RESERVE BANK OF FIJI

Economics Group

Working Paper

Money Demand Estimation for Fiji

Bedika Lachmi Mala

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Abstract

This paper revisits the subject of money demand for Fiji by exploring far larger money demand systems than sought earlier. Building on the traditional money demand equation and using quarterly data for a period of 10 years, the paper comprehensively estimates all potential money demand equations within the ambit of monetary policy. Of the numerous money demand systems estimated, the monetary aggregate which most closely exhibited a money demand relationship include currency in circulation and broad money excluding Fiji National Provident Fund deposits. However, since nominal GDP is found to be weakly exogenous, monetary policy operating through monetary aggregates has little influence over nominal GDP in Fiji. The finding supports RBF's current choice of an interest rate target for monetary policy.

1.0 Introduction

Monetary policy in Fiji's has evolved over the years in line with developments in Fiji's financial and domestic conditions. During the period 1989 – 1997, Fiji's monetary policy framework largely concentrated on targeting monetary aggregates as a means to achieve its policy objectives of low inflation and comfortable level of foreign reserves. The framework was revamped in October 1997 with the focus shifting to the price of funds rather than the quantity. The operational target under the revised framework was the 91-Day RBF note as opposed to the level of Bank Demand Deposits in the previous framework. Fiji's current monetary policy framework embodies the overnight policy rate (OPR) as the new policy indicator rate with an interest rate corridor of 50 basis points each on either side of the OPR. Under the new framework, an increase in the OPR signals a tightening of monetary policy while a decrease indicates an easing and movements in OPR are expected to be passed through to other interest rates in the market and ultimately to output.

Money demand systems are a useful tool to gauge the information content of money because first, they allow us to empirically establish the long-run determinants of money demand (if any) via cointegration analysis; this includes an analysis whether these relationships are stable, which is critical for the information content of money. Second, the Vector Error Correction Models (VECM) systems make it possible to test which variables in the economy adjust to disequilibrium between money supply and money demand. This helps to answer questions such as whether a spike in money supply not accounted for by money demand is likely to be inflationary.

Hence, the purpose of this paper is to apply cointegration technique to estimate the determinants of money demand in Fiji with a comprehensive set of money demand equations. This study also benefits from the more recent data compared to earlier studies on Fiji, and uses the quarterly gross domestic product figures which were not available earlier (Karan, 2012).

The rest of the paper is organised as follows: Section II covers literature review on the subject of money demand with sole emphasis on Fiji studies. Section III specifies the model used in the empirical work. Results from cointegration tests and impulse responses to money demand systems are discussed in Section IV. Section V presents the main conclusions and policy recommendations.

2.0 Literature Survey

There are few empirical money demand studies specific to Fiji. Apart from providing mixed evidence on the stability of money demand, these studies differ by the time period, monetary aggregate, data frequency, and model specification chosen for estimation. Jayaraman and Ward (1998) tested real income, real interest rate, the real effective exchange rate and the expected rate of inflation variables as likely determinants of money demand in Fiji. Using quarterly data for a period of 18 years (1979-1996), the authors found a stable demand for money in the review period and, using both the versions of the Chow test and the CUSUM and CUSUMSQ test, concluded that the years of financial reforms have had a negligible impact on the stability of money demand for Fiji. However, caution must be taken in modeling long series data for an economy which had undergone various shocks as argued by Narayan (2008).

Another study by Katafono (2001) that reexamined money demand using the cointegration technique found an unstable demand for money in Fiji. Using annual data from 1975-1999, the author applied the following framework to reach at the findings:

$$LRM = \alpha_1 + \alpha_2 LRGDP + \alpha_3 SVR + \alpha_4 TBR + \alpha_5 LREER + \varepsilon$$

where,

LRM is the *ln* (measure of broad 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)

The author does not find evidence of a long run relationship between the tested variables and concludes on an unstable money demand for Fiji.

In contrast, a study on the same subject by Rao & Singh (2005) found money demand in Fiji to be structurally stable. Using the Johansen cointegration technique, the authors tested annual data from 1971-2002 using the following model:

$$\left(\frac{M_T}{P_T} \right) = \alpha_0 + \alpha_1 Y_T + \alpha_2 R_T + \in_T$$

where,

M is narrow money consisting of currency in circulation and demand

deposits,

P is the GDP deflator,

Y is the real GDP measured at factor cost

R is the nominal 1-3 years weighted average interest rate on time deposits

and ε is the error term.

More recently, Narayan (2008) re-estimated Fiji's money demand function for the period 1971-2002 using the bounds testing approach to cointegration and reworked on the data and model specification used by Rao & Singh (2005). Unlike previous studies, he addresses the structural breaks encountered in the period by applying the Bai and Perron (1998) structural break test. The author estimated a long-run model of money demand, proxied by M1 (currency in circulation and demand deposits), as a linear function of real GDP (Y_t) and nominal interest rate (R_t), proxied by 1-3 years weighted average interest rate on time deposits. The model takes the following form:

$$\ln MD_t = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 R_t + \varepsilon_t$$

The author but does not find evidence for any long-run relationship between the tested variables and also finds money demand in Fiji unstable.

3.0 Model Specification

Our general framework for money demand is encapsulated in the traditional long-term demand function for money denoted by:

$$\frac{\mathbf{M}}{\mathbf{P}} = \boldsymbol{f}\ (\mathbf{S}, \mathbf{OC})$$

where the demand for real balances *M*/*P* is a function of the chosen scale variable (*S*) which represents economic activity and *(OC)* denotes the opportunity cost of holding money (Sriram 1999).

Regarding the specific parameterization of this general money demand function, we will estimate numerous equations[3] by accounting for various monetary aggregates, economic activity variables, opportunity cost variables and own interest rate variables. The total number of money demand systems we consider exceeds 500[4]. The objective is to be as comprehensive as possible in the range of models we test, as we have no strong a priori view which variables should constitute a money demand system in Fiji, which also reflects the diversity of money demand specifications in previous research. The study uses quarterly data from the first quarter of 2002 to the final quarter of 2011 – deliberately opting for a short sample period as structural breaks were visible in early 2000s data[5].

Given that we are not aware of previous analysis on money demand in Fiji using data covering the last ten years, we are not revisiting earlier

[3] Allowing for devaluation dummy has no major impact on the ultimate results.
[4] For a list of systems estimated, please contact the author.
[5] The drawback, however, of this approach is that the resulting sample period is relatively short for cointegration analysis, but this is the longest data range that is available without obvious structural breaks visible in the data.

empirical research on money demand per se but ask whether there is evidence for a long-run money demand relationship in the most recent time period, using a specification that is as broad as possible. Table 1 lists the various variables tested for money demand relationship.

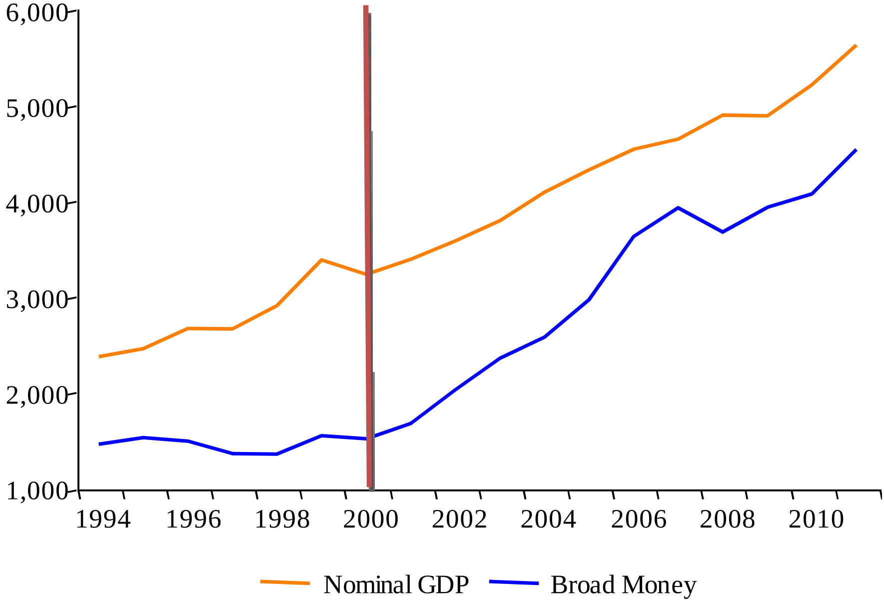
Table: 1 Estimated Variables

Variable	Proxied by:
Money	Broad Money (M3)
	Broad Money Excluding FNPF Deposits ($M3_{XFNPF}$)
	Narrow Money (M1)
	Currency in Circulation (CIC)
	Base Money (BM)
Activity	Nominal Gross Domestic Product (NGDP)
	Real Gross Domestic Product (RGDP)
Price	Headline Consumer Price Index (hcpi)
	Core Consumer Price Index excluding volatile items ($corecpi_{XVOL}$)
	Core Consumer Price Index – trimmed mean measure ($corecpi_{TRIM}$)
Interest Rate - own	Savings Deposit Rate (sav_{RATE})
	Time Deposit Rate ($tdep_{RATE}$)
Interest Rate – opportunity cost	Time Deposit Rate ($tdep_{RATE}$)
	15-year bond yield rate ($bond_{YIELD}$)
Inflation	Headline Consumer Price Index – annualized ($hcpi_{ANN}$)
	Consumer Price Index excluding volatile items - annualized ($corecpixvol_{ANN}$)
	Consumer Price Index trimmed mean measure - annualized ($corecpitrim_{ANN}$)
REER	Real Effective Exchange Rate

4.0 Methodology

As noted above, we choose to focus our analysis on the period 2002Q1—2011Q4 and exclude former years. The reasons are twofold. First, data from the 1980s exhibit volatility and noise brought about by various financial reforms (Waqabaca, 2000) and shocks encountered in this period; limiting the sample period to those years where structural breaks are less prevalent will help us find stable money demand functions. Second, a time series for the broad money aggregate M3 is available only from 2002 onwards. Given that international experience suggests that a stable money demand function is more likely to be found for broad money aggregates, it is useful to employ this relatively new time series here, not least because it was not available for earlier studies. Third, considering the relationship between M2 and nominal GDP, it is apparent that there is a break in this relationship sometimes in the early 2000s: in the first period covering the 1990s and early 2000s broad money as measured by M2 is flat while nominal GDP rose throughout this period, whereas in the second period covering the remainder of our sample period both broad money and nominal GDP rose in tandem. This paper is going to focus on the latter period.

Graph: 1 Annual Nominal GDP & Broad Money figures 1994-2011 (F$M)



Before commencing with the money demand analysis, we conduct a number of unit root tests in order to establish that our time series are indeed non-stationary. The statistical results of the Augmented Dickey-Fuller (ADF) test are reported in Table 2a. The test values indicate that we cannot reject the presence of a unit root in all the level variables at 5% level. They also indicate that all the variables are stationary in their first difference. Similarly, Table 2b[6] results confirm that the null hypothesis of a unit root in the interest rate variables cannot be rejected, regardless of whether a constant or linear time trend is included.

[6] Interest rates were tested separately to assess whether they contained a trend or just a constant.

Table: 2a Unit Root Results Using ADF Test

	Joint test of a unit root & no linear trend in log (variable)	Joint test of a unit root & no constant in dlog (variable)
Monetary Aggregates		
M3	3.6251	30.7506
M3 exc FNPF dep	4.1874	43.5465
M1	2.1072	18.5585
CIC	2.5895	36.0279
MB	5.1263	25.2470
Activity Variables		
GDPN	3.7236	30.6834
GDPR	6.0210	34.7388
Price Variables		
HCPI	3.1000	16.6033
$CORECPI_{XVOL}$	1.9078	14.6774
$CORECPI_{TRIM}$	5.1149	19.6333
REER variable		
REER	2.6878	22.3605

Critical Value at 5% level is 6.73 & 4.86, respectively.

Source: author's estimates

Table: 2b Unit Root Results Using ADF Test

	Joint test of a unit root & no linear trend in (variable)	Joint test of a unit root & no constant in (variable)
Interest Rate Variables		
Time deposit rate	0.8876	0.8983
Savings rate	1.1987	0.7143
15 year Gvt bond yield	2.2739	2.1983

Critical value at 5% level is 6.73 & 4.86, respectively.

Source: author's estimates

Turning now to our money demand systems, we use the Johansen approach to cointegration analysis that is based on estimating and testing vector error correction models. In general, our analysis takes the following steps:

- First, we specify the lag length for our vector error correction models using a universal lag length of 3, which strikes a compromise between a sufficiently generous parameterization to control for autocorrelation on the one hand and our short sample period on the other.

- Second, we systematically test all the money demand systems for the presence of cointegration relationships by computing the lambda-max and trace tests, with more weight assigned to the last in our assessment of the cointegration rank. As part of this procedure, we also test stability of the estimated money demand systems by computing the roots of the companion matrix. If the money demand system has instable roots—i.e., the value of modulus exceeds one—the system is considered explosive and excluded from further analysis.

- Third, if we find evidence for cointegration, we try to identify a money demand cointegration vector—we discuss the procedure for this purpose below—and check whether the estimated coefficients have the expected signs and plausible magnitudes. With the exception of the opportunity cost and inflation variable, all variables are expected to be positively related to the money variable.

The procedure outlined above appears straightforward but can become more challenging whenever multiple cointegration vectors are present, because in this case we need to impose identifying restrictions to identify the money demand relationship and other long-run relationships in the data. Without these identifying restrictions, the estimated cointegration vectors are just a linear combination of the true long-run relationships in the data and cannot be interpreted meaningfully. The challenge is to come up with useful identifying restrictions. Following the specific-to-general methodology to cointegration analysis outlined in Juselius 2006, we start with small systems and gradually expand into larger ones. Starting with smaller systems is useful, because they often contain only one cointegration vector, in which case no identifying restrictions are needed. This gives us an idea which cointegration relationships are present in the data. This information points us to the type of identifying restrictions that can be used in larger systems that display multiple cointegration vectors in order to identify in these systems the cointegration vectors that had been found previously. After all, cointegration relationships found in small systems should also be present in larger ones that contain the same variables.

The analysis of multiple cointegration relationships is greatly facilitated by the data-mining procedure available in CATS (Hansen and Juselius 1994). Using this analysis, our analysis proceeds in two steps whenever we find multiple cointegration vectors, which—as outlined above — an issue only in large systems:

- First, the data mining procedure in CATS checks whether there is a cointegration relationship that corresponds to our minimum specification of a money demand relationship in form of a velocity-type relationship: this minimum money demand function needs to link real money to our activity variable. Note that we do not restrict the coefficient for the activity variable to be 1, i.e., our minimum money demand function does not need to resemble strictly velocity. If the data mining procedure finds no such minimum money demand relationship, we reject the system from further consideration.

- Second, in those cases where the procedure finds our minimum money demand-type cointegration relationship to be present in the data, the data-mining procedure will estimate a large range of possible models by imposing identifying and over-identifying restrictions and listing them in order of their p-values of the over-identifying restrictions. We concentrate on those models that appear economically sound. The resulting systems will consist of a (i) a money demand-type relationship identified in the first step and (ii) other identified long-run relationships that we consider economically plausible.

5.0 Results

Out of the about 500 systems considered, we only found a handful that appeared consistent with our requirements of a long-run money demand relationship. In this chapter we are going to review our two favoured systems[7] in more detail. These are:

Currency in circulation with activity variable

a. $CIC = 1.67GDPN$

Broad money demand system with activity & own interest rate variable

b. $M3_{XFNPF} = 1.46GDPN + 0.05TDEP_{RATE}$

Our finding differs significantly from previous studies as all money demand systems which had the real GDP/Income variable were rejected from further consideration for being either, explosive or for not having a cointegration relationship with the money variable. Hence, only systems with nominal GDP qualified for further tests.

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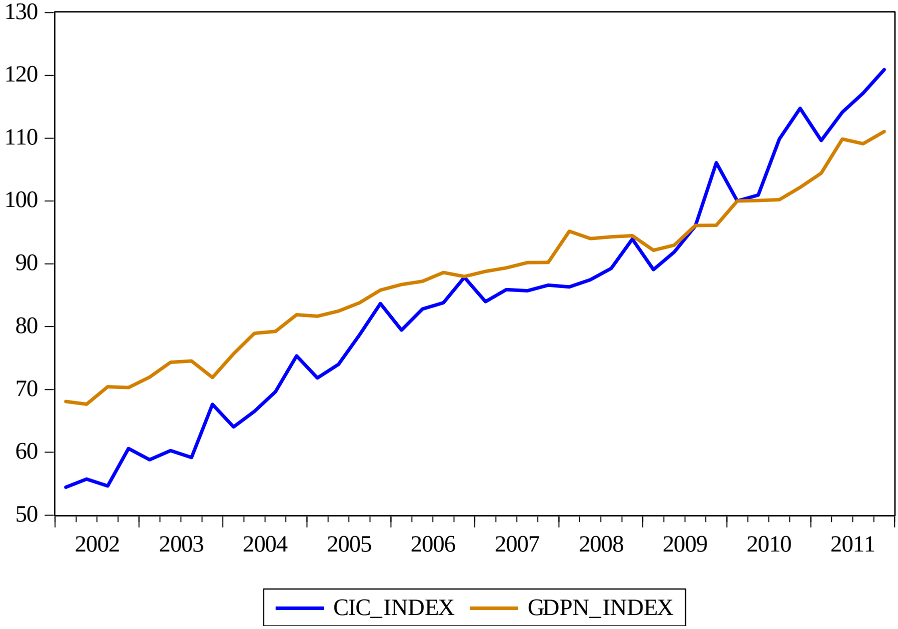
[7] Recursive stability tests on both systems do not show major signs of instability.

5.1 RESULTS FOR CURRENCY IN CIRCULATION SYSTEM

As noted above, the Johansen cointegration test finds a cointegration relationship between currency in circulation and nominal GDP[8]. Visual inspection of the two series in Graph 2 shows that both are trending upwards, displaying a broad co-movement consistent with a cointegration relationship where the income (nominal GDP) elasticity of currency in circulation is larger than one.

[8] The variables were also tested using the ARDL approach and the test results for cointegration were ambiguous and depended on the chosen lag length. Evidence for cointegration at the 1% significance level is present for very parsimonious systems but not for those with longer lag length. This could reflect the relative short sample period, which means only parsimoniously-specified systems can be estimated with some degree of precision. The Johansen procedure also uses a very parsimonious specification, consistent with evidence from information criteria. Moreover, evidence for cointegration is only found if the GDP variable is the dependent variable, which could suggest that the money variable is weakly exogenous. The cointegration results from the Johansen procedure, in contrast, showed significant feedback to the money variable. However, the estimates of the long-run parameters are very similar to those estimated using the Johansen procedure.

Graph: 2 Currency in circulation & Nominal GDP



Specifically, the cointegration vector implies that a 1.0 percent increase in nominal GDP will lead to an increase of around 1.7 percent in currency in circulation in the long run, ceteris paribus. In order to examine the short-term dynamics of the model, the complete vector error-correction model associated with the above long-run money demand function is reported in Table 3[9].

[9] All information criteria agree on lag = 1.

Table : 3 Vector Error Correction Estimates

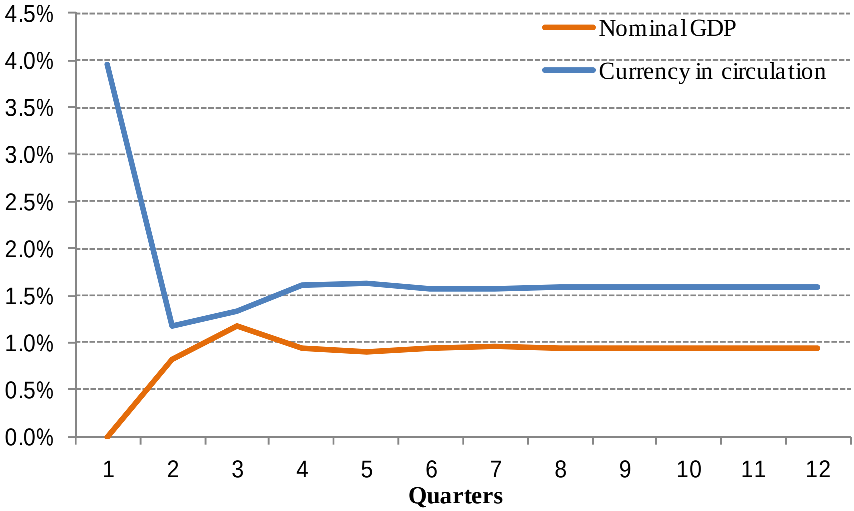
Sample (adjusted): 2002Q4 2011Q4
Included observations: 37 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1	
LOG_CIC(-1)	1.000000	
LOG_GDPN(-1)	-1.663369 (0.04743) [-35.0683]	
C	6.082066	
Error Correction:	**D(LOG_CIC)**	**D(LOG_GDPN)**
CointEq1	-0.550207 (0.29586) [-1.85967]	0.412139 (0.12288) [3.35386]
D(LOG_CIC(-1))	-0.161359 (0.27238) [-0.59240]	-0.208156 (0.11313) [-1.83994]
D(LOG_GDPN(-1))	-0.245142 (0.43586) [-0.56243]	0.112916 (0.18103) [0.62373]
C	0.030647 (0.01168) [2.62302]	0.015855 (0.00485) [3.26714]

Source: author's estimates

A key question is what happens if there is disequilibrium, for example, if the money stock is larger than money demand. It is tempting to view such a scenario as corresponding approximately to the old-style view of a monetary expansion where the central bank prints money quite literally—but, of course, this is not how the Reserve Bank of Fiji actually conducts its monetary policy operations, a point we return to below. The adjustment coefficients displayed in Table 3 show that such disequilibrium would feed back into both variables. That is, if there is excess money, the system would find its way back to equilibrium by reducing the money stock and by increasing nominal GDP. To shed more light on the economic adjustment mechanisms that might be behind such a process, we use the impulse response analysis in the next step.

Graph: 3 Impulse Responses w.r.t shock to currency in circulation



We begin by considering a shock to the money stock. More specifically, we estimate our vector error correction model with the cointegration relationship imposed as a structural vector autoregressive (VAR) model, which allows us to use impulse response analysis to investigate the dynamic adjustment processes of our model. To do so, it is necessary to impose a set of identifying restrictions that identify the two structural shocks driving the dynamics of our model.[10] We choose the Cholesky decomposition for this purpose, a procedure that is easily implemented in EViews. For the interpretation of the Cholesky decomposition, the ordering of our variables matter: our output variable comes first[11], which means the money stock can respond instantaneously to money shocks but our nominal GDP variable can respond to these shocks only with a delay of one quarter.[12] This is meant to be a relatively weak identifying restriction in the sense that it can be easily justified with nominal and real rigidities that prevent an instantaneous adjustment of output or prices to a change in the money stock.

Turning now to the interpretation of the money shock displayed in Graph 3, the first question is what type of economic event such a shock would represent. One interpretation is that this shock represents a money supply shock, i.e., an increase in the money supply generated by the central bank in order to stimulate economic activity. From this viewpoint, we would observe that it takes about three quarters for nominal GDP to fully respond to this shock, at which point it has increased by about 1 percent relative to its baseline path. This compares to an initial increase in the money supply of 4%, but most

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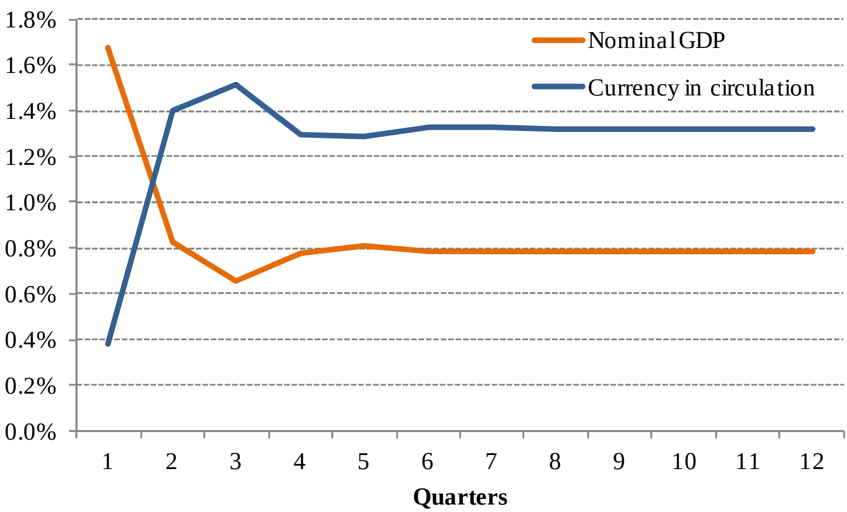
[10] There are only two types of shocks because our model has only two variables.
[11] However, results are robust to ordering.
[12] This restriction is visible in Graph 1 where the response of GDP to the money shock in the period where the money shock occurs is constrained to zero.

of this increase in the money stock is reversed immediately; in quarter 3, when the GDP response is approximately complete, both money and GDP have increased by about 1 percent. In the longer term, the GDP response is somewhat smaller than the money response, consistent with the estimated cointegration relationship. Economically, this scenario is consistent with the view that an expansionary policy raises nominal output, but we cannot say to what extent this is due to price or real output effects.

The drawback with this interpretation is that it is difficult to conceive a scenario where the Reserve Bank of Fiji directly increases the amount of currency in circulation as a means to stimulate economic activity. The Reserve Bank of Fiji provides currency in circulation at the demand of the public; there is practically no channel how it could impel the public to hold more currency than it wishes to hold, short of literally distributing currency to the public. That is not to say that monetary policy in Fiji cannot be expansionary; rather, the point is that an expansionary monetary policy does not operate through physically increasing the amount of currency in circulation but uses interest rate and exchange rate channels, both of which are not captured by our model used here. Hence, it would seem more appropriate to think of a shock to currency in circulation as a money demand shock which can be explained by the popularization of ATMs in recent years which has increased the public's demand for currency and, in turn, the amount of currency that banks order from the Reserve Bank of Fiji. Similarly, the growth in rural banking and microfinance facilities in the last decade has led to increased financial inclusion, which also raises the public’s demand for currency. Through easing liquidity constraints of households and businesses, such initiatives are likely to positively impact the economy's output, consistent with the increase in nominal GDP observed in the impulse response functions above.

Next, we investigate the second shock that is, a shock to nominal GDP, and its resulting impact on currency in circulation.

Graph: 4 Impulse Responses w.r.t shock to nominal GDP



The shock depicted in graph 4 is consistent with the transaction motive of money demand theory which postulates a greater demand for money as the level of income or activity rises in an economy. Here, an initial shock of around 1.6 percent to nominal GDP warrants an initial increase in currency in circulation, albeit by a lesser extent. After about four quarters, the money and output response settles down at a level consistent with the long-run relationship, i.e., the increase in money demand exceeds the increase in nominal GDP by a factor of about 1.7. That is, as the economy starts expanding, greater amount of money is demanded by various sectors of the economy for consumption and investment purposes.

The Granger Causality test indicates that causality runs from both directions that is, GDP has a causal effect on currency in circulation in the long run and vice versa.

Furthermore, the variance decomposition analysis shows that in the short run, variances in nominal GDP is largely underpinned by nominal GDP itself and it takes quite a while (around 3 years) for currency in circulation to attribute to around one-third of the variance in nominal GDP[13]. Regarding the money variable, in the short term money shocks account for practically all of the variation in this variable, but the contribution of output shocks rises to about a third at the one-year horizon and 50% in the long run. This finding suggests that even though there is evidence for a stable long-run relationship between currency in circulation and nominal GDP, it is difficult to utilize the money variable as an information indicator for nominal GDP because causation runs in both directions and GDP shocks account for only a modest share of the variation in the money variable in the horizon up to one year; at best, currency-in-circulation would be a very noisy indicator of nominal GDP developments at this horizon.

[13] The variance decomposition has been computed for the VAR in levels without the cointegration relationship imposed.

5.2 RESULTS USING BROAD MONEY EXCLUDING FNPF DEPOSITS, NOMINAL GDP & TIME DEPOSIT RATE

Similarly, the Johansen cointegration test finds a cointegration relationship between broad money excluding FNPF deposits, nominal GDP and the time deposit rate[14] (Graph 5). Specifically, a one percent rise in nominal GDP leads to a 1.5 percent increase in broad money excluding FNPF deposits and 1.0 percentage point increase in the term deposit rate raises broad money demand by about 5.0 percent. The results from the complete vector error-correction model associated with the above long-run money demand function is reported in Table 4[15].

[14] The variables were re-tested using the ARDL approach and evidence for cointegration at the 1% significance level was found for the specification which used the same lag-length as the Johansen procedure. Both procedures found money and GDP variables to be weakly exogenous and also found very similar long-run parameter estimates.

[15] Information criteria agrees on lag = 2.

Graph: 5 Broad Money excluding FNPF Deposits, Nominal GDP & Time Deposit Rate

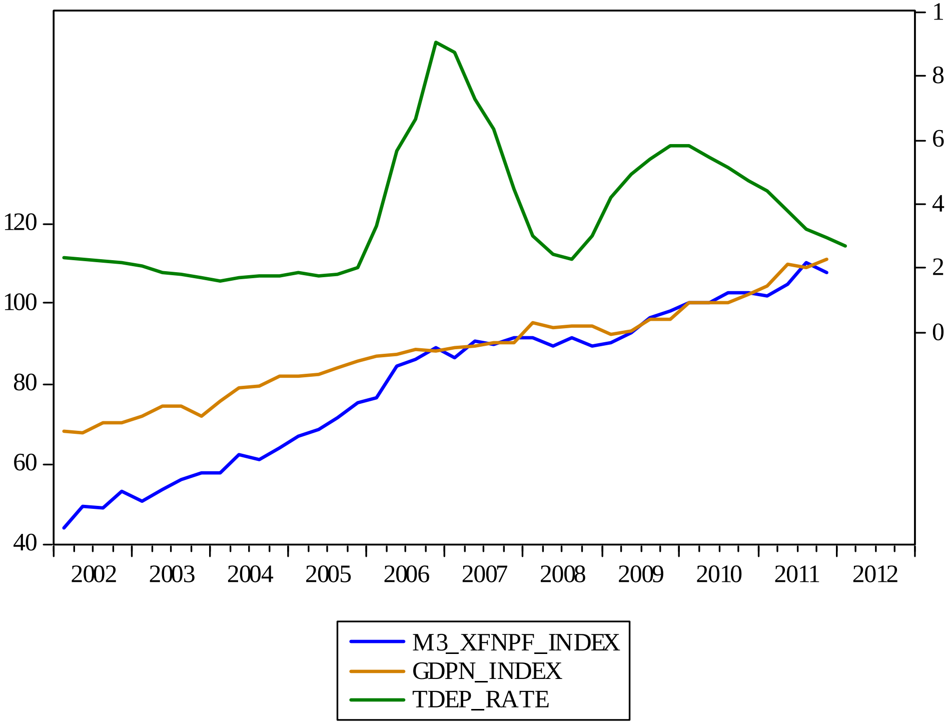


Table: 4 Vector Error Correction Estimates

Sample (adjusted): 2002Q4 2011Q4
Included observations: 37 after adjustments
Standard errors in ( ) & t-statistics in [ ]

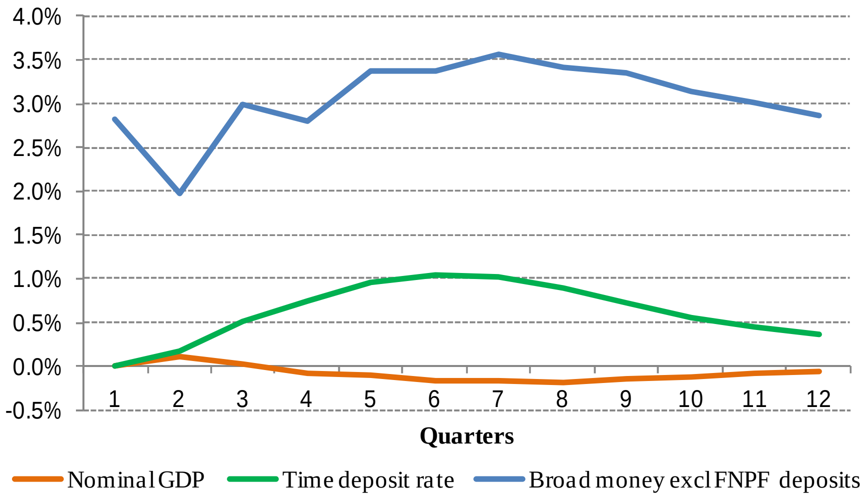
Cointegrating Eq:	CointEq1		
LOG_M3XFNPF(-1)	1.000000		
LOG_GDPN(-1)	-1.456147		
	(0.08929)		
	[-16.3088]		
TDEP_RATE(-1)	-0.051690		
	(0.00565)		
	[-9.15106]		
Error Correction:	**D(LOG_M3XFNPF)**	**D(LOG_GDPN)**	**D(TDEP_RATE)**
CointEq1	0.080107	0.036004	9.416136
	(0.09874)	(0.07225)	(1.74703)
	[0.81128]	[0.49832]	[5.38981]
D(LOG_M3XFNPF(-1))	-0.377261	-0.000115	-2.968118
	(0.19347)	(0.14157)	(3.42302)
	[-1.94998]	[-0.00081]	[-0.86710]
D(LOG_M3XFNPF(-2))	0.172923	0.004180	3.332503
	(0.15750)	(0.11525)	(2.78660)
	[1.09793]	[0.03627]	[1.19590]
D(LOG_GDPN(-1))	0.553214	-0.275743	12.92003
	(0.26736)	(0.19564)	(4.73045)
	[2.06913]	[-1.40945]	[2.73125]
D(LOG_GDPN(-2))	0.040764	-0.177741	6.382504
	(0.27358)	(0.20018)	(4.84038)
	[0.14900]	[-0.88789]	[1.31860]
D(TDEP_RATE(-1))	0.004787	-0.005225	0.584225
	(0.00761)	(0.00557)	(0.13466)
	[0.62899]	[-0.93818]	[4.33858]
D(TDEP_RATE(-2))	0.010730	0.003070	0.453352
	(0.00947)	(0.00693)	(0.16751)
	[1.13330]	[0.44316]	[2.70645]

Source: author's estimates

The adjustment coefficients displayed in Table 4 show that disequilibrium between money supply and money demand would feed back into the interest rate variable only. That is, if there is excess money, the system would find its way back to equilibrium through adjustments in interest rate. This is an important finding for the monetary transmission mechanism, because it implies that excess money—i.e., money supply exceeding money demand—does not affect real GDP or prices, given that the adjustment coefficient for nominal GDP is statistically insignificant, but rather is mitigated through an adjustment in the term deposit rate.

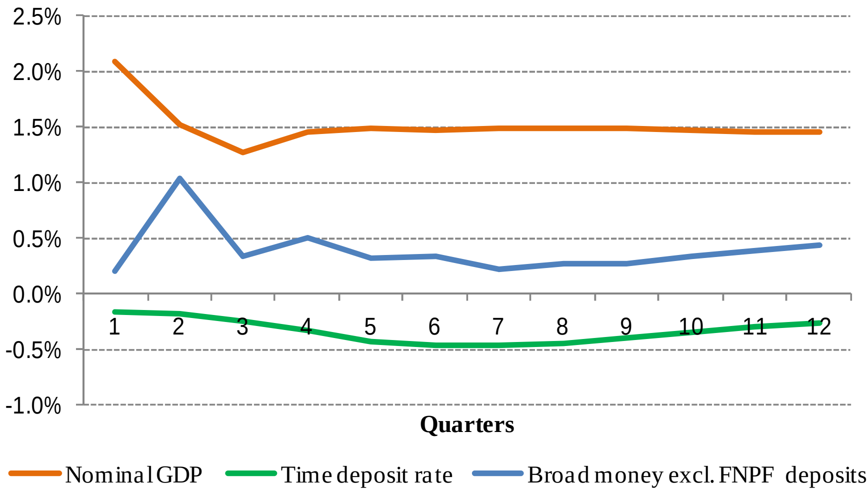
Next, we proceed to impulse response analysis which traces the adjustments of other variables given a shock to the primary variable. Regarding the ordering of the variables, the money variable precedes followed by the nominal GDP and lastly the interest rate variable.

Graph: 6 Impulse Responses w.r.t shock to money excl. FNPF deposits



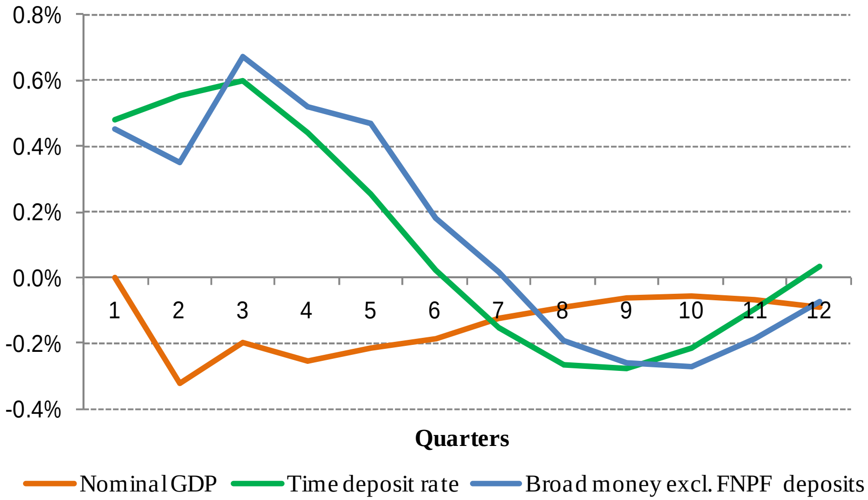
Turning now to the interpretation of the money shock displayed in Graph 6 the initial task is in identifying the economic event where such a shock would emanate from. Interpreting it as a money demand shock would imply that the increase in broad money is a result of a credit demand shock which could stem from higher credit demand as households or businesses take a more favorable view of their economic prospects; the last could translate into higher borrowing as a means to bring some of the anticipated gains into the present. Alternatively, the increase in broad money could be interpreted as a credit supply shock where banks ease their lending standards, which would allow borrowing by households and businesses that previously did not have access to credit. In both cases one would expect the credit expansion to go hand-in-hand with an increase in economic activity in general, i.e., nominal GDP should be rising as well. The fact that the impulse-response function for GDP shows practically no response—i.e., nominal GDP remains broadly unchanged—could be the result of most of the additional demand being met through imports. Incidentally, the last would lead to a drain on foreign reserves given the fixed exchange rate regime, which over the medium term could curtail the economic expansion as well. Finally, the increase in term deposit rates could reflect an effort by banks to attract more deposits to support the rise in lending. The sluggish increase in interest rates would point to interest rates being sticky.

Graph: 7 Impulse Responses w.r.t shock to nominal GDP



The scenario depicted in graph 7 could stem from a supply side shock in the economy for instance, those resulting from productivity or technological shocks. The shock initially elevates nominal GDP by around 2.0 percent but the aggregate demand fails to catch up due to rigidities. The shortfall in demand would impel monetary authorities to loosen monetary policy stance in the economy, which in turn would lead to a reduction in policy rates that would filter through eventually to lower deposit rates, in line with the interest rate response depicted above. Money demand would be pulled in two directions, with the increase in economic activity raising money demand whereas lower interest rates would reduce it.

Graph: 8 Impulse Responses w.r.t shock to time deposit rate



Graph 8 shows a shock to the interest rate variable that could be the result of a monetary tightening. That is, this graph could be interpreted as showing the effects of a monetary policy shock, or more specifically, a monetary tightening that leads banks to raise time deposit rates. As expected, the contractionary monetary policy stance would adversely affect aggregate demand, ultimately leading to lower nominal GDP. Money demand would again be pulled in two different directions, with the fall in nominal demand reducing money demand whereas the increase in deposit rates would raise it. In the short term, these two factors broadly cancel out. Over the medium term, the interest rate effect dominates.

Results from the Granger Causality test indicate that causality runs from nominal GDP to time deposit rate and vice versa. Moreover, the variance decomposition analysis reveals that the variance in the output variable is largely explained by this variable itself. This suggests that neither money nor interest rate shocks are important determinants of output, i.e., the link between domestic monetary conditions as measured through the interest rate and broad money to nominal output is weak. The last was also indicated by the fact that both variables are weakly exogenous in the broad money system, i.e., the corresponding adjustment coefficients were statistically insignificant. With respect to the information content of broad money for monitoring output developments, this is hampered by a modest contribution of output shocks to the variation in broad money and the fact that Granger-causality runs in both directions, as noted above.

Table 5: Variance Decomposition Analysis

Variance Decomposition of LOG_GDPN:

Period	S.E.	LOG_GDPN	TDEP_RATE	LOG_M3XFNPF
1	0.020803	100.0000	0.000000	0.000000
2	0.025602	98.87523	0.846669	0.278096
3	0.029928	97.98598	1.702848	0.311174
4	0.033331	97.44557	2.195652	0.358776
5	0.036210	97.40426	2.229027	0.366709
6	0.038608	97.57165	2.033981	0.394368
7	0.040640	97.71334	1.836165	0.450494
8	0.042369	97.69849	1.738783	0.562724
9	0.043855	97.53474	1.724005	0.741253
10	0.045141	97.28224	1.730804	0.986960

Variance Decomposition of TDEP_RATE:

Period	S.E.	LOG_GDPN	TDEP_RATE	LOG_M3XFNPF
1	0.573369	5.314940	94.68506	0.000000
2	1.055919	4.461384	94.55371	0.984903
3	1.426247	6.456738	90.29617	3.247090
4	1.662327	9.384470	84.11588	6.499652
5	1.792672	12.50239	77.38544	10.11217
6	1.863172	14.91656	71.92674	13.15670
7	1.909514	16.08410	68.98986	14.92604
8	1.945870	16.20242	68.33028	15.46730
9	1.971981	15.90434	68.72121	15.37445
10	1.986026	15.68034	69.12943	15.19023

Variance Decomposition of LOG_M3XFNPF:

Period	S.E.	LOG_GDPN	TDEP_RATE	LOG_M3XFNPF
1	0.026181	1.035393	8.083972	90.88063
2	0.031625	11.67622	15.60823	72.71555
3	0.037755	11.32601	18.72621	69.94778
4	0.041948	14.25486	19.72307	66.02207
5	0.045472	15.82156	18.63169	65.54675
6	0.048263	18.47649	16.97286	64.55065
7	0.050756	21.30917	15.36354	63.32730
8	0.053091	24.72245	14.07142	61.20614
9	0.055342	28.35254	13.02022	58.62724
10	0.057520	32.08234	12.09494	55.82272

Source: author's estimates

6.0 Conclusion & Policy Recommendation

The purpose of this study was to re-examine the determinants of money demand in Fiji for the period 2002Q1 through 2011Q4 using comprehensive and latest data. Of the exhaustive set of money demand systems estimated, we found two equations to fairly resemble a plausible money demand equation for Fiji.

The key determinants of money demand were found to be nominal income and time deposit rate while other financial variables were deemed insignificant in the estimation. Essentially, we did find a stable money demand relationship for Fiji for the period under study, but the failure to by and large establish a quantitatively important effect from money to nominal GDP suggests that targeting monetary aggregates to achieve macroeconomic objectives is not a feasible monetary policy option for the Fiji economy. As identified by the cointegration tests, in the long run, money variables are closely linked to nominal GDP, but in the short term they make at best very noisy indicators of GDP developments, given that Granger-causality runs in both directions and output shocks account at most for a modest share of the variation of money variables.

Moreover, time deposit rates responded strongly to the supply and demand of broad money and, in fact, brought supply and demand into equilibrium in the broad money system. Given that time deposit rates are part of the interest rate channel, taking into account demand and supply of broad money will help to better understand the interest rate channel.

In sum, the findings here support the choice of an interest rate-targeting arrangement for Fiji where the operating target of monetary policy is the overnight policy rate. The interest rate clearly plays an important role in the monetary transmission mechanism, because it is this variable that equilibrates demand and supply in the broad money system and the responses of money and output to an interest rate shock are consistent with the last representing a change in the monetary policy stance. A similar, independent role of monetary variables for the monetary transmission mechanism was not found. Hence, monetary variables can best support monetary policy as an (noisy) information variable, which is the current practice: money and credit aggregates are reviewed by the monetary policy committee to assess the stance of monetary policy, along with other financial, trade and real sector information.

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Appendix:

Table: 1 Data Definitions

Variable	Definition
M3	*M3* comprises M2 and securities other than shares issued by other depository corporations held by other financial corporations, public nonfinancial corporations and private sector. M2 comprises M1 and quasi money.
$M3_{XFNPF}$	$M3_{XFNPF}$ is M3 less Fiji National Provident Fund Deposits
M1	*M1* comprises currency in circulation outside commercial banks and transferable deposits of other financial corporations, local governments, public nonfinancial corporations, and private sector in national currency with commercial banks.
CIC	*Currency in circulation* includes both, the central bank and other depository corporations' currency in circulation.
MB	*Monetary Base* comprises currency in circulation, statutory reserve deposits, and excess reserves of commercial banks.
NGDP	Nominal GDP

Table: 2 Johansen Cointegration Test Results

a. *Results using Currency in circulation & Nominal GDP*

CATS for RATS version 2

Sample:	2002:01 to 2011:04 (40 observations)
Effective Sample:	2002:04 to 2011:04 (37 observations)
Obs. - No. of variables:	30
System variables:	LOG_CIC LOG_GDPN
Constant/Trend:	Unrestricted Constant
Lags in VAR:	3

I(1)-ANALYSIS

p-r	r	Eig.Value	Trace	Trace*	Frac95	P-Value	P-Value*
2	0	0.332	15.908	14.608	15.408	0.042	0.066
1	1	0.026	0.959	0.894	3.841	0.327	0.344

Source: author's estimates

b. Results using Broad money excluding FNPF deposits, Nominal GDP & Time deposit rate

CATS for RATS version 2

Sample:	2002:01 to 2011:04 (40 observations)
Effective Sample:	2002:04 to 2011:04 (37 observations)
Obs. - No. of variables:	27
System variables:	LOG_M3_XFNPF LOG_GDPN TDEP_RATE
Constant/Trend:	Unrestricted Constant
Lags in VAR:	3

I(1)-ANALYSIS

p-r	r	Eig.Value	Trace	Trace*	Frac95	P-Value	P-Value*
3	0	0.501	39.112	29.872	29.804	0.003	0.049
2	1	0.268	13.388	12.516	15.408	0.101	0.135
1	2	0.048	1.821	1.682	3.841	0.177	0.195

Source: author's estimates