A RE-EXAMINATION OF THE DEMAND FOR MONEY IN FIJI

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Abstract

The failure of conventional money demand functions in a number of countries has resulted in the downgrading of monetary aggregates in the conduct of monetary policy. Although prior studies have been conducted on the demand for money in Fiji, the results have been mixed. This paper seeks to use contemporary empirical methods to model the demand for money based on sound theoretical principles. The paper reviews some basic concepts of money demand theory, reviews model specification issues, and summarises the results of developed and developing countries' studies that have used cointegration and/or error correction techniques. In addition, the study tests for the existence of cointegration between a number of monetary aggregates, economic activity and interest rates. The error correction method is also used to support the cointegration findings. The empirical findings conclude that the demand for money in Fiji is unstable.

1.0 Introduction

The demand for money is at the heart of how policy should be conducted effectively. Money demand serves as a conduit in the transmission mechanism for monetary policy so the stability of the money demand function is critical if monetary policy is to have predictable effects on inflation and real output. In most developed and developing countries, policymakers have frequently questioned whether the demand for money is stable. Generally, the majority of studies find that the demand for money is unstable and monetary aggregates have lost their influence in the conduct of monetary policy.

In Fiji, for sometime, the role of monetary aggregates as intermediate targets has been downplayed. However, there has been renewed interest in the stability of the demand for money in Fiji and so this paper's objective is to re-examine this topical issue. Because of ongoing financial sector reforms[1], the determinants of money demand in Fiji will be difficult to establish. Nevertheless, this paper aims to provide a sound theoretical and empirical basis for modelling the demand for money. This paper employs cointegration analysis to examine the stability of the demand for money. Additionally, the error correction technique is also used to confirm the findings of the cointegration analysis.

The paper is divided into three parts. In the first part of the paper, the empirical survey covers the theories of money demand, selection of variables and model specifications. In addition, this part also outlines recent findings from both developed and developing countries as well as

[1] See Waqabaca (2000) for a detailed account of the financial sector reforms implemented so far.

studies done on the demand for money in Fiji. The second part of the paper outlines the model used in the study and discusses the results obtained from this model. The third part concludes the study.

2.0 Empirical Survey

The theory of money demand is one of the most enduring issues in economics and as such, the empirical literature and research available is very large. It is beyond the scope of this paper to address all the issues related to the demand for money. However, this section will briefly cover four areas – (1) theories of money demand, (2) selection of variables, (3) specification issues and lastly, (4) the latest empirical findings[2].

2.1 Theories of Money Demand

2.1.1 Classical Theories

According to classical economists, money acts as a numéraire. In other words, it is a commodity whose unit is used in order to express prices and values, but whose own value remains unaffected by this role (Sriram, 1999). However, money is deemed *neutral* with no real economic consequences since its role as a store of value, is limited under the classical assumption of perfect information and negligible transaction costs (Sriram, 1999).

The roots of modern theory of money demand began from the early contributions of Mill (1848), Walras (1900) and Wicksell (1906). The

[2] Majority of the works quoted in these sections was cited in Sriram (1999).

concept of money demand took formal shape through the quantity theory developed in the classical equilibrium framework by two different but equivalent expressions.

Fisher (1911) provided the famous *equation of exchange* ($M_sV_t = P_tT$, where M_s is quantity of money, V_t is the transactions velocity of circulation, P_t is prices and T the volume of transactions) where money is held simply to facilitate transactions and has no intrinsic value. The alternative paradigm, the so-called Cambridge approach, was primarily associated with the neo-classical economists Pigou (1917) and Marshall (1923). This approach stressed the demand for money as public demand for money holdings, especially the demand for real balances, which was an important factor in determining the equilibrium price level consistent with a given quantity of money (Sriram, 1999).

2.1.2 Keynesian Theory

Keynes (1930, 1936) built upon the Cambridge approach to provide a more rigorous analysis of money demand, focussing on the motives of holding money. Keynes postulated three motives for holding money: transactions, precautionary and speculative purposes. He also formally introduced the interest rate as another explanatory variable in influencing the demand for real balances.

The money demand function was then represented as $m^d = f(y, i)$ where the demand for real balances (m^d) is a function of real income (y) and nominal interest rates (i). The main proposition of the Keynesian analysis is that when interest rates are low, economic agents will expect a future increase in interest rates; thus, preferring to hold whatever amount of money is supplied. Therefore, the aggregate demand for money becomes perfectly elastic with respect to the interest rate (liquidity trap).

2.1.3 Post-Keynes

Following Keynes, a number of models were developed to confirm the relationship between the demand for real money and, income and interest rates. These models can be classified into three separate frameworks, namely transactions, asset and consumer demand theories of money.

Under the transactions theory of money demand framework, the inventory-theoretic approach (see Baumol, 1952 and Tobin, 1956) and the precautionary demand for money (see *inter alia* Cuthbertson and Barlow, 1991) models were introduced. These models were derived from the medium-of-exchange function of money.

The asset function of money led to the asset or portfolio approach where major emphasis is placed on risk and expected returns of assets (see Tobin, 1958). Alternatively, the consumer demand theory approach (see Friedman, 1956 and Barnett, 1980) considers the demand for money as a direct extension of the traditional theory of demand for any durable good (see Feige and Pearce, 1977).

The resulting implication of all the models discussed in the previous sections is that the optimal stock of real money balances is positively related to real income and inversely related to the nominal rate of return. Ultimately, the difference lies in the selection of variables that will enter the model.

2.2 Selection of Variables

2.2.1 Money Stock

Money stocks are mainly classified into two groups – narrow and broad money. As the name suggests, narrow money consists of those assets readily available for transactions while broad money encompasses a wider range of assets. Laidler (1993) states that the correct definition of money is an empirical matter. As such, several definitions of money have been used in various studies. The measures of money have been selected based on the objectives of the researchers (Sriram, 1999). For the purposes of this paper, the three widely used measures of money in Fiji (namely, narrow money, quasi money and broad money) are used to discover if there is a stable demand function for either of the measures.

2.2.2 Scale Variable

The scale variable is used as a gauge of transactions relating to economic activity. The most commonly used variables are gross national product (GNP) and other related variables such as gross domestic product (GDP) and net national product (NNP). Recent research have focussed on other scale variables involving more comprehensive measures of transactions and the segregation of transactions into various components under the idea that all transactions are not equally 'money intensive' (see Goldfeld and Sichel, 1990). However, Goldfeld and Sichel (1990) concluded that there is no firm evidence that the categorisation of GNP into components yields an improvement in the behaviour of money demand.

Wealth has also been used as a scale variable but usage has been constrained to only a few countries such as the United Kingdom and the United States where data is available. This paper uses real GDP as a proxy for the scale variable as the data is readily available and it satisfies both the income and wealth criteria that the scale variable should represent.

2.2.3 Opportunity Cost Variables

Typically, the opportunity cost of holding money involves two components, the own rate of return of money and the rate of return on alternative assets. Ericsson (1998) states that it is important to include both interest rates to avoid the collapse of the estimated money demand function. Considering portfolio choices, agents also consider money as part of real and foreign assets (Sriram, 1999).

The return on real assets is usually represented by the expected rate of inflation (Sriram, 1999). Theoretically, Friedman (1956, 1969) pioneered the inclusion of the expected rate of inflation, and the relationship between demand for money and expected inflation is well documented by Arestis (1988). Arestis postulated that the real value of money falls with inflation whilst the value of real assets is maintained. Therefore, there is a strong incentive for persons to switch out of money and into real assets when there are strong inflationary expectations. In developing countries where the financial sector is not well developed, the expected rate of inflation is usually the only variable used as the opportunity cost of holding money[3].

[3] There are two major reasons (relevant in Fiji's case) for including expected inflation. (1) There is narrow substitution between money and other financial assets as the financial sector is under-developed and (2) interest rates may show insufficient variation due to regulation (see *inter alia* Wong, 1977).

Foreign interest rates and the expected rate of depreciation usually represent the returns on foreign assets (Sriram, 1999). The currency substitution literature provides the necessary support in choosing the appropriate variables that account for foreign influence. Direct currency substitution concentrates on the exchange rate variable while the capital mobility or indirect currency substitution literature focuses on foreign interest rates (see *inter alia* Giovannini and Turtelboom, 1993 and Leventakis, 1993).

For the purposes of this paper, both the own rate of return of money and the rate of return of the alternative asset is included. The nominal rate is used since there are two costs associated with holding money balances – the real interest rate reflects the opportunity cost of holding deposits, while the expected rate of inflation is to compensate depositors for the expected depreciation in the real value of money because of inflation. Following Bahmani-Oskooee (1991), the real effective exchange rate is used as a proxy for expected depreciation. The foreign interest rate was disregarded as it is assumed that most economic agents in Fiji do not consider foreign securities as a relevant investment alternative, mainly due to the existence of exchange controls.

2.3 Specifications

2.3.1 Partial Adjustment Models (PAM)

The PAM, a log-linear specification extensively used for estimating money demand, was originally introduced by Chow (1966) and later popularised by Goldfeld (1973). This model augments the traditional formulation of money demand by introducing the following two concepts:

(i) distinction between *desired* and *actual* money holdings and (ii) the system by which the actual money holdings adjust to the desired levels (Sriram, 1999).

This model faired well when the post-war to 1973 data was used but it was unable to explain the instability in the demand for money experienced since the early 1970s (Sriram, 1999). The problems associated with this model were both theoretical[4] and empirical [5] in nature. The PAM soon lost favour to the buffer stock models (BSM) and error correction models (ECM). Boughton and Tavlas (1991) found that estimates obtained by the BSM and ECM for money demand significantly outperformed those of the PAM.

2.3.2 Buffer Stock Models

The BSM were predominant in the 1980s as an alternative paradigm for money demand estimation to overcome the two common problems with the PAM, namely the short-run interest overshooting and long implausible lags of adjustment (Sriram, 1999). Proponents of BSM postulated that the reason the PAM did poorly was that they failed to consider the short-run impact of monetary shocks (Sriram, 1999). The two main changes in the BSM over the PAM were that money shocks are explicitly modelled as part of the determination of money demand and the lag structure is much more complex (Sriram, 1999).

Despite the improvement made over the PAM, there have been

[4] See Goodfriend (1985).

[5] See *inter alia* Yoshida (1990) and Hendry and Doornik (1996).

mixed results in the empirical application of this approach (see Boughton and Tavlas, 1991 and Cuthbertson and Taylor, 1987). Milbourne (1988) concluded from his extensive survey that BSM had theoretical and empirical shortcomings. Consequently, as criticisms grew, the BSM lost their appeal while ECM moved to the forefront in estimating the demand for money.

2.3.3 Error Correction Models

The ECM has proved to be a successful tool in applied money demand research (Sriram, 1999). It is a dynamic error-correction representation where the long-run equilibrium is embedded in an equation that captures short-run variation and dynamics (see Kole and Meade, 1995). Granger (1983, 1986) showed that the concept of stable long-term equilibrium is the statistical equivalence of cointegration. Engle and Granger (1987) state that cointegration implies the existence of a dynamic error-correction form.

In regards to the estimation techniques, the two widely used approaches are Engle and Granger (1987); and Johansen (1988) and Johansen and Juselius (1990). The latter approach is more prominent as it provides an opportunity to evaluate the presence of multiple cointegrating vectors and has shown that it is more efficient than the former (Sriram, 1999).

Since the necessary precondition for the existence of a long-run relationship is the presence of a cointegrating vector, the empirical section begins with the cointegration analysis. When the cointegration relationships are found, weak exogeneity tests are done to explore whether the models can be reduced from a system to a single equation to analyse the short-run dynamics. However, before proceeding to the empirical section, the next section briefly summarises recent research results. The next section will also discuss the results of the studies done on the demand for money in Fiji.

2.4 Current Empirical Findings

With different econometric techniques and various measures of the determinants of money demand, the results obtained are diverse. This section focuses on research involving cointegration and/or error correction modelling for developed and developing countries. However, since there are only a few studies done on Fiji's demand for money, the relevant section will discuss all these studies.

2.4.1 Developed Countries

Studies of Australia's money demand generally define money in real terms and tend to focus on M3 while predominantly applying the Engle-Granger and Johansen procedures (de Brouwer, Ng and Subbaraman, 1993). The results are ambiguous in regards to M1 and M3. Orden and Fisher (1993) and de Haan and Zelhorst (1991) find that M3 and GDP are not cointegrated after deregulation. In contrast, Lim and Martin (1991) concluded that M3 and GDP are cointegrated after deregulation. Using alternative definitions of money, income and interest rates and applying different testing procedures, de Brouwer, Ng and Subbaraman (1993) found no evidence of cointegration between M1 and income with only weak evidence for the money base, M3 and broad money.

For New Zealand, Orden and Fisher (1993) found no cointegrating relationship for the full sample (quarterly data between 1965 and 1984). Similarly, applying Canadian data from 1968 to 1999, Tkacz (2000) found that money, output, prices and interest rates are only fractionally cointegrated.

However, in the United Kingdom, Drake and Chrystal (1994) found that a cointegrating relationship existed for all the monetary aggregates examined and the ECM indicated a rapid speed of adjustment. The latter results were mirrored in Miller's (1991) study in the US where he found a cointegration relationship for M2 and the ECM for M2 suggested a significant error-correction term. Hayo (1998) found a stable money demand for 11 European Monetary Union (EMU) countries. Factoring financial innovation, Scharnagl (1998) still found a stable long-run money demand relationship for Germany.

From these few studies, it is evident that the results vary. Much of the variation is dependent on the cointegration tests selected and the combination of money and interest rates (Haug and Lucas, 1996). Nevertheless, existence of cointegration between money and income would not, in itself, necessarily establish a paramount role for monetary aggregates in policy making (de Brouwer, Ng and Subbaraman, 1993). Presently, central banks generally agree that conventional monetary aggregates are of little use as targets or indicators for monetary policy (Woodford, 1997). Woodford (1997) also contends that it is possible to analyse equilibrium inflation determination without reference to money supply or demand, "as long as one specifies policy in terms of a 'Wicksellian' interest-rate feedback rule".

The next section investigates the results for money demand in developing countries. Since the financial markets are less developed and prone to regulation, the findings could be different.

2.4.2 Developing Countries

A money demand function was estimated for ten developing countries (including India, Mexico and Nigeria) and cointegration was only established in a minority of cases (Arrau et al, 1991). The instability of the money demand function in the latter study was probably a result of the failure to account for financial innovation (Arrau et al, 1991). However, including proxies for financial innovation in the study did not improve the stability of the demand for money in those developing countries. The findings in this study suggest that while it is difficult to forecast the path of financial innovation, it would be beneficial to model the process in some way so as to recover better estimates of the money demand function (Arrau et al, 1991).

In contrast, a stable relationship for narrow money was found for the West African Economic and Monetary Union (WAEMU[6]) even amidst financial liberalisation (Rother, 1998). However, Rother (1998) contends that the stability of the demand for money would only continue in WAEMU as long as the economic agents have confidence in the stability of the financial system.

On the other hand, for the Association of South East Asian Nations (ASEAN) countries, Dekle and Pradhan (1997) found continuing instability in the demand for money as financial liberalisation intensified. The results

[6] Countries included: Bénin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal, and Togo.

indicated that money growth rates were poor predictors of future inflation and output trends, so policy decisions needed to be based on a wider set of monetary and real sector indicators of inflationary pressures (Dekle and Pradhan, 1997).

These studies and many others not covered in this paper indicate that financial liberalisation is an important determinant of the stability of money demand. However, as to its effect on the demand for money, the results differ across countries. In addition, financial innovation is difficult to measure and a reliable proxy is quite difficult to find.

This paper does not examine the effects of financial innovation on money demand in Fiji as the financial markets are still at an embryonic stage. However, as Fiji's financial market develops, financial innovation will play an important role in the demand for money and will need to be included in future studies of money demand. Previous studies on the demand for money in Fiji are outlined in the next section.

2.4.3 Money Demand in Fiji

There have only been a few studies done on the demand for money in Fiji. The International Monetary Fund (IMF) conducted a study on the demand for money in Fiji in 1982. The IMF model of the demand for money was as follows:

$$\frac{M^d}{P} = f[c, Y, (r - \pi^e)]$$

where c is the constant, Y is income and $(r - \pi^e)$ is the expected real rate of return on time deposits. The results signal unitary income elasticity for income whereas the interest rate elasticity was not statistically significant.

However, the results from this study are dubious in that it suffers from a serious theoretical shortcoming. This study uses the real interest rate as a determinant of the demand for real money balances. However, it is widely recognised that the nominal interest rate is the appropriate determinant of the demand for real money balances (Sachs and Larrain, 1993).

In 1987, Luckett (1987) also modelled the demand for money. This time, the interest rate and expected inflation was separated:

$$\frac{M^d}{P} = f[c, Y, r, \pi^e]$$

Due to unavailability of data, Luckett (1987) used proxies for the interest rate, *r*, such as the interbank rate, adjusted liquid assets margin ratio and the loans and advances ratio. However, this study also suffered from theoretical as well as empirical difficulties. As *r* is the nominal rate, it already has expected inflation in it, so the coefficient on the expected inflation term (π^e) is not expected to pick up anything meaningful. The interest rate proxy was also constrained to only six years of unregulated data.

In addition, although the use of the adjusted liquid assets margin and the loans and advances ratio is representative of the interest rates of money, these proxies are themselves dependent on money balances. Therefore, the latter has the effect of possibly introducing endogeneity in the model. These concerns cast doubt on the results of Luckett's (1987) findings that no substantial conclusion could be made on the demand for money in Fiji.

In contrast, a recent study by Joynson (1997), applying the error correction technique and the Johansen methodology, found weak results for the demand for money. Joynson (1997) modelled the demand for real money balances as a function of income (real GDP) and the interest rate (proxies used were the one year weighted average savings deposit rate, the treasury bill rate and the lending rate).

However, the latest study on the demand for money by Jayaraman and Ward (2000) point towards a stable money demand function. In Jayaraman and Ward's (2000) study, the money demand function was expressed as:

$$LRM2_t = \beta_1 + \beta_2 LRGDP_t + \beta_3 RR_t + \beta_4 LREER_t + \beta_5 INF_t + \varepsilon$$

where *LRM2* is the logarithm of real broad money, *LRGDP* is the logarithm of real GDP, *RR* is the real interest rate, *INF* is the rate of inflation and *LREER* is the logarithm of the real effective exchange rate.

The authors applied a quarterly series to the model although GDP data is only available annually. To combat this problem, Jayaraman and Ward (2000) have interpolated the quarterly data from the annual series using a cubic spline function. However, basing a stable money demand function on a quarterly series, where the GDP data is statistically manipulated, biases the findings and interpretations and it will also provide problems when trying to forecast the monetary aggregates. For policymakers, a stable money demand function is only useful when it is used for forecasting purposes and this will be difficult as it will be hard to forecast GDP on a quarterly basis.

Considering the shortcomings of some of the previous studies, this paper will serve to provide a stronger theoretical basis on which a model for money demand is based. In addition, all empirical considerations will be addressed, to ensure the robustness of the results.

3.0 Model

The money demand function is estimated in log-linear form. All the variables, except the savings and treasury bill rate, enter the model in logarithms. The basic framework of the model is as follows:

$$LRM=\beta_1+\beta_2 LRGDP+\beta_3 SVR+\beta_4 TBR+\beta_5 LREER+\varepsilon$$

where	*LRM*	is the *ln* (measure of money/CPI)
	LRGDP	is the *ln* (real gross domestic product)
	SVR	is the savings deposit rate
	TBR	is the treasury bill rate
	LREER	is the *ln* (real effective exchange rate)

Real gross domestic product is used as a proxy for the scale variable. It is expected to be positively related to the real demand for money. An increase in economic or transactions activity would necessitate a greater demand for money. The coefficient of the savings rate is also expected to be positive since it represents the interest rate of money. With higher savings rates, the incentive to hold alternative assets will be lower. Consequently, higher rates on the alternative asset will lead to a disincentive for holding money. Therefore, the coefficient of the treasury bill rate is expected to be negative. The real effective exchange rate (proxy for the expected rate of depreciation) will also have a negative relationship with money. An increase in expected depreciation would lead individuals to substitute domestic currency for foreign currency under the implication that expected returns from holding foreign currency will increase.

3.1 Data

Most data series are available from 1966 except for the savings and treasury bill rate, which are only available from 1975. Therefore, the paper applies annual data from 1975 to 1999[7]. Before proceeding to the cointegration analysis, the unit root characteristics of the data are examined.

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)[8] unit root tests are carried out on the series. The results suggest that all variables, except for prices, appear to be integrated of order one. The estimated roots for Δ*Prices* is numerically much less than unity[9] so all the variables are treated as I(1).

Table 1: *Unit Root Tests*

Variables	Dickey-Fuller Test		Phillips-Perron Test	
	I (1)	I (2)	I (1)	I (2)
Real Broad Money	-1.075	-3.627**	-1.084	-5.167**
Real M1	0.585	-4.102**	0.773	-5.892**
Real Quasi Money	-1.751	-3.268**	-1.905	-4.686**
Real GDP	0.313	-5.378**	0.448	-7.866**
Prices	-2.364	-2.400	-4.041**	-2.506
Savings Rate	-0.087	-2.178	0.081	-2.981*
Treasury Bill Rate	-1.595	-4.853**	-2.445	-7.639**
REER	-0.882	-2.960*	-0.714	-3.791**

An **(*) indicates rejection of hypothesis of a unit root at the five (ten) percent level.

[7] See Appendix A for a detailed description of the data.

[8] See Dickey & Fuller (1979) and Phillips & Perron (1988).

[9] Using ADF tests, the estimated coefficient on the lagged price variable p_{t-1} is –0.41. Therefore, the estimated root is 0.59 (1-0.41). The PP results similarly conclude that the estimated root is numerically less than unity.

The time series for the variables were examined graphically[10] in order to observe any drifts or structural breaks that may bias the unit root tests. It is evident from the graphs that there are no noticeable breaks, which supports the unit root test results.

3.2 Cointegration Analysis

Since the variables are considered to be I(1), the cointegration method is appropriate to estimate the long-run demand for money. The cointegration technique helps to clarify the long-run relationships between integrated variables. The methods developed by Johansen (1988, 1991) and Johansen and Juselius (1990) are applied to the data.

The Johansen procedure, as it is known, obtains maximum likelihood estimates of the cointegrating vectors and adjustment parameters directly (as opposed to the two-step Engle-Granger procedure). This procedure can also test for the presence of multiple cointegrating vectors. Moreover, this method allows for tests on restricted versions of the cointegrating vector(s) and speed of adjustment parameters[11]. Variables *LRBM* (or *LRM1* or *LRQM*), *LRGDP*, *SVR*, *TBR* and *LREER* are entered as endogenous variables in that order. A constant is also included. The lag order of the VAR is not known *a priori* so tests of the lag order are needed to ensure sufficient power of the Johansen procedure.

Therefore, to attain a model with the appropriate lag length, the cointegration test is repeated by sequentially reducing one lag at a time

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[10] See Appendix B.

[11] See Appendix C for further details.

(beginning with a third order VAR) until the lag length reaches one. Multivariate tests[12] are undertaken for each run and the results suggest that it is statistically acceptable to simplify the model to a first order VAR.

The cointegration tests are applied to this first order VAR and the results are reported in Tables 2, 3 and 6. The following sections discuss the different models containing the three separate measures of money.

3.3 Real Broad Money

Cointegration results for the model with real broad money are reported in Table 2. The maximal eigenvalue and trace eigenvalue statistics (λ_{max} and λ_{trace}) reject the null hypothesis of no cointegration in favour of at least one cointegrating relationship. The eigenvalue associated with the first vector is indeed dominant over those corresponding to other vectors, thus confirming that there exists a unique cointegrating vector in the model.

The table also reports the standardised eigenvectors and adjustment coefficients, denoted β' and α. In order to discover whether the unique cointegrating vector represents the demand for real broad money, examination of the β' matrix containing the parameters of cointegration is necessary. In Table 2, the rows of the β' matrix correspond to the standardised coefficients of the variables entering the respective cointegrating vector. The coefficients are normalised with a value of one along the principal diagonal of the matrix.

[12] The multivariate Ljung-Box test based on the estimated auto- and cross-correlations of the first (T/4) lags (see Ljung & Box (1978) and Hosking (1980)) and LM-type tests for first and fourth order autocorrelation (see *inter alia* Godfrey (1988)).

Table 2: *Cointegration Analysis of the Variables (with Real Broad Money)*

Cointegration Test[1]

Eigenvalue	0.793	0.544	0.313	0.203	0.110
Null Hypothesis[2]	*r=0*	*r=1*	*r=2*	*r=3*	*r=4*
λ_{max}[3]	37.76	18.82	9.01	5.45	2.79
95% Critical Value	33.32	27.14	21.07	14.90	8.18
λ_{trace}[3]	73.83	36.07	17.25	8.25	2.79
95% Critical Value	70.60	48.28	31.52	17.95	8.18

Standardised Eigenvectors β'

Variable	*LRBM*	*LRGDP*	*SVR*	*TBR*	*LREER*	*Constant*
	1.000	-0.512	2.098	-2.439	2.745	-9.284
	-1.953	1.000	-4.096	4.764	-5.360	18.129
	0.477	-0.244	1.000	-1.163	1.309	-4.426
	-0.410	0.210	-0.860	1.000	-1.125	3.806
	0.364	-0.187	0.764	-0.889	1.000	-3.382
	-0.108	0.055	-0.226	0.263	-0.296	1.000

Standardised Adjustment Coefficients α

	LRBM	*LRGDP*	*SVR*	*TBR*	*LREER*
Δ*LRBM*	-0.002	0.001	-0.005	0.006	-0.006
Δ*LRGDP*	0.005	-0.002	0.010	-0.012	0.013
Δ*SVR*	-0.020	0.010	-0.043	0.049	-0.056
Δ*TBR*	0.434	-0.222	0.910	-1.058	1.191
Δ*LREER*	0.006	-0.003	0.013	-0.016	0.018

Weak Exogeneity Tests[4]

Variable	*LRBM*	*LRGDP*	*SVR*	*TBR*	*LREER*
$\chi^2(1)$	0.15	1.36	0.24	10.32**	1.80
p-value	0.70	0.24	0.63	0.00	0.18

Statistics for Testing the Significance of a Variable

Variable	*LRGDP*	*SVR*	*TBR*	*LREER*	*Constant*
$\chi^2(1)$	0.01	12.40**	18.24**	0.21	0.04
p-value	0.94	0.00	0.00	0.65	0.85

1. The system includes 1 lag for each variable and a constant. The estimated period is 1975 to 1999.
2. *r* stands for the number of ranks.
3. The statistics λ_{max} and λ_{trace} are Johansen's maximal and trace eigenvalue statistics for testing cointegration. The null hypothesis is in terms of the cointegration rank *r* and rejection of *r*=0 is evidence in favour of at least one cointegrating vector. The critical values are taken from Osterwald-Lenum (1992). See Appendix C for details.
4. The weak exogeneity test statistics are examined under the assumption that *r*=1 and so are asymptotically distributed as $\chi^2(1)$ if weak exogeneity of the specified variable for the cointegrating vector is valid.

Therefore, the first row of β' is the estimated cointegrating vector where *LRBM* is normalised as one. It can be written in an equation such as:

$$LRBM = 0.512*LRGDP - 2.098*SVR + 2.439*TBR - 2.745*LREER + 9.284*C$$

It is evident from the above equation and the table that the coefficient on *LRGDP* is well below unity and is statistically insignificant in explaining real broad money. Although the *SVR* and *TBR* coefficients are statistically significant, they have the wrong signs (the interplay between the interest rate variables might be causing these counter-intuitive signs). The examination of the standardised adjustment coefficients also concludes that significant corrections do not take place in most of the equations.

From Table 2, the coefficients in the first column of α measure the feedback effect of the lagged disequilibrium in the cointegrating relation onto the variables in the VAR. Specifically, -0.002 is the estimated feedback coefficient for the money equation. The negative coefficient signifies that lagged excess money induces smaller holdings of current money. However, its numerical value indicates that significant correction does not take place in the equation for *LRBM* (and all others except the equation for *TBR*).

The weak exogeneity tests also confirm the latter findings in that adjustments are primarily carried out via the treasury bill rate. In other words, the weak exogeneity results imply that the cointegrating vector and the feedback coefficients enter only the *TBR* equation

These results suggest that the behavioural relations of the dependent variables are poor and point towards the instability of the real broad money demand function. Given the weak exogeneity results, it is also not valid to model the short-run dynamics. Joynson (1997) adopted an error correction framework to model the demand for broad money and found that there was weak evidence of a short-run relationship. Although that model did not account for expected depreciation of the Fiji dollar, modelling the short-run dynamics in this paper will provide similar results to Joynson's (1997).

3.4 Real M1

The cointegration tests and analysis are performed on the model with real M1. Table 3 provides the results of the various tests imposed on the model. The λ_{max} and λ_{trace} statistics reject the null hypothesis of no cointegration relationship in favour of one cointegration vector. Examination of the eigenvalues also confirms that there is a distinctive cointegrating relationship.

The first row of the standardised eigenvectors in Table 3 can be interpreted as the long run demand for real M1 and the equation is as follows:

$$LRM1 = 0.610*LRGDP - 0.190*SVR + 0.104*TBR - 0.048*LREER - 2.964*C$$

The coefficients for *LRGDP*, *SVR* and the *TBR* are statistically significant. However, the coefficient for *LRGDP* is below unity and *SVR* and *TBR* coefficients have the wrong signs. This is evidence of the weak relationship within the model.

The results presented in Table 3 show that weak exogeneity is rejected for *LRM1*, *SVR* and *TBR*. This means that a short run model can be designed with a system of three equations, one with *LRM1*, one with

Table 3: *Cointegration Analysis of the Variables (with Real M1)*

Cointegration Test[1]

Eigenvalue	0.822	0.610	0.377	0.319	0.149
Null Hypothesis[2]	*r=0*	*r=1*	*r=2*	*r=3*	*r=4*
λ_{max}[3]	41.42	22.62	11.35	9.22	3.88
95% Critical Value	33.32	27.14	21.07	14.90	8.18
λ_{trace}[3]	88.50	47.08	24.45	13.11	3.88
95% Critical Value	70.60	48.28	31.52	17.95	8.18

Standardised Eigenvectors β'

Variable	*LRM1*	*LRGDP*	*SVR*	*TBR*	*LREER*	*Constant*
	1.000	-0.610	0.190	-0.104	0.048	2.964
	-1.640	1.000	-0.312	0.171	-0.079	-4.859
	5.254	-3.204	1.000	-0.547	0.253	15.570
	-9.613	5.862	-1.830	1.000	-0.462	-28.488
	20.806	-12.689	3.960	-2.164	1.000	61.660
	0.337	-0.206	0.064	-0.035	0.016	1.000

Standardised Adjustment Coefficients α

	LRM1	*LRGDP*	*SVR*	*TBR*	*LREER*
Δ*LRM1*	-0.298	0.182	-0.057	0.031	-0.014
Δ*LRGDP*	0.093	-0.057	0.018	-0.010	0.004
Δ*SVR*	-1.091	0.665	-0.208	0.114	-0.052
Δ*TBR*	-0.104	-2.786	0.869	-0.475	0.220
Δ*LREER*	0.048	-0.020	0.006	-0.003	0.002

Weak Exogeneity Tests[4]

Variable	*LRM1*	*LRGDP*	*SVR*	*TBR*	*LREER*
$\chi^2(1)$	3.71**	2.36	2.68*	3.64**	0.18
p-value	0.05	0.12	0.10	0.06	0.68

Statistics for Testing the Significance of a Variable

Variable	*LRGDP*	*SVR*	*TBR*	*LREER*	*Constant*
$\chi^2(1)$	4.53**	16.28**	7.45**	0.04	1.37
p-value	0.03	0.00	0.01	0.84	0.24

1. The system includes 1 lag for each variable and a constant. The estimated period is 1975 to 1999.
2. *r* stands for the number of ranks.
3. The statistics λ_{max} and λ_{trace} are Johansen's maximal and trace eigenvalue statistics for testing cointegration. The null hypothesis is in terms of the cointegration rank *r* and rejection of *r*=0 is evidence in favour of at least one cointegrating vector. The critical values are taken from Osterwald-Lenum (1992). See Appendix C for details.
4. The weak exogeneity test statistics are examined under the assumption that *r*=1 and so are asymptotically distributed as $\chi^2(1)$ if weak exogeneity of the specified variable for the cointegrating vector is valid.

SVR and another with *TBR* by considering *LRGDP* and *LREER* as weakly exogenous.

As this paper focuses on the demand for real M1, an unrestricted and parsimonious ECM is used to model the short run dynamics of the demand for real M1 while ensuring that the long run relationship is satisfied. Modelling the short run dynamics will provide information concerning how adjustments are taking place among the various variables, to restore long run equilibrium, in response to short term disturbances in the demand for real M1. Consequently, the unrestricted ECM is as follows:

$$\Delta LRM1_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta LRM1_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta LRGDP_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta SVR_{t-i}$$
$$+ \sum_{i=0}^{n} \beta_4 \Delta TBR_{t-i} + \sum_{i=0}^{n} \beta_5 \Delta LREER_t + \lambda_1 LRM1_{t-1} + \lambda_2 LRGDP_{t-1} + \lambda_3 SVR_{t-1}$$
$$+ \lambda_4 TBR_{t-1} + \lambda_5 LREER_{t-1} + \varepsilon_t$$

The long run equilibrium solution is:

$$\frac{M}{P} = -\left(\frac{\beta_0}{\lambda_1}\right) - \left(\frac{\lambda_2}{\lambda_1}\right) LRGDP - \left(\frac{\lambda_3}{\lambda_1}\right) SVR - \left(\frac{\lambda_4}{\lambda_1}\right) TBR - \left(\frac{\lambda_5}{\lambda_1}\right) LREER$$

The coefficients of *LRGDP*, *SVR*, *TBR* and *LREER* are the long run elasticities of money demand with respect to the variables. This specification permits interpretation of the speed of adjustment of real M1 demand to a shock in the variables. The results are presented in Table 4.

The results indicate that in the short run, none of the variables are significant in explaining short run variations in the demand for money. This is probably because as the financial system is under-developed in Fiji, economic agents are less responsive. For the long run relationship, all the

Table 4: *Real M1 Demand Estimation Results (Unrestricted ECM)*

Explanatory Variables: Short Run	(1)	(2)
Constant	-2.481	
	(-1.097)	
ΔReal $M1_{t-1}$	0.506	
	(1.603)	
ΔReal GDP_t	0.794	
	(1.630)	
ΔSavings $Rate_t$	-0.081	
	(-1.226)	
ΔTreasury Bill $Rate_t$	-0.026	
	(-1.269)	
ΔReal Effective Exchange $Rate_t$	-0.612	
	(-1.710)	
Explanatory Variables: Long Run		
Real $M1_{t-1}$	-1.516**	
	(-3.142)	
Real GDP_{t-1}	0.774**	0.391**
	(3.163)	(4.331)
Savings $Rate_{t-1}$	-0.158**	-0.087**
	(-3.603)	(-5.151)
Treasury Bill $Rate_{t-1}$	0.006	-0.014
	(0.181)	(-1.044)
Real Effective Exchange $Rate_{t-1}$	-0.227	-0.163*
	(-1.003)	(-1.779)
Summary Statistics		
Adjusted R^2	0.625	
σ	0.084	

Diagnostic Tests			**Probability**
Normality			
Jarque-Bera statistic	χ^2-statistic	0.848	0.655
Serial Correlation			
Breusch-Godfrey serial correlation	F-statistic	0.289	0.601
LM test	χ^2-statistic	0.565	0.452
AR Conditional. Heteroskedasticity			
ARCH LM test	F-statistic	0.567	0.460
	χ^2-statistic	0.605	0.437
Heteroskedasticity			
White heteroskedasticity test	F-statistic	4.201	0.131
	χ^2-statistic	23.173	0.280
Stability			
Chow breakpoint test	F-statistic	0.238	0.956
(mid-sample)	LR statistic	20.077	0.044*
Chow forecast test	F-statistic	6.455	0.076
(1990-1999)	LR statistic	74.743	0.000**
Specification Error			
Ramsey RESET test	F-statistic	2.838	0.118
	LR statistic	5.096	0.024*

1. **(*) denotes significance at the one (five) per cent levels.
2. t-values are in parenthesis.
3. For the long run explanatory variables, the implied long run coefficients (Column 2) were calculated as the ratio of the relevant long run ECM coefficients to the long run coefficient on the lagged dependent variable; the Bewley transformation was applied to obtain interpretable t-statistics. σ is the standard error of the equation.

variables except for the treasury bill rate and the real effective exchange rate, are significant. However, the savings and treasury bill rate have the wrong signs, the same results found in the cointegration analysis. A reason for this could be that these rates do not truly reflect the own rate and alternative rate for real M1, but data limitations make it impossible to include an alternative measure. Also, as mentioned earlier, the interplay between the interest rate variables might be causing these counter-intuitive signs.

Although the model appears to fit the data reasonably well there is still a wide margin of error (approximately, two thirds of the time, the predicted value is within about 8 percentage points of the actual value). Furthermore, standard diagnostic tests reveal that the model is not stable. Despite the latter findings, the unrestricted ECM is reduced into a parsimonious one by following the general-to-specific principles. This approach entails the sequential removal of those variables exerting no influence in the model. The results of the parsimonious ECM are shown in Table 5.

The results from the restricted model provide more significant coefficients than the unrestricted ECM. Real GDP has a strong and significant relationship with money. The *LRGDP* coefficient is also close to unity. Although the savings and treasury bill rate are significant, they have the wrong signs. The reasons for this have been discussed previously. Nevertheless, the model does not fit the data well enough to be used for forecasting purposes, especially with a wide margin of error.

Although most of the diagnostic tests did not present any flaws for the model, the test for stability was rejected. The results of the parsimonious model reinforce the results of the unrestricted ECM in that

Table 5: *Real M1 Demand Estimation Results (Parsimonious ECM)*

Explanatory Variables: Short Run	(1)	(2)	
Constant	-4.306**		
	(-3.209)		
ΔReal $M1_{t-1}$	0.344		
	(1.153)		
ΔReal GDP_t	0.927**		
	(2.247)		
ΔSavings $Rate_t$	-0.120*		
	(-1.987)		
ΔTreasury Bill $Rate_t$	-0.029**		
	(-2.243)		
Explanatory Variables: Long Run			
Real $M1_t$	-1.362**		
	(-3.229)		
Savings $Rate_t$	0.843**	0.504**	
	(3.616)	(7.063)	
Treasury Bill $Rate_t$	-0.132**	-0.103**	
	(-2.653)	(-10.677)	
Summary Statistics			
Adjusted R^2	0.600		
σ	0.087		
Diagnostic Tests			**Probability**
Normality			
Jarque-Bera statistic	χ^2-statistic	0.796	0.672
Serial Correlation			
Breusch-Godfrey serial correlation	F-statistic	0.126	0.727
LM test	χ^2-statistic	0.200	0.654
AR Conditional. Heteroskedasticity			
ARCH LM test	F-statistic	0.806	0.379
	χ^2-statistic	0.850	0.356
Heteroskedasticity			
White heteroskedasticity test	F-statistic	0.864	0.611
	χ^2-statistic	13.758	0.468
Stability			
Chow breakpoint test	F-statistic	1.231	0.388
(mid-sample)	LR statistic	19.260	0.014**
Chow forecast test	F-statistic	0.550	0.808
(1990-1999)	LR statistic	15.604	0.112
Specification Error			
Ramsey RESET test	F-statistic	8.255	0.012**
	LR statistic	10.523	0.001**

1. **(*) denotes significance at the one (five) per cent levels.
2. t-values are in parenthesis.
3. For the long run explanatory variables, the implied long run coefficients (Column 2) were calculated as the ratio of the relevant long run ECM coefficients to the long run coefficient on the lagged dependent variable; the Bewley transformation was applied to obtain interpretable t-statistics. σ is the standard error of the equation.

the demand for real M1 is not stable. The cointegration and ECM results also complement the results found by Joynson (1997).

3.5 Real Quasi Money

The cointegration test outlined in Table 6 accepts the alternative hypothesis of at least one cointegrating vector and the eigenvalue associated with the first vector is dominant enough to conclude that there is a unique cointegrating vector. On examination of the □□coefficients, the long run equation for real quasi money is as follows:

$$LRQM=1.543*LRGDP+0.928*SVR-0.944*TBR-0.902*LREER-4.754*C$$

All the coefficients have the expected signs. Unlike the models for real broad money and real M1, the long run demand for real quasi money is positively affected by the own rate of return (*SVR*) and negatively related to the alternative return for money (*TBR*). The coefficients of *SVR* and *TBR* also carry the expected magnitudes. However, the coefficient for *LRGDP* is much greater than unity. This could be a result of the exclusion of other opportunity cost variables such as expected inflation[13].

In terms of the real demand for quasi money, the excluded expected inflation variable could be highly correlated with money, and consequently, the scale variable is picking up its effects causing the income elasticity to significantly exceed one. However, including the inflation variable (instead

[13] The nominal interest rate probably does not move with expected inflation in Fiji due to the underdeveloped financial market. Therefore, inclusion of expected inflation in the model is warranted.

Table 6: *Cointegration Analysis of the Variables (with Real Quasi Money)*

Cointegration Test[1]

Eigenvalue	0.777	0.531	0.393	0.225	0.128
Null Hypothesis[2]	*r=0*	*r=1*	*r=2*	*r=3*	*r=4*
λ_{max}[3]	36.06	18.15	11.98	6.11	3.27
95% Critical Value	33.32	27.14	21.07	14.90	8.18
λ_{trace}[3]	75.57	39.51	21.36	9.38	3.27
95% Critical Value	70.60	48.28	31.52	17.95	8.18

Standardised Eigenvectors β'

Variable	*LRQM*	*LRGDP*	*SVR*	*TBR*	*LREER*	*Constant*
	1.000	-1.543	-0.928	0.944	0.902	4.754
	-0.648	1.000	0.601	-0.612	-0.585	-3.081
	-1.078	1.663	1.000	-1.018	-0.973	-5.124
	1.059	-1.634	-0.983	1.000	0.956	5.035
	1.108	-1.710	-1.028	1.046	1.000	5.269
						1.000

Standardised Adjustment Coefficients α

	LRQM	*LRGDP*	*SVR*	*TBR*	*LREER*
Δ*LRQM*	-0.018	0.028	0.017	-0.017	-0.016
Δ*LRGDP*	-0.012	0.019	0.012	-0.012	-0.011
Δ*SVR*	0.094	-0.145	-0.087	0.089	0.085
Δ*TBR*	-0.954	1.472	0.885	-0.901	-0.861
Δ*LREER*	-0.013	0.020	0.012	-0.013	-0.012

Weak Exogeneity Tests[4]

Variable	*LRQM*	*LRGDP*	*SVR*	*TBR*	*LREER*
$\chi^2(1)$	082	1.53	0.86	7.74**	1.30
p-value	0.36	0.22	0.35	0.01	0.25

Statistics for Testing the Significance of a Variable

Variable	*LRGDP*	*SVR*	*TBR*	*LREER*	*Constant*
$\chi^2(1)$	0.28	11.72**	16.12**	0.14	0.04
p-value	0.59	0.00	0.00	0.71	0.84

1. The system includes 1 lag for each variable and a constant. The estimated period is 1975 to 1999.
2. *r* stands for the number of ranks.
3. The statistics λ_{max} and λ_{trace} are Johansen's maximal and trace eigenvalue statistics for testing cointegration. The null hypothesis is in terms of the cointegration rank *r* and rejection of *r*=0 is evidence in favour of at least one cointegrating vector. The critical values are taken from Osterwald-Lenum (1992). See Appendix C for details.
4. The weak exogeneity test statistics are examined under the assumption that *r*=1 and so are asymptotically distributed as $\chi^2(1)$ if weak exogeneity of the specified variable for the cointegrating vector is valid.

of *SVR* and *TBR*) in the model did not improve the cointegration results. In any case, *LRGDP* and *LREER* are statistically insignificant and most of the adjustments (on examination of the α coefficients) occur in the equations for *TBR* and *SVR*.

Furthermore, the weak exogeneity tests reveal that weak exogeneity is rejected only for the treasury bill rate. Therefore, it would be implausible to model a short run model for the demand for real quasi money. Overall, the results indicate instability in the demand for real quasi money.

3.6 Discussion of Results

The previous sections reveal that the long run demand for money (*LRBM*, *LRM1* and *LRQM*) is not stable. Furthermore, the cointegration analysis invalidated the need to estimate the short run dynamics for real broad money and real quasi money. In the case of real M1, based on the weak exogeneity tests, the short run dynamics were specified through an ECM. However, the results for both the unrestricted and parsimonious models point towards an unstable demand for real M1.

Nevertheless, to confirm the results of the cointegration analysis for real broad money and real quasi money, an unrestricted ECM was modelled for both monetary aggregates. The results are outlined in Appendix D. In order to test the existence of cointegration within the ECM, the significance of the coefficients of $LRBM_{t-1}$ and $LRQM_{t-1}$ (long run explanatory variables) need to be examined. The respective tables show that these variables are insignificant and this suggests that cointegration does not exist for the equations explaining real broad money and real quasi money. In other words, there is no evidence of a long run relationship.

In terms of the short run dynamics of real broad money and real quasi money, the majority of the variables in both cases are insignificant and certain variables have the wrong signs. The results from the ECM confirm those of the cointegration analysis.

4.0 Conclusion

The results of the empirical study point to an unstable demand for money in Fiji. This finding has an important consequence on the viability of framing monetary policy around monetary aggregates as it implies that money growth rates are poor predictors of future inflation and real output[14]. However, as the Reserve Bank of Fiji has moved away from a monetary targeting framework, the question of whether there is an alternative measure by which monetary conditions can be assessed is raised.

Therefore, lacking an explicit intermediate target, the challenge for policymakers is to ensure that credibility of the central bank's resolve to maintain low inflation is sustained. Currently, the assessment of monetary conditions by the Reserve Bank is based on a range of indicators and although the ensuing policies may be consistent, transparency of the monetary policy decision-making process is also important. Transparency would require that more information be provided to market participants about the rationale for policy actions.

Nevertheless, some central banks have taken other avenues. Firstly, some argue that the operation of monetary policy could be simplified by

[14] Katafono (2000) also found similar results when utilising VARs to investigate the information content and predictive power of monetary aggregates.

adopting an exchange rate target. On the other hand, the alternative approach is to target inflation directly. Indeed, inflation targeting has become a popular issue amongst central bankers although only a few central banks have adopted an explicit inflation targeting system.

The Reserve Bank of Fiji will need to thoroughly weigh the pros and cons of any direction that it intends to follow. Even so, future policies that the Bank administers must be credible and transparent.

Appendix A Data Sources and Construction

Series	Construction and Sources
M1	The sum of currency in circulation plus demand deposits held with commercial banks by the rest of the domestic economy other than the central government. IMF *International Financial Statistics Yearbook* (1999).
Quasi money	Liabilities of the monetary system (i.e. the central bank and the commercial banks); time deposits with central bank plus savings and time deposits with commercial banks. IMF *International Financial Statistics Yearbook* (1999).
Broad money	M1 plus quasi money. IMF *International Financial Statistics Yearbook* (1999).
Savings Rate	Weighted average rate on savings deposits of all commercial banks. IMF *International Financial Statistics Yearbook* (1999).
Treasury Bill Rate	Yield on the 91-day maturity treasury bill. IMF *International Financial Statistics Yearbook* (1999).
Real effective exchange rate	Real effective exchange rate as calculated by the Reserve Bank of Fiji. For the period prior to 1979 an index was constructed using the trade-weighted consumer prices indices and bilateral exchange rates of Fiji's five major trading partners. IMF *International Financial Statistics Yearbook* (1999). Bureau of Statistics, *Current Economic Statistics*, various issues. Reserve Bank of Fiji, *Quarterly Review* (1999).