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Economic Policy Uncertainty and Economic Growth in India

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Abstract
        Economic and political commentators in India have repeatedly noted their concern about the recent slow-down in the Indian economy. Several recent papers have provided evidence that increase in the economic policy uncertainty (EPU) has played a significant role in the slow-down and the increase in unemployment in the U.S. In this paper we construct a measure of economic policy uncertainty for India and study its impact on the Indian economy. We find Indian GDP and Indian fixed investment are negatively related to EPU in India. More relevant, the economic magnitudes of these relations are quite significant. For example, if the economic uncertainty in India were to decrease today to the level observed in 2005, India's GDP growth would increase by 0.56%, and fixed investment growth would increase by 1.36%. Additionally, we document a negative correlation between the Bombay Stock Exchange (BSE) index and EPU in India.

JEL Codes: E60, F40, G30

1. Introduction

Economic and political commentators in India have repeatedly noted their concern about the slow-down in the Indian economy. Several recent papers, in particular, Baker, Bloom and Davis (2013) (BBD) and Bhagat and Obreja (2013) (BO), have provided evidence that increase in the economic policy uncertainty has played a significant role in the slow-down and the increase in unemployment in the U.S. In this paper we draw on the empirical methodology of the above papers to study the impact of economic policy uncertainty (EPU) on the Indian economy. Consistent with the findings of BBD and BO for U.S. data, we find Indian corporate investment activity negatively related to EPU in India. More relevant, the economic magnitudes of these relations are quite significant. For example, if the economic uncertainty in India were to decrease today to the level observed in 2005, India's GDP growth would increase by 0.56%, and fixed investment growth would increase by 1.36%. Additionally, we document a negative correlation between the Bombay Stock Exchange (BSE) index and EPU in India. Interestingly, EPU has a particularly negative impact on BSE index during the recent international financial crisis.

2. Uncertainty and the Economy

Why might uncertainty impact business and economic activity? Corporate investment policy has been studied by corporate finance scholars for the better part of the past century. The net present value investment decision rule is a well-accepted paradigm. In the traditional paradigm, larger expected cash flows impact positively corporate investment, while larger corporate cash flow uncertainty impact negatively corporate

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investment. Additionally, viewing business investment and employment as real options, that is, if capital investments are somewhat irreversible and hiring and firing employees is costly, businesses are likely to defer making capital investments or hiring employees when faced with increased uncertainty; see Bernanke (1983) and Pindyck (1988). As businesses defer investing and hiring, the economy slows down. An increase in business uncertainty will also increase the cost of capital and managerial risk-aversion leading to a negative impact on business investment and hiring; see Pastor and Veronesi (2011) and Panousi and Papanikolaou (2011). Finally, as argued by Freidman (1968), uncertainty in monetary policy has a negative impact on economic growth.

3. Data

To measure Indian policy-related economic uncertainty, we construct an index from two types of underlying components. One component quantifies newspaper coverage of policy-related economic uncertainty of 7 newspapers from India: *The Economic Times*, the *Times of India*, the *Hindustan Times*, *The Hindu, The Statesman, The Indian Express*, and the *Financial Express*. A second component uses disagreement among economic forecasters as a proxy for uncertainty. Details are noted in the Appendix, the data are available at www.policyuncertainty.com.

Figure 1 highlights a secular increase in EPU in India during the past decade. Some of the peaks in this index are noteworthy such as the Congress Party's surprise election victory in April 2004, the Lehman bankruptcy and associated financial crisis events in September 2008, and the onion price rise and inflationary fears in December 2010.

We obtain data on key economic indicators from the following sources. Monthly data for the Bombay Stock Exchange Sensex Index (BSE) are from www.bseindia.com. Monthly data on inter-bank call rates (IBCR), Index of Industrial production, and Rupee-Dollar exchange rates are from Reserve Bank of India's web site: http://dbie.rbi.org.in. Quarterly data for growth in GDP (CHGDP), growth in Fixed Investment (CHFI), and growth in Private Consumption (CHPC) are from Central Statistical Organization, India.

4. Economic Policy Uncertainty, Business Activity and Economic Growth in India

Tables 1 and 2 note the data summary statistics. Figures 2 and 3 highlight the time series of these variables. Table 3 documents a negative correlation between the Bombay Stock Exchange (BSE) index and EPU in India. Interestingly, EPU has a particularly negative impact on BSE index during the recent international financial crisis. On the other hand, the corporate cost of capital as measured by the InterBank Call Rate is positively correlated with EPU; this correlation is more pronounced during the recent international financial crisis.

Figure 4 graphically depicts quantile regression results. Our interest is to analyze the τ quantile of the distribution of the BSE Index, for various values of τ. Specifically, we consider $\tau \in \{0.05, 0.10, 0.25, 0.50, 0.75, 0.90, 0.95\}$. The three graphs show the parameter estimates at various quantiles of the BSE Index with "·" sign indicating the posterior means of the parameter and the shaded areas marking the 95 percent intervals. The solid black line marks the constant line at 0. The solid red line indicates the average value of the parameter estimates. The left panel of figure 4 provides strong evidence of the negative correlation between the BSE Index and EPU in India. It is interesting to see

that EPU has a reliable negative effect on the BSE Index above the 50th quantile and this effect becomes increasingly negative at higher quantiles. Thus, the BSE Index is especially sensitive to uncertainty when the market is at very high levels. This result emphasizes the importance of carrying out quantile regression at different values of τ.

While not the focus of the paper, the effect of Index of Industrial Production, IIP, (middle panel) and exchange rates (right panel) also show considerable variation across quantiles. IIP has a reliably positive effect on the BSE Index at all quantiles, with the effect increasing with quantile levels. Consistent with OLS results, exchange rates have a reliably negative impact on the BSE Index, with the effect being most negative at the lower quantiles of the Index.

Figure 5 reports impulse response functions. X-axis ranges from month 1 through 36 relative to the initial shock in EPU. Whereas industrial production in the U.S. declines for 14 months after a shock in EPU (see BBD), in India both change in GDP and change in private consumption decline for only 6 and 7 months, respectively, before reverting to original levels. Interestingly, change in fixed investment declines for 12 months before reverting to original levels. Change in fixed investment includes investment by all participants in the economy (households, government, and private sector).

The impulse responses are in standard deviation units. Thus, the peak decline for change in fixed investment is -0.53% in response to one standard-deviation increase in EPU in month 0. Magnitudes for peak declines are smaller for change in GDP (-0.22%) and change in private consumption (-0.09%). The effect of EPU on change in index of industrial production is statistically insignificant. To provide a measure of economic significance - from Figure 5, note that the increase in EPU from the end of 2005 to the

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end of 2012 is 103 points (55 to 158). Because the standard deviation of EPU is 40 points, the impact of increase in EPU on GDP growth over this period is -0.56% at 6 months. Similarly, the impact on one-year-ahead change on fixed investment is -1.36%. In other words, if the economic uncertainty in India were to decrease today to the level observed in 2005, India's GDP growth would increase by 0.56%, and fixed investment growth would increase by 1.36%.

5. Cross-country Cumulative Impulse Responses of Economic Policy Uncertainty

To evaluate whether India's EPU is influenced by and influences uncertainty of other countries, we estimate VAR-6 models of (a) India EPU and U.S. EPU and (b) India EPU and China EPU. Monthly data for U.S. EPU and China EPU are from www.policyuncertainty.com. Figure 6 plots the four impulse response functions from these models.

The two plots at the top of Figure 6 document the relation between EPU shocks in US and India. India's EPU increases for six months subsequent to a shock to US EPU before leveling off; U.S. EPU peaks at eight months after a shock to Indian EPU. In terms of magnitude, the peak response for both countries is about 7.8 points to a one-standard deviation increase to each other's EPU (Indian EPU standard deviation = 40 points; US EPU standard deviation is 44 points). In terms of statistical significance, the two-standard error intervals indicate that the Indian response to US EPU shocks is significance for eight months. Interestingly, the EPU response of U.S. to an increase in Indian EPU remains significant for twenty-two months.

Turning to the Indo-Chinese policy uncertainty relations, the bottom two plots in Figure 6 indicate that the one standard deviation impact of an increase in Chinese EPU on

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Indian EPU peaks at 5 months and is 2.5 units at that point. Thus, policy uncertainty in India is more sensitive to shocks in the US economy compared to those in China. In contrast, Indian EPU impact on Chinese EPU impulse response is larger. It peaks at 14.6 units at 6 months and remains statistically significant for fourteen months.

One possible explanation for the differences in EPU impulse response functions could be the ratio of a country's exports to GDP (scaled exports). For example if a significant part of country A's GDP is exported to country B, then country B's EPU will impact its own demand and the GDP of country A. Conversely, if country A does not export a significant part of its GDP to country B, then country B's EPU will not impact the GDP of country A. During the last ten years India's scaled exports to the U.S. is about twice as large as its scaled exports to China; this could potentially cause Indian EPU to be more sensitive to US EPU shocks compared to China EPU shocks.

6. Summary and Conclusions

Economic and political commentators in India have repeatedly noted their concern about the recent slow-down in the Indian economy. Several recent papers have provided evidence that increase in the economic policy uncertainty (EPU) has played a significant role in the slow-down and the increase in unemployment in the U.S. In this paper we construct a measure of economic policy uncertainty for India and study its impact on the Indian economy. We find Indian GDP and Indian fixed investment are negatively related to EPU in India. More relevant, the economic magnitudes of these relations are quite significant. For example, if the economic uncertainty in India were to decrease today to the level observed in 2005, India's GDP growth would increase by

0.56%, and fixed investment growth would increase by 1.36%. Additionally, we

document a negative correlation between the Bombay Stock Exchange index and EPU in

India, and a positive relation between the corporate cost of capital and EPU. Furthermore,

these correlations are stronger during the recent financial crisis.

References

Bernanke, B., 1983, Irreversibility, uncertainty, and cyclical investment, Quarterly Journal of Economics 98, 85-106.

Baker, S. R., N. Bloom and S.J. Davis, 2013, Measuring economic policy uncertainty, Stanford University working paper.

Bhagat,S. and I. Obreja, 2013, Employment, corporate investment and cash flow uncertainty, University of Colorado working paper.

Friedman, M., 1968, The role of monetary policy, American Economic Review 58.

Panousi, V. and D. Papanikolaou, 2011, Investment, idiosyncratic risk and ownership, Journal of Finance.

Appendix: Constructing the Indian Economic Policy Uncertainty Index

To measure Indian policy-related economic uncertainty, we construct an index from two types of underlying components. One component quantifies newspaper coverage of policy-related economic uncertainty. A second component uses disagreement among economic forecasters as a proxy for uncertainty.

News coverage about policy-related economic uncertainty: We construct this index in a similar manner as the Baker, Bloom, Davis (2012) index based on U.S. newspapers. We include 7 newspapers from India: *The Economic Times*, the *Times of India*, the *Hindustan Times*, *The Hindu, The Statesman, The Indian Express*, and the *Financial Express*. As with the U.S. newspaper index, we utilize the number of news articles containing the terms such as uncertain, uncertainty, worry, or fear, economic or economy, as well as policy relevant terms (scaled by the total number of articles). Policy relevant terms include terms such as 'regulation', 'central bank', 'monetary policy', 'policymakers', 'deficit', 'legislation', and 'fiscal policy'. Each paper-specific series is normalized to standard deviation 1 prior to 2011 and then summed. The series is normalized to mean 100 prior to 2011.

Indian Forecast Data: The second component of our Indian policy-related uncertainty index draws from forecast data from Consensus Economics. From Consensus Economics we obtain monthly data on individual forecasts regarding economic variables by professional forecasters. In particular, we utilize individual-level forecasts regarding consumer prices and federal government budget balances. We chose these variables because they are directly influenced by monetary policy and fiscal policy actions. For each series, we look at the monthly forecasts for the following year. We treat the

dispersion in the forecasts of these variables as proxies for uncertainty about monetary policy and about federal fiscal policy. This approach builds on a long literature using disagreement among forecasters as a proxy for economic uncertainty. For inflation, we look at the individual forecasts for the monthly consumer price levels for the following year. To construct the dispersion component, we then take the interquartile range of each set of inflation rate forecasts in each month. For the budget balance component, we look at the raw interquartile range of forecasts for the following year's budget balance and then divide this range by India's contemporaneous annual GDP.

For both of these variables, due to the mechanically decreasing variance in forecasts as the next calendar year approaches, we remove monthly fixed effects from the data (post-removal components given in the downloadable data). Furthermore, due to some forecasters reporting only once per quarter, we use the most recent forecast data for up to 3 months after a given forecaster's last forecast.

To construct our overall index of policy-related economy uncertainty for India, we first normalize each component by its own standard deviation prior to January 2011. We combine the components using weights of 2/3 on our broad news-based policy uncertainty index and 1/6 on each forecast dispersion measure. Compared to our European and U.S. indices, we weight the newspaper component more heavily relative to the forecast component due to a larger number of newspapers and a smaller number of individual forecasters. Finally, we standardize the mean to equal 100 prior to 2011.

Figure 1
Economic Policy Uncertainty (EPU) Index for India, 2003 – 2012
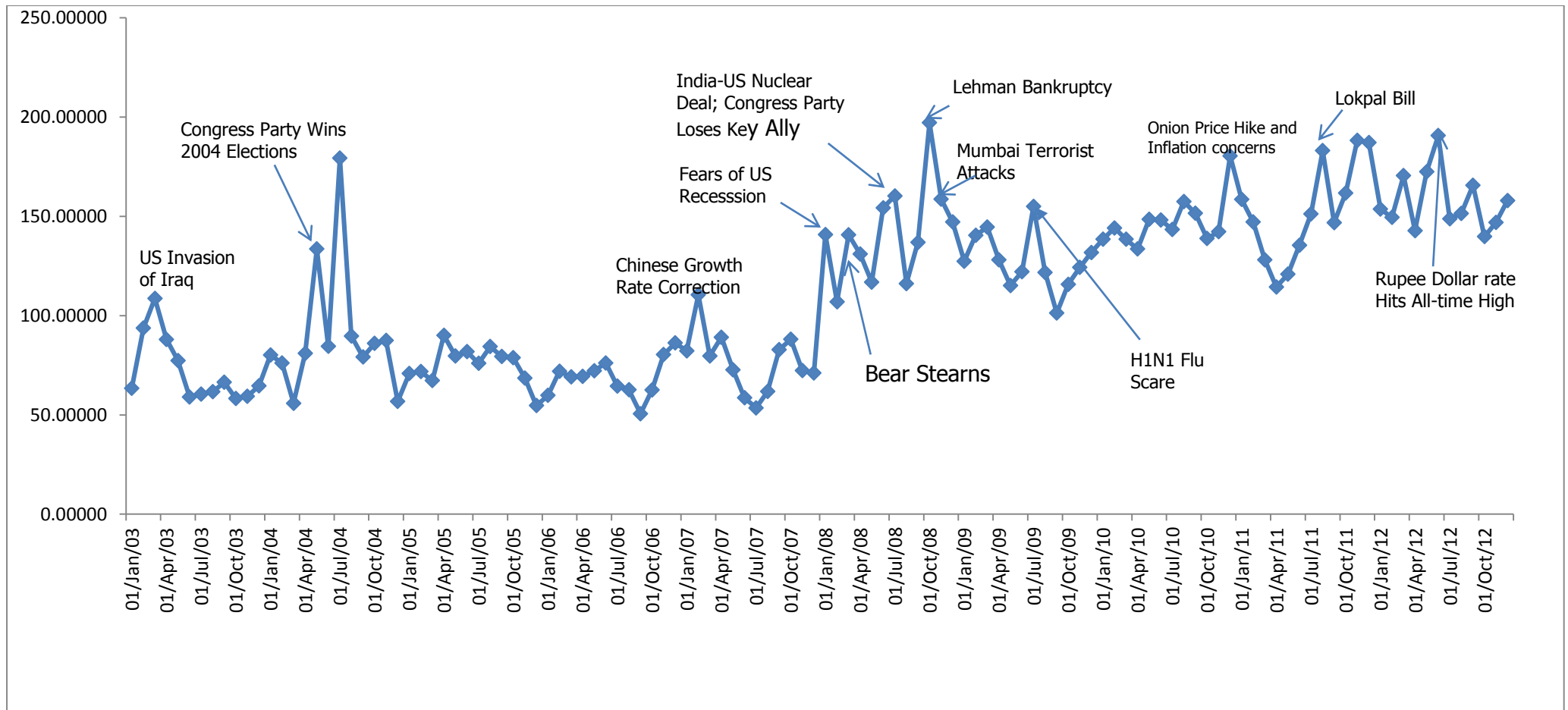
Index of policy-related economic uncertainty consists of two components: (a) monthly count of newspaper articles containing words such as uncertain, uncertainty, economic, or economy, as well as policy relevant terms (scaled by the total number of articles) and (b) the inter-quartile range on one year ahead monthly forecasts related to inflation and budget balance. We remove monthly fixed effects from both components and then normalize each component by its own standard deviation prior to January 2011. We combine the components using weights of 2/3 on the news-based policy uncertainty index and 1/6 on the forecast dispersion measures for inflation and budget balance. Further details are in the Appendix.
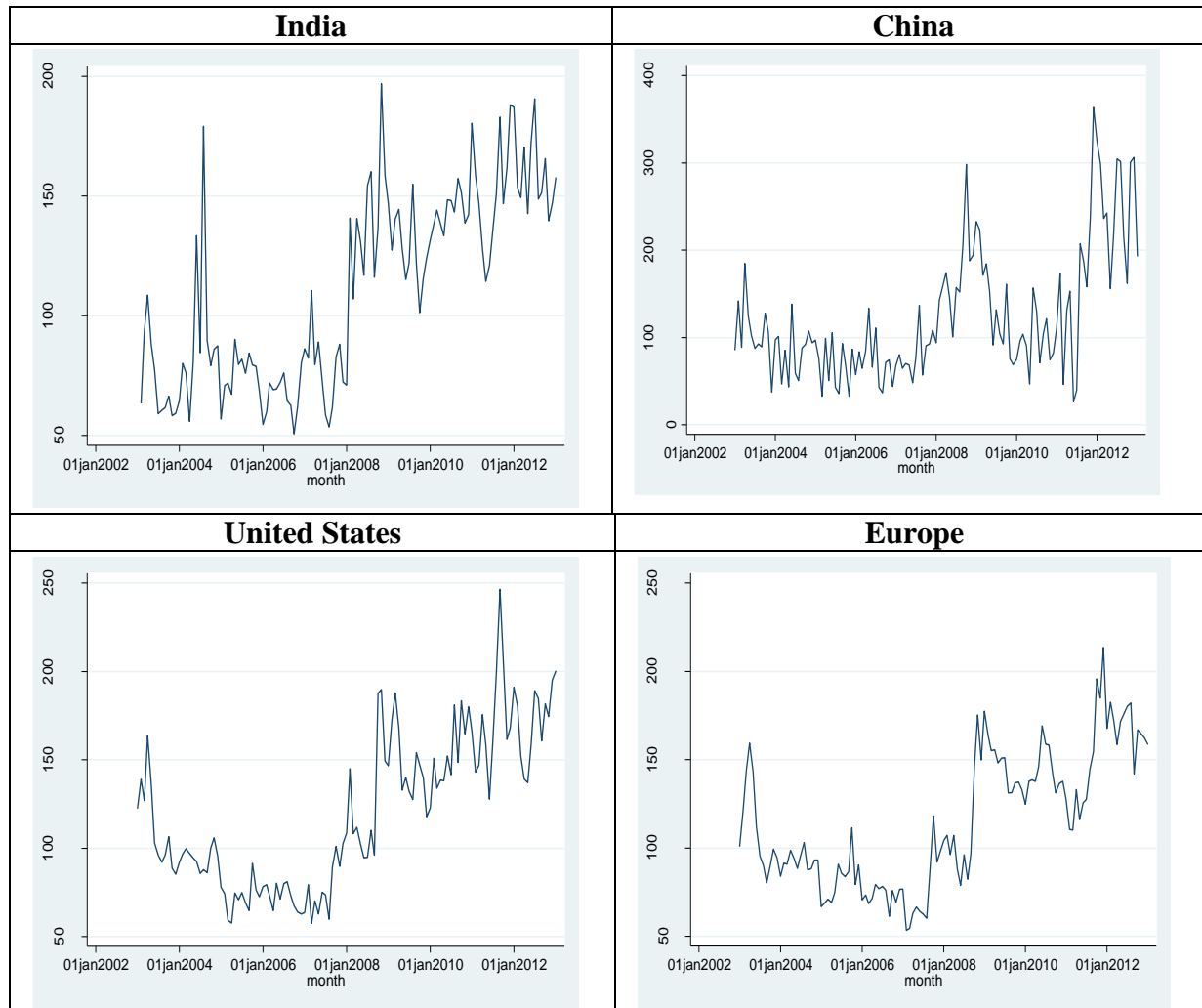
Figure 2
Time Series of Key Economic Indicators for India
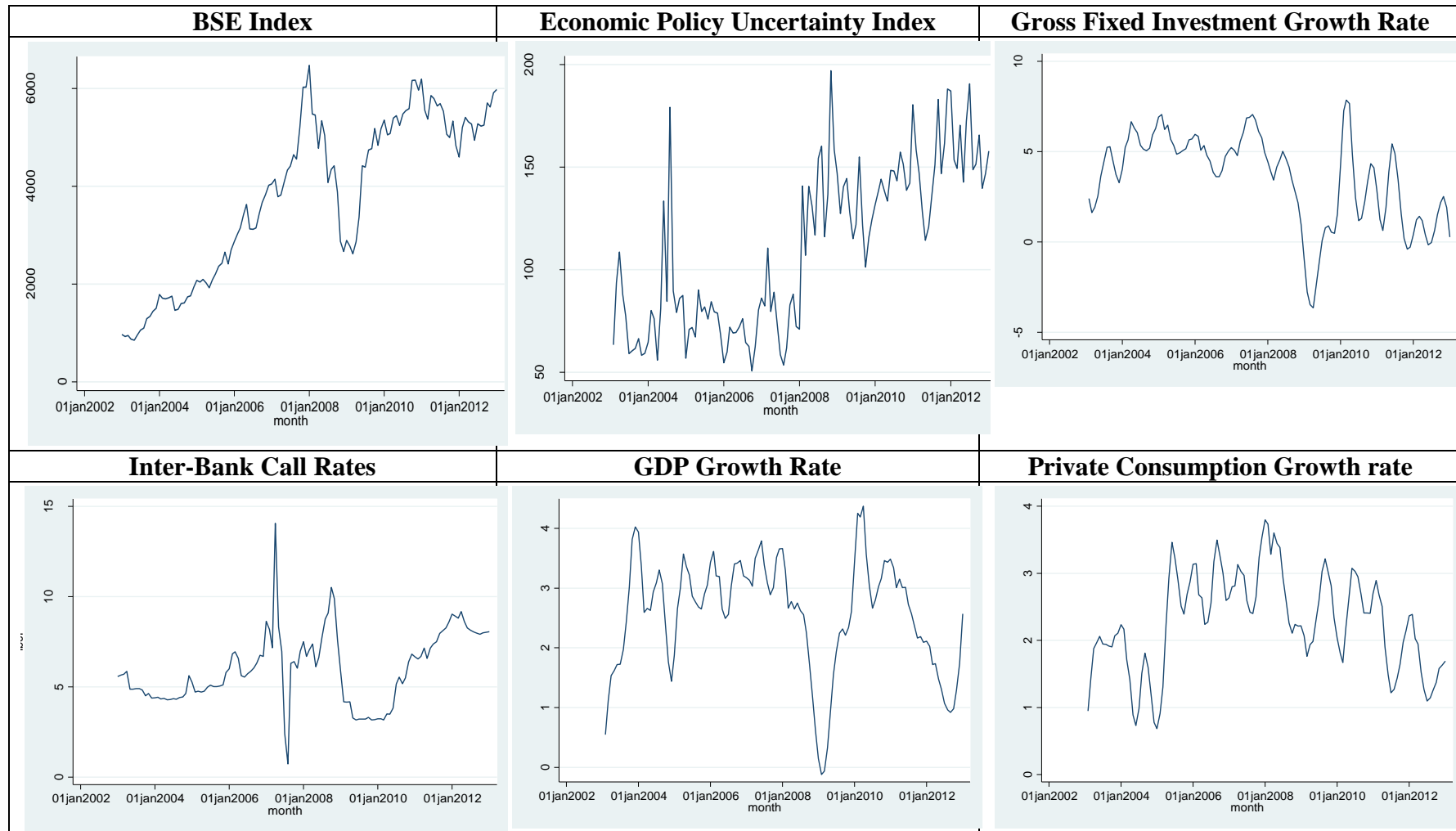
Monthly data for the Bombay Stock Exchange Sensex Index (BSE) are from www.bseindia.com. Inter-Bank call rates (IBCR) are from Reserve Bank of India's web site: http://dbie.rbi.org.in. The construction of the Economic Policy Uncertainty Index (EPU) is described under Figure 1. Quarterly data for growth in GDP (CHGDP), growth in Fixed Investment (CHFI), and growth in Private Consumption (CHPC) are from Central Statistical Organization, India. We use the cubic spline interpolation method to convert quarterly data into monthly data.

Figure 3

Comparison of Time Series of Economic Policy Uncertainty Indexes: India, China, USA, and Europe

The construction of the Economic Policy Uncertainty Index is described under Figure 1The details for the construction of the economic policy uncertainty index for U.S., China, and Europe are reported in http://www.policyuncertainty.com

Table 1
Descriptive Statistics (Monthly data)

	Mean	Median	Max	Min.	Std. Dev.	# of obs.	ADF Unit Root test (p-value)
Economic Policy Uncertainty Index (EPU)	110.93	112.42	197.08	50.60	40.02	120	-1.56 (0.50)
% Change in EUP (CHEPU)	3.00%	1.74%	112.17%	-49.96%	22.88%	119	-14.43 (0.00)
BSE Index (BSE)	3808.91	4079.10	6469.48	852.78	1653.071	121	-1.35 (0.60)
% Change in BSE Index (CHBSE)	1.85%	1.59%	31.29%	-25.97%	8.04%	120	-9.65 (0.00)
Inter Bank Call Rate (IBCR)	5.98%	5.79%	14.07%	0.73%	1.98%	121	-3.40 (0.00)
Index of Industrial Production (IIP)	283.11	294.81	407.63	174.00	63.11	121	-1.48 (0.54)
% Change in IIP (CHIIP)	0.75%	0.36%	14.94%	-14.11%	5.78%	120	-1.80 (0.38)
GDP	4049.78	3695.60	7762.51	1918.33	1580.41	111	-1.33 (0.99)
GDP Growth rate (CHGDP)	1.30%	1.61%	11.39%	-11.03%	5.33%	110	-2.63 (0.09)
Gross Fixed Investment Growth Rate (CHFI)	3.55%	4.15%	7.86%	-3.64%	2.50%	120	-2.17 (0.22)
Private Consumption Growth Rate (CHPC)	2.28%	2.27%	3.80%	0.68%	0.73%	120	-1.61 (0.47)
Rupee-Dollar Rate (EXCH)	46.06	45.52	56.03	39.37	3.56	121	-1.39 (0.59)
% Change in Rupee-Dollar Rate (CHEXCH)	0.13%	-0.16%	6.79%	-4.27%	1.98%	120	-7.59 (0.00)

The construction of the Economic Policy Uncertainty Index (EPU) is described under Figure 1. Monthly data for the Bombay Stock Exchange Sensex Index (BSE) are from www.bseindia.com. Monthly Inter-Bank Call Rates (IBCR), Index of Industrial Production (IIP), and Rupee-Dollar Rates (EXCH) are from Reserve Bank of India's web site: http://dbie.rbi.org.in.   Quarterly data for growth in GDP, growth in Fixed Investment, and growth in Private Consumption are from Central Statistical Organization, India. We use the cubic spline interpolation method to convert quarterly data into monthly data. All change series are computed as percentage changes between adjacent months.

Table 2
Univariate Correlations

	EPU	CHEPU	BSE	CHBSE	IBCR	IIP	CHIIP	GDP	CHGDP	CHFI	CHPC	EXCH
EPU												
CHEPU	0.300											
BSE	0.519	-0.022										
CHBSE	-0.345	-0.323	-0.053									
IBCR	0.263	0.033	0.270	-0.258								
IIP	0.726	-0.030	0.902	-0.175	0.335							
CHIIP	-0.019	-0.059	0.035	0.061	0.127	0.146						
GDP	0.777	-0.035	0.825	-0.157	0.319	0.951	0.054					
CHGDP	0.030	0.013	0.070	0.058	0.111	0.118	0.647	0.100				
CHFI	-0.556	0.044	-0.188	0.012	-0.062	-0.402	0.036	-0.477	0.006			
CHPC	-0.056	-0.065	0.415	0.041	0.177	0.247	0.075	0.093	0.103	-0.054		
EXCH	0.409	-0.082	-0.162	0.028	-0.044	0.129	0.053	0.312	0.054	-0.672	-0.336	
CHEXCH	0.351	0.162	-0.001	-0.471	0.241	0.118	0.114	0.129	0.095	-0.229	-0.011	0.198

The construction of the Economic Policy Uncertainty Index (EPU) is described under Figure 1. Monthly data for the Bombay Stock Exchange Sensex Index (BSE) are from www.bseindia.com. Monthly Inter-Bank Call Rates (IBCR), Index of Industrial Production (IIP), and Rupee-Dollar Rates (EXCH) are from Reserve Bank of India's web site: http://dbie.rbi.org.in. Quarterly data for growth in GDP, growth in Fixed Investment, and growth in Private Consumption are from Central Statistical Organization, India. We use the cubic spline interpolation method to convert quarterly data into monthly data. All change series are computed as percentage changes between adjacent months.

Table 3

Key Economic Indicators and Economic Policy Uncertainty (EPU)

(All t-statistics are based on Newey-West Standard errors)

Panel A: Dependent Variable: Log BSE Index

	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Log EPU	-0.27	-3.05	-0.37	-3.83	-0.20	-2.40	-0.33	-2.93
Log IIP	2.54	16.93	2.12	11.60	2.51	16.18	2.15	10.60
Log Dollar-Rupee rate	-1.28	-7.37	-1.43	-6.91	-1.31	-6.98	-1.40	-6.66
Log CP Index			0.69	2.74			0.60	2.03
Crisis Dummy					1.16	3.75	0.79	2.16
Log EPU * Crisis Dummy					-0.56	-3.74	-0.37	-2.07
# of obs.		120		120		120		120
Adjusted R^2		90.8%		91.6%		91.3%		91.7%

Panel B: Dependent Variable: Change in Log BSE Index

	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Log EPU	-0.09	-3.52	-0.10	-3.57	-0.07	-3.93	-0.08	-3.51
Log IIP	0.03	0.92	0.02	0.42	0.01	0.29	0.002	-0.05
Log Dollar-Rupee rate	0.07	1.95	0.10	2.08	0.08	1.88	0.10	1.91
Inflation			0.001	1.01			0.001	0.81
Crisis Dummy					0.70	2.75	0.69	2.58
Log EPU * Crisis Dummy					-0.33	-2.76	-0.33	-2.60
# of obs.		120		120		120		120
Adjusted R^2		12.6%		11.0%		16.3%		16.3%

Panel C: Dependent Variable: Inter Bank Call Rates

	Levels		Log levels	
	Coef.	t-stat.	Coef.	t-stat.
EPU	0.02	2.66	0.34	2.33
Crisis Dummy	-6.15	-2.81	-2.18	-2.59
EPU * Crisis Dummy	0.04	2.72	0.98	2.53
Change in CPI	4.22	6.43	0.09	0.33
# of obs.		120		120
Adjusted R^2		16.1%		14.5%

The construction of the Economic Policy Uncertainty Index (EPU) is described under Figure 1. Monthly data for the Bombay Stock Exchange Sensex Index (BSE) are from www.bseindia.com. Monthly Inter-Bank Call Rates (IBCR), Index of Industrial Production (IIP), and Rupee-Dollar Rates (EXCH) are from Reserve Bank of India's web site: http://dbie.rbi.org.in.

Figure 4
Quantile Regressions of the Log of BSE Index on EPU, IIP, and EXCH
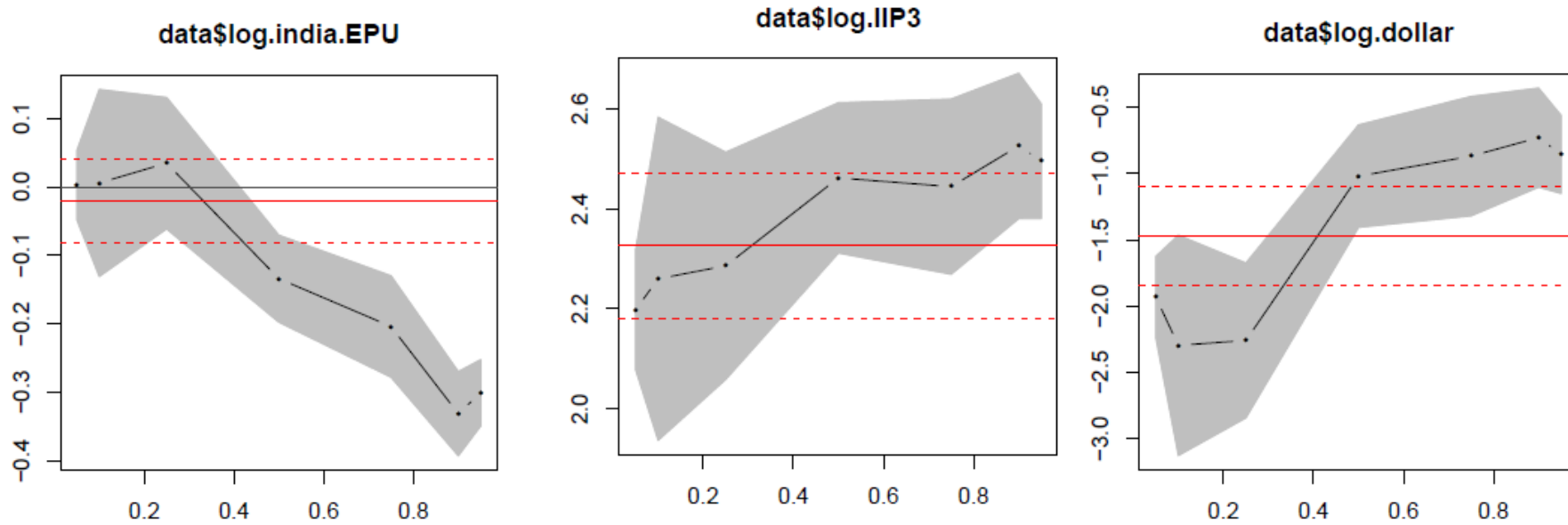
The x-axis shows the quantile of the BSE Index for which the regression has been run (5th, 10th, 25th, 50th, 75th, 90th, and 95th). The dots = "·" in the plot indicate the estimated values of the parameters at the different quantiles. The grey shaded areas mark the 95 percent credible intervals. The solid black line indicates the constant line at 0. The solid red line indicates the average value of the parameter estimate.

Figure 5

VAR (6) Models: Impulse Response Functions of GDP Growth (CHGDP), IIP Growth (CHIIP), Gross Fixed Investment Growth (CHFC), and Private Consumption Growth (CHPC) to an innovation in India EPU
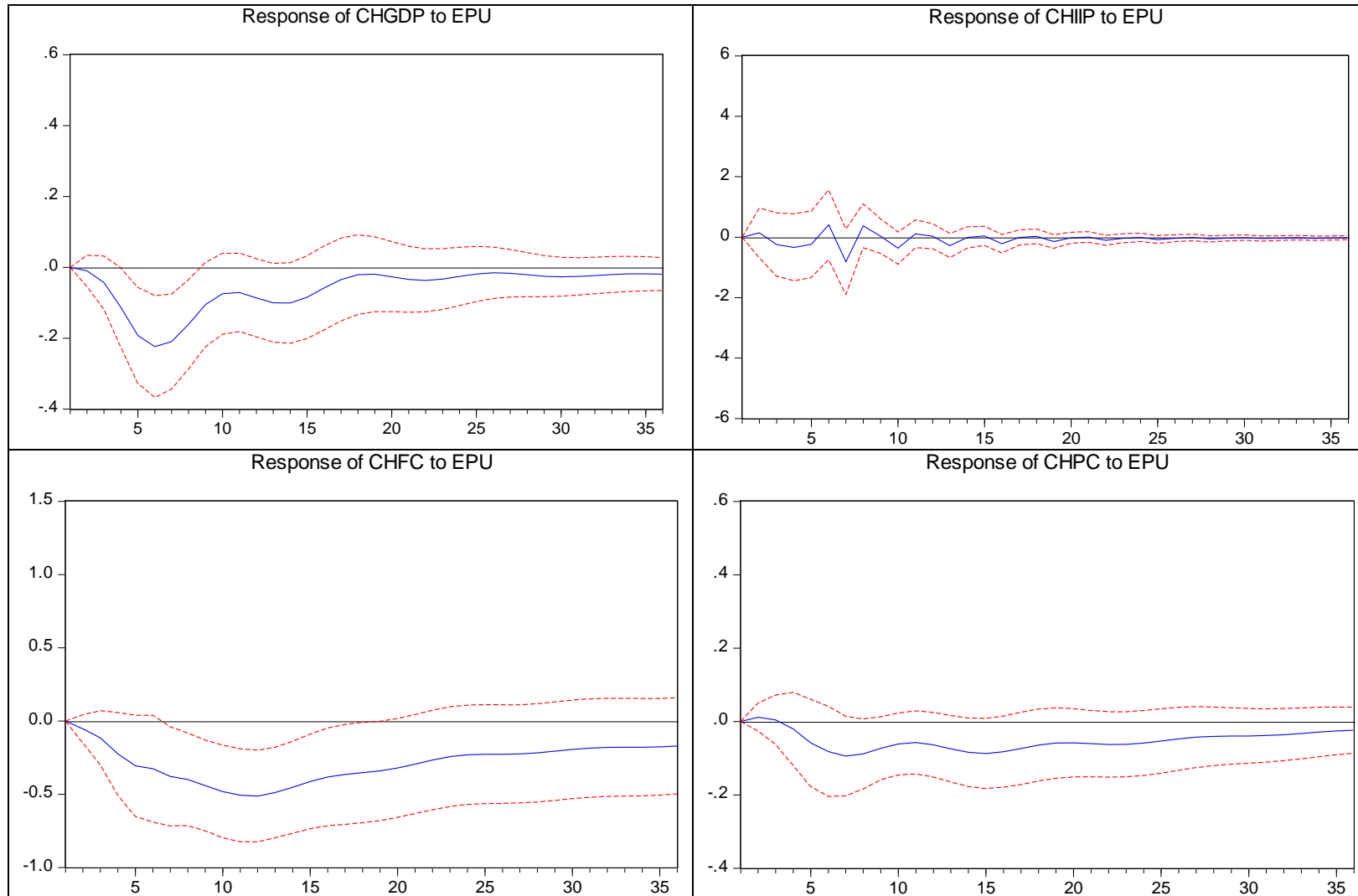
This shows the response of GDP Growth (CHGDP), IIP Growth (CHIIP), Gross Fixed Investment Growth (CHFC), and Private Consumption Growth (CHPC) to a one-standard deviation increase in Economic Policy Uncertainty (EPU). The blue line represents the mean estimate and the red lines are plus/minus two standard error bands about the impulse responses. The horizontal axis is in months.

Figure 6
VAR (6) Models: Impulse Response Functions of India EPU to and on U.S. EPU and China EPU
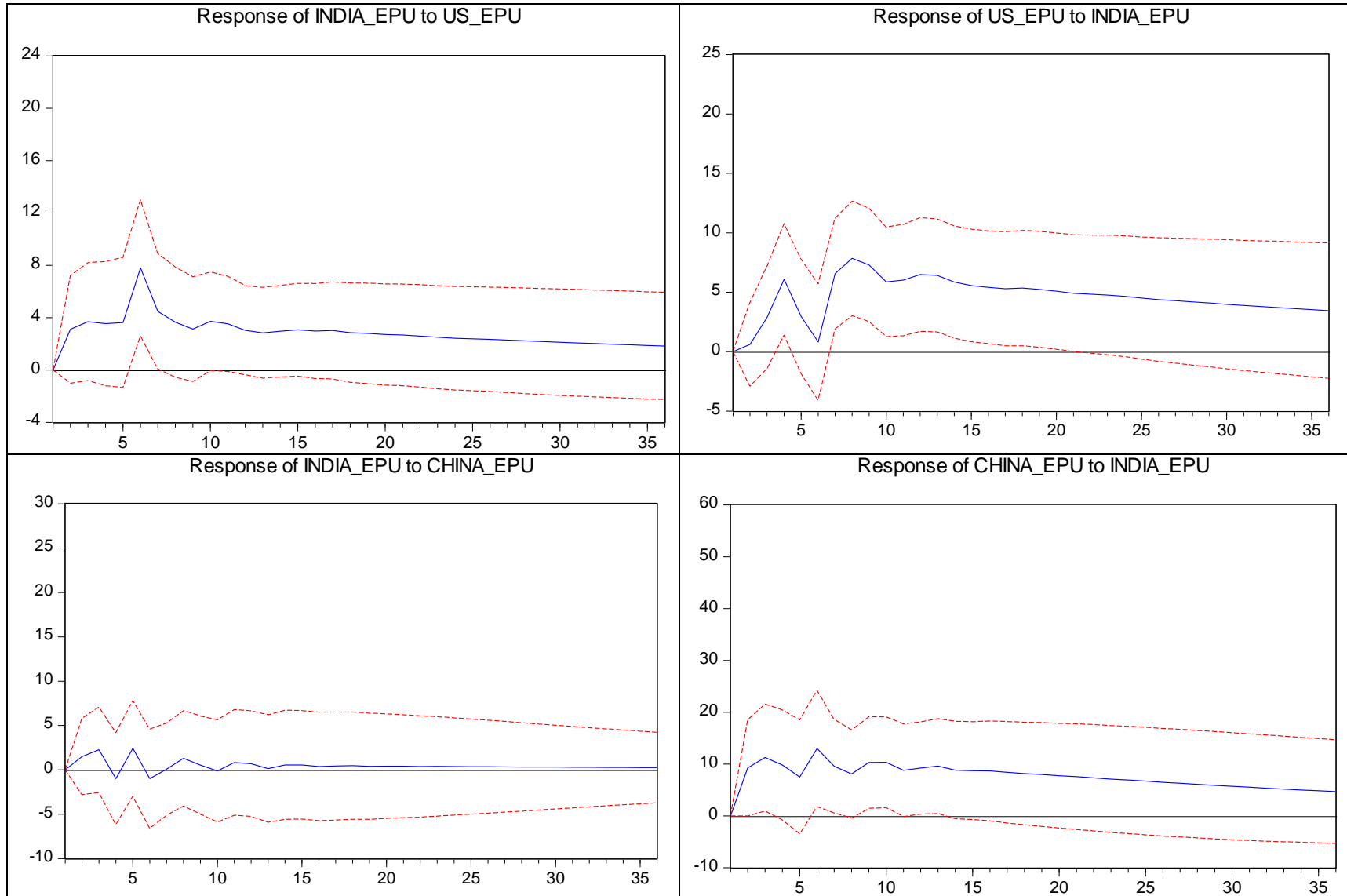
The top two graphs show the impulse response of the Economic Policy Uncertainty Index (EPU) of India to a one-standard deviation increase in the EPU of U.S. and vice-versa. Similarly the bottom two graphs show the impulse responses of India's EPU to China's EPU, and vice-versa. The blue line represents the mean estimate and the red lines are plus/minus two standard error bands about the impulse responses. The horizontal axis is in months.