). Thus, contrary to speculations that international monetary policy spillover is strictly negative, there is clear indication that it can rather be positive. Again, whether the effect is positive or negative depends largely on country characteristics and the behaviour of economic agents.

III. REVIEW OF EMPIRICAL LITERATURE

Although the effectiveness of unconventional monetary policy measures on domestic economy has been studied extensively, the analysis of cross-border spillover effects of such policies from one economy to another only started to receive increasing attention in the empirical literature in recent time. To be precise, empirical investigation of the spillover effect of non-standard monetary policy measures from advanced economies to emerging or even less developed economies started gaining momentum following the Fed's, ECB's and Japan's launch of series of unconventional monetary policy measures as a policy response to the 2007/08 global downturn.

Among the first studies addressing the spillover effects is Hamao, Masulis, & Ng (1990). The trio studied correlations in price changes and volatility across stock markets in Tokyo, London and New York. Utilising a GARCH-M model they estimated international spillovers of Yen, pounds and dollar exchange rates across Tokyo,

London and New York. Their study reveal that after one market closes, volatility is transmitted to the markets opening several hours later even though these markets are geographically distant. In a similar study Lin, Engle & Ito (1994) investigated the international transmission of stock returns and volatility between the U.S. and Japan. They particularly studied the movement of bulls and bears across borders. The study utilised daily yen and dollar exchange rate in a GARCH-M framework. The results show the existence of bi-directional spillovers, ie., daily returns of New York are correlated with Tokyo's overnight returns and vise versa. In contrast to Hamao et al. (1990), they find minor evidence of spillovers from daily returns in one market to daily returns in the other market.

Moessner (2014) in a panel VAR study investigated the international spillover effect of U.S. forward guidance on Eurozone's equity prices, CPI inflation and the GDP. He found that explicit FOMC policy rate guidance announcements at the zero lower bound led to higher equity prices in the Eurozone. He also found that equity indices of economies with lower sovereign ratings rose by more than that of those with higher sovereign ratings. This is consistent with the risk-taking channel of monetary policy. Chen, Mancini-Griffoli & Sahay (2014) investigated the spillovers from United States monetary policy on Emerging Markets. Using event study methodology they found that U.S. monetary policy shocks do affect capital inflows and asset price movements in emerging market economies. These results stem from an event analysis covering U.S. monetary policy announcements from January 2000 to March 2014. They also found that that spillover effects—"per unit" of U.S. monetary policy surprise—are different and stronger during the unconventional monetary policy (UMP) phase (starting in November 2008 with large scale asset purchases), relative to the phase of conventional monetary policy (January 2000 to July 2007). For many assets, spillovers were especially large when the U.S. began discussing the tapering of its asset purchases.

Fratzscher et al. (2013) studied the global spillovers of the Fed's unconventional monetary policy measures on emerging markets. They conclude that such policies affected capital flows to emerging market economies in a pro-cyclical manner, have raised asset prices globally and weakened the US dollar. Lim, Mohapatra & Stocker (2014) studied the effects of quantitative easing (QE) policies in the US on gross financial inflows to developing countries. They found that QE have been transmitted internationally through liquidity, portfolio rebalancing, and confidence channels. Neely (2013) argues that the large impact of the Fed's LSAP announcements on international yields are consistent with a portfolio balance effect but he does not directly evaluate the relative importance of signaling/portfolio balance effects. Pablo, Hachula & Offermanns (2015) further confirmed that a U.S. UMP shock significantly increases portfolio flows from the U.S. to EMEs for almost two quarters. The increase in inflows is accompanied by a persistent increase in several real and financial variables in EMEs. unlike Pablo, Hachula & Offermanns (2015) that utilised GVAR framework, Sayed & Reed (2015) rather employed historical decomposition graphs to investigate the spillover effects Of U.S. Federal Reserve's recent quantitative easing On Canadian commodity prices. They find significant spillover effects on the Canadian commodity prices under investigation in the immediate neighborhood (seven-month horizon) of the large-scale asset purchases, especially the second round of quantitative easing.

Sohrab (2015) employed a standard reduced-form VAR model to examine the effects of U.S. policy actions on a group of Asia Frontier Developing Economies (FDEs). He finds that the impact of unconventional monetary policy on Asia FDE has been relatively minor. He therefore concluded that the direct impact of any Fed tapering on FDEs in Asia is likely to be, at best, small. The findings of this study may be affected by the simplifying assumption that there is symmetry in the response of countries to unconventional monetary policy and its exit. However, the impact of unconventional monetary policy could be different from its exit depending upon whether the exit is orderly or not.

From the foregoing, one will conclude that a small-open economy with unrestricted trade and capital flow is vulnerable to spillover efefct of large economy's monetary condition. However, whether the overall effect is positive or negative remains empirically unsettled. Again, the magnitude of such effect is also uncertain.

IV. ESTIMATING THE SPILLOVER EFFECT OF UNCONVENTIONAL MONETARY POLICY

Econometric Method

To estimate the spillover effect of U.S. unconventional monetary policy on Nigerian economy,we estimated a bayesian BVARX model as utilised by Sims & Zha (1998) and Banbura, Giannone & Reichlin (2010). Bayesian VAR model sidesteps the problem of overparameterisation associated with associated with macroeconomic study of this nature by imposing restrictions on parametersto reduce the parameter set. Also, VARX method imposes weak exogeneity of the foreign country monetary policy variabes. That is, VARX model is a VAR model augmented by exogenous variable(s). Shocks from the exogenous variable are the focus of our study.

In our model, the vector of the first differences of *n* endogenous variables, y_t , is determined as follows:

$$y_t = \gamma_i.t + \sum_{j=1}^{pi} \Omega_j.y_{it-j} + \sum_{j=0}^{p_i^*} \Gamma_i.y^*_{i,t-j} + \sum \Lambda_i \Delta d_{i,t-j} + \varepsilon_{it} \quad (3.1)$$

For i = 1,2,3,...N variables
Where:

- $\gamma_i.t$ is time specific effects;
- ε_{it} is a vector of innovations that may be contemporaneously correlated but areuncorrelated with their own lagged values and uncorrelated with all of the righthand side variables. ε_{it} is assumed to be independently and identically distributed (*i.i.d*) with mean zero and an (*n x n*) symmetric variance-covariance matrix for each specific VAR equation and time *t* i.e. ε_{it} ~ i.i.d (0, Ψ).
- y_{it} is a $k_i \times 1$ vector of domestic macroeconomic variables, and $y^*_{i,t}$ is a $k_i^* \times 1$ vector offoreign macroeconomic variables such that

$$y_{it} = (\Delta gdp_t, \Delta cpi_t, fdi_{it}, er_{it}, \exp_t, m2_t, mpr_t, risk_t, ex_t, realr)'$$
$$y^*_{it} = (tspr_{it}, cspr_{it}, fbs_{it}, fist_{it}, mb_{it}, as)'$$

The vector of domestic macroeconomic variables y_{it} includes GDP growth rate (Δgdp),consumer price index inflation (Δcpi), foreign direct investment (fdi), external reserves(er),export (expind), monetary policy rate (mpr), broad money (m2), import (impind), risk premium (risk), real interest rate (realr) and exchange rate (ex)

In the same vein, the vector of foreign variables, y^*_{it} includes US term spread (tspr), US corporate spread (cspr), federal reserve bank balance sheet (fbs), US monetary base (mb), announcement surprises (as).

- d_{it} is the observed global factor such as the CBOE Volatility Index (VIX) and global oil price.

Data Source and Variables

The movement, covariances and summary statistics of the data set is presented in appendix I. Foreign data proxing US monetary policy instruments are obtained from Federal Reserves Bank of St. Louis database. All the foreign data obtained are in level and spans from 2006:M1 to 2015:M12. The foreign variables are term spread, corporate spread, Fed Balance Sheet, Monetary base, financial stress.

All domestic data used to proxy Nigerian macroeconomy, except naira-dollar exchange rate are obtained from World Bank Development Indicators online database. The data obtained spans from 2006 to 2015. However, we used Eview 8 to convert all the annual data into monthly data. The naira-dollar exchange rate used is monthly Bureaui de Change (BDC) rate obtained from the Central Bank of Nigeria. We used BDC rate since it represents the market rate. Given that Nigeria operates fixed regime, official rates are usually regulated such that the exogenous effects on the rate may be doused or trans-circuted. Otherdomestic variables are external reserves/GDP ratio, GDP growth rate. CPI inflation rate, foreign direct investment, risk premium, real interest rate, import and export.

To account for non-US contemporaneous effect on the domestic economy, global crude oil price and global volatility index represented by CBOE are included in the model specification. The monthly data for these variables are obtained from Federal Feserves Bank of St. Louis.

Analysis of Quantitative Estimates

US term spread is found to have significant spillover effect on Nigerian Import, Economic growth broad money supply and risk premium. From the quantitative estimates in table...., if term spread increases by one percent point, the import and money supply increases by 0.38% and 0.008% respectively. Also, if term spread doubles economic growth and risk premium delines by 0.64% and 0.77%. US corporate spread is also found to exact significant spillover on Nigerian economy. While ten *per cent* increase in corporate spread raises inflation rate, foreign direct investment and risk premium by 0.5%, 0.016% and 1.32%, it delines export, import, money supply and real interest rate by 0.89%, 35% and 0.08% 2.68%. This suggests that portfolio rebalancing channel operates in the global economy. Given that foreign long-term sovereign debt is an imperfect substitute for domestic debt (see Chen, Filardo, He and Zhu, 2011), lowering of US long term bond through quantitative easing may drive investors to swap their US bonds for Nigerian bonds in other to take advantage of higher risk-adjusted returns. This increases

nigerian FDI and may drive the MPR up as the Central Bank responds to excess liquidity in the financial market. This corroborates Ham,ilton&Iwu (2012).

US monetary is also found to comove with Nigerian export, foreign direct investment, economic growth, money supply, reserves, risk premium and real interest rate. Although monetary base is an admittedly imperfect proxy measure for central bank policies (Chinn, 2013), it has the virtue of being closely related to what the central bank itself is doing (in contrast to, for instance, the money supply, which is driven by both central bank and private sector decisions). While US monetary base has positive spillover effect on export, foreign direct investment, money supply, reserves, risk premium and real interest rate, it has negative effect on economic growth. Export, foreign direct investment, economic growth, money supply, reserves, risk premium and real interest rate entered the model with the following coefficients: 0.0197, 0.524, 0.159, 0.015, 0.0081, 0.131 and 2.927. This may suggests the validity of liquidity channel of UMP transiission as suggested by Lim, Mohapatra&Stocker (2014) and Krishnamurthy & Vissing-Jorgensen, 2011). Given the explicit and implicit policy commitment inherent in the UMP, the policy rate remained within the zero bound through the period. Thus, the Large Scale Asset Purchases (LSAPs) through QE increases the reserves assets of US private banks. This leads to decline in liquidity premium and borrowing costs. Consequently, private banks (including previously liquidity-constrained banks) extend more

Table 3.1 Summary of Parameter Estimates of Effects of UMP on Nigerian Economy

	CPI inflation	Exchange rate	Export index	Import index	Foreign Direct Investment as percentage of GDP	Economic Growth	Broad Money as percentage	Monetary Policy Rate	Foreign Reserves as percentage of GDP	Risk Premium	Real Interest Rate
US Term Spread	0.013	-0.07	0.032	0.377**	0.003	-0.0064**	0.0076***	0.0018	-0.315	-0.0077*	-0.0799
US Corporate Spread	0.0054***	0.509	-0.0089**	-3.50**	0.0016**	-0.0113	-0.008*	-0.0051***	-0.73	0.132***	-0.268***
Federal Reserves Balance Sheet	0.032	1.232	0.016	0.027	-0.001	0.004	-0.0007	-0.013	0.043	-0.00015	0.163
US Broad Money	-0.081	-0.26	0.0197***	1.835	0.024**	-0.159**	0.015**	0.0804	0.0081***	0.131**	2.927**
Financial Stress	0.034	4.90***	-0.044**	-1.291*	-0.003*	-1.496***	-0.0039**	-0.108***	-0.403*	0.136**	0,187
Global Volatility Index	-0.0010	-0.171**	0.0015	0.081**	0.0003	0.00029	0.003**	0.0000017	0.0073	0.0.0027	0.0046
Global Crude Oil Price	0.003***	-0.126***	0.002***	0.086***	0.00006**	0.0004	0.00008	-0.00003	0.292***	0.0078	0.0022
Announcement	-0.00065	-0.015	-0.0012	-0.036**	0.00015	0.00012	-0.0009	-0.00051	0.0604**	0.00077**	0.0040

			***	*			6**				

Source: Compiled by the researchers from the regression estimates

credit to investors including developing countries such as Nigeria. In turn, FDI in Nigeria improves and monetary aggregate may rise.

US financial stress index also exerts significant influence on Nigerian economy. One per cent point increase in financial stress index depreciates the exchange rate by 4.90 and increases the real interest rate and risk premium by 0.2% and 0.14% respectively; also, import and economic growth declines by 1.29% and 1.5% respectively. Also, doubling of financial stress index reduces export, foreign direct investment, reserves and risk premium by 4.4%, 0.3%, 40.3% and 13.6% respectively. This suggests that Nigerian economy is very sensitive to US financial stress.

The model estimates suggests that unconventional monetary policy announcements surprised markets with information on the future course of policy. Announcement of future path of monetary policy in the united state reduces Nigerian export by 0.12%,; import by 3.6% and money supply by 0.011%. Monetary policy surprises also increases risk premium by 0.077%.

Innovation Accounting through the Impulse Response Function

We computed the impulse responses with the assumption that the magnitude of a shock on ε_{jt} corresponds to the root of the $\sum \varepsilon$ diagonal elements or to one standard deviation ε_j . A shock to the j-th variable does not only directly affect the j-th variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VAR. An impulse response function (IRF) traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. Recall that the model specified in section 3.1 is:

$$y_t = \gamma_i.t + \sum_{j=1}^{pi} \Omega_j.y_{it-j} + \sum_{j=0}^{p_i^*} \Gamma_i.y^*_{i,t-j} + \sum \Lambda_i \Delta d_{i,t-j} + \varepsilon_{it}$$

Where y_t, y^* and ε_{it} denote vectors of endogenous variables, weakly exogenous foreign variables and contemporaneously uncorrelated innovations or shocks. Hence,

$$y_t = \Psi(B)\varepsilon_t = \sum_{j=0}^{\infty} \Psi_j \varepsilon_{t-j}$$

This will yield the structural form based on the orthogonalization such that

$$I = (I - \Gamma_j B_j)\Gamma(B)$$

since $\text{cov}(\varepsilon_t) = \sum$, then Ψ_j is the MA coefficients measuring the impulse response.

In other words, Ψ_{ij}, represents the response of variable y_j to unit impulse in variable y^*_j occurring i-th period ago. This follows the recursive Cholesky ordering scheme which is consistent with existing VAR literature (Chen , 2015). We also follow Chen at al (2015) and Dees, di Mauro, Smith and Pesaran (2007) by assuming that the U.S economy affects but does not respond to developments in Nigerian economy. However, unlike Smith (2006) and Chudik and Fratzscher (2012) that utilised 90 per cent bootstrapped error bands and 25th/75th percentiles error band, our confidence is 95 per cent. Given that we estimate our model using bayesian procedure, the modelis not affected by limited degree of freedom. We used IRF to evaluate response of Nigerian economy to unconventional monetary policy shocks from the US.

Impulse Responses of Economic growth, External Reserves and Export to US UMP

Figure 3. 1 suggests that **economic growth** responds persistently to US monetary shocks. It reveals that term spread raises economic growth by 0.04% in the first month after the shock. This is followed by a persistent negative response for the entire period of shock, US corporate spread and monetary base depreses economic growth by 0.79 and 0.18 percentage points respectively. However, growth showed a persistent positive response to the size of Federal Reserve balance sheet after one month lag. Financial stress however, depresses growth by average of 0.39 percentage point for a period of ten months after a deepening of financial distress had occurred. However, only term spread, corporate spread and financial stress have statistically significant impact on growth.This overall negative effect of UMP on growth corroborates Georgiadis (2015). However, he further noted that the impact of UMP on

growth will depend on such country characteristics as exchange rate regime, level of trade openness and financial intergration.

Turning to **external reserves,** term spread again follows similar path of negative impact. First, one standard deviation shock to US term spread raise reserves by about 7 percentage point in the first month. By the second month, the effect became progressively and persistently negative averaging 3.2 percent decline in external reserves. The effect of term spread on reserves is found to be statistically significant.However, corporate spread does not show a significant impact on external reserves except on the seventh month after a contemporaneous shock. Expansion of US monetary base leads to asignificant increase in external reserves.

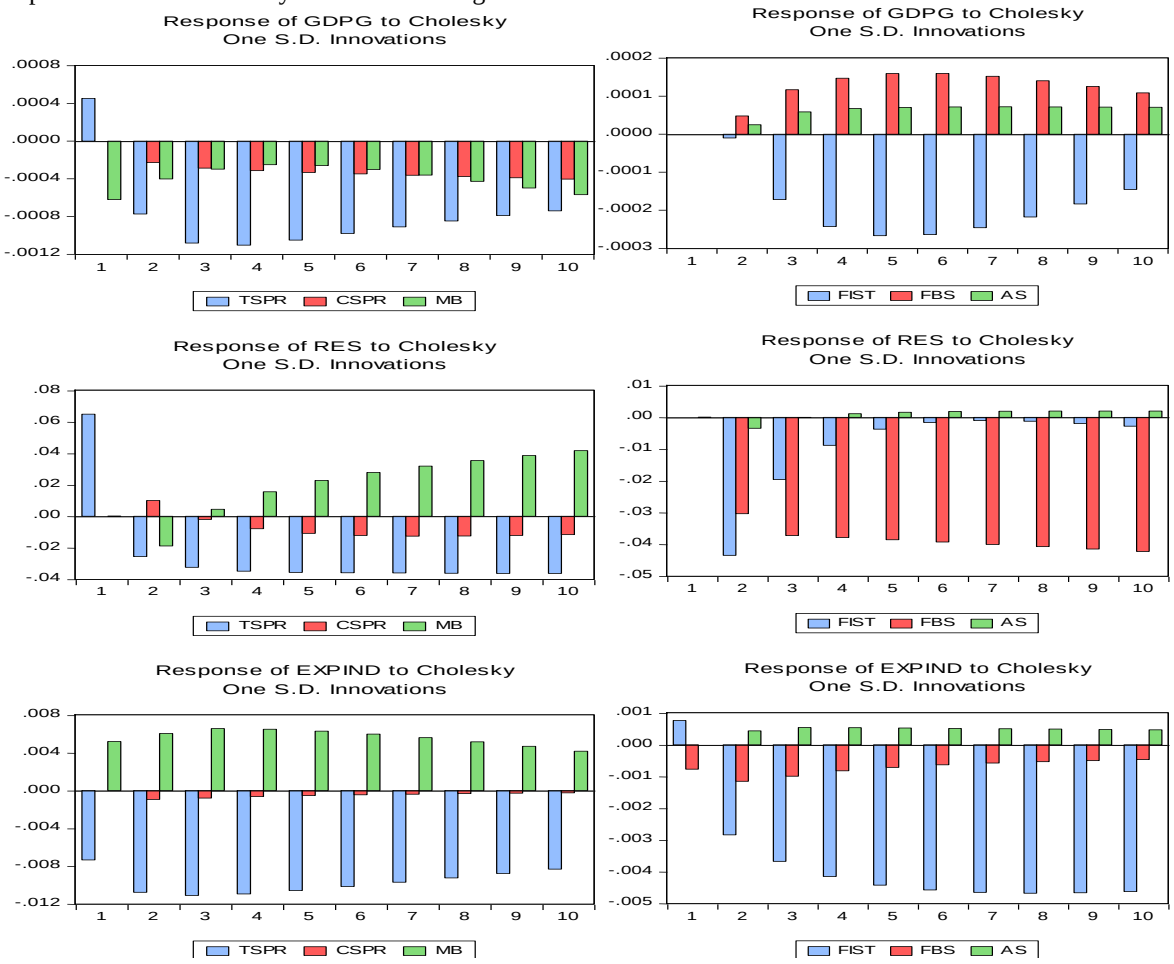


Figure 3.1. response of economic growth (GDPG), external reserves (RES) and export (EXPIND) to US term spread (TSPR), Corporate spread (CSPR), Monetary base (MB), Financial Stress Index (FIST), Federal reserves balance sheet (FBS) and Anouncement surprises (AS).

Contrarily, federal Reserves balance sheet size has significant negative impact on external reserves. It declines reserves by 3% in the second month, 4% in the third month and 4.5% in the tenth month. Announcement surprises, however, appeared to have negligible effect on reserves. 1%. After ten months following a shock, **export** falls by 4.8%. One standard deviation shock to term spread also declines export by 0.7% in the first month and 1.2% in the third month. However, the negative impact tapers gradually to 0.8% in the tenth month. However, a shock to US monetary base raises export to a peak of 4% in the fifth month after the shock and tapers gradually to 3% by the tenth month. The effects of corporate spread, federal reserves balance sheet size and announcement surprises are negligible are insignificant in the first ten months.

Financial stress index exerts a significant negative effect on Nigerian **export.** It worsens export by throught the period except the first month following the shocks where it raises export by less than

US dollar is the major reserves currency in Nigeria and given the level of global financial integration and monetary linkages, financial distress in the US is transmitted in a substantial magnitude to Nigeria. But it does appear that either the liquity and portfolio balance transmission channels are disturbed or the US economy exhibits

expenditure switching behaviour. For example, as consumer and business confidence improves through QE US consumers increase their demand for domestic goods in stead of foreign goods. This further depresses economic growth in Nigeria.

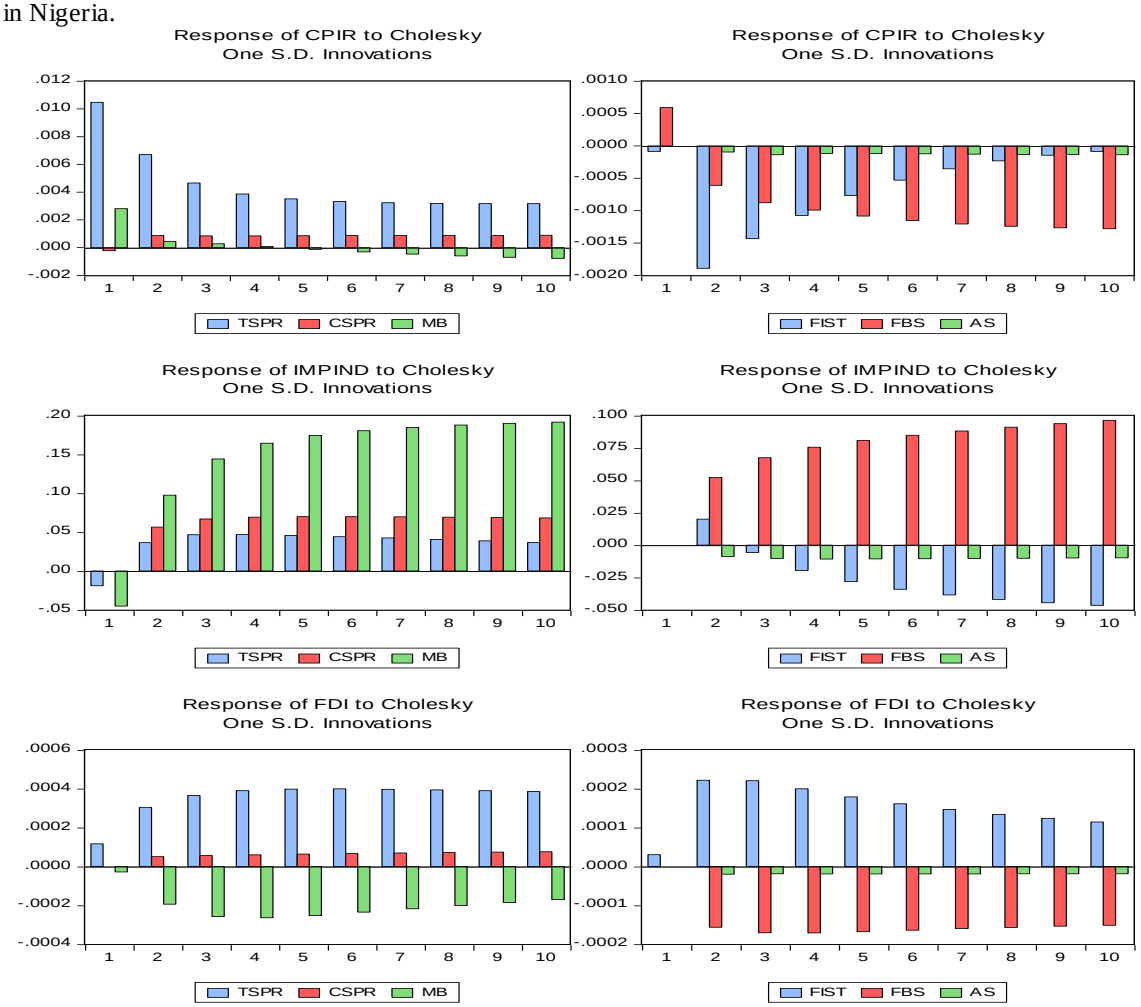


Figure 3.2 response of consumer price inflation rate (CPIR), import (IMPIND) and Foreign Direct Investmentt (FDI) to US term spread (TSPR), Corporate spread (CSPR), Monetary base (MB), Financial Stress Index (FIST), Federal reserves balance sheet (FBS) and Anouncement surprises (AS).

Impulse Responses of inflation rate, Import and Foreign Direct Investment to US UMP

A US easing raises Nigerian inflation. Following 12.2 basis point cut in the U.S term spread, the Nigerian consumer price index i**nflation** rate rises in the first month by 30 basis points in the first month and speedly tapers to 16.7 basis points in the sixth month through to the tenth month. One standard deviation shock to the monetary base initially raises inflation by 0.3% in the first month and collapsed grandually into negative impact from the fifth month. The impulse of unconventional monetary policy shock through corporate spread is found to be insignificant throughout the period. Nigerian inflation rate responds negatively to financial stress index, fed balance sheet and announcement surprises. For example, one standard deviation shock to financial stress lowers inflation by 2%. However, this effect dies off gradually until it normalises after the tenth month following the shock. But the negative effect of fed balance sheet size is rather amplified into the subsiquent periods from 0.5% decline in the secnd month to 1.5% decline in the nineth month after the shock. Announcement does not have significant effect on inflation rate.

Import responds positively to US policy response as indicated by monetary base, term spread and corporate spread. However effect of term spread is insignificant. US monetary base depresses import in the first month by 5% and raise it by 10% in the secnd month and almost 20% by the tenth month.

Impulse Responses of exchange rate, risk premium and real interest rate to US UMP

The response of FDI to one standard deviation shock from US monetary base, corporate spread and term spread is mixed. While FDI rises by 0.5% in the fifth month in response to US term spread, it declines by 0.2% in resonse to US monetary base in the same period. Corporate spread does not affect FDI significantly throughout the period.

While import responds negatively to financial distress and announcement, it responds positively to fed balance sheet. However, its response to announce is not significant. Every one standard deviation shock to fed balance sheet raises import by at least 5%. The impact amplifies frm 6% in the secnd month following the shock to 10% after ten months. Import responds to financial stress from the third month after a positive shock to it. In response to one percentage point increase in financial stress, import declines by 2.5% in the third month and amplifies to 5% in the tenth month following the shock.

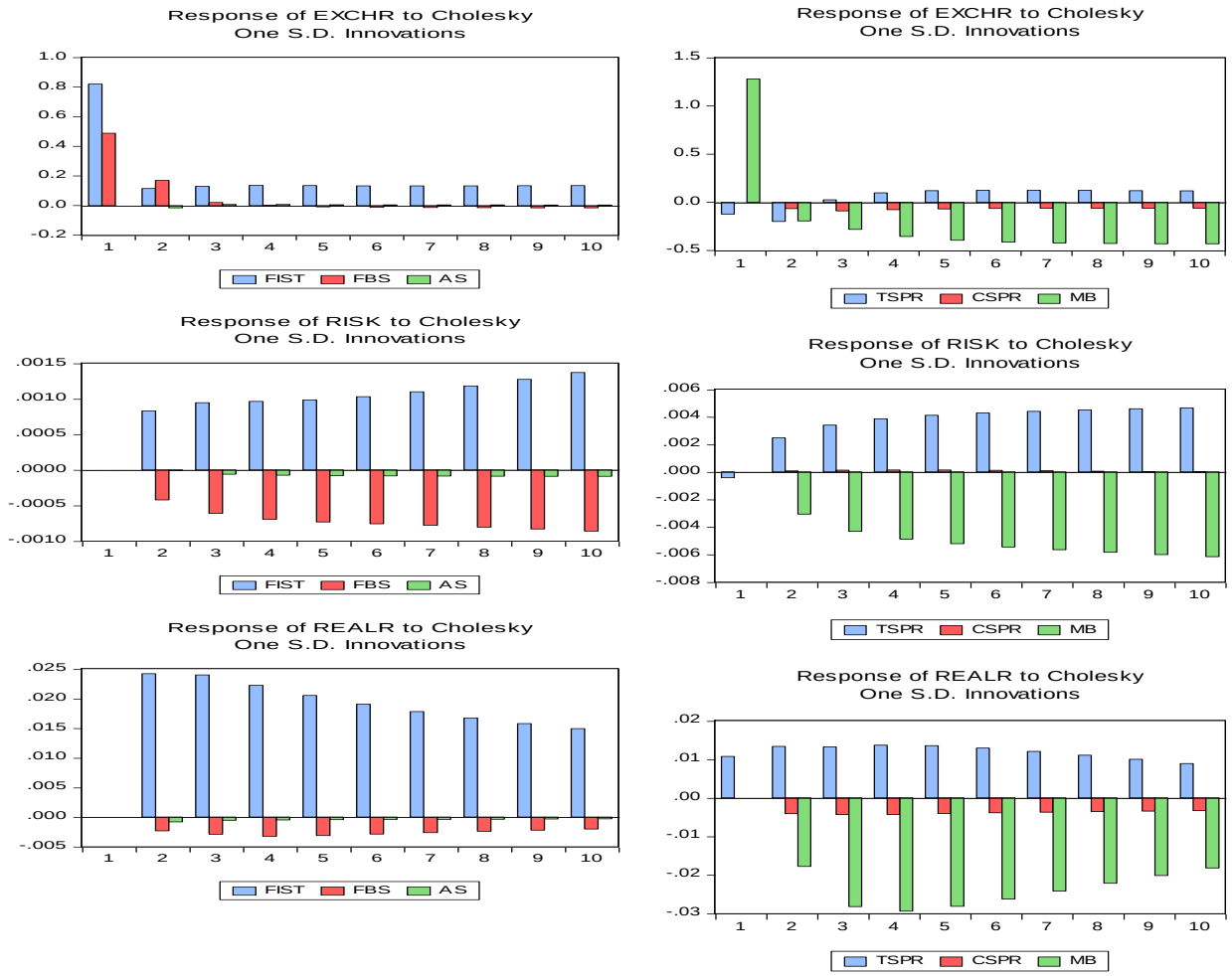


Figure 3.3. response of exchange rate (EXCHR), real interest rate (REALR) and risk premium (RISK) to US term spread (TSPR), Corporate spread (CSPR), Monetary base (MB), Financial Stress Index (FIST), Federal reserves balance sheet (FBS) and Anouncement surprises (AS).

Exchange rate depreciates in response to financial stress, term spread but appreciates in response to increase in monetary base. Although increase in fed balance sheet depreciates the exchange rate in the first month by 40%, the effect dies off at the end of the second month following the shock. Announcement does not seem to surprise the exchange rate throughout the period. Monetary base, however, appreciates the exchange rate. The average response of exchange rate to monetary base throughout the period is 8.6 percentage point appreciation. The response of exchange rate to US UMP gives insight to the vulnerability of the Nigerian economy. UMP initially appreciates the exchange rate as predicted by theory. But in less than a quarter the overall effect becomes depreciation of the naira. The depreciation effect is expected to have been transmitted through increased commodity importation.

The estimated response of risk premium to US unconventional monetary policy indicates that while risk premium is widened by financial stress and term spread, it is contracted by expansion of both fed balance sheet and monetary base. When the Nigerian risk premium increases relative to US, Nigeria becomes a persuasive portfolio destination: the premium on risky assets is now higher. The IRF suggests that the response of real interest rate is mixed. For example, after the first month following shock to financial stress real interest rate rose by 2.5%. This is

sustained in the second month but starts declining before the third month until it tapers to 1.5% by the tenth month. This is not unconnected with the behaviour of cross-border assets flow. As US policy rates fall relative to Nigerian policy rate, the real rate rises given inflation. This pulls assets from the US into Nigeria. As the supply of assets exceeds market demand, the real rate falls thereby initiating asset exit. Assets flow dynamics is however outside the scope of this study.

V. POLICY IMPLICATION AND CONCLUSION

In this study, we investigated the spillover effect of US unconventional monetary policy (UMP) on Nigerian economy. The findings from the quantitative estimates from BVAR and IRF indicates that US unconventional monetary policies since the late 2000 exerts beggar-thy-neighbour effect on Nigerian economy. In other words, Nigerian economy is vulnerable to both financial distress and UMP emanating from the US. UMP depresses export and economic growth in Nigeria. This suggests that US UMP rather has expenditure switching effect on US domestic economy through exchange rate depreciation. As US demand switches from foreign to domestic commodities, Nigerian export declines, trade balance worsens and economic growth declines. It does appear also that the response of Central Bank of Nigeria to excess liquidity orchestrated by the UMP wetted the pass-through. Since 2011 the CBN has consistently raised the policy rate. This procyclicality may worsen domestic investment, thereby depressing growth. However, it will also motivate more inflow of hot money which makes the economy more vulnerable.Thus Nigeria appeared to have opened up itself to strongcontagion effects in the way it went about attracting portfolioflows to build reserves, stimulate asset price recovery in the stockmarkets and stabilize or engineer appreciation in their domestic currencies. But the goal of reserves accumulation has not been achieved. This may be due to several factors. First, the US expenditure switching behaviour worsened export and thus reduced foreign exchange earnings. Second, depreciation of US dollar in response to UMP encourages importation in Nigeria which increases the demand pressure on the available external reserves. Third, given the Nigeria's fixed regime stance and the incipient depreciation of the nominal exchange rate, the CBN tends to increase its intervention activities in the forex thereby depressing the external reserves. Also, the effect of plumetting global oil price on reserves is nonetheless substantial thereby shortcircuting the full effect of capital inflow motivated by the UMP.

From the foregoing, we therefore recommend that to effectively insulate Nigerian economy from beggar-thy-neighbour effects of UMP, she must follow sound macroeconomic policies that would allow her to reap the benefits of and appropriately respond to capital inflow when the Federal Reserves Bank eases monetary policy. In particular, to minimize systemic risk arising from US UMP Nigeria needs to fully use macroprudential levers that will not only enhance automatic reduction of vulnerabilities but also raise real output. Macroprudential regulations will be designed to include capital flow measures (CFMs), both on inflows and outflows, as necessary, though not as a substitute for other needed policy adjustments) to reduce any vulnerabilities that may have emerged, build buffers, and continue to undertake reforms that will raise potential output and thereby maximize the strength of the pull factors. Nigerian policy makers need to make concerted effort to make export more competitive by focusing on export promotion and import substitution strategies. It must however be noted that import substitution is neither synonymous nor substitutable with import restriction. Nigeria has distatefully embarked on import restriction in recent time which has only succeded in raising domestic prices including export prices. This is rather counter productive and procyclical.

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