iBusiness, 2024, 16, 250-264
https://www.scirp.org/journal/ib
ISSN Online: 2150-4083
ISSN Print: 2150-4075

Symmetric and Asymmetric Effects of Monetary Policy Uncertainty on the Demand for Money in the United States

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How to cite this paper: Akter, A., Islam, S. M., & Hossain, J. A. (2024). Symmetric and Asymmetric Effects of Monetary Policy Uncertainty on the Demand for Money in the United States. *iBusiness, 16,* 250-264.
https://doi.org/10.4236/ib.2024.164018

Received: September 23, 2024
Accepted: December 20, 2024
Published: December 23, 2024

Abstract

This paper examines the stability of the demand for money in the United States by incorporating economic policy uncertainty (EPU) and monetary policy uncertainty (MPU) into the traditional money demand function. Using monthly data from 1987 to 2020, the study extends the literature by investigating both the symmetric and asymmetric effects of policy uncertainty on the real money aggregate (M2) for the first time. The analysis employs the Auto-Regressive Distributed Lag (ARDL) and Nonlinear Auto-Regressive Distributed Lag (NARDL) models, along with CUSUM and CUSUMSQ stability tests, to capture both short-run and long-run dynamics. Our findings reveal that while monetary policy uncertainty leads to an increase in money holdings in the short run, economic policy uncertainty reduces the demand for money as individuals shift to safer assets. In the long run, the effects of inflation and real effective exchange rates persist, while policy uncertainty shows no sustained impact. These results have significant implications for monetary policy formulation.

Keywords

Monetary Policy Uncertainty (MPU), Economic Policy Uncertainty (EPU), Money Demand, Real Effective Exchange Rate (REER), United States

1. Introduction

The demand for money is one of the oldest theories that has received, perhaps, the largest attention in the literature. In an effort to establish its stability, researchers have tried to identify some missing variables so that once they are added as new determinants, money demand becomes stable. In monetary economics, the demand for money is the desired holding of financial assets in the form of money. The demand for money is one of the areas in macroeconomics that has received the greatest attention. The demands for money, traditionally, depend on the price level, the interest rate, and real gross domestic product. Moreover, Nobel laureate Mundell (1963), and Arango and Nadiri (1981) suggest that, along with income level and interest rate, the exchange rate variable in the money demand function is a factor in determining the demand for money where a flexible exchange rate regime follows. Following Choi and Oh (2003), Greiber and Lemke (2005), and Bahmani-Oskooee et al. (2011), who all agree that economic policy uncertainty and monetary policy uncertainty also affect current money demand.[1] The existing studies strongly suggest that taking uncertainty output and monetary measures into account improves the stability performance of the demand for money.

Concerns about monetary policy uncertainty and economic policy uncertainty have intensified in the wake of the Global Financial Crisis, serial crises in the Eurozone, and partisan policy disputes in the United States. For example, Bernanke et al. (2008) and Güven (2012), and Moreno (2013) suggest that uncertainty about U.S. and European fiscal, regulatory, and monetary policies contributed to a steep economic decline in 2008-2009 and slow recoveries afterwards. Macroeconomic stability has always been a key point of monetary policy. In many economies, demand for money plays a significant role in macroeconomic analysis for formulating an appropriate and effective monetary policy.

The purpose of this study therefore is to fill this gap and extend the existing literature on money demand in the United States of America (USA) by investigating whether economic policy uncertainty (*EPU*), and monetary Policy uncertainty (*MPU*), along with real income (*Y*), inflation rate (P_t/P_{t-1}), real effective exchange rate (*NEX*) play any role in the stability of real money aggregate (M2) in USA by using the most robust and updated monthly data from 1987 (M1) to 2020 (M6). This paper also extends the literature by introducing asymmetric effect of monetary policy uncertainty on the US money demand function for the first time.

We employ the Auto-regressive Distributive Lag (ARDL), and Nonlinear Auto-regressive Distributive Lag (NARDL) approach to cointegration, along with CUSUM and CUSUMSQ stability tests to investigate the relationship between money demand function and the macroeconomic variables. We also report the Lagrange multiplier (LM) statistic to check for auto-correlation and Ramsey's RESET statistic for misspecification. Following the literature and detailed explanation and graphical presentation of the CUSUM and CUSUMSQ tests, we apply them to the residuals of the optimum model. Both tests yield the same outcome that all estimated coefficients are stable, as indicated in Panel C. Finally, the size of the

[1]The Policy Uncertainty Group today relies upon the method by Baker et al. (2016) and constructs the policy uncertainty measure by searching popular newspapers in a given country for such terms as "uncertain' and "uncertainty" associated with such words as "policy", "tax", "spending", "regulation", "central bank", "budget", "deficit", etc. From the volume of news associated with these terms, an index of uncertainty is then constructed. The larger the volume of the news, the higher the index, and the higher uncertainty. For more information and source of the data visit Economic Uncertainty Policy Group: https://www.policyuncertainty.com/bbd_monetary.html.

adjusted R^2 is reported to reflect on the goodness of fit.

The remainder of the paper is outlined as follows: Section 2 discusses the existing literature while Section 3 provides model specifications and NARDL estimation method. Section 4 discusses Empirical results. Section 5 presents policy implications and concluding remarks.

2. Literature Review

The demand for money is one of the most well-explored areas in economics, with numerous studies addressing its key determinants and the stability of these factors. It is widely acknowledged that variables such as income, interest rates, inflation, exchange rates, and measures of uncertainty can all influence money demand in various countries.

In the U.S. context, research has extensively examined these factors, focusing on their implications for the stability of money demand and policy effectiveness. For instance, studies have shown how interest rates, real exchange rates, consumer behavior, and fiscal policies (such as government deficits and debt levels) shape money demand. Recent work, such as Kia's 2024 study, highlights how agents in the money market adjust their behavior in response to changes in these variables. While the fundamental parameters of money demand may remain stable, external economic and policy shifts can cause fluctuations. Kia's research underscores the need to understand both short-term and long-term stability in money demand, which is essential for crafting effective monetary policies.

Earlier foundational work has also contributed to our understanding of money demand. Notably, Milton Friedman's research in the 1950s established the quantity theory of money and explored its empirical implications. Subsequent studies, including those by Stephen Goldfeld in the 1970s, examined the "missing money" puzzle, a phenomenon reflecting periods of instability in money demand. These classic contributions continue to guide policymakers and economists in grappling with the complexities of money demand, ensuring that monetary policy interventions remain both informed and effective.

Bahmani-Oskooee, Kutan, & Xi (2013) examine the impact of economic and monetary uncertainty on the demand for money in emerging economies. The empirical results find that economic uncertainty and monetary uncertainty both have short-run significant effects on the quantity of money demanded in emerging economies, except in the results for Bulgaria and South Africa. The long-run effects of economic uncertainty and monetary uncertainty on the money demand function in many of the emerging economies seem to be negative.

Choi and Oh (2003) examine a money demand function with output uncertainty, monetary uncertainty, and financial innovations. The paper investigates that output uncertainty and monetary uncertainty as well as output, interest rates, and financial innovations affect money demand. The estimated long-run relationships are consistent with the postulated relation but not with the conventional one. The model provides a high-income elasticity consistent with cross-sectional evidence and estimated in dynamic error correction form exhibits a good level of stability and forecast ability. The empirical results show that output uncertainty has a negative effect on money demand, whereas monetary uncertainty has a positive effect. The implementation of disinflationary policy, however, reduces both effects.

Özdemir & Saygılı (2013) investigate economic uncertainty and money demand stability in Turkey. The aim of this paper is to investigate a stable relationship in Turkey by including uncertainty variables in demand for money. The findings show that the inclusion of an appropriate measure of uncertainty is necessary to estimate a stable and consistent money demand function for Turkey. The income elasticity of the conventional money demand system is unstable and starts to increase towards the end of the period. The finding is the same for the elasticity of the interest spread. These two variables capture a level of uncertainty in the Turkish economy.

All the above studies have assumed that the impact of policy uncertainty on macroeconomic variables is symmetric. However, concentrating on the demand for money, Bahmani-Oskooee and Maki-Nayeri (2018) recently argued that the effects of policy uncertainty on the demand for money could be asymmetric. As they argued, while people hold more cash during times of increased uncertainty, people might hold even more cash during times of decreased uncertainty, as they might attempt to shield themselves from an uncertain environment in the future.

Murad, Salim, & Kibria (2021) investigate the asymmetric effects of economic policy uncertainty on the demand for money in India. This study shows that the asymmetric nonlinear framework supports the short-run asymmetric effect of uncertainty on both narrow and broad money. Hence, the policy uncertainty is a short-run phenomenon for the Indian money demand function. However, both linear and nonlinear models yield a stable demand for money in India, regardless of narrow money or broad money.

Hossain & Arwatchanakarn (2020) study whether the demand for money specified and estimated for this country remained stable over the study period of 1995Q1-2017Q4 and whether economic uncertainty affects narrow money-demand in New Zealand. The empirical results, found by the autoregressive distributed lag (ARDL) approach to cointegration, suggest that economic uncertainty negatively affects narrow money demand in New Zealand. The non-linear ARDL (NARDL) approach proves that the effect of economic uncertainty on narrow money demand and its stability in New Zealand is asymmetric. It implies that an increase in economic uncertainty lowers narrow money demand, while a decrease in economic uncertainty does not increase but rather decreases narrow money demand.

Bahmani-Oskooee & Maki-Nayeri (2018) investigate the asymmetric effects of policy uncertainty on the demand for money in the United States. The empirical results show a clear sign of asymmetric response. Policy uncertainty had no long-run effects when a linear money demand was estimated. However, in the case of a nonlinear model, the results reveal that while increased policy uncertainty induces the public to hold less money in the long run, decreased uncertainty has no long-run effects. Increased economic policy uncertainty makes people more cautious about the future. On the other hand, people do not change their portfolios to decrease uncertainty.

Murad (2021) again examines the asymmetric effects of economic uncertainty on the money demand function in Bangladesh. This study employs a nonlinear ARDL model and cumulative Fourier causality tests and finds that all the long-run estimates are consistent with the theory and imply a stable money demand function in Bangladesh. The empirical studies show that the income elasticity is less than unity, while the elasticity of the exchange rate is around one. The interest rate has a negative significant effect on the quantity of money demanded in Bangladesh. It is also found that demand for money increases in the short run and declines in the long run when uncertainty decreases. On the other hand, people hold less money in the short run when uncertainty increases, though it does not sustain in the long run.

Further research has delved into the complexities of economic uncertainty in different contexts. Lubu et al. (2023) examine the fundamentals and misalignment of the Real Effective Exchange Rate (REER) in the Democratic Republic of Congo. Their findings have significant implications for understanding the role of exchange rates in money demand, particularly in economies with unstable economic conditions. Zhou and Jiang (2020) analyze the relationship between China's economic policy uncertainty and its stock market, illustrating how policy-induced uncertainty can affect financial markets, and by extension, money demand through wealth effects and portfolio adjustments. Zhang (2023) highlights how venture capital in China responds to policy uncertainty, which influences overall investment climates and hence the demand for money through corporate liquidity preferences. Yan (2023) investigates monetary policy uncertainty in China and its impact on corporate financialization, further contributing to the discourse on how uncertainty drives money demand indirectly by shaping corporate financial behavior.

Overall, the literature on the money demand function underscores the importance of understanding both the traditional and extended determinants to accurately model the demand for money in various economic contexts. The incorporation of uncertainty variables, as well as a deeper analysis of asymmetric effects, provides a more nuanced understanding of money demand dynamics across different economies and time periods.

3. The Money Demand Function, Model Specification, and Estimation Methods

Why is money demanded? And what are the key determinants of the demand for money? People hold money since money works as a store of value, and it helps to smoothen different types of monetary transactions. Keynes (1936) postulated that two essential determinants of the demand for money in any country are a measure of economic activity, such as income. The other is the opportunity cost of holding a real money balance, such as the interest rate. Baumol (1952) and Tobin (1956) argued that there is a negative relationship between interest rate and motive for holding money. As a result, we can express the traditional money demand function in the following way:

$$\frac{M}{P} = m = \beta_i \left(y, r \right) \tag{1}$$

where M = nominal money balance, P = price level, m = demand for real money balance, y = income, r = interest rate, $\frac{\partial m}{\partial y} > 0$ and, $\frac{\partial m}{\partial r} < 0$.

Moreover, Nobel laureate Mundell (1963) and others such as Arango and Nadiri (1981) suggested that, along with income level and interest rate, the exchange rate variable in the money demand function is a factor in determining the demand for money where a flexible exchange rate regime follows. Along with Bahmani and Kutan (2010), Crockett and Evans (1980) also argued that the interest rate could be considered an opportunity cost of holding money in financially developed countries. Following Choi and Oh (2003), we finally extend specification (1) by including the economic policy uncertainty (EPU) and monetary policy uncertainty (MPU) index. These two uncertainty indexes measure real output volatility and the volatility of the nominal money supply in each country. Thus, we can write Equation (1) in the following long-run log-linear form:

$$\begin{aligned} \ln m_t = \beta_0 + \beta_1 \ln y_t + \beta_2 \ln r_t + \beta_3 \ln \left(\frac{P_t}{P_{t-1}} \right) + \beta_4 \ln REX_t \\ + \beta_5 \ln EPU_t + \beta_6 \ln MPU_t + \varepsilon_t \end{aligned} \tag{2}$$

where m = demand for real money balance (real M2), β_0 = intercept, REX = the real effective exchange rate, $\dot{P} = \frac{P_t}{P_{t-1}}$ = the inflation rate, EPU = the economic policy uncertainty index, MPU = the monetary policy uncertainty index, t = time period and $\varepsilon \approx N(0, \sigma)$.

We know that transaction demand for money increases with income. It is expected that an estimate of β_1 to be positive. In the money demand function, the interest rate and the inflation rate are considered to measure the opportunity cost of holding money. Therefore, the estimates of β_2 and β_3 are expected to be negative. Although Bahmani-Oskooee and Maki-Nayeri (2018) argued that if the income effect outweighs the substitution effect, the sign of β_2 can be positive. The relation between demand for money and the real effective exchange rate depends on the relative strength of the wealth effect and substitution effect. Thus, an estimate of β_4 could be positive or negative. Arango and Nadiri (1981) claimed that the value of foreign assets held by domestic residents rises in domestic currency with the depreciation of domestic currency or appreciation of the foreign currency. As a result, domestic residents increase their spending and demand for cash at home, which leads to a negative estimate for β_4. However, Bahmani-Oskooee and Pourheydarian (1990) argued that if the public expects further appreciation, people could hold more foreign currency by decreasing the cash maintaining at home despite the appreciation of the foreign currency. So, we can also expect a positive estimate of β_4.

Finally, policy uncertainty could affect the demand for money in either direction. Hence, we expect an estimate of β_5 and β_6 to be negative or positive. Choi and Oh (2003) conjectured that both monetary policy uncertainty and economic policy uncertainty negatively affect the demand for money depending on the degree of substitution between money and other less volatile assets. However, Bruggemann and Nautz (1997) and Friedman (1983) argued that uncertainty increases due to a rise in the volatility of the money supply, which leads to a rise in the demand for money. The same is true for economic uncertainty, during which people save more as a precautionary measure by increasing their cash holding. Specification (2) is a long-run formulation of the money demand. However, both uncertainty measures could have relatively more short-run phenomena than long-run.

Moreover, some studies also unveiled asymmetric effects of uncertainty on the money demand function (for instance, Murad, Salim, & Kibria (2021). Hence, to investigate the short-run effects from long-run effects, the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran et al. (2001) is employed in this study. Now, we need to specify Equation (2) in an error-correction format as follows:

$$\begin{aligned}\Delta \ln m_t &= \alpha + \sum_{i=1}^{n_1} \gamma_i \Delta \ln m_{t-i} + \sum_{i=1}^{n_2} \eta_i \Delta \ln y_{t-i} + \sum_{i=1}^{n_3} \lambda_i \Delta \ln r_{t-i} \\ &+ \sum_{i=1}^{n_4} \varphi_i \Delta \ln \dot{P}_{t-i} + \sum_{i=1}^{n_5} \psi_i \Delta \ln REX_{t-i} + \sum_{i=1}^{n_6} \omega_i \Delta \ln EPU_{t-i} \\ &+ \sum_{i=1}^{n_7} \theta_i \Delta \ln MPU_{t-i} + \rho_0 \ln m_{t-i} + \rho_1 \ln y_{t-i} + \rho_2 \ln r_{t-i} \\ &+ \rho_3 \ln \dot{P}_{t-i} + \rho_4 \ln REX_{t-i} + \rho_5 \ln EPU_{t-i} + \rho_6 \ln MPU_{t-i} + \varepsilon_t\end{aligned} \tag{3}$$

where n_1 to n_7 are the optimum lag lengths based on the Akaike information criterion (AIC). γ, η, λ, φ, ψ, ω θ, are the short-run parameters, while the long-run effects are inferred by the estimates of ρ_1 - ρ_6 which are normalized on ρ_0. We need to verify that the variables are cointegrated and that they are a combination of I(0) and I(1). According to Pesaran et al. (2001), If the calculated F-statistic exceeds the critical value of the upper bound, we can conclude that the considered variables are cointegrated. However, our goal is to examine the asymmetric effects of monetary policy uncertainty on the demand for money in the United States. Hence, we upgraded the above symmetric analysis to asymmetric analysis for *MPU*. Following Bahmani-Oskooee and Maki-Nayeri (2018), Shin et al. (2014), and Murad et al. (2021), we decomposed the ln*MPU* variable into two new time-series variables. We can write the partial sum of positive and negative changes in *MPU* as follows:

$$POS_t = \sum_{j=1}^{t} \max\left(\Delta \ln MPU_j, 0\right), NEG_t = \sum_{j=1}^{t} \min\left(\Delta \ln MPU_j, 0\right), \quad (4)$$

where POS_t = the partial sum of positive changes that increase policy uncertainty, and NEG_t = the partial sum of negative changes that decline in policy uncertainty. Now, we need to replace lnMPU with POS_t and NEG_t at Equation (3) to write the NARDL model:

$$\begin{aligned}\Delta \ln m_t = {} & \alpha + \sum_{i=1}^{n_1} \gamma_i \Delta \ln m_{t-i} + \sum_{i=1}^{n_2} \eta_i \Delta \ln y_{t-i} + \sum_{i=1}^{n_3} \lambda_i \Delta \ln r_{t-i} + \sum_{i=1}^{n_4} \varphi_i \Delta \ln \dot{P}_{t-i} \\ & + \sum_{i=1}^{n_5} \psi \Delta \ln REX_{t-i} + \sum_{i=1}^{n_6} \omega_i \Delta \ln EPU_{t-i} + \sum_{i=1}^{n_7} \theta_i^{+} POS_{t-i} \\ & + \sum_{i=1}^{n_7} \theta_i^{-} NEG_{t-i} + \rho_0 \ln m_{t-i} + \rho_1 \ln y_{t-i} + \rho_2 \ln r_{t-i} + \rho_3 \ln \dot{P}_{t-i} \\ & + \rho_4 \ln REX_{t-i} + \rho_5 \ln EPU_{t-i} + \rho_6 POS_{t-i} + \rho_7 NEG_{t-i} + \varepsilon_t \end{aligned} \quad (5)$$

Here Pesaran et al. (2001) bounds testing approach is used to analyze the NARDL model (for instance, Shin et al., 2014).

4. Empirical Results

This study estimates both the linear model and the nonlinear model using monthly data covering from 1987: M1 to 2020: M6. The main reason for restricting ourselves to this period is the availability of the data on *MPU* and *EPU* of the United States. The complete definitions of the variables and the sources of data are given in the Appendix section.

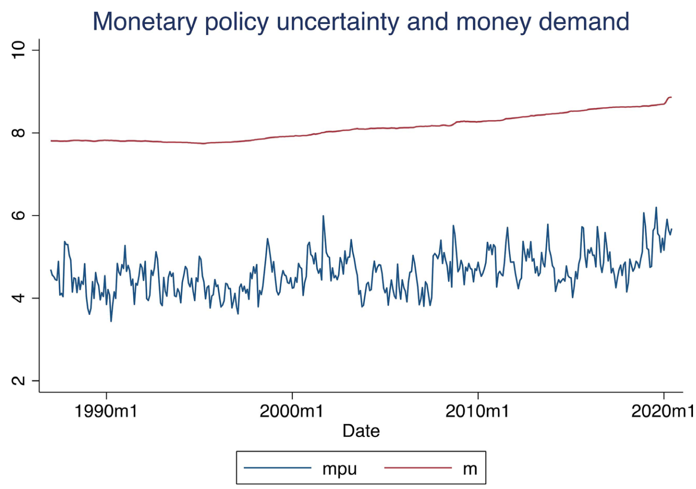

Figure 1. Monetary policy uncertainty index.

Figure 1 presents the monetary policy uncertainty index and money demand of the US to see the trend of the uncertainty index of the US. Both the Monetary Policy Uncertainty (*MPU*) index and money demand show an increasing trend over the period from 1987 to 2020. The *MPU* exhibits noticeable volatility, with sharp fluctuations particularly after 2008 and a significant spike around 2020, reflecting increased uncertainty during periods of economic and financial crises, including the COVID-19 pandemic. Despite these fluctuations, there is a clear upward trajectory over time. The money demand (red line) also increases steadily over the same period, although it does not exhibit the same level of volatility as the *MPU*. This steady rise could be linked to broader economic growth and increasing liquidity needs. Thus, while the *MPU* index shows more volatility, both the uncertainty index and money demand exhibit an upward trend over time.

In estimating both models, we use a maximum of ten lags on each first-differenced variable and use Akaike's Information Criterion (AIC) to select an optimum model. To estimate Both ARDL and NARDL models separately, the augmented Dickey Fuller test and Phillips Perron test are incorporated to identify the order of integration of the considered variables.

To confirm the I(0) or I(1) property of variables, we first apply the ADF and Phillips–Perron test to the level as well as first-differenced variables and the results are reported in **Table 1**.

It is completely clear from **Table 1** that variables such as monetary policy uncertainty and inflation rate are stationary after being differenced once while other variables such as EPU, money demand, interest rate and real effective exchange rate are stationary at their level.

Now, we concentrate on the estimate of the linear model and **Table 2** reports the results of Pesaran et al. (2001) ARDL bounds-testing approach. There are three parts in the table.

Table 1. Summary statistics for all variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
m	402	8.117	0.31	7.743	8.865
mpu	402	4.33	0.596	2.808	6.011
epu	402	4.654	0.298	4.047	5.859
y	402	4.44	0.187	4.029	4.646
p	402	4.431	0.237	3.936	4.78
reer	402	4.681	0.079	4.529	4.86
r	402	0.905	0.866	−1.386	1.946

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) *m*	1.000						
(2) *mpu*	−0.196	1.000					
(3) *epu*	0.413	0.521	1.000				
(4) *y*	0.780	−0.234	0.068	1.000			
(5) *p*	0.923	−0.217	0.289	0.925	1.000		
(6) *rex*	0.063	0.078	−0.142	0.213	0.025	1.000	
(7) *r*	−0.714	0.025	−0.574	−0.522	−0.707	0.166	1.000

Unit root tests

	Augmented Dickey-fuller test		Phillips-Perron test	
Variables	t-statistics	Integration Order	t-statistics	Integration Order
m	3.234***	I(0)	4.039***	I(0)
mpu	−8.299	I(1)	−9.745	I(1)
epu	−2.547***	I(0)	−5.193	I(1)
y	−2.055***	I(0)	−2.550***	I(0)
p	−3.924	I(1)	−4.519	I(1)
rex	−1.778***	I(0)	−1.927	I(0)
r	−0.893***	I(0)	−0.841***	1(0)

Note: Numbers inside the parentheses are the number of lags in the ADF and Phillips–Perron test selected by AIC. **denotes statistical significance at the 5% confidence level and ***denotes statistical significance at the 1% confidence level.

The short-run effects on the demand for money in the United States, as reflected in the coefficient estimates from Part A in Table 2, show that all the variables have significant impacts. Specifically, inflation (Δln*P*) has a significant positive effect on money demand, indicating that as prices rise, people tend to hold more money in the short run to maintain liquidity. This result is intuitive as inflation generally increases the need for money to cover the higher cost of goods and services. Similarly, the real effective exchange rate (Δln*REX*) also has a positive effect in the short run, meaning that when the domestic currency appreciates, the demand for money rises. This can be attributed to the increased attractiveness of holding domestic currency when its value strengthens against other currencies.

Table 2. Estimates of the Linear Autoregressive Distributed Lag (ARDL) model.

Part A: Short-Run Coefficient Estimates										
Lag Order	0	1	2	3	4	5	6	7	8	9
$\Delta \ln m$	-	0.267 (4.00)***	0.013 (0.20)	0.124 (1.77)*	−0.007 (−0.10)	0.006 (0.09)	0.179 (2.38)***			
$\Delta \ln y$	0.094 (−2.91)	−0.041 (−1.23)	−0.431 (−1.25)	0.048 (1.18)	0.051 (1.25)	−0.029 (−0.68)	0.002 (0.04)	0.830 (1.97)**		
$\Delta \ln r$	−0.014 (−8.37)	−0.12 (−7.85)***	−0.002 (−1.04)	0.005 (2.26)						
$\Delta \ln \dot{P}$	0.235 (1.87)	−0.254 (−2.09)	0.411 (3.31)	−0.009 (−0.07)**	0.089 (0.69)	0.306 (2.39)	0.019 (2.39)			
$\Delta \ln REX$	0.009 (0.47)	0.037 (1.93)*								
$\Delta \ln EPU$	0.009 (0.36)	0.001 (0.04)	−0.003 (−1.04)	−0.004 (−1.51)	−0.005 (−1.95)*					
$\Delta \ln MPU$	0.005 (0.41)	−0.002 (−0.29)	0.008 (0.73)	0.017 (1.55)	0.019 (1.77)*					

Continued

Part B: Long-Run Coefficient Estimates							
constant	$\Delta \ln m$	$\Delta \ln y$	$\Delta \ln r$	$\Delta \ln \dot{P}$	$\Delta \ln REX$	$\Delta \ln EPU$	$\Delta \ln MPU$
−0.0414 (−2.21)	-	−2.601 (−1.49)	−0.357 (−1.27)	3.60 (2.04)**	3.22 (1.69)*	−0.308 (−0.51)	−0.118 (−0.46)
Part C: Diagnostic measures							
F	ECM_{t-1}	RSSET	χ^2 ARCH	$\bar{R}^2$			
3.97**	−0.0043	5.487	21.714	0.3985			

Bounds test for cointegration relationship

Test statistics	Value	Level (%)	Lower I(0)	Upper I(1)
F-Statistics	3.97**	1	3.15	4.43
k	6	5	2.45	3.61
		10	2.12	3.23

Note: Numbers inside the parentheses are t-ratios. *Indicates significance at the 10% level. **Indicates significance at the 5% level and *represents significance at the 1% level.

In contrast, the interest rate ($\Delta\ln r$) has a negative and significant effect on money demand, as seen from Part A. This is consistent with traditional economic theory, where higher interest rates increase the opportunity cost of holding money, leading individuals to shift towards interest-bearing assets. Income ($\Delta\ln y$), while showing mixed effects in the short run, presents a negative coefficient in lag 2, suggesting that initially, as income rises, money demand might decrease, possibly due to a shift towards other forms of investment. However, this effect is complex and appears to diminish over time.

Monetary policy uncertainty ($\Delta\ln MPU$) has a positive short-run effect on money demand. The significant positive coefficient indicates that during periods of heightened uncertainty regarding monetary policy, the public holds more cash, likely as a precautionary measure. Conversely, economic policy uncertainty ($\Delta\ln EPU$) exerts a negative impact on money demand, suggesting that rising uncertainty around broader economic policies leads people to reduce their cash holdings in favor of safer or less liquid assets, such as foreign currencies or bonds.

In the long run, as demonstrated in Part B, only two variables—inflation and the real effective exchange rate—continue to have significant effects. Inflation ($\ln P$) remains a strong positive determinant of money demand, with a coefficient of 3.60. This suggests that a 1% increase in inflation leads to a 3.60% increase in the demand for money, highlighting that over time, higher prices create a sustained need for liquidity. Similarly, the real effective exchange rate ($\ln REX$) continues to positively influence money demand, with a coefficient of 3.22. A stronger domestic currency in the long term makes holding the currency more attractive, increasing demand for money.

The diagnostic results confirm the robustness of the model, as indicated by the cointegration test and other diagnostics from Part C. The F-statistic of 3.97, significant at the 1% level, confirms the existence of a long-run relationship between the variables and money demand. Additionally, the model shows no issues with serial correlation, ARCH effects, or heteroscedasticity, ensuring that the estimates are reliable. Overall, this analysis reveals that both inflation and the real effective exchange rate are crucial long-run determinants of money demand, while in the short run, variables such as interest rates, income, and uncertainties in economic and monetary policies play significant roles.

Table 3 explores the results obtained from Shin et al. (2014) nonlinear ARDL framework, now in two parts. The short-run coefficient estimates reported in Part B reveal that except the rate of real effective exchange and inflation, all variables have short-run effects on the demand for money of the USA. Income elasticity is positive and close to unity, and it explains that a 1% economic growth requires increasing the money supply by 1%. The interest rate elasticity is also positive, and this states that as interest rates rise, public increase their cash holding.

Table 3. Estimates of the Nonlinear Autoregressive Distributed Lag (NARDL) model.

Part A: Short-Run Coefficient Estimates											
Lag Order	0	1	2	3	4	5	6	7	8	9	10
$\Delta \ln m$	–	0.645 (12.07)**									
$\Delta \ln y$	−0.1133741 −1.68	−0.198 (−3.68)	0.0479 (0.62)	0.0203 (0.21)	0.958 (2.71)**	0.0202 (0.20)					
$\Delta \ln r$	−0.013 (7.280)**	−0.019 (−8.430)	0.001 (0.230)	0.090 (2.37)**	0.005 (1.070	0.006 (−1.170)	−1.130 (1.09)				
$\Delta \ln \dot{P}$	−1.072 (4.080)	0.803 2.560	0.245 0.770	−0.63 −2.000	0.444 1.350	0.191 0.580					
$\Delta \ln REX$	0.018 (0.5)	0.025 (0.210)	−0.021 (0.680)	0.035 (0.09)	0.076 (0.140)						
ΔPOS_t	0.0023 (2.62)	0.0018 (1.08)	0.123 (0.98)								
NEG_t	−0.0022 (−2.55)***										
Part B: Asymmetry statistics: long run effects of MPU on Money demand											
Constant	$\Delta \ln y$	$\Delta \ln r$	$\Delta \ln \dot{P}$	$\Delta \ln REX$	$\Delta \ln EPU$	ΔPOS_t	ΔNEG_t				
	2.707 (5.29)	−0.855 (0.005)	−0.008 (2.77)	−0.067 (−0.003)	−0.067 (2.11)	0.911 (0.607)	−0.874 (−0.589)				

Finally, the asymmetric effects of monetary policy uncertainty are estimated by incorporating the partial sum of positive monetary policy uncertainty $\Delta \ln POS_t$ and the partial sum of negative monetary policy uncertainty $\Delta \ln NEG_t$. We find the size of short-run coefficient estimates attached to $\Delta \ln POS_t$ and $\Delta \ln NEG_t$ variables are different. These different coefficients of $\Delta \ln POS_t$ and $\Delta \ln NEG_t$

support the short-run asymmetric effect of uncertainty. Specifically, when uncertainty decreases in the short run, people hold more real balances. It reveals that as uncertainty declines, people feel safe to carry cash. As a result, people hold more cash and fewer assets in the US. However, there is no significant effect of $\Delta \ln POS_t$ on demand for holding money in the short run. Moreover, the Moreover, neither the long-run normalized estimate to $\Delta \ln POS_t$ or $\Delta \ln NEG_t$ is statistically significant. Hence, the short-run effect of decreased uncertainty ($\Delta \ln NEG_t$) does not last in the long run. So, monetary uncertainty has no long-run effects on the demand for money in the United States.

5. Conclusion

This study adds to the existing literature on money demand by offering new insights into the impact of economic policy uncertainty (*EPU*) and monetary policy uncertainty (*MPU*) in the United States. By employing both the Auto-Regressive Distributed Lag (ARDL) and Nonlinear Auto-Regressive Distributed Lag (NARDL) models, we analyze the symmetric and asymmetric effects of these uncertainties on real money aggregates (M2) using monthly data from 1987 to 2020.

The findings indicate that in the short run, monetary policy uncertainty drives an increase in money demand as the public seeks liquidity during times of uncertainty. Conversely, economic policy uncertainty tends to decrease money demand as individuals shift towards safer assets. In the long term, however, only inflation and the real effective exchange rate maintain significant influence on money demand, while the effects of policy uncertainty fade.

These insights hold important implications for monetary policymakers. Recognizing the short-run sensitivity of money demand to different forms of uncertainty can help in designing targeted interventions. Policymakers should account for the asymmetric nature of these responses to achieve macroeconomic stability, manage inflation, and ensure financial stability. Incorporating uncertainty measures into money demand models enhances their utility for policy analysis and helps central banks implement more informed and effective strategies.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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