SCHOOL OF ECONOMICS
THE UNIVERSITY OF THE SOUTH PACIFIC

WORKING PAPER

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No. 2009/04 **June 2009**

This paper presents work in progress in the School of Economics at USP. Comments, criticisms and enquiries should be addressed to the corresponding author.

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Abstract

Amongst the 14 Pacific island countries, Vanuatu is unique in many respects. It has no exchange controls. Further, it allows full freedom for its citizens and resident expatriates alike to hold domestic bank deposits in any major currency of their choice. The country has adopted a fixed exchange rate regime, which in the absence of capital controls restricts full monetary independence. However, the Reserve Bank of Vanuatu has successfully established itself as a premier central bank in the region by pursuing the goals of monetary stability. This paper undertakes an empirical study of transmission mechanism of monetary policy in Vanuatu by resorting to a bounds testing approach.

Keywords: Monetary policy transmission, output, money, prices, bounds testing approach

JEL classification: E50, E30, P52

1. Introduction

Vanuatu is one of the six Pacific island countries (PICs), which have their own independent currencies amongst the 14 PICs[1], the other eight being dollarised economies[2] with one of the three currencies of the metropolitan countries in the region. Five of the six PICs with independent currencies have adopted fixed exchange rate regimes. They are Fiji, Samoa, Solomon Islands, Tonga, and Vanuatu, whereas the sixth country, Papua New Guinea has a floating exchange rate arrangement since 1994.

Vanuatu, which established its central bank, Reserve Bank of Vanuatu (RBV) in late December 1980 soon after its independence, is unique in many respects. Its residents, citizens and resident expatriates alike, are allowed to keep bank deposits in any currency of their choice. Since the country has no direct taxation on personal or corporate incomes of any kind, and since there are no death duties or gift taxes, its offshore financial centre (OFC) institutions, inherited from the country's colonial past enjoy pure tax haven status. Furthermore, since Vanuatu has no exchange controls, monetary independence in the context of a fixed exchange rate regime is generally limited. The RBV depended only on direct instruments, including statutory reserve deposit (SRD) ratio until 1998, when it began to conduct open market operations (OMO) in its own securities for liquidity management, with the objective of influencing the short-term interest rate.

There are no studies so far undertaken on monetary policy transmission in Vanuatu. The present paper seeks to fill the gap. Since the available data series covers only a 28-year period (1980-2007), we employ the bounds testing approach, as the latter does not require a large sample size data as well as other stringent requirements in regard to order of integration of the variables employed. The paper is organized as follows: Section 2 provides a background of Vanuatu's economy and monetary policy instruments employed by RBV. Section 3 reviews monetary

[1] The 14 PICs are: Cook Islands, Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. These 14 PICs, together with two metropolitan countries, namely Australia and New Zealand form the regional inter-governmental organization, known as Pacific Islands Forum (the Forum).

[2] The eight dollarized economies, using one of the three major currencies as legal tender, are: Kiribati, Nauru, and Tuvalu (Aus $); Cook Islands and Niue (NZ $); Marshall Islands, Federated States of Micronesia and Palau (US $).

policy formulation in Vanuatu, while Section 4 outlines various transmission mechanisms, discussing their applicability to PICs; Section 5 deals with the methodology adopted for the empirical analysis; Section 6 reports the results; and Section 7 presents conclusions with policy implications.

2. A Background

Vanuatu (population 215.000), whose selected key indicators are given in Table 1, share many commonalities with rest of the PICs. Its economy is heavily subsistence oriented, dominated by root crops; and commercial ranch and fishery activities to a small extent, which provide livelihood to 80 percent of the population. The country's manufacturing base is small, which is confined to processing coconut oil based soaps and detergents, and biscuits and breads. However, Vanuatu has been historically an open economy with OFC institutions inherited from the days of the joint Anglo-French condominium rule. The country also provides flag-of-convenience registration of ships. Additionally, absence of all forms of direct taxation, including personal and corporate income taxes, estate taxes, death duties and gift taxes, have made Vanuatu a popular tax free haven in the South Pacific. Thus, services sector of Vanuatu comprising financial and tourism activities, has been a major support to Vanuatu's economy.

Table 1: Vanuatu: Selected Key Indicators

Land Area (Sq.km.'000)	12.2
Population (2006: '000)	215
Per Capita GDP (US$) Current prices : 2006	1,799
Aid Per Capita in US$ (2006)	227
Aid as percentage of GDP (2006)	13.4
Human Development Ranking (2006)	118
Annual Average Growth Rate in percent (2001-2007)	2.7
Annual Average Inflation in percent (2001-2007)	2.5
Overall Budget Balance as percent of GDP (2001-2007)	-0.5
Current Account Balance as percent of GDP(2001-2007)	-5.4

Source: ADB (2006), UNESCAP (2008)

These developments have indeed given rise to the emergence of a dual economy, with OFC institutions in Port Vila, the country's capital on Efate, the main island and commercial tourism,

confined to Port Vila and the big island of Santo, whereas the rest of the country's scattered numerous islands still continue to be characterized by subsistence agriculture. Because of the customary land tenure system, unique to all Pacific islands in terms of the inalienable nature of communally held land to any private individual for land based activities, the development in the private sector, including resort hotel industry has been seriously hampered. The commercial banks find it difficult to lend in the absence of land as collateral.

Vanuatu has a fixed exchange rate regime[3] and this has served the country well. Since most of the imports have been sourced from Australia and New Zealand, whose monetary policies have been targeting inflation, inflation has been kept low. Being a small country with no mineral resources and limited commercial agriculture, Vanuatu is heavily dependent on imports ranging from food and beverages, to fuel and capital goods and transportation machinery and equipment. Vanuatu's exports have been beef, copra, cocoa and *kava*, a non-narcotic beverage root crop. Export earnings have been far less than imports with the result that trade balance always remained negative. However, tourism earnings, steady aid inflows and in recent years, remittances in particular, have provided substantial support to country's current account balance, minimising pressures on the fixed exchange rate regime.

Macroeconomic performance

Vanuatu's economic progress during the first ten years of independence has been uneven. Soon after independence in 1980, there were departures of skilled expatriate residents, consequent to a rebellion in the outer islands. When normalcy returned, three cyclones during 1985-1998 imposed severe damages to standing crops and coconut plantations. In 1986, as a foreign airliner discontinued its services tourist traffic plunged and exchange earnings fell. Domestic inflation rose closely tracking the exchange rate developments and it averaged 9 percent.

With bilateral grants falling from 80 percent of public sector expenditure in 1980 to nearly 50 percent in 1983 and 21 percent in 1989, government had to tighten expenditures and increase

[3] While the currencies of Fiji, Samoa, and Vanuatu are pegged to a basket of currencies of major trading partners, the exchange rate regime of Solomon Islands dollar is a crawling peg and Tonga's is within horizontal band of plus or minus 5 percent (IMF 2007, 2008).

revenues mainly through indirect taxes, which included fees, charges and import duties. Government gave up its conservative stand and began borrowing from international agencies, including Asian Development Bank (ADB) on concessional terms, which are available to lower-income countries for development projects. These included international telecommunication network and airport runway extension. These helped to augment tourism receipts by allowing larger aircrafts to land. As the domestic currency, the *vatu* appreciated, inflation moderated. A Comprehensive Reform Programme was also launched in 1998 with the ADB funding for improving economic and financial management.

Although gross domestic product grew annually at 4.25 percent during the period 1991–1995, there were several unanticipated shocks, which resulted in a deterioration of overall macroeconomic performance. In 1998, loss of trust in the state-sponsored VNPF led to a run on the institution and riots in Port Vila, which prompted the government to permit unconditional withdrawals of retirement savings of VNPF members. The payouts of funds by VNPF led to a sharp rise in liquidity in the banking system. There were capital outflows as well, as confidence in the domestic currency had already been shaken in the process. There was also an unsuccessful attempt by RBV to devalue the vatu, which only caused further large capital outflows[4]. Because of the VNPF crisis, the official reserves of the RBV decreased dramatically, from the equivalent of around six months of imports to less than three months of imports. Fresh monetary policy initiatives were undertaken in 1998. They included introduction of open market operation in the central bank's own short-term securities, known as RBV Notes for liquidity management, which helped to stabilize the economy.

Political instability in the first few years of the current decade had its toll on the economy. However, fiscal consolidation since 2001, which was supported by strong recovery in exports and rise in export prices of key crops, including copra and *kava*, expansion in airline capacity and greater number of flights, helped the economy to perform well. The pegged exchange rate regime helped to keep inflation low and the *vatu* remained stable. Improved economic

[4] In the aftermath of the Asian financial crisis in 1998, several countries such as Papua New Guinea, Fiji, and the Solomon Islands devalued their currencies by 20 percent. Shortly afterwards, because of the VNPF crisis, the RBV followed suit. However, the Government immediately revoked the RBV decision on the ground that the devaluation could have a potentially high cost if it were to spark an inflation-wage spiral.

performance (rates of growth in 2005: 6.5 percent, in 2006: 7.2 percent, in 2007: 6.6 percent) and better governance won the grant assistance of US$ 66 million from the US Millennium Challenge Corporation which would enable the government to improve physical infrastructure including ports, roads and jetties in outer islands for moving agriculture produce to the urban centres in two major islands and to the largest harbour, which would promote exports.

The latest assessment by IMF (2009) shows that with the strong growth in the tourism and construction sectors and increased aid inflows, real GDP has grown 6.6 percent in 2008. Inflation rose from 4.1 percent in 2007 to 5.8 percent in 2008, reflecting the effects of higher international prices of food and fuel, higher credit growth, and rise in government spending. Despite higher spending, fiscal surplus increased to 2.3 percent of GDP due to significant over performance on revenues, mainly VAT, reflecting buoyant economic activities and improved tax compliance.

The RBV, which relaxed its monetary stance in December 2008, now has to face the impact of global slowdown in Australia and New Zealand, the largest sources of tourism revenues and foreign direct investment (FDI). There are indications that new construction activities funded by large capital inflows from Australia and to a lesser extent from New Zealand, have begun to slow. Although tourist arrivals continued to remain strong, spending by tourists has been on the decline. A further relaxed monetary policy and an accommodative fiscal stance for 2009 should help to cushion the impact on growth. GDP growth is expected to be in the 3-4 percent range in 2009 and recover thereafter. Lower commodity prices would halt the rising inflation and rising international reserves supported by aid inflows would be able to finance imports (IMF 2009).

3. Monetary Policy formulation and Implementation

Structure of the financial system and market

Vanuatu's financial sector includes RBV[5], four commercial banks (a government-owned bank, a locally owned bank and two foreign banks namely Westpac and ANZ,), a number of trust and

[5] The RBV's responsibilities are governed by three key laws: the Reserve Bank Act (1980), the Financial Institutions Act (1999), and the International Banking Act (2002). Its supervisory functions were expanded to cover

insurance companies, the Vanuatu National Provident Fund (VNPF), and several smaller financial institutions (Table 2). In 2001, following a merger, the number of commercial banks dropped to four. At present, the largest bank has almost 70 percent of total assets of the banks.

Table 2: Vanuatu: Financial system structure

	Assets (billions of vatu)	Percent in Total Assets	Number of Institutions	Percent of GDP
Commercial Banks	43.1	11.2	5	147.2
of which: State controlled	2.7	0.7	1	8.5
Non-bank financial institutions	–	–	–	–
Offshore banks	337.5	87.9	36	1061.3
Insurance companies	0.5	0.1	3	1.6
Pension funds	3.1	0.8	1	9.7
Total	384.2	100.0	45	1219.8

Source: RBV (2008)

Vanuatu's OFC, includes 24 offshore banks with offshore banking licenses, and 16 insurance companies. Offshore banks are regulated by the International Bank Act (2002) and are supervised by the RBV, as are domestic banks. Offshore banks are not allowed to accept local deposits from, or make loans to, residents in Vanuatu. Prior to 2003 when the new act came into effect, offshore banks were supervised by the Financial Service Commission.

As of end-December 2008**,** the total assets of the financial system were about 387.9 billion vatu, equivalent to 1,219.8 percent of GDP. If offshore banks are excluded, however, the total assets drop to 50.4 billion vatu, equivalent to 158.5 percent of GDP (Table 1). Given the restrictions which apply to the ability of the offshore banks to deal in domestic currency and to do business with the domestic banks, the commercial banks play a dominant role in the domestic financial system and the offshore banks have no direct impact on the conduct of monetary policy.

The activities of the offshore banks, nevertheless, are likely to have an indirect impact on monetary conditions. The "trust funds" accepted from nonresidents are usually deposited with one of the domestic banks. The banks, in turn, deposit the funds with banks abroad, primarily

offshore banks and the VNPF in 2003. The RBV's monetary policy stance for the year ahead has been publicly announced in semi-annual statements since 2003.

with their European or Asian offices. However, a small segment leaks into the domestic system, which then becomes part of the money supply. Domestic banks sometimes make loans in foreign currency to residents, mainly for expatriates and local businesses engaged in foreign trading, but the amount of foreign currency loans is small.

Banking activities are largely confined to two urban centres in the country, Port Vila and Santo, in which formal sector activities are concentrated. The financial deepening process, as reflected in the ratios of narrow and broad money, has been slow. As Vanuatu has no vibrant primary and secondary markets in bond and equity and other financial securities, there are no attractive financial assets other than saving and time deposits for savers to invest in. Table 3 presents monetary statistics of Vanuatu. Narrow money consists of currency (the vatu) and demand deposits in vatu, while broad money comprises narrow money plus demand deposits in foreign currency and savings and time deposits in both vatu and foreign currency. Following liberalisation of the economy in general and financial sectors, with discontinuance of controls on lending and deposit rates in mid 1990s, the ratio of broad money to GDP has been on the rise. It has been in the range of 50 percent to 60 percent, while Vanuatu's broad money has been a close 200 percent of GDP.

Table 3: Vanuatu: Selected Output and Monetary Statistics

	Output Growth (%)	Inflation (%)	Interest Rate (%)	ER (US$/Dom Currency)	M1 (% of GDP)	M2 (% of GDP)
1980-89 (Ave)	8.8	8.8	16.7	0.010272	39.9	219.0
1990-99 (Ave)	5.1	3.2	13.6	0.008522	31.1	218.0
2000-04 (Ave)	0.6	2.5	7.9	0.007692	30.2	191.6
2005	6.5	1.2	7.5	0.009154	34.5	197.6
2006	7.2	2.0	8.3	0.009038	38.7	196.6
2007	6.6	3.9	8.2	0.009762	39.2	198.0

Source: International Monetary Fund (2008)

Monetary policy objectives

The objectives of RBV, as laid down by the 1980 RBV Act (Section 4), are to promote monetary stability in terms of low inflation and an adequate level of international reserves, while supporting conditions conducive to the orderly and balanced economic development. The RBV seeks to keep inflation below 4 percent and maintain at least 4 months of international reserves, with real GDP growth of 3.0 percent (RBV 2008).

The RBV Act specifies that the RBV and the Ministry of Finance (MoF) are both monetary institutions. There is a close working relationship between these two organizations. A representative of the MoF is a member of the Board of the RBV; and the RBV is represented as an advisor in committees advising the government on macroeconomic, monetary and budget affairs. However, Article 25(h) of the RBV Act gives the Minister of Finance the power to give directives to the RBV, with which the RBV must comply. By and large, RBV has enjoyed a high degree of independence until 1998 when the government intervened, annulling RBV's decision to devalue the vatu in 1998 and dismissed the central bank governor (Jayaraman 2000). There has been no further serious government intervention of the kind observed in 1998 (IMF 2008).

The government has an advance facility with the RBV. This facility has been frequently used in recent years as government had cash flow problems, contributing to build up of excess liquidity. In 2003, the advance facility was reduced from 500 million vatu to 400 million vatu.

Monetary framework

Vanuatu has a fixed exchange rate regime under which the value of domestic currency, *the vatu* is determined on the basis of an undisclosed transactions-weighted (trade and tourism receipts) basket of currencies of Vanuatu's major trading partners. The RBV quotes rates daily for vatu. Buying and selling rates of vatu against the currencies in the basket are quoted once a day with margins ranging between 0.25 and 0.3 percent around the middle rate. The RBV aims at maintaining a level of international reserves, approximately equivalent to cover six months of imports. There are no capital controls in Vanuatu, and therefore not much room for an

independent monetary policy. Within the exchange rate regime, the RBV attempts to guide monetary developments, including domestic credit conditions.[6]

Monetary policy instruments of a central bank are formally generally categorized into two: (i) rules-based instruments[7], and (ii) indirect instruments[8]. In 1988, RBV introduced its rule-based instrument, which was primarily intended for prudential reasons. It imposed for the first time a reserve requirement on all banks, the so-called Statutory Reserve Deposit (SRD) ratio, under which all commercial banks were required to keep 10 percent of demand, time, and saving deposits of residents in vatu with the RBV. In fact, until 1998, SRD ratio was the only monetary policy instrument of RBV. The RBV's lender-of-last resort facility (the advance Facility), it was more often used by nonbanks than commercial banks, as the latter were awash with liquidity.

In 1998, country's financial system came under great stress, as rumours were rife that the state sponsored Vanuatu National Provident Fund (VNPF), was not financially sound. Following the national unrest, the government allowed the public to prematurely withdraw their retirement savings from VNPF. Since Vanuatu has no exchange controls of any kind with both local and expatriate residents being free to hold deposits, currency substitution became rampant and capital flowed out. With a view to stemming the capital outflows, RBV devalued the vatu. Although the decision to devalue vatu was annulled by government within 24 hours, speculations continued to be strong. The RBV imposed temporary controls on capital movements.

[6] During the financial crisis in 1998, the RBV issued a guideline that it would sell foreign exchange to the banks for current transactions only. In addition, in June 2001, the RBV enforced a regulation that it would sell foreign exchange to the banks in minimal amounts of US$1.0 million per client. In September the amount was lowered to US$250,000.

[7] The rules-based instruments, which are based on the regulatory power of the central bank include: (i) liquid asset ratio, a requirement for a bank to hold minimum amounts of specified liquid assets, typically as a percentage of its liabilities; (ii) reserve requirements, a requirements for a bank to hold minimum balances with the central bank, typically as a percentage of its liabilities; and (iii) standing facilities, which are monetary instruments used at the initiative of banks and bearing a pre-specified interest rate, allowing banks to borrow from (refinance facility) or deposit funds with the central bank (deposit facility) (IMF 2004).

[8] Indirect instruments are linked to money market conditions. These are used at the discretion of the central bank. These include: open market operations conducted by the central bank as a participant in the money market, including (i) buying/selling bonds issued by government and government agencies on the secondary market; and buying/selling assets under a repurchase agreement in the repo market, or foreign exchange swaps and (ii) open market-type operations, which are monetary operations based on auction techniques that are regulated by the central bank. They involve primary market issuance of central bank's own securities or government securities issued exclusively for monetary policy purposes (IMF 2004).

Box 1: Vanuatu: Monetary Policy Instruments

Reserve requirements
Introduced in 1988, the Statutory Reserve Deposit (SRD) ratio is calculated on monthly average basis. This requirement stands now at 10 percent of deposits, which is defined as 50 percent of residents' demand deposits in foreign currency as well as all the demand, time, and saving deposits of residents in vatu.

Standing facilities
Discount Facility: Banks can sell (rediscount) treasury bills and/or RBV notes with an upto 90-day maturity to the RBV.

Repurchase Facility: Banks sell government bonds and/or RBV notes to the RBV and subsequently buy back the securities at a specified date and price. In the period between the sale and the repurchase of the securities, the RBV provides the bank with temporary liquidity. The discount rate applies to these operations.

Money market operations
RBV notes: The RBV intermittently auctions these RBV notes, which have maturities of 28, 91, 119, and 182 days to absorb excess liquidity.

Policy Variable: Reserve Money, defined as the sum of currency issued and bank's deposits, is the key monetary policy variable. Bank's deposits include compulsory deposits in connection with SRD requirements and excess reserves partly used by banks to meet daily clearing needs and to grant private sector credit.

Intermediate Variables: The RBV monitors closely a set of key monetary aggregates (e.g., various levels of money supply, private sector credit, and international reserves) for assessing the efficiency of its policies.

Monetary Instruments: The RBV controls the money supply by monitoring banks' liquidity through the following indirect instruments.

• ***Statutory Reserve Deposit (SRD):*** primarily a prudential instrument. Under the SRD commercial banks are required to maintain 10 percent of average Vatu deposits and 50 percent of foreign currency demand deposits for the two months preceding the calculation date.

• ***Open Market Operations:*** Central for liquidity management purposes. The RBV regularly buys and sell its own notes in open market operations to regulate banks' liquidity. The notes have maturities of 14 days, 28 days, 63 days, and 91 days.

• ***Rediscount Window and Repurchasing Agreement Facilities:*** Primarily lender-of-last resort facilities. Banks experiencing liquidity shortages can access RBV funds through these facilities. Banks holdings of RBV Notes and government bonds are used as collateral. These facilities have rarely been used since their inception in 1998 because of a generally favorable liquidity situation. The rediscount rate is the RBV's benchmark rate.

Source: RBV Quarterly Economic Review (Various issues)

As liquidity rose in the system, in 1998 RBV introduced open market operations (OMO) in the central bank issued short- term securities, known as RBV Notes through a tendering process. Since the selling of RBV short-term paper varying in maturity from 90 days to 180 days was through tendering/auctioning process, IMF (2004) calls it as open market type operations. The

RBV imposed another reserve requirement, namely the Prescribed Reserve Asset (PRA) ratio, under which banks were required to hold 16 percent of vatu deposit liabilities in the form of government securities and/or the RBV notes. Furthermore, RBV raised the base-lending rate of the Advance Facility to 11 percent. The commercial banks followed suit and raised their deposit and lending rates[9].

As these monetary policy changes helped to stabilize the financial system, RBV discontinued the PRA requirement in 1999. At the same time, the SRD requirement was also modified. Aside from covering all the demand, time, and saving deposits of residents in vatu, the new SRD included 50 percent of residents' demand deposits in foreign currency. As an instrument of monetary policy, the usefulness of the PRA was limited. The near-absence of a secondary market in government securities and the shallowness of the financial sector also made it difficult to use the PRA as an effective monetary policy instrument. Two new credit facilities were also introduced: the Rediscount Facility and the Repurchase Facility, which rendered the Advance Facility superfluous, leading to its abolition in 1999. The rediscount rate is the RBV's benchmark rate. Table A1 (Appendix 1) traces the changes in monetary policy instruments over the 28-year period.

Global economic Crisis of 2008

Economic recovery began with fiscal consolidation in early 2000s. It was followed by large aid and foreign direct inflows, consequent to the return of a better environment for investment. These inflows and rise in tourism earnings enabled the country to reach a very comfortable level of foreign exchange reserves. The level of international reserves was equivalent to 8 months of import cover during 2007/08, as compared to the targeted figure of 4 months, giving rise to high liquidity in the system. As a result there was no inter-bank lending. The volume of OMO in RBV Notes rose during this period to stabilize the money market conditions.

[9] Under the fixed exchange rate regime, monetary conditions are influenced by net capital inflows. If net inflows persist, sterilization to prevent the economy from overheating, though an option, is an expensive proposition (IMF 2007), as consequent operational costs and interest payments would be a big drag on central bank finances. Further, when there is excess liquidity in economies with shallow financial markets with a small number of participants, OMO in government issued securities or the central bank's own paper, would result in overshooting of interest rates and market volatility (IMF 2004, IMF 2005). Therefore, the more effective way appears to be using rules based instruments for containing credit growth to ensure that aggregate demand does not outpace the sluggish supply capacity in the short-run

The effects of global recession, since mid 2008, have now spread to Australia and New Zealand, being the main sources of tourism revenues as well as foreign direct investment, were then yet to be fully felt in Vanuatu. However, RBV in November 2008 took a preemptive step, which was aimed at easing the prevailing tight monetary conditions. The SRD ratio was reduced from 10 percent to 8 percent of all vatu deposits and 50 percent of demand deposits in foreign currency. In late 2008, when new construction activities funded by large capital inflows from Australia and to a lesser extent New Zealand began to experience a slowdown, there were clear indications that pressures would be felt soon. As a more accommodative policy was apparently needed, in January 2009 the SRD ratio was further reduced to 5 percent. It is expected that further easing in monetary policy and a more accommodative fiscal stance for 2009 would help to cushion the impact on growth. GDP growth is expected to be in the 3-4 percent range in 2009 ((IMF 2009).

The RBV's March 2009 monetary policy statement (RBV 2009) has indicated that the monetary policy stance announced in January 2009 would remain unchanged, while recognizing the possibility of a widening current account deficit, exercising downward pressure on the stock of foreign exchange. However, foreign exchange reserves, supported by falling import prices as well as commitments by development partners to continue increasing aid flows to Vanuatu, are likely to be sufficient to finance around 4.8 months worth of imports of goods by the end of 2009.

More pointedly, as Vanuatu's major trading partners and the important sources of tourists visiting the country - Australia and New Zealand - have slowed significantly in recent months, there are risks that demand for tourism and investment will slow sharply and growth might be less than the forecasted figure of 3 percent in 2009. In such an uncertain economic environment, prudent and coordinated fiscal and monetary policies would be needed to lessen the impact of global economic downturn. The RBV has taken initiatives to show that it can respond quickly when required to free up liquidity. Since government's fiscal position has been sound with budget surpluses accumulated in recent years, supportive expansionary fiscal policy actions would also help to meet the recessionary conditions.

4. Monetary Policy Transmission: A Brief Literature Survey

Monetary policy transmission is described as a process through which changes in monetary policy influence aggregate demand, output and price level in the economy. The impact of monetary policy decision on the country's GDP is through its influences on consumption and investment decisions of households, business and financial intermediaries. At least six channels through which monetary policy impacts economic activities have been identified (Mishkin 1995, 1996, 2001, 2006). These include: (i) interest rate channel; (ii) money supply channel; (iii) credit channel; (iv) the balance sheet channel; (v) asset price channel; (vi) exchange rate channel; and (vii) expectations channel[10].

Limitations in the island economies

There are constraints limiting the efficiency of transmission mechanisms acting through various channels. One of the constraints faced by Solomon Islands is that in the absence of a well-developed financial sector and a vibrant secondary market, in which financial assets could be traded with considerable ease and speed, interest rate channel does not effectively operate (Worrell 2000; Fairbairn and Worrell 1996).

The balance sheet approach presupposes that financial assets are important constituents of firms'/consumers' portfolios and assumes the existence of convertibility between illiquid (consumer durables) and liquid (financial) assets. Empirical studies have shown that markets for assets in the PICs and the Caribbean region have not attained such sophistication to function as an efficient conduit for monetary policy (Baksh and Craigwell 1997). A recent study (Dabla-Norris and Floerkemeir 2006) notes that the inability of banks in developing countries to properly assess credit risk, due to both weak risk management expertise and opaque corporate accounting practices, increases banking spreads and reduces the effectiveness of balance sheet channel.

With reference to asset price channel mechanism and its variants of Tobin's *q* theory (valuation of equities), the required pre-condition, namely the presence of financial assets constituting a key

[10] For a fuller discussion, see Jayaraman and Choong (2009b)

component of borrowers' and wealth holders' portfolios, does not exist in any PIC. Further, commercial banks dominate the financial sector, since the non-bank financial sector institutions (stock, debt securities and mortgage market, insurance industry) are still in their infancy. Thus, market financing does not matter, which largely precludes the asset price channel's working through wealth and income effects (Dabla-Norris and Floerkemeir 2006).

The exchange rate channel transmission mechanism for its full efficiency presupposes a floating system, which adjusts to capital flows. Since Solomon Islands has adopted a fixed exchange rate regime, this particular channel does not operate. In view of the constraints discussed above, it is more likely that in small island economies with undeveloped money markets, monetary pulses are transmitted to the real sector through money channel rather than through interest rate channel.

5. Variables, Data and Methodology

The choice of variables for our empirical study is severely constrained by data deficiencies. Further, the model has to remain simple since the number of annual observations is less than 30, the period covered being 1980-2007. We choose two policy variables, monetary aggregate and interest rate. Monetary aggregate is represented by broad money (M2), which includes currency, demand deposits and savings and time deposits in vatu as well as in foreign currency. Interest rate is proxied by average lending rate (IR), since there is no consistent data series for short-term rate in Vanuatu, as the RBV 91-day yield to maturity rate data series are available only from 1999. The target variables are output, which is represented by real gross domestic product (*RGDP*), and price level, which is represented by consumer price index (*P*). Besides these variables, we include the nominal exchange rate, to check whether it could be a channel of transmission mechanism. The nominal exchange rate (ER) is expressed as units of US dollar per unit of domestic currency[11]. The annual data for the empirical study are drawn from two sources: the monetary and exchange rate data from *International Financial Statistics* published by

[11] The reason for using the nominal exchange rate, instead of real exchange rate, is that one can isolate changes in the nominal exchange rate on real economic activity separately from changes in prices, since the real exchange rate is already adjusted for changes in prices and using this variable would make it difficult to isolate price changes (inflation) from exchange rate changes (Dabla-Norris and Floerkemeir, 2006).

International Monetary Fund (2008) and output data from Asian Development Bank (2008) and UN ESCAP (2008).

Bounds testing approach

Since the number of observations is not large enough for estimating a long-run money and output model, we resort to the autoregressive distributed lag (ARDL) procedure, developed by Pesaran, *et al*. (2001). The ARDL bounds testing model is a general dynamic specification, which applies lags of the dependent variable and the lagged and contemporaneous values of the explanatory variables, through which short-run impacts can be directly assessed and long-run relationship indirectly estimated. For econometric analysis, all variables are duly transformed into their natural logs. We also added a trend variable[12].

The conventional cointegration procedures proposed by both the Engle and Granger's (1987) residual-based procedure and the Johansen (1988) and Johansen and Juselius (1990) maximum likelihood approach require testing of unit roots to ensure that all series are integrated of order one. A same order of integration is necessary, because in the presence of a mixture of I(0) and I(1) regressors, Harris (1995) shows that both trace and maximum eigenvalue test results from the Johansen procedure will be difficult to interpret, as they generate nuisance parameters. Further, Rahbek and Mosconi (1999) also demonstrate how I(0) regressors in a Johansen-type framework can generate spurious cointegrating relations with other variables in the model[13].

On the other hand, bounds testing with ARDL framework has several advantages: (i) it allows testing for the existence of a cointegrating relationship between variables in levels irrespective of whether the underlying regressors are I(0) or I(1) (Pesaran and Shin, 1999; Pesaran et al., 2001); (ii) it is considered more appropriate than the Johansen-Juselius multivariate approach for testing the long run relationship amongst variables when the data are of a small sample size (Mah, 2000; Tang and Nair, 2002)[14]; and (iii) the estimators of the short-run parameters are consistent and the

[12] Narayan and Smyth (2006) have extensively discussed the inclusion of time trend variable in the estimation.
[13] Hassler (1996) provides extensive discussion on the problems of stationary variables in cointegrating regressions.
[14] Some previous studies have applied ARDL model to relatively small sample sizes with as few as 20 observations in their research. For example, Pattichis (1999) apply the ARDL model to estimate an import demand function for

estimators of long-run parameters are super-consistent in small sample sizes (Pesaran and Shin 1999). Therefore, ARDL model has become increasingly popular in recent years and we begin the empirical analysis with this procedure.

There are two steps involved in estimating the long-run relationship between money, output and other variables. The first step is to examine the presence of a long-run relationship among all variables in the equation. Once the long run relationship is confirmed in the model, the long-run coefficients are estimated using the associated ARDL model. For examining the existence of cointregration we utilize the bounds test approach as proposed by Pesaran *et al.*, Accordingly, the following models are constructed for Vanuatu.

$$\begin{aligned}\Delta LRGDP_t &= \delta_1 + \beta_{11}LRGDP_{t-1} + \beta_{21}LP_{t-1} + \beta_{31}LM2_{t-1} + \beta_{41}LIR_{t-1} + \beta_{51}LER_{t-1} \\ &+ \beta_{61}TREND + \sum_{i=1}^{p}\alpha_{11i}\Delta LRGDP_{t-i} + \sum_{i=0}^{p}\alpha_{21i}\Delta LP_{t-i} + \sum_{i=0}^{p}\alpha_{31i}\Delta LM2_{t-i} \\ &+ \sum_{i=0}^{p}\alpha_{41i}\Delta LIR_{t-i} + \sum_{i=0}^{p}\alpha_{51i}\Delta LER_{t-i} + \varepsilon_{1t}\end{aligned} \quad (1)$$

$$\begin{aligned}\Delta LP_t &= \delta_2 + \beta_{12}LRGDP_{t-1} + \beta_{22}LP_{t-1} + \beta_{32}LM2_{t-1} + \beta_{42}LIR_{t-1} + \beta_{52}LER_{t-1} \\ &+ \beta_{62}TREND + \sum_{i=1}^{p}\alpha_{12i}\Delta LRGDP_{t-i} + \sum_{i=0}^{p}\alpha_{22i}\Delta LP_{t-i} + \sum_{i=0}^{p}\alpha_{32i}\Delta LM2_{t-i} \\ &+ \sum_{i=0}^{p}\alpha_{42i}\Delta LIR_{t-i} + \sum_{i=0}^{p}\alpha_{52i}\Delta LER_{t-i} + \varepsilon_{2t}\end{aligned} \quad (2)$$

$$\begin{aligned}\Delta LM2_t &= \delta_3 + \beta_{13}LRGDP_{t-1} + \beta_{23}LP_{t-1} + \beta_{33}LM2_{t-1} + \beta_{43}LIR_{t-1} + \beta_{53}LER_{t-1} \\ &+ \beta_{63}TREND + \sum_{i=1}^{p}\alpha_{13i}\Delta LRGDP_{t-i} + \sum_{i=0}^{p}\alpha_{23i}\Delta LP_{t-i} + \sum_{i=0}^{p}\alpha_{33i}\Delta LM2_{t-i} \\ &+ \sum_{i=0}^{p}\alpha_{43i}\Delta LIR_{t-i} + \sum_{i=0}^{p}\alpha_{53i}\Delta LER_{t-i} + \varepsilon_{3t}\end{aligned} \quad (3)$$

Cyprus (1975 -1994: 20 observations). Tang (2001) applies the ARDL framework to study inflation in Malaysia during 1973-1997 (25 observations) while Tang and Nair (2002) apply the ARDL technique for estimating import demand function for Malaysia(1970-1998: 29 observations).

$$\Delta LIR_t = \delta_4 + \beta_{14} LRGDP_{t-1} + \beta_{24} LP_{t-1} + \beta_{34} LM2_{t-1} + \beta_{44} LIR_{t-1} + \beta_{54} LER_{t-1} + \beta_{64} TREND + \sum_{i=1}^{p} \alpha_{14i} \Delta LRGDP_{t-i} + \sum_{i=0}^{p} \alpha_{24i} \Delta LP_{t-i} + \sum_{i=0}^{p} \alpha_{34i} \Delta LM2_{t-i} + \sum_{i=0}^{p} \alpha_{44i} \Delta LIR_{t-i} + \sum_{i=0}^{p} \alpha_{54i} \Delta LER_{t-i} + \varepsilon_{4t} \quad (4)$$

$$\Delta LER_t = \delta_5 + \beta_{15} LRGDP_{t-1} + \beta_{25} LP_{t-1} + \beta_{35} LM2_{t-1} + \beta_{45} LIR_{t-1} + \beta_{55} LER_{t-1} + \beta_{65} TREND + \sum_{i=1}^{p} \alpha_{15i} \Delta LRGDP_{t-i} + \sum_{i=0}^{p} \alpha_{25i} \Delta LP_{t-i} + \sum_{i=0}^{p} \alpha_{35i} \Delta LM2_{t-i} + \sum_{i=0}^{p} \alpha_{45i} \Delta LIR_{t-i} + \sum_{i=0}^{p} \alpha_{55i} \Delta LER_{t-i} + \varepsilon_{5t} \quad (5)$$

where Δ is the first difference operator, ε_{it} are white noise error terms, *TREND* is the trend, or time variable. The joint significance of the lagged levels in these equations is examined by using the F-test, where the null and alternative hypotheses are expressed as follows:

For Equations (1) to (5):

$H_0 : \beta_{1i} = \beta_{2i} = \beta_{3i} = \beta_{4i} = \beta_{5i} = 0$ (There is no long run level relationship)
$H_1 : \beta_{1i} \neq \beta_{2i} \neq \beta_{3i} \neq \beta_{4i} \neq \beta_{5i} \neq 0$ (There is a long run level relationship)

where $i = 1,2,...,5$

The distribution of the F-statistics is non-standard under the null hypothesis and testing the hypothesis, two sets of critical values are based on Pesaran, *et al.* (2001) and Narayan (2005). Narayan and Narayan (2005) and Narayan (2005) show that the use of Pesaran, *et al.*'s (2001) critical values for small sample study may lead misleading inferences as the computed critical values are generally lower than those generated by Narayan who used similar GAUSS code provided by Pesaran, *et al*. (2001). Narayan (2005) has generated a set of critical values for small sample size ranging from 30 to 80 observations. Since the sample size in our study is small, and as the critical values provided by Pesaran, *et al.* (2001) are calculated on the basis of large

sample sizes of 500 and 1000 observations and 2000 and 40000 replications respectively, we use the critical values generated by Narayan (2005) [15].

If the computed F-statistic is greater than the upper critical bound value, the null hypothesis of no cointegration is rejected irrespective of whether the variable is I(0) or I(1). In contrast, when the F-statistic is smaller than the lower critical bound value, the null hypothesis is not rejected, and we conclude that there is no long-run level relationship between the variables under study. However, if the computed F-statistic lies inside the lower and upper critical bound values, there is inconclusive inference unless the order of integration of the series under consideration is clearly examined.

Granger causality test

If the variables are cointegrated, the next step is to perform the Granger causality test to examine the short-run dynamic causality relationship between variables. Equations (1) and (2) can be re-formulated into a vector error-correction model (VECM) framework in order to capture the short- and long-run effect of the cointegrating vector. Let Z_t as the vector of a set of endogenous variables, we can model Z_t as an unrestricted vector autoregression (VAR) model with optimum lag-length[16]:

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} + ... + A_k Z_{t-k} + U_t \quad where\ U_t \sim IN(0, \sigma) \qquad (6)$$

where Z_t is (5 x 1) vector comprised of *LRGDP, LP, LM2, LIR* and *LER*. Each of the A_i is (5 x 5) matrix of parameters. The 5-variable VAR model as shown in Equation (6).

is used if there is no long run relationship found by the bounds testing approach. If there is a cointegration vector, then the following VECM will be used to examine the long- and short-run causality relationship between variables under study.

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + ... + \Pi Z_{t-k} + U_t \qquad (7)$$

where ΔZ_t = [*LRGDP, LP, LM2, LIR* and *LER*]', $\Gamma_1 = -(I - A_1)$, $\Gamma_2 = -(I - A_1 - A_2)$ and $\Pi = -(I - A_1 - A_2 - A_3)$. Γ_i reflects the short-run relationship of the changes in Z_t. The (5 x 5) matrix of Π $(= \alpha\beta')$ contains both speed of adjustment to disequilibrium (α) and the long-run

[15] See Table 6 for these critical values.
[16] The optimum lag length is chosen based on the Akaike's information criterion.

information (β) such that the term $\beta' Z_{t-3}$ embedded in Equation (7) represents the *(n-1)* cointegrating relationship in the model.

5. Results and Discussions

Unit root tests

We employed three testing procedures for examining the order of integration of each series. The first test is proposed by Dickey and Fuller (1979, ADF) with the null hypothesis of unit root process. However, one of the problems with the ADF tests is that the test has low power in examining the properties of the series. Indeed, Pantula, *et al*. (1994) have argued that unit root tests based on the ordinary least squares (OLS) estimator such as ADF tests, are the least powerful among the test statistics they examined. Hence, we also resort to the ERS and KPSS unit root tests. The test suggested by Kwiatkowski, *et al*. (KPSS, 1992) with the null hypothesis of stationarity, while the test developed by Elliott, *et al.* (ERS, 1996) has a similar null hypothesis as ADF test.

Table 4, which reports the results of three unit root tests, shows that variables are non-stationary at levels, except for interest rate (*LIR*) as indicated by three unit root tests. However, after first difference, both ADF and KPSS tests reveal that the series are I(1) variables, while ERS test suggests both price (*LP*) and exchange rate (*LER*) are non-stationary at their first differences. Obviously, the conventional cointegration frameworks may be less applicable in this case as the variables are integrated at different orders.

Table 4: Vanuatu: Results of Unit Root Tests

Country / Variable	ADF		ERS		KPSS	
	Level	First Difference	Level	First Difference	Level	First Difference
LRGDP	-2.5243	-3.9553**	15.2735	1.8601**	0.1954**	0.0900
LP	-0.5065	-3.0126**	114.5609	30.1555	0.1811**	0.4382
LM2	-2.4077	-5.2102**	111.0838	2.0705**	0.1887**	0.3679
LIR	-2.2171	-5.2852**	15.1180	1.7900**	0.1407	0.0953
LER	-2.7599	-4.6573**	47.1089	14.6349	0.1526**	0.4362

Notes: The ADF critical values are based on Mckinnon. The optimal lag is chosen on the basis of Akaike Information Criterion (AIC). The null hypothesis for both ADF and ERS tests is a series has a unit root (non-

stationary) while the null hypothesis of the KPSS test is does not contain unit root (stationary). The asterisk ** denotes the rejection of the null hypothesis at the 5% level of significance.

Bounds testing results

The next step is to examine the long-run relationship between real output, price, money, interest rate and exchange rate using the bounds test developed by Pesaran, *et al.* (2001). The results of bounds test are reported in Table 5. The computed F-statistics for real output equation suggest rejection of the null hypothesis of no cointegration. However, the null hypothesis is not rejected for other equations. This finding shows that there is a long-run equilibrium relationship between real output, and prices, monetary aggregate (M2), interest rate, and exchange rate in Vanuatu.

Table 5: Vanuatu: Results of Bounds test

Dependent Variable			**Computed F-statistic**	
LRGDP			18.30***	
LP			1.03	
LM2			0.29	
LIR			1.39	
LER			1.02	
	Pesaran et al. (2001)[a]		**Narayan (2005)[b]**	
Critical Value	Lower bound value	Upper bound value	Lower bound value	Upper bound value
1 per cent	3.41	4.68	4.537	6.370
5 per cent	2.62	3.79	3.125	4.608
10 per cent	2.26	3.35	2.578	3.858

[a] Critical values are obtained from Pesaran *et al*. (2001), Table CI(iii) Case III: Unrestricted intercept and no trend, p. 300. [b] Critical values are obtained from Narayan (2005), Table case III: unrestricted intercept and no trend, p. 10. *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.

The long run estimated equation by OLS for real GDP as dependent variable is shown as follows:

$$LRGDP_t = 1.185 - 0.833LP_t ** + 0.885LM2_t *** - 0.008LIR_t - 0.339LER_t *$$
$$t = \quad (2.421) \ (-3.009) \quad (4.986) \quad (-1.736) \quad (-2.179)$$

*, ** and *** indicate significance at 10%, 5% and 1% levels, respectively.
Figures in parentheses are t-statistics.

We find that in the regression equation the coefficient of the monetary aggregate variable (M2) has a positive sign, which is also statistically significant. The coefficient which indicates the

magnitude of the long run elasticity of output with respect to money is 0.885. The coefficient of price has the theoretically expected negative sign and is also significant. However, the coefficient of interest rate, although with the expected negative sign, is not statistically significant. Exchange rate (units of US $ per one unit of vatu) has also a negative sign, indicating depreciation would contribute to a rise in output.

Equation (1) is adequate as the diagnostic test results indicate that disturbance terms are normally distributed and serially uncorrelated with homoscedasticity of residuals, confirming the model has a correct functional form. Moreover, the CUSUM and CUSUM of Squares plot show that the parameters of the model are stable over time[17].

Granger causality tests

Table 6 shows the results of the Granger causality tests in regard to the significance of the policy variables (money, interest rate) in explaining the variations in both output and prices, both in the long-and short-runs. In the long run, monetary aggregate, interest rate, price and exchange rate significantly Granger-cause the real output, as evidenced by the significance of the error correction term (ECT) in the equation with LRGDP as dependent variable. The magnitude of ECT indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium, which is 47% within a year. However, ECT is not significant in the other four equations with price, money, interest rate and exchange rate as dependent variables, indicating that the long run relationship exists in only one direction. That is the linkage runs from money, interest rate, price and exchange rate to output and not otherwise. This also confirms the results we obtained from bound tests that there is only one cointegrating equation, which was the equation with output as the dependent variable.

In regard to short run relationship, we find in the equation with RGDP as dependent variable, money, prices and interest rate Granger-cause output, while interest rate does not. It is also seen that in the short run RGDP significantly Granger-causes prices, interest rate and exchange rate. For monetary measure, there is no evidence of Granger causality.

[17] The CUSUM and CUSUM of Squares plots are shown in Appendix (Figures A and B).

Table 6: Vanuatu: Granger Causality Test Results

Dependent Variable	F-statistics					ECT (t-statistics)
	ΔLRGDP	**ΔLP**	**ΔLM2**	**ΔLIR**	**ΔLER**	
ΔLRGDP	-	44.8203***	8.3153***	1.3421	7.2601**	-0.4673*** (-8.8366)
ΔLP	12.8028***	-	1.7185	0.7721	1.3377	-0.1281 (-1.4359)
ΔLM2	0.1384	0.3136	-	0.0285	0.2861	-0.0117 (-0.0071)
ΔLIR	3.7845*	0.4593	2.4283	-	1.8409	-0.3570 (-1.0241)
ΔLER	4.0488**	3.5529*	1.1668	2.3707	-	-0.1405 (-1.0222)

Note: *, ** and *** indicate significance at 10%, 5% and 1% levels, respectively. Figures in parentheses are t-statistics.

Variance decomposition analysis

For undertaking variance decomposition analysis, we enter the variables with policy variables first followed by target variables: monetary aggregate (*LM2*), interest rate (*LIR*), exchange rate (*LER*), prices (*LP*) and real output (*LRGDP*). Results of variance decomposition analysis (Table 7) show that substantial variation in output (70.3 percent) is explained by prices in the first year, which slowly decreases in the long-run (at 10-year horizon) to a close 27.0 percent. Shocks to monetary measure (M2) and exchange rate explain about 27.7 percent of variation in output in the second year after rising from 1.7 percent in the first year. Thereafter, the influence of shock in monetary aggregate on real output decreases until the sixth year. It, however, rises from the seventh year onwards with steady momentum to reach about 28 percent.

As regards interest rate, its role is minimal in the initial two years. However, shocks in interest rate explain more of the variation in output in the fifth year, steadying around 20 percent in the long run. On the other hand, shock to exchange rate has a sizeable impact on output in the first year itself, as it explains 14.3 percent of output variation; Over the time horizon, its influence rises to a close 25 percent and steadies around 22 percent in the long run.

The variance decomposition of price analysis shows that more than 50 percent of variation is explained by its own shock in the first three years. However, a substantial variation of the variance of the forecast error of prices (say, after 3-year horizon) is explained by monetary aggregate (more than 50 percent) and followed by exchange rate (increasing to 30 percent over the 10-year horizon).

Table 7: Vanuatu: Results of Variance Decomposition Analysis

Period	S.E.	LM2	LIR	LER	LP	LRGDP
Variance Decomposition of LRGDP:						
1	0.0394	1.7411	4.0231	14.3221	70.2789	9.6348
2	0.0489	27.6795	6.9032	9.2772	47.4095	8.7306
3	0.0670	24.8611	17.0920	19.3205	33.7016	5.0248
4	0.0770	23.4635	22.5420	20.6219	29.5600	3.8127
5	0.0875	18.9058	25.4943	23.0904	29.5521	2.9575
6	0.0974	15.6399	25.4657	24.6098	31.3660	2.9186
7	0.1027	18.0403	23.8122	24.3426	30.9708	2.8341
8	0.1061	21.8457	22.3430	23.7445	29.4079	2.6590
9	0.1089	24.6770	21.1884	23.2013	28.3464	2.5869
10	0.1117	27.9269	20.1720	22.4325	26.9697	2.4989
Variance Decomposition of LP:						
1	0.0179	1.6717	0.9312	0.6091	96.7880	0.0000
2	0.0300	9.9919	1.0101	16.8183	68.6512	3.5285
3	0.0364	31.0180	0.6884	11.9644	53.5209	2.8083
4	0.0469	54.4840	0.4160	11.1192	32.2858	1.6950
5	0.0562	62.1602	0.4165	13.6157	22.5683	1.2393
6	0.0656	62.6715	0.8927	18.6682	16.7669	1.0009
7	0.0718	60.2949	1.7312	23.1151	14.0212	0.8377
8	0.0771	55.7217	3.6311	27.1417	12.7614	0.7441
9	0.0815	51.9242	5.4226	29.7421	12.1833	0.7278
10	0.0840	50.0239	6.4168	30.9191	11.9513	0.6889
Variance Decomposition of LM2:						
1	0.0947	100.0000	0.0000	0.0000	0.0000	0.0000
2	0.1237	84.2520	0.4884	8.5442	6.7116	0.0038
3	0.1528	63.1533	2.2818	24.5961	9.9547	0.0141
4	0.1806	49.4413	6.8915	33.9653	8.8753	0.8267
5	0.1963	47.1924	9.0727	34.6192	8.4007	0.7151
6	0.2101	46.0117	9.4972	36.3577	7.5073	0.6263
7	0.2174	44.3214	9.8924	36.8642	8.1829	0.7391
8	0.2213	44.1149	9.8021	36.8627	8.4675	0.7528
9	0.2215	44.1651	9.7823	36.8108	8.4557	0.7861
10	0.2219	44.0470	9.7967	36.7179	8.6543	0.7841

Variance Decomposition of LIR:						
1	0.0931	0.0781	99.9220	0.0000	0.0000	0.0000
2	0.1088	4.8529	76.9065	16.8480	0.4777	0.9150
3	0.1238	9.1771	61.3696	27.8342	0.7818	0.8373
4	0.1500	25.4814	44.4508	28.2438	1.2533	0.5707
5	0.1828	31.5253	33.0524	33.3332	1.1165	0.9726
6	0.2061	34.5757	26.7725	36.5500	1.1509	0.9510
7	0.2108	34.6654	25.7914	37.5120	1.1045	0.9268
8	0.2115	34.5732	25.6877	37.5286	1.2257	0.9847
9	0.2133	33.9668	25.6257	37.7409	1.6982	0.9683
10	0.2218	32.3557	25.1315	38.5325	2.9158	1.0645
Variance Decomposition of LER:						
1	0.0646	0.2627	27.4617	72.2756	0.0000	0.0000
2	0.0922	0.1880	36.9327	60.1108	2.6967	0.0719
3	0.1139	3.1832	35.9770	56.4567	3.8932	0.4899
4	0.1202	3.6330	34.5591	56.8305	4.5124	0.4651
5	0.1231	3.5206	33.5715	55.7652	6.6230	0.5197
6	0.1241	3.7356	33.0522	55.1474	7.3733	0.6914
7	0.1279	3.5500	32.5265	55.9752	7.2422	0.7062
8	0.1341	3.5362	31.9610	55.8770	7.8133	0.8125
9	0.1381	3.9330	31.6361	55.8691	7.7832	0.7786
10	0.1410	4.2699	31.2601	55.4710	8.2061	0.7929

Notes: Cholesky Ordering: LM2, LIR, LER, LP, LRGDP. We have used different orderings of the variables under concerned, but the findings are robust to changes (see Footnote 17).

Table 8: Vanuatu: Correlation Matrix of the Reduced Form VAR residuals

	LRGDP	**LP**	**LM2**	**IR**	**LER**
LRGDP	1.0000	-0.0748	-0.2757	0.1444	0.1233
LP	-0.7428	1.0000	0.2572	-0.1816	-0.2459
LM2	-0.2757	0.2572	1.0000	-0.1338	-0.1829
IR	0.1444	-0.1816	-0.1338	1.0000	-0.3930
LER	0.1233	-0.2459	-0.1829	-0.3930	1.0000

Impulse Response Analysis

The impulse response function (IRF) for a horizon of ten years, which is based on VECM model, enables us to trace out the response of output to a shock in policy variable. The shock is represented by one standard deviation of the error term in the underlying structural model for the variable. Since all variables are measured in log forms, the impulse response functions trace out a growth rate relative to the base period when the shock occurred. Compared to Granger causality tests, IRF has an additional advantage, as it indicates whether the effect is positive or

negative, For investigating IRF in regard to the output model by Choleski decomposition, the variables are entered in the same as we did earlier: policy variables first followed by target variable: monetary aggregate (*LM2*), interest rate (*LIR*), exchange rate (*LER*), prices (*LP*) and real output (*LRGDP*)[18].

Figure 1 shows the response of output to shocks in policy variables (monetary aggregate, interest rate and exchange rate) and prices. The response of real output to prices is "hump-shaped", that is, output declines over time with a trough and then it rises to its steady state. The response of real output to monetary measure decreases significantly for the first two years and is negative until the sixth year. After that the response increases substantially to become positive, reaching the peak in the eighth year and it stabilizes in the next two years until the end of the time horizon. The response of the real output to interest rate is negative and decreases for the first three years and then stable for the remaining time horizon. The response of the real output to exchange rate, however, is rapid, reaching its peak in the third year and then slowly decreasing to its steady state over the remaining time period.

Figure 2 shows the response of prices to shocks in policy variables (monetary aggregate, interest rate and exchange rate) and real output. Prices respond immediately to real output. It increases sharply in the second year and then slowly increases and eventually settling after seven years. As for the interest rate, the response is positive for the first two years. However, the response turns out to be negative and the trough occurs in the sixth year, and the magnitude of the response is small. Price is less sensitive to the exchange rate in the short-run. The response, however increases, achieving its peak in the sixth year and remain stable over the remaining time horizon. The results are quite similar to the findings reported in the bounds test, Granger causality test and variance decomposition analysis.

Figure 1: Vanuatu: Results of Impulse Response Function Analysis for Real Output

[18] We used different orderings of the variables. With a view to evaluating the robustness of the VAR results which vary according to different orderings of the variables, the correlation matrix of the reduced-form VAR residuals based on the ordering was examined. The elements of the correlation matrix between the M2 and the rest of the variables are very low, indicating that contemporaneous feedback is not a problem. These correlations suggest that the ordering of the variables in Choleski decomposition is not of any major concern (see Table8).

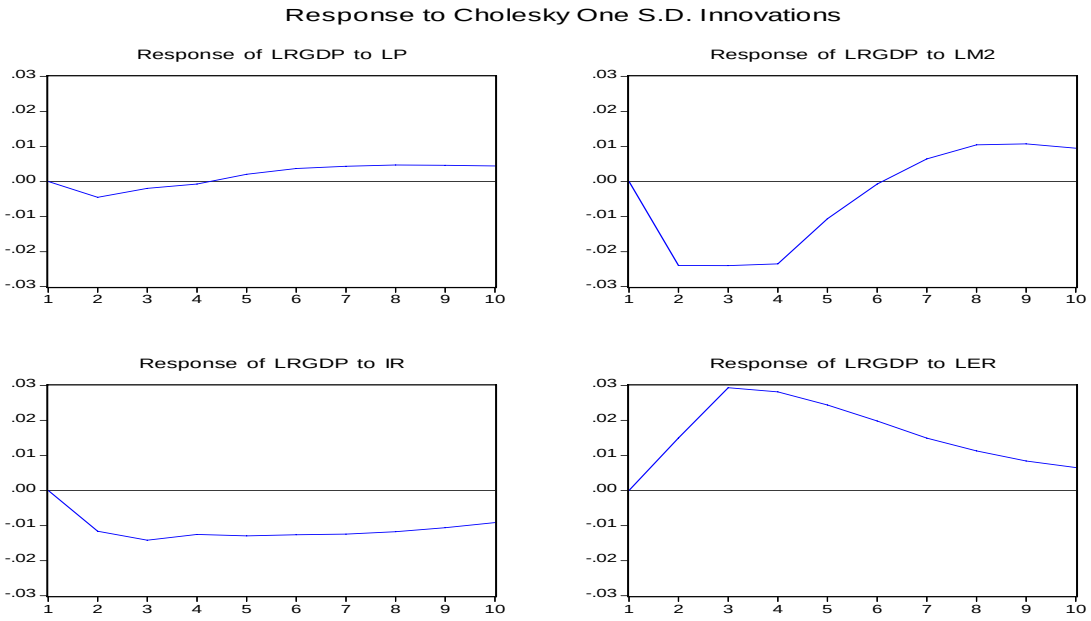
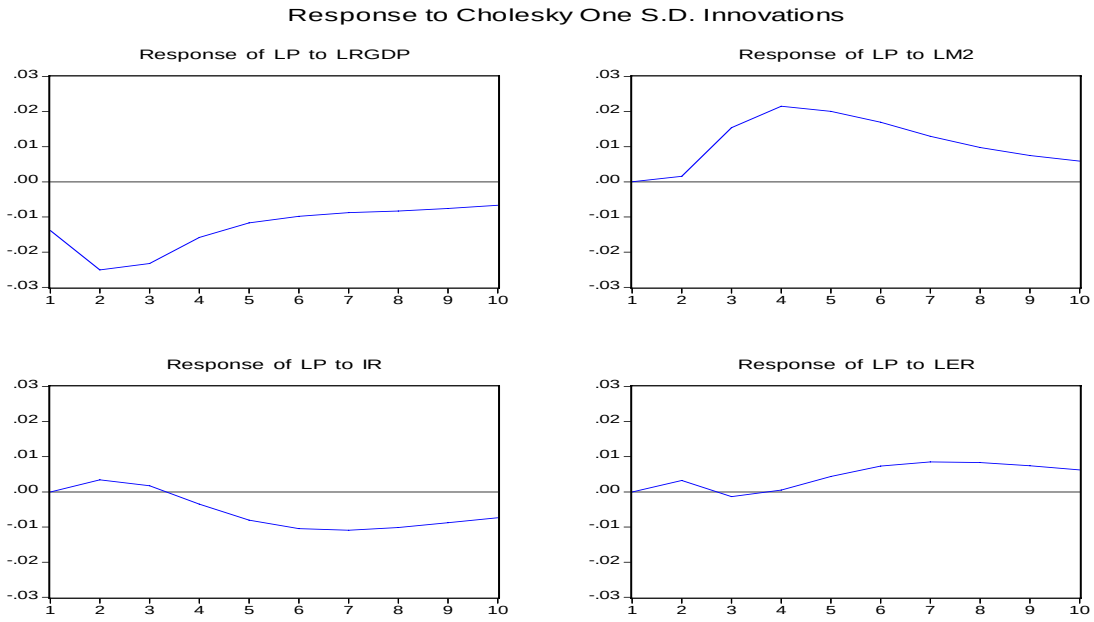


Figure 2: Vanuatu: Results of Impulse Response Function Analysis for Prices



6. Summary and Conclusions

This paper undertook an empirical investigation of monetary policy transmission mechanism in Vanuatu, which is one of the five PICs under fixed exchange rate regimes. Vanuatu's money market is shallow with a few players. It is dominated by government issued Treasury-bills, just as capital market is saturated with long term government bonds. Further, there are no secondary markets for short-and long- term debt securities. Given these circumstances, the findings of the empirical study on Vanuatu are not surprising.

The study findings are (i) there exists a long run relationship between real GDP and policy variables, including monetary aggregate and interest rate; and (iii) the linkage runs only from policy variables to target variable to output; and (iii) interest rate has had no influence on RGDP either in the long run or in the short run. The conclusion is that monetary aggregate is more important than short-term interest as a channel in transmitting impulses from the monetary sector to the real sector. These findings are consistent with the findings of studies conducted in countries with undeveloped money markets: money market is not the conduit of monetary policy changes.

With further development of financial markets, the channels through which monetary policy works will continue to evolve with efflux of time. As such, the question of how monetary policy is transmitted to the real sector in Pacific island economies would be of continuing interest to researchers and policy makers in years to come.

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Appendix 1

Table 4: Vanuatu: Monetary Policy Instruments: Chronological Developments & Changes 1980-2008

Year	Reserve Requirement	Discount Lending	OMO	Repurchase Rate	Direct credit Controls	Secured Advance facility
1980	None		None			10.97
1981	None		None			10.97
1982	None		None			10.97
1983	None		None		As weighted ave.interest rates on deposits were low and on loans were high Guidelines were issued: a) Rates on loans to productive sectors be in the range of 12-14%; (b) banks finance credit needs of ni-Vanuatu projects; c)weighted ave.rate on loans not to exceed 14% d)spread between deposits and lending not to exceed 4.50%	10.97
1984	None		None			10.97
1985	None		None		Guideline (d) was abrogated	10.97
1986	None		None			10.97
1987	None		None		Direct controls ceased	10.97
1988	SRD introduced at 10%		None		Interest rates market determined	10.97
1989	10%		None			10.97
1990	10%		None			10.97

Table 4
(contd)

Year	Reserve Requirement	Discount Lending	OMO	Repurchase Rate	Direct credit Controls	Secured Advance facility
1991	10%		None			10.97
1995	10%		None			10.97
1996	10%		None			10.97
1997	10%		None			10.97
1998	VNPF payouts were financed by issuance of Govt bonds. Towards ensuring banks investing in bonds SRD was replaced by PRA at 16%	Introduced at 6.20%	Introduction of RBV Notes 5.20%	Introduced rate at 6.20%		10.97
1999	PRA abolished SRD increased to 10%	5.87	3.40%	5.87		Abolished in May
2000	10%	7%	3.50%	7%		
2001	Reserve Requirement at 10% of all vatu deposits and 50% of demand deposits in foreign currency	6.50% Rediscount facility and Repurchase Agreement amalgamated	3.29%	6.50%	None	

Table 4
(contd)

Year	Reserve Requirement	Discount Lending	OMO	Repurchase Rate	Direct credit Controls	Secured Advance facility
2002		6.50%	4.98%	6.50%		
2003	No changes in the SRD ratio from 2001-2007	6.50%	4.15%	6.50%		
2004		6.50%	3.50%	6.50%		
2005		6.25%	4.34%	6.25%		
2006		6.25%	5.16%	6.25%		
2007		6.00%	4.25%	6.00%		
2008	In November SRD was reduced to 8% of all vatu deposits and 50% of demand deposits in foreign currency Reduced to 5% of all vatu deposits and 50% of demand deposits in foreign currency in Jan 2009	6.00%	4.30%	6.00%		Reintroduced in Oct allowing banks to borrow at 8.75% against RBV Notes and Govt Bonds In Nov. reduced to 7.75 %

Source: Reserve Bank of Vanuatu Quarterly Economic Review, Various Issues

Appendix 2

Figure A: Plot of CUSUM Test for Real GDP (LRGDP) Equation

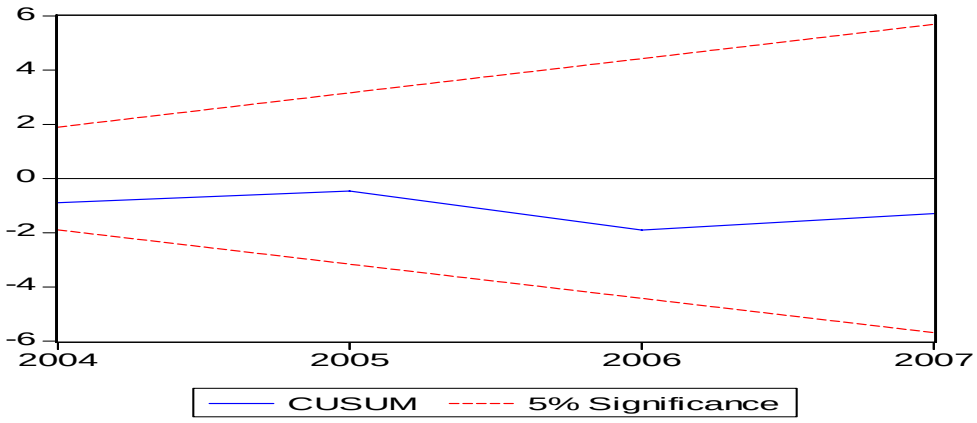
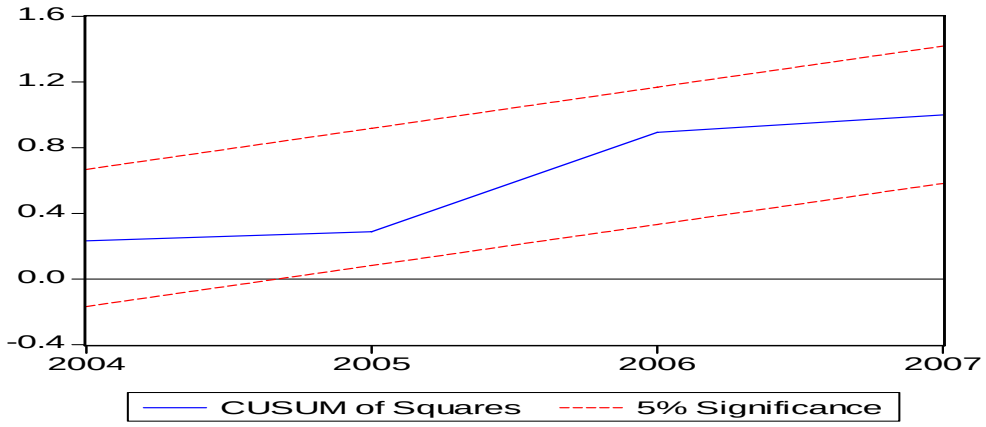


Figure B: Plot of CUSUM of Squares Test for Real GDP (LRGDP) Equation



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