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Households' Inflation Expectations in India: Role of Economic Policy Uncertainty and Global Financial Uncertainty Spill-over

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Indira Gandhi Institute of Development Research, Mumbai
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Keywords: BVAR, Inflation Expectations, Economic Policy Uncertainty, Price Puzzle

JEL Code: E41, E52, E58

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Abstract

Inflation expectations are an important marker for the conduct of monetary policy. Using a Bayesian structural VAR-X model that includes the inflation expectations of general public based on the Inflation Expectations Survey of Households (IESH), in a first of its kind of study using this dataset, we analyze the macroeconomic factors that determine inflation expectations in India with special focus on economic uncertainty. Besides the standard macroeconomic factors like real output, inflation rate and monetary policy, we also include economic policy uncertainty as a possible endogenous variable in our model that influences inflation expectations, while international financial volatility that has spill-over effects is an exogenous variable. Using non-recursive identification strategy, we find that economic policy uncertainty has considerable effects on households' expectations of inflation and in a longer horizon the international financial volatility also matters. Additionally, in presence of inflation expectations and economic policy uncertainty, we find that the monetary policy shock causes output and inflation to fall significantly; thereby solving the "price puzzle" that otherwise exists in the monetary transmission mechanism literature for India.

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1. Introduction

Expectation of future inflation plays a key role in the decision making process in an economy. It affects people's decisions regarding consumption, savings, investments and wage negotiations etc., thereby feeding into current inflation. As a result it plays an important role in the conduct of a country's monetary policy. The Central Bank's ability to achieve price stability depends considerably on how the general public forms expectations about future inflation. Thus, it is critical to understand the factors that affect inflation expectations of the general public.

In this paper, we investigate the macroeconomic determinants of households' inflation expectations in India for the period 2006 Quarter 3 to 2016 Quarter 3 with a special focus on domestic and international economic uncertainty. We estimate a five-variable Bayesian structural VAR-X model that includes inflation expectations of general public based on survey responses represented by the Inflation Expectations Survey of Households (IESH) conducted by the Reserve Bank of India since the year 2006. The other endogenous macroeconomic variables in the model are real output, inflation rate, monetary policy represented by repo rate and economic policy uncertainty. Economic policy uncertainty is a proxy for domestic economic uncertainty and its inclusion is driven by the observation that the people factor in economic uncertainties in their decision-making process. As India is increasingly integrated with the world economy and given that the sample period includes the phase of Great Recession and European monetary crisis, we also include international financial uncertainty or volatility as an exogenous variable and examine its spillover effect. Taking into account the simultaneous co-dependence between the various endogenous variables in the model, we impose a non-recursive restriction to identify the structural shocks.

Our results indicate that economic policy uncertainty has considerable effects on households' expectations of inflation, followed by international financial volatility in a longer time span. The two economic uncertainty variables have both a direct impact on inflation expectations as well as an indirect impact on the same through their effects on output, prices and monetary policy. There is a slightly greater impact on response of expected inflation due to different structural shocks in the model than the shock due to actual inflation. With the inclusion of inflation expectations and economic policy uncertainty, our model resolves the "price puzzle" where an interest rate rise decreases inflation.[1]

This paper is a part of the empirical literature on the factors that affect the formation of inflation expectations, in the line of works by Berk (2000), Leduc, Sill and Stark (2007), Mehra and Herrington (2008), Ueda (2010), Leduc and Sill (2013) and Istrefi and Piloiu (2014). The first three studies investigate the effect on inflation expectations of short-term nominal interest rates using structural VAR models. Ueda (2010) compares the determinants of households' inflation expectations in Japan and United States and concludes that exogenous prices and monetary policy shocks have significant effects on expectation formation and shocks to expectations have self-fulfilling effects on inflation. Leduc and Sill (2013) look at the impact of expectations in general on business cycles and conclude that changes in expected future economic activity are a quantitatively important driver for economic fluctuations. More recently, Istrefi and Piloiu (2014) analyze specifically the effect of economic policy uncertainty on inflation expectations and find that both short-term and long-term inflation rates are sensitive to policy uncertainty.

The contribution of this work to the existing literature is as follows.

First, we analyze inflation expectations survey data for India and its determinants, something that has not been done in the context of the Indian economy so far. The Inflation Expectations Survey of Households is the first of its kind in India and a relatively new source of information on general public's inflation expectations. This dataset has not been explored much, possibly due to a small sample period since it was initiated in 2006. We circumvent this problem by using Bayesian techniques for the estimation of the structural VAR-X model.

Second, we focus on the effects of economic uncertainty on inflation expectations by incorporating domestic economic policy uncertainty and international financial uncertainty in our analysis besides the standard macroeconomic variables. We use the policy uncertainty index by Baker et al (2016) for India. This work brings together two strands in the macroeconomics literature- inflation expectations and effects of economic policy uncertainty,

[1] A rise in interest rate should reduce inflation rate. However, there is evidence of "price puzzle" under which inflation rate rises with interest rate rise. The price puzzle might arise when marginal cost is positively affected by nominal interest rate, e.g, when firm pays labor wage by borrowing from bank with an interest rate. In this case rise in interest rate increases the matginal cost of production and thereby increases inflation rate (see, Ravenna and Walsh, 2006).

similar to Istrefi and Piloiu (2014). But, unlike Istrefi and Piloiu, who use recursive identification strategy, we impose non-recursive restrictions. While in their paper they construct a 4 variable VAR model, we include monetary policy as another endogenous variable so that the existence of monetary policy transmission can be verified. Additionally, the inclusion of the international financial volatility as an exogenous factor, allows us to examine the effects of global economic uncertainty on inflation expectations. This seems rational as our sample period covers the Great Recession and a significant proportion of mortgage backed securities associated with subprime mortgage crisis was financed by India and China, as noted by Mishkin (2014). This aspect of inflation expectations in India has not been studied thus far.

Third, with the inclusion of the inflation expectations and economic policy uncertainty, we resolve the "price puzzle" since our model shows a decline in prices in the wake of contractionary monetary policy. This is a significant contribution since existing papers on monetary policy transmission mechanism in India show the presence of the "price puzzle" (see Mishra, Montiel and Sengupta, 2016, for a list of studies on monetary policy transmission mechanism in India).

The rest of the paper proceeds as follows. We present an overview of the data in section 2. Section 3 presents the Bayesian SVAR-X methodology. Section 4 discusses the main results from the analysis and section 5 concludes.

2. Data

The 5-variable SVAR-X model that we estimate includes output gap (the difference between real GDP and the potential output), inflation rate, monetary policy captured by nominal short-term interest rate, expected inflation and economic policy uncertainty. Exogenous variable is International financial volatility.

The sample period spans from 2006 Quarter 3 to 2016 Quarter 3. The choice of the time period is constrained by the data of our main variable of interest, inflation expectations by general public in India that became available only since 2006.

2.1. GDP

Quarterly real GDP is obtained from the OECD database. Real output gap is estimated using the Hodrick-Prescott filter. Our results remain robust to the use of output gap using quadratic trend or simply, by using the level of output.

2.2. Inflation rate

Official inflation rate in India has been the wholesale price index or WPI until 2014. Since then, the consumer price index of CPI has been the official inflation rate. However, we stick to WPI for the entire period of analysis. WPI data is collected from RBI database and is transformed to quarterly data. Inflation rate is calculated as the annual percentage change in wholesale prices, which is also the headline inflation rate.

2.3. Monetary policy

The monetary policy is captured by the repo rate. During the period under consideration, the repo rate has been the monetary policy instrument used by the Reserve Bank of India and hence the choice of this particular interest rate rationalized. Data on repo rate is from the RBI database.

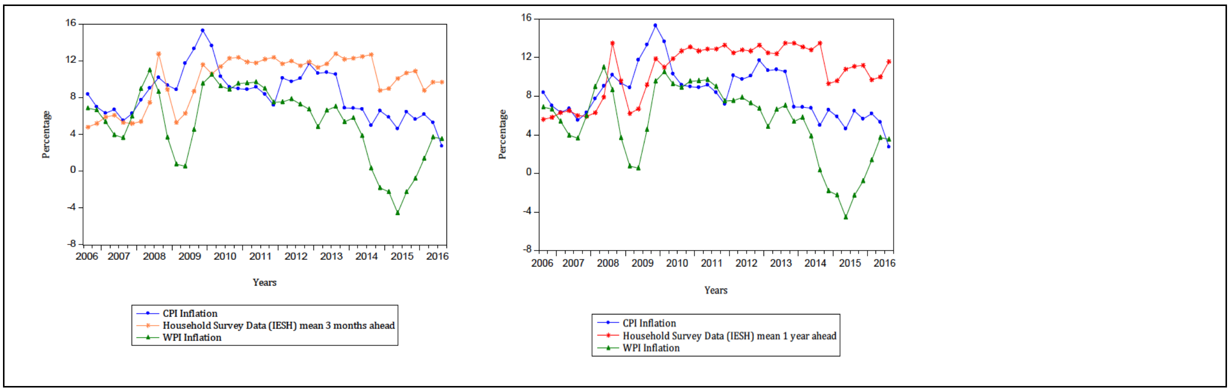
2.4. Inflation expectations

Survey-based quantitative data on inflation expectations in India is made available by the Reserve Bank of India (RBI). The Inflation Expectations Survey of Households (IESH) is conducted on a quarterly basis across different cities of India by the RBI since 2006. RBI also conducts the Survey of Professional Forecasters (SPF) that is presently bi-monthly and used to be quarterly since its inception in 2008. In this paper, we focus on the former.

The IESH is presently conducted across eighteen cities in India. During the recent round of the survey (46^{th} round, December 2016), nearly 5162 urban households were surveyed across these cities covering various age groups, genders and occupations.

The survey respondents are asked to state their quantitative perception regarding current and future inflation (3 month ahead and 1 year ahead) based on general prices and for five specific product groups- food products, non-food products, household durables, housing and services. Figure 1 below plots the 3-month ahead and 1-year ahead survey data against realized inflation.

Figure 1: 3-month ahead and 1-yearahead inflation expectations data of households



2.5. Policy uncertainty

We use the economic policy uncertainty (EPU) index by Baker et al. (2016). This index is supposed to capture uncertainty about what policy action the decision makers will undertake, uncertainty about the economic effects of current and future actions and/or inactions (Istrefi and Piloiu, 2014).

EPU is a monthly newspaper-based index whereby data is collected across seven daily English newspapers in India by counting the number of news articles containing at least one term from each of three term sets. The first set is uncertain, uncertainties, or uncertainty. The second set is economic or economy. The third set consists of policy relevant terms such as 'regulation', 'central bank', 'monetary policy', 'policymakers', 'deficit', 'legislation', and 'fiscal policy'. (http://www.policyuncertainty.com/india_monthly.html). The data is scaled by the total number of news articles in each newspaper every month and then it is normalized.

2.6. International Financial Volatility VIX

The CBOE (Chicago Board Options Exchange) Volatility Index or VIX index is used as a proxy for international financial volatility. This is a key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. The daily VIX based on the closing price is converted to quarterly data for our analysis.

3. Estimation and Methodology

We estimate a first order VAR-X with endogenous variables $(y_t, \pi_t, EPU_t, r_t, \pi_t^e)$, where, y is output gap calculated using Hodrick-Prescott filter, π is inflation rate based on annualized change in deseasonalized WPI (base 2004-05=100) and π^e is the inflation expectation of household (IESH) obtained from the survey of RBI. Moreover, r is repo rate and EPU is the economic policy uncertainty of India. In addition to these endogenous variables, VIX is introduced as an exogenous variable which is assumed to affect the entire domestic economy through the policy uncertainty. Introduction of VIX captures the effects global economic conditions on India. However, none of the domestic endogenous variables are assumed to impact VIX. All the data are of quarterly frequency. The paper uses Markov chain Monte Carlo integration analysis with the imposition of VAR-X structure for the lag coefficients and a structural VAR for covariance matrix.

3.1.The Structural VAR-X Model

The reduced form of the structural VAR-X model denoted by VAR-X(1,1) has five endogenous variables given by the vector $(y_t, \pi_t, EPU_t, r_t, \pi_t^e)$ with lag 1 and an exogenous variable VIX_t also included with lag 1 and a constant vector. The reduced form VAR-X(1,1) is given by equation (1). Lag 1 is selected by the SIC criterion for the estimated VARs.

$$\begin{pmatrix} y_t \\ \pi_t \\ EPU_t \\ r_t \\ \pi_t^e \\ VIX_t \end{pmatrix} = v + \begin{pmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & a_{44} & a_{45} & a_{46} \\ a_{14} & a_{14} & a_{14} & a_{14} & a_{55} & a_{56} \\ 0 & 0 & 0 & 0 & 0 & a_{66} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ \pi_{t-1} \\ EPU_{t-1} \\ r_{t-1} \\ \pi_{t-1}^e \\ VIX_{t-1} \end{pmatrix} + \begin{pmatrix} u_{yt} \\ u_{\pi t} \\ u_{eput} \\ u_{rt} \\ u_{\pi_t^e} \\ u_{vixt} \end{pmatrix} \qquad (1)$$

VIX is introduced as an exogenous variable is captured by the fact that lag values of VIX enters all the equations, however, none of the domestic endogenous variable enters in the VIX equation (indicated by the zero restrictions in the last row of the coefficient matrix).

Equation (1) is estimated by employing Seemingly Unrelated Regression (SUR) as there are efficiency gains in using SUR over OLS in a VAR-X system (Zellner, 1962).

We rewrite equation (1) as,

$$x_t = v + A\, x_{t-1} + u_t \qquad (2)$$

where $x_t = \begin{pmatrix} y_t \\ \pi_t \\ EPU_t \\ r_t \\ \pi_t^e \\ VIX_t \end{pmatrix}$ and $u_t = \begin{pmatrix} u_{yt} \\ u_{\pi t} \\ u_{eput} \\ u_{rt} \\ u_{\pi_t^e} \\ u_{vixt} \end{pmatrix}$

u_t, vector of reduced form residuals, are white-noise Gaussian residuals,$u_t \sim N(0, \Sigma)$. Moreover, VIX_t is uncorrelated with u_t for all leads and lags.

The identification strategy should be such that the structural shocks can recover parameters of the structural VAR-X from the estimated parameter of the reduced form model. Let ε_t denote the vector of structural shocks which are related to u_t, the vector of reduced form residuals in the following way:

$$B\varepsilon_t = u_t \qquad (3)$$

That is,

$$\begin{pmatrix} 1 & 0 & b_{13} & 0 & 0 & 0 \\ b_{21} & 1 & b_{23} & 0 & b_{25} & 0 \\ 0 & 0 & 1 & 0 & 0 & b_{36} \\ 0 & 0 & b_{43} & 1 & b_{45} & 0 \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \varepsilon_{yt} \\ \varepsilon_{\pi t} \\ \varepsilon_{eput} \\ \varepsilon_{rt} \\ \varepsilon_{\pi_t^e} \\ \varepsilon_{vixt} \end{pmatrix} = \begin{pmatrix} u_{yt} \\ u_{\pi t} \\ u_{eput} \\ u_{rt} \\ u_{\pi_t^e} \\ u_{vixt} \end{pmatrix}$$

The restrictions on the contemporaneous matrix B are based on the following assumptions. Output gap is affected only by policy uncertainty contemporaneously. Output gap, policy uncertainty, and expected inflation on the other hand are assumed to affect inflation rate contemporaneously. Although, policy uncertainty affects all the domestic endogenous variables contemporaneously, however, it remains unaffected contemporaneously from all the endogenous variables in the model. The Indian policy uncertainty is assumed to be instantly affected by the global variable VIX. Hence the spill over of global economic crisis on India is captured by effect of VIX on policy uncertainty of India and its subsequent effects on other domestic endogenous variables.

Since, monetary authority obtains data on output and inflation with a quarter lag, we have assumed current period output gap and inflation does not affect current period repo rate. Therefore, repo rate is based on the current policy uncertainty and the current expected inflation rate. Moreover, we assume that all endogenous variables contemporaneously affect expected inflation rate. The impulse response functions with the confidence bands are estimated using Monte Carlo integration and Gibbs sampling technique for an over-identified model with 19 restrictionsin RATS (see Doan 2012, 2013).

Innovation Accounting

This sub-section analyses the impulse response and variance decomposition of the above estimations.

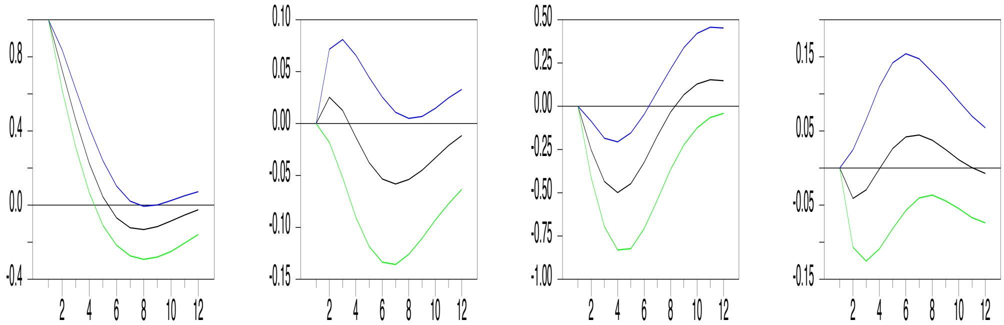
3.2. Impulse Response

Figure 2 and Figure 3 illustrate the impulse response functions (IRFs) of the five endogenous variables to five structural shocks. Each column represents the structural shock whose magnitude is one percent and each row represents the responses of the endogenous variables. The black lines represent the means and the blue and green lines represent the 95% confidence bands.

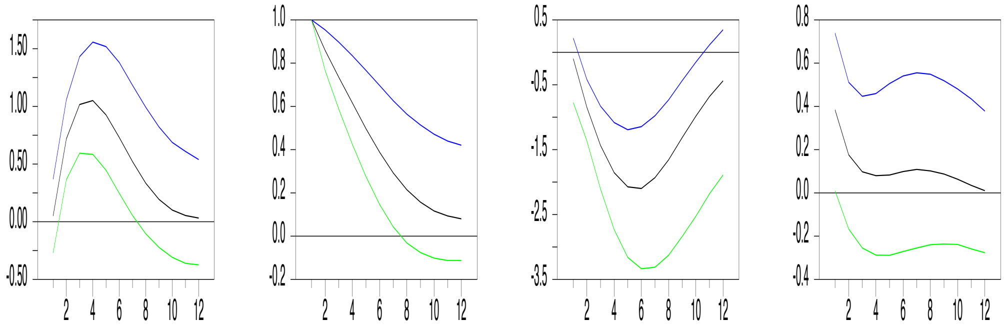
Figure 2: Impulse Response Function to different Structural Shocks

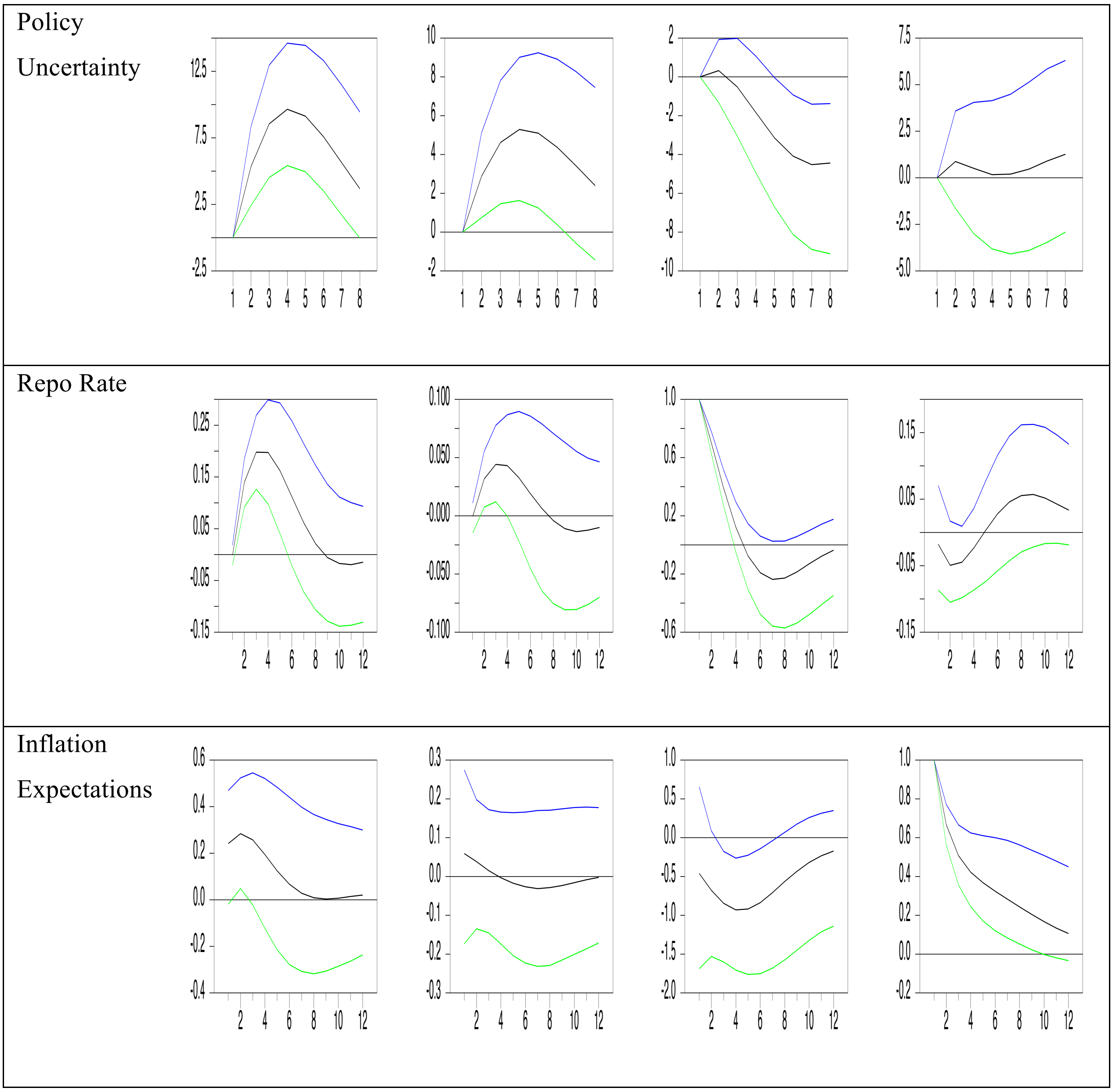
Responses of	Aggregate Demand Shock	Aggregate Supply Shock	Monetary Policy Shock	Inflation Expectations Shock

Output-Gap



Inflation





We have assumed that shock to output gap has a contemporaneous impact on inflation and expected inflation. Therefore, IRFs in the first column of figure 2 show that a positive one percentage shock to output gap increases expected inflation and inflation instantaneously. Note the hump-shaped response to inflation and domestic policy uncertainty due to demand shock portrayed in figure 2. Inflation increases to 1.0% by the fourth quarter and inflation expectations rises to 0.3% by the second quarter before coming back to equilibrium.

Column 2 in Figure 2 represents the IRFs of all endogenous variables due to the supply shock. Expected inflation rises instantaneously although temporarily, to one percent inflation shock. Negative supply shock as captured by 1% increase in inflation, increases domestic policy uncertainty, reduces output gap and results in a hump-shaped response in both of them.

US data also shows such a hump-shaped response of output gap and inflation to demand and supply shocks. Mankiw and Reis (2002, 2007) developed the sticky information model to explain the hump-shaped response of output gap and inflation of US. They have shown that demand and/or supply shocks percolate slowly and they produce maximum impact of the shock after 4 to 5 quarters under reasobale parameter values. Our results for India are consistent with the findings of Mankiw and Reis (2002, 2007). [2]

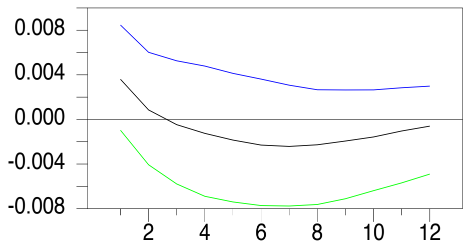
Column 3 in Figure 2 indicates contractionary monetary policy represented by a rise in the nominal interest rate. IRFs show it reduces output gap and inflation rate and causes a hump-shaped response to both of them. One percent increase in interest rate shock causes output gap to fall significantly to almost around 0.5% by the fourth quarter and inflation to fall by more than 2% by the 6th quarter after which the effect of monetary policy shock starts waning. Thus, our analysis does not exhibit the "prize puzzle" for the Indian economy. Hence, in the presence of inflation expectations, the problem of "price puzzle", that most papers on monetary transmission in India show, gets resolved. There is also significant negative impact on household's inflation expectations from a contractionary monetary policy shock where such expectation can fall up to 1%.

Expected inflation on the other hand does not have any significant impact to any of the endogenous variables, as evident from column 4 of Figure 2. One percent shock to inflation expectation feeds in to the realized inflation by instantly raising the actual inflation to 0.4%. However the result is not significant.

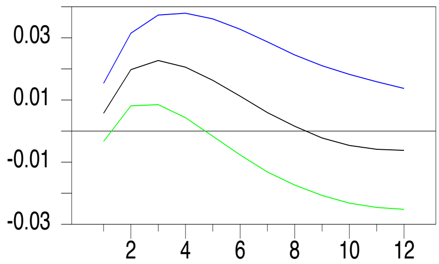
[2]Mankiw and Reis (2002, 2007) assume that information is costly to acquire and process, producing an information asymmetry among economic agents. While the information asymmetry is modelled with Calvo price setting, it produces a backward looking Phillips curve and backward looking aggregate demand curve. Mankiw and Reis (2002, 2007) show that the backward looking Phillips curve and aggregate demand curve are able to produce the hump-shaped response in output and inflation rate observed in US data. We get hump-shaped response of output gap and inflation for India to demand and supply shock too. It shows that sticky information and therefore backward looking Phillips curve and backward looking aggregate demand curve exists for India as well. Note, Ball, Chari and Mishra (2015), Kotia (2013), Goyal and Tripathi (2015) and Goyal and Tripathi (2016), Dua and Gaur (2009) also provide evidence that Phillips curve of India is backward looking.

Figure 3: Impulse Response Functions of Endogenous Variables to Shocks in Economic Policy Uncertainty

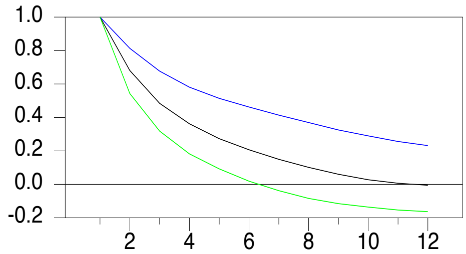
Output Gap



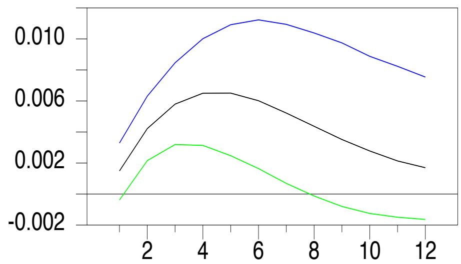
Inflation



Economic Policy Uncertainty



Repo Rate



Inflation Expectations

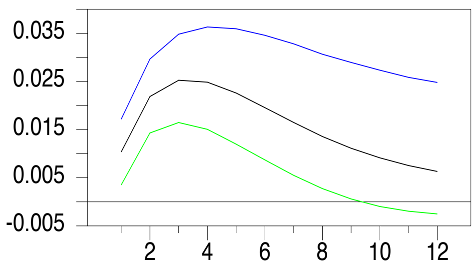


Figure 3 analyses the impact of shocks to economic policy uncertainty on the Indian macro economy. In our identification restrictions in section 3.1, economic policy uncertainty is assumed to contemporaneously affect output gap, inflation rate, interest rate and expected inflation. IRFs in Figure 3 show that a positive one percent shock to economic policy uncertainty significantly increases inflation and expected inflation instantly and then rising up by around 0.02% in the third quarter. On the other hand, output drops. The rise in expected inflation rate along with rise in EPU increases interest rate contemporaneously and in subsequent periods to stabilize the economy[3]. These results are similar to the findings of Istrefi and Piloiu (2014). Rise in expected inflation increases nominal interest rate. The hump-shaped response of inflation, expected inflation and interest rate are noteworthy here.

Figure 4 presents the IRFs of all the endogenous variables to the exogenous shock, VIX-representing global financial volatility/uncertainty. The IRFs of endogenous variables to one percent positive shock to global financial uncertainty allow us to understand the spill-over effects of global economic crisis on India. In our identification restrictions we have assumed that, VIX does not have direct impact to output gap, inflation rate, repo rate and expected inflation. Instead, VIX affects EPU directly and via EPU indirectly affects the rest of the variables. Figure 4 shows that there is a significant positive impact of VIX on EPU.

Figure 4 further shows that global economic crisis behaves like an adverse demand shock and has significant spill-over effects on the Indian economy. This is not surprising given that our sample starts from 2006. During this time, US suffered from recession due to subprime mortgage crisis funded mainly by India and China (Mishkin, 2014). Therefore, it is expected that the recession in US should adversely affect India. This is reflected in IRFs portrayed in Figure 4. One percent shock to VIX reduces output gap of India, which steadily falls until the 3rd quarter to 0.06% due to this shock. The contractionary effect on output remains till the 6th quarter. One percent shock in VIX also reduces inflation and expected inflation significantly. Both inflation and inflation expectations reduce by approximately 0.08%. These induce the monetary authority to reduce the interest rate to stimulate the Indian economy.

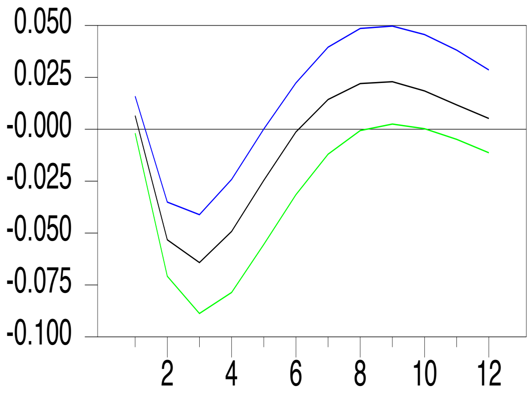
Note, the same dynamics can have an alternate explanation. Note that, higher US uncertainty captured by rise in VIX, causes recession and deflation and thereby discourages foreign investors to invest in India. This causes capital to fly out from India through the reduction of interest rate.[4] Most importantly shock to global financial uncertainty also increases the policy uncertainty of India.

[3] Data of output gap and inflation is obtained with a lag. Therefore, we assume interest rate is not affected contemporaneously either by output gap or inflation rate.

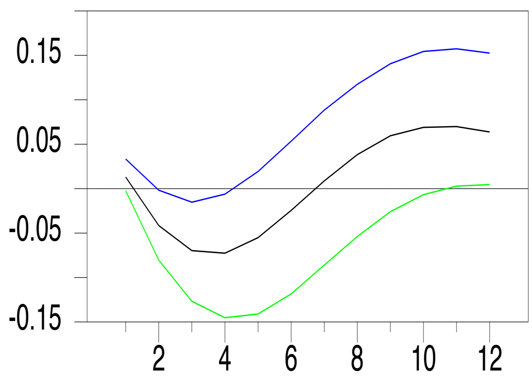
[4]Bhattarai, Chatterjee and Park (2016) have obtained US recession reducing output, increase interest rate and still causing capital fly out from developing country. To explain they said that when big brother sneezes, there is a fear that developing country might get a cold. India should be suffering from cold for sure as it has funded majority of subprime loan of US as explained in the text. Hence, recession India due to rise in US uncertainty as obtained by us and Bhattarai, Chatterjee and Park (2016) is expected.

Figure 4: Impulse Response Functions of Endogenous Variables to Shocks in Exogenous Variable VIX

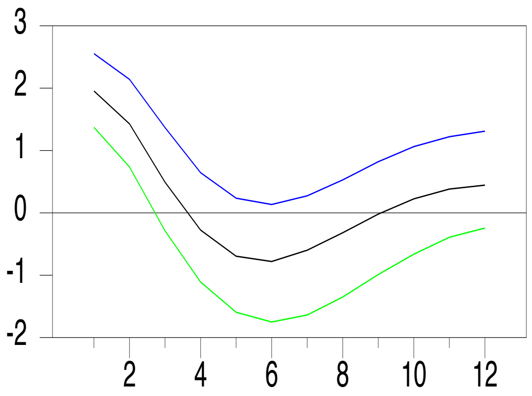
Output Gap



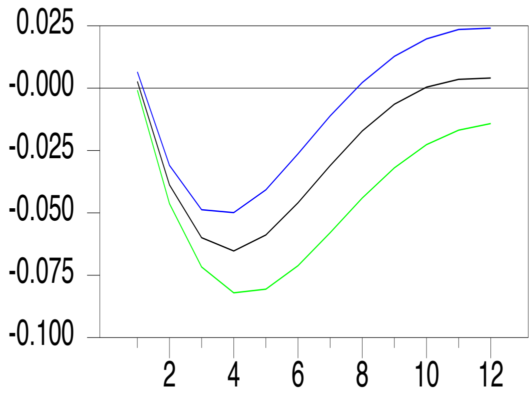
Inflation



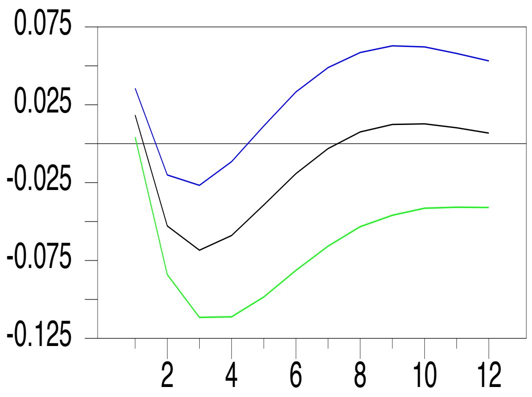
Economic Policy Uncertainty



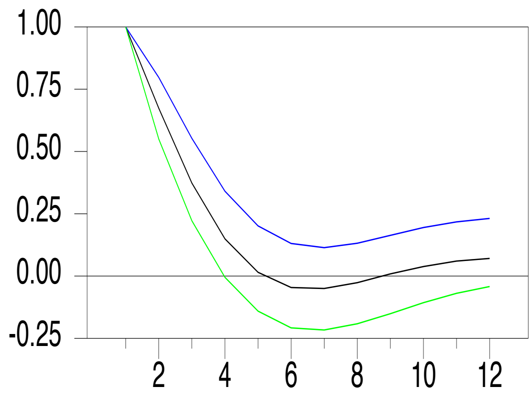
Repo Rate



Inflation Expectations



VIX



4.3. Variance Decomposition

Table 1 reports the variance decomposition analysis that shows the contributions made by the structural shocks and one exogenous variable to the forecast error variances of the endogenous variables at horizons 1, 2, 3, 4, 8 and 12 quarters.

The variance decomposition analysis in Table 1 shows that there is a global spillover as VIX explains a significant proportion of forecast error variance of all the variables as forecast horizon rises. It shows that Indian economy is no longer isolated from rest of the world and we have to take care the golabal affects while forecasting output gap and inflation rate of Inda.

To explain the impact of VIX note that while only 3% of forecast error variance of output gap is explained by VIX in quarter 1, it rises steadily to 9% in quarter 2 and 22.2% in quarter 12. However, the role of EPU and VIX is similar in explaining the forecast error variance of inflation rate. Output gap seems to be the most important variable for the forecast error variance decomposition of inflation rate (0.9% in quarter 1, 6.9% in quarter 2 and 15.1% in quarter 12).

VIX also plays an important role in explaining the forecast error variance of EPU. It explains on an average 18% of the forecast error variance of EPU along all forecast horizon. Output gap also explains a significant proportion of forecast error variance of EPU. Along with these, VIX explains a significant prpoportins of forecast error variance of repo rate as well. Table 1 shows while it explains only 0.3% of forecast error variance of repo rate in quarter 1, it rises stadily to 22.3% in quarter 2 and 42.4 % in quarter 12. The forecast erros variance decomposition of repo rate shown in Table 1 and IRF of repo rate shown in Figure 4 imply that India is highly integrated to global economy and its monetary policy is highly sensitive to global shocks.

Table 1: Variance Decomposition (in percentages)						
Horizon	**Shocks in Output Gap**	**Shocks in Inflation**	**Shocks in *EPU***	**Shocks in Monetary Policy**	**Shocks in Inflation Expectations**	**Shocks *in VIX***
Variance Decomposition of Output						
1	98.1	0	1.5	0	0	0.3
2	85.8	0.2	1.9	0.5	0.3	9.1
3	74.9	0.5	2.4	1.6	0.7	17
4	67.9	0.9	3	2.7	1.1	20.1
8	56.5	2.8	5.2	4.2	2.7	21.1
12	52.3	3.5	6.3	4.9	3.2	22.2
Variance Decomposition of Inflation						
1	0.9	84.6	1.5	0.2	7.6	0.3
2	6.9	71.5	5.9	1.5	5.6	1.8
3	12.6	59.4	8	3.2	4.8	3.3
4	15.8	51.4	8.7	5.1	4.6	4.3
8	16.6	37.9	9.4	10.5	5.7	7
12	15.1	32.7	11.1	10.4	6.4	10.8
Variance Decomposition of EPU						
1	0	0	80.6	0	0	19.4
2	2.3	0.6	75.3	0.1	0.3	19.4
3	6.5	1.9	69.3	0.3	0.6	16.7
4	10.7	3.1	63.2	0.6	0.9	15.4
8	15.3	4.9	48.9	3.1	2.3	16.2
12	14.6	5.5	44.8	4.3	3.3	17
Variance Decomposition of Monetary Policy						
1	0.1	0.1	1.7	90.9	3.6	0.3
2	5.4	1.2	5.8	56.5	3.7	22.3
3	8.6	1.6	8.1	33.1	3.1	40.3
4	9.5	1.8	9.5	22.2	2.6	48.8
8	9.1	3	13	14.8	4.2	47.3
12	9.6	4	14.2	14.2	5.5	42.4
Variance Decomposition of Inflation Expectations						
1	1.9	3.9	4	3.5	75.2	0.9

2	3	3.5	12.4	3.8	62.6	4
3	3.5	3.4	18.3	4.4	52.6	6.5
4	3.7	3.6	22	5.1	46.3	7.5
8	4.8	4.9	24.7	6.5	37	8.6
12	5.5	5.9	24.2	6.9	33.9	9.8

5. **Conclusion**

Analysis of inflation expectations of households in India, based on a quarterly survey conducted by the Central Bank of India for the last one decade, is a relatively unexplored area. In this work, we analyse the macroeconomic factors that affect the inflation expectations of general public in the Indian economy, with special focus on the effects of economic uncertainty.

We estimate a five-variable Bayesian structural VAR-X model that includes inflation expectations of general public based on survey responses represented by the Inflation Expectations Survey of Households (IESH) conducted by the Reserve Bank of India since 2006. This captures the perception of individual about overall economy. Besides the standard macroeconomic variables like output gap, inflation rate, monetary policy etc., we include the economic policy uncertainty of India captured by the EPU index of Baker et al (2016) and the global financial uncertainty proxied by VIX. Using a non-recursive strategy for identification of our model, the results indicate (i) economic policy uncertainty has considerable effects on households' expectations of inflation, followed by international financial volatility in a longer time span, (ii) there is a significant impact of global uncertainty on the monetary policy of India and, (iii) with the inclusion of inflation expectations and economic policy uncertainty, our model resolves the "price puzzle" where an interest rate rise decreases prices.

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