

# Dynamic Interactions of Geopolitical Risk, Economic Policy Uncertainty and Market Volatility with Stock and Commodity Markets: Evidence from India

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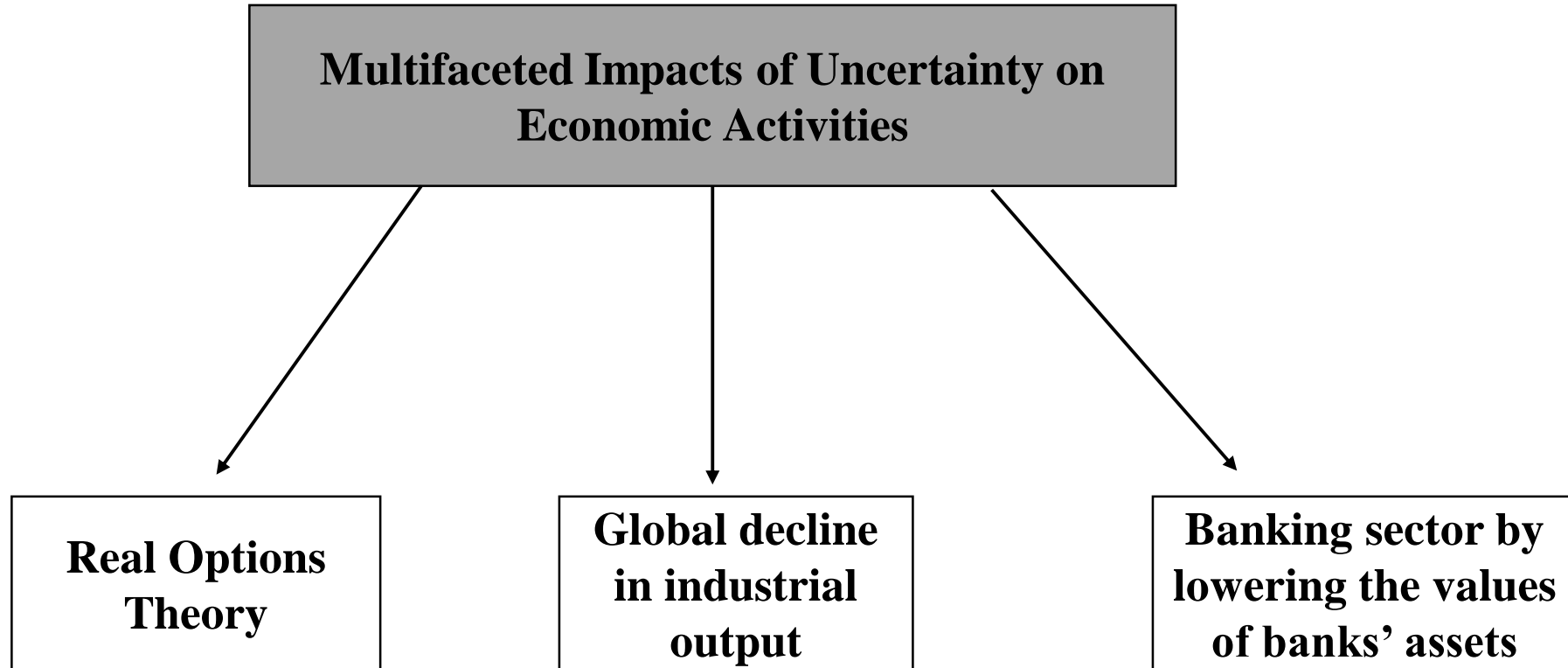
# Outline

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# Introduction

- Financial and commodity markets constitute fundamental components of the global economy.
  - Financial markets are the centres of business expansion and economic activities reflecting the sentiments, hopes, fears, and behavioural patterns of investors regarding the future.
  - Commodity markets on the other hand have emerged as an attractive alternative to traditional portfolios in recent times.
- The global financial landscape has undergone significant changes amidst various uncertainties arising from frequent economic and geopolitical tensions.
- The interconnectedness of global markets have increased the systemic risk, leading to heightened volatility spillovers across various markets and assets.
- Thus, both financial and commodity markets are influenced by macroeconomic shocks and uncertainties.

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# Objective

- To investigate the dynamic interactions between key macroeconomic uncertainty indicators including Geopolitical risk (GPR), Economic Policy Uncertainty (EPU), and the Volatility Index (India VIX) and asset classes in stock, commodity, and energy markets.

# Contributions of the Study

- First, our study integrates three major uncertainty indices, viz. GPR, EPU, and VIX, to examine their co-movements and lead-lag relationships with stock, commodity, and energy markets within a unified framework in an emerging market economy, India.
- Second, our study seeks to analyse the correlations and lead-lag relationships between these variables across varying times and frequencies using the wavelet coherence analysis. This approach captures co-movements over both the short and long-term, addressing the needs of both short and long-term investors.
- Third, macroeconomic uncertainties prompt investors to adopt a ‘flight-to-quality’ strategy by resorting to safe-haven assets. Our study examines this behaviour in the Indian context to assess whether gold and silver act as effective hedges and safe-havens amid inconsistent correlations with uncertainty indicators.

# Variables

Variable	Variable Description	Source
BSE 500	A proxy for the financial markets (monthly first log differences of prices)	BSE SENSEX Website
Gold spot price	A proxy for the commodity markets (monthly first log differences of prices)	Handbook of Statistics on the Indian Economy, RBI
Silver spot price	A proxy for the commodity markets (monthly first log differences of prices)	Handbook of Statistics on the Indian Economy, RBI
WTI Crude oil spot price	A proxy for the energy market (monthly first log differences of prices)	International Energy Agency (IEA)
World GPR Index	A newspaper-based measure derived from the digital archives of ten prominent global newspapers	Caldara and Iacoviello (2022) database
India GPR Index	A newspaper-based measure derived from the digital archives of newspapers naming the country in question	Caldara and Iacoviello (2022) database
India EPU Index	A newspaper-based index derived from the digital archives of 7 prominent Indian newspapers	Economic Policy Uncertainty Website
India VIX	India VIX is a volatility index computed by NSE India based on NIFTY options	Investing.com

# Empirical Framework and Methodology

- We adopt a two-step methodology in our study. First, we use the *Wavelet Coherence* approach developed by Torrence and Compo (1998)<sup>1</sup> to examine the co-movements between uncertainty indices and different asset classes in financial, commodity, and energy markets. In the 2<sup>nd</sup> step, we use the *DCC-GARCH (1,1)* model to parametrize the correlations between the variables under study.

➤ Wavelet Coherence is a powerful tool for exploring financial and economic relationships, as it decomposes financial time-series into time-frequency domains. The main advantages of using wavelet analysis are: *compact, indexed in both time and frequency domains, irregular data series, non-stationary time-series.*

➤ The wavelet coherence equation depicting the co-movements is given below:

$$R_{xy} = \frac{|S(W_{xy})|}{[S(|W_x|^2)S(|W_y|^2)]^{1/2}}$$

where,  $R_{xy}$  = ranges between 0-1

$S$  = smoothing operator in both time and scale dimensions

➤ The DCC-GARCH (1,1) model can be given as:

$$H_t = D_t R_t D_t$$

where,  $H_t = 2 \times 2$  conditional covariance matrix

$R_t$  and  $D_t$  = conditional correlation and diagonal matrices respectively

<sup>1</sup>Torrence, C., & Compo, G. P. (1998). A practical guide to wavelet analysis. *Bulletin of the American Meteorological society*, 79(1), 61–78.



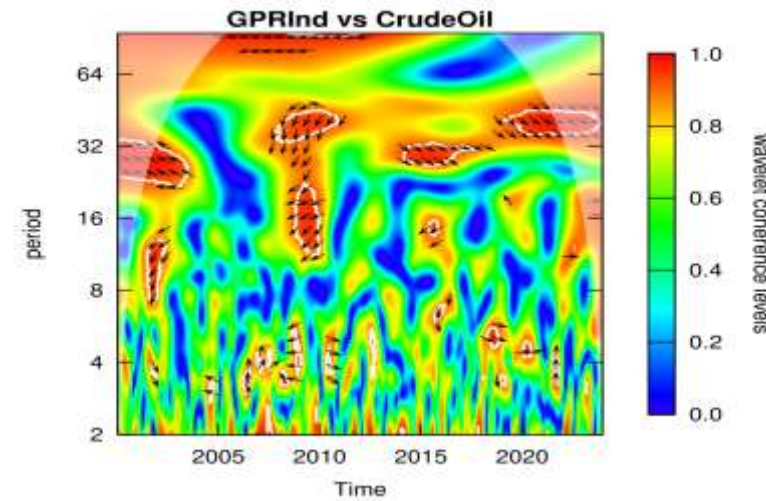
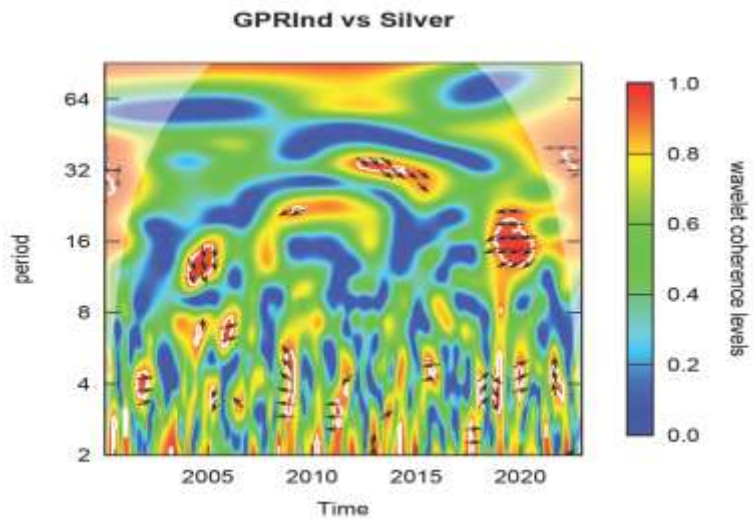
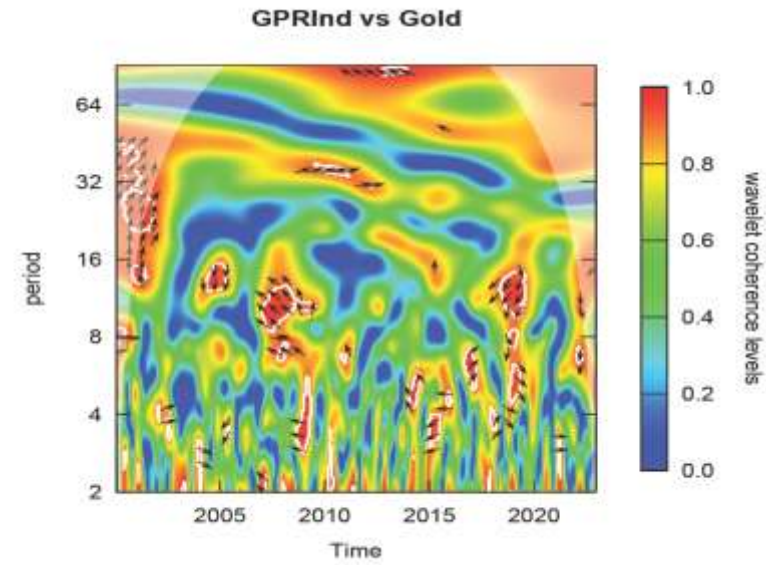
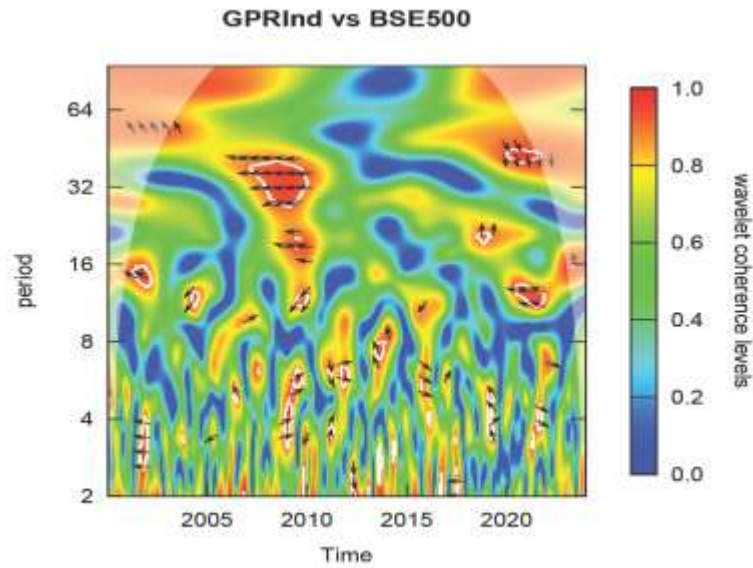
## Cont.

- Graphically, heat maps are used in wavelet coherence analysis to illustrate positive and negative co-movements, with arrows indicating phase differences.
- The up-right and down-left ( $\nearrow$  $\swarrow$ ) arrows indicate that the first time-series leads (positive correlation) and lags (negative correlation) against the second time-series.
- The down-right and up-left ( $\searrow$  $\nwarrow$ ) arrows imply that the second time-series leads the first.
- Rightward ( $\rightarrow$ ) and leftward ( $\leftarrow$ ) arrows signify positive and negative correlations, respectively.
- Upward ( $\uparrow$ ) and downward ( $\downarrow$ ) arrows indicate that the variable is leading and lagging, respectively

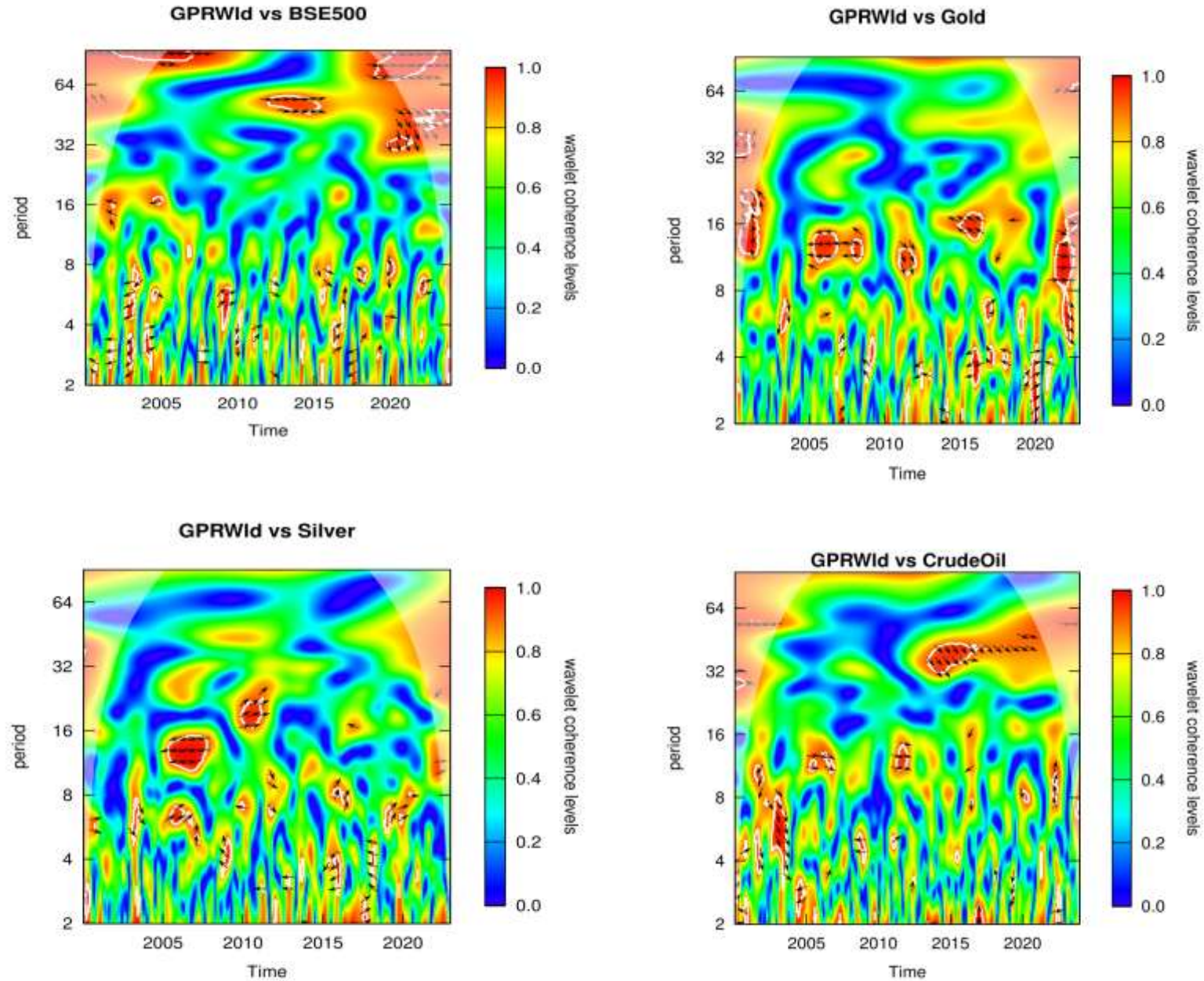
# Results and Analysis

## A. Wavelet Coherence Analysis:

- Co-movements between India GPR (GPR\_Ind) and other Markets:

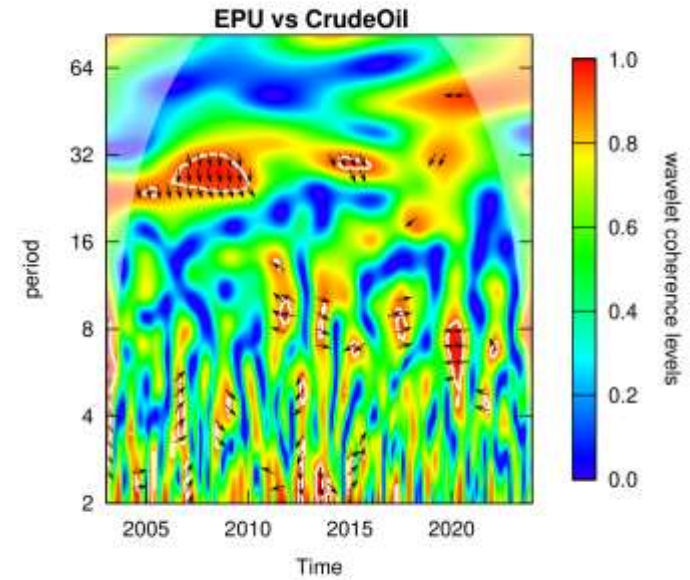
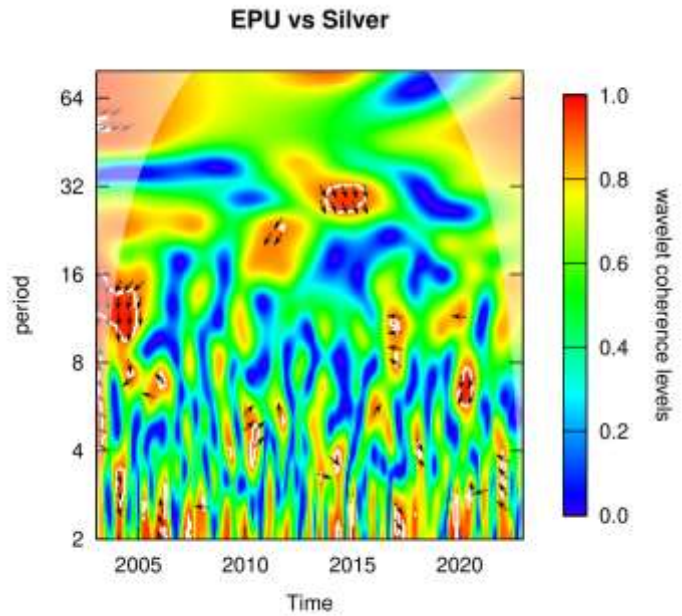
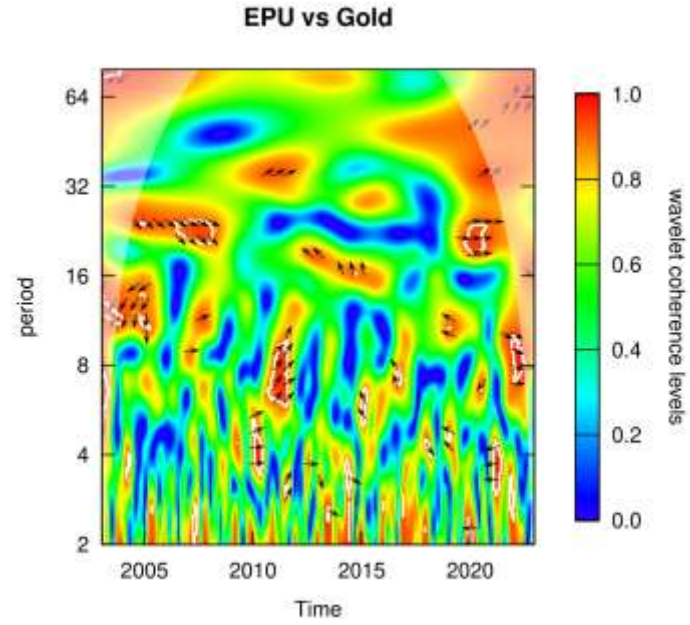
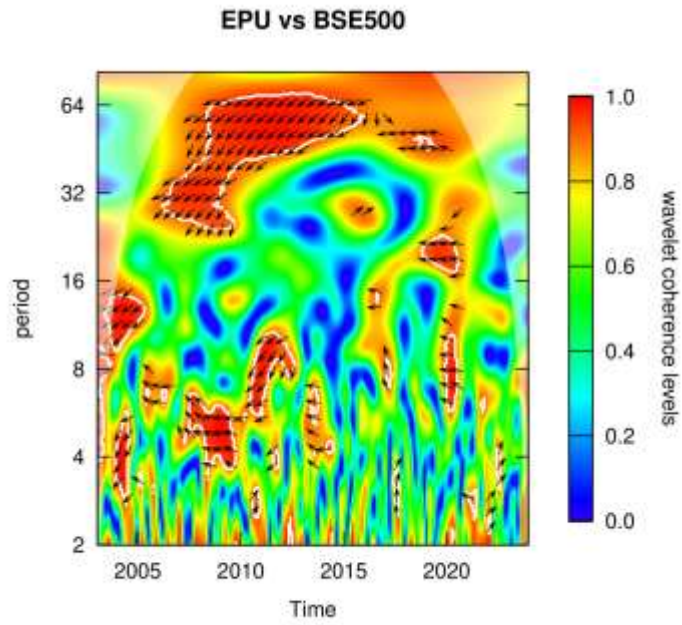


■ Co-movements between World GPR (GPR\_Wld) and other Markets:

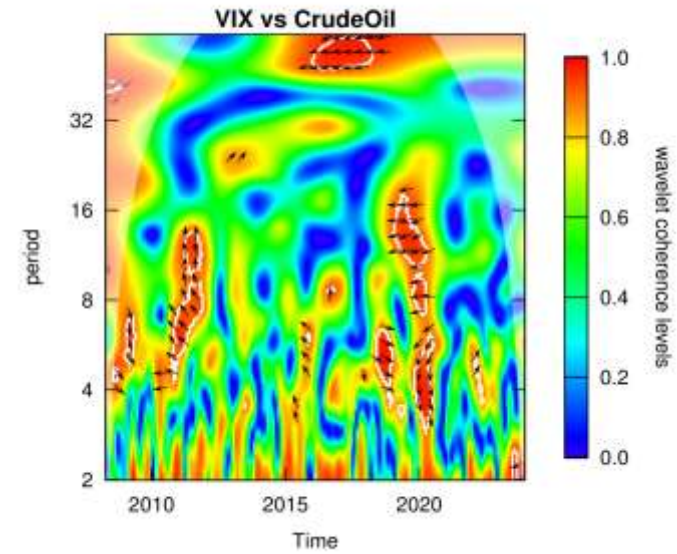
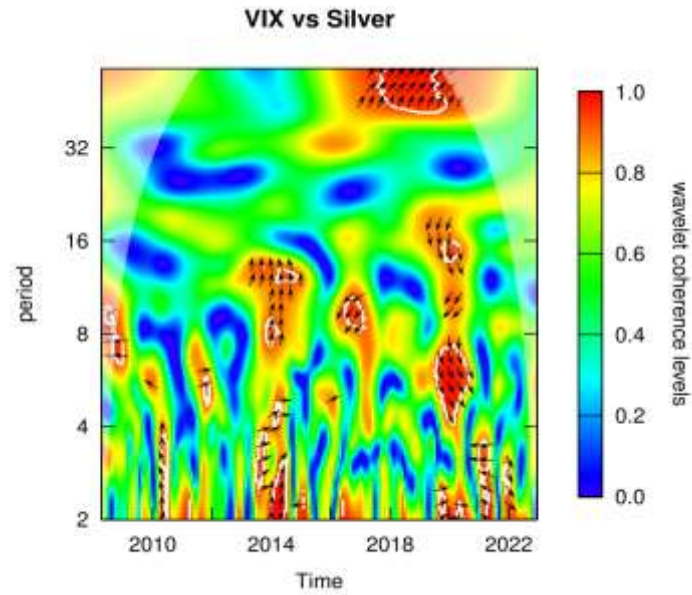
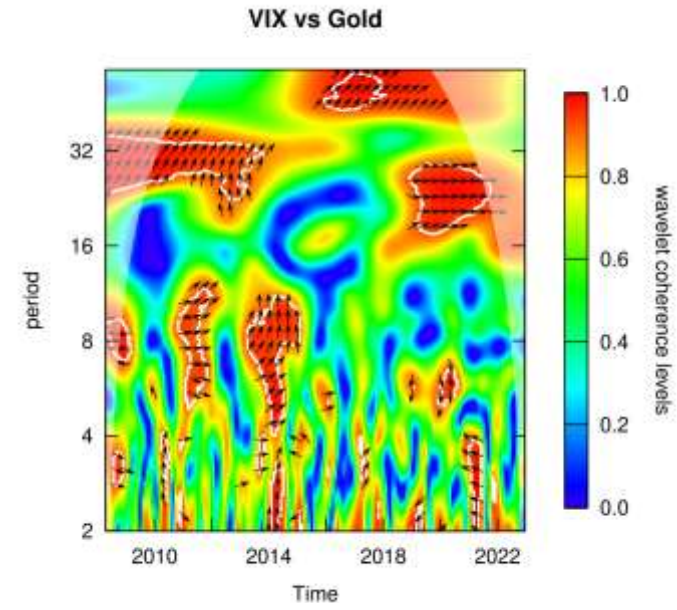
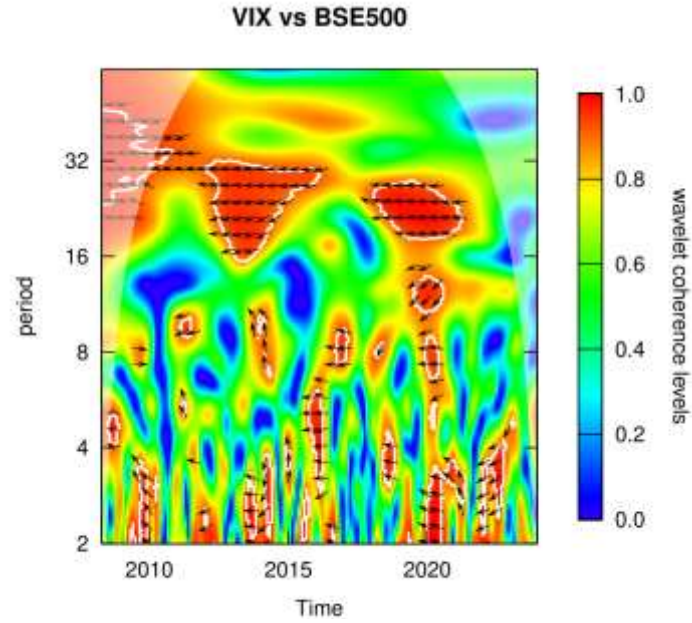




■ Co-movements between EPU and other Markets:



■ Co-movements between India VIX and other Markets:



## *B. DCC-GARCH (1,1)*

<b>Parameters</b>	<b>DCC-GARCH Correlation Coefficients</b>	
GPR_Ind-BSE 500	0.04838	
GPR_Ind-Gold	0.08359	
GPR_Ind-Silver	0.02368	
GPR_Ind-Crude Oil	0.02312	
GPR_Wld-BSE 500	-0.02533	
GPR_Wld-Gold	0.04531	
GPR_Wld-Silver	0.06682	
GPR_Wld-Crude Oil	0.00910	
EPU-BSE 500	-0.22561	
EPU-Gold	-0.04255	
EPU-Silver	-0.06306	
EPU-Crude Oil	-0.00123	
VIX-BSE 500	-0.47552	
VIX-Gold	0.14306	
VIX-Silver	0.10386	
VIX-Crude Oil	-0.10377	

# Discussion

## ■ Findings:

- Global-GPR demonstrates a weak and negative correlation with BSE 500 over the long-term scale. However, the India-specific GPR exhibits a positive relationship with BSE 500 across the medium-term frequency bands, reflecting the asymmetric response of the GPR index to the Indian market.
- EPU and India VIX have a negative relationship with BSE 500 indicating that domestic uncertainties and volatility affect the stock market adversely.
- Gold and silver display positive correlations with both GPR indices and the India VIX, confirming their hedging properties implying that increased uncertainty and volatility lead to increased gold returns. Silver is however found to be a moderate hedge.
- Both gold and silver do not appear to be effective hedges against EPU.
- Crude oil is found to be negatively related to EPU and India VIX but positively correlated to both the GPR indices mostly in the long-term frequency band.



# Conclusions and Policy Implications

- Our study finds strong coherence between the variables over the medium- and long-term frequency bands, compared to the short-term.
- Given the evident heterogeneity in the impact of uncertainty indices on financial and commodity markets across different time horizons and frequency bands, the government should design appropriate policies to monitor fluctuations in the indices and minimize their adverse impact on the Indian economy.
- The government should take steps to strengthen domestic economic policies and maintain a risk-monitoring system to help insulate the country from external shocks.
- The regulators should try to implement prudent monetary and fiscal policies to contain the vulnerability of different assets to uncertainties and thereby, maintain economic stability.
- Effective investor-friendly policies should be framed to promote diversification, considering that gold and silver act as hedges in the Indian market against VIX and GPR specifically.



**Thank You**