The money demand function in Suriname

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ABSTRACT

The empirical literature on the money demand function largely pertains to large, closed and advanced economies and developing economies. The empirical findings on the experience of very small open developing economies are therefore limited. This study fills that gap by estimating a money demand function for Suriname and by assessing the stability between real money demand (RM0, RM1 and RM2) and its determinants, namely real gross domestic product (RGDP), real exchange rate (RER) and real lending rate (RLR). Two co-integration approaches are applied to analyze the real money demand for the period 1981-2010.Consistent with money demand theory, empirical evidence reveals that in the long run real broad money growth is positively linked to RGDP growth, while real demand for money responds inversely to RER changes and RLR. In the short run, real money demand is influenced by RGDP growth and RER changes. Stability tests on the real money demand function seem to suggest that a lack of stability exist in the coefficients. Consequently, monetary targeting solely is not considered a policy option, while interest rate policy may be ineffective given the statistically insignificant impact on real money demand. Since income elasticity is greater than one and real exchange rate influences real money demand in the short and long run, a combination of income-related fiscal policy measures, exchange rate targeting and money demand management seems to be more effective in Suriname to establish macroeconomic stability.

Contents

1. Introduction

The influence money can have on the economy has been studied both theoretically and empiricallyby many academics. During the last decade this subject gained wide spread attention,particularlyin relation to the determinants of money demand. The macroeconomic importance of the relationship between money demand and its determinants lies, in particular, in selecting the appropriate monetary policy measure in directing the economy. In this regard, the stability of the money demand function is conceived as an important prerequisite for effective money control.

Monetary policy,which is aimed at managing the supply of money, facilitates controlling the money demand and thus enables policymakers to achieve price stability (Narayan and Narayan, 2008). Monetarists assume a constant ratio between money growth and the desired growth of production which enables policy makers to exercise control over price increases (Korteweg & Keesing, 1979).In their view, a stable money demand function implies a stable money multiplier, which in turn enhances the controllability of reserve money and the predictability of money stock.

In various empirical studies several variables have beenconsidered as determinants of realmoney demand, such as real GDP, real interest rate and real exchange rate. Structural changes affect the stability of the money demand function (Choi & Jung, 2009;Lee &Chien, 2008 and Abbas, 2005). Testing the stability of themoney demand function is therefore also a crucial part of the empirics.

Many studies on money demand have been largely conducted on large advanced economies and emerging economies, such as USA, Argentina, China and Canada (Choi & Jung, 2009; Hsing, 2008; Lee &Chien, 2008 and Bose&Rahman, 1996). The case on small open economies is relatively unexplored. The sensitivity and therefore difficulty to have monetary control in small open economies because of structural differences and limitations, such as the vulnerability to external shocksand foreign exchange constraint, provides some justification for more empirical research on the money demand function in very small open developing economies. Towards that end, theSuriname's economy shows similar characteristics.Estimating the money demand function should provide a unique opportunity for empirical testing. This research makes a first attempt to examine the money demand function and its stability in Suriname during 1981-2010. The model estimation is conducted within a Vector Auto Regression (VAR)/Vector Error Correction Model (VECM) and an Engle-Granger framework.

The remainder of the paper is structured as follows.The first section elaborates on the institutional changes with respect to monetary aggregates in Suriname, while in the second sectionthe theories and some results of empirical studies on money demand are briefly highlighted. The third section examines the statistical properties of the time series used for empirical testing. In the fourth section the money demand model is specified, the methodology is described and the results are presented. Finally, section five summarizes the conclusions and provides policy implications.

2. Institutional changes and money supplydevelopments

From 1968-2010the Central Bank of Suriname used the monetary aggregate M2, initially consisting of cash held by the public, demand deposits,all short-term liabilities held by the public at banking institutions and goldcertificates, for monetary policy and analytical purposes.In 2011 the Bank redefined money by including foreign currency deposits of residents at all depository corporationsand abandoning the distinction between short-term and long-term liabilitiesof the private sector in its monetary aggregates.

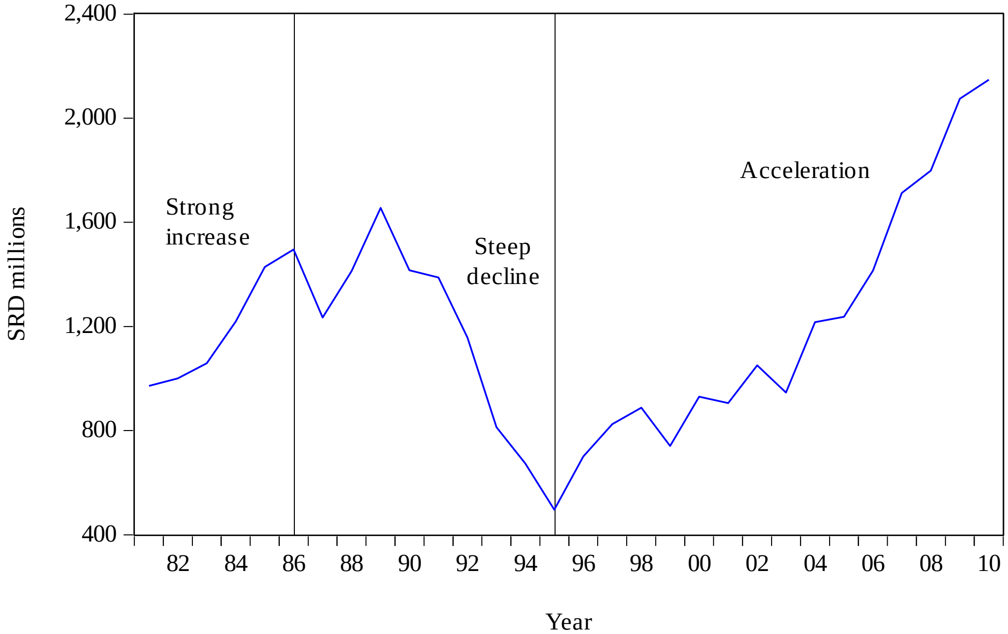
The phenomenon of foreign currency transactions by residents outside the banking system existed since 1983, although the foreign exchange legislation considered these transactions illegal.Yet, residents settled their foreign currency transactions in the informal/illegal circuit, because of the scarcity of foreign exchange in the banking system. In the early 1990s the government of Suriname started a liberalization process embedded in a Structural Adjustment Program(SAP)[1]. One of the first measures commenced in June 1992, when residents were allowed to possess foreign currency and commercial banks were allowed to open foreign currency balances for residents. In June 1993 the 'free' market rate was officially acknowledged as a flexible exchange rateby the monetary authorities. The legislation on the free market rate also recognized foreign exchange houses ('cambios') with permits as legal entities in spot foreign exchange trade. As of July 1995, commercial banks were permitted to provide foreign currency loans to residents.

The funding of foreign currency loans from foreign currency deposits supported economic activity, but by omitting these deposits from the money definition the monetary statistics lacked an adequate coverage of financial activities in the economy. However, the Bank kept a record on commercial banks' foreign currency deposits of residents and loansto residents for registration purposes and policy analysis. This omission was dealt with in early 2011, when the Bank augmented the monetary aggregates with foreign currency deposits of residents. So now narrow money (M1) includes cash in local currency and demand deposits in local and foreign currency, while broad money (M2) comprises M1, saving and term deposits in local and foreign currency and other monetary liabilities to the private sector in local and foreign currency.

Figure 1 presents the development of broad money in real terms (RM2), in which three periods have been distinguished, namely a period with astrong increase, a steep decline and an acceleration of RM2. Since RM2 is the outcome of nominal M2 adjusted using the Consumer Price Index (CPI), these distinct periods also reflect the developments of the general price level in the economy. In the first and third distinct period the annual average increase of CPI was 11% and 20%, respectively. In the second period, however, CPI increased by 70% on an annual average basis. So, real money declined as inflation worsened.

[1] The austerity measures of the SAP entailed, among other things, liberalization of exchange rate regime and improvement of the tax regime. Additional measures included government spending cuts, domestic debt restructuring and conduct of open market monetary operations.

Figure 1:Real Broad Money (RM2)



Source: Authors' calculations

The sources of monetary expansion in the first period (1981-1986) can be attributed to a combination of events. In the early 1980s,the dominant bauxite industry suffered from the effects of the world recession on international aluminum prices, and the suspension of the Dutch Development aid resulted in a sharp decline of foreign currency inflows. As a consequence, the Government relied on domestic sources to finance its expenditures. In this period fiscal dominance of monetary policy emerged, but inflationary pressures were contained. The reason for this seemingly contradictory phenomenon was that the Central Bank maintained an overvalued exchange rate vis-a-vis the US-dollar, while the Government conducted tight capital and consumer price controls. As a result of moderate price movements, a strong increase of real broad money was evident.

In the second distinct period (1987-1995) fiscal dominance of monetary policy continued and the country's terms of trade deteriorated resulting in exchange rate and inflationary pressures. Early 1990s, the Government adopted a SAPto stabilize and reform the economy. The main policy measures were focused on liberalization of the exchange rate regime and foreign exchange transactions, stabilization of government finances and containment of central bank financing of Government deficits. In addition, capital and price controls were gradually eased. As a consequence, Suriname experienced its first near-hyperinflation episode when inflation peaked at nearly 600% in 1994. The steep decline of broad money in real terms from 1990 onwards was influenced by the high inflation rates in this period.

The policy measures and improvement of the country's terms of trade ultimately stabilized the exchange rates and reduced inflation early in the third distinct period (1996-2010). However, during 1998-2000 the macroeconomic environment deteriorated once again when foreign exchange inflows declined because of lower international aluminum export prices and expansionary fiscal policy and loose monetary policy re-emerged. As a result, the economy experienced its second near-hyperinflation episode when inflation exceeded 100% in 1999, which was also evident in the decline of real money supply. From 2000 onwards, prudent fiscal and monetary policy and improved terms of trade largely set the foundation for a steady economic recovery. Overall, broad money in real terms accelerated in this period, which mainly reflected lower inflation relative to previous periods and accumulation of foreign assets induced by favorable international prices for the country's export commodities.

3. Literature review

3.1 Theoretical literature

Money demand theories, which areat the center of macroeconomic policy, havebeen subject of debate among several economic schools of thought and are derived from a spectrum of hypotheses.The theoretical foundations are well established in the economic literature with great consensus that the demand for money is in the first place determined by real cash balances (Lungu et al., 2012). According to Telyukova (2008), three dominant views can be distinguished, namely the classical, the Keynesian and the post-Keynesian view.

The classical school approachesthe theory on money from the quantity theory of money which is based on the equation of exchange. This equation expresses the relationship between the nominal supply of money (M) and the total nominal expenditure on final goods and services produced in an economy(PY), indicating Prices (P) multiplied by Real Output (Y). The variable linking M and PY is the velocity of money (V). The precursor of this view within the classical school is Irving Fisher, who suggested that institutions in the economy determine the velocity of money by affecting the way in which economic agents conduct transactions (Mishkin, 2009). He argued that because of slow advances in transactions' technology, the velocity of money will remain constant in the short run. Underlying the theory is the belief that agents hold money only for transactions' purposes, therefore ignoring the sensitivity of interest rate to money demand.

However, the great depression shed some light on economists' view on the rigidity of money velocity because of the sharp fall of money velocity during severe economic contractions. The data available at that time showed that velocity was not constant, which started the search for other factors affecting the money demand (Mishkin, 2009). The Cambridge School of Economics attempted to augment the classical theory by allowing flexibility to the decisions of individuals to hold money. According to their concept the level of people's wealth is also viewed as a determinant of money demand and, therefore,individuals have two reasons to hold money namely for transactions' purposes and for enhancing their wealth(Keynes, 1936).Thismotiveenables individuals to reserve a part of their income as a store of wealth, which allows velocity of money to fluctuate in the short run. However, the decision to reservemoney for wealth purposes depends on the gains and expected returns on other assets that also function as stores of wealth(Mishkin, 2009).The interest rate philosophy was also adapted by the Cambridge school, but in spite of the use of a different angle their equation is identical to Fishers'.

Keynes with his liquidity preference theory highlighted the significance of the interest rate as determinant of the money demand function. In his view the interest rate is a compensation for the renouncing of liquidity and thereby rejecting the argument of the classicalschool that the velocity of money is constant. He postulated three motives for holding money, namely the transaction, precautionary and speculative motive. The first two proportionally depend on income (Sahadudheen, 2012).This means that as income increases more money will be reserved for transaction and precautionary measures, which reflects the medium of exchange function of money. Thus, there exists a positive correlation between money demand and income. On the other hand, speculative demand for money has been found to have a negative relation with interest rate. To facilitate the analysis of the latter, Keynes used the assets' theory, indicating that if the expected return of holding bonds is greater than the return on holding money,individuals will hold bonds as a store of wealth rather than money(Mankiw, 2010).Profound developments of the Keynesian approach were conducted by Baumol and Tobin in order to understand the role of interest rates in the money demand. The three basic propositions of Keynes for holding money were maintained as a basis, but only precise theories were developed to explain the money demand motives (Mishkin, 2009).

Another economist analyzing the money demand function was Milton Friedman, who generally relied on assets demand determinants which is almost in conformity with Keynes analysis. In his post-Keynesian view, money is considered as a type of asset implying its demand must also be influenced by the same factors affecting the demand of any other assets. Hence, he arranged bonds, equity and goods as types of assetsto form his wealth concept. The assessment of an individual to hold an asset rather than money depends on the expected return of the asset with respect to that of money.However,since the incentive to hold money does not changevery much, the impact of interest on the demand for money is, according to Friedman's theory, very poor. This is in contradiction with the explanation of Keynes concerning the role of interest within the money demand function.The Friedman equation indicates that the money demand function is determined by the expected return on money and permanent income of which the permanent income is positive correlated with the demand for money while all other variables are negativelycorrelated(Mishkin, 2009).The permanent income which is the present value of all expected future income has short run fluctuations because many movements of the income are short-lived. Income will increase in times of economic growth, but because much of this increase is temporary, permanent income will not change much(Mankiw, 2010). This ensures that the demand for money does not fluctuate much with the cyclicality of the economy, which is usually also temporary.

The theoretical discussions reveal different approaches to money demand, yet they still share common variables as determinants. Generally, they draw up a relationship between the quantity of or the demand for money and income or output and interest rate, whether in nominal or real terms.

3.2 Empirical literature

The exploration of empirical studies on money demand was mostly focused on the selectedmacroeconomic variables included in the money demand function, the applied empirical methodology and the country-specific conditions that have been taken into account.

Several monetary aggregates have been used as the dependent variable, representing the demand for money. In some less developed countries (LDCs) narrow money (M1) has been employed as the dependent variable, while other researchers used a broader definition of money (M2 and M3). The choice was mostly based on the monetary aggregate which was manageable by the monetary authorities and hada stable relationship with the selected real variables. Evidence gathered by several authors suggests that the money demand function should have scaled explanatory variables,such as real income, expenditure or wealth and alternative assets (Bitrus et al., 2011; Yu &Gan2009; Bahmani et al., 2005&Marashdeh et al., 1997).

Some of the empirical studiesalso highlighted theinclusion of the exchange rate in the money demand function, particularlyin developing countries. The impact of internal and external shocks usually takes place through the exchange rate in these economies.The argumentis that a real exchange rate can generate a substitution and a wealth effect on money demand, especially in open economies with flexible exchange rate and high degree of capital mobility. The proposition is that expectation of a deterioration of the local currency will result in an increase of foreign currency holdingsat the expense of domestic currency holdings(substitution effect) or a higher return onforeign currency assets following the lower interest rate on domestic assets (wealth effect).

With the bound testing approach to co-integration,Bahmani et al. (2005) demonstrated that indeed the exchange rate and interest rate hypothesis matter in Iran. Their study suggested that the money demand function should be augmented with the exchange rate volatility.In Malaysia the estimated money demand function also indicated currency substitution(Marashdeh et al., 1997). The determinants income, exchange rate, price and interest rate co-integrated with real money balances. They used the Chow tests and the demand function turned out to be stable (Marashdeh et al., 1997).

Studies have also provided evidence that underdeveloped economies suffer from a lack of well-developed financial and capital markets, which diminish the alternatives of the public for holding money (Lungu et al., 2012). According to Lungu et al. (2012) underdeveloped financial and capital markets could affect the stability of the money demand function. Rutayisire et al.(2008) used the Johansen co-integration procedure and they concluded that the currency substitution effect and the positive relationship with income do exist in Rwanda. In his empirical model the interest rate turned out to be insignificant, which was attributed to the controlled mechanism of the authorities.

Bashier et al.(2011) examined the money demand function and its stability for Jordan over the period 1975-1990. They recalled earlier studies which assessed the demand of money in Jordan and presented mixed results. The shortcomings of the previous studies were attributed to the omission to employ a stability test and therefore causing spurious regression problems. The Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) test provided evidence of a stable money demand function. The empirical results showed that real money balances hada positive relationship with real income anda negative relationship with interest rate and exchange rate.This was in line with the money demand theory.

Narayan et al. (2008) proved with Fiji's time seriesthat beside the stability test also structural breaks should be considered when estimating the money demand function. They used the bound test which can be applied irrespective of whether or not the underlying variables are non-stationary. They pointed out that because previous studies on the demand of Fiji did take structural breaks into account the unit root null hypothesis was disclaimed(rejected). He underpinned that structural breaks in the data diminishes the power to reject a unit root, when the alternative hypothesis is true and the break is therefore disregarded. However, Lunga et al. (2008) revealed that several structural changes in Malawi did not affect the stability of the money demand function.

Table 1 summarizes the outcome of selected empirical studies on the money demand function.

Table 1:Selected Empirical Evidence on Money Demand

Reference	Period	Country	Methodology	Determinants	Results
Marashdeh. 1997	1980.1-1994.10 (monthly)	Malaysia	VAR	Nominal GDP, Nominal ER Expected inflation and Deposit rate	Variables cointegrated; money demand stable
Bahmani et al., 2005	1979-2007 (annual)	Iran	Bounds test	Real GDP, RER, Inflation and ER volatility	Long-run relationship and short-run dynamics
Hossain, 2007	1970-2005 (annual)	Indonesia	Simple linear regression model	Real GDP, Nominal interest rate and Inflation	Determinants significant, except interest rate; money demand stable
Nair et al., 2008	1970-2004 (annual)	Malaysia	UECM & Bounds test	Real GDP, REER, Real interest rate and CPI	Variables cointegrated with real money demand; money demand stable
Narayan et al., 2008	1971-2002 (annual)	Fiji	OLS/Bounds test	Real GDP and Nominal interest rate	No long-run relationship; money demand unstable
Moghaddam et al., 2008	1970-1998 (annual)	Gambia	IS-LM-BB model	Real GDP, REER, nominal interest rate and CPI	Variables cointegrated with real money demand
Ozturk et al., 2008	1994-2005 (annual)	10 Transition countries	Feasible GLS panel model	Real GDP, REER and Inflation	Determinants significant in explaining money demand
Lungu et al., 2012	1985-2010 (annual)	Malawi	VECM	Real GDP, Nominal ER, Tbills interest rate and Financial depth	Variables significant; money demand stable

Source: Authors

4. Empirical Model

4.1 Data analysis

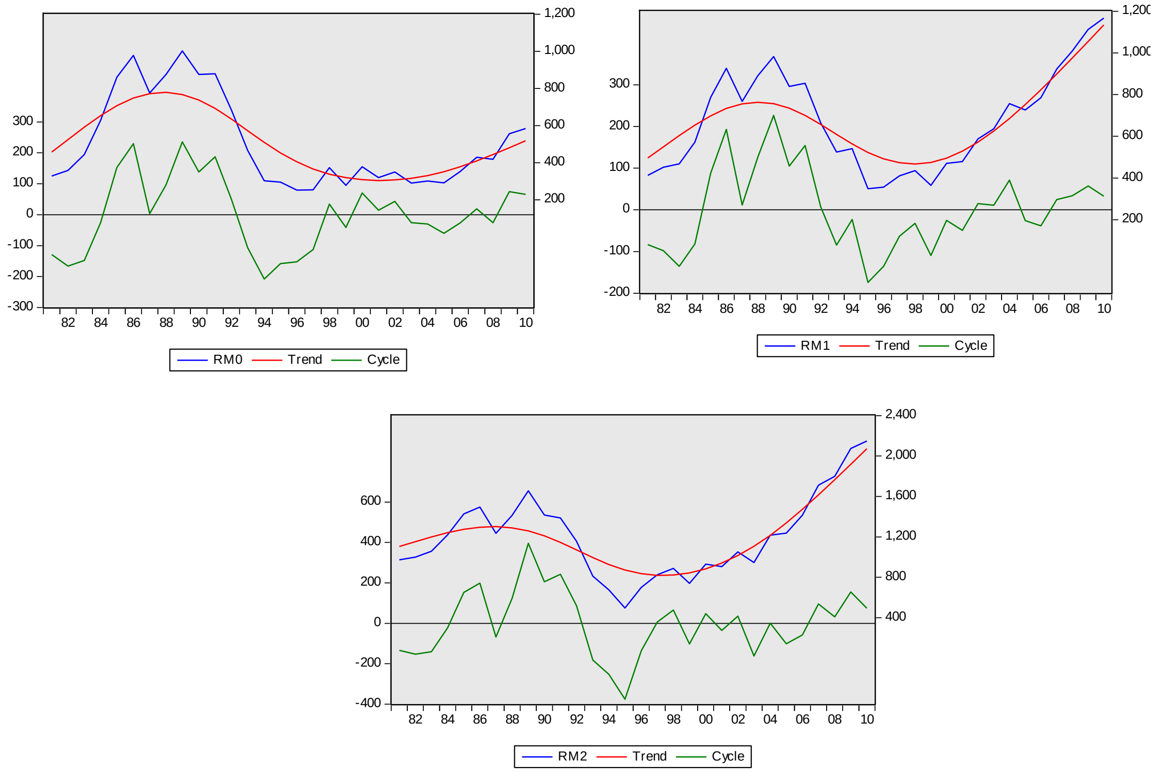
The choice of determinants for the money demand function in Suriname is primarily based on variables considered in the theoretical debates, variables employed in empirical studies of developing countries and the availability of time series data. In many studies a real money demand function was estimated. This is also done in the case of Suriname, because nominal variables may be biased or distorted by the high price developments during the sample period. The period of 1981-2010 is considered because of data availability reasons.

Real base money (RM0), real narrow money (RM1) and real broad money (RM2) serve as proxies for real money demand. The estimated model should reveal the significance of these proxies. The nominal monetary aggregates are deflated by CPI to get the real values. Base money comprises local currency in circulation and liabilities to other depository corporations in local and foreign currency. Narrow and broad money have been defined in Section 2. Real GDP (RGDP) is a proxy for real income in the real money demand function. The openness and small size of the Surinamese economy justifies the inclusion of real exchange rate (RER) together with real average lending rate (RLR) as proxies for the opportunity costs of holding money.In highly dollarized economies, such as Suriname, the exchange rate influences decisions on holding local money or foreign money (currency substitution) and it covers financial innovation of the economy. The interest rate is important for deciding on two types of return, namely one for holding money and the other one for holding alternative financial assets.

The statistical properties of the variables will be examined by using the Hodrick-Prescott filter to extract the trend and cyclical component of the time series. Moreover, a summary of descriptive statistics is presented mainly to test the time series on normal distribution.

Figure 2 shows the development of RM0, RM1 and RM2 during 1981-2010, in which the actual series is decomposed into the trend and cyclical components. The trend component is displayed as the more smoothed line (red line). Overall, the monetary aggregates show more or less similar patterns. They moved above their long-term trend line during 1985-1991, which was followed by a large swing below the trend line. After 2000 the cyclical variations were less volatile. The economic background of these developments has been explained in Section 2.

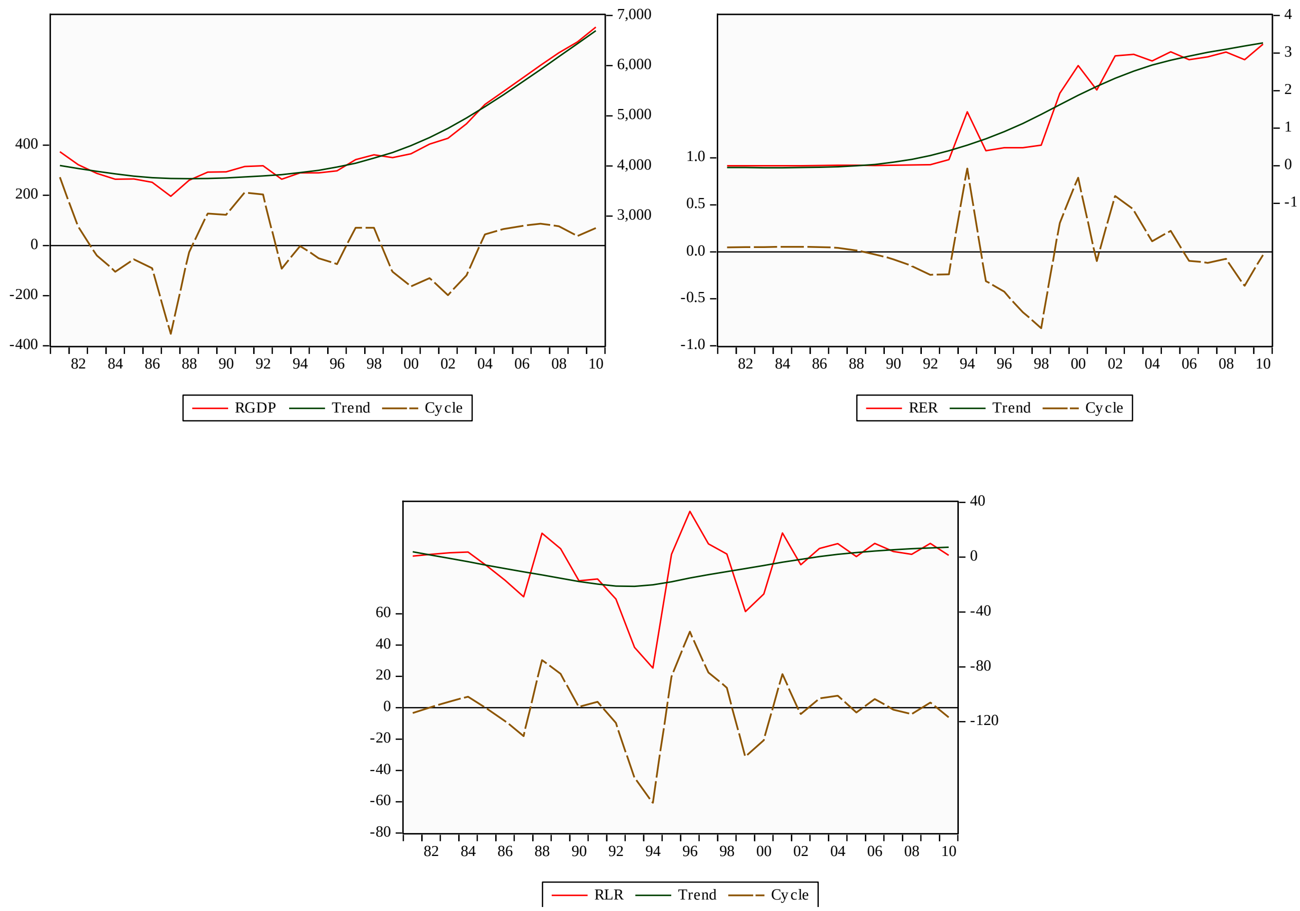
Figure 2: Monetary Aggregates with a Hodrick-Prescott Filtered Trend and Cycle Line (Lambda=100)



Source: Authors using Eviews 7.0

Figure 3 displays the trend and cyclical components of RGDP, RER and RLR. In the first graph the smoothed trend line shows the country's long-term potential real output (dark green line), while the cyclical variations in real output display the output gap (brown line). During 1983-1987 real output was far below its long-term output level. The dominant bauxite sector suffered from low international prices which compromised investment. In addition, the suspension of the Dutch development aid urged the Government to cut on capital spending. During 1988-1992 real output recovered and was well above its long-term trend level. The revival was primarily caused by the improvement of international market conditions for the bauxite industry, which enabled the bauxite companies to increase production. In the period 1993-2003, real output primarily developed below its long-term potential level. This development largely reflected poor external market conditions for the bauxite sector and its negative impact on Government transfers, which in turn reduced the Government's capacity to finance capital expenditure. From 2004 onwards, the commencement of large-scale gold mining and ongoing large investment in the oil and gold sector, among others, contributed to a recovery of real output.

Figure 3: RGDP, RER and RLR with a Hodrick-Prescott Filtered Trend and Cycle Line (Lambda=100)



Source: Authors using Eviews 7.0

The trend-cycle decomposition of RER[2]in the second graph revealsthe deviation of the US-dollar exchange rate from its trend, particularly in the 1990s and 2000s. These deviations primarily reflect the overvaluation and undervaluation of the Surinamese currency on the parallel market. Since the methodology of RER is based on inflation difference between Suriname and the USA, the price effects of the large devaluations in 1993-1994 and 1999-2000 are also displayed in the cyclical component.

[2] RER series comprises official buying rate (1981-1982) and parallel market buying rate (1983-2010) for the US-dollar.. RER is calculated as:$((\pi_d - \pi_f) - \left(\frac{ER_t - ER_{t-1}}{ER_{t-1}}\right))$, where $(\pi_d - \pi_f)$ is the difference between domestic and foreign inflation.

The cyclical fluctuation of RLR[3] was mainly influenced by inflation developments. In the period 1995-1997, however, real positive interest rates were evident. Following the near-hyperinflation episode in 1994, commercial banks increased their interest rates accordingly. Nevertheless, RLR remained negative in that year. Under the influence of lower inflation in 1995 and higher interest rates at commercial banks induced, by the real positive return on the gold certificates of the Bank, RLR turned positive. The issue of gold certificates was, among other things, intended to mob up excess liquidity. A side effect of this open market type operation was that the high return on the gold certificates forced commercial banks to increase their interest rates.

Table 2: Summary Statistics
(sample period: 1981-2010)

	Mean	St.dev	Skewness	Kurtosis	Jarque-Bera	Probability
RM0	505.785	244.054	0.806	2.162	4.122	0.127
RM1	675.122	238.549	0.348	2.006	1.841	0.398
RM2	1200.384	406.383	0.569	2.816	1.663	0.435
RGDP	4469.847	933.488	1.209	3.169	7.341	0.025
RER	1.226	1.327	0.390	1.325	4.271	0.118
RLR	-6.345	24.125	-1.442	5.133	16.077	0.000

Source: Authors using Eviews 7.0

The summary statistics in table 2 provide additional information on the statistical properties of the variables. The lower standard deviation of RMO, RM1, RM2 and RGDP with respect to their mean value suggests that de data points tend to be close to their mean. The higher standard deviation of RER and RLR with respect to their mean indicates that a large portion of the observations are further away from the center of the data. One of the premises for conducting a regression is predicated on the normality of the data, which suggest a benchmark value of 3 for kurtosis[4] and 0 for skewness[5]. Confirmation of this analogy on normal distribution is provided by conducting the Jarque-Bera (JB) test. According to the hypothesis test for normality, the null hypothesis states zero mean and constant variance, while the alternative hypothesis implies the opposite.In symbols, the notation of this hypothesis test is as follows:

$$H0: \mu = 0 \text{ and } \sigma^2 = 1 \qquad H1: \mu \neq 0 \text{ and } \sigma^2 \neq 1$$

If the p-value of the JB test is greater than 0.05, the null hypothesis of normality cannot be rejected indicating that a variable is normally distributed. The probability results of the JB test indicate that the variables are normally distributed, except for RGDP and RLR.

[3] RLR is calculated as: $\left(\frac{1+r}{1+\pi} - 1\right) \times 100$, whereby r symbolizes the nominal lending rate and π is the inflation rate.
[4]Measurespeakedness of a distribution.
[5]Measures asymmetry of a distribution.

The Hodrick-Prescott trend-cycle decomposition, the gap between the mean value and standard deviation and normality properties of the data series seem to suggest that in some instances transformation of the series may be necessary to deal with issues, like structural breaks or non-stationarity. Yet, these observations need to be substantiated with other tests, which will be discussed in the next paragraph.

4.2Methodology

The model estimation is preceded by the process of testing the unit roots. The aim for performing a unit root test is to verify whether the variables, which are to be included in the model, are stationary. The importance of stationarity, i.e. the mean and variance are transitory and do not deviate over time, derives from the fact that the results of the variables are statistically reliable and they are not biased. Moreover, the result of the regression will not lead to spurious regression and consequently will produce genuine correlation between the variables of interest. Two widely used statistical procedures are employed, namely the Augmented Dickey-Fuller (ADF) test statistic (1981) and the Phillips-Perron (PP) test statistic (1988), to trace the presence of unit root in the data and to establish the order of integration of the variables, I(0) or I(1). The null hypothesis of the ADF and PP tests state that the data series have a unit root. It is worth mentioning that these tests have their constraints, namely:

- The difficulty to reject the null hypothesis, because the unit root tests have low power to differentiate between a unit root process and a borderline stationary process (Brooks, 2008);
- These unit root testsare very sensitive to trend breaks or regime shifts often resulting in non-rejection of the unit root null hypothesis (Ghosh, 1999).

The ADF and PP tests concluded that RM0 is integrated of the order one (see Annex 1).The stationary properties of RM1, RM2 and RGDP are undecided, because the ADF and PP tests provided mixed results. For this reason and also for the ease of interpretation of estimated coefficients, the real monetary aggregates, RGDP and RER will be transformed in a logarithmic form. It allows for the interpretation of the parameters as elasticities.

Table 3presents the results of the order of integration of each transformed variable, except for RLR, in its level and first difference. The stationary properties of the logarithmic values of real base money (LRM0) are undecided. The results of the ADF test suggest non-stationary series in both level and first difference, while the PP test indicates that the series are stationary in their first difference. All other variables are stationary when first differencing them. So RM0, RLR and the logarithmic values of RM1, RM2, RGDP and RER will be included in the regression model. Both tests reveal that these variables are integrated of the order one.

Table 3: ADF and PP Test Statistics on Money Demand Variables

Variable	ADF	PP
LRM0	-1.343	-1.703
	(0.596)	*(0.419)*
Δ LRM0	-2.232	-4.508
	(0.200)	*(0.001)*
LRM1	-0.966	-1.469
	(0.752)	*(0.535)*
Δ LRM1	-4.611	-4.697
	(0.001)	*(0.001)*
LRM2	-0.721	-1.029
	(0.826)	*(0.729)*
Δ LRM2	-4.605	-4.605
	(0.001)	*(0.001)*
LRGDP	3.243	1.537
	(1.000)	*(0.999)*
Δ LRGDP	-3.021	-4.035
	(0.048)	*(0.004)*
RLR	-3.911	-2.908
	(0.006)	*(0.057)*
ΔRLR	-4.838	-9.668
	(0.001)	*(0.000)*
LRER	-1.338	-1.486
	(0.598)	*(0.527)*
ΔLRER	-4867	-4.851
	(0.001)	*(0.001)*

Source: Authors using Eviews 7.0

Note:
Probability values are in parentheses.

According to Engle,a vector of time series that are integrated of order one, may have stationary linear combinations without differencing and thus may be considered co-integrated time series (Engle &Yoo, 1987). Engle and Granger (1987) established that a co-integrated system can be represented in an error correction structure, which incorporates both changes and levels of time series such that all the elements are stationary (Engle &Yoo, 1987). Several error correction models (ECMs) have been developed over the years, such as ECM of Engle & Granger andStock & Watson (1993) or Vector Error Correction Model (VECM). ECMs allow for specifying the time series in terms of long-run relationships and deviations from the long-run equilibrium in the short run.

The estimation of the real money demand function is conducted with aVECMand an ECM with the Engle-Granger two stepsco-integration approach. In a VAR/VECM framework the variables in the regression model are considered endogenous (Brooks, 2008). Since the model is not explicitly specified in exogenous and endogenous terms, the degree of causality between the variables is determined in the regression model.The Engle-Granger two steps co-integration approach, however, assumes that all explanatory variables are exogenous.

The regression is first conducted in an unrestricted VAR model to determine the optimal lag length for the variables and is then followed by co-integrating analysis. There are many tests of co-integration (Watson, 1994), but within a VAR framework the Johansen co-integration testing procedure is usually employed. This is a two-stage testing procedure, in which the first co-integration step is conducted without imposing any information about the co-integrating vector (Ibid, 1994). The null hypothesis in this test states that there is no co-integration. If co-integration is identified, then a second stage test is employed to see whether the co-integrating vector takes on the value predicted by economic theory (Ibid, 1994). If co-integration exists, a VECM is estimated using Seemingly Unrelated Regression (SUR) instead of Ordinary Least Squares (OLS). OLS estimates are biased and inconsistent, if the explanatory variables are assumed to be endogenous.

The Engle-Granger two steps approach first estimates the co-integration regression by using OLS. Subsequently, the residualsderived from this estimation aresubjected to ADF unit root testing. If unit root is rejected, which indicates a co-integration relationship, the second step is to estimate the ECM by applying OLS. The ECM describes the short-run dynamics and long-run equilibrium relationship among the variables.

In ECMs the error correction term (ECT) is required to be negative and statistically significant (Butts, 2009). A negative ECT indicates a move back towards long-run equilibrium relationship, while a positive ECT implies movements away from long-run equilibrium. The stability of the coefficients can be tested by the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) test, which test the stability of the model within a 5%-significance band. The Chow test for breakpoints also provides information on the stability of a model.

4.3 Model specification and results

The real money demand function is estimated within a VECM structure. If the variables are co-integrated, the estimated model provides a framework to analyze the long-run equilibrium relationship between the regressand and regressors and the short-run dynamics. The general form of the VECM can be formulated as follows:

$$\Delta y_t = \gamma_1(y_{t-1} - \alpha_o - \alpha_1 x_{t-1} - \alpha_2 z_{t-1} - \alpha_3 p_{t-1}) + \sum_{j=1}^{n} \beta_{1j}\Delta y_{t-j} + \sum_{j=1}^{n} \delta_{1j}\Delta x_{t-j} + \sum_{j=1}^{n} \theta_{1j}\Delta z_{t-j} + \sum_{j=1}^{n} \varphi_{1j}\Delta p_{t-j} + \varepsilon_{1t} \quad (1)$$

$$\Delta x_t = \gamma_2(y_{t-1} - \alpha_o - \alpha_1 x_{t-1} - \alpha_2 z_{t-1} - \alpha_3 p_{t-1}) + \sum_{j=1}^{n} \beta_{2j}\Delta y_{t-j} + \sum_{j=1}^{n} \delta_{2j}\Delta x_{t-j} + \sum_{j=1}^{n} \theta_{2j}\Delta z_{t-j} + \sum_{j=1}^{n} \varphi_{2j}\Delta p_{t-j} + \varepsilon_{2t} \quad (2)$$

$$\Delta z_t = \gamma_3(y_{t-1} - \alpha_o - \alpha_1 x_{t-1} - \alpha_2 z_{t-1} - \alpha_3 p_{t-1}) + \sum_{j=1}^{n} \beta_{3j}\Delta y_{t-j} + \sum_{j=1}^{n} \delta_{3j}\Delta x_{t-j} + \sum_{j=1}^{n} \theta_{3j}\Delta z_{t-j} + \sum_{j=1}^{n} \varphi_{3j}\Delta p_{t-j} + \varepsilon_{3t} \quad (3)$$

$$\Delta p_t = \gamma_4\left(y_{t-1} - \alpha_o - \alpha_1 x_{t-1} - \alpha_2 z_{t-1} - \alpha_3 p_{t-1}\right) + \sum_{j=1}^{n} \beta_{4j}\Delta y_{t-j} + \sum_{j=1}^{n} \delta_{4j}\Delta x_{t-j} + \sum_{j=1}^{n} \theta_{4j}\Delta z_{t-j} + \sum_{j=1}^{n} \varphi_{4j}\Delta p_{t-j} + \varepsilon_{4t} \quad (4)$$

Where:

Δ = Symbol of difference operator
y_t = Real base money (RM0) or log of real narrow/broad money (LRM1/LRM2) as proxy for real money demand
x_t =Log of real gross domestic product (LRGDP) as proxy for real income
z_t = Log of real exchange rate (LRER) as proxy for opportunity cost for holding money
p_t = Real lending rate (RLR) as proxy for opportunity cost for holding money
ε_{1t}; ε_{2t}; ε_{3t} and ε_{4t}= Residuals.
$\left(y_{t-1} - \alpha_o - \alpha_1 x_{t-1} - \alpha_2 z_{t-1} - \alpha_3 p_{t-1}\right)$ = Co-integrating vector or long-run equilibrium relationship
γ_1; γ_2; γ_3 and γ_4 = Parameters of ECT indicating the speed of adjustment to equilibrium
$\beta_{ij}\Delta y_{t-j}$; $\delta_{ij}\Delta x_{t-j}$; $\theta_{ij}\Delta z_{t-j}$ and $\varphi_{ij}\Delta p_{t-j}$= Short-run dynamics in the system

Equation (1) represents the real money demand function. Money demand theory prescribes a positive relationship between (log) real money and (log) real GDP implying that as output/income rises the demand for money increases. However, there are some debates on the selection of the scale variable. Some empirical studies on money demand in developing countries have concentrated on a scale variable using industrial production (Sriram, 1999) or consumption expenditure or wealth or have even employed a more comprehensive measure of transactions. The underlying idea is that not all transactions have a similar degree of money dependence. Nevertheless, there is no evidence of deviated behavior of the money demand when one of the latter scale variables is employed. Moreover, log of real GDP is frequently used in empirical studies.

With regard to the other determinants, namely (log) real exchange rate and real lending rate, money demand theory assumes a negative relationshipwhich implies that if thedomestic currency depreciates or interest rate increases demand for money declines. The log of exchange rate captures the degree of currency substitution in the economy. Equations (2), (3) and (4) will provide additional information on the direction of causality among the variables and their dynamic response to a shock in the system.

An unrestricted VAR model is estimated to determine the optimal lag length and whether the money demand variables are co-integrated. These tests have been done with RM0, LRM1 and LRM2 separately asproxies for money demand. The selection of lag length was based on the number of lags indicated by the Schwarz Information Criterion, which is often used in small sample regression. The results are presented in Annex 2 together with the results of the residual tests in the unrestricted VAR model. The VAR model with LRM1 and LRM2 failed the normality test, but the other testsindicated no autocorrelation and no heteroskedasticity of the residuals. Although normality of the residuals is desirable, the estimation process still can be continued.

The decision on the number of co-integrating vector is based on the Johansen co-integration rank test. This test is done assuming a linear deterministic trend with intercept and no trend in the co-integrating equations. Many time series are well captured by this approach. The results of the Johansen test with RM0 and LRM1 as money demand variable are shown in Annex 3 and 4 respectively.Estimation of the reduced VECM with one co-integrating equation revealed that money demand with RM0 and LRM1 as proxies has no long-run equilibrium relationship and thus no short-run dynamics. These results are presented in Annex 5 and 6. The results of the VECM with LRM2 as a proxy for money demand are different, yet questionable.

The Johansen trace statistic indicates that at most two co-integrating vectorsexist in the model with LRM2 in the money demand function (see Annex 7). The maximum eigen statistic, however, indicates at most one co-integrating vector.Existence of co-integration justifies the estimation of a VECM, which is conducted with the Seemingly Unrelated Regression method. The results of the long-run equilibrium relationship, the co-integrating coefficients of the error correction term (ECT) and the short-run dynamics are shown in Annex 8.

The speed of adjustment on the co-integrating vector, indicated by the ECT coefficients, is highly significant in the relationship between real money demand growth (ΔLRM2), real economic growth (ΔLRGDP) and change in the real exchange rate (ΔLRER). However, the ECT coefficients of real money demand and real economic growth are positive instead of negative, implying movements away from long-run equilibrium. This impedes the interpretation of the VECM results. So,real money demand in a VECM framework proves not to be the Best Linear Unbiased Estimator.

Alternatively, anEngle-Granger model is specified and estimated to determine the real money demand function. The general form of the Engle-Granger long-run equation of real money demand is as follows:

$$y_t = \beta_0 + \beta_1 x_t + \beta_2 z_t + \beta_3 p_t + \varepsilon_t \qquad \text{(I)}$$

Where:

y_t; x_t; z_t and p_t = the respective variables as defined in the VAR model
β_0; β_1; β_2 and β_3 = coefficients of the constant and explanatory variables respectively
ε_t= error term or residual

The long-run equation is estimated by applying OLS. OLS estimates are assumed to provide consistent coefficients, but the standard errors of the coefficients are unreliable because of the inclusion of I(1)-variables in the model. ADF unit root testing on the residual of the long-run modelwill determine whether co-integration exists amongst the variables.

Table 4: Engle-Granger Co-integration Test Using ADF Test Statistic

	t-Statistic	Critical values		
		1%	5%	10%
ECM_RM0	-2.401	-3.679	-2.968	-2.623
ECM_LRM1	-2.663	-3.679	-2.968	-2.623*
ECM_LRM2	-2.841	-3.679	-2.968	-2.623*

Source: Authors using Eviews 7.0

* Denotes stationary level

The error term of the long-run real money demand function, with LRM1 and LRM2 as proxies, are stationary at 10% significance level, which suggests that a co-integrating relationship exists between thesereal money demand variables and their determinants.

The basic Engle-Granger ECM regresses changes in the dependent variable on changes in the explanatory variables and one-period lagged error correction term. Additional lags and deterministic terms may be included (De Boef, 2000). A general-to-specific approach is applied to the following model with one lagged variables:

$$\Delta y_t = \alpha \Delta y_{t-1} + \delta_1 \Delta x_t + \delta_2 \Delta x_{t-1} + \gamma_1 \Delta z_t + \gamma_2 \Delta z_{t-1} + \lambda_1 \Delta p_t + \lambda_2 \Delta p_{t-1} + \varphi ECM_{t-1} + \mu_t \qquad \text{(II)}$$

Where:

Δ = Difference operator
α; δ_1;δ_2; γ_1; γ_2; λ_1 andλ_2 = Short-run dynamics
φ = Speed of adjustment to long-run equilibrium
μ_t= Residual

Table 5 presents the long-run multipliers and short-run dynamics of the estimated Engle-Granger ECM. Based on the residual tests, both real narrow money and real broad money demand functionsbehave well. The LRM2 model performs even better based on the correlation coefficient (R^2). Furthermore, the coefficient of the ECM is significant and negative, which indicates that short-run deviations move back to the long-run equilibrium relationship.

The quantity theory of money assumes an income elasticity of unity, but the long-run equation in the case of Suriname reveals an income elasticity of greater than one. The result suggests that a 1%-rise of real economic growth increases real demand for broad money by about 1.9%. The currency substitution effect, which is indicated by the exchange rate elasticity, shows that a 1%-increase in real exchange rate lowers the real demand for broad money by 0.09% in the long run. In addition, a 1%-increase of the real lending rate causes real money demand to decline by 0.001%. The limited interest rate sensitivity signals the effects of the shallowness and underdevelopment of the domestic financial markets. The Surinamese public lacks alternatives to holding money. The market for Government paper is shallow and not accessible for the general public. Consequently, interest rate changes will have very limited effects on investment decisions of the public.

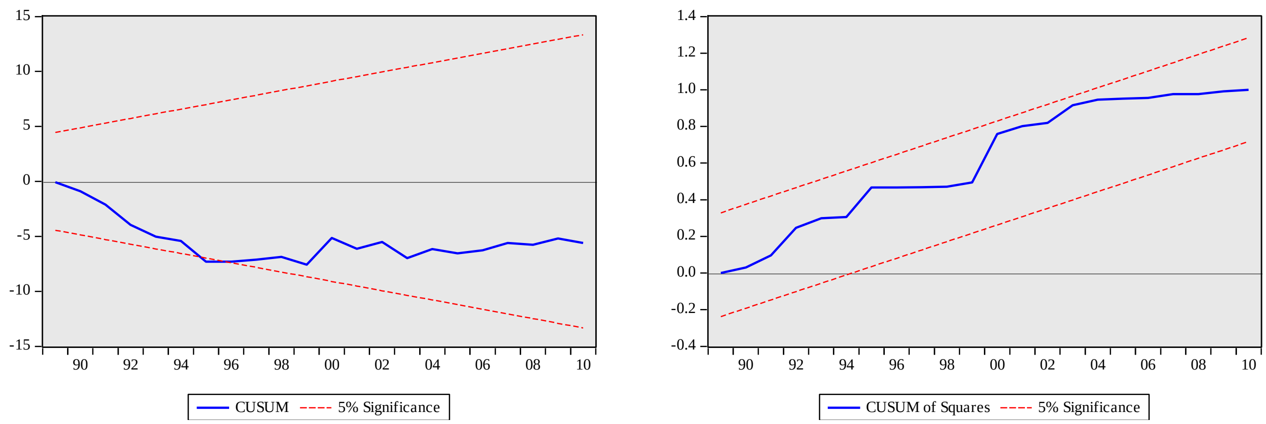
Table 5: Engle-Granger Real Money Demand Function

Dependent variable	**LRM1**	**LRM2**
Long-run multipliers		
LRGDP	1.696	1.913
LRER	-0.070	-0.094
RLR	-0.003	-0.001
C	-7.910	-9.179
Short-run dynamics:		
ΔLRGDP	2.862	2.006
$\Delta LRGDP_{t-1}$	-1.228	-1.204
ΔLRER		-0.065
$\Delta LRER_{t-1}$		-0.142
ΔRLR	-0.002	
RLR_{t-1}		
ECM_{t-1}	-0.182	-0.224
R^2	0.436	0.606
Adjusted R^2	0.365	0.517
Residual Tests (p-values):		
Normality test	0.821	0.486
Serial correlation (χ^2)	0.056	0.272
Heteroskedasticity (χ^2)	0.460	0.399

Source: Authors using Eviews 7.0

In the short-run, real economic growth and real depreciation of the local currency can induce deviations from the long-run equilibrium relationship. The error correction coefficient states that, in response to a shock to the system, real growth of broad money would decline in order to correct 22% of the deviation from long run equilibrium each year. The speed of adjustment to a shock in the system would last about five years, with real money demand adjusting to restore long-run equilibrium.

Figure 4: Stability Test on Money Demand Coefficients



The CUSUM stability test displays instability in the coefficients of the real money demand function in 1995. Although the CUSUMSQ stability test indicates a fairly stable real money demand function within the 5% significance band, the hike in 2000 gives reasons for concern. The Chow breakpoint test is employed to verify whether instability can be observed in these years. The results are presented in table 6. The Chow test identified a breakpoint in 2000, indicating an unstable money demand function in Suriname.

Table 6: Chow Breakpoint Test

	Probability (χ^2)
$Chow_{1995}$	0.201
$Chow_{2000}$	0.013
$Chow_{2002}$	0.453

Source: Authors using Eviews 7.0

The years that the CUSUM, CUSUMSQ and Chow testsidentified as having unstable money demand coefficients correspond with shifts in the macroeconomic performance of the economy, namely a shift from macroeconomic instability to macroeconomic stabilization. In the second half of 1995, the first near-hyperinflation episode and exchange rate volatility came to an end. In 2000, the second near-hyperinflation episode was halted. These developments reflect turning points from accommodating monetary policy, loose fiscal policy and deteriorated terms of trade to prudent monetary and fiscal policy stance and improved term of trade. So the stability tests do provide evidence, which seem to suggest sudden shifts in the stability of the broad money demand parameters.

5. Conclusions and policy implications

In this paper the first attempt is made to estimate the real money demand function and to determine the stability in the demand for real money in Suriname. The research is done for the sample period 1981-2010 by applying a VAR/VECM and an Engle-Granger estimation procedure. The estimation is conducted with real base money, real narrow money and real broad money as proxies for money demand. Ultimately, both methods indicated long-run equilibrium relationship and short-run dynamics, which links real demand for broad money with real gross domestic product, real exchange rate and real lending rate.

Based on the required statistical properties for regression models, the Engle-Granger real money demand model behaved better than that of the VECM. Both estimation procedures provided the expected positive relationship between real broad money demand and real income and also the expected negative relationship between real broad money demand and real exchange rate and interest rate in the long run. Contrary to the VECM model, the Engle-Granger model provided the desired negative and significant error correction term, which indicates an adjustment back to long-run equilibrium relationship. The error correction model in the VECM framework has raised doubt about the results because of the positive rate of adjustment (co-integrating coefficient) to long-run equilibrium. This suggests movements away from the long-run equilibrium relationship among the money demand variables. On the stability of the money demand function, the CUSUM, CUSUMSQ and Chow tests seem to suggest sudden shifts in the parameters of real demand for broad money, implying an unstable real money demand function.

The long-run Engle-Granger equation reveals an income elasticity of greater than one, implying a multiplier effect of 1.9% for every one-percentage point growth of real output. The exchange rate elasticity indicates that in the long run the demand for real broad money declines by 0.09%,ifa real depreciation of the domestic currency takes place. This decline may be attributable to the currency substitution behavior of the public when the value of the domestic currency deteriorates. The impact of a change in the real lending rate is negligible, given the coefficient of 0.001. The underdevelopment of domestic financial markets may explain the limited interest rate sensitivity in the economy.

The short-run dynamics in the real money demand function are induced by real economic growth and real exchange rate changes. In case of a shock to the system, the error correction termindicates that real growth of broad money would decline in order to correct 22% of the deviation from long run equilibrium each year. This adjustment process would last about five years, with real money demand adjusting to restore long-run equilibrium.

The empirical findings suggest that broad money is the most appropriate monetary aggregate for policy analysis. However, monetary targeting or targeting of broad money solely is less appropriate for policy implementation purposes because of the instability of real money demand. Furthermore, the insignificant impact of real lending rate suggests that interest rate policy would be ineffective to manage real money demand. Instead, the high income elasticity suggests that income-related policy measures in the fiscal area, such as taxation and changes in investment spending, may prove to be more effective to influence the real demand for money. The estimated real money demand function confirms the presence of currency substitution in Suriname. This provides justification for the Central Bank's move early 2011 to impose higher reserve requirements on foreign currency balances at commercial banks in order to have better control over these balances.

Presently, the Central Bank does not target a monetary aggregate explicitly. Its policy framework is primarily based on influencing credit supply of commercial banks through reserve requirements and on exchange rate anchoring through foreign exchange market intervention to hold the exchange rate at its pre-announced level. As a very small open developing economy, the mixture of money demand management, exchange rate targeting and prudent fiscal policy seems to deliver macroeconomic stability.

This study is considered a first chapter of research on money demand in Suriname. In particular, further study may be required to investigate the sudden shifts/structural breaks by employing more sophisticated econometric techniques.

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Annex

Annex 1:ADF and PP Test Statistics

Variable	ADF	PP
RM0	-1.343	-1.694
	(0.596)	*(0.424)*
Δ RM0	-3.916	-3.964
	(0.008)	*(0.005)*
RM1	-1.948	-1.138
	(0.306)	*(0.002)*
Δ RM1	-4.439	-4.6
	(0.687)	*(0.001)*
RM2	-0.042	-0.566
	(0.947)	*(0.884)*
Δ RM2	-2.557	-4.398
	(0.114)	*(0.002)*
RGDP	3.177	2.484
	(1.000)	*(1.000)*
ΔRGDP	-1.901	-3.294
	(0.326)	*(0.025)*
RLR	-3.911	-2.908
	(0.006)	*(0.057)*
ΔRLR	-4.838	-9.668
	(0.001)	*(0.000)*
RER	-0.572	-0.267
	(0.862)	*(0.918)*
ΔRER	-6.668	-6.668
	(0.000)	*(0.000)*

Source: Authors using Eviews 7.0

Note:
Probability values are in parenthesis.

Annex 2: Lag selection and Residual Tests Unrestricted VAR model

With money demand variable:	**RM0**	**LRM1**	**LRM2**
Lags selection:			
Likelihood Ratio (5% level)	2	2	2
Final Prediction Error	3	2	3
Akaike	3	2	3
Schwarz	2	2	2
Hannan-Quin	3	2	3
Residual Tests (p-values):			
Autocorrelation LM test	> 0.05 (7 lags)	> 0.05 (12 lags)	> 0.05 (12 lags)
Normality test	0.277	0.000	0.009
White Heteroskedasticity	0.112	0.151	0.086

Source: Authors using Eviews 7.0

Annex 3: Johansen Co-integration Test with RM0 as Money Demand Variable

Rank	Eigenvalue	Trace statistic	5% critical value	p-value
$r = 0$	0.790	73.134	47.856	0.000
$r \leq 1$	0.499	31.048	29.797	0.036
$r \leq 2$	0.354	12.365	15.495	0.140
Rank	**Eigenvalue**	**Max. Eigen statistic**	**5% critical value**	**p-value**
$r = 0$	0.790	42.086	27.584	0.000
$r \leq 1$	0.499	18.683	21.132	0.106

Source: Authors using Eviews 7.0

Annex 4: Johansen Co-integration Test with LRM1 as Money Demand Variable

Rank	Eigenvalue	Trace statistic	5% critical value	p-value
$r = 0$	0.479	20.961	20.262	0.040
$r \leq 1$	0.091	2.725	9.165	0.633
Rank	**Eigenvalue**	**Max. Eigen statistic**	**5% critical value**	**p-value**
$r = 0$	0.479	18.236	15.892	0.021
$r \leq 1$	0.091	2.725	9.165	0.633

Source: Authors using Eviews 7.0

Annex 5: Results of Reduced VECM with RM0 as Money Demand Variable

Regressand	Regressors	Coefficient	t-Statistic	Prob.	R^2	DW
CE =						
	$RM0_{t-1}$	1.000				
	$LRGDP_{t-1}$	-549.677	-2.868			
	$LRER_{t-1}$	107.125	6.913			
	RLR_{t-1}	21.42	4.907			
	C	4400.127				
ΔRM0 =					0.095	1.335
	$\Delta LRGDP_{t-2}$	-928.255	-2.145	0.035		
ΔLRGDP =					0.359	1.629
	ECT	0.0001	6.320	0.000		
	$\Delta RM0_{t-1}$	-0.0001	-4.027	0.000		
	$\Delta RM0_{t-2}$	-0.0002	-5.633	0.000		
	$\Delta LRGDP_{t-1}$	-0.358	-2.891	0.005		
	$\Delta LRGDP_{t-2}$	0.322	3.078	0.003		
	$\Delta LRER_{t-1}$	0.058	5.727	0.000		
	$\Delta LRER_{t-2}$	0.022	2.945	0.004		
ΔLRER =					0.361	1.914
	ECT	-0.001	-4.916	0.000		
	$\Delta LRGDP_{t-1}$	-6.055	-6.001	0.000		
	$\Delta LRGDP_{t-2}$	2.894	3.368	0.001		
	$\Delta LRER_{t-1}$	-0.580	-3.378	0.001		
	$\Delta LRER_{t-2}$	-0.494	-3.262	0.002		
	C	0.664	5.852	0.000		
ΔRLR =					0.462	1.838
	$\Delta LRER_{t-1}$	16.689	3.328	0.001		
	$\Delta LRER_{t-2}$	29.906	5.846	0.000		
	ΔRLR_{t-2}	0.098	2.401	0.018		
	C	-13.841	-4.088	0.000		

Source: Authors using Eviews 7.0

Notes:
CE = Co-integrating equation
R^2 = Correlation coefficient
DW = Durbin-Watson Statistic

Annex 6: Results of Reduced VECM with LRM1 as Money Demand Variable

Regressand	Regressors	Coefficient	t-Statistic	Prob.	R^2	DW
CE =						
	$LRM2_{t-1}$	1.000				
	$LRGDP_{t-1}$	-2.351	-7.328			
	$LRER_{t-1}$	0.178	7.579			
	RLR_{t-1}	0.031	4.584			
	C	13.716				
ΔLRM1 =	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ΔLRGDP =					0.293	2.229
	ECT	0.066	5.470	0.000		
	$\Delta LRM1_{t-1}$	-0.085	-2.442	0.017		
	$\Delta LRER_{t-1}$	0.056	4.336	0.000		
ΔLRER =					0.316	1.900
	$\Delta LRGDP_{t-1}$	-8.434	-8.059	0.000		
	$\Delta LRGDP_{t-2}$	4.307	4.199	0.000		
	C	0.422	4.414	0.000		
ΔRLR =					0.428	1.988
	$\Delta LRER_{t-1}$	12.084	4.833	0.000		
	$\Delta LRER_{t-2}$	17.858	8.253	0.000		
	C	-11.089	-3.392	0.001		

Source: Authors using Eviews 7.0

Notes:
CE = Co-integrating equation
R^2 = Correlation coefficient
n.a. = not applicable, indicating no long-run equilibrium relationship nor short-run dynamics
DW = Durbin-Watson Statistic

Annex 7: Johansen Co-integration Test with LRM2 as Money Demand Variable

Rank	Eigenvalue	Trace statistic	5% critical value	p-value
$r = 0$	0.739	70.308	47.856	0.000
$r \leq 1$	0.502	34.124	29.797	0.015
$r \leq 2$	0.416	15.321	15.495	0.053
Rank	**Eigenvalue**	**Max. Eigen statistic**	**5% critical value**	**p-value**
$r = 0$	0.739	36.184	27.584	0.003
$r \leq 1$	0.502	18.803	21.132	0.103

Source: Authors using Eviews 7.0

Annex 8: Results of Reduced VECM with LRM2 as Money Demand Variable

Regressand	Regressors	Coefficient	t-Statistic	Prob.	R^2	DW	NORM	RESET (χ^2)	SC (χ^2)	HET (χ^2)
CE =										
	$LRM2_{t-1}$	1.000								
	$LRGDP_{t-1}$	-2.273	-8.160							
	$LRER_{t-1}$	0.158	8.080							
	RLR_{t-1}	0.036	5.267							
	C	12.502								
ΔLRM2 =					0.417	1.460	0.976	0.000	0.229	0.581
	ECT	0.206	5.077	0.000						
	$\Delta LRM2_{t-1}$	-0.657	-3.673	0.000						
	$\Delta LRGDP_{t-2}$	-1.223	-2.218	0.029						
	C	0.055	2.167	0.033						
ΔLRGDP =					0.357	2.156	0.083	0.010	0.418	0.362
	ECT	0.104	6.060	0.000						
	$\Delta LRM2_{t-1}$	-0.205	-5.116	0.000						
	$\Delta LRM2_{t-2}$	-0.145	-4.169	0.000						
	$\Delta LRGDP_{t-2}$	0.231	2.026	0.046						
	$\Delta LRER_{t-1}$	0.058	4.934	0.000						
	$\Delta LRER_{t-2}$	0.032	2.849	0.006						
	ΔRLR_{t-1}	-0.001	-2.257	0.027						
ΔLRER =					0.402	1.995	0.608	0.028	0.005	0.082
	ECT	-0.380	-3.968	0.000						
	$\Delta LRGDP_{t-1}$	-6.224	-7.229	0.000						
	$\Delta LRGDP_{t-2}$	2.663	2.928	0.004						
	$\Delta LRER_{t-1}$	-0.447	-2.507	0.014						
	$\Delta LRER_{t-2}$	-0.402	-2.590	0.011						
	C	0.601	4.964	0.000						
ΔRLR =					0.462	1.966	0.592	0.031	0.214	0.095
	$\Delta LRER_{t-1}$	13.882	2.577	0.012						
	$\Delta LRER_{t-2}$	23.415	4.622	0.000						
	C	-11.258	-2.996	0.004						

Source: Authors using Eviews 7.0

Notes:

CE = Co-integrating equation

R^2 = Correlation coefficient

DW = Durbin-Watson Statistic

NORM = p- value of normality

RESET (χ^2) = Chi-square p-value Ramsey Reset Test

SC (χ^2) = p-value of serial correlation

HET (χ^2) = Chi-square p-value of heteroskedaticity