

# DETERMINANTS OF MONEY DEMAND FUNCTION: A PANEL ARDL APPROACH ON SELECTED EMERGING COUNTRIES

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## ABSTRACT

Central Banks have the authority to influence many macroeconomic variables by changing the money aggregates. The interaction between the money supply changes and other macroeconomic variables contributes to the determination of the most appropriate policy rules. Therefore, it emphasizes the significance of the stability and the examination of the money demand function. This study investigates the short-run and long-run relations amongst money demand and its determinants during the period of 1996-2017 for nine selected Emerging Economies. These are, Brazil, Chile, China, India, Hungary, Malaysia, Mexico, South Africa, Thailand. To reach this goal, a panel Autoregressive Distributed Lag (ARDL) approach was used to determine the dynamics of money demand employing the pooled mean group (PMG) estimator. Empirical results affirm the presence of a long-term relationship among real money demand and its determinants; real income and real interest rate. Whereas the short-run estimations show the insignificance of real interest rate coefficients. An important policy implication that can be derived from these results is that fiscal policy shall be used, rather than monetary policy, to stabilize emerging-market economies.

**Keywords:** Panel ARDL approach, Emerging Markets, Money Demand

## ÖZ

### PARA TALEBİ FONKSİYONUNUN BELİRLEYİCİLERİ: SEÇİLMİŞ GELİŞMEKTE OLAN ÜLKELERDE BİR PANEL ARDL YAKLAŞIMI

Merkez Bankaları para arzını değiştirerek ekonomide birçok makroekonomik değişkeni etkileyebilme gücüne sahiptir. Para arzında oluşabilecek değişimlerle diğer makroekonomik değişkenler arasındaki etkileşim, en uygun politika kurallarının belirlenmesine katkı sağlayarak, para talebi fonksiyonunun tahmini ve istikrarlılığının önemini vurgulayacaktır. Bu çalışmada 1996-2017 yılları arasında Yükselen Piyasa Ekonomileri içerisinde yer alan

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*seçilmiş 9 ülke ekonomisi (Brezilya, Şili, Çin, Hindistan, Macaristan, Malezya, Meksika, Güney Afrika, Tayland) için kısa ve uzun dönem ilişkisi pooled mean group (PMG) tahmincisine dayanarak, Panel ARDL (Panel Autoregressive Distributed Lag) yöntemi ile incelenmiştir. Analiz sonucunda elde edilen bulgular; seçilmiş ülke ekonomileri için reel para talebi belirleyicilerinin; reel gelir ve reel faiz oranı olduğu ve bu değişkenler arasında uzun dönemli bir ilişkinin olduğu tespit edilmiştir. Ayrıca ele alınan değişkenler ile yapılan kısa dönem tahmin sonuçları ise reel faiz katsayısının önemsizliğini göstermektedir. Analiz sonucunda elde edilen temel bulgular ise yükselen piyasa ekonomilerini istikrara kavuşturmak için para politikasından ziyade maliye politikasının kullanılması gerektiğini göstermektedir.*

**Anahtar Kelimeler:** *Panel ARDL yöntemi, Yükselen Piyasalar, Para Talebi*

## **1. Introduction**

The analysis of money demand function involves the determination of the factors that specify public choices to hold money balances as well as the formulations of money function that is traditionally determined by scale variable (nominal GDP) and the opportunity cost of holding money measured by the interest rate. Many theoretical and empirical studies have addressed money demand function due to its important role in conducting the monetary policy. It allows a change in monetary aggregates that is driven by monetary policy to have predictable effects on real output, the ultimate price, and the interest rate.

Previous studies address the money demand starting with the quantity theory of money, which concentrates on the means of exchange as determinants of money demand. Following Fisher (1911), a scale of transactions brings about by a constant amount of nominal income (PY) indicates money quantity (Md) that individuals demand. Thus, the quantity theory of money that was developed by Fisher (1911) assumes that the money demand is solely an income-based, and interest rate has no impact on the demand for money. The alternative paradigm of quantity theory, which is known as the approach to cash balances, was provided by Pigou (1917) and Marshall (1923), who emphasized the significant role of money demand and income.

Based on the cash balance money framework, money considers a store of value, and demand for money is a share (k) of the nominal income. Following Pigou, Patinkin (1965) stated that a portion of wealth is held in liquid form by individuals. Rest on Patinkin's assumption, the quantity of cash that is held is not just subject to real variables but similarly to "real-balances effects" this was the basic difference concerning Pigu's theory. Keynes (1936) considered the demand for money as a store of value, however, in the liquidity preference theory Keynes proposed that interest rate is also a key determinant of money demand as well as real income. In the modern quantity theory of money,

Friedman (1956) stated that the money demand should be driven by the same factors influencing any asset demand. Therefore, Friedman's money demand function emphasizes that wealth ought to be a further steady indicator than current income.

In the light of the empirical literature, many scholars contend that there is a limited effect of interest rate on money demand due to the deficiency of financial assets in many developing countries. There is a consensus among the economists in support of the perspective according to which it is unreasonable evidence to concentrate on a particular political tool and ignore a significant variable in the light of the fact that mutually monetary aggregates and the interest rates are essential in the structure of policies. Thus, in a period of inflation targeting policies, indicated demand for money function is critical to monetary policy implementation.

Many countries have used monetary policy based on promptly decreasing policy rates or employing unconventional procedures to boost the operating of financial markets (OECD, 2009), to stimulate aggregate demand after the 2008 crisis and thus targeting inflation. Several monetary economists have found a fault with this new approach. They have argued that models that offer money no role present an inaccurate demonstration of the origins of cyclical fluctuations as well as the spread of shocks that emerge from monetary causes.

Many empirical studies have been dedicated to investigate the money demand function yet few of the studies have addressed money demand function in emerging countries. Therefore, our study intends to contribute to the existing empirical literature by utilizing different estimation techniques and recent data to increase empirical evidence reported concerning money demand function in emerging economies. This study attempts to investigate the short-run and long-run relationship between money demand also the study seeks to answer the question of what are the real factors that determine the demand for money in emerging economies. To attain this, the paper is organized as follows: The following section displays a brief review of the empirical studies concerning the money demand function, focusing generally on the developing countries. The third part shows the empirical methodology of money demand function and the variables utilized in the study. Data and empirical findings are elaborated in the fourth part, pursued by a conclusion.

## **2. Central banks and the effectiveness of the monetary policy**

### **2.1 The Place and Importance of Central Banks in the Economy**

The procedures that are taken by the central bank influence the money aggregates, interest rate, and, the level of credit all of which immediately affect the inflation level, the total output, and the financial markets. The conduction of monetary policy is one of the crucial roles that central banks play to achieve the macroeconomic goals, which include price stability emphasizing in low and stable inflation rate. Another goal is the stability of the economy. Following the global financial crisis, the Central Banks use instruments to resolve financial stable challenges and control exchange rate fluctuations have risen. To achieve their targets, the Central Bank require specific political structures. The organizational processes suited to the conditions of each country increase the efficiency of the policies of central banks.

The Central Banks' overall aim must be to preserve market stability and ensure steady economic growth in condntions of low inflation. Financial stability is becoming increasingly important to the Central Banks. In the industrialized countries, the growth of this obligation has been consistent. The Central Bank established a lender role as a last resort during the gold standard period in compliance with Bagehot's rule. But, between the world wars, financial institutions were highly suffering from instability, as large banking failures impacted the early 1920s and 1930s (Dafe and Volz, 2015). The role of the Central Banks in the developing nations has spread later than in the industrialized countries, and so many central banks are now constructively pursuing sustainable economic development in developing countries. As central banks are the key mechanisms to boost competition in any country, independence from government interference is required to make decisions. However, in developed economies, the Central Banks' independence has been provided by the government.

A very insightful explanation of the Central Bank's function as a "lender of last resort" notes it as responsible for the supplying of loans to countries whenever their commercial banks have the trouble of satisfying liquidity shortages. One of the issues influencing the efficiency of the Central Banks is that of asset booming and busting in recent times. Booms in capital markets and housing are also related to the global boom, and bust causing economic downturns. The orthodox approach of a central bank is not that bubbles be disfigured before busting for the fear of a contraction but that they behave after a bust has taken place and that they have enough liquidity to secure bank payments and structures.

## **2.2. Past and Present of the Central Banking in the Economy**

The the Central Bank's role and duties seem to have been more

centralized in the last few decades. Goals have changed and been more involved as a tool for influencing the central bank's efficiency. Leading up to 1914, central banks gave little weight to ensure the stability of the national economy. This shifted after World War I, as they started to be concerned regarding employment, economic activity, and the price level. The transition reflected shifts in many countries' political economy suffers escalated, labor forces developed and migration barrier was imposed. Over the past two decades, significant shifts have taken place in the constitutional system under which central banks operate. Inflation targeting has been the leading monetary policy mechanism since the late 1980s.

Central Banks also adopted precise inflation targets in Canada, the euro region, the UK. Besides, several developing countries are switching from a monetary aggregate to an inflation-targeting system where the monetary transmission mechanism is not as efficient in many countries, particularly developing countries, as it is in developed countries. After the 2008 financial crisis, advanced-economic central banks have pursued an easing monetary policy by lowering interest rates until the short-term rate almost approaches zero, minimizing the choice of additional declines in policy rates.

With the risk of recession increasing, the Central Banks have adopted non-conventional monetary policies with the intention of even more reducing long-term rates and easing monetary policy, namely bonds bought, particularly in the United States, the UK, and Japan. Central bank independence was a crucial factor in the background of central banks. It relied on the government to keep its authority, but otherwise, it was able to select its instruments and policies. Gold convertibility was limited to their objectives. Many central banks became nationalized and deprived of their independence entirely in the 20th century where the fiscal officials formulated their strategies.

## **2.3 The Schools of Economics Views on the Effectiveness of Monetary Policy**

### **2.3.1 Monetarists**

In the monetarist theory that followed the works of Friedman, there were some pillars. In the first case, persistent inflation was a monetary phenomenon and central banks were responsible for preserving the stability of price level. The monetarist theory concluded that central banks must regulate the amount of money in the economy rather than direct the nominal short-term interest rate as a tool for achieving the long-term inflation target. The explanation for the emphasis on money supply growth is that the money supply offers the nominal anchor to the monetary policy regime.

Monetarism considered the regulation of inflation is not the sole responsibility that the monetary authorities have to carry. It has been contended that monetary policy has a major influence on shorter volatility in aggregate output, but this does not impact long-term output growth (Andersen, Jordan, 1968). Certainly, several monetarists have demonstrated monetary policy as accountable for exaggerating, rather than reducing cyclical volatility in total output (Friedman and Schwartz, 1963, Meltzer, 1995).

### **2.3.2 Keynesians**

Contrary to the classical theory of money, the Keynesian theory contended that there is no direct association between the money supply and the level of price. Keynes (1973) has dismissed the view that the economy is at or above the normal amount of real GDP for  $Y$  to be perceived as being set in the exchange equation. Moreover, they have argued that the velocity of money circulation is not constant as the classical framework states and it may vary according to shifts in the supply of money.

Keynesians argued that the money supply has an indirect relation to real output. They assumed that easing monetary policy raises the level of lending funds to the banking system which results in lower interest rates. Through low-interest rates, total consumption, and investment spending rise, increasing real GDP. Therefore, monetary policy will also have an implicit impact on real GDP. Nonetheless, Keynesians stated some concerns about the effectiveness of the monetary policy. They pointed out that an easing monetary policy that raises banks' reserves does not have to result in a multi growth in the supply of money since banks may easily stop lending their surplus reserves.

Also, the lower interest rates generated by easing monetary policies do not necessarily lead to a rise in total spending of investment and consumption, since demands on investment and consumer goods by businesses and individuals might not be quick to reactive to the low-interest rates. This is why the Keynesian view tends to put less assertiveness on monetary policy effectiveness and further focus on fiscal policy effectiveness, that they consider having a further direct impact on real output.

### **2.3.3 Post Keynesians**

The Post Keynesian models based on Keynes's (1973, 1980) proposals, the monetary policy effectiveness rests on achieving the goal of full employment economic growth. Thus, the monetary authorities can use the interest rates and regulations to attain immediate aims such as stability of the exchange rate and financial system. The key point is that monetary

authorities must consider debt management as an instrument that enables the control of interest rates. Since it seeks to impact the yield curve as a whole, making it easier for monetary policy to create a yield curve that is suitable for investment.

Also, debt management can make the monetary policy more active by influencing several immediate objectives. Therefore monetary policy in Post-Keynesian economics is a strong instrument that is capable of boosting investment levels through affecting the yield-curve without generating an opportunity cost. Besides, it can also raise cheaper consumer loans and promote “lending” operations individuals indulge in when buying shares on the stock market. Consequently, monetary policy must not be limited to the strictly inflationary stance as demanded by the inflation targeting regime.

#### **2.3.4 Classicalists**

The classical framework argued that the economy would always be at the full employment level. However, classical also considered that easing monetary policy can adjust the presence of unemployment resulted from the declining levels of money wages. They argued that the velocity of money and the level of real income are constant, so an easing monetary policy requires the monetary authorities to raise the money supply.

As a result, the amount of cash held by the individuals increase and thus their demands on goods and services raise pushing price level up. The increase in the level of prices causes a decline in the real wages and then enables employers to increase employment level and actual output moving the economy to the full level of employment. Therefore, the easing monetary policy is efficient in returning the classical economy to the full employment level. The classical model was also applied to the long-term growth in which market forces moved for a full-employment level.

#### **2.3.5 New Classical**

The controversy regarding the ineffectiveness of monetary policy has begun to rise when the New classical framework introduced the rational expectations assumption (Sargent and Wallace, 1975). They developed a model where the rational expectations are included thus if the monetary authorities determine targets for nominal interest rates, the price level might be indefinite due to the absence of a “nominal anchor”.

The original perceptions of this framework were that assuming rational expectations could make monetary policy inefficient to affect actual output in short- and long-term terms for any macroeconomic model. Therefore, as to

stabilizing output, the monetary policy had a little part to play. Following contributions of Fischer, 1977, Taylor, 1980, and Calvo, 1983, it is illustrated that behind the policy ineffectiveness postulate was the interconnection of the postulate of perfectly flexible levels of price and wage and the rational expectations hypothesis.

### **3. Empirical Literature**

Much of the applied research in monetary economics has been dedicated to specifying the function of demand for money because the determination of money demand has important political implications. A function of poorly specified money demand could produce, for example, spurious implications about the underlying demand for money stability and thus the construction of monetary policy (Mehra 1991). Pesek (1963) attempted to examine the determining factors of money demand based on cross-sectional data and standard multiple correlation analysis with one modification. Empirical results revealed that income elasticity of money demand was very low, both in the case of the Czech data and in the case of the (recomputed) British data, which indicates that money is not a luxury asset and that other explanations of the secular decline of velocity must be sought. Besides, for the Czech data, it has been shown that changes in the degree of industrialization of a region strongly affect the demand for money.

Applying pooled mean group estimation on a data set covering 22 Mongolian regions, Slok (2002) highlighted the main role that monetary policy plays in stabilizing the economy and revealed that stable money demand exists even in a transitional economy as primitive as Mongolia. Also, empirical results pointed out that the demand for money elasticity concerning transactions about 0.5. This represents the greater part of transactions in the money demand function. Alfredo (2006) study estimated the demand for money function proposed by Cagan (1956) employing a model of panel data for 27 countries including marked economic differences, findings revealed that opposing to the model suggested by Cagan, estimations of the income elasticity of money demand between 0.18 to 0.20.

Valadkhani (2006) examined the short and the long-term determining factors of the money demand in several Asian –Pacific countries utilizing a panel data approach. The study found that several variables include the real effective exchange rate, inflation rate, US real interest rate and the interest rate spreads play a negative role in demonstrating the variation in money demand while the real income positively affects money demand, however, both real effective exchange rate variable and US real interest rate found to be



insignificant within the short run. The income elasticity, in the long run, was more than unity while income elasticity was about 0.79 in the short-run. Rao and Kumar (2008) investigated the long-run money demand function using a panel data of 14 Asian countries, the study applied three different panel data techniques proposed by Pedroni, Breitung, Mark, and Sul. Estimates display that income elasticity almost equals one and that in the short-run variations in interest rate adversely affect money demand.

Utilizing Westerlund's (2005) panel co-integration test, Nautz and Rondorf (2011) estimated the long-term demand for money function in the Euro-zone and they argued that omitted factors such as technological advancement may demonstrate the volatility in the demand for money in the Euro-zone. Gholizadehkivi (2013) examined the money demand function in several countries with a similar financial sector. The study introduced financial development as a variable that positively influences real demand for money measured by (M2/GDP), estimations display that real income and financial development variables positively affect demand for money in the long-run while the nominal interest rate variable has an adverse impact. Foresti and Napolitano (2013) utilized the dynamic estimation method that has been presented by Pedroni (2001) and Mark and Sul (2003) to check the presence of a long-term demand for money for nine developed OECD countries. They found that total wealth elasticity positively determines the demand for money also the predicted demand for money function using the wealth variable was further stable based on the stability test.

Kjosevski (2013) applied the Johansen cointegration approach and Vector Error Correction (VEC) model to indicate the long and short-run determinants of money demand. Results indicate that the real demand for money M1 in Macedonia is a stable function. Moreover, the exchange rate and the rate of interest payable on one-month deposits clarify the greatest changes in the long-term money demand, whereas the interest rate was only significant within the short term. Bahmani (2014) investigated the stability of money demand in the Middle East employing the VEC model, the results point out that money demand is stable in almost all the 14 countries in a sample over the period 1971-2004.

Concerning panels of countries, Farazmand and Moradi (2015) using the GLS method found that inflation is the main determinant and has a significant effect on demand for money in MENA countries. Also, the exchange rate variable adversely affects the demand for money while the income variable has a positive impact. Nyumuah (2017) shows that in the short term the interest rate is inelastic to the money demand however, it is elastic in the long term for

eight developing Sub-Saharan African countries. lean on the IS-LM framework, this study concluded that the economies of these countries will be in the Keynesian range in the long term, and suggested the ineffectiveness of monetary policies in developing countries.

Utilizing a Dynamic Panel Approach on 36 countries sample, Sidik and Achسانی (2018) analyzed the impact of financial inclusion on money demand. They suggested that monetary policy can be ineffective in the presence of financial inclusion. The reason is that financial inclusion influences the sensitivity of interest rates, and thus results in the money demand instability. Results concluded that financial inclusion in many developed countries encourages the rise in reserve money demand (M0). However, in emerging economies, the growing financial inclusion might cause a decline in money demand. Regarding Africa, a study of Sanya (2019) investigated the association between money demand and both financial innovation and currency substitution. Findings highlight the existence of a long relationship between these two factors and money demand also there is evidence of a currency substitution according to the great value of the exchange rate parameter. The latest study of Heinrich (2020) examined the stability of money demand function in Hungary utilizing quarterly data. The results point out that the demand for money is stable in Hungary and there is a long relationship between money demand and its determinants. Table 1. illustrates a summary of the empirical literature.

**Table 1.** Summary of empirical studies

Author(s)	Sample	Estimation technique	Variables	Result
Sok (2002)	Mongolia 1993–1999	The fixed effect, dynamic fixed effect	Real money (M1), Real income (GDP), Real interest rate, Real exchange rate	Monetary policy has a key role in stabilizing the Mongolia economy.
Alfredo (2006)	27 countries 1988-1998	The fixed effect, dynamic fixed effect	The monetary base (M1), GDP of 1990 prices, consumer price index, nominal interest rate	The income elasticity of money demand is in the range from 0.18 to 0.20.
Valadkhani (2006)	6 Asian Pacific countries 1975-2002	Dynamic fixed effect	Broad money (M2), Real income (GDP), Real interest rate, Inflation rate, Real effective exchange rate	The income elasticity of demand is more than unity in the long run.
Rao and Kumar	14 Asian	dynamic	Real money demand	Income elasticity

(2008)	countries 1970-2005	ordinary least squares method (DOLS)	(M1), real GDP, nominal interest rate	of demand is equal to unity and the financial forms have no major impact on money demand in the selected sample.
Nautz and Rondorf (2011)	EU countries 1999Q1- 2008Q4	Pooled Mean Group estimation (PMG)	Monetary aggregate (M3), GDP, interest rate, house, and equity prices.	The reason for the instability of money demand is the omitted variables such as technological advancement
Gholizadehkivi (2013)	7 countries 1985-2010	Static fixed effect	Broad money (M2), real GDP, nominal interest rate, financial development	The income elasticity is estimated as 0.7739 in the long run.
Foresti and Napolitano (2013)	9 OECD countries 1982Q1– 2008Q4	panel Dynamic Ordinary Least Squares (DOLS)	Nominal money (M1), nominal GDP, nominal interest rate, nominal effective exchange rate, nominal Aggregate Wealth Indicator	The predicted demand for money function using the wealth variable was further stable based on the stability test.
Kjosevski (2013)	Macedonia Jan 2005 - Oct2012	Vector Error Correction (VEC)	Money demand (M1), industrial production index, interest rate, exchange rate, CPI	Stable money demand exists and interest rate and exchange rate are responsible for the most variation in the money demand.
Bahmani (2014)	14 Middle Eastern countries 1971–2004	cointegration technique	Money aggregate (M2), real GDP, inflation rate, exchange rate	Stable money demand exists in most selected countries.
Farazmand and Moradi (2015)	MENA countries 1980-2013	GLS method	Money aggregate (M2), real GDP, exchange rate, the inflation rate	The inflation rate plays a significant role in determining the money demand.
Nyumuah (2017)	8 SSA countries 1998-2012	Panel Fully Modified Ordinary Least Squares (FMOLS)	Money demand (M1), real GDP, interest rate, the inflation rate	The interest rate is inelastic in the short run.

Sidik and Achsani (2018)	36 countries 2004-2014	Dynamic Panel Approach	Reserve money (M0) real GDP, deposit rate, index of financial inclusion	The financial inclusion leads to an increase in the money demand in developed countries contrary to developing countries, it leads to a decline in money demand.
Sanya (2019)	Selected African countries 1980Q1 – 2016Q4	Panel ARDL	Real money stock Treasury bill rate Foreign interest rate Saving deposit rate Effective exchange rate Inflation rate GDP Financial innovation	A sufficiently great currency substitution exists in the selected countries, also financial innovation has an impact on money demand in these countries.
Heinrich (2020)	Hungary 1995Q1 - 2013Q4	ARDL	real money M2, GDP, domestic interest rate, inflation rate, exchange rate	The demand for money is stable in Hungary and there is a long relationship between money demand and its determinants.

#### 4. Data and Methodology

The panel data analysis covers nine Emerging Markets, Namely, Brazil, Chile, China, India, Hungary, Malaysia, Mexico, South Africa, and Thailand. In the selection of countries, besides the common feature of elevated market volatility and variation in geographical location, priority was given to the countries with available data for the 1996-2017 periods. Data were collected from the World Bank development indicators database. From the theoretical framework and empirical literature link to the function of money demand, two variables were identified as the major determinants of money demand.

The function of money demand is specified as follows:

$$\ln Md_t = \alpha_i + \beta_{it} \ln Y_{ti} + \gamma_{it} r_{ti} + \varepsilon_{ti} \quad (1)$$

Where  $Md_t$  denotes real money demand measured by M2 monetary aggregate,  $Y_{ti}$  indicates real income measured by Gross Domestic Product

(GDP),  $r_{it}$  signifies real interest rate and the stochastic error term is  $\varepsilon_{it}$ . Whereas, money demand and GDP variables have been divided by the consumer price index (CPI) to get real terms of variables. Also, the natural logarithm of these two variables was taken.

Intending to set the order of integration, the study uses the unit root tests of Levin, Lin, and Chu (LLC) (2002) and the Im-Pesaran-Shin (IPS) (2003). The distinction between LLC and IPS tests is that the IPS test is lean on the presumption of the autoregressive parameter variation for entirely cross-sections, while the LLC test takes on a common autoregressive parameter in all cross-sections. Cointegration tests of Pedroni (2004) and the Kao residual cointegration test were utilized to define the presence of a long-term relation among money demand and its determining factors; real income and real interest rate. Eventually, the money demand function was estimated utilizing the pooled mean group (PMG) estimation technique proposed by Pesaran, Shin, and Smith (1999). This estimator employs the cointegration method of the ARDL estimation and then adjusts it to a panel data by enabling intercepts, short term coefficients, and cointegrating terms to vary within cross-sections.

Thus, the model of the PMG technique is expressed as:

$$Y_{it} = \sum_{j=1}^p \lambda_{ij} Y_{i,t-j} + \sum_{j=1}^q \gamma_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (2)$$

Where  $X_{i,t-j}$  represents the  $(K \times 1)$  vector of regressors for a group  $I$ , and  $\mu_i$  indicates a fixed effect. Considering the Vector Error Correction (VEC) technique, the equation is illustrated as:

$$\Delta Y_{it} = \theta_i (Y_{i,t-1} - \beta' X_{i,t-1}) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta Y_{i,t-j} + \sum_{j=1}^{q-1} \gamma_{ij} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad (3)$$

Where  $\beta'$  indicates the long-run parameters with a restriction that  $\beta'$  are common across countries and  $\theta_i$  specifies the coefficient of error correction and it refers to the adjustment speed to the equilibrium in the long term.

## 5. Empirical Results

In order to achieve the research purpose, the analysis tools used consist of panel unit root tests, cointegration tests, Panel Autoregressive distributed lag (ARDL) model utilizing the Pooled Mean Group (PMG) estimation technique. Panel unit tests were executed to inspect the characteristics of the time series before cointegration analysis. Having established cointegration amongst the model variables, the short run and the long-run money demand functions were estimated employing the panel ARDL model.

The first portion of empirical results begins with illustrating summary statistics of the study variables. Table 2. shows notable differences in minimum and maximum investigated variables values, as in the case of money demand minimum value is (2.21E+11) whereas the maximum value is (3.66E+08), There is a great difference in real income values between (1.22E+13) to (4.67E+10), the minimum value of real interest rate is -3.9 while the maximum value is 13.01.

**Table 2.** Summary statistic of study variables

Variable	Mean	Max	Min	Std. dev
Md	1.28E+10	2.21E+11	3.66E+08	3.33E+10
Y	1.04E+12	1.22E+13	4.67E+10	1.98E+12
r	3.681800	13.01244	-3.903257	3.106980

The summary statistics were calculated before taking the natural logs.

### 5.1. Panel Unit Root Tests

This paper utilizes the unit root test of Levin, Lin, and Chu (2002), ADF (Augmented Dickey-Fuller), Im, Pesaran and Shin (2003), and Fisher tests. The logarithm variables of real money demand (MD), real income (Y) have been concerned while and real interest rate (r) taken with original values due to negatives. As seen in Table 3. and 4. The time series of real money demand (lnMD), real income (lnY) are non-stationary at level [I (0)] means that the series contain unit root problem. Therefore, the primary differences of the series were investigated. Considering the primary differences of the series for real money demand (lnMD), income (lnY) time series was observed to be stationary at [I (1)]. While for real interest rate (r) results show no presence of unit root at the level which states that time series stationary at level [I (0)].

**Table 3.** Panel unite root tests 1996-2017

variable	At the level I (0)					
	Ln (MD)		Ln(Y)		(r)	
	intercept	intercept and trend	intercept	intercept and trend	intercept	intercept and trend
Levin,lin	-0.84283 (0.1997)	-0.97178 (0.1656)	-1.22553 (0.1102)	-0.76241 (0.2229)	-3.65562 (0.0001)	-4.64670 (0.0000)
IPS	2.39920 (0.9918)	-0.82240 (0.2054)	-0.57684 (0.2820)	-2.48818 (0.0064)	-3.43097 (0.0003)	-2.89422 (0.0019)
ADF-Fisher	5.00420 (0.9989)	22.5803 (0.2072)	24.1440 (0.1504)	30.8044 (0.0303)	44.5322 (0.0005)	41.0147 (0.0015)
PP Fisher	4.34459 (0.9996)	12.6396 (0.8125)	9.31788 (0.9519)	17.3861 (0.4967)	45.0620 (0.0004)	40.9048 (0.0016)

**Note:** The probability values are mentioned in parenthesis.

**Table 4.** Panel unit root tests 1996-2017

variable	At first difference I (1)			
	Ln(MD)		Ln(Y)	
	intercept	intercept and trend	intercept	intercept and trend
Levin,lin	-7.40819 ( 0.0000)	-6.21322 ( 0.0000)	-6.49473 (0.0000)	-5.63889 ( 0.0000)
IPS	-5.73783 ( 0.0000)	-3.73070 ( 0.0001)	-5.39869 (0.0000)	-3.54151 ( 0.0002)
ADF-fisher	67.1211 ( 0.0000)	45.6677 ( 0.0003)	62.1847 (0.0000)	41.9402 ( 0.0011)
PP Fisher	81.2324 ( 0.0000)	155.739 ( 0.0000)	61.8817 (0.0000)	37.6792 ( 0.0043)

**Note:** The probability values are reported in parenthesis.

## 5.2. Panel Cointegration Results

Based on the cointegration tests proposed by Pedroni (2004) and that include four within-dimension and three between-dimension group statistics, the outcomes in Table 4. demonstrate the existence of a cointegration relation between the investigated variables. As real money demand (MD), real income (Y) variables are stationary at I(1), and real interest rate (r) stationary at level I(0), the Pedroni cointegration test has been applied in the following stage.

The long-run relation between these series is examined by the Pedroni cointegration test under the null hypothesis of no presence of cointegration. As seen in Table 5. The findings of the Pedroni co-integration tests do not certainly confirm the long-term relation between the model variables. Therefore, the Kao test should be applied In order to confirm or deny the presence of a long-term relation between variables.

**Table 5.** Result of Pedroni cointegration tests

Test statistic	Within-Dimension	Between-Dimension
V-stat	2.455553 (0.0070)	- -
roh-stat	0.509359 (0.6947)	1.292866 (0.9020)
PP-stat	-0.893454 (0.1858)	-1.147435 (0.1256)
ADF-stat	-1.678696 (0.0466)	-1.637569 (0.0508)

**Note:** The values of probability are noted in parenthesis.

**Table 6.** Kao residual test

t statistic of ADF test	Prob.
-3.294452	0.0005

Table 6. displays that the probability value of the ADF t-statistic equals (0.0005) which is less than the significance level of 5% that indicates the presence of cointegration between the examined variables.

### 5.3. Pooled Mean Group Estimator

According to the outcomes of unit root and cointegration testing, it can apply to the panel ARDL model to find the relationship in the long-run and short-run for money demand function employing the PMG estimation technique. The estimators of the Pooled Mean Group (PMG) technique combines the averaging and pooling model parameters (Shin and Smith ,1999). This estimation method sets a restriction on the long-run elasticity to be equivalent across all panel groups and therefore if the homogeneity condition is satisfied, estimated coefficients would be efficient and consistent (Casni, Badurina, and Sertic, 2014). Another feature is enabling short-run dynamics to be heterogeneous among cross-sections while the short-run adjustment is based on country specification (Kang, 2006).

The unit root test is a prerequisite for the PMG estimation. When all model variables are I(1) stationary, I(0) stationary, or a group of both I(1) and I(0) then the PMG estimation can be carried out. Automatic selection of lag length indicating that ARDL (4,4,4) is optimal.

**Table 7.** PMG estimation result

Variables	Coefficients	Std.Error	t-Statistics	Prob.
<b>Long-run equation</b>				
(Y)	1.260791	0.037510	33.61242	0.0000
r	-0.087591	0.013556	6.461549	0.0000
<b>Short-run equation</b>				
COINTEQ01	-0.263005	0.125870	-2.089504	0.0399
$\Delta(\text{MD}(-1))$	-0.080594	0.275399	-0.292643	0.7706
$\Delta(\text{MD}(-2))$	-0.820267	0.198370	-4.135034	0.0001
$\Delta(\text{MD}(-3))$	-0.442932	0.210983	-2.099373	0.0390
D (Y)	0.430042	0.143175	3.003609	0.0036
$\Delta(Y(-1))$	0.096333	0.262522	0.366951	0.7146
$\Delta(Y(-2))$	0.736381	0.208910	3.524878	0.0007
$\Delta(Y(-3))$	0.765322	0.265255	2.885233	0.0051
$\Delta(r)$	-0.007623	0.011031	-0.691103	0.4916
$\Delta(r(-1))$	-0.004407	0.011815	-0.373010	0.7102



$\Delta (r(-2))$	-0.007024	0.006666	-1.053769	0.2952
$\Delta (r(-3))$	-0.001611	0.003339	-0.482488	0.6308

The PMG estimation outcomes in Table 7. Shows that over the long term, the explanatory variables; real income (Y), and real interest rate (r) influence money demand statistically significantly at the 5% level. Real income (Y) in a positive, real interest rate (r) in a negative statistical way as expected. The long-term real income elasticity of money demand was calculated as 1.260791 greater than unity. That is to say, A percentage rise in real income causes a 1.3 percent increase in money demand. The semi-real interest rate elasticity of money demand was calculated as - 0.087591. This indicates that a 1% increase in real interest rate leads to an approximately 0.09 % percent decline in money demand over the long term. In the short term, results point out that real income (Y) affects money demand statistical significance level at 5%. While short term coefficients of real interest rate (r) are statistically insignificant at the 5% level. In other words, the money demand is high inelastic for the short-term fluctuations in the interest rate. The error correction term in the short-run equation is statistically significant and negative. It points out that agents adjust to equilibrium at the rate of 26% annually.

Rest on the IS-LM framework, When the demand for money is a completely inelastic interest the LM-curve becomes vertical at the level of real output that clears the money market. Increased government spending would increase income and motivate people to hold more money balances. Excessive demand for money will push interest rates to rise to the point at which the equilibrium of the money market is returned. Alternatively, income will have to go back to its original level before the money market is back in equilibrium. It suggests that interest rates will have to increase until the amount of investment expenditure has been decreased by the same level as that of government expenditure. As a consequence, the needed output level remains unchanged, and crowding out is complete. The high-interest rate levels in many developing countries compared to interest rates level in developed countries explain interest rate inelasticity of money demand in the short run. A high-interest rate is required to influence a low change in the money demand in these countries.

## 6. Conclusion

This study is set out to examine the short and long-term determinants of the money demand function of nine Emerging Economies such as, Brazil,

Chile, China, India, Hungary, Malaysia, Mexico, South Africa, Thailand. The panel Autoregressive Distributed Lag (ARDL) approach was employed to determine the dynamics of money demand based on the pooled mean group (PMG) estimator. Firstly, the presence of unit roots within model variables was examined, results show that while the real interest rate time series is stable at the level  $I(0)$ , real money demand and real income series exhibit a unit root at the level  $I(0)$ . Once the state of non-stationary time series has been identified, the presence of a long-term relationship among model variables employing a cointegration analysis was tested. Pedroni cointegration tests have not provided evidence of long term co-integrating relationship amongst the variables. Therefore, the Kao Residual Cointegration test was applied to detect the presence of long-term relationships amongst the variables where results confirm the presence of cointegration between the examined variables.

The estimation technique of Pooled Mean Group (PMG) is developed by Pesaran, Shin, and Smith (1999) and they utilize to estimate the short and the long-term determinants of money demand. The PMG estimation result shows that over the long run, real income and the real interest rate influence demand for money in the nine selected emerging countries. This result is significant at 5 % and the long-term real income elasticity of money demand was calculated as 1.260791 greater than unity. That is to say, a 1% increase in income causes an approximately 1.3 % percent increase in money demand. The semi-real interest rate elasticity of money demand was calculated as - 0.087591. It signifies that a 1% increase in real interest rate leads to an approximately 0.09 % percent decline in money demand over the long-run. Also, results point out that in the short-run real income (Y) affects money demand statistical significance level at 5%. While short-run coefficients of real interest rate (r) are statistically insignificant level at 5%. The error correction term in the short-run equation is negative and statistically significant. It points out that agents adjust to equilibrium at the rate of 26% annually.

Supported by the empirical evidence, this study concludes that the emerging economies of these selected countries will be in the Keynesian range in the long term. As a result, policymakers cannot confidently depend on monetary policy to affect output and inflation in the long run. Therefore, an important policy implication that can be derived from these results is that fiscal policy rather than monetary policy should be used to stabilize emerging-market economies. Where, the monetary policy is more efficient in stabilizing the economy when the money demand is highly inelastic of interest rate, while fiscal policy will be more effective when the money demand is interest elastic.

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