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Monetary Policy Uncertainty and Stock Market Returns in Developed and Emerging Countries: Evidence from a Quantile-on-Quantile Approach

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Abstract

Purpose: In the recent past, investors, decision-makers, and academics have shown an immense level of stake in policy uncertainty because of its devastating effect on the macroeconomic landscape of countries. Consequently, this study examines the impact of monetary policy uncertainty (MPU) on the stock market returns of emerging and developed countries.

Methodology: To achieve the study's objective, monthly data of MPU and stock prices covering January 2000 to June 2023 are employed. This study used the Quantile-on-Quantile regression (QQR) approach for empirical estimations.

Findings: The outcome indicates that stock returns in developed as well as emerging economies are negatively affected by MPU. Furthermore, findings observe significant variation between quantiles of MPU and stock returns within each economy. Additionally, this study also reveals that MPU has a positive impact on stock market returns when the uncertainty is at a lower quantile. It is also noticed that stock market reactions are more erratic in emerging as well as in developed economies.

Originality/value: This study provides a comprehensive and precise interpretation of the dynamic relationship between MPU and stock returns, revealing how the stock market counters the MPU across various quantiles.

Implications: The findings provide valuable insights for both policymakers and investors, emphasizing the role of financial openness, stock market conditions, and varying levels of policy uncertainty when developing domestic policies. More specifically, the results offer valuable guidance for portfolio managers seeking to hedge against policy-driven volatility and for regulators aiming to strengthen financial resilience.

Keywords: MPU; Quantile-on-Quantile approach; Stock market return; Developed economies; Market interdependence.

JEL classifications: G15, G10, E44, C14

1. Introduction

Uncertainty in monetary policy is the main risk factor in financial markets. It influences the price of an asset, investment decisions, financial allocation, and the general well-being of the economy. Similarly, sector-specific industries and stock markets are significantly affected by MPU (Borio & Zhu, 2012; Clance et al., 2020; Paule-Vianez et al., 2020). Recently, the global financial markets have become increasingly interconnected, significantly impacting domestic financial markets. Consequently, such markets are susceptible to external shocks. These shocks are caused by many factors, such as global financial crises, recessions, monetary and trade policy spillovers, black swan events, natural disasters, calamities, and other geopolitical risks (Billio et al., 2012). In line with this concept, Mishkin (2007) documented that a decline in the real interest rates results in lowering the capital cost and enhancing the level of investments. Similarly, with exposure to various risk variables, each sector responds differently to changes in monetary policy. In response to this, investors and policymakers need to understand how stock returns and MPU are related to managing risk and formulating the right strategies (Adebayo et al., 2022; Dhaene & Schoutens, 2015; Gohar et al., 2022; Li & Li, 2019). Amid the unforeseen economic and financial catastrophe in 2007, the Federal Reserve promptly reduced the interest rates to nearly zero. Then, it launched three consecutive quantitative easing (QE) rounds, ushering in a new era in US monetary policy. Similarly, as part of the process of normalizing policy, from 2015 to 2018, the Federal Reserve declared that it would increase the federal funds policy rate target (Chen et al., 2016). Similarly, global financial markets and the United States (US) monetary policy affect interest rates and, more specifically, other regions of the US. The Fed's FRB/US model suggests that the equivalence of 3 percentage points of policy space (offsetting the impacts of the lower bound) can be achieved by QE forward guidance, even at the range between 2-3 percent of the nominal neutral interest rate, which is consistent with most estimates of the US.

The financial markets worldwide have recently experienced significant uncertainty due to the Federal Reserve's monetary decisions (Jiang et al., 2023; Ren et al., 2022). Similarly, MPU uncertainty in the US has a significant influence on other countries (Yin & Han, 2014; Zhang & Hu, 2023). Several recent studies have shown that changes in U.S. monetary policy significantly influence financial markets. However, these studies do not adequately examine how various uncertainty quantiles affect the stock return quantiles (Bernanke & Kuttner, 2005; Jensen & Johnson, 1995; Pearce & Roley, 1983). Similarly, Khan et al. (2023a) document that MPU in the U.S. has an asymmetric spillover effect on returns in emerging economies. Several studies have documented that U.S. MPU shocks possess predictive power for emerging economies, particularly in terms of their vulnerability to stock prices (Balcilar et al., 2021; Bekaert et al., 2021). Numerous studies have investigated the impact of MPU on stock market performance. As a result, Chevapatrakul (2015) employs quantile regression (QR) to investigate how MPU affects stock market performance. The author concludes that the underlying variables in the upper quantiles have an unbalanced relationship. Similarly, previous literature has documented that the traditional econometric approach has failed to capture stock price characteristics accurately (Jiang et al., 2018; Souza et al., 2023; Waqar et al., 2023; Xiao et al., 2018). Several studies have documented a heterogeneous relationship between stock returns and financial factors under different market conditions (Imane et al., 2023; Maydybura et al., 2023; Zhu et al., 2016). Similarly, several studies have reported that fluctuations in U.S. monetary policy exert a significant influence on financial markets. Nevertheless, the existing literature does not sufficiently address the impacts of

varying quantiles of uncertainty on the quantiles of stock market returns. (Bernanke & Kuttner, 2005; Zhang & Hu, 2023).

The prevalent techniques for analyzing the stock market, such as the vector autoregression (VAR) approach and Ordinary Least Squares (OLS) or QR, fall short of capturing the complex interdependent association at various quantiles for variables. To overcome the issue, Sim and Zhou (2015) developed the Quantile-on-Quantile regression (QQR) model, which cartels the QR and non-parametric assessment approaches to demonstrate the non-linear association among variables, providing in-depth knowledge of the general interdependence of these variables. In addition to measuring the magnitude of MPU, Baker et al. (2016) established an index based on how frequently important terms, such as the Federal Reserve, FED funds rate, money supply, etc., were reported in the newspaper. A high MPU index shows a high level of uncertainty concerning the prospects of the Federal Reserve's policy rate due to the quantitative easing (QE) tapering and timing linked to the ever-changing economic conditions (Wen et al., 2022b). Similarly, Bernal et al. (2016) concentrate on the impact of the policy uncertainty index on stock market returns. According to Laffont (1998), emerging markets with very small market segments have imperfect competition. Numerous studies have focused on the relationship between monetary policy uncertainties and inflation or financial assets. Therefore, in-depth explanations of MPU on stock markets still require further investigation (Kyriazis et al., 2024). Previously, numerous studies investigated this phenomenon e.g., MPU, inflation and volatility (Athari et al., 2021; Choi et al., 2018; Hoffmann et al., 2022; Selmi et al., 2020), uncertainty and gold prices (Beckmann et al., 2019; Wen et al., 2022b), uncertainty in the U.S. and global oil prices (Tiwari et al., 2023; Yang et al., 2024), uncertainty and consumption (Al-Thaqeb et al., 2022) uncertainty and bond yields (Chen & Tillmann, 2021; De-Pooter et al., 2021) MPU and stock markets (Kurov & Stan, 2018).

To analyze the differences and similarities in how the market responds to MPU in the selected countries, this study reviews the nexus between MPU and stock returns in developed and emerging countries. According to Potjagailo (2020), the interdependencies across nations create a common factor that underpins the global economic cycle. By doing so, a MPU index formulated by Baker et al. (2016) is considered to examine the impact of the θ^{th} quantile of MPU on the θ^{th} quantile of stock market returns, employing the QQR approach. Here are a few ways this study expands existing literature. To begin with, this study is the first one to use the QQR methodology to examine the effect of MPU on both the stock market returns of developed and emerging economies in the United States. Second, our study complements other studies in that regard, as the QQR methodology captures the effect of MPU on various quantiles of stock market returns more accurately. The conclusion of this study emphasizes the importance of considering both the result and the explanatory variable quantiles. Therefore, employing the QQR approach of Sim and Zhou (2015), this study concludes that the U.S. MPU has a negative and significant influence on the stock returns of emerging as well as developed countries. Similarly, our studies also report the positive effect of MPU at various quantile levels.

Furthermore, contrary to the earlier findings of Antonakakis et al. (2013), which report a negative correlation between stock returns and MPU, our study reports that MPU positively affects the stock market returns at some specific quantiles. Second, by providing a more thorough analysis of MPU's effect on other economies, this study analyses the nexus between stock returns and the monetary uncertainty index in U.S. emerging markets. The varying responses to MPU shocks observed in each

specific stock market during the mentioned period indicate how different countries are affected by uncertainty. Similarly, the degree of economic openness (Ehrmann & Fratzscher, 2009), variations in exchange (Wei et al., 2019), international trade and economic ties between countries (Liu et al., 2023), and other significant influencing factors must all be taken into consideration. Similarly, this study provides significant insights for investors and portfolio managers. These findings are also helpful for policymakers, monetary authorities, and central banks.

The rest of the paper is organized as follows: Section 2 describes the data and methodology. Sections 3 and 4 discuss empirical findings and discussion. This study concludes with policy implications in Section 5.

2. Literature Review

2.1 Real Option Theory

The real option theory mainly originated from the work of Myers (1977), McDonald and Siegel (1986), and Majd and Myers (1990), which document a paradigmatic influence on the way investment choices are made, both in practice and in theory. Economic uncertainty, technical uncertainty, and managerial flexibility of the project affect investment decisions, including purchases of new equipment, the increase in workforce, the creation of new products, and the economic evaluation of the project. Economic uncertainty refers to the aspects that are exogenous to the project and are normally reflected by stochastic prices of products and project costs (Pacheco & Vellasco, 2009). Internal factors bring about technical uncertainty, including uncertainty about the magnitude of the outcome of the project and how the project will perform due to the technologies used. Managerial flexibility built into projects offers managers the freedom to decide whether to invest to expand, to temporarily close, or abandon a particular project. These flexibilities are referred to as real options. Any of these possibilities, not taken into consideration during economic analysis, are likely to result in the project being possibly undervalued, and this could be irreparable and cause irreversible decision-making errors. Thus, the value of managerial flexibility is not considered through traditional methods like the net present value (NPV) and the internal return rate (IRR) approaches (Copeland & Antikarov, 2005; Dixit & Pindyck, 1994).

Similarly, under the Keynesian literature paradigm, monetary policy is discussed as a critical tool that affects the economic activities and performance of stock markets (Abille & Mpuure, 2020). Moreover, the existing literature on financial markets reveals that an easy monetary policy is reflected in the injection of liquidity into the economy, which increases practical demands and boosts stock prices (Alaoui et al., 2020). Chauvet and Jiang (2023) find a positive stock market return response to an expansionary monetary policy. Considering the rational expectation theory, Wang et al. (2023) document that unanticipated policy changes significantly affect the stock market performance. In this context, the research direction of MPU is more focused on the reaction of stock markets in response to unexpected policy changes. However, overcoming the consequences of the lower bound may necessitate additional steps if the neutral rate is significantly lower. These might include a slight rise in the inflation target or a stronger dependence on fiscal policy to stabilize the economy (Bernanke, 2020). In addition, Kumar and Paramanik (2022) reported that business and financial cycles also received primary shocks due to policy uncertainty, apart from the changes in the policy rate of the Central banks, due to the high international financial amalgamation, investors, policymakers, and

scholars have paid attention to policy uncertainty (Han & Wang, 2023; Kamara & Koirala, 2023; Uddin et al., 2020; Wen et al., 2022a).

Additionally, according to Trung (2019), the characteristics of the receiving nation, including its level of development, trade, and financial competitiveness, and the caliber of its organizations, are related to the spillover effect of MPU in the U.S. on various countries. Hassani et al. (2020) demonstrate that the U.S. interest rate forecast does not significantly benefit from changes in uncertainty measure movements. Further, it finds that policymakers in the United States are unlikely to enhance their forecasting accuracy of future mean and volatility movements. Shiba and Gupta (2021) examined the predictive power of the uncertainty index for U.S. securities. Their findings indicate that the uncertainty index significantly impacts U.S. treasury stock in the short-medium and long-run horizons. Aor et al. (2021) demonstrate that the shocks to the U.S. MPU have adverse effects on real equity prices. However, the effects are more significant in advanced markets than in emerging ones, due to the former's stronger ties with the U.S. economy. Similarly, Vo et al. (2024) examine the return spillover of specific sectors and their response to U.S. uncertainty, employing the VAR connectedness approach. Their findings indicate that heightened uncertainties in the U.S. significantly affect stock returns. Similarly, Sen and Rajan (2024) examine the spillover from U.S. MPU to other advanced economies, employing the pooled mean group (PMG) estimator. Their findings suggest that the U.S. MPU has a substantial impact on the financial position of advanced economies. Furthermore, it finds that the advanced economies are comparatively better off in the short run. Arshad et al. (2024) investigate the impact of the MPU of the US on Asian developed, emerging, and frontier stock markets. Employing the Quantile-on-Quantile regression (QQR) approach, their findings indicate that MPU in the US has a negative influence on Asian stock markets. Ullah et al. (2025) examine the effect of Japan's MPU on Asian developed, emerging, and frontier stock markets. Utilizing the QQR approach, the authors document that across various quantiles, Japan's MPU negatively influences the stock returns of Asian developed, emerging, and frontier economies. Similarly, Arawomo et al. (2025) examine the impact of MPU on African stock markets. Employing quantile regression, their findings reveal that MPU has a positive impact on stock returns in South Africa and Egypt. Conversely, their findings reveal that MPU negatively affects stock returns in Mauritius, Kenya, Ghana, and Nigeria.

3. Data and Methodology

3.1 Data

To investigate the impact of U.S. MPU on stock markets, we use monthly data on the MPU and stock market returns from December 2010 to July 2023. Similarly, the stock market includes the USA (S&P 500), Canada (S&P/TSX), Brazil (Bovespa), Chile (S&P CLX IPSA), Colombia (COOLCAP), Mexico (BMV IPC), and Peru (S&P Lima General), which are the stock price indexes for both developed and emerging countries. These markets are selected based on classifications from Morgan Stanley Capital International (MSCI). Furthermore, the index price data are taken from investing.com, and the monthly logarithmic series of the MPU index (lnMPU) were obtained from the official database (<http://www.policyuncertainty.com/>) created by Baker et al. (2016). Previous studies highlight that while excessive or suboptimal uncertainty can stifle economic activity, a certain amount of uncertainty could encourage future economic growth (Gong & Lin, 2018; Segal et al., 2015).

Moreover, Pástor and Veronesi (2013) argue that when economic policies are perceived as suboptimal by stakeholders, the likelihood of policy adjustments increases during periods of economic stress.

3.2 Methodology

For the empirical analysis, we employ the QQR approach, following the methodology of Sim and Zhou (2015), since it makes it easier to combine non-parametric estimation with quantile regression. To observe how the explanatory variable affects the quantiles of the response variable, Koenker and Bassett (1978) proposed the conventional quantile regression. More specifically, this methodology has two key advantages over Quantile Regression (QR). First, QR is employed to estimate how changes in one model parameter affect the quantiles of another model (Bao et al., 2022; Sim & Zhou, 2015). Whereas the QQR approach serves as a generalization of standard QR and examines how the quantiles of an explanatory variable impact the conditional quantiles of the dependent variable. Second, unlike the standard QR technique, the QQR approach also elucidates how different states of the explanatory variable influence the conditional quantiles of the dependent variable (Hung et al., 2022). Similarly, Dagar and Malik (2023) consider the QQR as a practical methodology for achieving a robust outcome in the pragmatic analysis of monthly frequency data, allowing for the investigation of asymmetries and their ability to capture heterogeneity in the effects of MPU across several levels of returns on stock. By evaluating how these effects vary across quantiles, this study provides an in-depth understanding of how different market segments respond to uncertainty shocks. Similarly, QQR enhances the robustness of the study findings by mitigating the influence of outliers and extreme observations, ensuring that the analysis accurately captures the nuanced relationship between MPU and stock returns over time and across different economic conditions in the region. Furthermore, we examine the local effects of quantiles of the explanatory factors on the exogenous variable using the local linear regression method proposed by Stone (1977) and Cleveland (1979). Likewise, QQR avoids the "curse of dimensionality," a problem mainly linked with non-parametric estimation.

Furthermore, by combining these two methods to empirically assess the relationship among the quantiles of explanatory and exploratory variables, the QQR approach, unlike other related techniques like OLS or simple QR, stipulates a detailed and accurate description of how the variables are associated. Similarly, Baharumshah et al. (2016) document that future economic growth and uncertainty are positively correlated. On the other hand, too little uncertainty could lead to a pessimistic forecast for economic development. Furthermore, the anticipated changes will intensify during unfavorable times if policy stakeholders do not view the financial policy as optimal due to the region's shifting political and economic dynamics. This study obtains data from December 2010 to July 2023, providing a detailed insight into the outcomes of policy uncertainty. The stock return in the study is calculated as:

$$R_{i,t} = 100 * \ln \left(\frac{P_{i,t}}{P_{i,t-1}} \right), \quad (1)$$

Where, $P_{i,t}$ is the monthly price index of country i at time t . Furthermore, Shahbaz et al. (2018) claim that the quantile regression and non-parametric equation represent the QQR technique.

$$R_i = \beta^\theta (MPU_{US}) + \alpha^\theta r_{i-1} + \mu_i^\theta, \quad (2)$$

where stock market returns are denoted by R_i at time i . MPU shocks are depicted by MPU_{US} , the quantile error term is denoted by μ_i^θ , whereas the β^θ is the slope that identifies the effect of MPU shock on stock prices.

The critical advantage of the QQR approach is that it further captures the complex nexus between the uncertainty index and stock market returns. To highlight the association concerning the θ^{th} quantile of the stock market returns and the τ^{th} quantile of MPU is mentioned as MPU_{US}^τ . A linear regression model is employed to investigate the relationship in the vicinity of MPU_{US}^τ . Furthermore, considering the uncertain value of β^θ , the 1st order Taylor expansion used along the quantile of MPU_{US}^τ , given as follows:

$$\beta^\theta(MPU_{US}) \approx \beta^\theta(MPU^\tau) + \beta^{\theta'}(MPU^\tau)(MPU_{US} - MPU^\tau), \quad (3)$$

where $\beta^{\theta'}$ shows the partial derivative of $\beta^\theta(MPU_{US})$ w.r.t MPU . This is commonly known as the marginal effect of the response variables in the equation, like the slope coefficient of the simple linear regression equation. Where the term $\beta^\theta(MPU^\tau)$ and $\beta^{\theta'}(MPU^\tau)$ represents the functions of θ and τ respectively. Furthermore, $(MPU_{US} - MPU^\tau)$ described the unexpected shock of MPU. In addition, $\beta^\theta(MPU^\tau)$ and $\beta^{\theta'}(MPU^\tau)$ can be rewritten, and the following equation is obtained, represented as follows:

$$\beta^\theta(MPU_{US}) \approx \beta^\theta(\theta, \tau) + \beta_1(\theta, \tau)(MPU_{US} - MPU^\tau), \quad (4)$$

Substituting Equation (4) in Equation (2), the following equation is derived:

$$R_i = \beta_0(\theta, n) + \beta_1(\theta, \tau)(MPU_{US} - MPU^\tau) + \alpha(\theta)r_{i-1} + \mu_i^\theta, \quad (5)$$

where in Equation (4), $\beta_0(\theta, \tau) + \beta_1(\theta, \tau)(MPU_{US} - MPU^\tau) + \alpha(\theta)r_{i-1}$ is the θ^{th} conditional quantile estimates of stock returns. In contrast to the typical quantile regression model, the equation in Equation (5) presents the authentic estimates of the effect of various MPU quantiles on the corresponding stock return quantiles. While the magnitude of the coefficients of β_0 and β_1 are explained by the values of θ and τ . Furthermore, by connecting their respective distributions, Equation (5) captures the overall dependence structure between the stock market returns and the MPU index, as this method only produces a linear relationship across the quantiles of variables.

The severity of situations in the stock market is indicated by greater or lower quantiles of stock returns in Equation (5). Accordingly, we regard a higher θ -quantile as a boom and a lower θ -quantile as a stormy period. In addition, lower quantiles of the MPU index reflect the reduction in the levels of uncertainty and vice versa by the masses about the policy repercussions and actions, and there may be significant changes to future policy with huge τ – quantiles. The magnitudes of β_0 and β_1 contain information about the potential impact, which might be complex as well. For example, $\beta_0(\theta, \tau)$ shows an impulsive change in stock returns at various levels of uncertainty, while $\beta_1(\theta, \tau)$ measures the extent of response to an uncertain shock of policy on the market returns. Thus, β_0 and β_1 are approximated by simple regression to derive the subsequent equation:

$$\min b_0, b_1 \sum_{i=1}^n \rho_\theta [R_i - b_0 - b_1(\widehat{MPU}_{US} - \widehat{MPU}^\tau) - \alpha(\theta)r_{i-1}] K\left(\frac{F_n(\widehat{R}_i) - \tau}{h}\right), \quad (6)$$

where in Equation (6), ρ_θ reflects the quantile loss function, which is given as $\rho_\theta(u) = u(\theta - I(\mu < 0))$, where I , shows a common function. $K(\cdot)$ shows the Gaussian kernel function (GKF), including bandwidth h , applied to weigh the variables in the vicinity of MPU^τ . These allotted weights are inversely associated with the gap between the functional division of \widehat{R}_i , which is estimated by a function $F_n(\widehat{R}_i) = \frac{1}{n} \sum_{k=1}^n I(\widehat{R}_k < \widehat{R}_i)$, and the value of the distribution function matches the τ th quantile of MPU, denoted by τ .

Furthermore, choosing the bandwidth h in the GKF is important, as it determines the smoothness of the result and indicates the magnitude of the region surrounding the focal point. The variance would be higher, but the deviation may be minor if the bandwidth (h) is small and vice versa. This study selects the bandwidth of $h = 0.05$, following Sim and Zhou's (2015) methodology, which also considers kernel regression.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1. Summary Statistics

Variables	Mean	Std. Dev	Skewness	Kurtosis	Jarque-Bera	ADF	DW-Stat	Obs
Canada	0.00284	0.0353	-1.2546	9.2100	282.26***	-13.5641***	2.2180	151
US	0.00857	0.0415	-0.5573	3.9411	13.392***	-14.3201***	2.3287	151
Brazil	0.00374	0.0647	-1.0571	8.0896	191.11***	-11.1579***	1.8239	151
Chile	0.00173	0.0491	0.0142	3.5951	2.234	-14.2540***	2.2876	151
Colombia	-0.00291	0.0528	-1.5413	11.2852	491.68***	-12.1016***	1.9881	151
Mexico	0.00252	0.0420	-0.5109	5.7136	52.902***	-13.9521***	2.2433	151
Peru	0.00004	0.0614	-0.3149	3.8332	6.863**	-11.0728***	1.8103	151
lnMPU	4.27135	0.6319	0.1414	2.2290	4.244	-4.68729***		151

“Note: *, **, and *** denote significance at 10%, 5%, and 1% level, respectively.” US stands for the United States, and MPU is the natural logarithm of monetary policy uncertainty.

Table 1 shows the summary of key descriptive statistics of the variables. The MPU index has a high standard deviation and a positive average value. This suggests that MPU is unstable and time-varying in the United States, except in Colombia, where positive values are observed in stock returns. **Table 1** indicates that stock returns in the emerging and developed markets of the United States are also volatile, as noted in the levels of the standard deviations of the stock market data. Moreover, the Augmented Dickey–Fuller (ADF) test confirms the statistical significance at the 1% level, leading to the rejection of the null hypothesis of the presence of a unit root. This confirms that all variables are stationary at level I (0). Furthermore, the significant Jarque-Bera statistic rejects the null hypothesis of normality, suggesting that the stock return series follows a non-normal distribution characterized by fat tails and skewness. This justifies employing a quantile-based approach rather than relying solely on traditional mean-based models. The MPU index and stock return properties exhibit comparable patterns, including abnormality with fat tails and generally positive means for all the variables. The Durbin–Watson statistics (DW-Stat) range from 1.81 to 2.32, clustering around the benchmark value of 2.0. This suggests that the residuals are largely free from serial correlation, thereby validating the reliability

of the regression estimates. Furthermore, regarding non-stationary series for independent variables, our findings align with those of Cheng et al. (2021), Wong and Pham (2022), and Wong et al. (2024), who documented no evidence of spurious regression when regressing independent and nearly non-stationary series. Furthermore, for detecting nonlinearity and serial correlation in the data, the BDS test introduced by Brock et al. (1996) is employed as in **Table 2**. The empirical results lead to the rejection of the null hypothesis, indicating that the data is not independently and identically distributed (i.i.d.), and contains a degree of nonlinearity, often indicating that the sequence is not random but follows a more complex pattern. This result confirms the significance of the QQR method used in this study.

Table 2: Brock, Dechert, and Scheinkman (BDS) test for detecting non-linear serial dependence

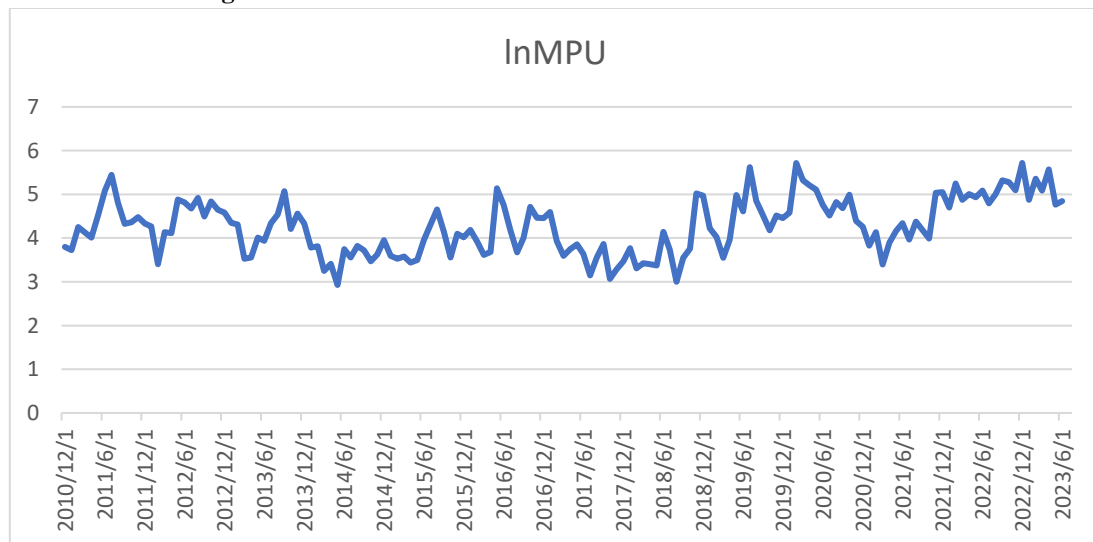
D	Brazil	Canada	Chile	Colombia	Mexico	Peru	US	lnMPU
2	2.6204***	4.0531***	3.5086***	2.9299***	4.7241***	2.5463***	5.9595***	19.8288***
3	3.8828***	5.3772***	2.5846***	3.9126***	6.4018***	3.4501***	7.5510***	19.9053***
4	3.8492***	6.2523***	2.4271***	5.2509***	7.4132***	3.9522***	8.4746***	19.0127***
5	4.1018***	6.9298***	2.6819***	6.2234***	8.4996***	4.1939***	9.4070***	17.8596***
6	4.1595***	7.6674***	2.6682***	7.6544***	10.147***	4.7099***	10.3929***	17.2807***

Note: In this Table, *d* shows the embedding dimensions, and the BDS test of Brock et al. (1996) is applied for detecting nonlinearity and serial dependence in time series data. For the significance level, please refer to Table 1.

4.2 Movements of the MPU index (Line Graph)

Figure 1 exhibits the monthly MPU index trend. In 2013, when the Taper Tantrum began, and in October 2015, when "lift-off uncertainty" peaked, there were notable times for the MPU index to soar. This indicates that the MPU index is a reliable indicator that effectively captures changes in Fed news over time.

Figure 1. Trend of MPU index from December 2010 to June 2023.



Note: Figure 1 demonstrates the time series movement of MPU, which shows how MPU changes over time.

4.3 Correlation Matrix

Table 3 presents an unconditional correlation between the stock exchange returns and MPU. The correlation coefficient between stock market returns and the MPU index is significantly negative in all

developed countries, with a lower significance level. In contrast, the relationship between stock returns and MPU is significantly negative in emerging countries except for Chile, Peru, and Mexico. This result suggests that, compared with stock markets in developed countries, there is less integration between the U.S. and emerging countries. These results are understandable, as shown by the study by Wen et al. (2022a), who stated that although markets in Asia and Africa are less developed, European Union (EU) markets are highly integrated due to numerous internal linkages.

Table 3. Correlation between Developed and Emerging Economies' Stock Market Returns

Correlation Matrix

		lnMPU	Canada	US	Brazil	Chile	Colombia	Mexico	Peru
lnMPU	Pearson's r	—							
	P-value	—							
Canada	Pearson's r	-0.041	—						
	P-value	0.614	—						
US	Pearson's r	-0.049	0.823	—					
	P-value	0.548	0.001	—					
Brazil	Pearson's r	-0.016	0.627	0.528	—				
	P-value	0.842	0.001	0.001	—				
Chile	Pearson's r	0.030	0.519	0.464	0.586	—			
	P-value	0.716	0.001	0.001	0.001	—			
Colombia	Pearson's r	-0.071	0.605	0.485	0.565	0.488	—		
	P-value	0.388	0.001	0.001	0.001	0.001	—		
Mexico	Pearson's r	0.057	0.682	0.627	0.573	0.516	0.579	—	
	P-value	0.487	0.001	0.001	0.001	0.001	0.001	—	
Peru	Pearson's r	0.023	0.598	0.456	0.573	0.374	0.520	0.466	—
	P-value	0.776	0.001	0.001	0.001	0.001	0.001	0.001	—

4.4 Quantile on Quantile Regression (QQR)

Figures 2 and 3 highlight the estimated results of QQR for selected emerging and developed markets. QQR measures the shock effect of n^{th} quantile of MPU on the θth quantile of the market returns in developed as well as emerging markets, with a time-variant value of θ and n . In **Figures 2 and 3**, the quantiles of the MPU index are represented along the x-axis, whereas the y-axis shows quantiles of stock returns. Higher or lower values of quantiles reflect the optimum situation for the uncertainty levels. Likewise, higher or lower quantiles depict market conditions as bullish or bearish, respectively.

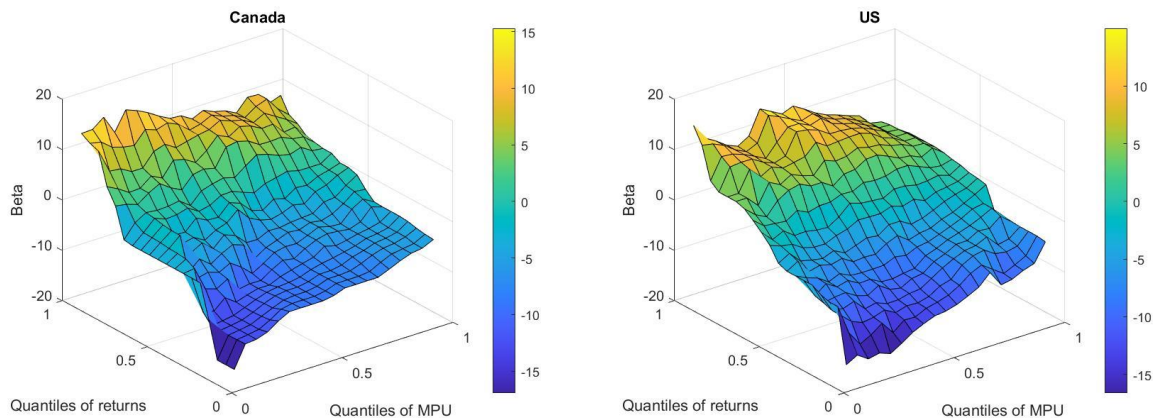
The z-axis represents the tendency of $\beta_1(\theta, n)$. Looking at these figures, the MPU of the U.S. possesses a quantile-specific impact on the country's stock markets. Our findings align with Bauer et al. (2022), who documented that MPU negatively affects stock returns. On the contrary, a notable heterogeneity also exists among the group of selected countries regarding the nexus of MPU and stock returns. This might be because of the extent of financial leniency of the country and its exchange rate management (Ehrmann & Fratzscher, 2009), interest rate management (Ammer et al., 2010), and local monetary

policy administration feedback to internal policy shocks. The diverse biases among these countries and the fluctuation across quantiles demonstrate that the impacts of MPU do not follow a consistent pattern. Moreover, this study splits the analysis into two distinct parts: developed and emerging countries, respectively, and developing countries decide on their internal circumstances, laws, and other interactions with the outside world.

4.4.1 Results of QQR (Developed Countries)

Figure 2 shows an adverse effect of MPU at the center of the upper quantiles as the country's stock market is experiencing a rise in the uncertainty index. However, the two variables' relationship varies across quantiles, and in certain markets, for the U.S., a significant adverse effect is observed in the lower to higher quantiles of MPU. The adverse impact of the MPU document on the SP&500 index of the US significantly reduces when the uncertainty of U.S. monetary policy is high. However, the situation with the higher quantiles of stock returns is vice versa. The returns are high in the higher quantile, and the lower quantiles of MPU indicate that lower uncertainty will lead to a bullish market. Moreover, the figure also shows that in the U.S., the negative impact is very prominent in the lower quantiles compared to the upper quantiles of the stock returns, which is shown in line with the non-linear relationship between stock returns and policy uncertainty. The positive coefficient might be because the low level of uncertainty indicates a stable monetary environment where information is efficiently released. As a result, it builds up the investors' confidence and causes the bearish market to improve. Additionally, Brogaard and Detzel (2015) reported that policy-induced uncertainty raised the risk premium, producing a high stock return and positively affecting stock prices. Currently, the QQR approach also finds the uneven impacts of policy uncertainty on stock market returns at different times, which the traditional classical approaches cannot explain.

Figure 2. QQR Graph for Developed Countries



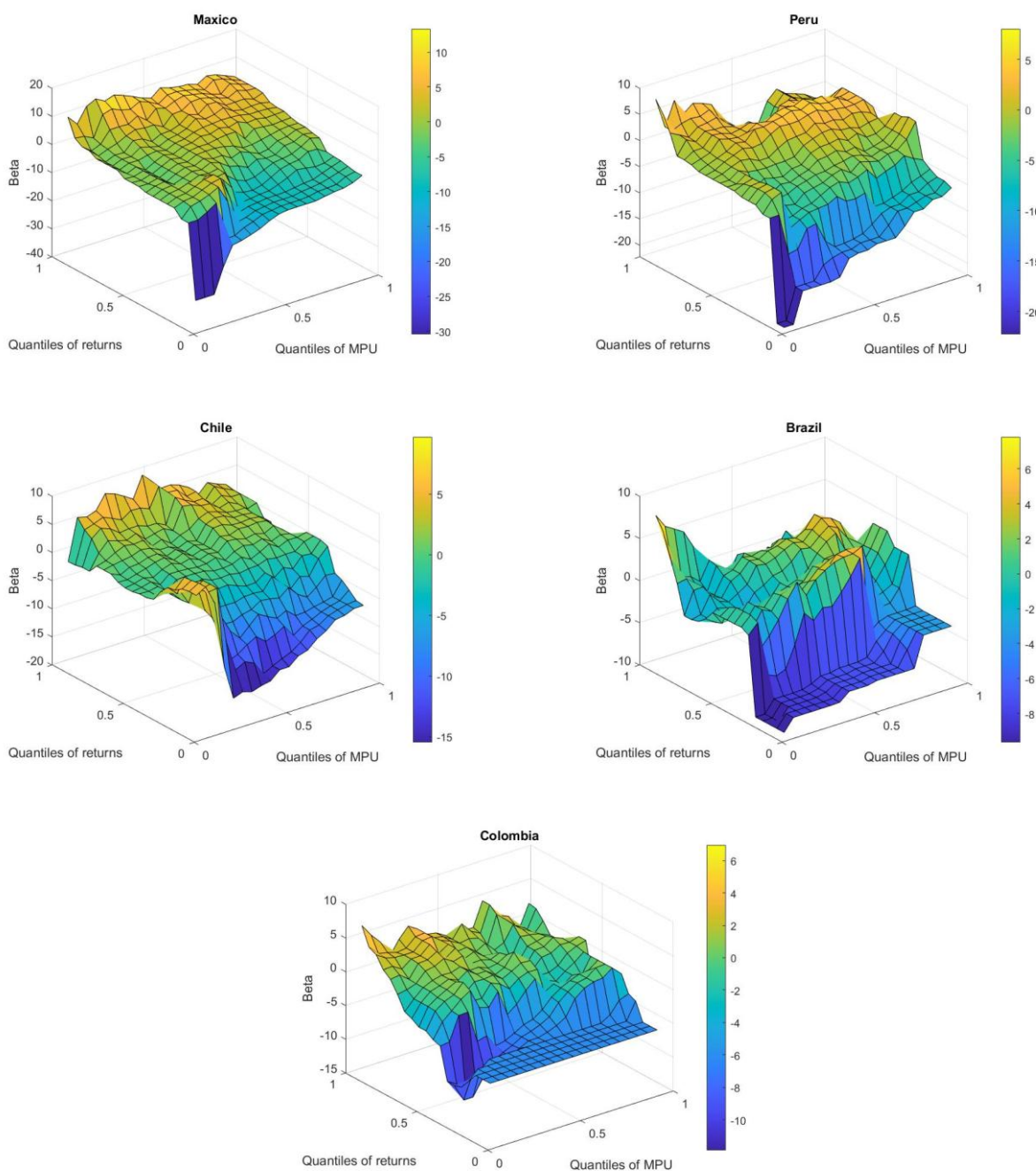
Notes: The z-axis shows the slope coefficient $\beta_1(\theta, \tau)$, which measures how MPU shocks affect US and Canadian stock returns, and these results are estimated using Equation (5).

For Canada, the impact of policy uncertainty on the stock return is quite exciting and resembles that of the U.S. Most stock markets' returns at lower quantiles show the detrimental effects of MPU. This may be attributed to Canada's geographic isolation from the United States. The closest economic ties exist between the two nations (Donadelli & Paradiso, 2014). Interestingly, Canadian stock returns remain stable around zero at the quantiles of policy uncertainty shocks (Balcilar et al., 2021).

4.4.2 Results of QQR (Emerging Countries)

Figure 3 presents the QQR graphs for Brazil, Colombia, Chile, Mexico, and Peru. In the case of emerging economies, we find adverse and significant effects in the upper quantiles of the policy uncertainty, implying that the stock exchange will observe a bullish trend at a lower level of monetary uncertainty. However, this situation is not uniform among the different quantiles.

Figure 3. QQR Graph for Emerging Countries



Notes: z-axis indicates the slope coefficient $\beta_1(\theta, \tau)$, which quantifies the impact of MPU shocks upon the stock returns in the region of emerging countries, namely Mexico, Peru, Chile, Brazil, and Colombia, and these results are estimated using Equation (5).

In Brazil, the slope coefficient's performance $\beta_1(\theta, n)$ fluctuates significantly at the lower, middle, and higher quantiles of policy uncertainty. Figure 3 illustrates that the nexus between stock returns and MPU is strongly negative and becomes zero at the higher quantile of policy uncertainty. This implies that the relationship between the magnitude of uncertainty shocks and the performance of the Brazilian stock market is less dependent. According to Hillier and Loncan (2019), there has been less reliance since Brazil's financial authorities implemented an inflation-targeting regime in 1999 to control inflation and improve economic performance. Moreover, the Brazilian stock market performed better, with fewer risks due to this action (Montes & Tiberto, 2012).

The results are unpredictable for Peru. According to findings, the coefficient of MPU is found to be negative at lower-level quantiles of stock market returns, while the upper quantiles have a positive coefficient. Most of the remaining portion generally revolves around zero. These results are aligned with Guo et al. (2018), who documented irregular dependence between MPU and stock market returns before and after Peru's IT regime (Portilla et al., 2022). The figures show an overall negative impact of uncertainty in the Peru stock market, meaning that high uncertainty will lead to reduced stock returns and vice versa.

For Chile, most of the stock return quantiles are close to zero, which makes policy shocks neutral toward the stock market returns. However, the lower-middle quantiles of the MPU shocks have a significant negative impact on the stock returns. These findings show that stock returns are high in the mid quantiles of the MPU index. The uncertainty index's overall impact in Chile seems neutral or unresponsive. This shows a solid communicative channel of information from the Central Bank of Chile (Sagner & Becerra, 2023).

For Mexico, the QQR estimates reflect that MPU does not affect stock returns. Furthermore, a relatively more apparent negative effect is noted in the lower quantiles of MPU and stock returns, explaining that uncertainty in MPU reduces the stock return in bearish market conditions. The remaining area fluctuates around zero, and there is a relatively positive association between the MPU index and stock returns in some upper quantiles. This may be because most of the region's emerging countries adopted a free-floating exchange rate.

For Colombia, the relationship between MPU and stock returns varies across quantiles. At lower quantiles of returns during a bearish market, MPU exerts a negative effect on returns. Whereas, during bullish market conditions, MPU has a positive relationship with returns across all quantiles of MPU. Policymakers who communicate carefully may be able to mitigate extreme negative market reactions, particularly if markets are already experiencing stress.

These countries have attracted significant attention from investors and policymakers due to their economic development. The markets exhibit varying degrees of resilience and sensitivity to monetary policy. For example, Chile demonstrated relative stability, while Brazil experienced heightened volatility due to political and economic turbulence. Mexico, despite benefiting from close ties with the United States, faced uncertainty stemming from trade policies. Colombia's performance is strengthened by commodity exports and foreign investment, whereas Peru's growth is mostly driven by its natural resources. Overall, from 2010 to 2023, these markets reflected a combination of local and global economic forces. Our analysis offers insights into how these emerging stock markets

respond to changes in monetary policy, providing valuable insights for both policymakers and stakeholders seeking to navigate the dynamics of these economies within the broader global financial system.

5. Discussion

Concluding results for developed countries, including the U.S. and Canada, MPU shocks negatively impact the stock prices and market returns in these countries. The stock market returns, in general, decline as the uncertainty level rises. In addition, the low level of uncertainty in the US monetary policy has also had some positive effects on the bullish market. This could result from the lower MPU, which denotes a predictable and stable economic environment in these nations. Underlying this certainty are foreign nations that modify pertinent policies per expectations to protect their domestic economies. The outcome of the QQR reflects some heterogeneity in the overall results in different countries under consideration. For example, the U.S. and Canada show nearly identical responses to the outcome, with a notable and more pronounced negative impact on the lowest quantiles of market returns. These countries possess these stable conditions because of their sovereignty and strong jurisdiction in monetary policy.

Results for emerging countries are summarized as follows: First, a strong influence of MPU shocks is reflected in these countries, with a relatively high level of volatility in the stock returns in response to MPU shocks. Since growing nations differ in how transparent they are about infrastructure, geopolitical issues, and economic policies, each nation's specific answer reveals a distinct characteristic related to the underlying variables (Bianconi et al., 2013). Figure 2 shows the adverse effects of MPU shocks on stock markets in the US and Canadian economies. A robust negative trend is seen at the higher MPU quantiles, and the adverse impact is most noticeable at the stock market's lower quantiles. Conversely, in certain circumstances, a lower MPU can also be advantageous. According to Abel et al. (2016), if businesses have the option to resell assets later, uncertainty can increase investments and potentially raise share prices. After considering investor sentiment, He et al. (2022) find that current risk compensation significantly boosts stock returns. The outcome is in line with the research of Ehrmann and Fratzscher (2013), which finds that open and developed equity markets respond to shocks in US monetary policy more strongly than closed economies do. The varying stock market reactions to MPU shocks among U.S. developed nations could be attributed to their financial interdependence (Das & Kumar, 2018). According to Dimic et al. (2016), equity prices respond more strongly to FOMC announcements through a foreign exchange rate channel and the nation's exchange rate regime in nations where local rates are vulnerable to U.S. monetary policy. The results of this study support the earlier findings of Anderson et al. (2019), indicating stronger correlations between developed and developing economies because developed economies' financial markets are more developed and open than those of developing economies.

6. Conclusion and Policy Implications

Due to the substantial degree of global financial interconnection, MPU has drawn a lot of attention from a variety of stakeholders, such as policymakers, investors, and academicians (Chiang, 2020; Uddin et al., 2020; Ullah et al., 2025). Hence, this study examines the effects of various MPU shock quantiles on various stock return quantiles in developed and emerging countries using a QQR approach.

Unlike traditional methods like OLS or QR, the QQR methodology of Sim and Zhou (2015), improves comprehension of the overall dependence structure by giving a more thorough and accurate representation of the relationship. The QQR approach uses quantile-on-quantile plots to show how the quantiles of one factor relate to those of others, in contrast to traditional methods that concentrate on mean or median values. This approach provides essential insights into the distributional relationship between variables. Additionally, this study contributes to the corpus of current literature by concentrating on the regions of developed and emerging countries. From the empirics, we draw three primary conclusions. First, MPU negatively affects stock returns in both developed and emerging markets. However, significant variations exist between economies, various MPU quantiles, and stock returns within each country. Arshad et al. (2024) find that overall, an increase in MPU tends to suppress returns more severely in less mature markets, whereas its influence in advanced economies is more nuanced, as MPU is negatively associated with stock returns in Australia and New Zealand. However, it exhibits a positive relationship with stock return in Hong Kong and Japan at higher quantiles. More specifically, the region that combines the lower stock market quantiles with the higher MPU quantiles shows a more pronounced detrimental effect of MPU. High MPU is a risk factor influencing stock markets, especially during bearish conditions. Second, contrary to other research that only found a negative association between MPU and stock market returns at lower quantiles (Uribe & Chuliá, 2022). Third, the stock market reactions to MPU shocks in U.S. emerging economies are more erratic than in U.S. developed countries. The findings suggest that, compared to the other countries, Canada's economic circumstances fluctuate more in tandem with the U.S. policies. Moreover, our findings confirm that neither of the two countries is the same and that there is not always evidence to support the theoretical prediction that stock prices will drop when policy changes are announced (Liu & Zhang, 2015). Furthermore, a country's equity returns are significantly impacted by monetary policy in various ways; for instance, the most significant effects are seen in those with open and well-developed financial markets (Sum, 2012). The impact of U.S. MPU prompts investors to recalibrate their investment policies. Such adjustments ripple through financial markets in developing countries and beyond, impacting stock returns and investment flows. Furthermore, MPU often translates into currency impulsiveness, which influences the aspects of stock market volatility in other countries. The policymakers of developing countries find themselves restructuring monetary policy reactions to mitigate the spillover effects of MPU on stock market returns to achieve economic stability. Additionally, the changes in U.S. monetary policy sentiment rumble across borders, i.e., shaping investor sentiment and economic outlooks worldwide. According to policymakers, stock market volatility affects the stability of the national economy (Lee & Lee, 2023; Li et al., 2020; Lin & Ye, 2018). Therefore, to protect the domestic economy, suitable macroeconomic regulations and controls must also be implemented. In reaction to external shocks, it might be beneficial to modify domestic policies, considering the degree of financial openness and the condition of the stock market, in addition to the degree of uncertainty surrounding the shocks.

Moreover, these findings report significant implications for scholars and practitioners in a decision sciences setting because it demonstrates the significance of MPU in determining the dynamics of a stock return in developed as well as developing economies. On the academic side, the results aid in extending classical asset pricing and decision-making models to uncertainty-driven and state-dependent models, and in terms of institutional heterogeneity, global spillovers, and nonlinear procedures like quantile and regime-based models to more accurately reflect the real-world

complexities. Furthermore, these findings demonstrate the importance of the incorporation of MPU indicators into decision-making and the necessity of policymakers to increase transparency and credibility to minimize the market instability caused by uncertainty.

6.1 Limitations and Directions for Future Research

This study stipulates a valuable understanding of explaining the MPU-stock return nexus in developing and emerging countries classified by MSCI country classification, including the U.S. as a significant influencing economy on its existing emerging countries. This study is limited by the choice of variables, model specifications that could affect the outcomes, and alternative model selection to assess robustness. However, it also opens exciting possibilities for further research. Future research is needed to investigate other diverse samples of countries requiring instrumental variables or alternative econometric approaches, which presents a promising avenue for further understanding. Future research could consider several paths to further understanding this underlying issue. One path could employ high-frequency data that could provide deep insights or short-term dynamics, enhancing understanding. Additionally, observing the influence of MPU on various sectors within the financial market could offer meaningful insights for policymakers.

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