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Monetary Policy Shock Transmission in Emerging Markets

Hummaira Jabeen[1]

Abstract
The mortgage financial crisis that sooner converted into a global crisis affirms the evidence of the contagion. This study attempts to study the impact of monetary policy shock arising from the United States on the economy of emerging markets in a time-varying context. I have employed the TVP-VAR model with stochastic volatility to study this objective. The results indicate the significant impact of the shock on the growth and price of emerging markets. This study provides a unique inside into the studies on emerging markets in a way by treating each country as a separate entity and then observing the country-specific impact of the shocks arising from United States monetary policy upon the growth and inflation of developing countries. This study benefits the economy watcher and gives a deep inside into the subject matter from different dimensions.
***Keywords*:** monetary policy shock, emerging economies, TVP-VAR analysis

1. Introduction

Likewise, to earthquakes, countries face sudden movements. These types of turbulence in the economy are known as shocks that may result in crises (Zumbach, et al. 2000). Due to globalization, such a crisis does not have implications for a single country. They impact other financial and economic institutes and at times create a death spiral. Open economies are more prone to get affected by these events. When such correlations of economic events in neighboring and cross-border economies rise exceptionally, it is known as contagion. Contagion impact among economies spread through diverse networks.

The global financial crisis (2007) started initially as a subprime mortgage problem in the United States (US). With a high default rate of the subprime mortgage, economies have suffered disastrous losses in coming years (e.g., Fornari and Stracca, 2013 Olmo and Sanso-Navarro 2014). In its initial state, this fear was there that this crisis will spill over to the rest of the world's economies (see e.g., Ciccarelli et.al, 2013 and Wolf 2012). With time, many fears come true, and a largely negative impact was seen in debt markets, real estate, bond markets, and other macroeconomic variables. This is a true case of contagion indicating how a local problem turns into a global crisis (see, e.g., Hab 2014 and Wagan and Ali 2014). This global response to the crisis has initiated a heated debate among researchers on the means of the contagion.

Believed by many researchers and market watchers while discussing this global-level response to a financial crisis that monetary policy is actively responsible for transmission (Fatima, 2013; Abdullah et al., 2013; Audi et al., 2021) and possibly it's a source of contagion in times of crisis (Kazi et.al 2013; Ali, 2022). The effectiveness of monetary policy has been under question for decades, especially during a crisis. Timely information on monetary policy transmission is useful for policymakers and regulators in developing relevant plans. With this background, this can be said that the responsibilities of the central/federal/state (state bank henceforth) banks are higher than past; they need to consider the international impact in the form of contagion in their decision-making process to minimize impact at the macroeconomic level. It is believed that this approach to decision-making will result in better conduct of Monetary Policy objectives (Blinder, 2010 and Borio, 2009; Mehmood et al., 2013).

Contagion arising specifically from the financial or economic shock is an area of study for several decades both in the theoretical and empirical literature. If I talk about the focus of theoretical literature, it has tried to develop relationships in different ways. Bernanke and Gertler (1995) developed a shock model of the balance sheet conditions and found that negative shocks are having a greater impact than positive shocks. Allen and Gale (2000) conducted a study on the development of the contagious model of liquidity preference shock. They modeled financial contagion as an equilibrium phenomenon and found that Liquidity preference shock imperfectly correlated across regions. Gai (2013) developed a contagion model of financial systems by using network theory. He found that financial systems display a robust yet fragile tendency while the probability of contagion may be low, but effects are extremely widespread when problems do occur. Elliott et.al (2014) modeled contagions and cascades of failures among organizations. Glasserman and Young (2013) proposed a framework that analyzed the probability of contagion and the expected losses generated by contagion. Beltran et.al, (2021) demonstrated in their study the transformation of the federal funds market, changes in monetary policy implementation, and an increase in counterparty credit risk during the financial crisis of 2007 by using a network approach. Ghassibe, (2021); studied the Novel econometric evidence on the amplification of monetary shocks by networks. At least 30% of total US consumption responded to a monetary shock due to networks.

Mostly these studies have conducted contagious impacts arising from advanced countries to developing nations. The contagious impact of monetary policy exists not only from region to region, but sectors do have implications. Ito (2021) found evidence of monetary policy transmission on real estate in Japan. Dang (2022) investigated the impact of monetary policy on bank liquidity creation. They found that an expansionary (contractionary) monetary policy tends to increase (decrease) bank liquidity creation. Fisera and Kotlebova (2020) studied the effectiveness

[1]Assistant Professor/Program Manager, Indus University, Karachi, Pakistan, hummairajabeen@gmail.com

of the bank lending channel in the transmission of the unconventional monetary policies of the European Central Bank (ECB). They distinguished two groups of unconventional monetary policies - Quantitative Easing (QE) and central bank lending to commercial banks. They found that the two groups of unconventional policies did not have a statistically significant effect on bank lending in all the sampled countries. However, Slovakia, with its comparatively healthy banking system, found that the QE boosted credit provision to the private sector. Dedola *et al.,* (2021) explained how the relevant effects can be estimated using a statistical methodology derived from theory. The results suggest that QE has large and persistent effects on the USD/EUR exchange rate, mainly through shifts in exchange rate risk and short-term interest rates between the two currencies. Changes in expectations about the future monetary policy stance, reflecting the "signaling channel" of monetary policy, also affect how the USD/EUR exchange rate responds to QE.

Many researchers have conducted an empirical analysis of macro-economic contagious impact using different variants of VAR. e.g., Kazi et.al (2013), Neri and Nobili (2010), Bagliano and Morana (2010), Audi et al., (2021), Barakchian (2015), Cross and Nguyen (2016), Arshad and Ali (2016), Ali and Ahmed (2016), Roussel et al., (2021), Ciccarelli and Rebucci (2003) Ghani (2013), Goldstein (2005) and Fornari and Stracca (2013), Kim (2001), Bluedorn and Bowdler (2001), Scrimgeour (2010) covering the same aspect. In most recent example Hoang and Nguyen (2021) examined the monetary policy transmission on Vietnam's economy and found evidence of monetary policy transmission on output and price.

Iorember *et al.,* (2021) conducted a study for finding the impact of monetary policy shocks on domestic output growth in Nigeria. They found that shocks in money supply have a positive impact on domestic output growth in the long run, while shocks in the interest rate and exchange rate have a negative impact on domestic output growth in the long run. Bernstein (2021) highlighted in his study that Output responses to shocks depend on the Euler equation of unconstrained households. He concluded that output responds less to monetary policy in recessions and Contractionary monetary policy is more powerful than expansionary policy. Kolte et.al, (2021) studied the Indian economy in a turmoil time by using a qualitative research approach. As a result, they suggested that monetary policy according to the situation may give the right result. Hassen and Hamdi (2020) investigated the impact of the monetary policy conduct of the Tunisian central bank on overall and sector-wise economic growth, particularly over crisis periods and found evidence of the impact of monetary policy. Palazzo and Yamarthy (2022) found a positive relation between corporate credit risk and unexpected monetary policy shocks during FOMC announcement days. Falck et.al, (2021) studied US economy in the context of New Keynesian Model and empirically demonstrated in their study how a contractionary monetary policy shock leaded to a statistically significant increase in inflation and inflation expectations in times of high disagreement, whereas in times of low disagreement it leaded to a significant decline in these variables. (Bu, Rogers and Wu, 2021) worked on the identification of Fed Monetary Policy Shock. They found that information effect can lead to the result that shocks to monetary policy have transmission effects with signs that differ from traditional theory. There are several studies available covering the shock transmission to the stock market. E.g., Yiu et.al (2010), Todorov (2012), Ehrmann and Fratzsher (2009), Markwat et.al (2009), and Hab et.al, (2014) to name a few.

In the light of reviewed literature, it can be stated that studies are available on monetary shock, but studies have majorly focused on advanced economies whereas crises do not know about the boundaries. Moreover, the crisis has been studied using the static method whereas the impact is time-varying. In keeping these issues in front, this study has been done that covers emerging economies using time-varying methods. Motivated by the influential work of Primiceri (2005), the objective of this paper is to present empirical proof of the Monetary Policy shock in a time-varying method in emerging markets. Moreover, this study is also based upon the study of Sims (1992) in that he asserts that economists and researchers have no clear clue about the size and extent of the effects of the Monetary Policy on aggregate activity. This view is still true in the case of many countries. Economists have agreed on this part that monetary authorities are capable enough to control short-term interest rates and hence can have an influence on aggregate activity. There is formal statistical and theoretical evidence for this view (e.g., Nakajima, 2011, and many others). In this study, this hypothesis is being tested as contagion arising from United State Monetary Policy. The evidence available in this area is majorly in the case of advanced countries (Jannsen et.al 2015 and Marfatia 2015). The monetary policy of advanced countries is equally important for emerging countries. But very few studies are available addressing this issue. This study attempts to fill the gap in the case of emerging markets. This study addresses the following questions:

- How enormous is the influence of the US Monetary Policy shock on the aggregate economy of emerging markets?

For the study of the research question, I have employed the TVP-VAR model, proposed by Nakajima (2011). This model creates an impulse response in the economy arising from the Monetary Policy Shocks. I gave contractionary Monetary Policy Shocks to the economy and found that the mechanism of Monetary Policy shocks transmission to the aggregate economy. The extent varies from country to country, but it is true for all emerging countries.

The major contribution of this study is as follows. Firstly, I have applied a more recent and stronger model for studying the contagion effects unlike many previously available studies, which employ static models for studying transmission or contagion impacts. Secondly, for transmission study, this study covers normal and the turmoil time and gives a comprehensive account of the transmission process that linear constant parameters models failed

to answer. Moreover, this study differs from other studies that treat countries in the panel but failed to indicate country-specific impact. For this reason, this study indicated country-specific impact.

The rest of the paper is structured as follows.

- Section 2 deals with the conceptual framework
- Section 3 deals with the methodology.
- Section 4 with results section.
- Section 5 deals with the discussion and conclusion.

2. Conceptual Framework:

Majorly it was in the 50s and 60s when standards on the role of Monetary Policy in the economic structure started to emerge. The role of Monetary Policy has been discussed by the Keynesian and Monetarist schools of thought in length. As a result, the ISLM framework has emerged. In this framework, it is assumed that any innovation in Monetary Policy has an impact on the economy. In this study as it is role identified that short-term interest rates will represent Monetary Policy Shocks. Under monetarists and ISLM's explanation monetary contraction will create declining output and the meaning of monetary contraction is deflation. If these responses are not created, then it would be known as a puzzle e.g., a price puzzle.

This study is an attempt to study the shock transmission of inflation and growth arising from monetary policy. To study monetary policy, the very first task is identification. In the literature, there is no consensus on the identification problem of exogenous Monetary Policy shock from endogenous components of the Monetary Policy. In this study, the identification strategy proposed by Bernanke and Mihov (1998) is employed. In view of this strategy, it is assumed that some good single measure for Monetary Policy is available. In this scenario, the "true" structure of the economy can be modeled as follows:

$$Z_t = \sum_{i=0}^{k} B_i Z_{t-i} + \sum_{i=0}^{k} C_i p_{t-i} + A^y v_t^y \quad (1)$$

$$p_t = \sum_{i=0}^{k} D_i Z_{t-1} + \sum_{i=1}^{k} g_i p_{t-i} + v_t^p \quad (2)$$

There

Z_t=vector of non-policy macroeconomic variables

p_t=variable indicating the Monetary Policy stance.

I define Monetary policy shock as the unexpected change in the short-term interest rate of the central banks. The inspiration to use the short-term interest rate as a proxy of Monetary Policy comes from Sims (1992) who used it for the study of the Monetary Policy transmission mechanism in the USA. Apart from him, many prominent researchers have used short-term interest rates as a proxy of Monetary Policy namely Nakajima (2011); Primiceri (2005), and Bernanke and Blinder (1992) among many. In the light of reviewed literature, it can be stated that studies are available on monetary shock but studies covering emerging markets specifically national and international contexts still are lacking or are in less number. This is an area where this study fits and will cover.

3. Methodology

The VAR approach is an econometric method mainly used for economic analysis. For empirical evidence see [Luporini (2008); Best (2013); Rodolfo Cermeno and Polo (2012); Aleem and Lahiani (2011); Zakir and Malik (2013); and Phiromswad (2015)]. VAR models have gone through many developments and still, and this process is ongoing.

TVP-VAR is a new approach in this area for studying economic issues. Cogley and Sargent (2001) were the pioneers in the development of the VAR model with time-varying coefficients. This model was criticized by Stock (2001) on the ground of the assumptions employed in the study related to the constant variance of the VAR's structural shock. In response to this criticism, Cogley and Sargent (2001) modified their model using Stochastic Volatility (Stochastic Volatility originally proposed by Black (1976) is having a significant place in TVP-VAR models). Primiceri (2005) proposed the TVP-VAR model in the context of Bayesian inference (the TVP-VAR model with stochastic volatility, and the Markov Chain Monte Carlo (MCMC) method). Primiceri (2005) employed TVP-VAR model for studying the systematic and non-systematic Monetary Policy of the United States. This study reassured the argument of Primiceri (2005) that the state of the economy tends to vary over time which is true for the transmission and contagion process. By permitting parameters to change over an interval, Monetary Policy shocks may closely be observed. This is done using TVP-VAR models where it is assumed that parameters for the low first-order random walk process allow them a long-lasting and short-lived shift in parameters and the economic structure can be studied in a flexible and vigorous manner.

The objective of this study is to estimate Monetary Policy shock in a time-varying nature upon macro-economies of emerging markets. To work on this objective, the TVP-VAR model proposed by Nakajima (2011) is estimated in this study. For illustrating the identification of structural shock in the TVP-VAR model it is convenient to present non-policy and policy variables by a k-dimensional vector of variables (y_t).

In this case, stated two equations earlier can be written in the following TVP-VAR model proposed by Joushi Nakajima (2011):

$$Ay_t = F_1 y_{t-1} + \cdots + F_s y_{t-s} + u_t, \quad t=s+1,\ldots,n, \quad (3)$$

where
y_t= (k*1) vector of observed variables,
A, F_1, …, F_s= (k*k) matrices of coefficients
u_t=structural shock
it is assumed that $u_t \sim N(0, \Sigma\Sigma)$ where

$$\Sigma = \begin{pmatrix} \sigma_1 & 0 & \cdots & 0 \\ 0 & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & \sigma_k \end{pmatrix}$$

Simultaneous relations of the structural shock are specified by recursive identification, assuming that A is lower-triangular,

$$A = \begin{pmatrix} 1 & 0 & \cdots & 0 \\ a_{21} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{k1} & \cdots & a_{k,k-1} & 1 \end{pmatrix}$$

Equation (3) can be rewritten as the following reduced form VAR model:
$y_t = c_t + B_1 y_{t-1} + \cdots + B_s y_{t-s} + A^{-1}\Sigma\varepsilon_t, \quad \varepsilon_t \sim N(0, I_k), \quad (4)$
Where
$B_i = A^{-1}F_i$ for i=1,….,s.
stacking the elements in the rows of the B_i's to form β ($k^2 s * 1$ vector) and defining $X_t = I_k \otimes (y'_{t-1}, \ldots\ldots, y'_{t-s})$ where $\otimes$ denotes the Kronecker product, the model can be written as
$y_t = X_t\beta + A^{-1}\Sigma\varepsilon_t, \quad (5)$
All the parameters of equation (2) are constant. To extend this model to TVP-VAR, parameters need to be time-varying.
Consider the TVP-VAR model stochastic volatility specified by
$y_t = X_t\beta_t + A^{-1}\Sigma_t\varepsilon_t, \quad t=s+1, \ldots., n, \quad (6)$
where the coefficients and the parameters are all time-varying. To model the process of time-varying parameters, Primiceri (2005) is being followed, let $a_t = (a_{21}, a_{31}, a_{32}, a_{41}, \ldots, a_{k,k-1})'$ be a stacked vector of the lower-triangular elements in A_t and $h_t = (h_{1t}, \ldots, h_{kt})'$ with $h_{jt} = \log\sigma_{jt}^2$, for j=1,…,k, t=s+1,….,n. it is assumed that the parameters if equation (3) follow a random walk process as follows:

$$\beta_{t+1} = \beta_t + u_{\beta t}, \quad a_{t+1} = a_t + u_{at}, \quad h_{t+1} = h_t + u_{ht},$$

$$\begin{pmatrix} \varepsilon_t \\ u_{\beta t} \\ u_{at} \\ u_{ht} \end{pmatrix} \sim \left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma_\beta & 0 & 0 \\ 0 & 0 & \Sigma_a & 0 \\ 0 & 0 & 0 & \Sigma_h \end{pmatrix} \right)$$

for t=s+1,…,n, where
$\beta_{s+1} \sim N(u_{\beta o}, \Sigma_{\beta 0}), a_{s+1} \sim N(u_{ao}, \Sigma_{a0})$ and $h_{s+1} \sim N(u_{ho}, \Sigma_{h0})$. for more details, refer Nakajima (2011).
For studying the Monetary Policy shock variables include the gross domestic product (GDP) and inflation. The time span for the study is 1995Q1–2012Q2. All series are downloaded from the website of the International monetary fund (IMF), FRED — St. Louis Fed, Bank for International Settlements (BIS) accounts and State Bank of Pakistan. For finding stationary in series Phillips Perron (2001) test is employed. The data consists of quarterly variables for the US and emerging countries namely Advanced emerging markets and Secondary Emerging as classified by FTSE (Financial Times Stock Exchange). Detail on variable and transformation is given in appendix 1.
As a proxy of the growth, I have used GDP (gross domestic product, Real, Seasonally Adjusted index in units), downloaded from IMF except in case of Pakistan, for Pakistan data on GDP is taken from a paper by Hanif et. al (2013) who have quartered national accounts of Pakistan. Consumer Price Index (index in units of the base year 2010) is serving as a proxy of inflation that is taken from IMF for all the countries.

4. Results

This study is an attempt to study the shock transmission arising from USA's monetary policy. This section covers the results of TVP-VAR model for the emerging markets. Model is based on three variables and data frequency is quarterly. Number of lags is four and it is assumed that Σ_β is a diagonal matrix. The following priors are assumed for the i-th diagonals of the covariance matrices:
$(\Sigma_\beta)_i^{-2} \sim$ Gamma (20, 0.01)
$(\Sigma_a)_i^{-2} \sim$ Gamma (4, 0.01)
$(\Sigma_h)_i^{-2} \sim$ Gamma (4, 0.01)
For the initial state of the time-varying parameter, rather flat priors are set. $\mu_{\beta 0}=\mu_{a0} = \mu_{h0}=0$, and $\Sigma_{\beta 0}=\Sigma_{a0} = \Sigma_{h0}=10*1$. For computing the posterior estimates, M=10,000 are sampled from where 1,000 are discarded. The

results in table and figure show that the MCMC algorithm produces posterior draws efficiently (for details refer appendix 2).

The impulse response is used to observe the dynamics of the model. For the TVP-VAR model, the responses are computed at all points in time using the estimated time-varying parameters. The impulse response is generated in the following way:

- Before the crisis in 1998 Q4-represented by the dotted line
- During crisis in 2008 Q4-represented by blue and dash line
- After crisis 2012 Q2-represented by the red line

These time periods are chosen due to the availability of data. Year 1998 is being chosen for the pre-crisis time, reason behind this choice is that data for most of the countries start with this year that's why this has been taken as pre crisis and year 2012 has been taken as posted, again this choice has been made due to availability of the data.

Figure 1 pointed the impulse response of the Brazilian economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow\rightarrow x$) remained positive and volatile most of the time; the response of before crisis remained more volatile than other responses and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow\rightarrow p$) stayed positive and of stable nature. Before the crisis response remained positive followed by a negative response after an initial positive response that turned into a positive stable response. During and after response initially negative than remained positive afterward. In the study of United States monetary policy contagion to the Brazil, I observed the direct response in both variables.

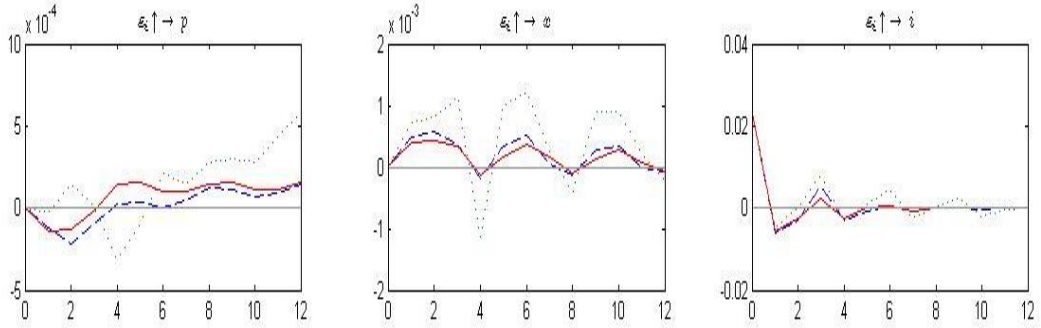

Fig.1: Posterior means of time-varying impulse response from the US to Brazil

Note: Time-varying responses for Before crisis at 1998 Q4 (Dotted Line), During Crisis at 2008 Q4 (Dashed Line), and after crisis at 2012 Q1 (Solid Line) horizons for the TVP-VAR model where impulse variable is monetary policy (ε_i) and output (x) and inflation (p) are response variables.

The figure 2 pointed the impulse response of the Czech Republican economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow\rightarrow x$) remained positive and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow\rightarrow p$) stayed positive and of varying nature. In the study of monetary policy transmission of Czech Republic, I observed the direct response in both variables.

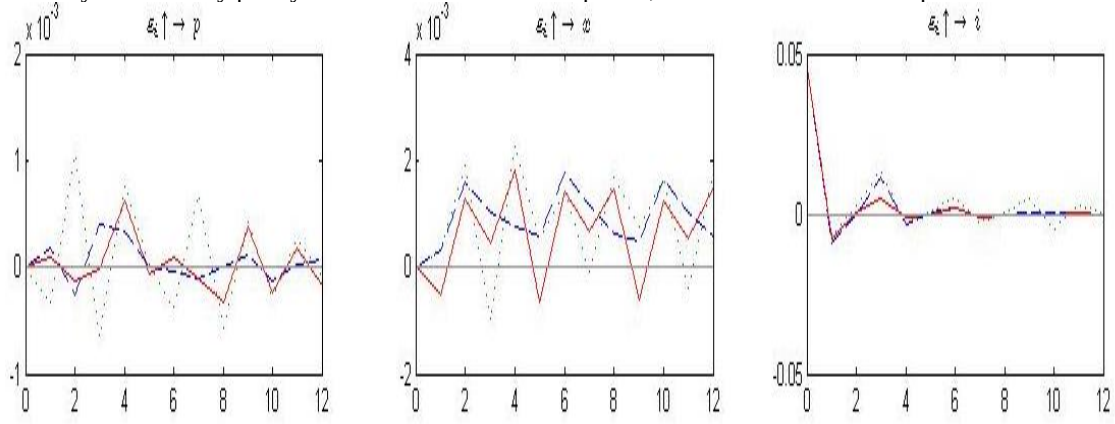

Fig.2: Posterior means of time-varying impulse response from the US to the Czech Republic

Figure 3 pointed the impulse response of the Hungarian economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow\rightarrow x$) stayed positive and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow\rightarrow p$) remained positive and of varying nature.

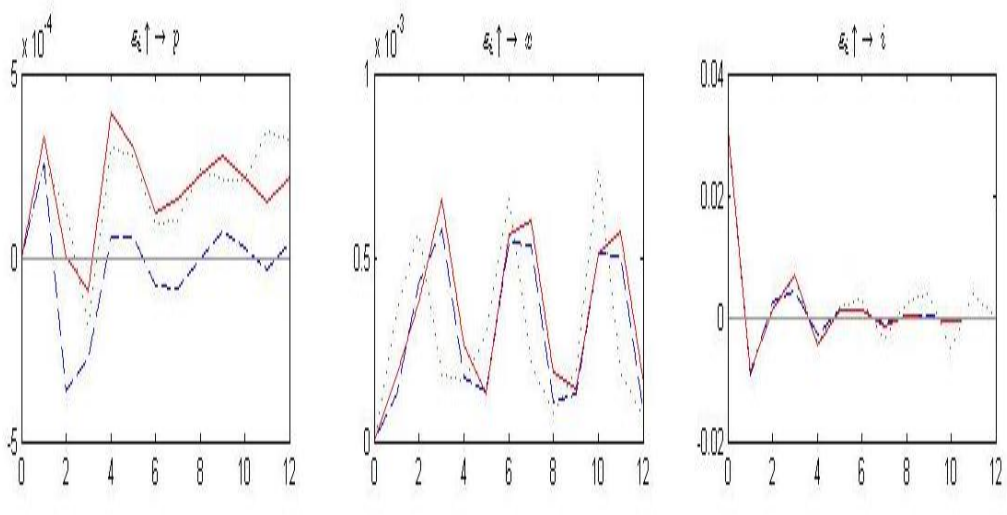

Fig.3: Posterior means of time-varying impulse response from the US to Hungary

Figure 4 indicated the impulse response of the Malaysian economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) stayed positive and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) stayed positive but of stable nature; the response of before crisis was somewhat volatile.

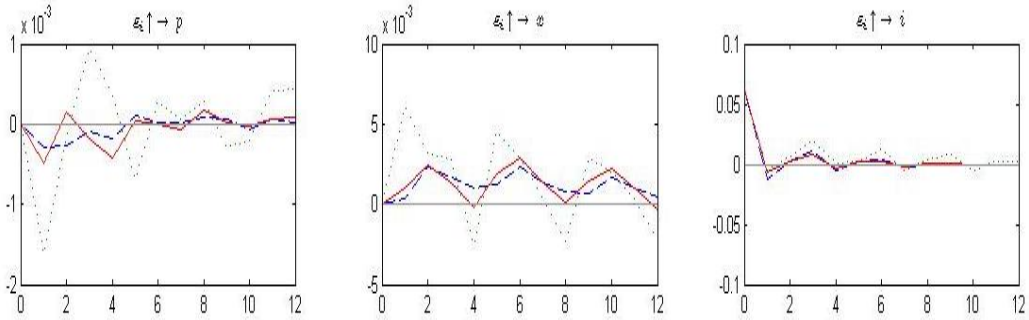

Fig.4: Posterior means of time-varying impulse response from the US to Malaysia

Figure 5 is showing the impulse response of the Mexican economy to the US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) stay positive and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) is negative and of varying nature but less as compared to output.

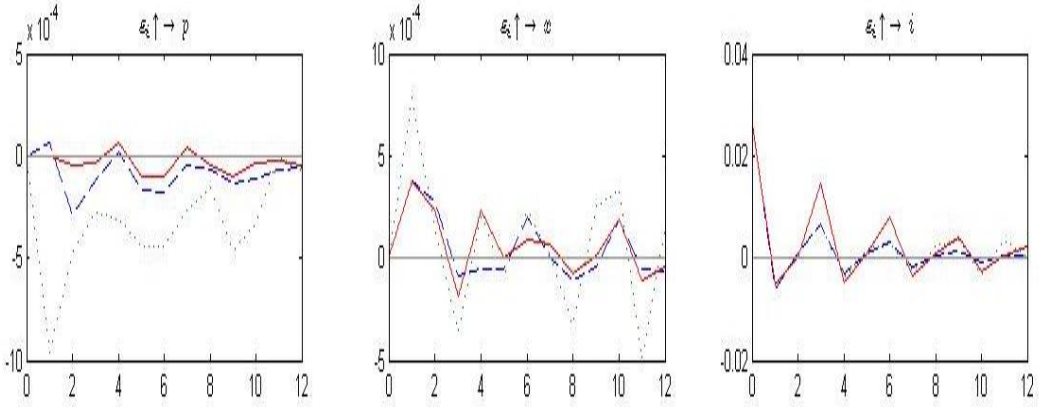

Fig.5: Posterior means of time-varying impulse response from the US to Mexico

Figure 6 pointed the impulse response of Poland economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) remained positive and volatile most of the time; before crisis response showed highest volatility and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) stayed positive but of stable nature.

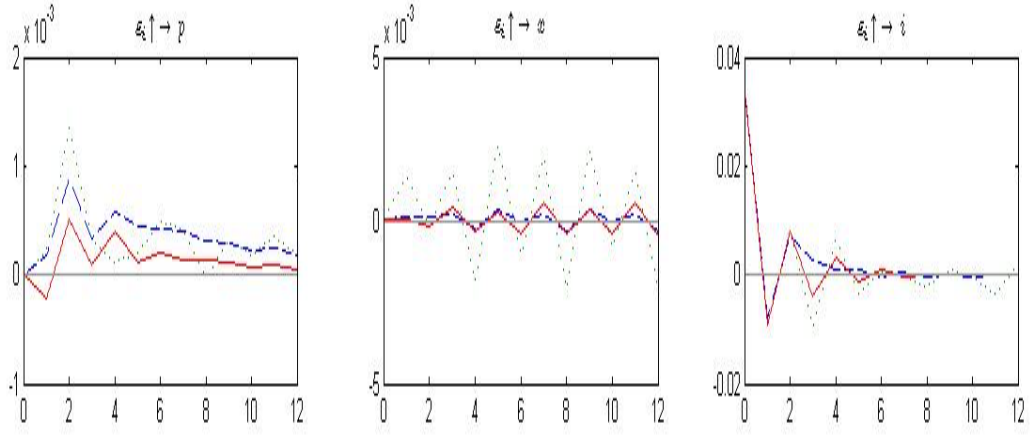

Fig.6: Posterior means of time-varying impulse response from the US to Poland

Figure 7 highlighted the impulse response of the Turk economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) stayed positive and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) remained positive but of stable nature (near to zero).

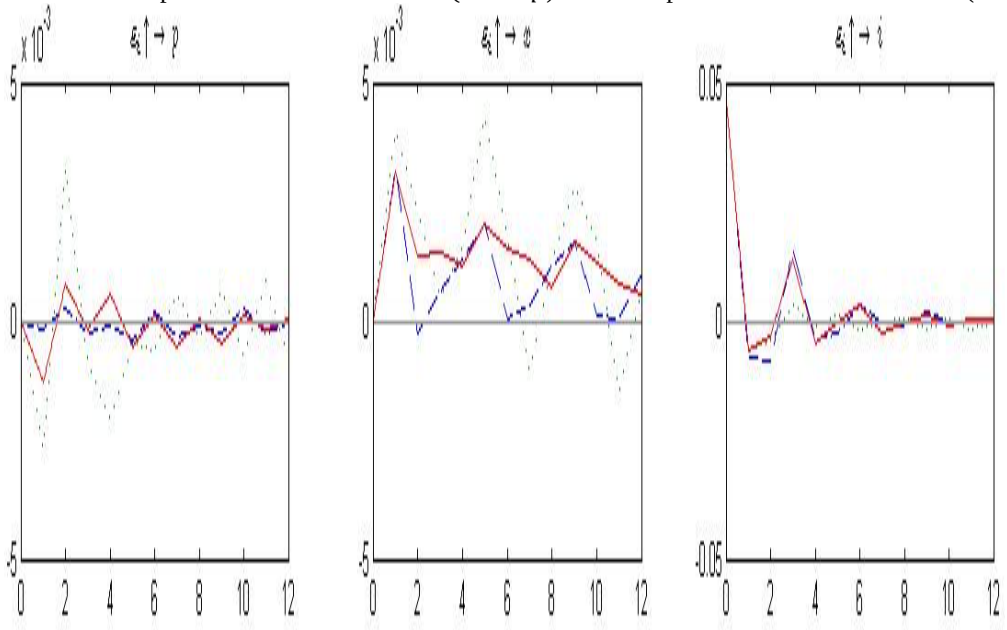

Fig.7: Posterior means of time-varying impulse response from the US to Turkey

Figure 8 highlighted the impulse response of the Colombian economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) stayed positive and near zero; the response of before response remained more volatile compared to other responses. The impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) stayed positive but of varying nature and same as output, response of price before crisis stayed more volatile.

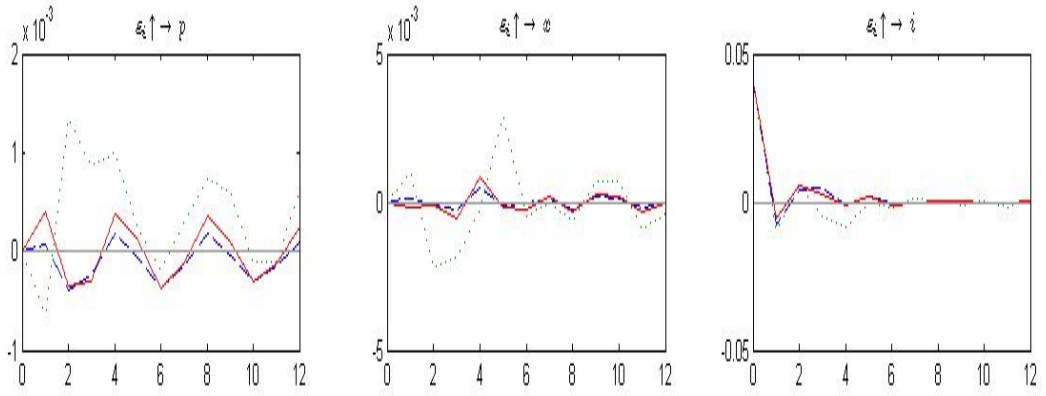

Fig.8: Posterior means of time-varying impulse response US to Colombia

Figure 9 highlighted the impulse response of Pakistani economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) stayed positive and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) remained mix and of varying nature.

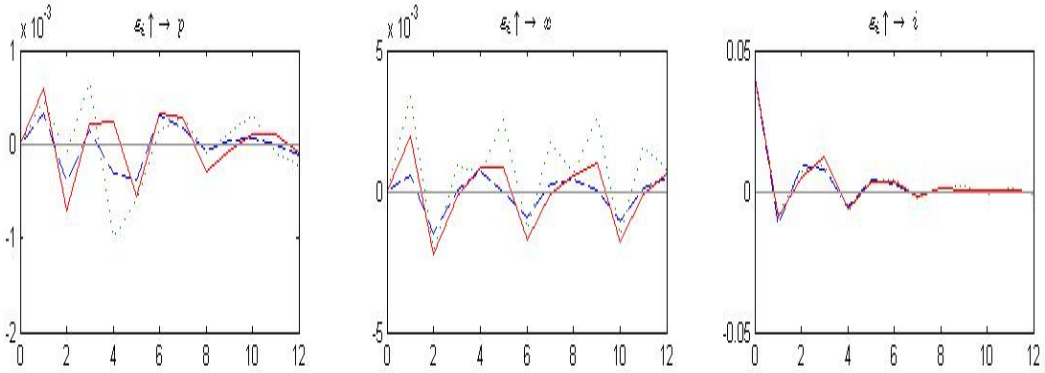

Fig.9: Posterior means of time-varying impulse response from the US to Pakistan

Figure 10 presented the impulse response of Peru economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) stayed negative and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) remained negative but of stable nature; during crisis response showed a positive response followed by a stable negative response.

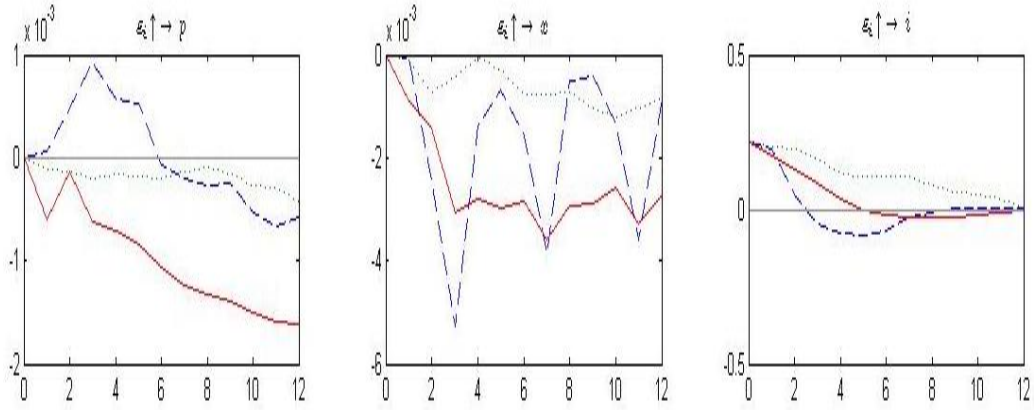

Fig.10: Posterior means of time-varying impulse response from the US to Peru

Figure 11 highlighted the impulse response of Philippines economy to US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) remained positive and volatile most of the time and

impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) stayed positive and of varying nature; the response of before crisis remained more volatile compared to other responses.

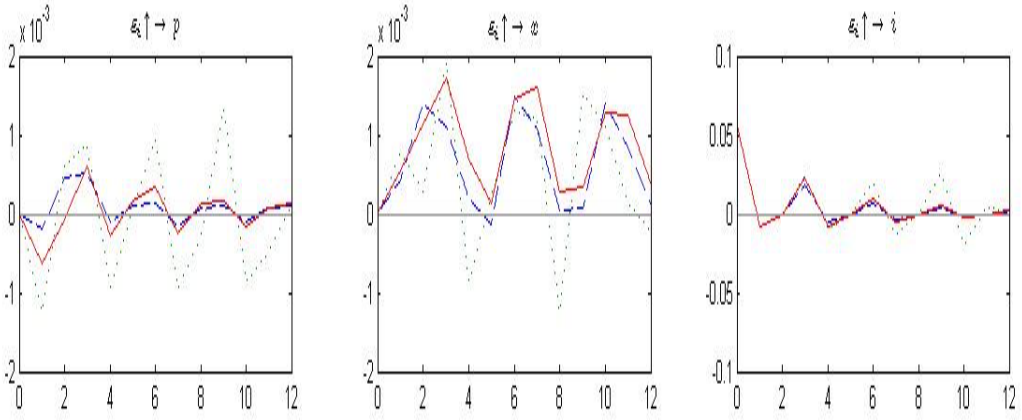

Fig.11: Posterior means of time-varying impulse response from the US to the Philippines

Figure 12 highlighted the impulse response of the Russian economy to the US Monetary Policy. The impulse responses of output to a positive interest rate shock ($\varepsilon i \uparrow \rightarrow x$) stayed positive and volatile most of the time and impulse response of inflation to positive interest rate shock ($\varepsilon i \uparrow \rightarrow p$) remained negative followed by near zero response of stable nature.

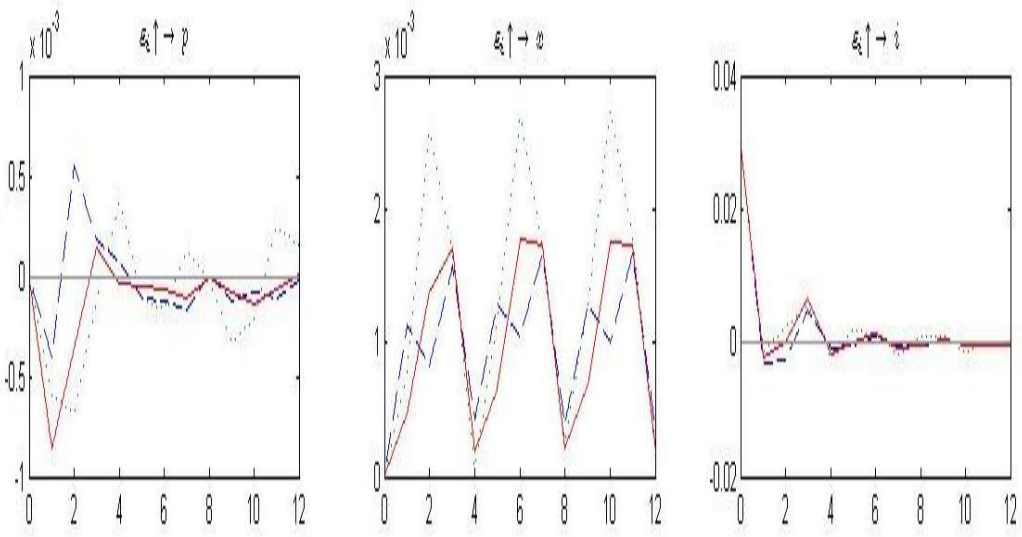

Fig.12: Posterior means of time-varying impulse response from the US to Russian Federation

In this study, I took two group of countries namely advanced emerging countries and secondary emerging countries. I found that results did not show any sort of diversity based on the group. Each country responded in a different way.

Under monetarists and ISLM's explanation monetary contraction will create declining output and the meaning of monetary contraction is deflation. If these responses are not created, then it would be known as a puzzle e.g., a price puzzle. This study is an attempt to study the shock transmission of inflation and growth arising from monetary policy. The table 1 summarized the country response in the light of ISLM framework.

Specifically, at country level, positive Monetary Policy shock created declining output only in Peru, but this behavior could be attributed to the trade agreement that happened between United States of America and Peru in April 2006 (Federal Register, 2009). This agreement eliminated the trade obstacles and fostered the private investment between United States and Peru. For the rest of the countries namely Brazil, Colombia, Czech-republic, Hungary, Malaysia, Mexico, Pakistan, Philippines, Poland, Russian-federation, and turkey standard deviated.

Positive Monetary Policy shock resulted in the increase in prizes in Brazil, Colombia, Hungary, Malaysia, Pakistan, Philippines, Poland. The response is mixed in Czech-republic, Russian Federation, and turkey. Prize puzzle existed in Mexico, Peru and somewhat in Russian Federation.

Table 1: Contagion of US Monetary Policy under ISLM Framework

Country	Output	Price Puzzle	ISLM
Brazil	No	No	Partly Applicable
Czech Republic	No	No	Partly Applicable
Hungary	No	No	Partly Applicable
Malaysia	No	No	Partly Applicable
Mexico	No	Yes	Not Applicable
Poland	No	No	Partly Applicable
Turkey	No	Yes	Not Applicable
Colombia	No	No	Partly Applicable
Pakistan	No	No	Partly Applicable
Peru	Yes	Yes	Partly Applicable
Philippines	No	No	Partly Applicable
Russia	No	Yes	Partly Applicable

5. Discussion and Conclusion

Mortgage financial crisis that sooner converted into global crisis affirms the evidence of the contagion. For this reason, this study attempts to study the contagion arising from monetary policy. The contagion of monetary policy shock arising from United States on the economy of emerging markets studied in a time varying context. This objective is achieved using the TVP-VAR model with stochastic volatility proposed by Jouchi Nakajima (2011). The results are indicating significant impact of shock upon growth and price of the emerging markets and evidence for prize puzzle and deviation from standards are also found in transmission mechanism in some countries. This study discusses in length case of contagion arising from US. This study specifically follows saltwater school of economics and majorly employ ISLM framework for studying the impact of monetary policy. This states that monetary contraction (positive Monetary Policy shock) creates declining output and increasing prices. From the results diversity of the result is visible under the ISLM framework. Impulse responses of the emerging markets affirm the predictive power of the Monetary Policy of macroeconomic movements in emerging markets. This finding echoes the findings of Sims (1992), Agha et.al (2005), Nakajima (2011), Primiceri (2005) who established that Monetary Policy is being transmitted upon macro-economy. From a theoretical perspective, this study provides evidence for prize puzzle in emerging markets to some extent. From a practical perspective, this study is beneficial for the researcher's, economists, and market practitioners. This study is a comprehensive in nature in studying the shock in emerging markets and it has tried to cover many aspects. But no study is perfect. Same is true for this study. Emerging markets do lag due to lack of specialized and well-maintained data. This study is being limited by the availability of data. This limits the number of countries, data time span, and data available on different frequencies. This study may be extended in the future for broader results and application with the availability of data. I was limited by data and the time span. Future work can be more reliable once these limitations are overcome.

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