The Efficacy of Monetary Transmission Mechanism: The Case of the United States

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Abstract

This paper empirically investigates the effectiveness of monetary policy transmission in the United States from 1975-2010 using the Long-Run Structural Modelling (LRSM) and the techniques of error correction and variance decompositions. The results indicate that the domestic credit and exchange rate channels are relatively effective in influencing the real GDP per capita, and so is inflation-targeting, while the interest rate channel does not appear to play an important role as a monetary transmission mechanism, bearing in mind the interlinkages between the channels. The empirical analysis suggests that policy measures and structural reforms must be targeted accordingly in order to promote the effectiveness of monetary transmission mechanisms in the US and similar countries.

Key words*: Monetary Policy, Monetary Transmission Mechanism, Time Series Techniques, Johansen Cointegration, Granger Causality, United States.*

A. Introduction

Over the time, a plethora of studies has been devoted to the analysis of monetary transmission mechanism; owing to two reasons. First, it is intended to provide an essential evaluation of monetary policy at the status quo, and, secondly, to advise monetary policymakers of the timing and the effect of their policies on the economy (Boivin, Kiley, and Mishkin, 2010). Monetary policy, as defined by the Federal Reserve (Fed), is the actions undertaken by monetary authorities to influence the availability and cost of money and credit in the economy (Labonte, 2012). Such undertakings are made for the purpose of achieving the objectives of monetary policy with relation to employment and price stability. Effective monetary transmission channels ultimately transmit monetary authorities' decisions and signals into conforming actions by the private sector. In other words, monetary transmission mechanism describes how policy-induced changes in the nominal stock of money or the short-term nominal interest rate impact other real macroeconomic variables such as aggregate output and price level (Ireland, 2005). Thus, appropriate interventions, through policies from monetary authorities, is at all times needed to whether shocks in financial markets and manage impact to real economy.

Despite such, the recent financial crisis in the U.S. and the E.U. raised questions about the shortcomings of the current monetary policy and its transmission mechanism. In particular, there has been mounting doubts over the efficacy of policies of Quantitative Easing in achieving the desired objectives of economic stimuli and paving the way for recovery; thus providing impetus for interest in academic research to evaluate the same. In the U.S., the Fed and its monetary policy has been accused of being one of the culprits of the subprime crisis (Stiglitz in Yahoo Finance, 2011). Mishkin (2011) went further to urge a total rethink of the science of monetary policy. How far is the truth? Has monetary policy, particularly in the U.S., lost its efficiency? If not, what could be inferred

regarding the efficacy of the transmission mechanism in place? To answer all of the above, academic research must be undertaken.

B. Research Objectives and Motivation

In light of the previous studies by Boivin, Kiley, and Mishkin (2010) and Cevik and Teksoz (2012) and given the significance of domestic monetary policies in the US to interconnected markets and economies around the globe, this paper intends to investigate the efficacy of monetary transmission mechanism in the US, using a sample of annual data for the period from 1975 to 2010 by analyzing the dynamic relationships between the monetary channels (represented by domestic credit, T-Bills, and exchange rate) and the economy (represented by Inflation rate and GDP), through:

1. Analyzing the cointegration amongst the variables;
2. Analyzing the causality amongst the variables.

An understanding of the variables' dynamic relationships is pertinent to arrive at recommendations regarding the timing and effectiveness of policy actions, better understanding of current policy environment, and suggesting a modest way to reform ahead.

C. Literature Review

Many of the thoughts of monetary policy are rooted in the neoclassical synthesis. The Theory of Optimal Monetary Policy, for instance, starts by specifying an objective function that represents economic welfare, that is, the well-being of households in the economy and then maximizes this objective function subject to constraints that are provided by a model of the economy (Mishkin, 2011). The objective function has been translated in two matters; (1) the price stability, and (2) maintaining economic output of the economy. The objective of price stability involves minimizing the variances of inflation from its optimal rate, while the second objective is concerned with minimizing deviations of real economic activity from the natural rate of productivity level. Monetary policy decisions influence such variables.

Nonetheless, it is argued that the effectiveness of monetary transmission mechanisms change over time in accordance with changing economic and financial landscape in any particular country; the degree of financial intermediation and central bank autonomy and the development of domestic capital markets. In other words, the development in financial landscape would possibly provide alternative channels for monetary policy transmission.

Despite variations, the respective channels of monetary transmission mechanism can be any combination of the following:

i. **The interest rate channel** transmits monetary shocks to the economy through its impact on interest rate-sensitive components of aggregate demand such as consumption and investment. Despite its well-established position as a mechanism of monetary transmission, interest rate significance is affected by such other variables as feedback from exchange rate; especially in financially-developed open market economies.
ii. **The credit channel**, which complements the interest rate channel by changing the supply of bank credit to the private sector in response to changes in interest rate and statutory reserve requirements, among other instruments of monetary policy. It will be of most interest to investigate the

relative efficacy of this channel in light of the ongoing change in the process of credit creation, whereby bank's role in credit creation is increasingly over-shadowed by new emerging financial intermediaries and expansion of corporate bond and equity markets.

iii. **The exchange rate channel**, the effectiveness of which is dependent upon the exchange rate regime adopted by the economy, whether it is fixed or flexible, and the degree of capital freedom. In the United States, for example, if interest rate rises, yields on dollar-denominated assets will look more attractive leading to inflow of foreign capital and appreciation of the dollar in foreign exchange markets. This in turn will lower the cost of imports and raise the price of US exports impacting the demand of both respectively.

iv. **The balance sheet channel** operates through impacts to wealth and credit worthiness of borrowing households and firms.

v. **The asset price channel**; as monetary authorities change interest rate, the valuation of financial assets, such as stocks and bonds, changes; thereby affecting firms' investment decisions and households consumption decision through impact on firms' and projects' profitability and households' wealth.

vi. **The expectation channel;** changes to monetary variables may signal future course of actions thereby affecting households and firms expectations with regards to interest rates, inflation, assets prices and others and impacting their consumption and investment decisions today.

D. Research Methodology

In testing the effectiveness of monetary transmission mechanism, time-series studies of individual countries over time are deemed to be more appropriate; as they capture the dynamics of the variables over time and address the peculiarity attributed to country-specific characteristics; conditions and stages of development, valuable considerations that are overlooked in cross-sectional or pooled cross-section time-series studies.

Within time series techniques, however, traditional regression analysis is abandoned due to its major limitations of assuming stationarity of variables which results in misspecification of the regression and invalidity of conventional statistical tests if the variables were in fact cointegrated. On the other hand, when variables are first-differenced to justify stationarity assumption; the theoretical component is removed and only the short-run relationship can be estimated. In light of the above, the more recent cointegration-based techniques is adopted; using vector error-correction and variance decomposition methods to test Granger causality and long-run structural modelling (LRSM) to test the long-run theoretical relationship among the variables.

Unlike traditional regression, the strength of time series techniques lies in the following: (1) testing rather than assuming long-run theoretical relationships among the variables (cointegration), and (2) testing rather than assuming the direction of causality among the variable (Granger-causality). It, nonetheless, shares the same assumption of linearity as traditional regression.

1. Data, Empirical Results and Discussions

This study investigates the transmission of monetary shocks in the US economy through the channels of interest rate, credit and exchange rate, with the hope of providing meaningful insight into the linkages through which monetary policy decisions are transmitted to the real economy.

Bearing in mind the goals of monetary policy, as documented in the Federal Reserve Act, which are to promote maximum employment, price stability and moderate long-term interest rates, we consider a five-variable model for our lead-lag analysis. The variables are the real GDP per capita (LGDPPCAP), domestic credit provided by the banking sector as a percentage of GDP (LCRDT), Treasury bill rate (TBIL), the real effective exchange rate (ER) and rate of inflation (INF). The data was sourced from the World Bank database. All the 'level' forms of the variables were transformed into the logarithm scaleto achieve stationarity in variance but that was not necessary for the Treasury Bill rate (TBIL)and inflation rate(INF) variables, as they were originally in percentage form.

2. Cointegration Test

STEP 1. UNIT ROOT TEST

To begin the cointegration test, we need to ensure that the variables are in fact I(1). I(1) signifies that the variables used are non stationary in their original form and stationary at their level-form. This is achieved by applying Augmented Dickey-Fuller (ADF) & Phillips-Perron (PP) tests on the level and first differenced forms of the variables. The results of former tests are tabul ated below in Table 1 and Table 2 respectively. The variables are found to be integrated of order one in levels; as the hypothesis that they contain a unit root cannot be rejected at the 95% level. There is clear evidence that the variables have changed over the sample period.

Table 1. ADF Unit Root Test Results

		Test-Statistic	ADF C.V.	Implication
Level form				
Intercept and trend	RGDPPC	-2.0752	-3.5671	Non-stationary
	INF	-3.6631	-3.5671	Stationary
	CRDT	-3.4464	-3.5671	Non-stationary
	ER	-2.6478	-3.5671	Non-stationary
	TBIL	-3.2996	-3.5671	Non-stationary
First-differences				
Intercept but not a trend	GDPPC	-3.2184	-2.9665	Stationary
	INF	-3.4882	-2.9665	Stationary
	CRDT	-4.9429	-2.9665	Stationary
	ER	-3.7992	-2.9665	Stationary
	TBIL	-5.1604	-2.9665	Stationary

Source: Processed Data

Table 2. Phillips-Perron Unit Root Test Results

Level Form	Test-Statistic	ADF C.V.	Implication
GDPPC	-1.6605	-3.5671	Non-stationary
INF	-2.9071	-3.5671	Non-stationary
CRDT	-.48268	-3.5671	Stationary
ER	-3.6902	-3.5671	Stationary
TBIL	-1.4737	-3.5671	Stationary

Source: Processed Data

Worth noting that in ADF test at level-form, variable INF is stationary. Nevertheless, under Phillips-Peron test, the variable is found to be non-stationary as evidenced by the insignificance effect of INF(-1) to INF at differenced-form. Hence, the variable is kept in the model.

Implication for policy making at this stage: as mentioned before, the result in this stage informs the condition of the examined variables, that is whether or not they are non-stationary (experiences the infinite variances, permanent shocks, and autocorrelation) or stationary (experiences a finite variances, temporary shocks, and disarrayed autocorrelation problem). This information is pertinent since policy makers are interested to have the best variables which are, presumably, reflecting a free market condition in order to form a sophisticated model to arrive into a better policy making. In our case, it is shown that all variables are I(1) implying that demand-side monetary policies are seemed to be more effective.

STEP 2. ORDER LAG SELECTION

An optimal lag order of VAR is then selected using the Akaike Information Criterion (AIC) & Schwarz Bayesian Criterion (SBC). A lower VAR order is often associated with the problem of serial correlation, while a higher VAR may risk over-parameterization in a small sample. While our SBC test statistic suggests a lag of 0, AIC suggests a lag of 1. Both statistics are significant. We, nonetheless, proceed with a VAR of 1*, bearing in mind we only have 35 observations.

Table 3. Selecting the Order of the VAR Model

Order	AIC	SBC	Adjusted LR test
1	**104.9770**	83.4672	46.9496[.995]
0	88.8631	**85.2781**	73.4747[.979]

Source: Processed Data

The importance of this stage is to determine the number of lags to be used before the researcher proceeding to the cointegration test.

* Kindly be advised that a VAR of 2 was also considered. However, results in latter steps were unfavorable, especially at the LRSM exact identification stage where all variables were rendered insignificant.

STEP 3. COINTEGRATION

Under this stage, there are two cointegration tests applied. They are: (1) Engel Granger residual-based approach and (2) Johansen ML cointegration test.

a. Engel Granger residual-based approach

The motive using Engel Granger residual-based approach is to find non-spurious relationship amongst the examined variables. Engel and Granger (1987) considered seven asymptotically valid, residual-based test statistics for testing the null hypothesis of non-cointegration against the alternative of cointegration. Moreover, based on Microfit Tutorial Lessons handout in page 298, Engel and Granger residual-based approach is useful when a time-series data set needs to include dummy variables which possibly alter the critical values for the unit root test. Considering that the examined data set does not include dummy variable, hence, the deployment of Engel Granger residual-based approach here is a mere experiment.

Table 4. Engel Granger Residual-Based Cointegration Test

DF	T-Stat	AIC	SBC	Dickey-Fuller CV.
ADF(1)	-3.3441	66.3233	64.9221	-4.8967

From the result, it is implied that null hypothesis of non-cointegration could not be rejected. It is such because the t-statistics value of the highest Aike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) is less than the critical value of Dickey-Fuller statistics. This evidences that, according to EG residual approach, there is no long-run theoretical relationships amongst the variables. However worth noting that, this test only accommodates one cointegration relationship and the endogenous variable has been determined prior. Hence, Johansen ML cointegration test is preferred.

b. Johansen ML cointegration test

The results of testing for cointegration based on both Maxim and Trace Eigenvalue statistics, strongly reject the null hypothesis of no cointegration (r=0) but do not reject the alternative hypothesis, that there is one cointegration relation between these variables (r=1) at the 95% level.

Table 4. Cointegration Test Result

	Null	Alternative	Statistic	95% Critical Value	90% Critical Value
Maximal Eigenvalue	r = 0	r = 1	56.6863	37.8600	35.0400
	r ≤ 1	r = 2	30.0202	31.7900	29.1300
	r<= 2	r = 3	15.7121	25.4200	23.1000
Trace	r = 0	r = 1	114.1451	87.1700	82.8800
	r ≤ 1	r = 2	57.4587	63.0000	59.1600

Source: Processed Data

Cointegration implies that the relationship among the variables is not spurious; that there is a theoretical relationship among the variables and that they are in equilibrium in the long run. It implies that each variable contains information for the prediction of other variables. However, cointegration cannot tell us the direction of Granger-causation as to which variable is leading and which variable is lagging. Table 4 below depicts the cointegrating test results based on Maximal Eigenvalue and Trace of the Stochastic Matrix.

Policy implication at this stage is to show the extent of effectiveness of a Government's short run monetary policies, as it indicates the co-movement of the variables in the long-run, as envisaged by theory. The Federal Reserve Bank may therefore form design its policy in such a way that effectively affect the endogenous variable, to be discerned in the next steps.

STEP 4. LONG RUN STRUCTURAL MODELLING (LRSM)

In order to make the coefficients of the cointegrating vector consistent with the theoretical and relevant information of the economy, we applied the 'LRSM' procedure. LRSM enable the imposing and then testing of both identifying and over-identifying restrictions. Exact identification involves normalizing the variable of interest, which is LRGDPPC in our model, by introducing the restriction of unity of its coefficient and testing the same. Results of exact identification are presented in Panel A of Table 5 and suggest that all of the variables are significant except for LER, which has a t-statistic of 1.621 (in comparison with a critical value of 2).

An over-identifying restriction is, therefore, imposed to test the significance of the exchange rate variable in the cointegrating relation. Acceptance of the restriction would imply that the variable must be omitted.

Table 5. Exact and over identifying restrictions on the cointegrating vector

	Panel A		Panel B	
	Coef.	(Std. Error)	Coef.	(Std. Error) / [Prob.]
LRGDPPC	1.0000	*NONE*	1.0000	*NONE*
INF	.033640	(.017021)	.025522	(.012518)
LCRDT	-.97098	(.31566)	-1.0931	(.30556)
LER	-.23375	(.14420)	-.0000	(*NONE*)
TBIL	-.014119	(.0068040)	-.0094917	(.0050389)
Trend	.0069035	(.0088605)	.011012	(.0089253)
Log-Likelihood	103.4656		100.2452	
Chi-Square			6.4408	[.011]

Source: Processed Data

To over-identify, we set LER coefficient equal to zero and test the null that the restriction is correct. Given the result, tabulated in Panel B of Table 5, and based on the p-value of the Chi-Squared test, we reject the null of restriction and proceed with the exact-identification relation of:

ecm1 = 1.0000*LRGDPPC + .033640*INF -.97098*LCRDT -.23375*LER -

.014119*TBIL + .0069035*Trend

Despite the fact that exchange rate is insignificance (t-statistic is 1.621), the result supports the traditional view of transmission mechanism that there is indeed long-run theoretical relationship amongst domestic credit, T-Bills, inflation rate, and real GDP. In succeeding tests, exchange rate would still be included in the analysis considering its t-statistic value which is deemed to be close to the threshold.

3. CAUSALITY TEST

STEP 5. VECTOR ERROR CORRECTION MODEL (VECM)

As stated earlier, cointegration cannot tell us the direction of Granger-causality; as to which of the variables is leading and which one is lagging in the relationship. Hence, the vector error-correction modeling technique is used to distinguish the absolute exogeneity and endogeneity of variables; to the benefit of policy-makers' planning and optimal choice of monetary instrument. At least one of the ECT terms should be significant for the long term cointegrating relationship to be valid, as the ECT embodies the long term relationship where the long-run co-movement between the variables cannot be captured by differenced variables. The 'F' test of the joint significance/insignificance of the lags of each of the differenced variables captures the impact of each variable on other variables in the short run.

Table 6 shows the results of the error-correction model (ECM) for each variable, estimated by OLS based on cointegrating VAR (1). Given the tabulated results, we find the inflation rate, the domestic credit, the exchange rate and the Treasury Bill rate to be all *exogenous* (leaders) whereas the Real GDP per Capita is the only *endogenous* variable (follower) in the cointergation. The exogeneity of the inflation rate, the domestic credit, the exchange rate and the Treasury Bill rate means that they do not depend on the deviations of other variables, that they are the first recipients and transmitters of exogenous shocks to equilibrium.

Table 6. ECM estimated by OLS based on cointegrating VAR (1)

	DLRGDPPC	DINF	DLCRDT	DLER	DTBIL
ECM(-1)	-.17293 (.028985)*	-6.5156 (3.3240)	.011435 (.075268)	.13161 (.14022)	1.4707 (3.1341)
Chi-square SC(1)	.49687 [.481]	3.1037 [.078]	2.4811 [.115]	.96482 [.326]	3.6462 [.056]
Chi-square F(1)	.1102E-3 [.992]	2.7429 [.098]	.16094 [.688]	.077825 [.780]	.62983 [.427]
Chi-square N(2)	.54090 [.763]	.55892 [.756]	5.5919 [.061]	17.0295 [.000]	1.0191 [.601]
Chi-square HET(1)	.085344 [.770]	1.9685 [.161]	.18475 [.667]	.10634 [.744]	3.3685 [.066]

Standard errors are in parentheses.* indicates significance at 5%.
Source: Processed Data

The significance of the error correction term in LRGDPPC equation, on the other hand, implies that changes in economic growth is brought about by changes in the inflation rate, domestic credit, exchange rate and short-term interest rates, in line with the theorized literature except that one could have expected inflation to be endogenous too, however it is worth noting that the strategized monetary policy in the US is often influenced by the level of independence of the Fed towards the dominant political party in parliament. Consequently, inflation has been targeted at times, depending on the interests of the political party in power. Moreover, it is the real GDP per capita that has to undergo change in the short-run in order to bring about the long term equilibrium among the cointegrating variables. More specifically, the size of the coefficient of the error correction term indicates the speed of short term adjustment; hence it could take up to 6 years for Real GDP per capita to restore equilibrium in the long run; following a shock to the economy. Which is sadly not surprising; given the efforts that continue to date to contain the aftermath of the financial crisis of 2007-2008.

The diagnostics of all the equations of the error correction model were obtained in order to test for the presence of autocorrelation, functional form, normality and heteroskedasticity. Tabulated results suggest that the equations are well-specified.

All in all, implication for policymakers based on the result, monetary authorities have at their disposal the named exogenous variables as policy tools to achieve their objectives and affect necessary changes in the country's economic activities.

STEP 6. VARIANCE DECOMPOSITIONS (VDCs)

Despite the value-adding information on variables' exogeneity and endogeneity provided by VECM, a measure of relative exogeneity and endogeneity of the variables is more important for policy makers so as to enhance the effectiveness of their policy-making. We, thus, apply the variance decomposition technique, which decomposes the variance of the forecast error of a particular variable into proportions attributable to shocks in each variable in the system, including its own. The variable that isexplained mostly by its own shocks, and is less dependent on others, is deemed to be the most exogenous of them all.

There are two types of VDCs; orthogonalized VDCs and generalized VDCs. Orthogonalized VDCs are sensitive to the ordering of the variable in the VAR and assume all other variables to be switched-off when one-specific variable is shocked. As such it is less realistic compared to generalized VDCs. Generalized VDCs are not dependent upon the particular-ordering of the variables in the VAR, and do, in fact, allow other variables to change when a variable is shocked.

Table 7 summarizes the forecast variance explained by innovations in generalized variance decompositions. Based on the statistics at the end of the forecast horizon 5, the domestic credit variable leads the cointegration relation with 92% contribution of its own shocks, followed by the real effective exchange rate (83%), inflation rate (63%) and the Treasury bill rate (52%). The real GDP per

capita lags with only 23% of its forecast variance contributed by own shocks, while the majority 77% is explained by the other variables.

These out-of-sample variance forecast results are consistent with the previous within-sample results given by the error correction model and tend to suggest that the domestic credit provided by the banking sector is the most exogenous variable, explaining 21% of the variance in real GDP per capita, whereas the latter explains only 0.3% of the variance in the supply of domestic credit (an alarming reality that reinforces the notion of the financial sector being decoupled from the real economic sector and having a lift of its own).

Table 7. Percentage of forecast variance explained by innovations in: Generalized variance decompositions

Horizon: Years	Percentage of Forecast Variance Explained by Innovations in:				
	ΔLRGDPPC	ΔINF	ΔLCRDT	ΔLER	ΔTBIL
Relative Variance in ΔLRGDPPC (Rank:5)					
1	0.529915	0.112521	0.074861	0.120429	0.162273
3	0.310633	0.268566	0.172824	0.194426	0.053551
5	**0.232282**	0.322568	0.205361	0.211772	0.028017
Relative Variance in ΔINF (Rank:3)					
1	0.010175	0.631603	0.026943	0.127766	0.203513
3	0.011306	0.634325	0.021704	0.116413	0.216251
5	0.012056	**0.630696**	0.02578	0.107734	0.223733
Relative Variance in ΔLCRDT (Rank:1*)					
1	0.003186	0.053931	0.909187	0.001091	0.032605
3	0.003153	0.050252	0.914296	0.000759	0.03154
5	0.003135	0.048285	**0.917016**	0.0006	0.030963
Relative Variance in ΔLER (Rank:2)					
1	0.031359	0.143986	0.00175	0.798683	0.024222
3	0.037455	0.11501	0.007148	0.821895	0.018492
5	0.041112	0.098734	0.01216	**0.832637**	0.015357
Relative Variance in ΔTBIL (Rank:4)					
1	0.241682	0.178496	0.024172	0.023132	0.532517
3	0.231526	0.19057	0.029211	0.026591	0.522102
5	0.226381	0.196693	0.031856	0.028384	**0.516686**

*Where 1 denotes the most exogenous variable

Source: Processed Data

By further decomposing the forecast variance of LRGDPPC, we find that 32% of the variance is attributed to change in the rate of inflation, 21% is caused by change in the real effective exchange rate and less than 3% is explained by change in the Treasury bill rate. VDC tend to indicate that the channels of credit and exchange rate have significant influence on the country's real GDP per capita, so does inflation rate targeting; reflecting their efficacy in the conduct of monetary policy.

The seeming insignificance of the interest rate channel is in line with existing literature, whereby the traditional interest rate channel is expected to give way to other transmission channels in an open economy, in light of the ongoing internationalization of economies, dominance of flexible exchange rate regimes (Mishkin, 1996) and the revolutionary changes in financial systems

around the world. Moreover, the above findings lend justification to the disputed failure of rounds of quantitative easing in the US and other developed countries. Nonetheless, the indirect impact of real interest rates that penetrates the economy indirectly through its effects on credit, as the cost of funding, exchange rates and asset prices; among other transmission channels, cannot be ruled out.

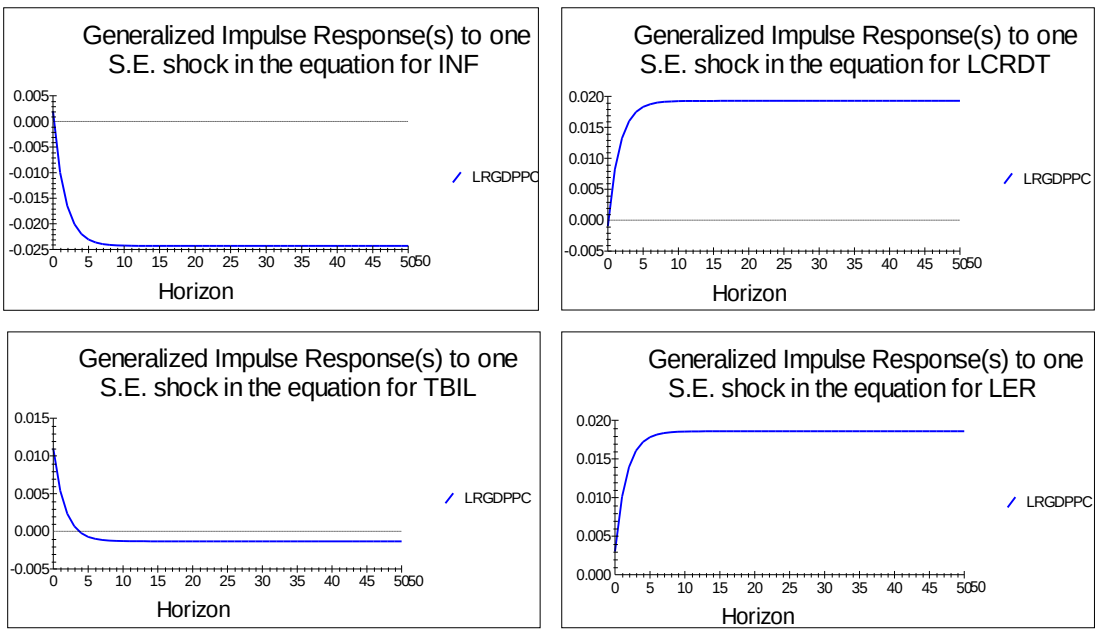
Overall, these findings have important implications for policy makers, who should ideally target the most exogenous variable (domestic credit) and pay close attention to developments in foreign exchange markets, in order to achieve desired monetary objectives. However, policy makers ought to be more innovative in their approach especially given the on-going financial development that sees more and more credit created by non-banking institutions. In addition to monetary policy, monetary authorities may wish to embark on a strategy of prudential regulation and supervision.

STEP 7. IMPULSE RESPONSE FUNCTIONS (IRFs)

The information contained in the VDCs can be equally represented by the impulse response functions (IRFs), which are graphical illustration of the dynamic response of a variable owing to a one-period standard deviation shock to another variable. In an IRF graph, zero represents the steady-state value of the response variable.

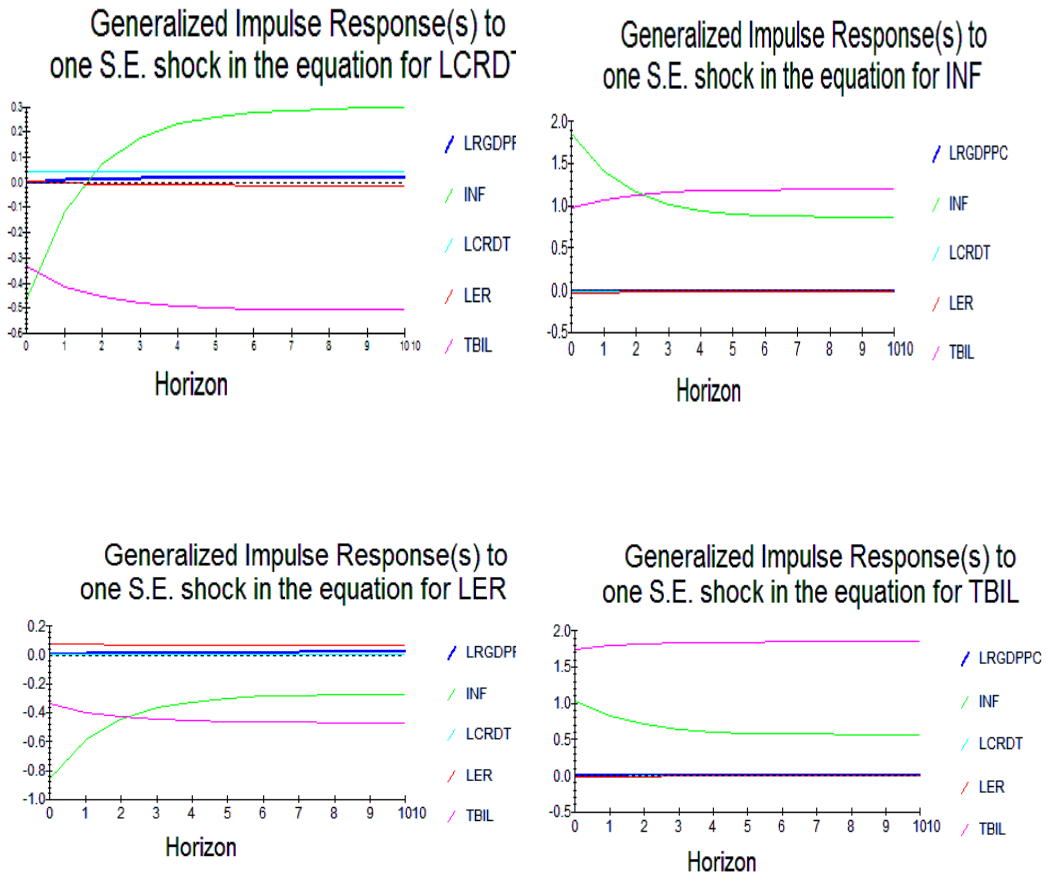
The generalized IRFs, as depicted in Figures 2 and 3 are found to be consistent with the earlier results of generalized VDCs; the LRGDPPC variable is most sensitive to1% SD shocks in domestic credit; the inflation rate and the exchange rate. However, it is least responsive to a 1% SD shock to the interest rate variable. Hence, IRFs have same policy implications as the former VDCs.

Fig. 2. Generalized impulse responses of LRGDPPC to one SE shock in the equations of exogenous variables



Source: Processed Data

Fig. 3. Generalized impulse responses to one SE shock in the equations of exogenous variables

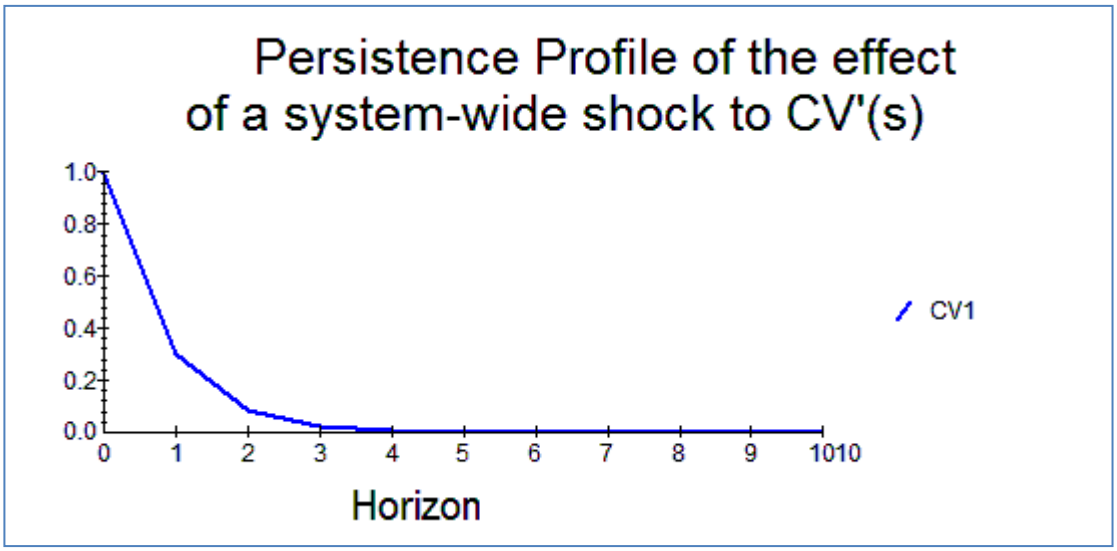


Source: Processed Data

STEP 8. PERSISTENCE PROFILE (PP)

While the above illustrations of IRFs map out the response to variable-specific shocks, the persistence profile traces out the effects of a system-wide shock on the long-run relationship of the variables. In particular, it shows that it could take up to 4 years to restore equilibrium in the economy following an external shock to the cointegrating relationship.

Figure. 3. Persistence profile of the effect of a system-wideshock



Source: Processed Data

C. CONCLUSION AND POLICY IMPLICATIONS

Unlike, contemporary empirical evidence that suggested the relative importance of the interest rate channel in advanced economies with developed financial markets and the opposing dominance of bank lending and exchange rate channels in emerging market economies, our study suggests that monetary policy in the US is best transmitted using the channels of domestic credit, exchange rate and inflation rate targeting. This suggestion could be further generalized to countries with similar macroeconomic and financial structure, such as the UK. The interest rate channel, on the other hand, appears to be of less importance.

Bearing in mind the interlinkages between all the channels, monetary authorities are more likely to achieve their objectives in a timelier manner with the use of the earlier instruments. It follows that monetary authorities need to pay close attention to developments in the credit and foreign exchange markets with more innovative approach to monetary conduct especially given the on-going financial development that sees more and more credit being created by non-banking institutions. Strategies of prudential regulation and supervision shall also be considered.

D. LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The underlying study exhibits some limitations which could provide area for future research. One important limitation is the focus on the investigation of only 3 of the likely channels of monetary transmission mechanism, in consideration for the small sample size and risk of over-parameterization. These channels are namely: the interest rate channel, the domestic credit channel and the exchange rate channel. It will be interesting to retest the same with the inclusion of the remaining channels of balance sheet, asset prices and expectation (if robust mathematical and probability models could be obtained) in order to measure their relative efficacy and draw more concrete recommendations for the conduct of monetary policy.

In addition, this study has examined the relative efficacy of monetary policy transmission mechanism alone, it could, therefore, be of value addition to compare and evaluate its efficacy with that of fiscal policy (despite the current limited fiscal space in the US) with quantification of the merits of adopting risk-sharing equity-based policy instruments, the like of share certificate in substitution for the currently used debt-based instruments, which are arguably failing policy makers anyways with the attested insensitivity to the interest rate channel.

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