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Threshold effects of macroeconomic uncertainty on monetary policy in G7 Countries

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Abstract

Macroeconomic uncertainty poses significant challenges for policymakers, especially in the context of designing effective monetary policy. Despite extensive research on the effects of macroeconomic uncertainty on economic outcomes, the specific thresholds at which macroeconomic uncertainty influences policy decisions remain underexplored. This study addresses this gap by examining the threshold effects of macroeconomic uncertainty proxied with economic policy uncertainty on monetary policy in G7 countries. Using quarterly data from 2000 to 2024 and employing the Structural Vector Autoregression (SVAR) model, we uncover a distinct uncertainty threshold that divides the sample into two regimes: low-macroeconomic uncertainty and high-macroeconomic uncertainty periods. Our results reveal that policymakers face a critical dilemma during high-macroeconomic uncertainty periods, where the effects of macroeconomic uncertainty shocks on key macroeconomic variables are significantly amplified. By identifying and quantifying these threshold effects, we contribute new insights into how macroeconomic uncertainty alters the effectiveness of monetary policy. This study further emphasizes the importance of adaptive and responsive policy frameworks, particularly when financial markets are unstable. These results are crucial for policymakers and researchers aiming to better understand and navigate the complex dynamics of macroeconomic uncertainty in monetary policy formulation.

Keywords: Macroeconomic-uncertainty, Impact, Threshold, SVAR model, Monetary Policy, Taylor rule, Transmission-mechanism

JEL classification: E32, D80, C24, C32, E52, E51

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1. Introduction

Macroeconomic uncertainty is an enduring challenge for policymakers in advanced economies. Events such as the 2008 Global Financial Crisis (GFC), the COVID-19 pandemic, and the Ukraine War have all revealed how unexpected economic shocks can disrupt economic stability and force central banks to adjust their monetary policies. For instance, during the GFC, central banks in G7 countries, such as the U.S. Federal Reserve and the European Central Bank, adopted unconventional policy tools like quantitative easing in response to unprecedented macroeconomic uncertainty. Similarly, the COVID-19 pandemic pushed global economies into recessions, prompting rapid and aggressive monetary actions. These crises exemplify how heightened macroeconomic uncertainty

influences policy decisions, yet the threshold effects, that is, the degree to which macroeconomic uncertainty impacts policy under different conditions remain underexplored. The G7 context is highly relevant when studying the threshold effects of macroeconomic uncertainty on monetary policy for the following key reasons: The G7 comprises of the world's largest and most influential economies: the United States, Canada, Japan, Germany, the United Kingdom, France, and Italy. IMF (2025), argues that these countries collectively represent a large portion of global GDP, international trade, and financial markets. Macroeconomic uncertainty in these nations can have significant ripple effects across the world economy, making it a critical area of study.

Dibiasi et al., (2023) postulated that despite being high-income economies, the G7 countries have varied economic structures. For example, Cekin et al., (2020), found that the U.S. economy is highly consumer-driven, while Germany has a strong manufacturing base, and Japan is marked by an aging population and a unique monetary policy approach. This distinction allows for examining how different types of macroeconomic uncertainty impacts monetary policy in different economic contexts. Nusair et al., (2022) further claims that, although the G7 countries have independent monetary policies, there is often a degree of coordination or at least an awareness of each other's actions due to their interconnectedness. A change in policy in one G7 country may influence others, especially in times of macroeconomic uncertainty, specifically during the global financial crisis or pandemic, leading to similar threshold effects across these economies.

Most studies such as Mordi et al., (2015), Hua et al., (2022), Chen et al., (2021), and Wu et al., (2022a) estimated the asymmetric effects of macroeconomic uncertainty on monetary policy but confined their research to a single country. This study selected the G7 countries for the following reasons: The G7 countries have well-developed financial markets, and we intuitively expect these countries to be at the forefront of responding to macroeconomic uncertainty with monetary policy actions. The G7 countries to our knowledge have not been the subject of empirical investigation when it comes to the impact of macroeconomic uncertainty on monetary policy. The study opted to study the G7 countries as being the representative of the most advanced economies globally. By analysing the G7 economies together, researchers can identify common trends, policies, and reactions to macroeconomic uncertainty.

Studying how the G7 central banks react to macroeconomic uncertainty provides insights into the potential for policy spillovers and coordination in times of crisis. As main players in the global economic system, their collective monetary policy decisions often have significant implications for global financial stability. By grouping them together, research can uncover patterns and relationships that may not be visible when focusing on individual countries, leading to more comprehensive and broader understanding of global policy dynamics.

The central research question of this study is: What is the threshold effects of macroeconomic uncertainty on monetary policy in G7 countries? Specifically, the paper examines whether the impact of macroeconomic uncertainty on policy effectiveness varies across different macroeconomic uncertainty regimes, such as periods of low versus high macroeconomic uncertainty. We hypothesize that monetary policy responsiveness to macroeconomic uncertainty is non-linear, with larger and more pronounced effects during periods of extreme macroeconomic uncertainty, while policy responses might be more muted during stable uncertainty periods. By quantifying the threshold effects, the study extends previous research that typically considers linear relationships and provides new empirical evidence on how G7 central banks adjust their monetary tools, such as interest rates and unconventional measures, during periods of extreme macroeconomic uncertainty.

This study will also contribute to the analysis of threshold effects of macroeconomic uncertainty on monetary policy by using the Structural Vector Autoregressive (SVAR) model of Aquino et al., (2022) that allows for the incorporation of asymmetry defined by an endogenously determined threshold. This contrasts the ad hoc choice of thresholds in extant literature that employed standard SVAR or similar VAR frameworks for this purpose.

This article is structured as follows: Section 2 makes available an appraisal of appropriate literature; Section 3 deals with the research methodology, the data and econometric model used; Section 4 presents empirical results on the G7 countries, followed by a final section on concluding remarks.

2. Literature Review

2.1 *Theoretical Literature Review*

Recent literature highlights the pivotal role that macroeconomic uncertainty plays in influencing key macroeconomic variables, particularly monetary policy transmission. For instance, Tillmann (2020) finds that tightening monetary policy yields a weaker response in long-term interest rates during periods of heightened macroeconomic uncertainty. This finding resonates with earlier observations by Vavra (2014), who developed a price-setting model based on Consumer Price Index (CPI) microdata and demonstrated that output is less responsive to monetary policy interventions in times of high volatility. Supporting this, Balcilar et al., (2017) reveal that both price and output react more significantly to monetary policy shocks during periods of lower policy macroeconomic uncertainty in the United States.

Moreover, Pellegrino (2021) highlights the significance of accounting for shocks that emanates from uncertainty in order to accurately examine monetary stimulus impacts. While existing literature highlight how uncertainty affects monetary policy, they do not address potential non-linearities or threshold effects. This gap is addressed in this study by analysing how the effect of monetary policy might change once macroeconomic uncertainty crosses a certain level, especially in advanced countries.

Hua et al., (2022) examined the impact of macroeconomic uncertainty on China's economy during the COVID-19 pandemic using a TVP-VAR model, specifically on consumption, investment, and exports, with more severe effects compared to the 2008 financial crisis. However, they did not address how these effects might differ depending on the level of macroeconomic uncertainty, a crucial aspect for understanding threshold impacts. Furthermore, the United Nations (2023) noted the adverse effects of interest rate hikes on emerging markets post-COVID, but did not examine threshold dynamics.

The current literature, however, lacks a strong theoretical or empirical foundation that explicitly justifies the expectation of threshold effects in the context of macroeconomic uncertainty. Although Aquino et al., (2022) supports the use of threshold SVAR model, there remains insufficient discussion regarding the theoretical underpinnings and empirical evidence confirming that macroeconomic uncertainty causes threshold effects on monetary policy.

2.2 *Empirical Insights*

Empirical studies on the relationship between macroeconomic uncertainty and monetary policy transmission often employ various methodologies, including VAR, GARCH, and DSGE, each with its advantages and limitations. In an extensive analysis, Pooter et al., (2020) build upon the findings of Gürkaynak et al., (2005), Gilchrist et al., (2015), and Hanson and Stein (2015), which conclude that the transmission of monetary policy to long-term interest rates is more pronounced when macroeconomic uncertainty is low compared to when it is high. Their regression framework explains that a monetary policy surprise impacts yields non-linearly in relation to the level of macroeconomic uncertainty. This offers a strong foundation for understanding how macroeconomic uncertainty impacts monetary policy and emphasizes the need to account for different uncertainty regimes in empirical analysis.

In contrast, Mordi et al., (2015) conduct a comparative analysis within the Nigerian context, employing a multivariate GARCH model to investigate the relationship between macroeconomic uncertainty and monetary policy. Their findings suggest that macroeconomic uncertainty does not significantly hinder monetary policy effectiveness in Nigeria. Their findings, although are

methodologically strong, do not account for non-linear or threshold impact, which limits perspectives into asymmetric responses of monetary policy. To address this gap, the current study adopts the SVAR model using quarterly data for the G7 to explicitly capture threshold dynamics to offer a more precise understanding of how macroeconomic uncertainty affects monetary policy across different regimes.

Hua et al., (2022) explores the impacts of macroeconomic uncertainties, particularly during the 2008 financial crisis and the Covid-19 pandemic by revealing that expansionary monetary policy support investment in China. Their application of a TVP-VAR model indicates that macroeconomic uncertainty exerts significant effects on investment and consumption. However, their primary focuses on the Chinese economy and their absence of threshold impacts on monetary policy, limits their findings to the G7 economies. This is in contrast to the current study that emphasizes the impacts and policy asymmetries in advanced countries.

Contrasting with the above studies, Aquino et al., (2022) present a robust analysis of macroeconomic uncertainty's effects on U.S. monetary policy. Utilizing a threshold regression model that distinguishes between high and low macroeconomic uncertainty regimes, their findings suggest that monetary policy shocks are less effective during periods of heightened macroeconomic uncertainty. While their focus on the U.S. offers valuable insights, the proposed study aims to broaden the scope by including the G7 countries, facilitating an examination of cross-country dynamics in the context of macroeconomic uncertainty.

3. Methodology and Data

The study examines the threshold impacts of macroeconomic uncertainty on monetary policy across the G7 countries using quarterly data from 2000 to 2024 (N=100). The Structural Vector Auto Regression (SVAR) model, as applied by Aquino et al., (2022) was employed due to its effectiveness in identifying structural shocks such as monetary policy and supply shocks, which makes it ideal for analysing the dynamic relationship between macroeconomic variables and monetary policy. However, alternative approaches like Time-Varying Parameter VAR (TVP-VAR), Markov-Switching Models (MSMs), and Bayesian VAR (BVAR), the SVAR is ideal because it strikes a balance between theoretical clarity, empirical traceability, and robustness.

The VAR (TVP-VAR) allows the relationships between variables to evolve over time, but it is computationally intensive and requires more data (Purchase et al., 2025). MSMs can capture changes in the structure of the economy or policy regime but may be difficult to estimate in high-dimensional models with many variables (Sam et al., 2024), while BVARs also perform better in small samples by regularizing parameter estimates but are often more sensitive to the choice of priors, and the results may be less transparent compared to other methods like SVAR (Damette et al., 2025).

An endogenously determined threshold model is integrated to avoid threshold selection, to allow for a more pronounced exploration of non-linear impacts. The five main macroeconomic variables selected for this study are: GDP, CPI, commodity prices, non-borrowed reserves and interest rates. GDP and CPI represents overall economic activity and inflation respectively, of which both are crucial in analysing how uncertainty shapes economic outcomes and effectiveness of monetary policy responses (Angeloni et al., 2015). Commodity Prices are often seen as leading indicators of global economic conditions. Interest Rates are the primary tool used by central banks in implementing monetary policy, which reflects the central bank's response to changes in uncertainty. Non-Borrowed Reserves represents the system liquidity and reserves in the banking system (Atkinson et al., 2020). Together, these variables allow for an analysis of how macroeconomic uncertainty impacts various channels of monetary policy.

Data was obtained from the World Development Indicators Data Bank (2023), Macro trends, Trading Economics, OECD, IMF, Statistica and World economics. The period of 2000 to 2024 captures some of the major macroeconomic uncertainty events such as the early 2000s recession,

the September 11 attacks of 2001, the energy crisis of 2003 to 2009, the global financial crisis of 2007–2008, the subprime mortgage crisis of 2007 to 2010, the Arab Spring and global protest of 2011, Brexit vote and U.S election of 2016, the stock market crash of 2020, the COVID –19 pandemic of 2019, the stock market crash of 2020, The Russian invasion of Ukraine in 2022 and the Post Pandemic Recovery and Global Inflation, 2023 to 2024, making it ideal to examine both short term and long term effects of uncertainty on policy. Quarterly data was selected to enhance the empirical power of the model and provide a more detailed aspects of policy diversities overtime. Economic Policy Uncertainty (EPU) index is used as a proxy for macroeconomic uncertainty, which uses newspaper coverage, expiring tax provisions, and future years disagreement among macroeconomic forecasters (Elroukh, 2025).

The EPU index is particularly relevant in the context of monetary policy, as macroeconomic uncertainty about policy changes can influence expectations and economic behaviour.

3.1 Empirical Model

3.1.1 The G7 panel of countries' SVAR model

The study employed the Taylor rule equation within a threshold regression model. Hence, macroeconomic uncertainty will be used as a threshold variable that divides the sample into two different regimes based on different levels of uncertainty. The study also estimated the SVAR model to determine the macroeconomic uncertainty impact of the G7 panel of countries on monetary policy. The SVAR takes the form:

$$\gamma'_t A_0 = \sum_{i=1}^v \gamma'_{t-i} A_i + C + \epsilon'_t \quad \text{for } 1 \leq t \leq T, \quad (1)$$

where γ_t is an $n \times 1$ vector of endogenous variables of the G7 panel of countries, and A is an $n \times n$ matrix of structural parameters for $0 \leq i \leq v$ with A_0 invertible, c is a $1 \times n$ vector of parameters, v is the lag length, and T is the sample size. The vector g_t are Gaussian with mean zero and covariance matrix In , conditional in $\gamma_0 \dots \gamma_{cv}$ and $\gamma_0 \dots \gamma_{bv}$. The SVARs described in equation (1) can be written as:

$$\gamma'_t A_0 = x'_t A_+ + \epsilon'_t \quad \text{for } 1 \leq t \leq T, \quad (2)$$

where $A_+ = [A_1 \dots A_v e^t]$ and $X_v = [Y_{t-1} \dots X_{cv}]$ for $1 \leq t \leq T$ and

The dimension of $A_+ + ism \times n$, where $m = qx + 1$. This paper will call A_0 is the structural parameters. The reduced form vector auto regression (VAR) implied by equations (2)

$$\gamma'_t = X'_t B + u'_t \quad \text{for } 1 \leq t \leq T, \quad (3)$$

Where $Z = A + A_0^{-1}$, $\gamma'_t = g'_t A_0^{-1}$, and $E[\gamma_t \gamma'_t] = \Sigma = (A_0 A_0^{-1})^{-1}$.

The impulse response function (IRF) of the variable j to the structural shock j in the horizon k correspond to the element (j, j) of the matrix $L_0 (A_0, A_+)$, where L_k is recursively defined by:

$$L_0 = (A_0^{-1})', \quad (4)$$

$$L_k = \sum_{i=1}^k (A_i A_0^{-1})' L_{k-i} \quad \text{for } 1 \leq k \leq v, \quad (5)$$

$$L_k = \sum_{i=1}^v (A_i A_0^{-1})' L_{k-i} \quad \text{for } v \leq k \leq \infty, \quad (6)$$

The study thus imposed sign and zero restrictions unswervingly on the structural coefficients. For the reason that the identification scheme limits only the monetary policy equation and less than $n - 1$ zero restrictions, the structural parameters are not exactly identified. Identifying only one macroeconomic uncertainty or subset of macroeconomic uncertainties follows the work of Benanke and Mübov (1998) and Uhlig (2005). Correspondingly, the specification of the systematic component of monetary policy is consistent with the works of Sims and Zha (2006). Without loss of simplification, the study lets the first shock be the monetary policy shocks. Thus, the first equations of the SVARs are the monetary policy equations, where ε_{it} denotes the first entry of ξ_t , $a_{l,1}$, denotes the first column of A_l for $0 \leq l \leq \nu$, and $a_{l,i,j}$ denotes the (i,j) entry of A_l and describes the systematic component of the monetary policy. The restrictions are imposed on $a_{l,1}$ for $0 \leq l \leq \nu$.

$$y'_{t0,1} = \sum_{l=1}^{\nu} y'_{t-l} a_{l,1} + \varepsilon_{t,1} \quad \text{for } 1 \leq t \leq T, \quad (7)$$

The reduced-form SVAR specification consists of six endogenous variables ordered in the following form: GDP, y_t ; CPI, p_t ; commodity prices, $p_{c,t}$; total reserves, tr_t ; non borrowed reserves, nbr_t ; and the interest rate, r_t . These variables have been used by Bernanke and Mihov (1998), Uhlig (2005) and Arias et al., (2019). The study imposes the following two restrictions:

Restriction 1. The repurchase rate is the monetary policy instrument, and it only reacts simultaneously to GDP, prices, and commodity prices; and

Restriction 2. The coincident reaction of the repurchase rate to GDP and prices is positive. Restriction 1 suggests that the central bank interest rate does not react to changes in reserves. The second restriction is on the qualitative response of the central bank interest rate to economic conditions. Restriction 2 indicates that the central bank simultaneously increases the repurchase rate in response to a coincident increase in GDP and prices, while leaving the response to commodity prices unrestricted. It is supposed that central banks have access to an enormous amount of real-time indicators to learn about the current state of real activity and prices. So, this study can rewrite equation (7), abstracting from lag variables, as:

$$r_t = \psi_y y_t + \psi_p p_t + \psi_{pc} p_{c,t} + \psi_{tr} tr_t + \psi_{nbr} nbr_t + \sigma \varepsilon_{1,t} \quad (8)$$

Therefore, Restriction 1 implies that: $\psi_{tr} = \psi_{nbr} = 0$ and Restriction 2 implies that $\psi_y = \psi_p > 0$. At the same time, the coefficient ψ_{pc} remains unrestricted.

3.1.2 Threshold Equation

The first equation, that is, the monetary policy equation of the SVAR (7) in its reduced form is given by:

$$y_{1t} = \sum_{i=1}^n \gamma_{t-i}^2 + \beta_{t,i} + u_{1t} \quad \text{for } 1 \leq t \leq T, \quad (9)$$

where y_{1t} and u_{1t} denote the first entry. Equation (9) describes the study's specification for the Taylor rule as a time series regression, where y_{1t} is the country's interest rate, y_{1t} is the vector which contains the intercepts and lags of the six variables, u_{1t} is the error term of the Taylor rule equation, and t indexes time periods in months. The variables in y_{1t} are the interest rates, GDP, CFR, commodity prices, total reserves, and non-borrowed reserves; $\beta_{l,1}$ are the parameters to be estimated.

In order to assess whether or not the macroeconomic uncertainty can affect the monetary policy equations, this paper will thus estimate the following time series regression with a threshold variable:

$$\gamma_{1t} = \sum_{l=1}^v \gamma'_{t-l} + \beta_{1l,I} 1(q_{t-l} \leq \gamma) + \sum_{l=1}^v \gamma'_{t-l} \beta_{2l,I} 1(q_{t-l} > \gamma) + u_{1,t} \quad \text{for } 1 \leq t \leq T \quad (10)$$

where q_t is the macroeconomic uncertainty of the G7 panel, and $1(\cdot)$ is an indicator variable which takes the value of 1 if macroeconomic uncertainty level is lower or above a threshold γ and 0 otherwise. Here, γ is the macroeconomic uncertainty threshold parameter to be estimated. $\beta_{1l,I}$ and $\beta_{2l,I}$ are the slope coefficients; that is, in this specification, the effects of the lags of the six variables mentioned above on the monetary policy depend on the macroeconomic uncertainty regime. The empirical analysis of these models involves estimation, inference, and testing for threshold effects (or test for non-linearity). After estimating equation (6), this study tests whether the threshold parameter is statistically significant and whether $\beta_{1l,I} = \beta_{2l,I}$, which is the hypothesis of no threshold effect. We expect monetary policy to be more effective in the low uncertainty regime when $q_{t-l} \leq \gamma$, than in the high uncertainty regime, when $q_{t-l} > \gamma$.

3.1.3 Parameters estimation

Using the notation of equation 3, equation 10 is equivalent to:

$$\gamma_{1t} = X_t' B_1 1(q_{t-l} \leq \gamma) + X_t' B_2 1(q_{t-l} > \gamma) + u_{1,t} \quad \text{for } 1 \leq t \leq T \quad (11)$$

and let $X_t(\gamma)' = [X_t' 1(q_{t-l} \leq \gamma) \quad X_t' 1(q_{t-l} > \gamma)]$ and $B = [B_1 B_2]$.

Thus, with these notations (11) can be written in the vector notation stacked over time as:

$$Y_1 = X(\gamma)' B + U \quad (12)$$

The estimation procedure starts considering a given γ , within the empirical support of the threshold variable – in our case the uncertainty variable. The coefficients α_1 and α_2 can then be estimated using ordinary least squares, conditional on the given value for γ :

$$\hat{B}(\gamma) = (X(\gamma)' X(\gamma))^{-1} X(\gamma)' Y_1, \quad (13)$$

and the regression residuals are given by:

$$\hat{U}(\gamma) = Y_1 - X(\gamma)' \hat{B}(\gamma); \quad (14)$$

Finally, the sum of squared errors to be minimized is

$$S(\gamma) = \hat{U}(\gamma)' \hat{U}(\gamma) \quad (15)$$

The criterion function (15) is not smooth, so conventional gradient algorithms are not suitable for its maximization. Thus, the minimization of this sum of squared errors is carried out using a grid search over the threshold variable space. This involves constructing an evenly spaced grid on the empirical support of uncertainty, q_t and minimizing the concentrated sum of squared errors (15). Finally, once $\hat{\gamma}$ the macroeconomic uncertainty threshold parameter is estimated, the slope coefficient estimates are:

$$\hat{B}'_1 = \hat{B}_1(\hat{\gamma}) \quad \text{and} \quad \hat{B}_2 = \hat{B}_2(\hat{\gamma})$$

4. Results

4.1 Estimation results

In this section, we discuss the main findings on the relationship between macro-economic uncertainty and monetary policy. That is, it comprises the subsequent macroeconomic uncertainty threshold estimation, and Impulse Response Functions (IRFs) to a change in monetary policy for the G7 economies under low and high macroeconomic uncertainty regimes and compares them with findings from previous research. Prior to these, preliminary analysis results on summary statistics are presented.

4.2 Descriptive Statistics for G7 Countries

Table 1 below provides a descriptive statistic for the G7 countries based on quarterly frequency from 2000 to 2024, with each variable having 100 observations per country. The analysis includes the main variables: CPI, GDP, EPU, GDP deflator, Interest rates, Commodity prices and Reserves. A normally distributed series should have skewness of zero (0), kurtosis near three, and the P (J-B) greater than 0.05.

For commodity prices, Canada (Table 1B) indicates the average commodity price of 106.78, implying a larger resource-based imports. Germany (Table 1E) indicates 104.86, Italy (Table 1D) with 103.90, and USA (Table 1A) with 101.77 have moderate averages, whilst France (Table 1G) has the lowest mean of 100.44. Despite having similar standard deviations, differences in economic tendencies reflect different commodity market exposures. As for CPI, the USA has a moderate inflation (Mean = 102.35; std. dev = 13.23) with a maximum of 123.14 and a minimum of 77.93. The U.K displays a maximum CPI of 147.18, suggesting higher inflation, while Japan has a comparatively lower fluctuation.

For EPU, Canada has the highest of approximately 19,226,901, indicating a significant level of macroeconomic uncertainty that might be affecting its monetary policy decisions. Italy shows a very high maximum of 1.01E+08, reflecting extremely volatile macroeconomic uncertainty periods, particularly during economic recessions. The USA has a moderate mean of 108.28, with a high maximum of 351.37. This suggests significant macroeconomic uncertainty at certain times, especially during financial crises or major policy shifts. Japan and Germany also show relatively notable peaks, but the average values are lower, suggesting different economic stability levels.

The USA has the highest GDP averages of 4.31E+06, highlighting its massive economy. Other countries like Germany (736,163.5) and Canada (469,234.9) have lower average GDP values but still rank as large economies. The USA and Germany show higher GDP volatility, evidenced by larger standard deviations of 1,282,229 and 159,219.7 respectively, compared to Canada's GDP deviation of 133,967.8. Inflation adjusted by GDP is stable across all countries. The USA's average is 105.11. Other countries, such as Germany and France, have somewhat comparable GDP deflators, but the values for Italy and UK have larger standard deviations, indicating greater inflationary shifts.

Canada (2.93) and Germany (2.18) indicate the highest average interest rates, implying a more conscious monetary policy. The USA (1.91) has a broad range of a maximum of 6.5 and a minimum of 0.13, reflecting an accommodative policy response after 2008. Japan (2.41) has a moderate mean of 2.41 but has a highly skewed distribution which suggests occasional spikes. For Foreign Reserves, Japan has the highest foreign reserves (1,020,894), which is consistent with its creditor status and a more robust external position. France, the U.K, and Germany have the moderate reserves whilst the USA has the lowest reserves at 28,765.07 million, indicating a relatively lower level of foreign currency reserves compared to some other G7 nations.

Overall, the descriptive analysis indicates a notable cross-country variation in all variables in the G7 countries. There is a presence of high skewness and kurtosis in some variables especially in EPU and commodity prices which suggests that the data deviates from normality, with other countries such as Italy and Japan showing extreme values and volatility, indicating periods of extreme

macroeconomic uncertainty or outliers affecting monetary decisions. These distributional features justify the use of non-linear estimation techniques such as the threshold models that captures the asymmetric effects of macroeconomic uncertainty on monetary policy.

Table 1. Descriptive Statistics for G7 Countries

Table 1A. USA Descriptive Stats for variables

	Commodity Prices	CPI	EPU	GDP	GDP Deflator	Interest Rate	Reserves
Mean	101.7661	102.3538	108.2754	4310572	105.1140	1.913049	28765.07
Median	106.8762	104.9502	94.93206	4047165	103.9422	1.250000	29045.50
Maximum	126.0800	123.1400	351.36661	7364675	140.0600	6.500000	33814.29
Minimum	70.31142	77.93123	37.54771	2448892	80.41156	0.125000	22971.14
Std.Dev.	16.54717	13.23195	53.03778	1282229	15.97932	2.030520	2885.744
Skewness	-0.509784	-0.296133	1.669375	0.658923	0.491181	0.872537	-0.242365
Kurtosis	2.074757	1.808486	7.11198	2.636394	2.559975	2.342727	2.324601
Jarque-Bera	7.898307	7.377021	116.8717	7.709334	4.827743	14.48871	2.879697
Probability	0.019271	0.025009	0.000000	0.021181	0.089468	0.000714	0.236964
Sum	10176.61	10235.38	10827.54	4.27E+08	10511.40	191.3049	2876507
Sum Sq.Dev.	27107.06	17333.36	278487.6	1.61E+14	25278.51	408.1782	8.24E+08
Observations	100	100	100	100	100	100	100

Table 1B. Canada Descriptive Stats for variables

	Commodity Prices	CPI	EPU	GDP	GDP Deflator	Interest Rate	Reserves
Mean	106.7775	105.0019	19226901	469234.9	104.9037	2.932000	65314.53
Median	108.0910	104.5507	16572104	454746.0	104.3905	3.250000	67946.63
Maximum	128.1400	138.8094	65402952	769600.0	142.1200	5.750000	126375.1
Minimum	88.28529	80.82427	3932267	267547.0	78.42768	0.250000	29801.34
Std.Dev.	12.21566	14.87770	12606965	133967.8	16.69937	1.558303	26842.31
Skewness	0.14445	0.453803	1.098451	0.539271	0.497362	-0.360895	0.324131
Kurtosis	1.767036	2.533241	4.188908	2.526625	2.630807	2.094019	1.998225
Jarque-Bera	6.682148	4.340044	25.99951	5.722757	4.690753	5.590761	5.873154
Probability	0.035399	0.114175	0.000002	0.057190	0.095811	0.061092	0.053047
Sum	10677.75	10500.19	1.92E+09	46454254	10480.37	293.2000	6466138
Sum Sq.Dev.	14773.02	21913.25	1.57E+16	1.76E+12	27608.02	240.4026	7.06E+10
Observations	100	100	100	100	100	100	100

Table 1C. Japan Descriptive Stats for variables

	Commodity Prices	CPI	EPU	GDP	GDP Deflator	Interest Rate	Reserves
Mean	103.3708	101.8807	107.8301	1.34E+08	103.5425	2.414400	1020894
Median	102.0719	101.3623	106.7239	1.34E+08	102.7694	1.430000	1184867
Maximum	116.0837	109.4246	204.4793	1.53E+08	112.6063	101.0000	1358141
Minimum	99.27931	94.65683	49.68584	1.23E+08	97.20645	0.940000	304370.0
Std.Dev.	4.035655	4.117143	31.17910	6657685	4.088614	9.965786	302038.2
Skewness	1.575750	0.119988	0.795509	0.699602	0.512399	9.826267	-1.093354
Kurtosis	4.877439	2.143306	3.930690	3.622193	2.436829	97.70981	2.992956
Jarque-Bera	25.99951	4.340044	7.709334	5.722757	4.690753	500.8717	15.87315
Probability	0.000002	0.114175	0.021181	0.057190	0.095811	0.000000	0.000353
Sum	10337.08	10188.07	10783.01	1.34E+10	10354.25	241.4400	1.02E+09
Sum Sq.Dev.	14773.02	21913.25	1.57E+16	1.76E+12	27608.02	240.4026	7.06E+10
Observations	100	100	100	100	100	100	100

Table 1D. Italy Descriptive Stats for variables

	Commodity Prices	CPI	EPU	GDP	GDP Deflator	Interest Rate	Reserves
Mean	103.8966	102.5969	12523355	857432.9	102.3425	4.700847	44658.67
Median	102.8326	106.1483	10901963	403958.2	103.4338	5.123333	46801.91
Maximum	163.9294	130.4005	1.01E+08	45676678	130.1200	7.628167	84819.45
Minimum	81.52599	79.89983	6192201	334885.2	78.63703	1.916667	23584.37
Std.Dev.	17.61147	12.66990	9734215	4527220	12.80814	1.565081	16711.30
Skewness	1.510630	0.216875	7.663382	9.849213	0.099042	-0.181821	0.802694
Kurtosis	5.279300	2.625282	70.07517	98.00805	2.476613	2.058070	3.152625
Jarque-Bera	59.68009	1.368971	19724.95	39227.33	1.304882	4.247780	10.83568
Probability	0.000000	0.504350	0.000000	0.000000	0.520773	0.119566	0.004437
Sum	10389.66	10259.69	1.25E+09	85743285	10234.25	470.0847	4465867
Sum Sq.Dev.	30706.22	15892.12	9.38E+15	2.03E+15	16240.80	242.4985	2.76E+10
Observations	100	100	100	100	100	100	100

Table 1E. Germany Descriptive Stats for variables

	Commodity Prices	CPI	EPU	GDP	GDP Deflator	Interest Rate	Reserves
Mean	104.8574	104.3991	213.9761	736163.5	106.3806	2.185567	62506.90
Median	104.1001	104.1253	47.3477	700970.5	102.6606	1.790000	60221.10
Maximum	149.5669	135.8481	983.7729	1087972	142.6606	5.460000	101962.8
Minimum	80.46198	85.27377	47.40408	529558.0	88.74831	-0.123333	41683.34
Std.Dev.	16.17896	13.01174	185.0689	159219.7	14.01837	1.814077	16512.31
Skewness	1.295562	0.673055	2.053353	0.604437	0.928246	0.212541	1.241718
Kurtosis	4.265223	2.920890	6.749824	2.302395	3.088288	1.456820	3.737095
Jarque-Bera	34.64462	7.576118	128.8592	8.116774	14.39315	10.67541	27.96151
Probability	0.000000	0.022640	0.000000	0.017277	0.000749	0.004807	0.000001
Sum	10485.74	10439.91	21397.61	73616350	10636.06	218.5567	6250690
Sum Sq.Dev.	25914.12	16761.23	3390801	2.51E+12	19454.94	325.7966	2.70E+10
Observations	100	100	100	100	100	100	100

Table 1F. United Kingdom Descriptive Stats for variables

	Commodity Prices	CPI	EPU	GDP	GDP Deflator	Interest Rate	Reserves
Mean	105.8807	105.1953	22259915	447854.7	104.7780	3.134793	105047.0
Median	105.6314	105.3264	20802267	428403.0	103.6630	3.548517	98050.00
Maximum	117.4618	147.1796	79993409	716101.0	146.3200	5.609367	204000.0
Minimum	94.50672	80.78417	587273.0	268962.0	79.14798	0.273000	35700.00
Std.Dev.	5.698475	17.36847	14254537	116512.5	17.42094	1.592073	56615.03
Skewness	-0.108749	0.520024	1.180277	0.469025	0.484998	-0.255379	0.317335
Kurtosis	2.275095	2.547271	5.232186	2.472165	2.562640	1.612822	1.520930
Jarque-Bera	2.386633	5.361091	43.97862	5.095159	4.717395	9.104737	10.79355
Probability	0.303214	0.068526	0.000000	0.078271	0.094543	0.010542	0.004531
Sum	10588.07	10519.53	2.23E+09	44337618	10477.80	313.4793	10504700
Sum Sq.Dev.	3214.789	29864.71	2.01E+16	1.33E+12	30045.44	250.9349	3.17E+11
Observations	100	100	100	100	100	100	100

Table 1G. France Descriptive Stats for variables

	Commodity Prices	CPI	EPU	GDP	GDP Deflator	Interest Rate	Reserves
Mean	100.4435	102.1590	218.4255	525414.1	101.8334	2.698060	52733.76
Median	102.2457	103.8378	222.9835	521959.9	102.0486	3.088250	50743.13
Maximum	153.4400	127.0619	567.7089	736398.3	126.0375	6.670000	102438.8
Minimum	71.01647	83.78821	35.07029	361865.7	83.81505	0.168367	25162.99
Std.Dev.	21.37879	10.82328	116.1541	95591.72	10.49955	1.613176	19127.01
Skewness	0.364417	0.303574	0.485250	0.313850	0.358945	-0.080676	0.771920
Kurtosis	2.691828	2.607307	2.932679	2.506360	2.705163	1.622463	3.117594
Jarque-Bera	2.609044	2.178483	3.943351	2.657030	2.509561	8.015176	9.988629
Probability	0.271302	0.336472	0.139223	0.264870	0.285138	0.018177	0.006776
Sum	10044.35	10215.90	21842.55	52541409	10183.34	269.8060	5273376
Sum Sq.Dev.	45248.22	11597.19	1335686	9.05E+11	10913.81	257.6313	3.62E+10
Observations	100	100	100	100	100	100	100

Source: Author's own Computation

4.3 Stationarity Tests for G7 Countries

The stationarity of the macroeconomic variables used in the SVAR was examined using the Augmented Dickey-Fuller (ADF) test with results presented in Table 2. The ADF test is used to test for the presence of a unit root (e.g. it is non-stationary) and determines whether there is a need for differencing to achieve stationarity. Variables are considered to be stationary after taking the first difference in the first levels [1(0)] if the ADF test rejects the null hypothesis of a unit root at the 5% level of significance, and stationary in the first difference [1(1)] if stationarity is achieved after differencing.

In all G7 countries, most variables are non-stationary in all levels and become stationary after first differencing, which is typical of the macroeconomic data. Although there are some exceptions that are noted. Commodity prices are 1(1) in all countries except USA (Table 2A) and Canada (Table 2F) that have 1(0). CPI is non-stationary in level and are stationary after differencing in all countries except for Japan with a 1(0). GDP is generally 1(1) for most countries except in Japan where it is stationary in level. GDP deflator is non-stationary in levels in all the G7 countries, but stationary after the first differencing implying they are 1(1).

Interest rates in Germany and Japan show stationarity in levels 1(0), with very strong test statistics for stationarity, suggesting a consistent stable long-term mean while it is I (1) for the remaining countries. Similarly, reserves are non-stationary in levels for all countries but become stationary after differencing (1(1)) except in France and Japan where they are stationary, that is, I (0). The EPU is generally stationary in levels for all the countries except in Canada where it is non-stationary but became stationary after first differencing (1(1)).

These findings are a confirmation that most of the variables are integrated of order one, which justifies the use of the SVAR model in the first differences or cointegration settings, which relies on the presence of long-run relationships.

Table 2. Stationarity Tests Results for G7 Countries

Table 2A. Summary of Unit Root Test for UK Augmented Dickey Fuller (ADF)

Variable	Stationarity in levels		Stationarity in differences		ADF Decision
	With intercept and no trend	With intercept and trend	With intercept and no trend	With intercept and trend	
Commodity Prices	-2.332836**	-2.401733	-12.35030**	-12.29644**	1(0)
CPI	1.228313	-2.797715	-3.668149**	-3.969118**	1(1)
GDP	0.152457	-2.928724	-4.647091**	-4.638918**	1(1)
GDP Deflator	1.463070	-0.488458	-11.81565**	-12.00144**	1(1)
Interest Rates	-1.561438	-2.912025	-9.126956**	-9.172863**	1(1)
Reserves	-0.972405	-1.901905	-10.84421**	-10.79086**	1(1)
EPU	-1.783233	-5.720251**	-7.774567**	-7.742718	1(0)

Table 2B. Summary of Unit Root Test for USA Augmented Dickey Fuller (AFD)

Variable	Stationarity in levels		Stationarity in differences		ADF Decision
	With intercept and no trend	With intercept and trend	With intercept and no trend	With intercept and trend	
Commodity Prices	-1.557300	-1.779928	-7.899628**	-7.976166**	1(1)
CPI	-2.246677	-0.947763	-4.209133**	-4.752828**	1(1)
GDP	-0.971832	-11.63428**	-6.241722**	-6.212261**	1(0)
GDP Deflator	-0.042187	-2.592140	-2.896007**	-2.885089	1(1)
Interest Rates	-1.987873	-1.702267	-8.448563**	-8.558353**	1(1)
Reserves	-1.705463	-0.915096	-10.28197**	-10.71463**	1(1)
EPU	-3.390032**	-3.554531**	-9.920481**	-9.861613**	1(0)

Table 2C. Summary of unit root test for France Augmented Dickey Fuller (ADF)

Variable	Stationarity in levels		Stationarity in differences		ADF Decision
	With intercept and no trend	With intercept and trend	With intercept and no trend	With intercept and trend	
Commodity Prices	0.110467	-2.109613	-6.037229**	-6.070564**	1(1)
CPI	0.499379	-1.912882	-3.249052**	-3.337753	1(1)
GDP	-0.501504	-2.566441	-11.33039**	-11.27131**	1(1)
GDP Deflator	0.759926	-0.532576	-10.66271**	-10.69110**	1(1)
Interest Rates	-1.822101	-1.736439	-8.302678**	-8.350189**	1(1)
Reserves	-1.319533	-4.407965**	-5.482127**	-5.467050**	1(0)
EPU	-2.534820	-3.996375**	-9.682523**	-9.654921**	1(0)

Table 2D. Summary of Unit Root Test for Germany Augmented Dickey Fuller (ADF)

Variable	Stationarity in levels		Stationarity in differences		ADF Decision
	With intercept and no trend	With intercept and trend	With intercept and no trend	With intercept and trend	
Commodity Prices	-0.860613	-2.730199	-4.598727**	-4.650729**	1(1)
CPI	1.318762	-2.659181	-3.274628**	-3.613475**	1(1)
GDP	0.980870	-2.024232	-10.28411**	-10.42605**	1(1)
GDP Deflator	1.872798	-0.823652	-10.80063**	-11.21842**	1(1)
Interest Rates	-9.848858**	-9.988171**	-16.70329**	-16.61346**	1(0)
Reserves	-0.482223	-2.351149	-2.351149**	-9.656196**	1(1)
EPU	0.452488	-4.181617**	-7.909304**	-7.828112**	1(0)

Table 2E. Summary of Unit Root Test for Italy Augmented Dickey Fuller (ADF)

Variable	Stationarity in levels		Stationarity in differences		ADF Decision
	With intercept and no trend	With intercept and trend	With intercept and no trend	With intercept and trend	
Commodity Prices	0.134015	-1.531791	-4.295645**	-4.310377**	1(1)
CPI	0.006958	-2.765939	-3.761806**	-3.761312**	1(1)
GDP	0.457968	-1.534684	-3.239495**	-3.208243	1(1)
GDP Deflator	-0.513825	-1.951360	-3.827181**	-3.799011**	1(1)
Interest Rates	-2.256859	-2.730842	-4.522783**	-4.579071**	1(1)
Reserves	-0.198321	-1.994342	-12.78574**	-12.70194**	1(1)
EPU	-4.253971**	-4.299697**	-8.977563**	-8.919379**	1(0)

Table 2F. Summary of Unit Root Test for Canada Augmented Dickey Fuller (ADF)

Variable	Stationarity in levels		Stationarity in differences		ADF Decision
	With intercept and no trend	With intercept and trend	With intercept and no trend	With intercept and trend	
Commodity Prices	-0.033143	-4.411569**	-4.288702**	-4.174040**	1(0)
CPI	0.828269	-1.636478	-3.502359**	-3.637737**	1(1)
GDP	-0.277328	-2.508814	-9.129724**	-9.085963**	1(1)
GDP Deflator	0.125404	-1.447985	-3.960910**	-3.941848**	1(1)
Interest Rates	-2.653415	-2.690844	-8.922812**	-8.917930**	1(1)
Reserves	-0.202125	-1.977805	-12.470801**	-12.40957**	1(1)
EPU	-1.550069	-2.661738	-8.909648**	-8.843901**	1(1)

Table 2G. Summary of Unit Root Test for Canada Augmented Dickey Fuller (ADF)

Variable	Stationarity in levels		Stationarity in differences		ADF Decision
	With intercept and no trend	With intercept and trend	With intercept and no trend	With intercept and trend	
Commodity Prices	2.443553	-0.230716	-8.190120**	-9.168072**	I(1)
Consumer Price Index	-1.071874	-3.770390**	-6.773687**	-6.796783**	I(0)
GDP	-0.104291	-1.262662	-10.98297**	-11.29507**	I(1)
GDP Deflator	-1.351409	0.467130	-3.055517**	-8.345805**	I(1)
Interest Rates	-8.171339**	-9.810329**	-7.107305**	-7.066932**	I(0)
Reserves	-3.697516**	-1.785883	-7.060094**	-8.070276**	I(0)
EPU	-3.164154**	-3.344879	-11.36824**	-11.30894**	I(0)

Note: ** denotes stationarity at 5% significance levels.
Source: Author's own Computation

4.4 Threshold estimation results

To determine the existence of uncertainty threshold effects in the monetary policy regression equation, this study tested for the existence of an uncertainty threshold effect in the monetary policy regression equation using the F test given in equation:

$$F = T \frac{S_0 - S(\hat{\gamma})}{S(\hat{\gamma})} \quad (16)$$

This step involved estimating equation (11) using a 2000 bootstrap repetitions to perform the threshold effects test. The bootstrap p-value of 0.000 rejects the null hypothesis of no uncertainty threshold by splitting the regression sample into two regimes. Other tests were performed for the existence of more uncertainty thresholds, but did not find any evidence of more than two uncertainty regimes.

Figure 1 illustrates the likelihood ratio function $LR(\gamma)$, minimized at $\gamma = 109.789$, indicating two distinct regimes of macroeconomic uncertainty: Low macroeconomic uncertainty regime ($\gamma < 109.789$) and high macroeconomic uncertainty regime ($\gamma > 109.789$). The threshold estimated lies at 57th percentile of the uncertainty distribution, together with the narrow 95% confidence interval of $[107.955, 115.214]$. This tight interval signals a high degree of precision in the estimation of the macroeconomic uncertainty threshold.

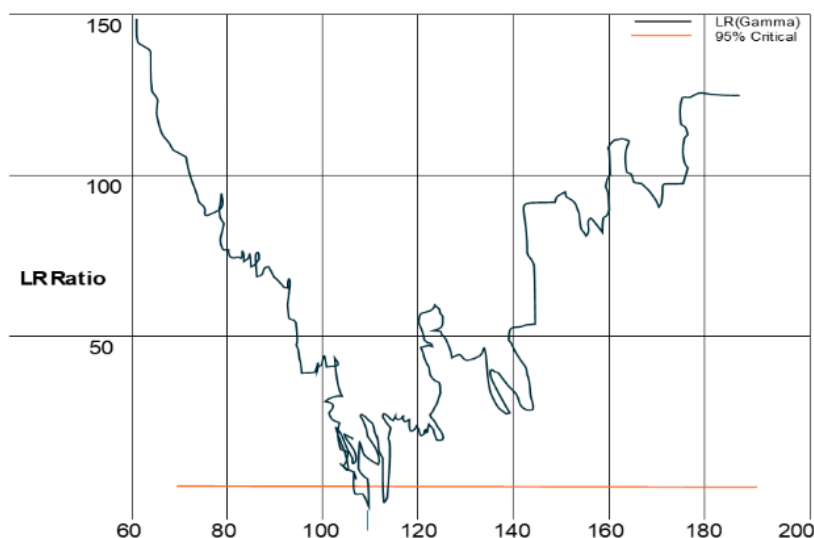


Figure 1. Confidence interval construction for threshold

Source: Author's own Computation

Figure 2 below highlights the estimates of macroeconomic uncertainty threshold using the EPU index from 2000 to 2024. The threshold is estimated at a high precision, as shown by the 95% confidence interval for the range $[107.955; 115.214]$, which spans in a mere 7.259 points. This tightness indicates a strong dependence and minimal variability in the estimate, which confirms that the threshold can be determined with a high confidence level. The threshold estimate based on the 57th percentile rule, which highlights that the latter may overstate uncertainty. The 57th percentile provides a more accurate estimate given the data.

This highlights the importance of using empirical methods compared to rule-based approaches for threshold estimation.

In addition, figure 2 shows fluctuations in the index, with periods of high macroeconomic uncertainty. The threshold is within the EPU range, which provides a reliable benchmark to identify uncertainty. The narrow confidence interval influences the precision of estimates, helping policymaker and economists in understanding the threshold at which economic policy uncertainty becomes particularly impactful.

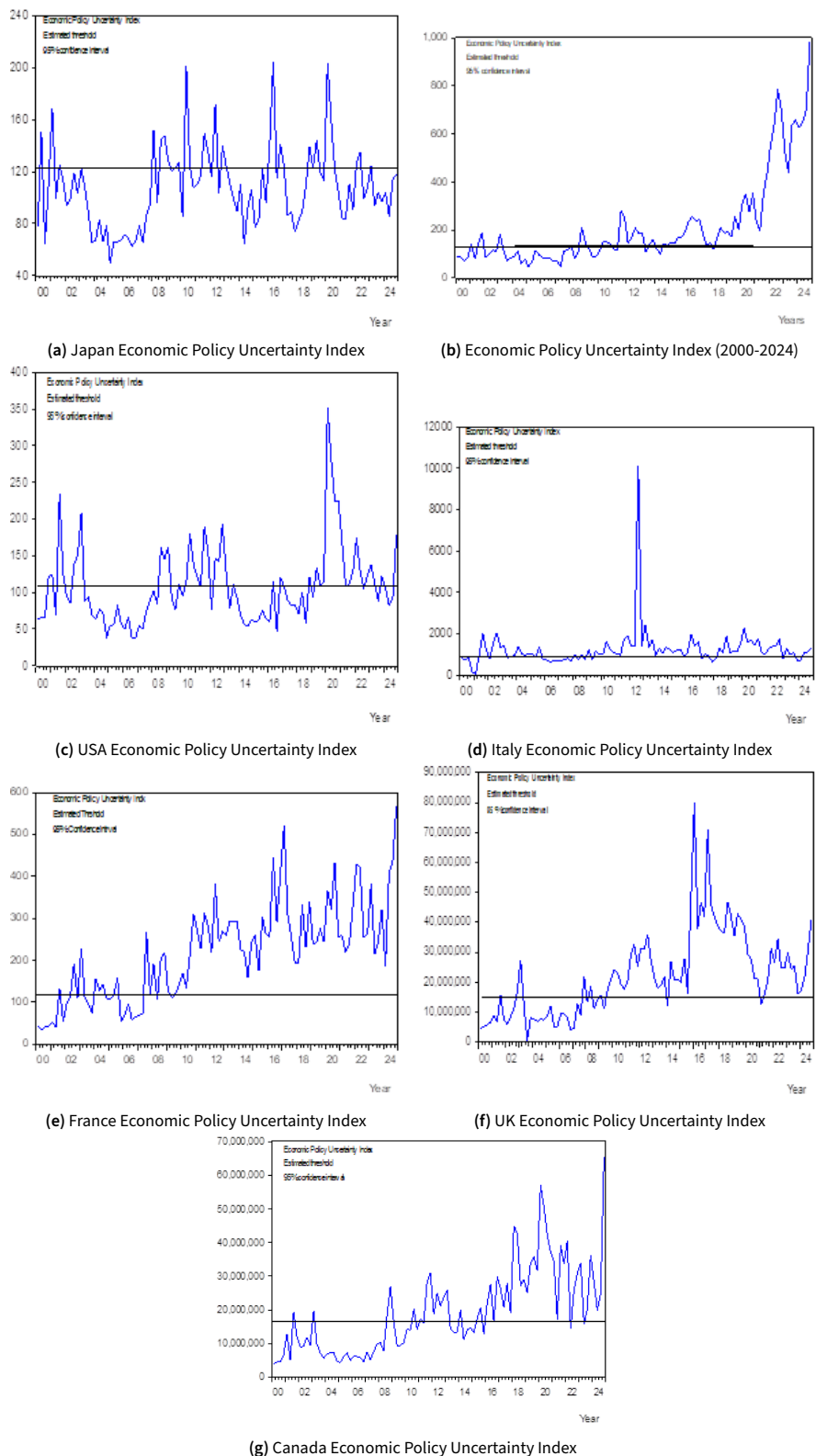


Figure 2. Economic Policy Uncertainty Index (2000-2024)

4.5 SVAR Model Estimation

In this segment, we discuss the main outcomes of how macroeconomic uncertainty affects monetary policy, by focussing on the threshold estimation and IRFs under low and high macroeconomic uncertainty regimes for the G7 countries.

Firstly, the study estimated a VAR model using commodity prices, CPI, GDP, GDP Deflator, interest rates, and reserves in log. The optional lag length was estimated based on criteria such as AIC, SIC, HQ, and FPE to ensure that serial correlation is reduced. The model was then re-estimated using lag length 1 and long run restriction, which implied that the cumulative impacts of macroeconomic shocks on monetary policy are zero. Finally, structural factorization was performed using a triangular matrix to identify IRFs.

The lag selection used Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), Hannan-Quinn (HQ)) to help in balancing the goodness of fit and model complexity. Granger causality and other theoretical considerations, like the delayed effects of changes in interest rates also supported the lag chosen. Robustness checks in many lag lengths confirmed the reliability and stability of the results.

The IRFs would allow for the detection of this shock on various endogenous variables like CPI, interest rates and GDP over time. Following Aquino et al., (2022) this is helpful by revealing the dynamic transmissions of endogenous shocks and provides informed economic policy decisions that address short-term fluctuations while also considering long-term effects. The detailed analysis of the IRFs for the G7 countries under different uncertainty regimes is discussed in the next section.

4.6 SVAR results

In this section, we present the SVAR model results, analysing how key macroeconomic variables, interest rates, GDP, commodity prices, CPI, GDP deflator, and reserves, respond to a monetary policy shock. Figure 3 illustrates the impulse response functions (IRFs) to a one-standard deviation monetary policy shock for a panel of G7 countries. The discussion compares these findings to existing empirical studies and explores their potential implications.

Figure 3: Impulse responses to a monetary policy shock

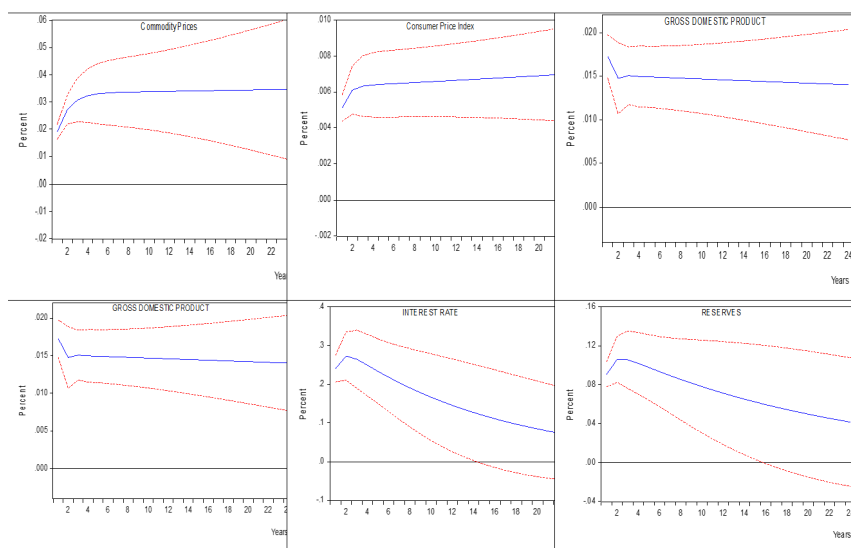


Figure 3A. France Impulse responses to a monetary policy shock

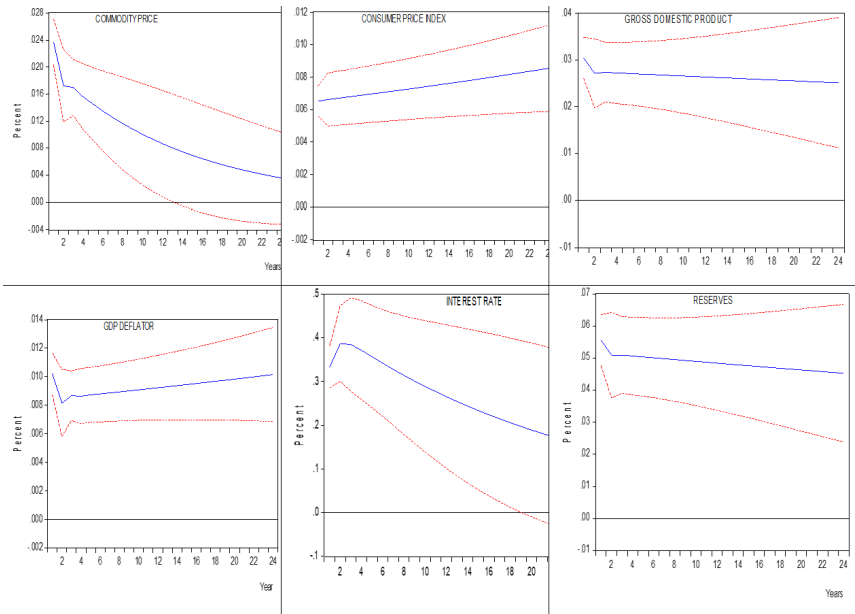


Figure 3B. United Kingdom Impulse responses to a monetary policy shock

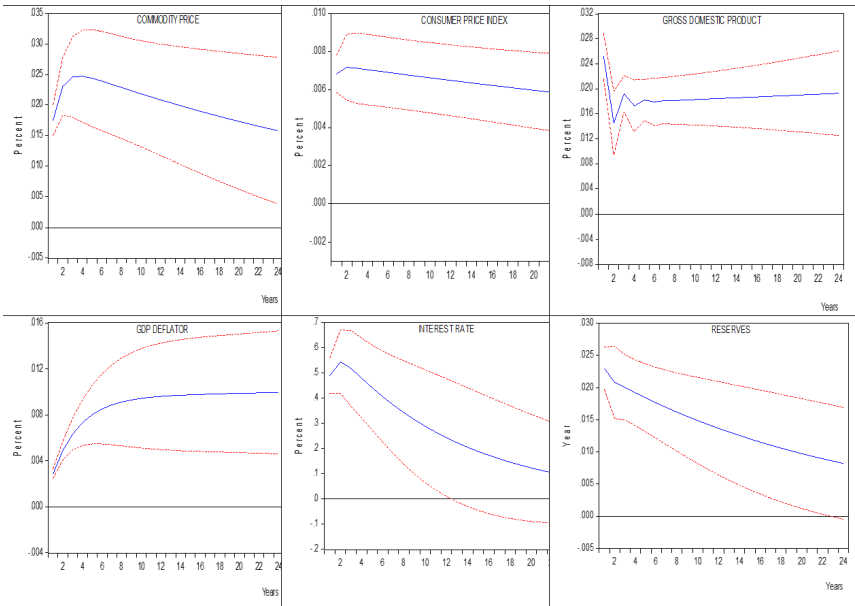


Figure 3C. United States Impulse responses to a monetary policy shock

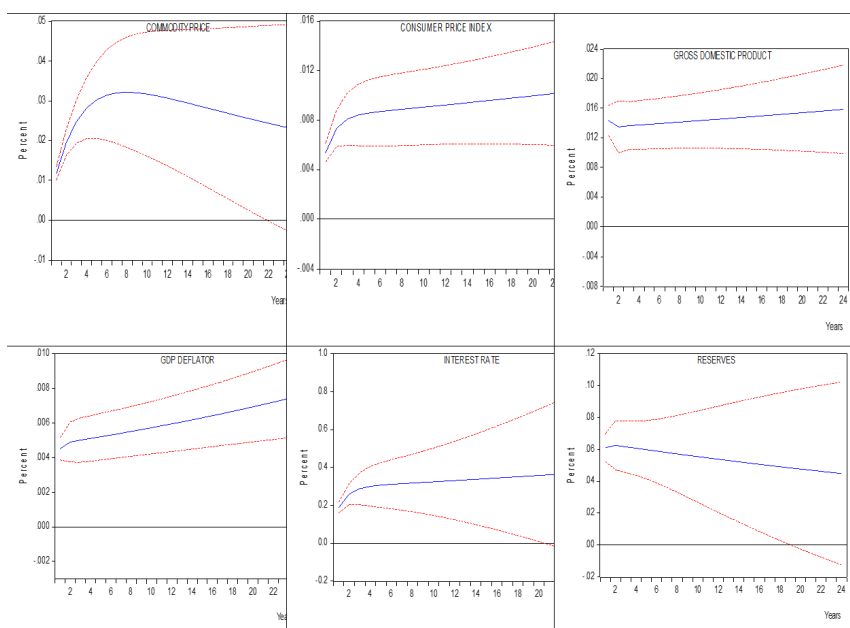


Figure 3D. Germany Impulse responses to a monetary policy shock

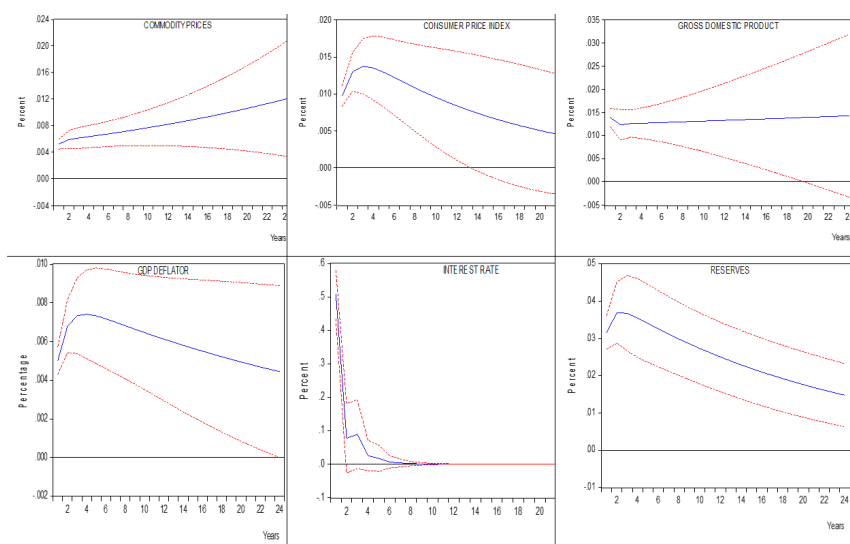


Figure 3E. Japan Impulse responses to a monetary policy shock

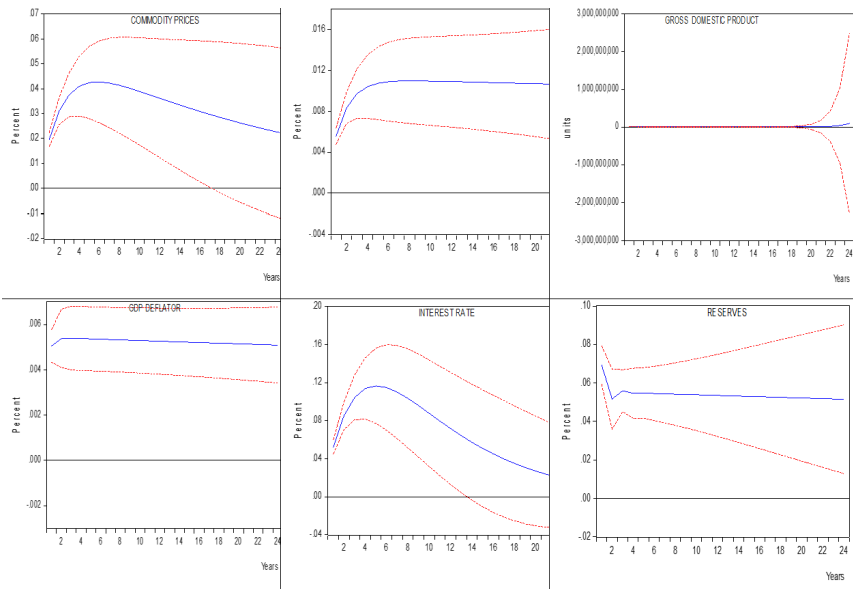


Figure 3F. Italy Impulse responses to a monetary policy shock

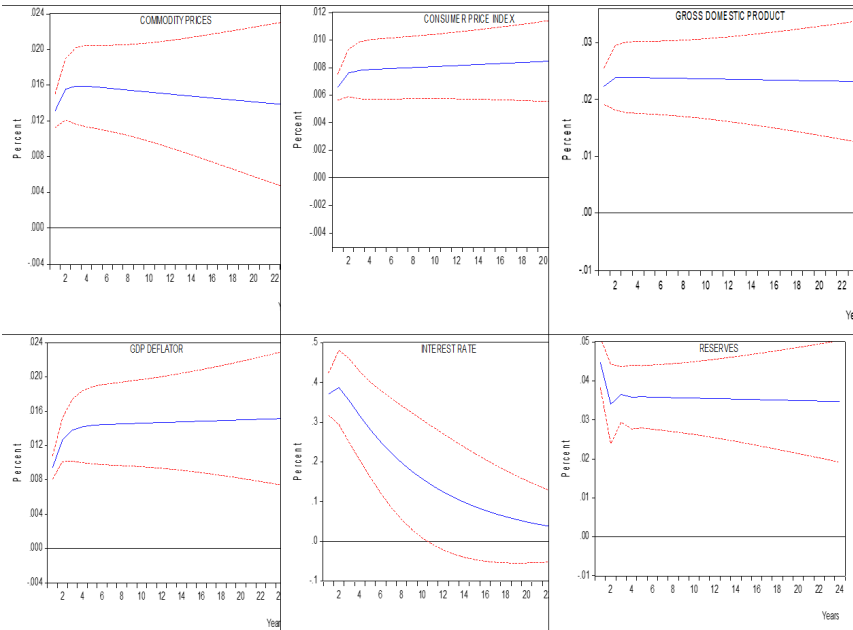


Figure 3G. Canada Impulse responses to a monetary policy shock

Source: Author's own Computation

The IRFs to a monetary policy shock reveal an immediate increase in interest rates for all countries, which aligns with the results of Bernanke and Blinder (1992). GDP initially decreases around 5 basis points, which is a typical response to a monetary tightening, as higher interest rates reduce investment and consumption. However, the medium-term effects reveal heterogeneity among countries: In the USA (Figure 3C), Italy (Figure 3F), and Japan (Figure 3E), GDP continues to exhibit a negative response over a five-year horizon. On the other hand, countries like Canada (Figure 3G), UK (Figure 3B), Germany (Figure 3D), and France (Figure 3A) show a positive response after a few periods, suggesting a potential recovery. These results are broadly in line with studies such as Christiano et al., (1999), who also observed both short- and medium-term contractions in output following a monetary shock.

The response of GDP can be linked to several factors, including the sensitivity of each economy to changes in interest rates, fiscal policy reactions, and structural characteristics such as the openness of trade. The changes in prices measured by commodity prices, CPI, and GDP deflator display notable variation across countries following the monetary policy shock: In France, commodity prices decreased, CPI increased, and reserves remained unchanged. In Germany, both reserves and CPI decreased, while commodity prices and the GDP deflator increased. The UK saw decreases in reserves and GDP deflator, but CPI and commodity prices fell. In Canada, GDP deflator and reserves dropped, while CPI and commodity prices increased. In Italy, all price measures (CPI, GDP deflator, commodity prices, and reserves) decreased with high certainty.

These price movements reflect the complex dynamics between monetary policy and inflationary pressures, which are consistent with those found in Borio and Filardo (2007), who emphasize the asymmetric effects of monetary policy on inflation, depending on whether the economy is in a liquidity trap or experiencing overheating.

Changes in reserves were generally found to be insignificant, reflecting the reduction in bank reserves that typically accompanies tightening monetary policy, which is designed to reduce liquidity in the banking system. To account for the potential impact of extreme financial crises (such as the Global Financial Crisis of 2007–2008 and the COVID–19 pandemic), the study conducted a robustness check using data from 2000 to 2024. The study confirmed similar results, especially regarding the response of GDP, supporting the findings in Gertler and Karadi (2015), who noted that although the economic environment may change, the basic response of output to monetary policy shocks remains largely the same.

In summary, the results from the SVAR analysis of monetary policy shocks provide valuable insights into the transmission mechanism of monetary policy across G7 economies, emphasizing a need for a dynamic global economic environment.

4.6.1 Monetary Policy Under Low Macroeconomic Uncertainty Regime

Figure 4 confirm the IRFs to a change in monetary policy shock for the years where the level of macroeconomic uncertainty is beneath the threshold. This surprise points to an abrupt median surge in the interest rate that is then corrected. In this case, the noteworthy tightening in monetary policy leads to a more noticeable instantaneous median drop in output. In addition, this fall is obstinate for the rest of the period. The response of output is negative with a high subsequent probability for the first few years after the shock.

Furthermore, Figure 4 displays a prolonged weakening in CPI and the response of commodity prices is close to zero. The response of reserves is essentially zero with a 95 percent subsequent likelihood.

Figure 4: Impulse responses to a monetary policy shock - low macroeconomic uncertainty regime.

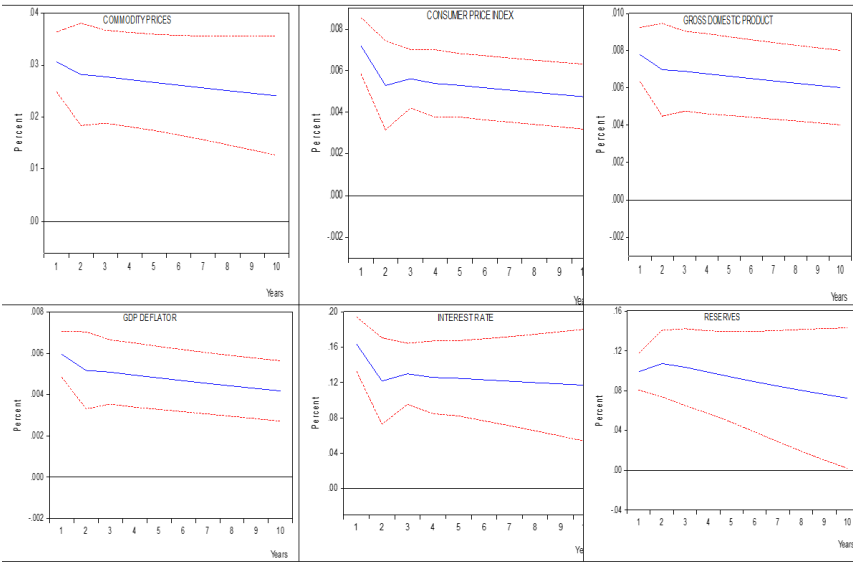


Figure 4A. France

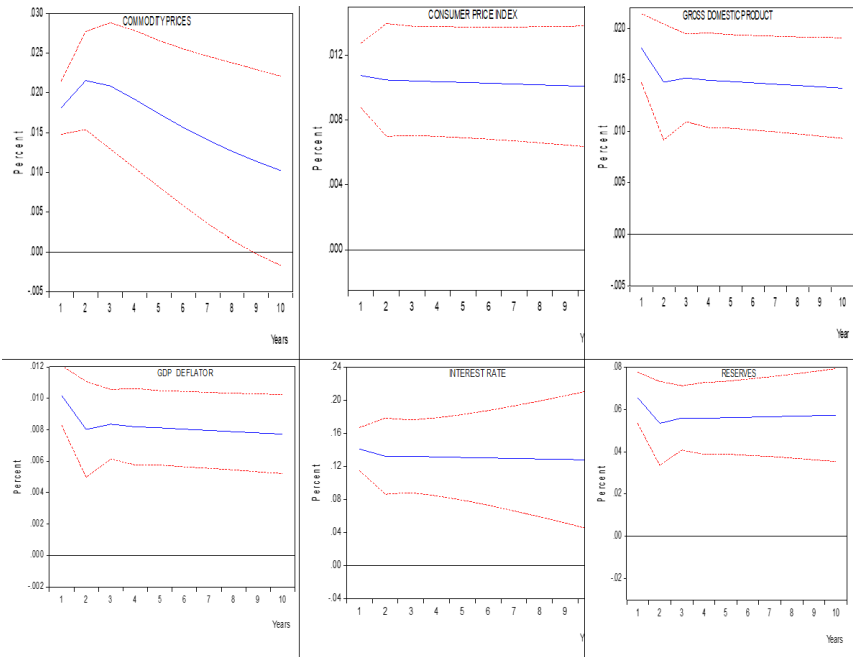


Figure 4B. United Kingdom

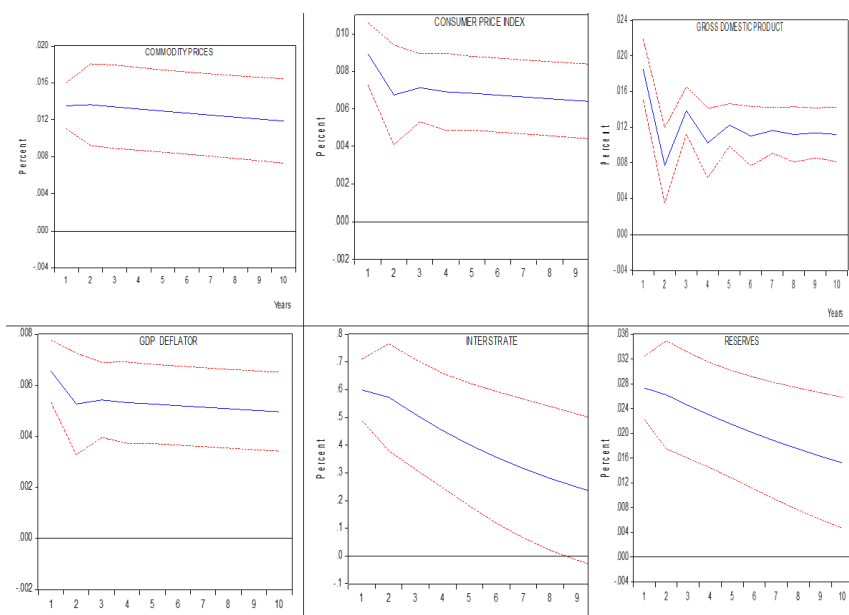


Figure 4C. United States

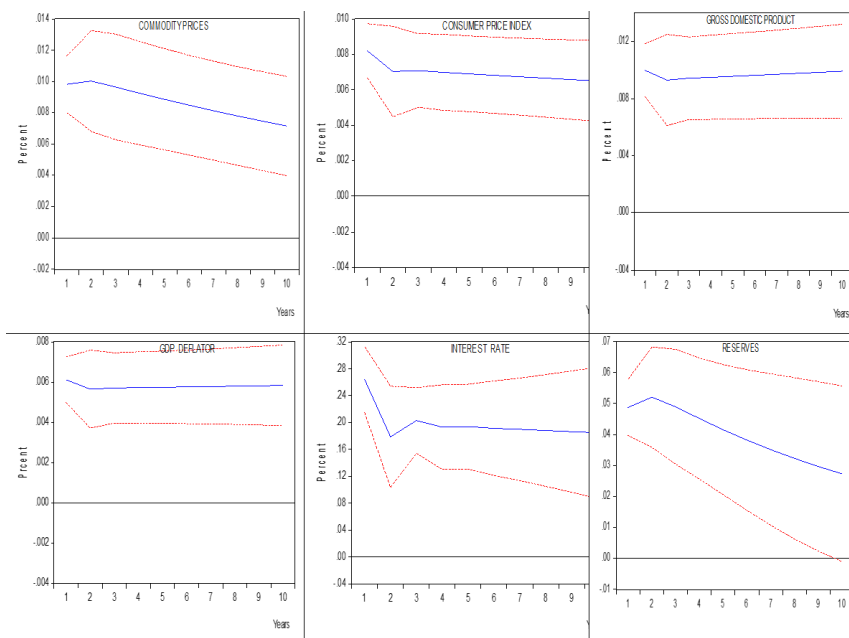


Figure 4D. Germany

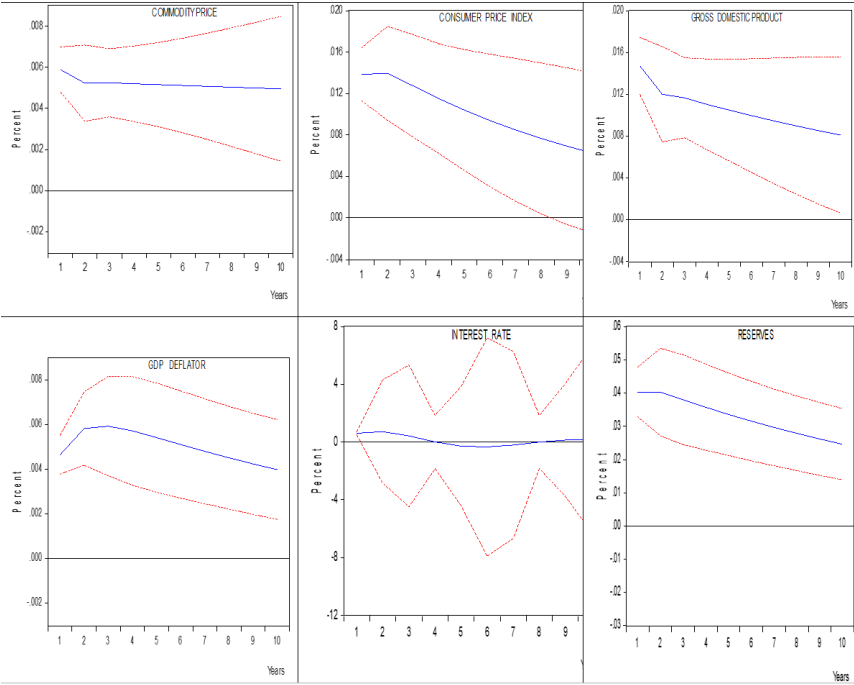


Figure 4E. Japan

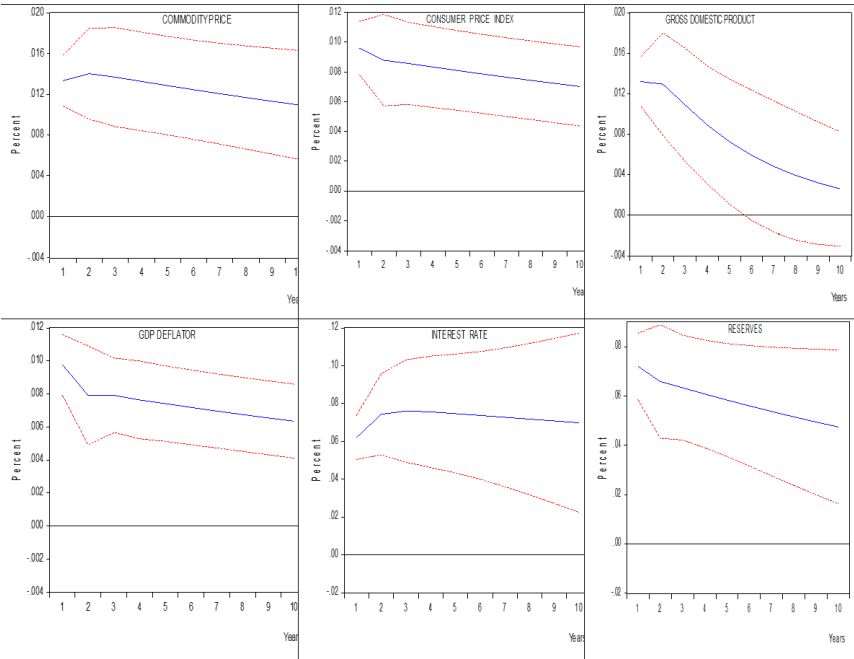


Figure 4F. Italy

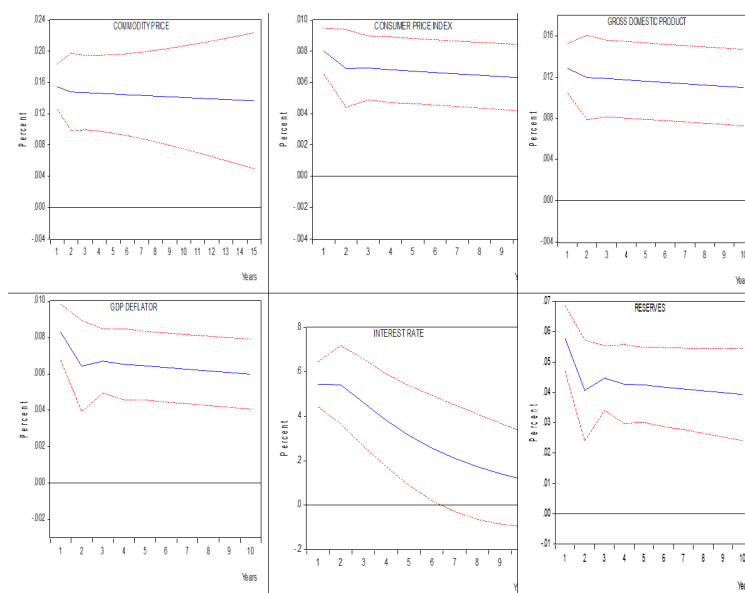


Figure 4G. Canada

Note: IRFs to one standard deviation to a change in monetary policy shock identified using Restrictions 1 and 2. The solid lines depict the point-wise posterior medians and the area in between the solid lines represent the 68 and 95 percent equal-tailed point-wise posterior probability bands.

Source: Author's own Computation

Understanding how macroeconomic uncertainty influences monetary policy is crucial for central banks, particularly in the context of the G7 countries. The IRFs depicted in Figure 4 (Figure 4A to Figure 4G) illustrate how monetary policy shocks in all countries manifest differently during periods of low macroeconomic uncertainty. This analysis is imperative as it provides insights into the dynamics of economic variables when macroeconomic uncertainty is at manageable levels. As shown in Figure 4, during periods when macroeconomic uncertainty falls below a certain threshold, the response of the economy to a monetary policy shock is markedly pronounced. This surge in interest rates following a monetary policy shock is abrupt and reflects the central bank's immediate tightening response. However, this increase is not sustained; it is followed by a correction, where the rates return closer to baseline over time. Such responses are characteristic of central banks adjusting their monetary stance to control inflationary pressures, especially when the economic outlook is relatively stable, as is often the case when macroeconomic uncertainty is low.

Specifically, an unexpected increase in interest rates leads to an immediate median decrease in output, consistent with existing literature on the effects of tightening monetary policy. For instance, similar findings are corroborated by studies such as Christiano et al., (2005), which detail how positive monetary policy shocks result in declines in output following a conventional transmission mechanism where higher borrowing costs dampen investment and consumption.

One of the key findings from Figure 4 is the noticeable drop in GDP following the initial policy tightening under low uncertainty regime. This decline is sharp and immediate, with the median GDP response remaining negative for an extended period, which highlights the concept of "hysteresis". This pattern is consistent with theoretical models of the transmission mechanism, where higher interest rates typically dampen investment and consumption, leading to a reduction in output. Such persistent effects align with the findings of other empirical studies, such as Blanchard and Quah (1989) and Bernanke and Gertler (1995) who emphasize that responses of output to policy shock can

endure especially in uncertainty periods that are stable. Additionally, the persistence of the output drop aligns with the findings of Blanchard and Gali (2007), who also show that monetary policy shocks can have long-lasting effects on output, particularly in economies that exhibit low levels of macroeconomic uncertainty.

In addition to output, Figure 4 shows a marked and prolonged weakening in the Consumer Price Index (CPI) following the monetary policy shock. This is in line with expectations under a tightening regime, where the primary aim of increasing interest rates is to curb inflationary pressures. The downward movement in CPI suggests that the monetary tightening is effective in reducing inflation, though it is not an instantaneous process. The persistence of this reduction further reinforces the idea that central banks target medium- to long-term inflation stability, even when faced with short-term economic downturns. This is an important observation, as it contrasts with the more immediate effects on output and highlights the time-lagged response of inflation to monetary policy. Empirical studies such as those by Taylor (1993) and Clarida et al., (2000) provide evidence that interest rate hikes often result in gradual reductions in inflation, especially in advanced economies where central banks have credibility in their commitment to price stability. The observed lag between the policy shock and the CPI response in the current study aligns well with these findings. Research by Bernanke and Gertler (1995) also supports this observation, positing that monetary policy affects inflation with a lag due to factors like price stickiness and adaptive expectations.

Figure 4 also reveals that commodity prices remain largely unaffected by these shocks, with their responses drifting close to zero. This outcome suggests that in a low-macroeconomic uncertainty environment, commodity markets might not react strongly to changes in interest rates, possibly due to the prevailing stability in global supply and demand dynamics. This view is reflected in the elasticity of commodity prices, as discussed in the analysis by Kilian (2009) regarding the dissociation between monetary policy and the commodity market under certain economic conditions. In contrast, higher levels of macroeconomic uncertainty could amplify commodity price volatility, as market participants react more strongly to potential risks.

Finally, it is noteworthy that the response of reserves following a monetary policy shock remains effectively zero, with a 95% likelihood micrometric to this trend. This could indicate that during periods of low macroeconomic uncertainty, banks may not adjust their reserve holdings significantly in response to interest rate changes, possibly due to stable expectations of future economic conditions. This could mirror findings in literature such as that of Kashyap and Stein (2000), who discuss the stickiness of bank reserves in response to monetary shocks.

When comparing these results to existing empirical literature, several key patterns emerge. For example, in their work, Giannone et al., (2008) find that the transmission of monetary policy shocks is more pronounced during periods of low macroeconomic uncertainty, which is in line with the findings here. The more robust response of output and inflation to policy tightening in a low-macroeconomic uncertainty regime reflects the fact that during such periods, economic agents have greater confidence in the stability of future economic conditions, amplifying the effects of policy changes. Moreover, a study by Cogley et al., (2010) demonstrate that during periods of low macroeconomic uncertainty, central banks tend to implement more aggressive policy adjustments, as seen in the sharp initial surge in interest rates. These studies emphasize the significant role of macroeconomic uncertainty in shaping the strength and duration of monetary policy transmission.

The analysis presented in in this section highlights that monetary policy is more effective in low levels of uncertainty, especially in influencing output and inflation. However, the persistence of these effects may vary depending on the broader economic environment. Future research could further explore how these dynamics differ across various countries, particularly in the context of the G7 nations, comparing the responses across different regimes of macroeconomic uncertainty could offer valuable insights into optimal monetary policy strategies.

4.6.2 Monetary Policy Under High Macroeconomic Uncertainty Regime

In the context of monetary policy, understanding the dynamics of macroeconomic uncertainty is crucial for effective decision-making. In this section, the study illustrates how a monetary policy shock affects various macroeconomic indicators when the level of macroeconomic uncertainty surpasses a certain threshold, previously identified in the analysis. Thereafter, the study provides a robust analysis of how high levels of macroeconomic uncertainty affect the efficacy of monetary policy in G7 countries. Thus, the study will discuss the IRFs illustrated in Figure 5, compare these findings to existing empirical studies, and integrate relevant figures that demonstrate the overall argument more effectively.

Figure 5: Impulse responses to a monetary policy shock - high uncertainty regime

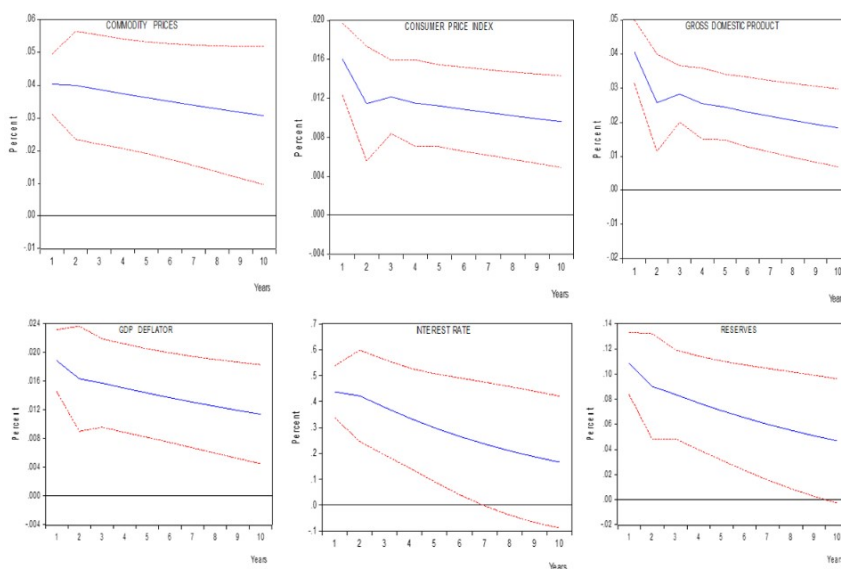


Figure 5A. France

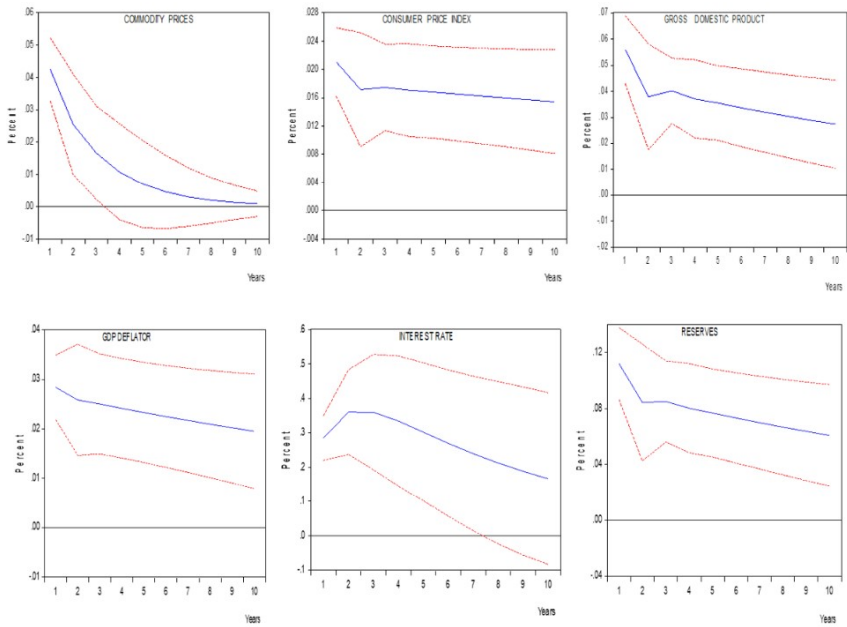


Figure 5B. United Kingdom

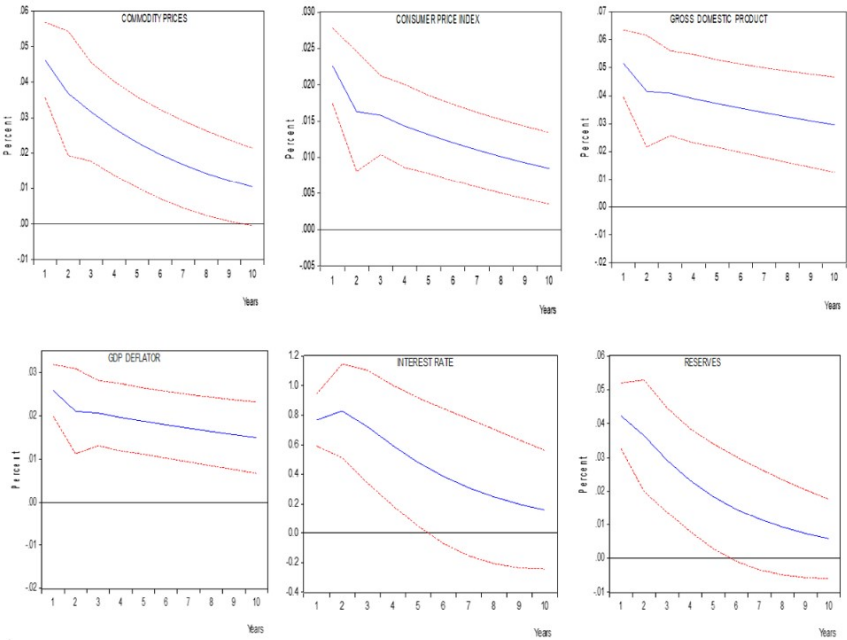


Figure 5C. United States

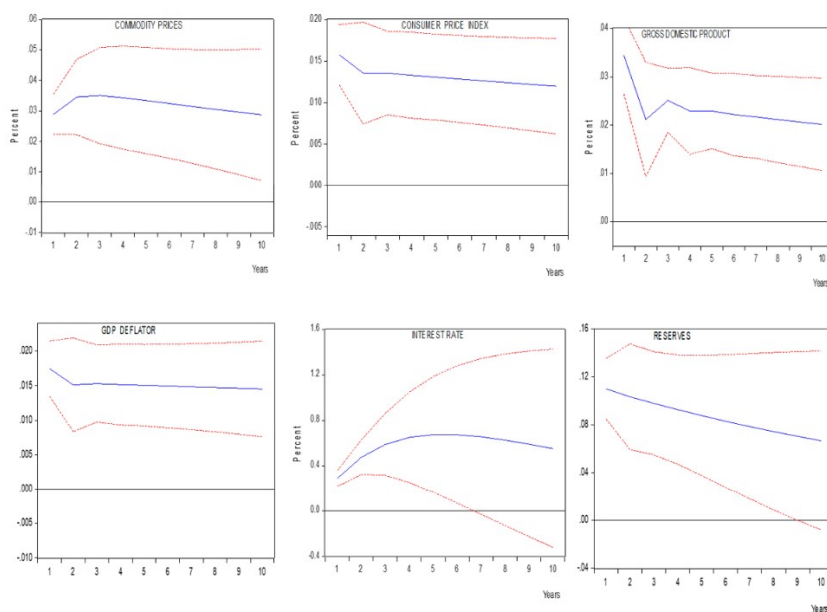


Figure 5D. Germany

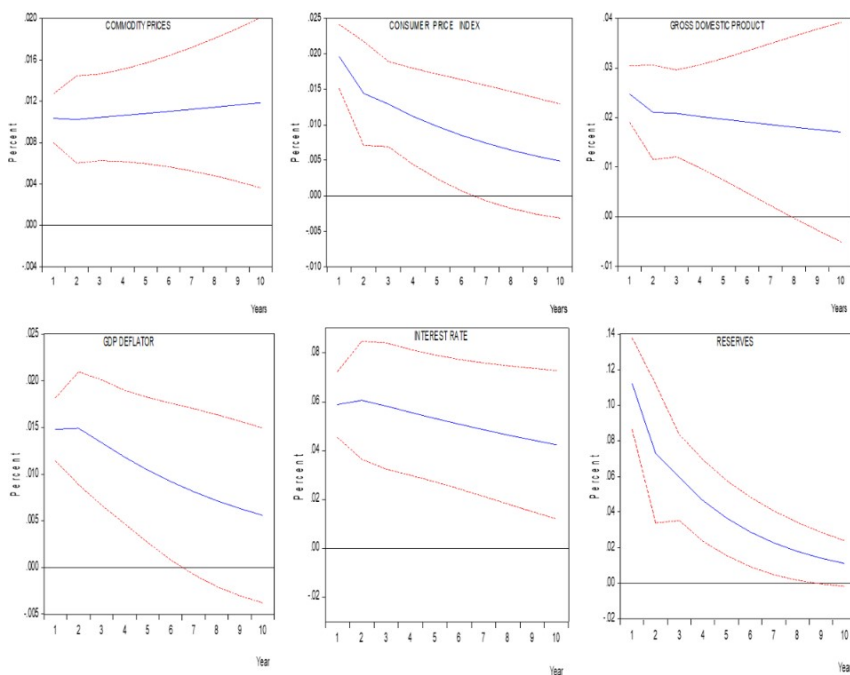


Figure 5E. Japan

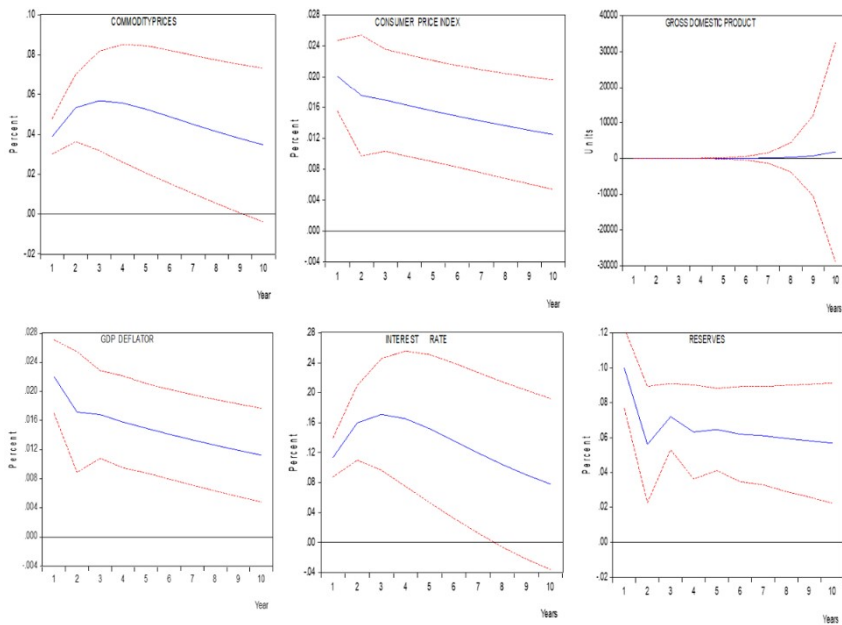


Figure 5F. Italy

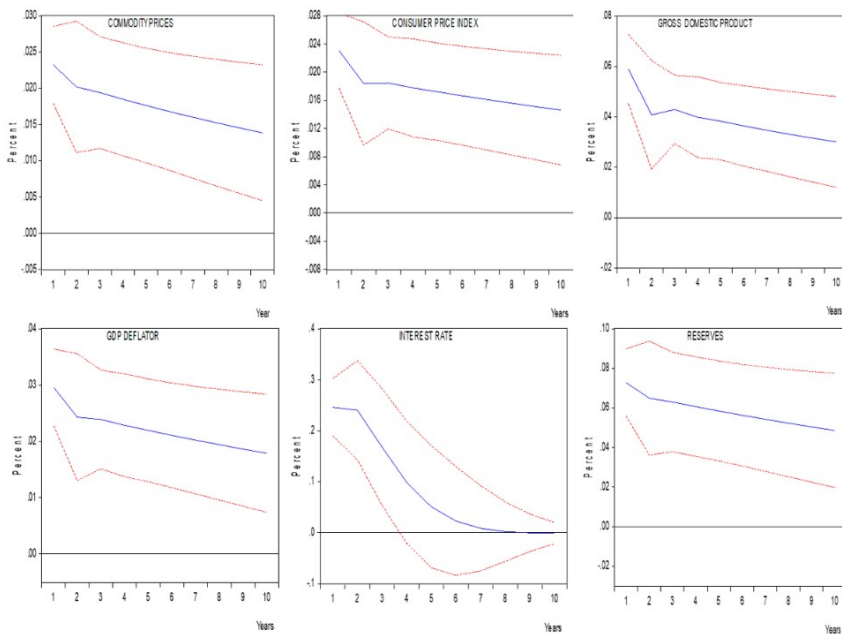


Figure 5G. Canada

Note: IRFs to a one standard deviation change in monetary policy shock are identified using Restrictions 1 and 2. The solid lines depict the point-wise posterior medians, and the area in between the solid lines represents the 68 and 95 percent equal-tailed point-wise posterior probability bands.

Source: Author's own Computation

The IRFs in Figure 5 (Figure 5A to Figure 5G) present the response of key economic variables, including output, commodity prices, the Consumer Price Index (CPI), and reserves, to a monetary policy shock during periods of high macroeconomic uncertainty in all G7 countries. Under these circumstances, the immediate effects of a monetary policy shock on the interest rate are significant, resulting in an instantaneous median rise in the interest rate. However, this is followed by a relatively modest median decrease in output, around 20 basis points. The response of output shows a high degree of macroeconomic uncertainty, with a 95 percent probability that the response will be zero, indicating that the effects on output are not substantial in these high macroeconomic uncertainty periods. This outcome aligns with the hypothesis that during high macroeconomic uncertainty regimes, the transmission mechanism of monetary policy weakens, reflecting diminished economic activity as firms and consumers exhibit greater caution in spending and investment decisions.

Interestingly, commodity prices show some periods of positive responses after a policy shock, though with a high posterior probability. CPI and reserves remain close to zero, indicating that high macroeconomic uncertainty dampens traditional monetary policy effects. Using a high threshold of 90th percentile, can reduce the number of high uncertainty observations, which leads to a larger confidence interval, suggesting that data limitations, not only uncertainty alone, can explain weaker effectiveness of policy.

To highlight this point further, figure 5 shows that high macroeconomic uncertainty regimes do not frequently occur across various G7 countries. The stark contrast in the number of observations during these regimes concludes that any suggested ineffectiveness of monetary policy may stem from sample size limitations rather than true economic responses.

The study's findings resonate with several previous empirical works exploring the differentiated effects of monetary policy shocks in low versus high macroeconomic uncertainty environments. For instance, Ehrmann et al., (2006) utilized CPI microdata to demonstrate that policy effects are significantly weaker amidst heightened firm-level volatility, suggesting inherent responsiveness variances under macroeconomic uncertainty.

Similarly, Pellegrino (2018), as cited in Aquino et al., (2022), Westhuizen et al., (2023), and Martin (2021), finds that interest rate responses to monetary shocks are less pronounced during periods of high macroeconomic uncertainty. These findings are aligned with this study's IRFs, suggesting reduced effectiveness of policy on output and inflation during uncertainty periods.

Additionally, Tillmann (2020), cited in Aquino et al., (2022), highlights that policy contraction in times of high uncertainty leads to a more muted rise in long-term bond yields, due to a fall in term premia. The current study's findings corroborate this view, as it shows a less pronounced effect on long-term impacts of monetary policy when uncertainty is high.

The study's results also align with those of Castelnuovo and Pellegrino (2018), who found that inflation tends to rise faster when macroeconomic uncertainty is high. This study finds that inflation and commodity prices are less predictable during similar periods, whilst they are more stable in low uncertainty periods.

Furthermore, Mano et al., (2020) indicate that in both high and low volatility regimes, prices initially rise following monetary tightening but weaken overtime, supporting the notion that the effects of monetary policy shocks on inflation are delayed. This is consistent with the findings in the current study, where inflation (measured by means of CPI) shows little immediate response but experiences changes over longer horizons.

The implications of these findings for monetary policy discourse are profound. Caraiani et al., (2023) argues that, as central banks navigate periods of economic turbulence characterized by high macroeconomic uncertainty, they may need to realign their policy tools and messaging strategies. Acknowledging the existence of threshold effects can lead to more adaptive monetary policy frameworks that consider current economic sentiment and macroeconomic uncertainties.

4.6.3 *Robustness Check: Alternative Proxy for Macroeconomic Uncertainty*

To ensure the reliability and consistency of our results, a robustness check is conducted using an alternative measure of macroeconomic uncertainty. While the Economic Policy Uncertainty (EPU) Index developed by Baker, Bloom, and Davis (2016) serves as the primary proxy throughout the main analysis, we incorporate an additional uncertainty measure to test the sensitivity of our findings.

Specifically, we employ the Macroeconomic Uncertainty Index constructed by Jurado et al., (2015), which captures a broader and model-based estimate of macroeconomic uncertainty derived from a large panel of macroeconomic and financial time series. Unlike the EPU Index—which is primarily based on newspaper coverage frequency—the Jurado et al., (2015) Index reflects the conditional volatility of unforecastable components in economic variables, offering a complementary and theoretically grounded perspective.

The robustness check involves re-estimating the SVAR model using this alternative measure and identifying whether the threshold effects and the general direction and magnitude of monetary policy responses remain consistent. The results confirm that the key empirical findings—namely, the amplification of macroeconomic shocks during high uncertainty regimes and the nonlinear impact of uncertainty on monetary policy—are robust to the use of a different uncertainty proxy.

This robustness analysis enhances the credibility of the study's conclusions and mitigates concerns about model dependence on a single uncertainty metric.

4.7 *Conclusion*

In this study, we examined how macroeconomic uncertainty affects monetary policy in the G7 countries. By employing the SVAR model, we conclude the presence of a statistically significant macroeconomic uncertainty threshold. When macroeconomic uncertainty crosses this threshold, central banks respond differently to shocks. In the high uncertainty regime, central banks face a complex dilemma in responding to macroeconomic shocks, as they become hesitant or overly cautious, leading to weaker policy decisions. In low uncertainty regime, monetary policy is more effective and has a stronger impact on inflation and output.

Our study also highlights that these effects across the G7 economies are not the same, based on their unique economic structures, institutional frameworks, and historical experiences. This finding reinforces the importance of considering country-specific dynamics when designing and implementing monetary policy in the context of macroeconomic uncertainty.

For further research, it would be imperative to investigate how global macroeconomic uncertainty influences domestic monetary policy decisions, particularly in open economies such as those in the G7. Studies could also investigate how fiscal and global uncertainty affects monetary policy decisions. An additional potential avenue for future study is to investigate the impact of external shocks, such as geopolitical events or global financial crises, on the macroeconomic uncertainty thresholds and monetary policy response. By extending the analysis to emerging economies and examining how central banks' communication and behaviour influences decision making, could also provide valuable insights for implementing policies that are more effective in uncertain periods.

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