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LONG-RUN MONEY DEMAND FUNCTION: SEARCH FOR STABILITY IN TWENTY (20) NON-EMU MEMBER COUNTRIES

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ABSTRACT

This study examined the long-run money demand function in search for stability in twenty (20) Non-EMU member countries by applying Co-integration, an ARDL bounds test, CUSUM, and CUSUM squared estimation techniques to data spanning 1996 – 2019. We found co-integrating relationship between money demand and its determinants for all the countries under consideration (19 out of 20) except for Sweden. Stability in the money demand was also confirmed in seven (7) countries (Russia, Hungary, Montenegro, Bosnia, Bulgaria, Romania, and Croatia) based on both the CUSUM test results and CUSUM squared test. The remaining countries exhibited partial stability as indicated by the non-simultaneous stability of the CUSUM and CUSUM squared test. The divergence and heterogeneity found in the money demand functions and its determinants in these countries only give further impetus to their non - membership in the Eurozone. Hence there is the need for stability and convergence in the monetary policy management and money demand function to be admitted into the Eurozone holding other conditions fixed.

Contribution/ Originality This study is an empirical attempt that investigates and logically analyses the feasibility of a parallel monetary zone for European countries outside the Eurozone. It also contributes to the existing literature by expanding and investing the possibilities and implications of an economic zone among non-member Eurozone countries through money-demand stability.

1. INTRODUCTION

In the words of the pioneering figure of the optimum currency area (Mundell, 1970), *an area or a region will constitute a currency area if the geographical area would maximize economic efficiency by the adoption of a single currency.* In other words, an optimum currency area is an economic region made up of units influenced symmetrically by disturbances and for which factors of production (including labor) can freely move. *He proposed two models, namely, the stationary expectations and the international risk-sharing model. He, however, called for the implementation of the international risk sharing model over the stationary expectations model by favoring the introduction of the Euro.*

According to Pytlarczyk and Kawalec (2012), a monetary union's concept suggests that the economies within the union forfeit their mechanisms of recovery of their international competitiveness by weakening (depreciating) their currency. This means that there is a loss of economic sovereignty and the economic recovery of such countries

in the event of economic shocks. According to Frankel and Rose (1998), the suitability for a country to join a currency union are dependent on a number of economic scenarios. These necessary and sufficient conditions include the volume and value of trade it engages in with other expected members of the union as well as the correlation between the country's business cycles and other potential members of the union. Bearing in mind the endogenous nature of the relationship between international trade dynamics and international business cycles, Frankel and Rose (1998) developed and examined the relationship between the two phenomena. From a data span of thirty (30) years for twenty (20) developed countries, they found that countries with closer trade relations tend to have highly correlated business cycles. One advantage especially to both creditors and issuer is the fact that national and corporate bonds issued in Euro are more liquid and attracts lower interest rates than bonds issued in national currencies. Benchimol (2014) stated that with the adoption of a single currency, financial markets within the area are expected to be more liquid and flexible than in the past. He also found that with a reduction in cross-border transaction cost, banks, and other financial institutions can offer a broader spectrum of financial services that can compete within and beyond the Eurozone. In sharp contrast, some studies have, however, identified that risk aversion in the Eurozone has gone up during the last forty years.

Goldberg and Verboven (2005) also assert that a significant effect of common currency such as the Euro is the general decline in the price level due to the law of one price. This is because arbitrage opportunities will exist due to differences in prices of commodities across borders. Therefore within the currency area, prices of goods and services mostly traded may converge, triggering inflation in some parts of the zone and deflation in some parts during the process. So many fears and concerns are entertained due to the heterogeneity and divergence of member countries' economies in the Eurozone, as expressed by Eichengreen (2007). For example, before the late 2000s recession, never was it envisaged that a member would exit the Eurozone or even the collapse of the entire zone. However, according to Ogunnoiki (2016) the Eurozone debt crisis, which significantly caught the global economy's attention, did not only come as a surprise, especially over the enormous external debt hanging over Greece. With a high disproportionate debt to GDP ratio of other member states of the Eurozone, Italy, Ireland, Portugal, and Spain. The Eurozone's future was bleak if left in its current state. This he perceived as a result of the rule and regulations created in the lead up to the Euro's adoption. Accordingly, Ogunnoiki (2016) further argues that the main guiding principles to introducing the currency in 1999 included the setting of a constraint limiting the member country's annual budget deficit to a maximum of three percent of GDP and limiting total accumulated debt to GDP ratio to sixty percent. However, by the year 2004, the two biggest economies, Germany and France run contrary to these critical guiding principles (rules) for three consecutive years. The formation of a currency zone removes all the complexities and inefficiencies associated with exchanging currency. From both empirical and theoretical points, adopting a single currency allows businesses and households to engage in trades or exchanges that were previously unprofitable with convenience. De Haan (2000) *found that even far before the coming into effect of the Euro, the economic consequences of inflation had been accommodated successfully by some countries. However, establishing a largely independent central bank (*the European Central Bank) modeled after the Bundesbank in Germany was necessary. On the contrary, Silvia (2004) observed that the Euro came under severe criticism due to its regulations and rigidities towards cooperating with member countries.

By taking into account all the benefits that a country derives from an economic union or a currency union, this study seeks to examine the stability and money demand functions of European countries that are not Eurozone members. This is imperative because the stability of the money demand function and other macroeconomic variables are part of the necessary economic conditions for an optimal currency union.

2. LITERATURE REVIEW

This study relates to the literature on optimal currency area and the stability of long-run money demand function. For example, Fagan and Henry (1998) found co-integrating relationship for monetary aggregates with

GDP and interest rate both in the long and short-run after examining the long-run properties of the three monetary aggregates; currency, M1, and M3H in the EU. The extension of the conventional aggregates of national aggregates by introducing Cross Border Holdings did not improve the results. They also found that the relatively good area-wide performance of the Euro was essentially a mean effect, and aggregation bias was found not to be a significant issue. From a panel co-integrating analysis of money demand conditions for new member countries with the potential of joining the euro area, Dreger, Reimers, and Roffia (2007) identified the possibility of a stable money demand function with the inclusion of exchange rate as an opportunity variable. The income elasticity of the long-run money demand function was greater than unity. In contrast, the US dollar exchange rate was a significant and reliable variable in the money demand function.

In a related study, Chen and Wu (2004) found an alternative interpretation to the inability of most of the available literature to support a long-run money demand function. They argued that applying the traditional linear cointegration method in assessing the long-run money demand might not be reliable considering that transaction cost exists. They provided evidence to the claim that disequilibrium in the money demand function is followed by a mean-reverting process beyond a specified range and follows a random walk within the range (Kai, 2006) also examined the presence of any structural changes in money demand at the end of 2001 due to the significant growth in M3 which outstripped the base value fixed by the European Central Bank. He found evidence of unstable money demand in the standard specification. Instead, money demand functions with augmented variables such as equity returns and volatility are stable. From the augmented money demand function, it was found that high growth in M3 did not cause excess liquidity; hence was no threat to price stability.

Ibrahim (1998) found the absence of a long-run relationship between monetary balance (M1) and macroeconomic variables but found a long-run relationship between M2 and macro variables in Malaysia. Evidence was found that M2 was not stable in the short run, and the effectiveness of M2 as a monetary policy tool was premised on the degree to which monetary policymakers can identify structural breaks in the money function and the extent to which they can identify the presence of a behavioral change in money demand. In the absence of this, he suggested the long-run stabilization policies should be the central focus of monetary policymakers.

Ahad (2017) examined Pakistan's money demand function from 1972 to 2012 by incorporating financial development indicators and including industrial production, income, and exchange rate. The study adopted the Bayer-Hanck combined co-integration and the Johansen co-integration methods to test for co-integration among the variables and a vector error correction model to establish the direction of causality in the short and long run. His study identified the presence of a long-run relationship between money demand and the determinants of financial development. The money demand function was mainly determined by financial development both in the short and long run. Also, from Pakistan, Qazi (2009) applied a robust time series method to data spanning from 1995 to 207 to interrogate the causal relationship between financial innovation and money demand. His empirical analysis found the presence of a long-run stable relationship between money demand, its determinants, and opportunity variables such as exchange rate, economic activity, and financial innovation. Most important from the empirical results is the fact that financial innovation positively affected money demand both in the long-run and short run. In addition, the elasticity in the short run was found to be more elastic than in the long-run.

Nchor and Adamec (2016) found that income level (GDP) affects money demand in the long-run, whereas interest rate only has a short-run effect. They employed Johansen's co-integration test and an error correction model to examine the determining factors of real money balances in Ghana from 1990 to 2014. From the error correction terms for each case, it was established that 18% of the deviations in the real money demand is corrected annually. Their analysis from the CUSUM test of parameter stability also revealed the presence of a stable money demand function in Ghana. From a post-financial sector deregulation data analysis in Nigeria, Oludele and Simplice (2019) found a stable long-run money demand function in Nigeria. For the opportunity variables, they found inflation a better and reliable proxy than the interest rate. The study employed both the cumulative sum test and

cumulative sum squared test after determining the presence of a long-run relationship between monetary balances (M1 and m2) and their determinants through the ARDL bounds test method.

Bhatta (2013) found the presence of long-run nexus among the demand for real money aggregates (M1and M2) and its determinants in Nepal through an ARDL and co-integration estimation technique using annual time series data from 1975 to 2009. Analysis of the long-run stability from both the CUSUM test and CUSUM squared technique proved the stability of both M1 and M2 (narrow money and broad money). Based on these findings, it was recommended that the monetary policymakers could achieve the broader macroeconomic objectives by relying on monetary aggregates of M1 and M2 as intermediate targets.

Korhonen and Mehrotra (2010), from a money demand function in Russia, examined the monetary determinants of inflation after the 1998 crisis. They found that the demand for real rubble aggregates and the income elasticity of money was greater than one, representing the Russian economy's remonetization. Shocks in broad money caused higher inflation, whereas adjustment towards equilibrium was affected by inflation. Their study also demonstrated that fluctuations in exchange rates significantly affected money demand in Russia. They established that, despite the Russian economy's de-dollarization, the stable influence of exchange rate on money demand would dominate. Papadamou, Nikolaos, and Panayiotis (2019)found from both theoretical and empirical examination of the interrelationship between consumers' confidence indicator, proxied by optimism (pessimism) and money demand including transaction cost in a panel data analysis involving 11 Eurozone countries (defined into two groups; core and periphery countries) which confirmed that the influence of confidence indicator (optimism/pessimism) on money demand are positive/negative. They also observed that countries in the periphery group that recorded greater responsiveness to the 2008 financial crises exhibited lower real money demand elasticity to consumer spending and consumer confidence index. From a panel dataset consisting of 38 countries, Benati, Lucas Jr, Nicolini, and Weber (2020) observed the dynamics of the long-run money demand for M1. For most of the countries under consideration, they found a long-run stable relationship between the ratio of M1 to GDP and the short-run interest rate. The elasticity coefficient of interest rate was estimated between 0.3 and 0.6 from the model's log-log specification. Ozdemir and Saygılı (2013) adopted the Nymblom test of the Co-integrated VAR technique to examine the stability of Turkey's money demand function by including uncertainty variables in the model. Their study indicated that by adding the precise measure of uncertainty in the model, a stable and reliable money demand function is estimated for Turkey. In quarterly panel data analysis of 11 OECD countries from 1983 to 2006, Dobnik (2013) examined the long-run money demand function using the principal component analysis to detect the presence of cross-member cointegration and to ascertain whether national or international factors are the reasons why money demand and its determinants are not stationary. The common factors were found to be integrated after the first difference I (1), whereas the idiosyncratic factors were found to be integrated at a level I(0). The study established a positive impact of income on money demand but recorded a negative effect on the interest rate, exchange rate, and stock prices. It also found supporting evidence that the exchange rate is a significant factor of money demand, even though the result is inconclusive for stock prices. The panel error correction model results concluded that the various domestic money aggregates would converge to a unified international equilibrium.

Kjosevski, Petkovski, and Naumovska (2016) also adopted a dynamic ordinary least squares technique to investigate the stability of the money demand function in five Western Balkan countries using quarterly data from 2005 to 2014. Their estimation result identified the presence of a stable long-run relationship between real money demand and its determinants (interest rate, inflation, exchange rate, and the European debt crisis affect variable). The long-run coefficients (elasticity) of the model were found to be -0.086, 0.002, 0.519, and 0.030, respectively

3. DATA

The study adopts annual time series data (broad money (M2), GDP, inflation, exchange rate, real interest rate,

obtained from the World Development Indicators (WDI), annual Libor rate, and the S&P 500 were obtained from macro.net

Price index: Inflation, GDP deflator (annual %).

Broad money: (M2 in Local Currency Unit).

Income: Gross Domestic Product - GDP (constant Local Currency Unit).

Interest rate: Real domestic interest rate (%).

Libor is the London interbank overnight rate (annual 3-month rate).

Stock index: S&P 500 end of year adjusted price.

Official exchange rate (LCU per US$, period average).

4. METHODOLOGY

Following the standard macroeconomic theory of money demand and its determinants;

$$\frac{M}{P} = f(Y, R, ov) \qquad (1)$$

Where:

M represents nominal monetary aggregates (M0, M1and M2).

Y is the income level.

R is the domestic interest rate.

P is the general price level (inflation).

ov is the vector of opportunity variables, such as exchange rate, international interest rate, stock prices, etc.

However, in this study, we employ annual series of broad money (M2), gross domestic product (GDP) as our income variable, annual series of GDP deflator as our measure of the general price level (inflation), real domestic interest rate, exchange rate, international interest rate (Libor rate) and the S&P 500 index to capture the international movement of asset prices.

Equation 1 is formally expressed as:

$$ln(RM2)_{it} = \beta_0 + \beta_1 lnRGDP_{it} + \beta_2 lnEXCH_{it} \beta_3 INFL_{it} + \beta_4 RINT_{it} + \beta_5 Libor_{it} + \beta_6 ln(S\&P\ 500)_{it} + \varepsilon_{it} \qquad (2)$$

Where,

ln(RM2) is the natural log of real broad money.

ln(RGDP) is the natural log of real GDP.

ln(EXCH) is the natural log exchange rate.

RINT is the real domestic interest rate.

Labor is the London interbank overnight rate.

ln(S&P 500) is the natural log of the S&P 500 index.

The parameters β_1, $\beta_2$and β_6 of Equation 2 are the income, exchange rate, and S&P 500 elasticities, respectively. β_3, β_4, and β_5 also represent semi-elasticities of inflation, real interest rate, and the labor rate. Macroeconomic theory predicts a negative relationship between real money demand (real M2) and all the independent variables except income (real GDP). According to Mark and Donggyu (2003) the income elasticity is significant in monetary expansion, consistent with the long-run price stability level. The semi elasticity of interest rate also helps to ascertain the welfare cost of long-term inflation.

4.1. ARDL Model Specification

In this adopt, we adopt the ARDL bounds co-integration technique developed by Pesaran, Shin, and Smith (2001) to investigate the long-run relationship between the money demand function and its determinants. The method's adoption is based on the fact that it can detect and wipe out the problems of autocorrelation and

endogeneity that may arise between the independent and dependent variables. Even for a small sample size, it provides consistent results.

The ADRL (p, $q_1, q_2, \ldots q_k$) model specification is given as follows:

Pesaran et al. (2001).

$$\alpha(L,p)y_{it} = \mu + \sum_{1=i}^{k} \beta i(L,p)\chi_{it} + \lambda' w_{it} + \varepsilon_{it} \quad \forall t = 1,\ldots\ldots\ldots\ldots,n$$

where;

$\alpha(L,p) = 1 - \alpha_1 L - \alpha_2 L^2 - \ldots\ldots\ldots\ldots\ldots - \alpha_p L^p$

$\beta_i(L,q_i) = \beta_{i0} + \beta_{i1}L + \beta_{i2}L^2 + \ldots\ldots + \beta_{iqi}L^{qi} \quad \forall i = 1, 2\ldots\ldots\ldots\ldots, k$

y t = dependent variable

μ = constant term.

L = lag operator

w t =s×1 vector of deterministic variables such as intercept term,

time trends, or exogenous variables with fixed lags.

Table 1 reports summary information of the variables in this study. The table contains 484 country-year observations from 1996 - 2019. The descriptive statistics are the mean, standard deviation, minimum, and maximum of all the key variables.

Table-1. Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
lnRM2	484	13.331	90.395	-386.013	1368.489
lnRGDP	484	13.583	90.987	-395.812	1385.303
INFL	484	12.014	46.544	-18.899	914.126
lnEXCH	483	3.334	2.154	-6.628	5.056
RINT	484	5.423	12.357	-69.134	139.812
Libor	484	3.002	2.016	0.56	6.87
ln(S&P 500)	484	7.22	0.375	6.03	7.977

Table-2. Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) lnRM2	1.000						
(2) lnRGDP	1.000*	1.000					
(3) INFL	-0.032	-0.032	1.000				
(4) lnEXCH	0.051	0.051	-0.116*	1.000			
(5) RINT	0.013	0.016	-0.429*	0.160*	1.000		
(6) Libor	-0.059	-0.057	0.192*	-0.045	0.065	1.000	
(7) lnSP500	0.017	0.017	-0.120*	0.042	-0.159*	-0.362*	1.000

Note: * shows significance at the .05 level.

Table 2 reports the correlation matrix among the variables of the study. The correlation coefficients for most variables are less correlated and statistically significant at a 5% significance level.

Table-3. Unit root test of the variables.

Country	Variable	Level Mackinnon P-Value	First Difference Mackinnon P-Value
Amernia	lnRM2	0.0452 **	0.0000***
	lnRGDP	0.0465 **	0.0000***
	INFLATION	0.0000 ***	0.0000***
	LnEXCHANGE RATE	0.7405	0.0715*
	INTEREST RATE	0.2078	0.0520*
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Azerbaijan	lnRM2	0.0715*	0.0124**

	lnRGDP	0.5657	0.0115**
	INFLATION	0.0479**	0.0005***
	LnEXCHANGE RATE	0.9132	0.0179**
	INTEREST RATE	0.0314**	0.0012***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Belarus	lnRM2	0.9783	0.0000***
	lnRGDP	0.7921	0.0000***
	INFLATION	0.1977	0.0013***
	LnEXCHANGE RATE	0.0584*	0.0011***
	INTEREST RATE	0.1004	0.0038***
	LIBOR	0.1105	0.0033**
	S&P 500	0.8059	0.0033***
Bosnia & H	lnRM2	0.1092	0.0517**
	lnRGDP	0.1093	0.0520**
	INFLATION	0.1635	0.0126**
	LnEXCHANGE RATE	0.5517	0.0750*
	INTEREST RATE	0.0000***	0.0026***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Bulgaria	lnRM2	0.0028***	0.0000***
	lnRGDP	0.0025***	0.0000***
	INFLATION	0.1607	0.0003***
	LnEXCHANGE RATE	0.1571	0.0002***
	INTEREST RATE	0.4199	0.0057***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Croatia	lnRM2	0.0754*	0.0257**
	lnRGDP	0.0761*	0.0256**
	INFLATION	0.3033	0.0093***
	LnEXCHANGE RATE	0.4248	0.0562*
	INTEREST RATE	0.1644	0.0568*
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Czech	lnRM2	0.0522**	0.0013***
	lnRGDP	0.0520 **	0.0013***
	INFLATION	0.0000***	0.0271**
	LnEXCHANGE RATE	0.5355	0.0386**
	INTEREST RATE	0.7703	0.0295**
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Georgia	lnRM2	0.0337**	0.0007***
	lnRGDP	0.0316**	0.0007***
	INFLATION	0.0132**	0.0001***
	LnEXCHANGE RATE	0.7142	0.0070***
	INTEREST RATE	0.7072	0.0005***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Hungary	lnRM2	0.2636	0.0013***
	lnRGDP	0.2609	0.0013***
	INFLATION	0.0013***	0.0020***
	LnEXCHANGE RATE	0.1613	0.0637*
	INTEREST RATE	0.9525	0.0139**
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Iceland	lnRM2	0.0906*	0.0005***
	lnRGDP	0.0898*	0.0005***
	INFLATION	0.1227	0.0119**
	LnEXCHANGE RATE	0.2039	0.0715*
	INTEREST RATE	0.8200	0.0040***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Kosovo	lnRM2	0.4101	0.0037***
	lnRGDP	0.4078	0.0037***
	INFLATION	0.1967	0.0026***
	LnEXCHANGE RATE	0.0576	0.0618*
	INTEREST RATE	0.0000***	0.0011***

	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Moldova	lnRM2	0.0851	0.0015***
	lnRGDP	0.0852	0.0015***
	INFLATION	0.6069	0.0000***
	LnEXCHANGE RATE	0.9658	0.0000***
	INTEREST RATE	0.0008***	0.0000***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383***
Montenegro	lnRM2	0.2350	0.0126**
	lnRGDP	0.2323	0.0127**
	INFLATION	0.4443	0.0299**
	LnEXCHANGE RATE	0.5610	0.0146**
	INTEREST RATE	0.2332	0.0058***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
N. Macedonia	lnRM2	0.1448	0.0006***
	lnRGDP	0.1414	0.0006***
	INFLATION	0.0184**	0.0168**
	LnEXCHANGE RATE	0.2422	0.0000***
	INTEREST RATE	0.5052	0.0168**
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Romania	lnRM2	0.5052	0.0510**
	lnRGDP	0.5049	0.0510**
	INFLATION	0.0056***	0.0419**
	LnEXCHANGE RATE	0.5183	0.0000***
	INTEREST RATE	0.0891	0.0003***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Russian FeD	lnRM2	0.4662	0.0000***
	lnRGDP	0.4565	0.0000***
	INFLATION	0.6883	0.0000***
	LnEXCHANGE RATE	0.6769	0.0013***
	INTEREST RATE	0.0002	0.0000***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Serbia	lnRM2	0.8031	0.0012***
	lnRGDP	0.7991	0.0012***
	INFLATION	0.3808	0.0000***
	LnEXCHANGE RATE	0.0065	0.0955*
	INTEREST RATE	0.8457	0.0005***
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Sweden	lnRM2	0.0050	0.0011***
	lnRGDP	0.0051	0.0011***
	INFLATION	0.0002	0.0001***
	LnEXCHANGE RATE	0.8960	0.0000***
	INTEREST RATE	0.0399	0.0048***
	LIBOR	0.3651	0.0028***
	S&P 500	0.4694	0.0072***
Switzerland	lnRM2	0.0208**	0.0003***
	lnRGDP	0.0206**	0.0003***
	INFLATION	0.3815	0.0830*
	LnEXCHANGE RATE	0.5752	0.0236**
	INTEREST RATE	0.5537	0.0009**
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383**
Ukraine	lnRM2	0.0890	0.0190
	lnRGDP	0.0867	0.0186
	INFLATION	0.1004	0.0148
	LnEXCHANGE RATE	0.3982	0.0030
	INTEREST RATE	0.1424	0.0836
	LIBOR	0.3203	0.0051***
	S&P 500	0.9512	0.0383

Note: *** p<0.01, ** p<0.05, * p<0.1.

Table 3 presents the summary report of the unit root test of the variable for each country. Even though most of the variables are not stationary at level, none is stationary at the second difference. The need to difference the data (to ensure stationarity) is to avoid spurious regression results. The ARDL model also requires that all the variables be stationary at their level or first difference.

Table-4. Im-Pesaran-Shin unit-root test.

Variable	Level	First Difference
LnRM2	-6.2808***	-15.7224***
LnRGDP	-6.3186***	-15.7284***
INFL	-61.8712***	-50.6141***
lnExch	-2.5673***	-10.0807***
RINT	-8.2465***	-19.1037***
Libor	-4.6970***	-8.8950***
LnS&P500	3.0645	-10.6517***

Note: *** p<0.01.

The unit root test for stationarity of the entire panel data is also reported in Table 4. It is indicated that the S&P 500 series's natural log is not stationary at level; however, stationary after the first difference.

Pedroni's cointegration tests:

No. of Panel units: 20 Regressors: 6

No. of obs.: 483 Avg obs. per unit: 24

Data has been time-demeaned.

Table-5. Pedroni's cointegration test

Test Stats.	Panel	Group
V	-2.21	.
Rho	1.324	3.079
T	-6.793	-6.837
Adf	-1.992	-1.576

Table 5 is the summary result of the panel test for co-integration using the Pedroni cointegration test. The summary report indicates the presence of a long-run relationship among the variables.

Table-6. ARDL bounds test.

Country	Lags	F-stats	Remark
Armenia	1 2 2 0 0 2 2	7.173	Co-integrated
Azerbaijan	2 2 2 2 2 2 2	533.080	Co-integrated
Belarus	2 2 2 2 2 2 2	8.276	Co-integrated
Bosnia & H	1 1 0 0 2 0 2	18.270	Co-integrated
Bulgaria	2 2 2 2 2 2 2	17.253	Co-integrated
Croatia	2 0 1 2 2 2 2	1.5e+07	Co-integrated
Czech Rep	2 2 1 2 2 2 1	15.067	Co-integrated
Georgia	2 2 2 2 2 2 2	1737.341	Co-integrated
Hungary	2 2 2 2 2 0 2	5.017	Co-integrated
Iceland	1 0 0 0 0 0 1	2.5e+05	Co-integrated
Kosovo	1 1 1 0 0 0 0	5.563	Co-integrated
Moldova	1 1 2 2 1 2 2	9.509	Co-integrated
Montenegro	2 1 0 2 2 2 2	73.722	Co-integrated
N. Macedonia	2 2 2 2 2 2 2	155.872	Co-integrated
Romania	2 2 2 1 2 2 2	14.145	Co-integrated
Russian FeD	2 2 2 2 2 2 2	9.171	Co-integrated
Serbia	2 2 2 2 2 2 1	127.763	Co-integrated
Sweden	2 2 1 2 0 2 2	2.273	Not Co-integrated
Switzerland	1 2 0 2 2 2 1	21.453	Co-integrated
Ukraine	2 2 1 2 2 2 0	23.242	Co-integrated

Table 6 summarizes the ARDL bounds test summary report indicating the maximum lags for each specific country. Based on the F-stats and the corresponding remarks, the variables in Sweden are not co-integrated.

Table-7. Regression results.

	Armenia	Azeber.	Belarus	Bosnia	Bulgaria	Croatia	Czech.
	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2
L.lnRM2	-1.461***	-0.577	-0.430	-1.511***	-1.353*	-0.997***	-1.377***
	(0.233)	(0.160)	(0.493)	(0.257)	(0.192)	(0.000)	(0.218)
LR:lnRGDP	0.922***	1.014**	0.963***	0.978***	0.963***	0.988***	0.989***
	(0.008)	(0.021)	(0.012)	(0.001)	(0.006)	(0.000)	(0.001)
LR:INFL	0.164	0.213	-0.001	0.004	0.233	-0.060***	-0.136
	(0.140)	(0.061)	(0.001)	(0.011)	(0.051)	(0.009)	(0.120)
LR:lnEXCH	2.531	2.209	0.015	0.291	-1.568	2.079***	1.669
	(1.691)	(0.881)	(0.042)	(0.163)	(0.468)	(0.123)	(0.892)
LR:RINT	0.300***	0.117	-0.001	0.002	0.157	0.037***	-0.426
	(0.074)	(0.031)	(0.001)	(0.003)	(0.033)	(0.006)	(0.343)
LR:Libor	-0.694***	-0.128	0.000	0.024	-0.166	0.035***	0.102
	(0.179)	(0.054)	(0.014)	(0.013)	(0.042)	(0.006)	(0.107)
LR:lnSP500	1.367	-2.129	0.000	0.166*	1.224	0.095***	-0.033
	(0.834)	(0.829)	(0.134)	(0.078)	(0.238)	(0.017)	(0.829)
SR:D.lnRGDP	-0.418	0.372	0.546	-0.500*	-0.322		-0.374
	(0.216)	(0.150)	(0.472)	(0.251)	(0.189)		(0.216)
SR:LD.lnRGDP	0.011**	0.459	0.802		2.791		-0.255
	(0.004)	(0.090)	(0.365)		(0.766)		(0.144)
SR:D.INFL	0.515**	-0.071**	0.000		0.018	0.040***	-0.661**
	(0.195)	(0.003)	(0.000)		(0.004)	(0.005)	(0.193)
SR:LD.INFL	0.440**	-0.076**	0.000		-0.002		
	(0.143)	(0.004)	(0.000)		(0.001)		
SR:D.Libor	0.891**	0.068	-0.007		0.283	-0.047***	-0.686**
	(0.335)	(0.014)	(0.006)		(0.056)	(0.006)	(0.184)
SR:LD.Libor	1.729**	0.176*	-0.005		0.046	0.057***	-0.401**
	(0.559)	(0.024)	(0.003)		(0.012)	(0.007)	(0.119)
SR:D.lnSP500	-9.547**	0.478	-0.019	0.218	-2.085	-0.275***	2.680
	(3.264)	(0.171)	(0.050)	(0.423)	(0.409)	(0.040)	(1.343)
SR:LD.lnSP500	-5.692	-0.459	0.083	1.433***	-0.952	-0.231***	
	(3.034)	(0.151)	(0.054)	(0.334)	(0.200)	(0.048)	
SR:LD.lnRM2		-0.496	-0.831		-2.806	-0.001***	0.258
		(0.096)	(0.381)		(0.771)	(0.000)	(0.145)
SR:D.lnEXCH		1.890**	-0.001		-6.141	-0.817**	5.023
		(0.138)	(0.009)		(1.693)	(0.195)	(2.247)
SR:LD.lnEXCH		-0.323	0.041		-1.767	-2.982***	-9.086*
		(0.166)	(0.013)		(0.691)	(0.429)	(3.530)
SR:D.RINT		-0.034*	-0.000	0.006	0.056	0.019*	-0.495
		(0.003)	(0.000)	(0.007)	(0.019)	(0.007)	(0.235)
SR:LD.RINT		-0.054**	-0.000	0.011**	-0.053	0.003	0.381*
		(0.004)	(0.000)	(0.004)	(0.013)	(0.002)	(0.143)
SR:_cons	-33.881**	7.215	-0.011	-2.320**	-3.648	-10.376***	-8.571
	(11.814)	(1.155)	(0.423)	(0.916)	(0.828)	(0.597)	(9.464)
Obs.	22	22	22	22	22	22	22
R-squared	0.980	0.980	0.980	0.980	0.980	0.980	0.980
DW stats	2.1185	2.64357	1.3224	2.9586	2.68687	1.3584	2.1229
BG LM test	0.1379	0.1547	0.0569	0.0023	0.2908	0.2934	0.6173
Imtest White	0.416	0.4017	0.4017	0.4017	0.4017	0.4017	0.4017
Skewness	0.4587	0.1751	0.9350	0.0220	0.8958	0.1306	0.4020
Kurtosis	0.2406	0.2042	0.260	0.3564	0.0680	0.3432	0.2366
All	0.4106	0.2548	0.623	0.1088	0.4873	0.2482	0.3849
CUSUM	Stable	Stable	Not stable	Stable	Stable	Stable	Stable
CUSUMsq	Not stable	Not stable	stable	stable	stable	stable	Not stable

Note: Standard errors are in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1.

Table 7 is the report of the long-run demand function of Armenia, Azerbaijan, Belarus, Bosnia, Bulgaria, Croatia, and the Czech Republic. For all the countries, the income elasticity coefficient is positive and statistically significant at 1% in the long-run. This result is consistent with macroeconomic theory, which predicts a positive

relationship between income and money demand. This result is also consistent with the findings of Dritsaki and Dritsaki (2020), who found a positive relationship between real GDP (income) and nominal M1.

Table-8. Regression results.

	Georgia	Hungary	Iceland	Kosovo	Moldova	Mont.	N. Maced.
	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2
L.lnRM2	-12.672**	0.182	-1.000***	-1.606***	-0.080	-1.480***	-1.851*
	(0.324)	(0.283)	(0.001)	(0.286)	(0.119)	(0.084)	(0.182)
LR:lnRGDP	0.951***	0.973***	0.982***	0.960***	0.982***	0.971***	0.959***
	(0.000)	(0.020)	(0.002)	(0.002)	(0.011)	(0.000)	(0.001)
LR:INFL	0.064***	-0.042	0.028**	-0.024***	0.010	0.007**	-0.136
	(0.001)	(0.081)	(0.011)	(0.007)	(0.018)	(0.002)	(0.022)
LR:lnEXCH	1.345***	-2.078	-0.127	-0.020	0.714	-0.370**	3.002
	(0.006)	(3.435)	(0.238)	(0.235)	(1.239)	(0.083)	(0.934)
LR:RINT	0.033***	0.002	0.027**	-0.161	-0.003	-0.031**	-0.033*
	(0.000)	(0.034)	(0.012)	(0.297)	(0.011)	(0.007)	(0.003)
LR:Libor	-0.047***	-0.043	-0.048**	0.056**	-0.025	-0.029**	-0.032
	(0.000)	(0.047)	(0.016)	(0.022)	(0.034)	(0.007)	(0.011)
LR:lnSP500	0.439***	-0.192	0.262***	0.133	-0.422	0.300***	-0.694*
	(0.002)	(0.516)	(0.079)	(0.091)	(0.631)	(0.018)	(0.056)
SR:LD.lnRM2	2.712**	-0.851*				-0.001**	0.190
	(0.060)	(0.323)				(0.000)	(0.080)
SR:D.lnRGDP	-11.110**	1.161**		-0.582*	0.897***	-0.466***	-0.821
	(0.309)	(0.279)		(0.274)	(0.116)	(0.081)	(0.174)
SR:LD.lnRGDP	-2.605**	0.837*					-0.187
	(0.058)	(0.318)					(0.077)
SR:D.INFL	-0.646**	-0.004		0.019**	0.003***		0.419**
	(0.022)	(0.003)		(0.009)	(0.001)		(0.032)
SR:LD.INFL	-0.034**	-0.010*			0.005***		0.634
	(0.001)	(0.004)			(0.001)		(0.115)
SR:D.lnEXCH	-13.131**	0.034			-0.179*	0.459**	-3.448
	(0.414)	(0.071)			(0.071)	(0.117)	(1.346)
SR:LD.lnEXCH	-2.050**	-0.175			0.256**	0.685***	10.986*
	(0.057)	(0.143)			(0.066)	(0.129)	(0.869)
SR:D.RINT	-0.405**	-0.002			-0.001	0.035**	0.308*
	(0.014)	(0.003)			(0.001)	(0.008)	(0.027)
SR:LD.RINT	-0.014**	-0.006				0.035***	0.611
	(0.001)	(0.003)				(0.007)	(0.114)
SR:D.Libor	0.355**				-0.011**	-0.002	0.207*
	(0.010)				(0.004)	(0.010)	(0.031)
SR:LD.Libor	0.991**				0.006	0.035**	0.385
	(0.033)				(0.004)	(0.010)	(0.075)
SR:D.lnSP500	-4.530**	-0.074	0.452**		0.047	0.120	-1.569
	(0.147)	(0.035)	(0.197)		(0.029)	(0.086)	(0.298)
SR:LD.lnSP500	-7.297**	-0.044			-0.246**	0.222*	0.467
	(0.230)	(0.057)			(0.054)	(0.092)	(0.209)
SR:_cons	-126.189**	-2.026*	-1.490	-1.344	0.008	-3.185***	-13.817
	(3.827)	(0.684)	(0.912)	(1.120)	(0.142)	(0.292)	(7.080)
Obs.	22	22	23	23	22	22	22
R-squared	0.980	0.980	0.980	0.980	0.980	0.980	0.980
DW stats	2.2849	0.8556	1.5252	2.5759	0.7995	1.8560	2.2330
BG LM test	0.1905	0.024	0.7317	0.2775	0.0193	0.4336	0.0315
Imtest White	0.4017	0.4017	0.4017	0.4017	0.4017	0.4017	0.4017
Skewness	0.9883	0.2165	0.1213	0.0652	0.3123	0.3060	0.0248
Kurtosis	0.0392	0.2015	0.5097	0.2230	0.4027	0.6498	0.2601
All	0.5082	0.2802	0.2574	0.1637	0.3752	0.3957	0.1067
CUSUM	Stable	Stable	Stable	Stable	Not Stable	Stable	Stable
CUSUMsq	Not Stable	Stable	Not Stable	Not Stable	Stable	Stable	Not Stable

Note: Standard errors are in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1

We also report that the long-run semi-elasticity and elasticity for inflation and exchange rate are not statistically significant for all the countries in Table 7 are not statistically significant except Croatia at 1%. However, the long-run semi-elasticity coefficients of interest rate (positive) and Libor rate (negative) are

statistically significant at 1%. . The results from the CUSUM test and CUSUM squared test also indicates that total stability in the long-run demand function was only recorded in Bosnia, Bulgaria, and Croatia whereas Armenia, Azerbaijan, Belarus, and the Czech Republic recorded partial stability.

Table 8 is the report of the long-run demand function of Georgia, Hungary, Iceland, Kosovo, Moldova, Montenegro, and Northern Macedonia. For all the countries, the income elasticity coefficient is positive and statistically significant at 1% in the long-run. This result is consistent with macroeconomic theory, which predicts a positive relationship between income and money demand. This result is also consistent with the findings of Dritsaki and Dritsaki (2020), who found a positive relationship between real GDP (income) and nominal M1 in Italy. We also report mixed results for the long-run semi-elasticity and elasticity for the opportunity variables (inflation, exchange rate, interest rate Libor rate, and the S&P 500); even though they are most significant across countries, their signs do contradict macroeconomic predictions in some cases. A particular case is found in Georgia, where the elasticity coefficients of inflation, exchange rate, interest rate, and S&P 500 are all statistically significant at 1% but positive, except for the semi-elasticity coefficient of LIBOR. The results from the CUSUM test and CUSUM squared test also indicates that total stability in the long-run demand function was only recorded in Hungary and Montenegro, whereas Georgia, Iceland, Kosovo, Moldova, and Northern Macedonia recorded partial stability.

Table-9. Regression results continued.

	Romainia	Russia	Serbia	Switzer	Ukraine	Sweden
	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2	lnRM2
L.lnRM2	-2.114**	-0.661	0.965**	-1.610***	-1.409***	0.746**
	(0.280)	(0.415)	(0.113)	(0.158)	(0.126)	(0.261)
L2.lnRM2						0.786**
						(0.293)
lnRGDP						0.973***
						(0.002)
L.lnRGDP						-0.728**
						(0.255)
L2.lnRGDP						-0.770**
						(0.286)
INFL						-0.111**
						(0.043)
L.INFL						-0.127**
						(0.049)
lnEXCH						-0.095
						(0.504)
L.lnEXCH						-1.354*
						(0.606)
L2.lnEXCH						0.448
						(0.358)
RINT						-0.014
						(0.019)
Libor						0.055
						(0.030)
L.Libor						0.076**
						(0.028)
L2.Libor						-0.059**
						(0.024)
lnSP500						-0.867**
						(0.280)
L.lnSP500						0.272
						(0.248)
L2.lnSP500						0.385
						(0.222)
_cons						6.602
						(4.217)

LR:lnRGDP	0.968***	0.973***	0.972***	1.023***	0.968***	
	(0.001)	(0.004)	(0.000)	(0.001)	(0.005)	
LR:INFL	-0.002	-0.003	-0.001*	0.220	0.001	
	(0.001)	(0.005)	(0.000)	(0.165)	(0.001)	
LR:lnEXCH	-0.173	0.202	-0.085**	7.233	0.120	
	(0.071)	(0.075)	(0.010)	(5.290)	(0.061)	
LR:RINT	-0.001	-0.006	-0.002	0.617	-0.002***	
	(0.001)	(0.007)	(0.001)	(0.574)	(0.000)	
LR:Libor	0.010	0.013	-0.026**	0.071	-0.014**	
	(0.004)	(0.012)	(0.004)	(0.079)	(0.003)	
LR:lnSP500	-0.002	0.106	0.149***	-1.321**	0.016	
	(0.011)	(0.045)	(0.010)	(0.420)	(0.021)	
SR:LD.lnRM2	0.708*	0.490	-0.818**		0.550**	
	(0.211)	(0.439)	(0.105)		(0.128)	
SR:D.lnRGDP	-1.081*	0.336	1.917***	-0.625**	-0.374**	
	(0.271)	(0.404)	(0.110)	(0.162)	(0.121)	
SR:LD.lnRGDP	-0.687*	-0.477	0.799**	-0.002**	-0.514**	
	(0.204)	(0.428)	(0.102)	(0.001)	(0.123)	
SR:D.INFL	0.000	-0.001	0.002***		0.003	
	(0.000)	(0.002)	(0.000)		(0.002)	
SR:LD.INFL	0.000	-0.005	-0.001**			
	(0.000)	(0.002)	(0.000)			
SR:D.lnEXCH	0.120*	-0.227	-0.088**	-21.114**	-0.333***	
	(0.040)	(0.118)	(0.009)	(6.075)	(0.053)	
SR:LD.lnEXCH		-0.289	-0.074**	-11.601*	-0.243**	
		(0.048)	(0.011)	(5.344)	(0.062)	
SR:D.RINT	0.001	-0.002	-0.009***	-1.526	0.004	
	(0.000)	(0.003)	(0.001)	(0.775)	(0.002)	
SR:LD.RINT	0.002	-0.005	-0.005***	-1.902**	-0.001	
	(0.001)	(0.002)	(0.000)	(0.592)	(0.001)	
SR:D.Libor	-0.022	0.012	0.010**	-0.546**	0.011**	
	(0.010)	(0.007)	(0.002)	(0.170)	(0.003)	
SR:LD.Libor	-0.007	-0.011	-0.015**	-0.754**	0.022***	
	(0.003)	(0.005)	(0.003)	(0.198)	(0.003)	
SR:D.lnSP500	0.057	-0.078	0.066**	4.798**		
	(0.031)	(0.071)	(0.013)	(1.726)		
SR:LD.lnSP500	0.062	-0.117				
	(0.048)	(0.091)				
SR:_cons	1.655	-1.081	0.671**	-41.471	-0.889	
	(0.877)	(0.830)	(0.092)	(35.310)	(0.600)	
Obs.	22	22	22	22	22	22
R-squared	0.980	0.980	0.980	0.980	0.980	0.980
DW stats	1.8631	2.0147	1.4021	2.4572	1.4399	1.0285
BG LM test	0.6306	0.0141	0.6672	0.0858	0.3280	0.0133
Imtest White	0.4017	0.4017	0.4017	0.4017	0.4017	0.4093
Skewness	0.6638	0.0640	0.7748	0.7496	0.1998	0.7843
Kurtosis	0.6719	0.1518	0.3239	0.0442	0.3286	01905
All	0.5569	0.1472	0.5588	0.3891	0.2977	0.5214
CUSUM test	Stable	Stable	Not Stable	Stable	Stable	Not Stable
CUSUMsq test	Stable	Stable	Stable	Not Stable	Not Stable	Stable

Note: Standard errors are in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1.

Table 9 shows the long-run demand function of Romania, Russia, Serbia, Switzerland, Ukraine except for Sweden. The money demand curve for Sweden is not co-integrated. For all the countries, the income elasticity coefficient is positive and statistically significant at 1% in the long-run. This result is consistent with macroeconomic theory, which predicts a positive relationship between income and money demand. This result is also consistent with the findings of Dritsaki and Dritsaki (2020), who found a positive relationship between real GDP (income) and nominal M1 in Italy. We also report that the long-run semi-elasticity and elasticity of the

opportunity variables (inflation, exchange rate, interest rate, Libor rate, and S&P 500) are all negative and statistically significant in Serbia and Ukraine. The results from the CUSUM test and CUSUM squared test also indicate that total stability in the long-run demand function was only recorded in Romania and Russia. In contrast, Serbia, Switzerland, Ukraine, and Sweden recorded partial stability.

Table-10. Regression results continued.

	Full effect	**Joint effect**
	D.lnRM2	**D.lnRM2**
lnRGDP	0.908***	1.021***
	(0.006)	(0.001)
INFL	-0.157**	-0.057**
	(0.077)	(0.029)
lnEXCH	4.689***	1.079*
	(1.707)	(0.601)
RINT	0.212***	-0.048*
	(0.074)	(0.025)
Libor	-0.235*	-1199.658
	(0.140)	(0.000)
lnS&P500	0.273	-0.647**
	(0.662)	(0.314)
Armenia __ec	-0.945***	
	(0.179)	
D.lnRGDP	0.060	
	(0.165)	
D.INFL	0.181	
	(0.148)	
D.lnEXCH	0.224	
	(4.091)	
D.RINT	-0.029	
	(0.113)	
D.Libor	0.821***	
	(0.271)	
D.lnSP500	-3.313	
	(2.030)	
Cons	-22.597***	
	(7.367)	
Azerbaijan __ec	0.012	
	(0.046)	
D.lnRGDP	0.964***	
	(0.041)	
D.INFL	-0.048*	
	(0.027)	
D.lnEXCH	-0.150	
	(1.365)	
D.RINT	-0.044*	
	(0.024)	
D.Libor	0.130	
	(0.133)	
D.lnSP500	-1.564	
	(1.259)	
Cons	0.059	
	(0.153)	
Belarus __ec	-0.000	
	(0.000)	
D.lnRGDP	0.956***	
	(0.002)	
D.INFL	-0.000	
	(0.000)	

D.lnEXCH	0.010	
	(0.008)	
D.RINT	-0.000**	
	(0.000)	
D.Libor	-0.004**	
	(0.002)	
D.lnSP500	0.038***	
	(0.015)	
Cons	0.000	
	(0.003)	
Bosnia & H__ec	0.008	
	(0.017)	
D.lnRGDP	0.983***	
	(0.016)	
D.INFL	-0.003	
	(0.007)	
D.lnEXCH	0.383	
	(0.706)	
D.RINT	0.008	
	(0.006)	
D.Libor	-0.004	
	(0.069)	
D.lnSP500	1.103	
	(0.681)	
Cons	-0.010	
	(0.089)	
Bulgaria__ec	-0.015**	
	(0.007)	
D.lnRGDP	0.977***	
	(0.006)	
D.INFL	-0.001***	
	(0.000)	
D.lnEXCH	1.156***	
	(0.392)	
D.RINT	-0.014***	
	(0.002)	
D.Libor	0.022*	
	(0.012)	
D.lnSP500	0.021	
	(0.106)	
Cons	-0.347**	
	(0.164)	
Croatia__ec	0.002	
	(0.003)	
D.lnRGDP	0.988***	
	(0.003)	
D.INFL	-0.007	
	(0.006)	
D.lnEXCH	1.211***	
	(0.442)	
D.RINT	-0.007**	
	(0.003)	
D.Libor	-0.002	
	(0.009)	
D.lnSP500	0.165*	
	(0.085)	
Cons	0.041	
	(0.080)	
Czech Rep__ec	-0.005	
	(0.012)	
D.lnRGDP	0.982***	

	(0.011)	
D.INFL	-0.108	
	(0.207)	
D.lnEXCH	2.021	
	(3.930)	
D.RINT	-0.290	
	(0.248)	
D.Libor	-0.104	
	(0.199)	
D.lnSP500	0.996	
	(1.600)	
Cons	-0.257	
	(0.302)	
Georgia __ec	-0.019	
	(0.017)	
D.lnRGDP	0.930***	
	(0.016)	
D.INFL	0.007***	
	(0.002)	
D.lnEXCH	0.223	
	(0.262)	
D.RINT	0.008**	
	(0.004)	
D.Libor	0.013	
	(0.017)	
D.lnSP500	0.092	
	(0.159)	
Cons	-0.430	
	(0.410)	
Hungary __ec	0.002	
	(0.002)	
D.lnRGDP	0.985***	
	(0.002)	
D.INFL	0.004**	
	(0.002)	
D.lnEXCH	-0.012	
	(0.064)	
D.RINT	0.002	
	(0.002)	
D.Libor	-0.001	
	(0.003)	
D.lnSP500	0.008	
	(0.026)	
Cons	0.036	
	(0.048)	
Iceland__ec	-0.015	
	(0.026)	
D.lnRGDP	0.968***	
	(0.025)	
D.INFL	0.006	
	(0.010)	
D.lnEXCH	0.150	
	(0.332)	
D.RINT	0.001	
	(0.013)	
D.Libor	-0.015	
	(0.024)	
D.lnSP500	0.154	
	(0.170)	
Cons	-0.361	
	(0.629)	

Kosovo__ec	-0.073	
	(0.050)	
D.lnRGDP	0.889***	
	(0.047)	
D.INFL	0.003	
	(0.009)	
D.lnEXCH	0.730	
	(0.737)	
D.RINT	0.077	
	(0.355)	
D.Libor	0.089	
	(0.073)	
D.lnSP500	-0.721	
	(0.580)	
Cons	0.103	
	(0.374)	
Moldova __ec	0.002	
	(0.001)	
D.lnRGDP	0.977***	
	(0.001)	
D.INFL	0.003***	
	(0.001)	
D.lnEXCH	0.079	
	(0.071)	
D.RINT	-0.001	
	(0.001)	
D.Libor	-0.002	
	(0.005)	
D.lnSP500	-0.013	
	(0.043)	
Cons	0.038	
	(0.025)	
Montenegro __ec	0.000	
	(0.008)	
D.lnRGDP	0.971***	
	(0.007)	
D.INFL	0.027***	
	(0.003)	
D.lnEXCH	-0.145	
	(0.161)	
D.RINT	0.012**	
	(0.005)	
D.Libor	0.001	
	(0.015)	
D.lnSP500	-0.140	
	(0.121)	
Cons	0.037**	
	(0.015)	
N. Macedonia__ec	-0.024	
	(0.049)	
D.lnRGDP	0.939***	
	(0.047)	
D.INFL	-0.120	
	(0.178)	
D.lnEXCH	1.662	
	(2.622)	
D.RINT	-0.051	
	(0.161)	
D.Libor	0.110	
	(0.097)	
D.lnSP500	-0.726	

	(0.833)	
Cons	-0.503	
	(1.122)	
Romania __ec	-0.000	
	(0.000)	
D.lnRGDP	0.966***	
	(0.001)	
D.INFL	-0.000	
	(0.000)	
D.lnEXCH	0.006	
	(0.023)	
D.RINT	-0.000	
	(0.000)	
D.Libor	-0.002	
	(0.002)	
D.lnSP500	0.035***	
	(0.012)	
Cons	-0.011	
	(0.008)	
Russia Fed _ec	-0.003**	
	(0.001)	
D.lnRGDP	0.977***	
	(0.002)	
D.INFL	-0.001	
	(0.000)	
.lnEXCH	0.008	
	(0.038)	
D.RINT	-0.002**	
	(0.001)	
D.Libor	0.004	
	(0.004)	
D.lnSP500	-0.010	
	(0.037)	
Cons	-0.062**	
	(0.031)	
Serbia __ec	-0.001	
	(0.001)	
D.lnRGDP	0.975***	
	(0.001)	
D.INFL	0.001***	
	(0.000)	
D.lnEXCH	0.014	
	(0.015)	
D.RINT	-0.001**	
	(0.001)	
D.Libor	0.013***	
	(0.003)	
D.lnSP500	-0.082***	
	(0.024)	
Cons	-0.001	
	(0.014)	
sweden__ec	0.030	
	(0.020)	
D.lnRGDP	1.000***	
	(0.019)	
D.INFL	-0.030	
	(0.022)	
D.lnEXCH	0.123	
	(0.327)	
D.RINT	-0.027	
	(0.018)	

D.Libor	-0.002	
	(0.017)	
D.lnSP500	-0.175	
	(0.132)	
Cons	0.666	
	(0.455)	
Switzerland __ec	-0.001	
	(0.014)	
D.lnRGDP	1.019***	
	(0.014)	
D.INFL	-0.321	
	(0.353)	
D.lnEXCH	-3.773	
	(7.060)	
D.RINT	-1.480***	
	(0.518)	
D.Libor	0.021	
	(0.299)	
D.lnSP500	-0.125	
	(2.220)	
Cons	0.065	
	(0.397)	
Ukraine __ec	-0.001	
	(0.002)	
D.lnRGDP	0.980***	
	(0.006)	
D.INFL	0.000	
	(0.001)	
D.lnEXCH	-0.075	
	(0.063)	
D.RINT	-0.002	
	(0.001)	
D.Libor	0.010	
	(0.007)	
D.lnSP500	-0.035	
	(0.053)	
Cons	-0.022	
	(0.046)	
SR:__ec		-0.079
		(0.049)
SR:D.lnRGDP		0.892***
		(0.048)
SR:D.INFL		-0.017
		(0.014)
SR:D.lnEXCH		0.453**
		(0.215)
SR:D.RINT		-0.049
		(0.037)
SR:Libor		94.888
		(58.909)
SR:D.lnSP500		-0.039
		(0.139)
SR:_cons		0.080
		(0.074)
Obs.	462	462

Note: Standard errors are in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1.

Table 10 shows the long-run demand function of the full and the joint sample of twenty (20) countries. From the full sample results, as displayed in column two of Table 10, all the elasticity coefficients of the opportunity

variables are all statistically significant and meet expectations except the coefficient of the S&P500, which not significant. Also, all the short-run elasticity coefficients of income are positive and statistically significant except for Armenia from the full sample results. The elasticity coefficient for Sweden is equal to unity, and the elasticity coefficient of Switzerland is greater than unity. From the joint panel results reported in column three (3) the income elasticity coefficient is positive and statistically significant at 1% in the long-run. This result is consistent with macroeconomic theory, which predicts a positive relationship between income and money demand. It is also consistent with the findings of Dritsaki and Dritsaki (2020) who found a positive relationship between real GDP (income) and nominal M1. Also, from column three (3), we find evidence that the long-run elasticity coefficients of the opportunity variables are also statistically significant. Their signs meet expectations except for the Libor rate with is not statistically significant.

Test for the stability of the money demand functions

According to Asongu, Folarin, and Biekpe (2019), an economy's money demand function is stable when both the CUSUM test and CUSUM – squared test is stable at a 5% significance level. It is said to be partially stable when only one is significant at 5%. The figures below are outcomes of the test for stability from both the CUSUM and CUSUM squared tests for all the countries under consideration. From the graphs, only seven (7) countries, namely; Russia, Hungary, Montenegro, Bosnia, Bulgaria, Romania, and Croatia, exhibited total stability. From the CUSUM test, partial stability is recorded in nine (9) countries; Armenia, Azerbaijan, Czech, Georgia, Iceland, Kosovo, Northern Macedonia, Switzerland, and Ukraine. While partial stability is also established in Belarus, Moldova, Serbia, and Sweden based on the CUSUM squared test of stability.

The figures below present the stability test from the CUSUM test and CUSUM squared test for all the countries under consideration.

4.2. Stability Graph of Armenia

The stability graphs from the CUSUM test and CUSUM squared test for Armenia are presented as Figures 1(a) and 1(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only stayed between the two bounded red lines just for the CUSUM test at the 5% significance level.

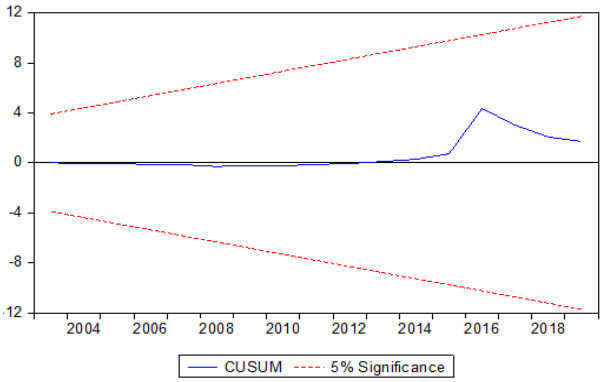

Figure-1(a): CUSUM test for Armenia.

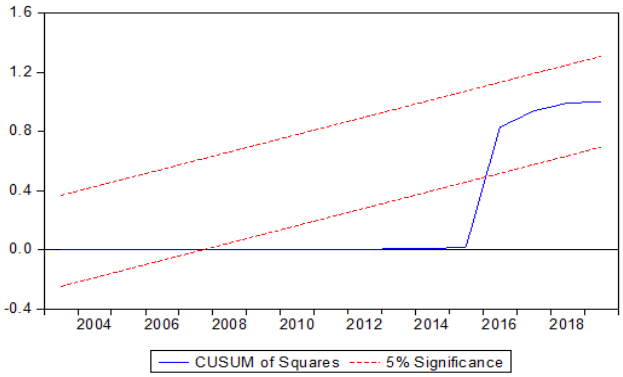

Figure-1(b): CUSUM squared test for Armenia.

4.3. Stability Graph of Azerbaijan

The stability graphs from the CUSUM test and CUSUM squared test for Azerbaijan are presented as Figures 2(a) and 2(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only stayed between the two bounded red lines just for the CUSUM test at the 5% significance level.

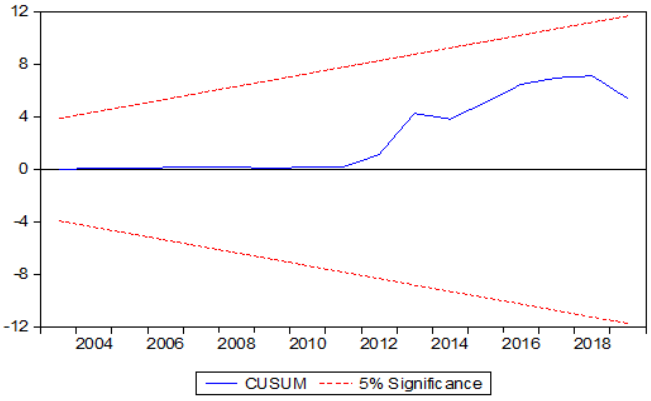

Figure-2(a). CUSUM test for Azerbaijan.

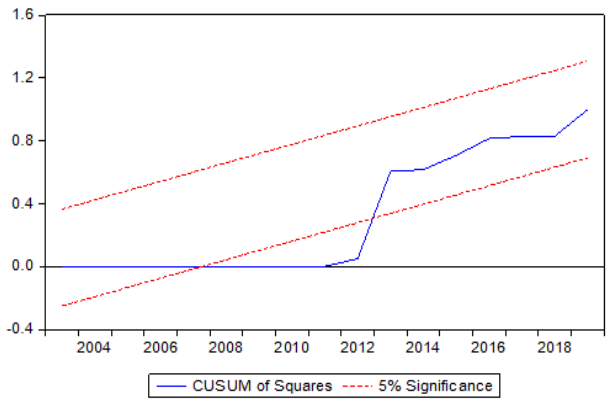

Figure-2(b). CUSUM squared test for Azerbaijan.

4.4. Stability Graph of Belarus

The stability graphs from the CUSUM test and CUSUM squared test for Belarus are presented as Figures 3(a) and 3(b), respectively. The result is interpreted as partial stability. The blue line (stability line at 5% significance level) stayed between the two bounded red lines just for the CUSUM squared test at a 5% significance level.

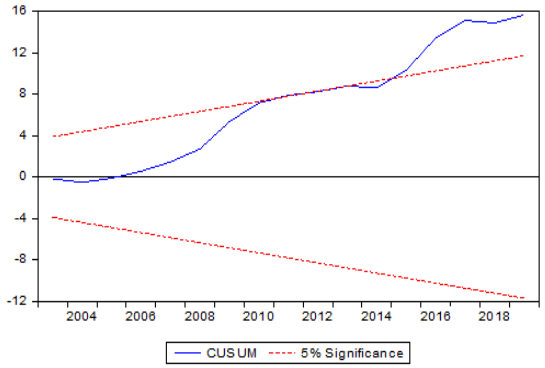

Figure-3(a). CUSUM test for Belarus.

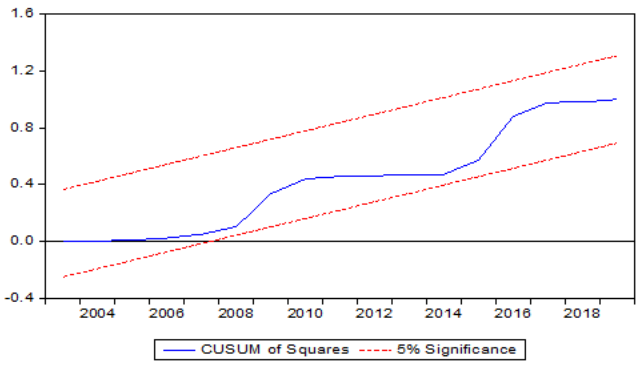

Figure-3(b). CUSUM squared test for Belarus.

4.5. Stability Graph of Bosnia

The stability graphs from the CUSUM test and CUSUM squared test for Bosnia are presented as Figures 4(a) and 4(b), respectively. The result is interpreted as total stability since the blue line (stability line at 5% significance level) stayed between the two fixed red lines for both the CUSUM test and the CUSUM squared test at 5% significance level.

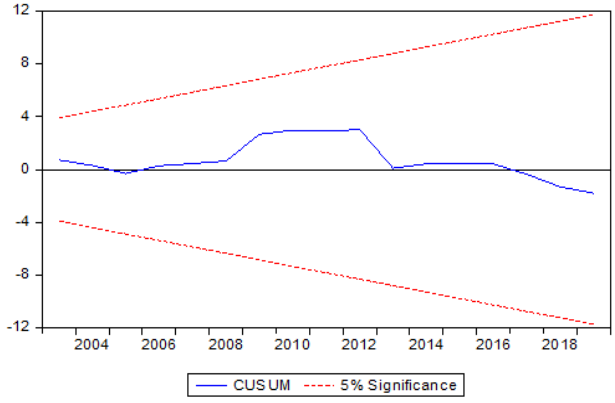

Figure-4(a). CUSUM test for Bosnia.

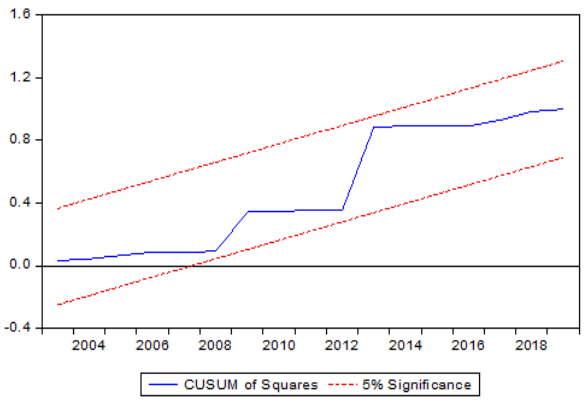

Figure-4(b). CUSUM squared test for Bosnia.

4.6. Stability Graph of Bulgaria

The stability graphs from the CUSUM test and CUSUM squared test for Bulgaria are presented as Figures 5(a) and 5(b), respectively. The result is interpreted as total stability since the blue line (stability line at 5% significance level) stayed between the two fixed red lines for both the CUSUM test and the CUSUM squared test at a 5% significance level.

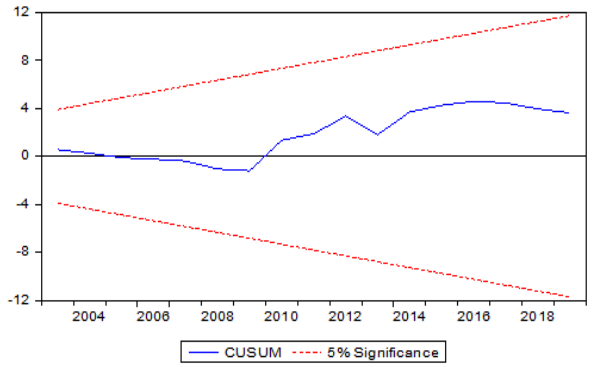

Figure-5(a). CUSUM test for Bulgaria.

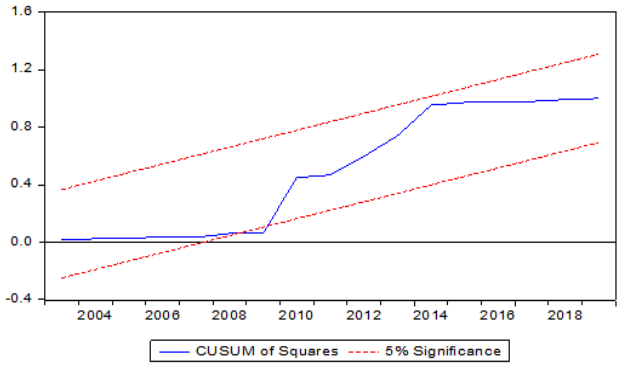

Figure-5(b). CUSUM squared test for Bulgaria.

4.7. Stability Graph of Croatia

The stability graphs from the CUSUM test and CUSUM squared test for Croatia are presented as Figures 6(a) and 6(b) respectively. The result is interpreted as total stability since the blue line (stability line at 5% significance level) stayed between the two bounded red lines for both the CUSUM test and the CUSUM squared test at 5% significance level.

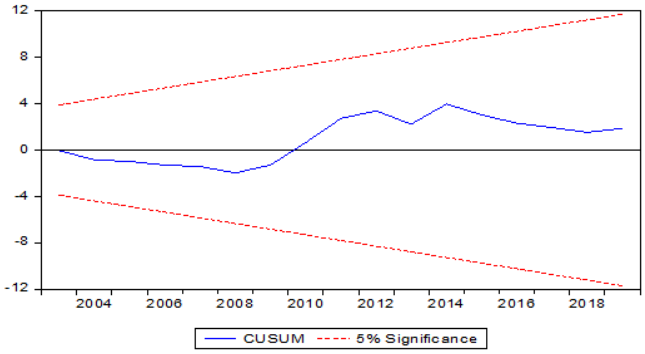

Figure-6(a). CUSUM test for Croatia.

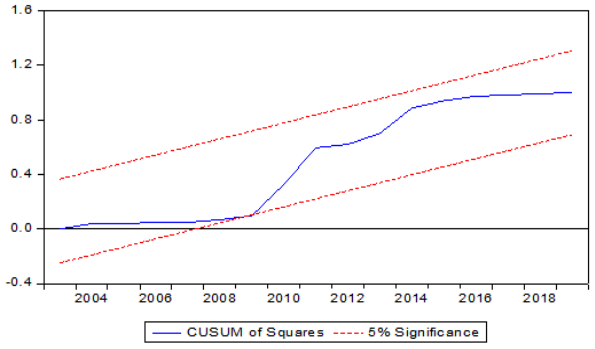

Figure-6(b). CUSUM squared test for Croatia.

4.8. Stability Graph of Czech

The stability graphs from the CUSUM test and CUSUM squared test for Czech are presented as Figures 7(a) and 7(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only stayed between the two fixed red lines just for the CUSUM test at the 5% significance level.

4.9. Stability Graph of Georgia

The stability graphs from the CUSUM test and CUSUM squared test for Georgia are presented as Figures 8(a) and 8(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only stayed between the two fixed red lines just for the CUSUM test at the 5% significance level.

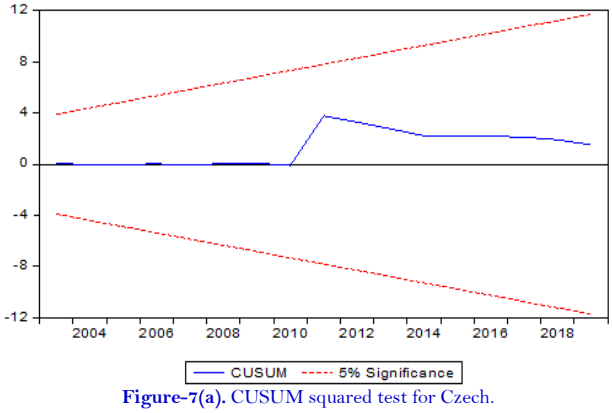

Figure-7(a). CUSUM squared test for Czech.

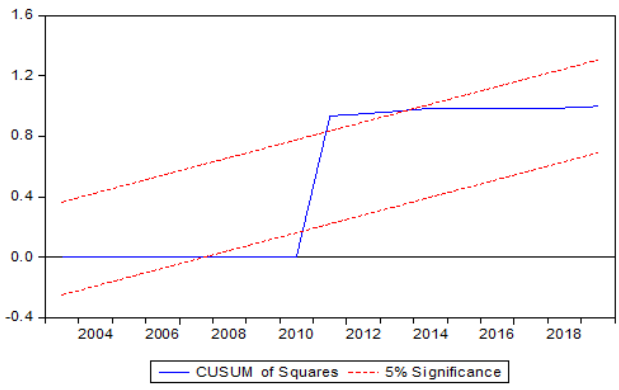

Figure-7(b). CUSUM squared test for Czech.

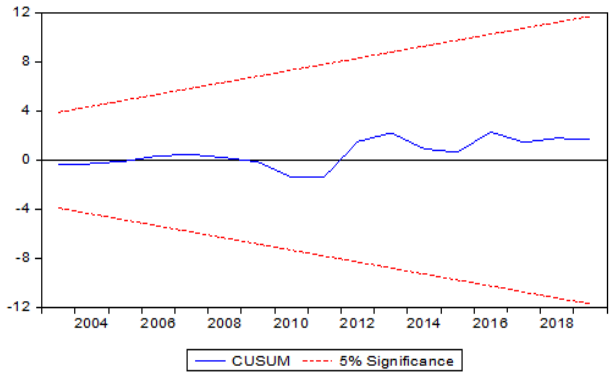

Figure-8(a). CUSUM test for Georgia.

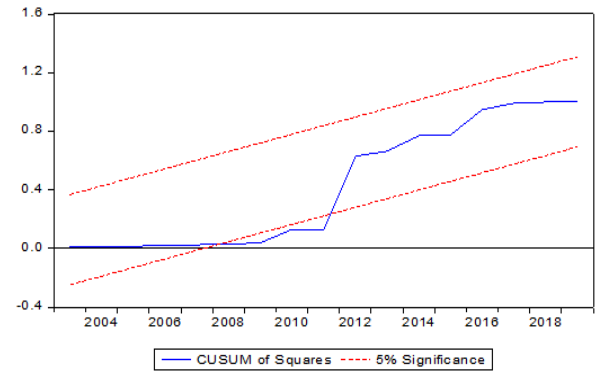

Figure-8(b). CUSUM squared test for Georgia.

4.10. Stability Graph of Hungary

The stability graphs from the CUSUM test and CUSUM squared test for Hungary are presented as Figures 9(a) and 9(b), respectively. The result is interpreted as total stability since the blue line (stability line at 5% significance level) stayed between the two fixed red lines for both the CUSUM test and the CUSUM squared test at 5% significance level.

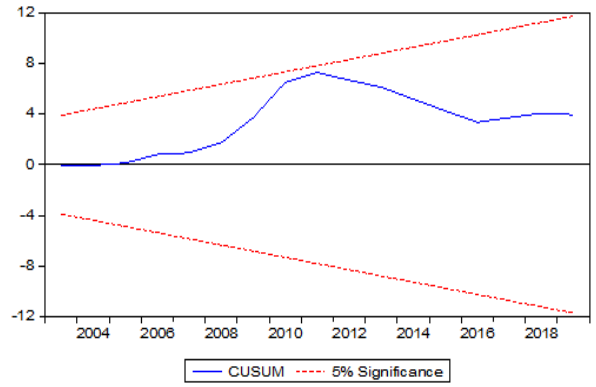

Figure-9(a). CUSUM test for Hungary.

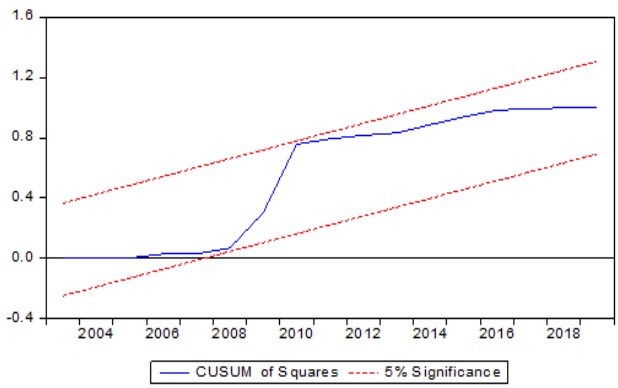

Figure-9(b). CUSUM squared test for Hungary.

4.11. Stability Graph of Iceland

The stability graphs from the CUSUM test and CUSUM squared test for Iceland are presented as Figures 10(a) and 10(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only stayed between the two fixed red lines just for the CUSUM test at the 5% significance level.

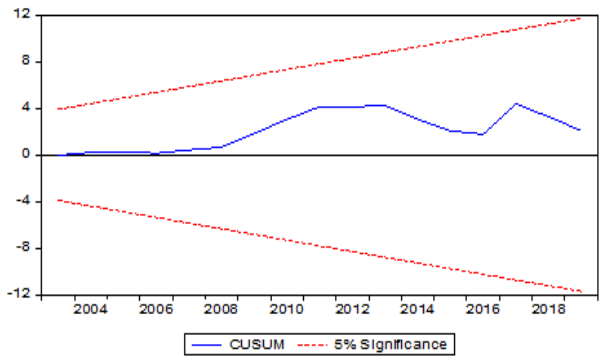

Figure-10(a). CUSUM test for Iceland.

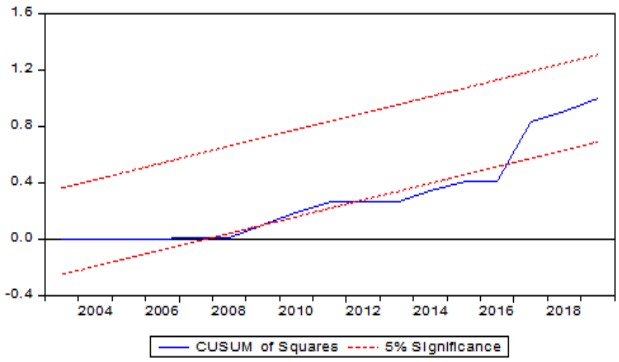

Figure-10(b). CUSUM squared test for Iceland.

4.12. Stability Graph of Kosovo

The stability graphs from the CUSUM test and CUSUM squared test for Kosovo are presented as Figures 11(a) and 11(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only stayed between the two fixed red lines just for the CUSUM test at the 5% significance level.

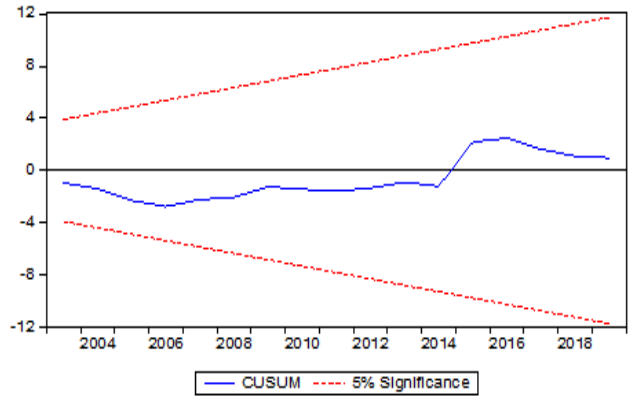

Figure-11(a). CUSUM test for Kosovo.

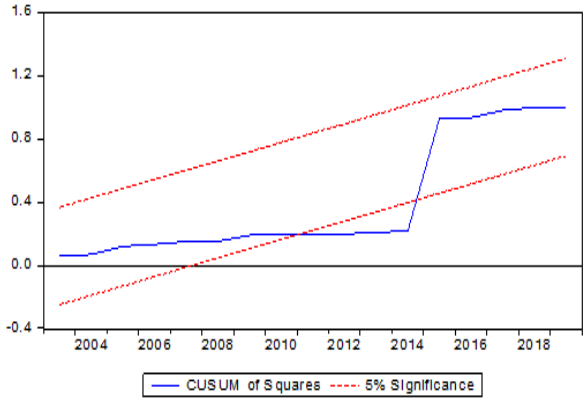

Figure-11(b). CUSUM squared test for Kosovo.

4.13. Stability Graph of Moldova

The stability graphs from the CUSUM test and CUSUM squared test for Moldova are presented as Figures 12(a) and 12(b), respectively. The result is interpreted as partial stability. The blue line (stability line at 5% significance level) stayed between the two fixed red lines just for the CUSUM squared test at a 5% significance level.

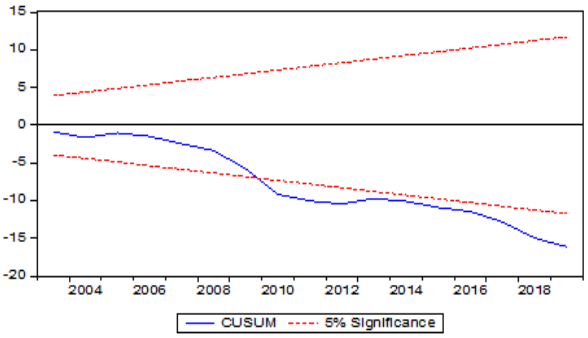

Figure-12(a). CUSUM test for Moldova.

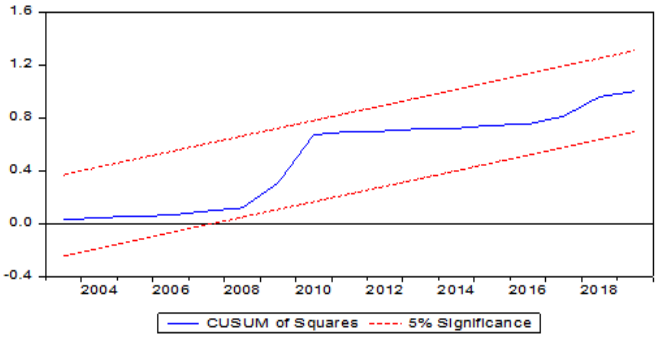

Figure-12(b). CUSUM squared test for Moldova.

4.14. Stability Graph of Montenegro

The stability graphs from the CUSUM test and CUSUM squared test for Montenegro are presented as Figures 13(a) and 13(b), respectively. The result is interpreted as total stability since the blue line (stability line at 5%

significance level) stayed between the two fixed red lines for both the CUSUM test and the CUSUM squared test at a 5% significance level.

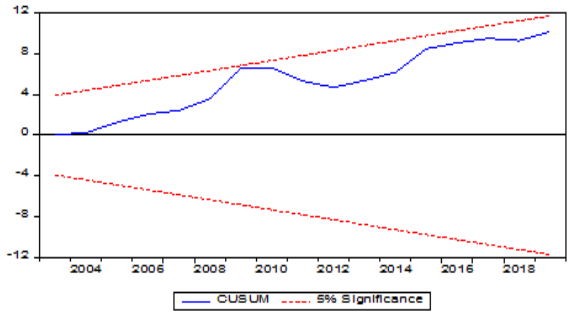

Figure-13(a). CUSUM test for Montenegro.

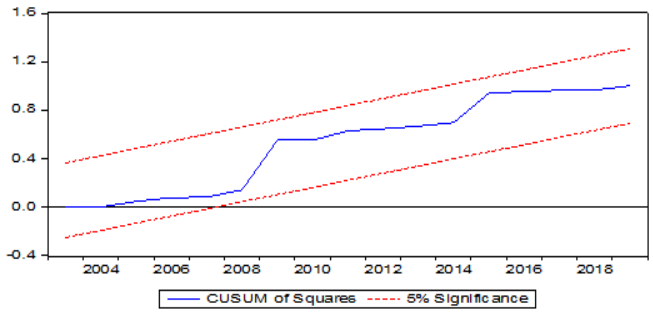

Figure-13(b). CUSUM squared test for Montenegro.

4.15. Stability Graph of N. Macedonia

The stability graphs from the CUSUM test and CUSUM squared test for N. Macedonia are presented as Figures 14(a) and 14(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only stayed between the two fixed red lines just for the CUSUM test at the 5% significance level.

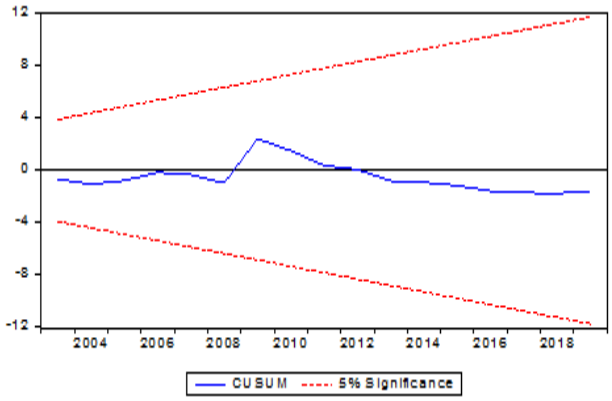

Figure-14(a). CUSUM test for N. Macedonia.

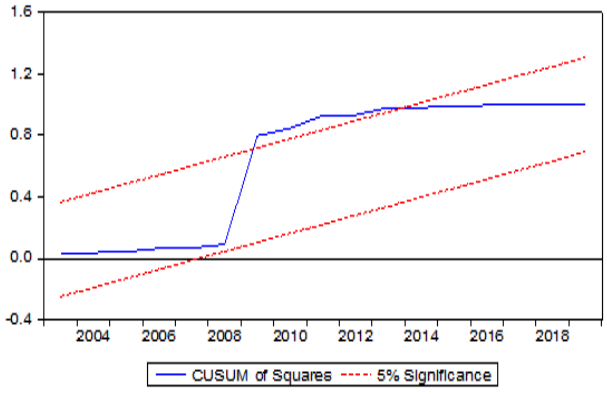

Figure-14(b). CUSUM squared test for N. Macedonia.

4.16. Stability Graph of Romania

The stability graphs from the CUSUM test and CUSUM squared test for Romania are presented as Figures 15(a) and 15(b), respectively. The result is interpreted as total stability since the blue line (stability line at 5% significance level) stayed between the two fixed red lines for both the CUSUM test and the CUSUM squared test at a 5% significance level.

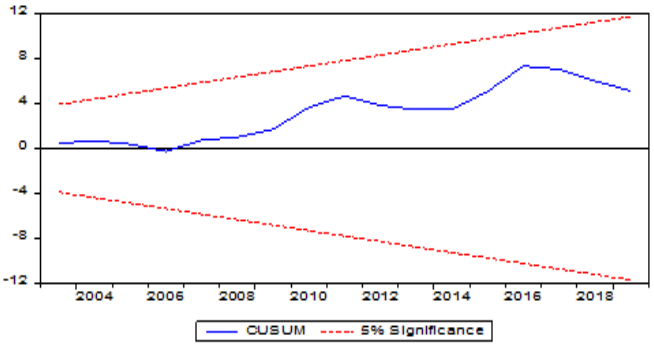

Figure-15(a). CUSUM test for Romania.

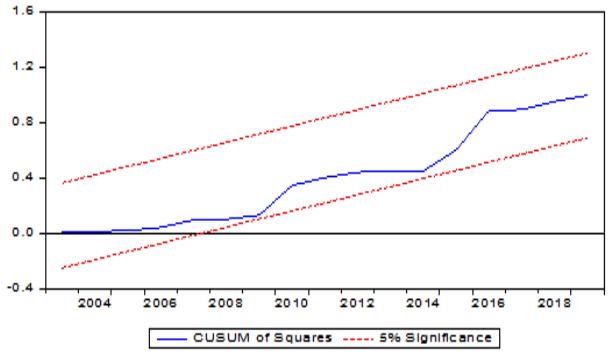

Figure-15(b). CUSUM squared test for Romania.

4.17. Stability Graph of Russia

The stability graphs from the CUSUM test and CUSUM squared test for Russia are presented as Figures 16(a) and 16(b), respectively. The result is interpreted as total stability since the blue line (stability line at 5% significance level) stayed between the two fixed red lines for both the CUSUM test and the CUSUM squared test at a 5% significance level.

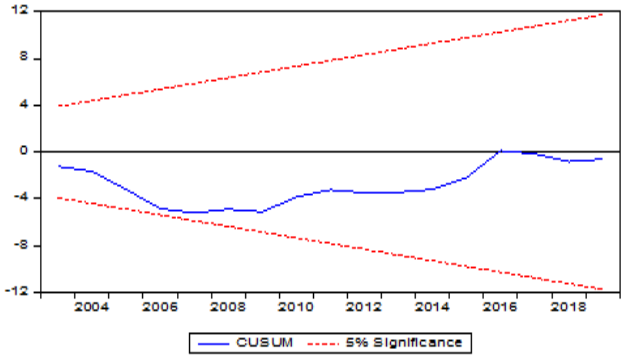

Figure-16(a). CUSUM test for Russia.

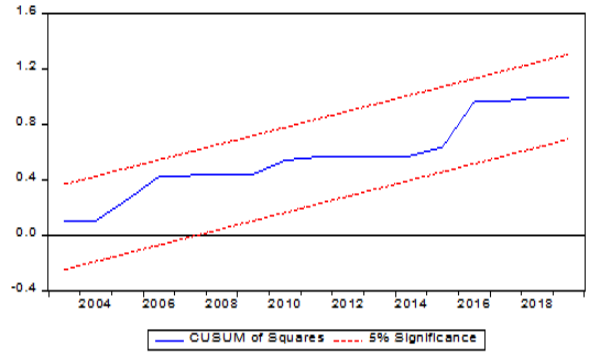

Figure-16(b). CUSUM squared test for Russia.

4.18. Stability Graph of Serbia

The stability graphs from the CUSUM test and CUSUM squared test for Serbia are presented as Figures 17(a) and 17(b), respectively. The result is interpreted as partial stability. The blue line (stability line at 5% significance level) stayed between the two fixed red lines just for the CUSUM squared test at a 5% significance level.

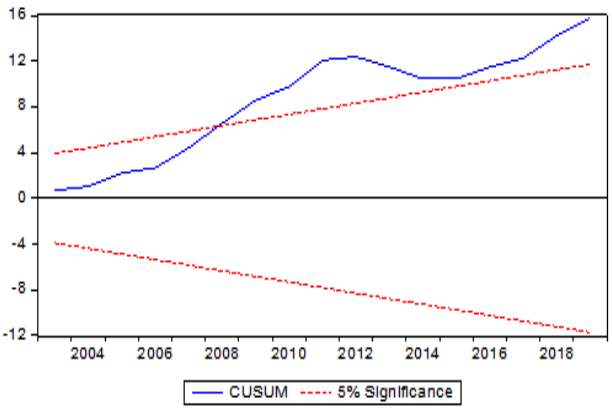

Figure-17(a); CUSUM test for Serbia.

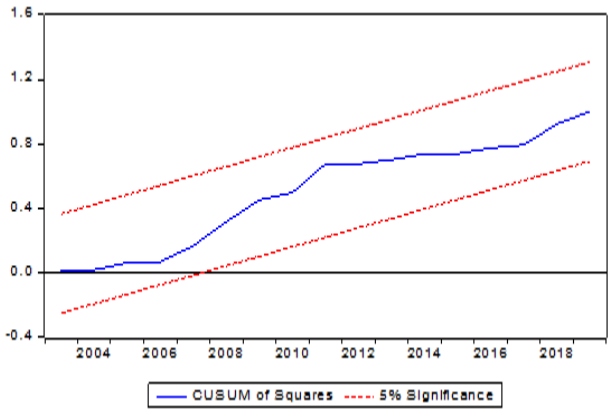

Figure-17(b): CUSUM squared test for Serbia.

4.19. Stability Graph of Switzerland

The stability graphs from the CUSUM test and CUSUM squared test for Switzerland are presented as Figures 18(a) and 18(b) respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only remained between the two bounded red lines just for the CUSUM test at the 5% significance level.

4.20. Stability Graph of Ukraine

The stability graphs from the CUSUM test and CUSUM squared test for Ukraine are presented as Figures 19(a) and 19(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only remained between the two fixed red lines just for the CUSUM test at the 5% significance level.

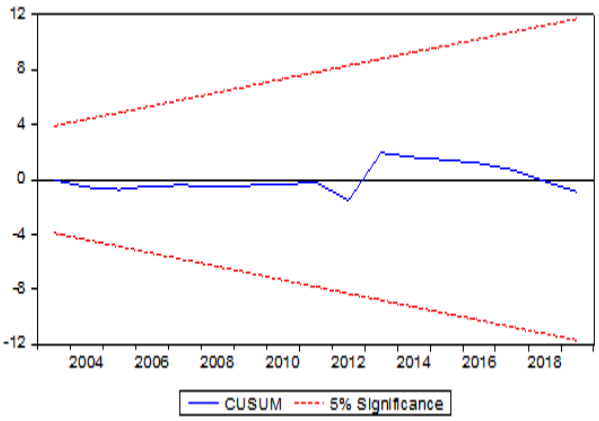

Figure-18(a). CUSUM test for Switzerland.

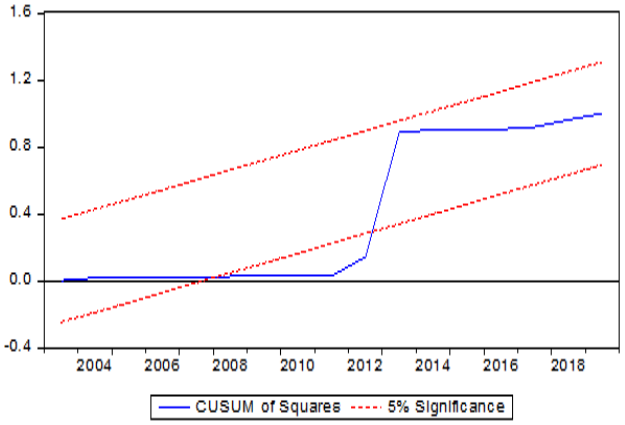

Figure-18(b). CUSUM squared test for Switzerland.

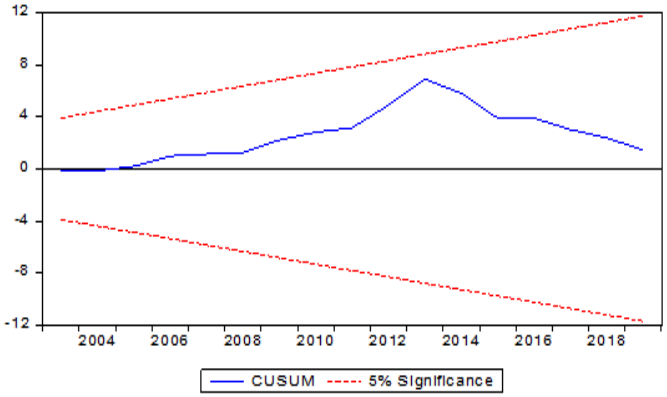

Figure-19(a). CUSUM test for Ukraine.

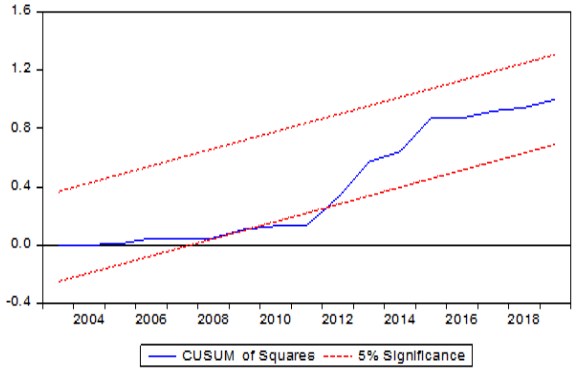

Figure-19(b). CUSUM squared test for Ukraine.

4.21. Stability Graph of Sweden

The stability graphs from the CUSUM test and CUSUM squared test for Sweden are presented as Figures 20(a) and 20(b), respectively. The result is interpreted as partial stability since the blue line (stability line at 5% significance level) only remained between the two fixed red lines just for the CUSUM squared test at a 5% significance level.

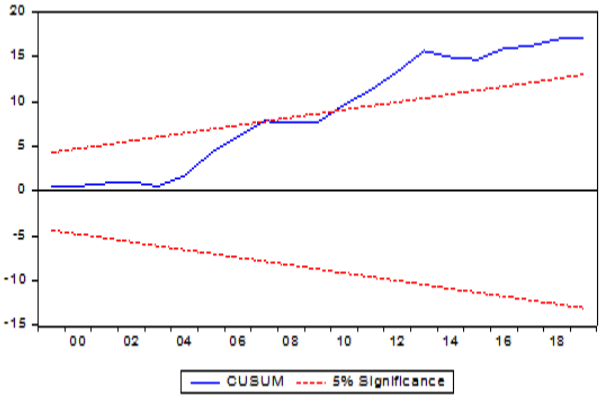

Figure-20(a). CUSUM test for Sweden.

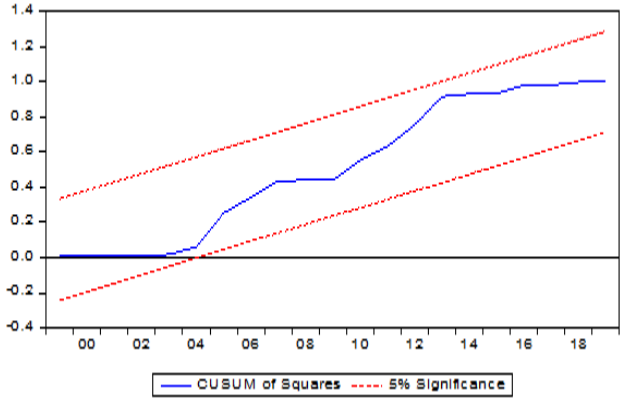

Figure-20(b). CUSUM squared test for Sweden.

5. DISCUSSION AND CONCLUSION

In this paper, we focused on the money demand function for twenty (20) countries in Europe yet remaining outside the Eurozone using a panel data analysis and a data set spanning from 1996 to 2019. We adopted the estimation technique of Co-integration to test for the presence of a long-run relationship among the variables for each country. We also employed the auto-regressive distributed lag model (ARDL) and error correction model

(ECM) to examine the long-run and short-run equilibrium of the models. The co-integration test confirmed the presence of both long-run and short-run relationships among the variables and ARDL estimates. For most countries, the signs of the elasticity coefficients are consistent with the expectations of macroeconomic theory. The results from the panel regression reported in column three (3) of Table 10 also meets expectation. We also found the presence of total stability in seven countries (Russia, Hungary, Montenegro, Bosnia, Bulgaria, Romania, and Croatia) from both the CUSUM test and CUSUM squared test, while the remaining thirteen (13) countries are partially stable. The stability conditions and the regression results of the seven countries are consistent with the findings of Dritsaki and Dritsaki (2020), who also found evidence of a stable money demand function in Italy, as well as the findings of Benati et al. (2020).

Bearing in mind that a stable macroeconomic environment is a pre-requisite condition for any country to join a currency union, attaining a membership status in the euro currency area will require a stable money demand function, stable prices, and a stable exchange rate regime. Considering that all the countries under investigation are in Europe and are potential members of the Eurozone. Hence addressing the significant divergence in the stability of their money demand functions is of pivotal importance in designing monetary goals and targets to achieve the needed convergence for a monetary zone (to join the Eurozone). This study draws similarities from the findings of Asongu et al. (2019); Harvey and Cushing (2015) on their study of long-run stability of money demand in West Africa (using 13 countries) and the presence of a currency union in West Africa, respectively.

The benefits and efficiencies attributed to a currency zone as echoed in both the theoretical and empirical literature is undoubtedly enormous to be ignored by these countries outside the Eurozone. However, joining the currency zone is premised on the stability of their macroeconomic environment through the stable monetary policies implemented by their sovereign central banks, especially for countries either than Russia, Hungary, Montenegro, Bosnia, Bulgaria, Romania, and Croatia. Such countries will have to initiate prudent macro policies to achieve and maintain stability.

Therefore, we strongly recommend to the monetary policymakers of the remaining thirteen countries to maintain balanced and moderation in monetary targets towards ensuring stable growth in monetary aggregate and the real side of their economies.

6. SUGGESTION FOR FURTHER STUDY

It is suggested for further study a comparative study between the money demand functions of the Eurozone and countries outside the zone. The essence is to provide a better proof of how prudent and better the European Central Bank has performed in terms of monetary and price stability over the central banks of non-eurozone countries.

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