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UNDERSTANDING THE MONETARY POLICY TRANSMISSION MECHANISM OF THE SOLOMON ISLANDS

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UNDERSTANDING THE MONETARY POLICY TRANSMISSION MECHANISM OF THE SOLOMON ISLANDS

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Abstract: The article examines the impact of changes in monetary policy variables, monetary aggregate (M1) and the exchange rate, on two policy variables, namely output and inflation via the bank lending rate in the Solomon Islands from 2002 to 2012. Currently, the Central Bank of the Solomon Islands (CBSI) does not operate an interest rate instrument. Our main findings are: 1) inflation and output are, in the main, explained by their own shocks; 2) exchange rate shocks have some impact on inflation whilst monetary shocks have minimal influence on inflation; 3) lending rate shocks, monetary and exchange rate shocks have relatively short and temporary effects on inflation, impacting in the first quarter and fully absorbed within six months. Shocks in real output are slightly more lagged but also temporary in affecting inflation; and 4) shocks in money supply, the bilateral exchange rate, the lending rate, and inflation impact real output within the first quarter and are fully absorbed within the first six months.

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1. Introduction

Monetary policy is the process by which the Central Bank of the Solomon Islands (CBSI) controls the supply of money, the availability of money, and the cost of money (or interest rate), in order to attain its primary mandate of domestic price stability.

In the Solomon Islands, monetary policy has been conducted since the genesis of the Solomon Islands Monetary Authority (SIMA) in June 1976 (SIMA, 1976). With the introduction of the Solomon Islands Monetary Authority (Amendment) Act 1982, SIMA was formally superseded by its successor, the CBSI. It was at this point that the subsequent increase in legislative powers, capabilities, and responsibilities ensured that monetary policy in the Solomon Islands became more pronounced. Following this, CBSI, subject to changing economic, social, and political conditions, has used a range of direct and indirect monetary policy instruments in order to achieve its objectives over the years. More recently, with the CBSI Act 2012 taking effect from the 1st January 2013, the legislation outlines and focuses more explicitly on the Central Bank's attention to a primary objective; *to achieve and maintain domestic price stability in Solomon Islands*[1] (CBSI, 2012a). Whilst the new act has endowed the monetary authority with more powers, it also calls for greater accountability. As a result, scrutiny over the CBSI's operations is likely to become more ostensive. It is, therefore, imperative for the CBSI to clearly explain its policies in the context of its primary objective. In this regard, understanding the monetary policy transmission mechanism of the Solomon Islands; that is, the way in which the CBSI, via its policy instruments, can influence inflation and output, is crucial.

There is a vast body of theoretical and empirical economic literature spanning developed and developing economies that helps us to understand the transmission mechanism of monetary policy. Furthermore, in the last five years, several studies on monetary policy transmission mechanisms in the Pacific have emerged. For a study on Fiji, see Jayaraman and Choong (2008); for a study on

[1] Its additional objective is to foster and maintain a stable financial system whilst supporting the general economic policies of Government, without the prejudice of attaining its two priority objectives.

Vanuatu, see Jayaraman and Choong (2009); and, for a study on Samoa, see Jayaraman and Dahalan (2010). More recently, regional studies by the International Monetary Fund (IMF) have concentrated on estimating the transmission mechanisms of the Pacific Island countries (see Yang *et al.*, 2010). In addition to regional studies, there is a growing amount of empirical analysis on the impacts of monetary policy changes on economic growth and inflation in the Solomon Islands. Sterne (1996) provides a detailed review of monetary policy in the Solomon Islands since 1980. However, the study falls short of establishing a transmission mechanism. Jayaraman and Choong (2010) examine the impact of monetary policy tools in the Solomon Islands over the period of 1980 and 2007 and find that monetary impulses flow mainly through the money channel. However, this study was produced before the new developments in open market operations. Feridhanusetyawan and Peiris (2011) estimate the monetary transmission mechanism of the Solomon Islands in the post-ethnic tension period (2002-2012) and conclude that the exchange rate channel was a powerful channel whilst the money supply channel was less effective.

This paper seeks to build on the work that has been produced in the Pacific and more specifically on the Solomon Islands by undertaking an empirical study of the Solomon Islands' monetary policy transmission mechanism over the period 2002-2012. We examine five key variables most applicable to the Solomon Islands, namely, narrow money, lending rate, nominal bilateral exchange rate, inflation and GDP.

The rest of the paper is organised in the following manner. Section 2 provides a brief overview of the recent literature from which we draw implications for the Solomon Islands. Section 3 outlines the methodology adopted for the study. Section 4 presents and interprets the results. Section 5 contains a summary of our main findings and policy implications.

2. Overview of the literature and the implications for Solomon Islands

2.1. Key features of the literature

The monetary policy transmission mechanism, described as the process through which monetary policy decisions affect economic activity and the general price level, (Meltzer, 1995), has received significant attention particularly since the rise of Monetarism in 1960's. From these studies, we can identify four main features of the literature on the monetary policy transmission mechanism.

The first feature to note regards the coverage of countries. The majority of studies concentrate on developed economies albeit with a burgeoning interest in the emerging and developing countries. Far fewer studies, however, have been produced on low-income countries, and even fewer in the case of the Pacific region. One reason for this trend is the lack of sufficient time-series data to model monetary policy transmissions.

The second feature relates to the findings on the channels through which monetary policy is transmitted. The extensive body of literature provides some consensus of several channels of transmission, namely the money supply channel, interest rate channel, asset pricing channel, bank lending channel, balance sheet channel, exchange rate channel and the expectations channel (see Mishkin, 2006; De Bondt, 2000). Empirical findings are generally consistent with these proposed hypotheses that explain monetary policy transmission.

The third feature relates to the econometric methodology. The majority of the studies employ Structural Vector Autoregressive (SVAR) models that are capable of identifying shocks and their effects. The methodology is widely used because it is able to measure the dynamic response of a particular variable to a shock, such as a shock to the monetary policy variable.

The final feature of the literature relates to the variables used to assess the impact of monetary policy on inflation and economic growth. A conventional monetary transmission mechanism model comprises of variables that represent the monetary policy instrument, the intermediate variables

(that is, transmission channels), and the final target variables, that is, price and output. Given the general consensus on the channels, the use of a national consumer price index to measure price changes and GDP to measure economic activity as final target variables is common among the empirical studies.

Where empirical models differ, they differ in terms of the policy variables used. In developed countries, the use of the interest rate as the policy variable is often chosen (see Christiano *et al.,* 1999; Cecchetti, 1999; Weber *et al.*, 2009; Boivin *et al.*, 2011). A similar approach is taken by studies on emerging and transition economies (see Mohanty and Turner, 2008; Jarociński, 2005). However, the use of alternative monetary policy variables is also well-documented. Mishra *et al.* (2010) explain that, in the absence of a policy interest rate, central banks in low-income countries are more likely to conduct monetary policy through buying and selling of short-term government securities in a well-functioning secondary market. This is also true in the case of the Pacific region. Yang *et al.* (2010) when assessing the transmission mechanism in Fiji, Papua New Guinea, the Solomon Islands, Samoa, Tonga, and Vanuatu, identify that the main instruments used were open-market operations through the money supply channel. Furthermore, Jayaraman and Choong (2009) use monetary aggregates (M2) to represent the policy variable for Vanuatu while Jayaraman and Dahalan (2008) use monetary aggregates (M1) in the context of Samoa. In the case of Fiji, Jayaraman and Choong (2008) use an interest rate variable, which is linked to the weighted average yield of the 91-day central bank-backed auctioned bill. Specifically to the Solomon Islands, Jayaraman and Choong (2010) also represent monetary policy by using money supply (M1). In contrast, some studies use both policy instruments; Davoodi *et al.* (2013) use monetary aggregates and policy interest rates when assessing East African economies.

2.2. An overview of the Solomon Islands financial system

In order to comprehend the applications and limitations of transmission mechanism theories in the Solomon Islands context, it is important to understand the structure of their financial system.

Between 2010 and 2012, the composition of the Solomon Islands financial system remained relatively unchanged (see Table 1).

Table 1
Composition of the Solomon Islands Financial System, 2010-2012

	2010	2011	2012
Commercial Banks	3	3	3
Superannuation funds	1	1	1
Credit institutions	1	1	1
Credit unions	17	17	17
General insurance companies	3	3	3
Insurance brokers	4	4	4
Insurance agencies	3	3	3

Source: CBSI Annual Report 2012

By 2012 year-end, the financial system consisted of three foreign-owned commercial banks, namely Westpac, Australia and New Zealand Bank, and the Bank of the South Pacific, one credit institution (Credit Corporation [SI] Limited), 17 credit unions, a superannuation fund (SINPF), a development bank, and three insurance companies with seven intermediaries comprising of four brokers and three agencies. Financial services are, in the main, provided in the urban areas although efforts to increase access to rural areas have been intensifying under initiatives taken by the Financial Inclusion Unit within the CBSI.

As presented in Table 2, the combined assets of supervised institutions in the Solomon Islands stood at SBD$5,246 million in 2012 compared to SBD$4,555 million in 2011, an increase of 15%. Asset growth was largely fuelled by the increased participation of the banking sector in debt securities, together with the expansion of investments from the Solomon Islands National Provident Fund. Increased lending by Credit Corporation [SI] Limited during the year also contributed to the growth in assets of the financial system. Commercial banks continue to dominate the financial system, accounting for two thirds of total assets with SINPF contributing 29%, and other supervised sectors make up the remaining 5% of total assets.

Table 2
Solomon Islands Financial System Assets (SBD$ millions), 2010-2012

	2010	2011	2012
Commercial banks	2,364	2,989	3,458
SINPF	1,181	1,325	1,534
Insurance	111	120	118
Credit Corporation [SI] Ltd	31	69	87
Credit Unions	43	52	50
Total Assets	3,729	4,555	5,246

Source: CBSI Annual Report 2012

Despite some growth in total assets in the Solomon Islands financial system, Table 3 shows that the depth and wider development of the system remains relatively shallow. Using the World Bank's *World Development Indicators*, we find that for most financial sector development indicators, the Solomon Islands performs relatively poorly compared to its Pacific island neighbours and trading partners. For example, the Solomon Islands have yet to develop a stock market, a sign of a shallow market. In terms of efficiency, proxied by the interest rate spread, the Solomon Islands fare the worst among the selected countries. The country also performs relatively badly in terms of financial access and outreach with fewer branches and ATMs than other selected countries in Table 3. Furthermore, in relation to getting credit, the country scores very poorly on getting credit information although performs significantly better concerning the strength of legal rights.

The implications of a shallow and underdeveloped financial system will vary by country but the general consensus suggests that this impedes the effectiveness of the transmission mechanism. Yang *et al.* (2010) argue the underdeveloped domestic financial markets in the Pacific Island countries are one of the main impediments for the transmission mechanism. Worrell (2000) and Fairburn and Worrell (1996) explain the limitations encountered by small island economies, such as those in the Pacific and the Caribbean, as a result of the absence of a well-developed financial sector and a functioning secondary market in which financial assets would usually be traded with significant ease and expedience. Furthermore, Cottarelli and Kourelis (1994) also argue that weak financial structures weaken the transmission process and advocate the need to remove barriers to competition and policies aimed at enriching the financial structure. Kareken (1984) argues that

proper bank regulations are necessary for the conduct of monetary policy, particularly open market operations, and that the opposite would render monetary policy ineffective.

The World Development Indicators also suggest that the bank lending channel is unlikely to operate efficiently in the Solomon Islands. Dbala-Norris and Floerkemeir (2006) explain how weak risk management expertise and opaque corporate accounting practices render banks in developing countries unable to properly assess credit risk; therefore, resulting in increasing banking spreads. Evidence from the Solomon Islands supports the notion of high interest rate spreads. Vaught (2010) analysed interest rate spreads across selected Pacific island countries over time and found that the Solomon Islands has historically endured stubbornly high interest rate spreads compared to other Island economies. A recent update of this study by CBSI (2013) showed that this spread remains prevalent. The current interest spread stands at 9.64% as of November 2013 albeit declining slightly since 10.53% in December 2012. CBSI (2012b) also analysed the barriers to successful lending, which provided further challenges to bank lending. The study on rejected loan applications in the Solomon Islands found that lending was also constrained by poorly completed applications and the lack of credit history information. In addition, the absence of an international credit rating for the Solomon Islands is likely to further impede the commercial banks' ability to assess credit risk.

The fluency of the transmission mechanism is also largely determined by the expectations of economic agents. The credibility of the CBSI is a prerequisite to a more reactive and quicker transmission. The responses to monetary changes of economic agents are dependent on whether they perceive or expect monetary policy changes to be permanent or transitory. Furthermore, any misperception or uncertainty about monetary policy may cause undesired fluctuation in prices and output**.** Theissen (1995) contends that in order to reduce uncertainty, the central bank should clearly establish the long-run goal of monetary policy, the shorter term operational targets and its own interpretation of current and future economic developments. In other words, the transparency of monetary policy and the reasoning, which informs the central bank activities, are essential.

Table 3

Selected World Development Indicators for financial sector development

	Getting credit						Financial access and outreach						Efficiency			Depth of the Financial Sector					
	Strength of legal rights index			Depth of credit information index			Commercial bank branches			Automated teller machines			Interest rate spread			Number of listed domestic companies			Market capitalisation of listed companies		
	0-10 (weak to strong)			0-6 (low to high)			per 100,000 adults			per 100,000 adults			Lending rate minus deposit rate (%)						current US$ millions		
	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
Pacific Island Countries																					
Fiji	7	7	7	4	4	4	11	11	11	33	36	37	2.07	3.72	4.55	16	18	16	419	392	452
Kiribati	5	5	5	0	0	0	0	6	6	0	11	10	0.00	0.00	0.00	0	0	0	0	0	0
Marshall Islands	9	9	9	0	0	0	17	20	0	3	6	0	0.00	0.00	0.00	0	0	0	0	0	0
New Caledonia	0	0	N/A	0	0	N/A	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0	0
Papua New Guinea	5	5	5	3	3	4	2	2	2	6	7	8	9.06	9.89	10.33	10	11	11	9,742	8,999	10,711
Samoa	7	7	7	0	0	0	25	18	19	25	28	28	6.41	-6.13	-1.64	0	0	0	0	0	0
Solomon Islands	9	9	9	0	0	0	8	7	7	11	11	11	11.15	11.17	10.42	0	0	0	0	0	0
Tonga	7	9	9	0	0	0	22	21	20	28	28	28	7.51	7.46	6.78	0	0	0	0	0	0
Tuvalu	0	0	N/A	0	0	N/A	0	0	0	0	0	0	0.00	0.00	0.00	0	0	0	0	0	0
Vanuatu	9	9	9	0	0	0	20	20	22	28	28	35	3.91	0.00	0.00	0	0	0	0	0	0
SI Trading Partners																					
Australia	9	9	10	5	5	5	31	31	32	161	167	166	3.07	3.40	3.06	1,913	1,922	1,959	1,454,547	1,198,164	1,286,438
China	5	5	5	4	4	4	0	0	8	25	30	38	3.06	3.06	3.00	2,063	2,342	2,494	4,762,837	3,389,098	3,697,376
Singapore	10	10	10	4	4	4	10	10	10	58	59	58	5.17	5.21	5.24	461	462	472	370,091	308,320	414,126
Malaysia	10	10	10	6	6	6	20	20	20	53	53	53	2.50	2.00	1.81	957	941	921	410,534	395,083	476,340
New Zealand	10	10	10	5	5	5	34	34	33	72	76	75	1.67	1.84	1.72	144	144	142	71,833	71,657	79,802
Thailand	5	5	5	5	5	5	11	11	12	77	79	84	4.92	4.64	4.30	541	545	502	277,732	268,489	382,999

Source: World Bank, 2013

2.3. Major developments in monetary policy in the Solomon Islands (2002-2012)

It is also important to understand the nature of the monetary policy instruments used by the CBSI to properly understand the nature of the transmission mechanism. In this section, we look at the policy instruments used between 2002 and 2012.

Economic development was hampered by the ethnic tensions between 1999 and 2001 with the destruction of infrastructure and businesses and disruption to production and export activities against a backdrop of unsustainable government borrowing. Although the resumption of economic activity was already underway in 2002, the arrival of the Regional Assistance Mission to the Solomon Islands (RAMSI) in 2003 led to the subsequent restoration of law and order and political stability, which in turn supported the return to a state of economic development.

Since its inception and even after the ethnic tensions, the CBSI has utilised several monetary policy instruments, both direct and indirect. Appendix A summarises the major monetary policy instruments. Direct instruments, in the form of the Cash Reserve Requirement, have not witnessed any alterations to its level of 7.5% of total deposit liabilities since May 1999. Indirect instruments, namely, open market operations (OMOs) of the central bank-backed Bokolo bills, were re-introduced in October 2008 following spells of suspension in the 1990's (CBSI, 1990; 1997). Furthermore, exchange rate policy was also used as an effective instrument to maintain real exchange rates in order to boost foreign reserves while enhancing the competitiveness of export and import-substituting businesses. Prior to the ethnic tensions, four devaluations were implemented to the Solomon Islands Dollar (CBSI, 1987; 1999). Since then, a revaluation took place in 2011 as well as a policy shift to a managed peg operating within a narrow band of ±1% in October 2012.

3. Empirical Framework

3.1. Methodology

This section presents the empirical framework to estimate the monetary policy transmission mechanism of the Solomon Islands. In terms of variables, we utilise M1 as our policy variable[2], reflecting the main monetary policy instruments used in the Solomon Islands over the course of the time series. This is also similar to other PICs. Jayaraman and Dahalan (2009) explain, in the case of Samoa, that monetary impulses are transmitted to the real sector via the money supply channel as opposed to interest rates. Open market operations of its central bank-backed bills influence commercial bank reserves, which consequently affect levels of lending and money supply. Simultaneously, commercial banks will consider asset transformation in their balance sheets, changes to bank credit and interest rates and exchange rates, which filter through to output and prices. A similar transmission is likely to apply to the Solomon Islands with the recent developments in the Bokolo Bills auction market and the permission for the Solomon Island National Provident Fund (NPF) to invest funds abroad. Furthermore, interbank lending is fairly non-existent because of exceptionally high levels of excess liquidity. In the forthcoming paper by Samani *et al.* (2014), they estimate that excess liquidity at the end of 2012 witnessed another record high reaching $1,251 million, a 29% increase on the same period in 2011. Growth continues to be supported by donor aid inflows and export earnings. Until this is tackled, conditions for interbank lending remain less than adequate for effective interest rate policy.

We also choose to include an exchange variable, ER. This is because the Solomon Islands typifies the exchange rate policy of many Pacific countries by maintaining a de facto peg to the US dollar, with the exception of the last quarter of 2012, where policy shifted to an invoice-basket of currencies within a narrow ±1% band to a set base rate. In addition to this, despite continued liberalisation of exchange controls set by the CBSI over the post ethnic tension period, their operations mean that perfect asset substitution and perfect capital mobility do not exist. The importance of the exchange

[2] The use of M1 over M2 is based on the argument that the role of holding of liquid assets in a developing country plays a much larger role in the transmission of monetary policy, (see Haut *et al.*. 2003).

rate rests mainly on it being an instrument to ensure the competitiveness of exports and the accumulation of foreign reserves driven by the country's high import dependency. Hence, the exchange rate is likely to be an important monetary policy instrument through this transmission.

The inclusions of the lending rate, IR, and of private sector credit, PSC, represent intermediate variables to proxy asset transformation in commercial bank balance sheets as well as an indicator for changes in aggregate demand.

Finally, inflation, denoted by CPI, and real output, denoted by RGDP, are included to represent the target variables in our monetary policy transmission mechanism. This is consistent with other empirical studies. It should also be noted that we do not use a variable to capture the asset price channel. However, this is not uncommon in studies of developing countries and specifically for the Solomon Islands where the opportunities to hold financial assets are constrained by the infancy of non-bank financial sector institutions (Jayaraman and Choong, 2010). Furthermore, despite the encouraging developments in the government securities market in recent years in the Solomon Islands, characterised by the healthy participation of tenders by the public in the auctioned treasury bills market, the ability to meet persistent oversubscription continues to be mired by the Government's past record of debt defaults and a more prudent approach to debt financing enshrined in the Honiara Club Agreement in 2005.

In order to explore how monetary policy shocks affect prices and output in the economy, we employ a vector autoregressive (VAR) methodology, which has been increasingly adopted in recent empirical studies. VAR models capture the evolution and the interdependencies between multiple time series by treating all variables symmetrically. This is achieved by including an equation for each variable to explain its evolution based on its own lags and the lags of all the other variables in the model.

3.2. ADF Unit Root Test

The Augmented Dickey and Fuller (1979, 1981) test is based on the following regression model:

$$\Delta y_t = \kappa + \alpha y_{t-1} + \beta_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \quad (1)$$

Eq. (1) tests for a unit root in y_t, where y consists of each of the six variables in our model, t=1,…,T is an index of time, Δy_{t-j} is the lagged first differences to accommodate serial correlation in the errors, ε_t. Eq. (1) tests the null of a unit root against a trend stationary alternative. The null and the alternate hypotheses for a unit root in y_t are: $H_0 : \alpha = 0$ and $H_1 : \alpha < 0$. To select the lag length (k), we use the '*t*-sig' approach proposed by Hall (1994).

4. Empirical Analysis

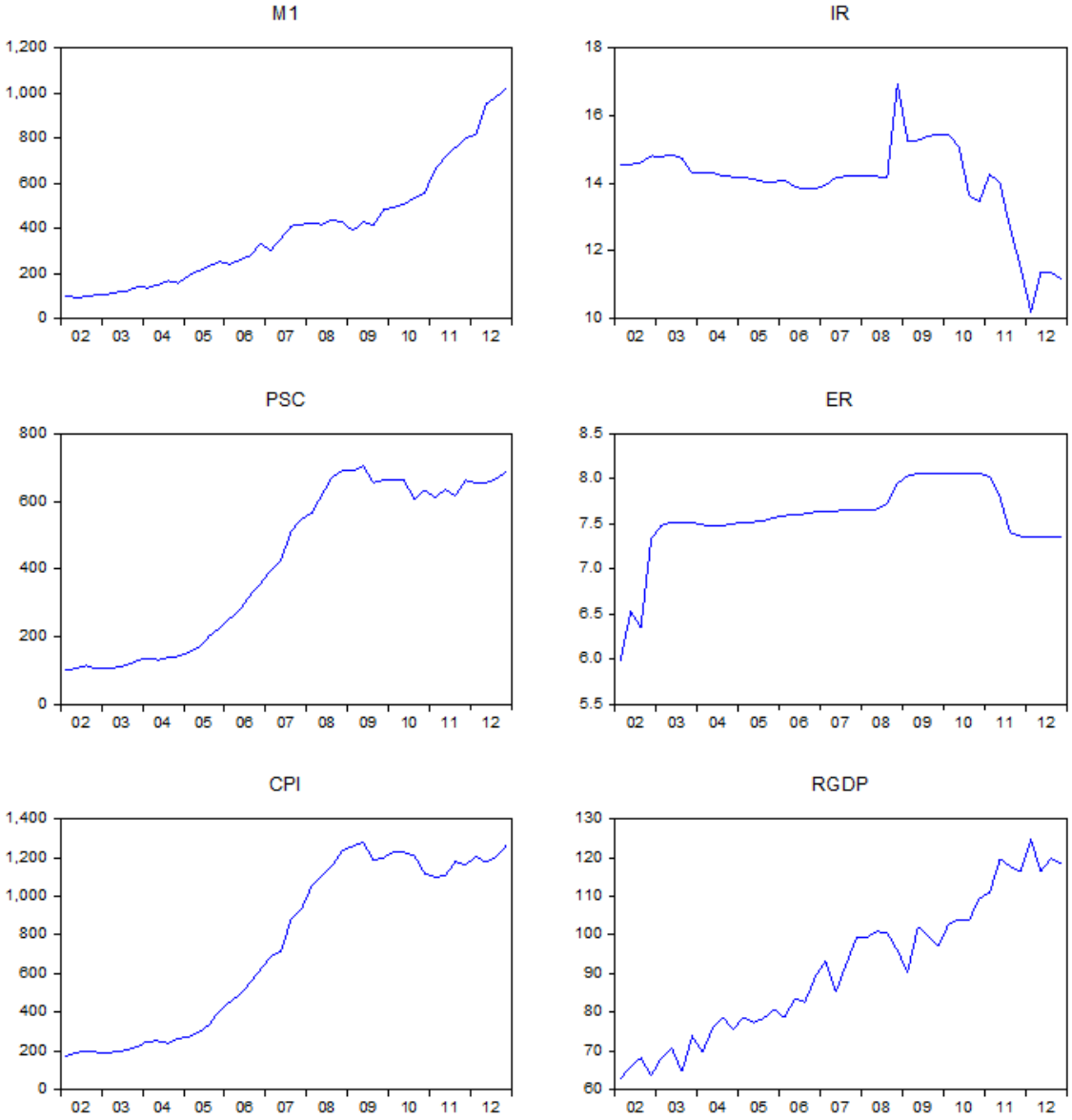
4.1. Data

This study uses quarterly data for the period 2002Q1 to 2012Q4 covering an 11-year time period. The choice of the sample period is dictated by the availability of data while the rationale for using a quarterly frequency as opposed to annual data was to ensure reasonable number of observations for time-series econometric modelling as well as being the preferred frequency for monitoring and reporting procedures within the CBSI and for timely monetary policy-making.

With the exception of the lending rate, all data series are converted into natural log form for ease of interpretation. The Honiara Consumer Price Index, with a 2005Q4 base year, is compiled by the Solomon Islands National Statistics Office, to measure changes in the general price level of the basket of goods and services. All other data have been sourced from the CBSI. It should be noted that owing to data limitations and in the absence of quarterly GDP data, annual real GDP has been decomposed into quarterly estimates using the Chow-Lin (1971) procedure.

We plot each of the six variables in our data set in Figure 1. Two observations are worth noting. First, we notice that, in broad terms, $\mathrm{M1}$ and RGDP display upward trends, while PSC and CPI also follow suit. However, the flattening of PSC and CPI from 2009 onwards reflects the delayed effects of the global financial crisis on the Solomon Islands. On the other hand, IR exhibited a relatively flat time series until the Global Financial Crisis when lending rates spiked before steadily declining from 2010 onwards. ER reflects the various decisions taken by the CBSI concerning the exchange rate policy, as explained in Section 2.

Figure 1: A plot of the data series, 2002Q1 – 2012Q4



Source: Authors' own plot

Selected descriptive statistics are presented in Table 4 on a quarterly basis. Over the time series, the average value of M1 was SBD$391 million, the mean nominal bilateral exchange rate, ER, stood at SBD$7.56 per USD, the average domestic lending rate, IR, at 14.04% and private sector credit, PSC, averaged SBD$415 million over the same period. Meanwhile, the Consumer Price Index, CPI, witnessed an average index value of 748 points and the average RGDP stood at SBD$91 million.

Table 4
Selected descriptive statistics

	M1	ER	IR	PSC	CPI	RGDP
Mean	391.1720	7.5625	14.0434	415.3148	747.9070	91.0730
Median	371.9950	7.5800	14.2050	468.9650	799.9100	91.3000
Maximum	1024.4600	8.0600	16.9600	704.1100	1279.7000	124.6500
Minimum	93.8300	5.9700	10.2000	100.0000	173.2600	62.8500
Std. Dev.	257.7682	0.4273	1.2579	240.2376	438.7027	18.0164

Source: Author's own calculation

4.2. Unit root test

The aim of this section is to assess the integrational properties of the data series, namely $\mathrm{M1}$, ER, $\mathrm{IR}, \mathrm{PSC}, \mathrm{CPI}$ and RGDP. First, we use a conventional test, namely the ADF (1979, 1981) test, to examine the null hypothesis of a unit root against the alternative hypothesis that the series is trend stationary. The results of the unit root test are presented in Table 5.

Table 5
ADF unit root test results

	Level	First difference
$ln\,\mathrm{M1}$	-0.1473 [0]	-8.4874***[0]
$ln\,\mathrm{ER}$	-3.6192*** [0]	-7.5007***[1]
IR	-1.1196 [1]	-7.2977 ***[0]
$ln\,\mathrm{PSC}$	-1.2011 [1]	-2.2624 [1]
$ln\,\mathrm{CPI}$	-1.2465 [1]	-2.6526**[0]
$ln\,\mathrm{RGDP}$	-0.6262 [1]	-8.2483***[0]

Source: Authors' own calculations.
Notes: The ADF critical values, based on Mackinnon are 2.604, 2.933,and 3.597, at the 10%, 5% and 1% levels, respectively. The optimal lag length for each autoregressive process of the ADF test is determined by the Schwartz Info Criterion (SIC) and presented in [].
, * denote statistical significance at 5% and 1% levels, respectively and Δ denotes the first difference of the variable.

The results are as follows. We find that for $\mathrm{M1}$, $\mathrm{IR}, \mathrm{PSC}, \mathrm{CPI}$ and RGDP, we cannot reject the null hypothesis in the level form. However, we can reject ER at the 1% level. In the first difference of the levels variables, we can reject the null hypothesis at the 1% level in all variables with the exception of the first difference of PSC. Since PSC is $I(2)$, we exclude the variable from further analysis. Furthermore, although we find that $\mathrm{M1}$, IR, CPI and RGDP are all $I(1)$, we also witness ER to be $I(0)$. Hence, variables are different in nature, suggesting that there is no long-run relationship

between the variables. We now proceed to the variance decomposition and impulse response analyses.

4.3. Variance decomposition

In this section, we employ an unrestricted VAR model for purposes of variance decomposition and impulse response analyses. We explore the relative strengths of the various channels through which monetary and exchange rate pulses are transmitted to our target variables, inflation and output. Variance decomposition indicates the magnitude of the fluctuations in a given variable contributed to by different shocks. We calculate the variance decomposition at forecast horizons of 1 through 10 quarters, where 1-4 quarters represents the short-run and 5-10 quarters represents the medium-run. The variables entered are in the following order starting with the policy variables, followed by the intermediate variable, and then the target variables, that is, $\mathrm{M1}$, IR, ER, CPI and RGDP. Table 6 presents the findings for RGDP.

Table 6
Variance decomposition

Variance Decomposition of $ln\mathrm{RGDP}$:						
Period	S.E.	$ln\mathrm{M1}$	IR	$ln\mathrm{ER}$	$ln\mathrm{CPI}$	$ln\mathrm{RGDP}$
1	0.0422	1.2619	7.3181	7.6339	0.2212	83.5649
2	0.0449	3.7260	11.2544	8.2296	2.5122	74.2779
3	0.0473	6.3334	13.7748	8.3100	4.6817	66.9001
4	0.0496	8.9558	15.8430	7.9563	6.3491	60.8958
5	0.0518	11.6057	17.7034	7.4748	7.5503	55.6659
6	0.0542	14.3174	19.4101	6.9764	8.3404	50.9558
7	0.0566	17.1182	20.9664	6.4987	8.7771	46.6396
8	0.0592	20.0211	22.3642	6.0551	8.9171	42.6425
9	0.0620	23.0239	23.5950	5.6506	8.8147	38.9159
10	0.0650	26.1120	24.6528	5.2868	8.5210	35.4274

Source: Authors' own calculations.
Cholesky Ordering:$ln\mathrm{M1}$ IR $ln\mathrm{ER}$ $ln\mathrm{CPI}$ $ln\mathrm{RGDP}$

After one quarter, we find that real output, in the Solomon Islands is sensitive to its own shocks, explaining approximately 84% of the variation in real output. The exchange rate and the lending rate explain about 7% each, while money supply and the inflation make negligible contributions towards explaining real output. After one year, real output remains most sensitive to its own shocks, while

the lending rate explains approximately 16% of the variation. The rest of the variables explain less than 10% of real output. After two years, we find that money supply and the lending rate account for 50% of the variation in real output while inflation accounts for another 9% by this time. We now look at the Table 7, which presents the findings for CPI.

Table 7
Variance decomposition

Variance Decomposition of lnCPI:						
Period	S.E.	lnM1	IR	lnER	lnCPI	lnRGDP
1	0.0640	2.4487	0.4892	7.4487	89.6134	0.0000
2	0.0933	3.6830	2.9514	5.7291	87.2070	0.4295
3	0.1160	4.5123	4.6740	5.0624	85.1481	0.6032
4	0.1348	5.1026	5.7567	4.7320	83.7218	0.6868
5	0.1509	5.5596	6.4275	4.5456	82.7319	0.7354
6	0.1650	5.9427	6.8415	4.4329	82.0152	0.7677
7	0.1776	6.2859	7.0916	4.3628	81.4685	0.7911
8	0.1890	6.6092	7.2330	4.3196	81.0289	0.8094
9	0.1993	6.9253	7.2988	4.2943	80.6572	0.8243
10	0.2089	7.2428	7.3099	4.2820	80.3283	0.8370

Source: Authors' own calculations.
Cholesky Ordering: lnM1 IR lnER lnCPI lnRGDP

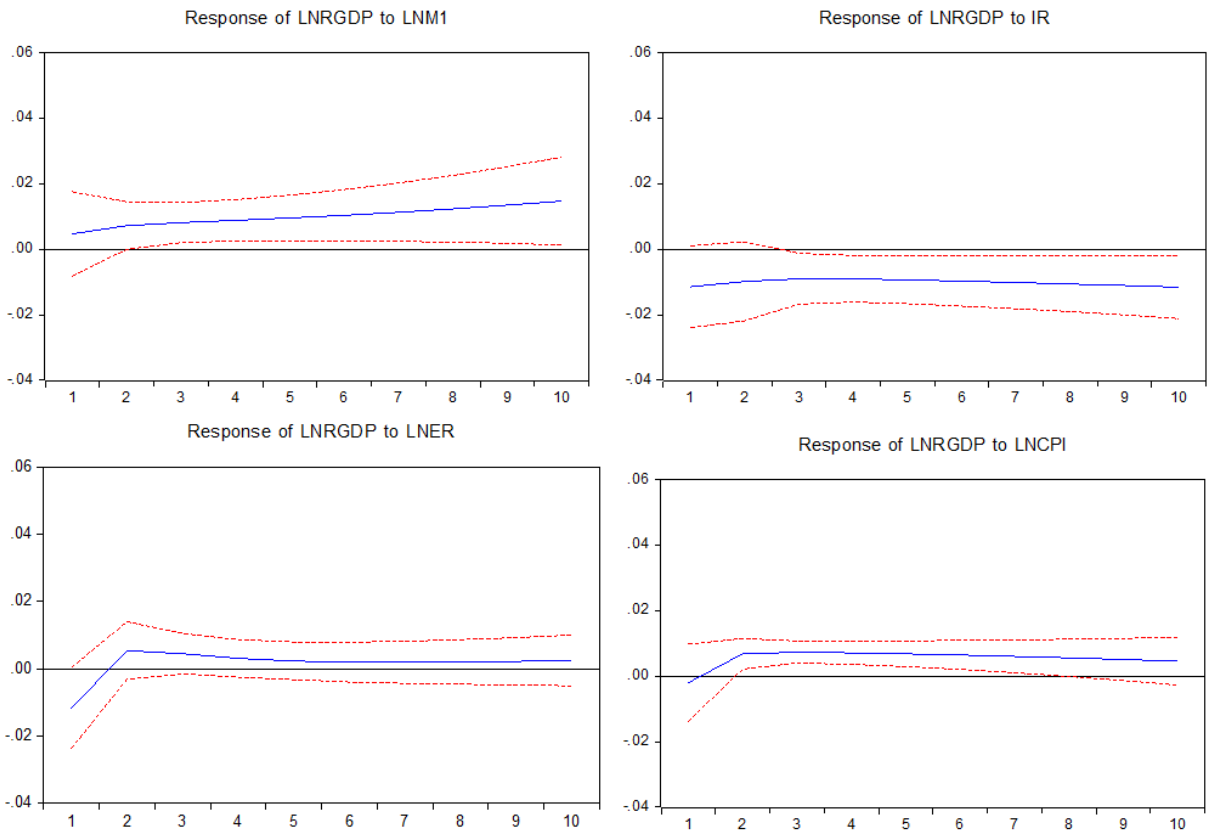
We find that after one quarter, inflation is mainly explained by its own shocks. Money supply, lending rate, and real output shocks provide negligible explanations while an exchange rate shock explains only around 7% of the variation in the inflation. After one year, the contributions of the shocks to inflation change very little. After two years, inflation still explains about 80% of its own variation whilst money supply and the lending rate each explain about 7% of the variation and the exchange rate starts to decline to around 4% of the variation.

4.4. Impulse response analysis

The aim of this section is to trace the responsiveness of the dependent variable when there is a one standard deviation (SD) innovation or a shock to the economy through each of the explanatory variables in our system. In this case, the time taken for CPI and RGDP to respond to these shocks is of importance for policy decisions.

Given the functional form of the model, the impulse response functions trace a growth rate relative to the base period when the shock occurred as well as being able to indicate the direction of the effect, that is, whether the effect is positive or negative. For investigating the impulse response function by the Choleski decomposition, we adopt the same ordering of variables as for the variance decomposition analysis. The results for RGDP and CPI are illustrated in Figures 2 and 3, respectively.

Figure 2: Response of real output to shocks

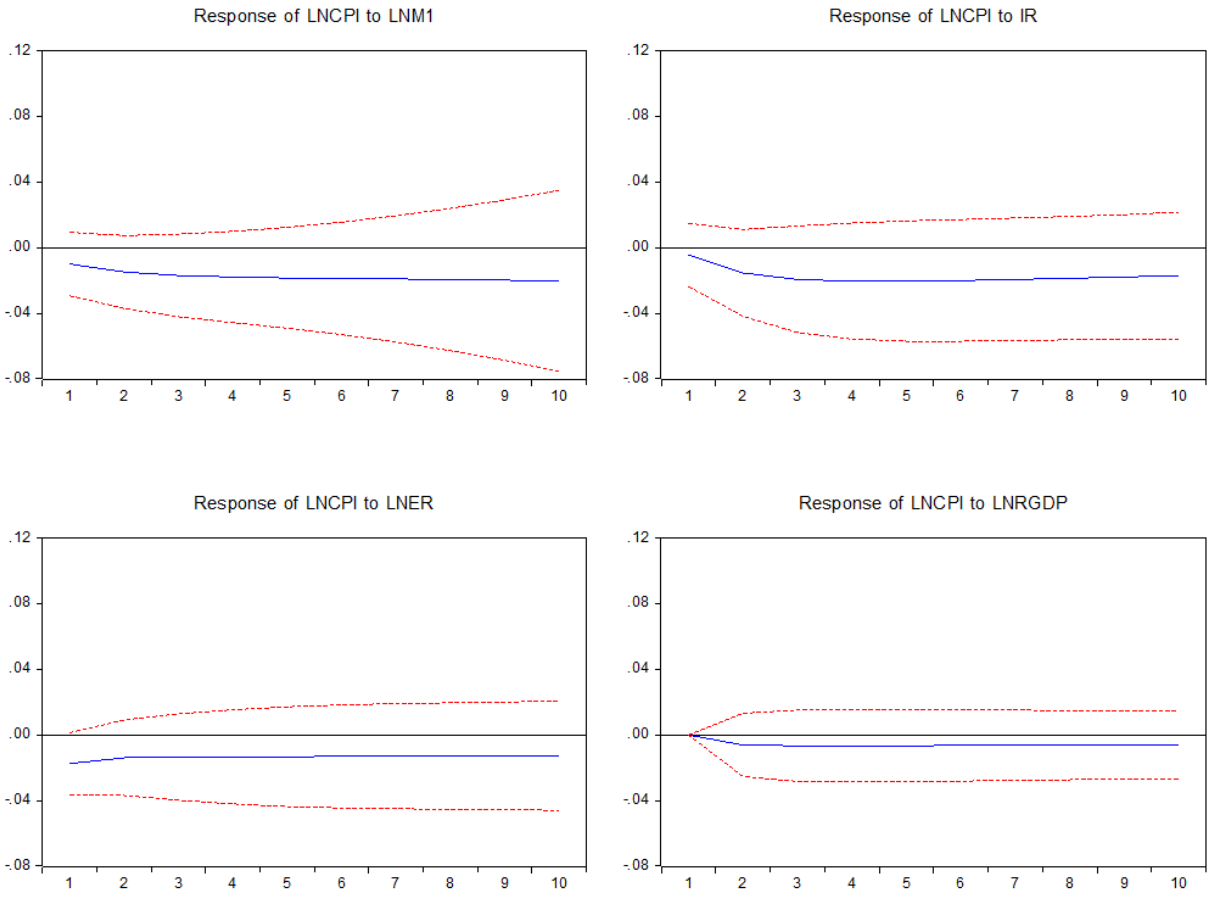


Source: Authors' own plot

Figure 2 shows that a one SD innovation in money supply is transmitted to real output within the first quarter, taking six months for the economy to fully absorb the impact. This is likely to reflect the delay from holding money to spending money, which eventually translates to economic growth. All other variables display a similar outcome such that a one SD innovation in the nominal bilateral exchange rate, the lending rate, or inflation impacts real output within the first quarter and are fully absorbed by the second quarter.

Figure 3 illustrates the responses of the inflation to shocks in money supply, interest rate, nominal bilateral exchange rate and real output.

Figure 3: Responses of inflation to shocks



Source: Authors' own plot

From the results, we observe that monetary and exchange rate shocks matter to inflation; one SD innovation in M1 and ER affects inflation in the first quarter and fully absorbed within six months. A similar case exists in shocks in the lending rate. Meanwhile, a shock in real output affects inflation after two quarters and is fully absorbed within six months.

5. Conclusion and policy implications

The monetary policy transmission mechanism is well documented for developed economies and many developing countries. The goal of this paper was to understand the impact of monetary policy shocks, via money supply and the exchange rate, on inflation and real output in the Solomon Islands during the period 2002-2012.

Our findings are: 1) inflation is mainly explained by its own shocks accounting for 89% after the first quarter; 2) Explaining 7% of the variation in inflation, exchange rate shocks exhibit more influence than money supply shocks, which we conclude to be negligible in the short-term. After one year, the contributions of the shocks remain the same; 2) a similar picture emerges for real output such that it is sensitive to its own shocks, explaining approximately 84% of the variation in real output after the first quarter. After one year, real output remains most sensitive to its own shocks with the lending rate explaining approximately 16% of the variation in real output; 3) As well as lending rate shocks, monetary and exchange rate shocks have relatively short and temporary effects on inflation impacting in the first quarter and fully absorbed within six months of the shock. Shocks in real output are slightly more lagged, impacting inflation in the second quarter and are fully absorbed within six months; and 4) shocks in money supply, the bilateral exchange rate, lending rate, and inflation impact real output within the first quarter and are fully absorbed after six months.

The policy implication emerging from our study is that given that the transmission from monetary and exchange rate shocks to inflation are relatively weak, typical for small islands states that have underdeveloped financial systems and a high dependency on food and fuel imports, the CBSI should continue to introduce financial regulation that promotes competition in the financial system and enhances financial sector development, as argued by Cottarelli and Kourelis (1994) and Kareken (1984). More can also be done to remove the large amounts of excess liquidity to encourage the advancement of an interbank lending market.

However, as with all empirical studies, considerations regarding data limitations require the reader to proceed with some caution. To improve the analysis, work can be carried out to extend the time series through applying structural breaks to take account of the period during the ethnic tension. Further research into understanding the individual channels within the Solomon Islands' transmission mechanism should also be conducted to help improve the assumptions underlying the analysis.

Appendix A: Solomon Islands monetary policy instruments (2002-2012)

Policy Instrument	Description
Cash Reserve Requirement	From 1st July 2011, CBSI formally established the monetary policy tool known as the Cash Reserve Requirement (CRR) from a prudential monitoring tool previously known as the Liquid Asset Ratio (LAR). The CRR is set as an amount determinable by multiplying the average level of deposits liabilities by the reserve ratio for each working day. As of November 2008, the assets eligible for meeting the requirement were redefined to solely cash held by commercial banks in their call accounts at the CBSI. The reserve ratio has remained at 7.5% since May 1999.
Liquid Asset Ratio	Since the separation of the CRR, the LAR is a requirement for commercial banks to maintain an average balance of liquid assets to total deposits liabilities for each working day not less than 7.5%, for prudential monitoring purposes. Cash and call balance deposits held with CBSI were considered as liquid assets. After November 2008, the liquid asset definition was altered to include only the call account deposits of commercial banks with CBSI. The deposit liabilities that are eligible for the purpose of this requirement includes: 1. Demand deposits; 2. Saving deposits; 3. Time deposits; 4. Non-resident deposits; and 5. Resident deposits in foreign currency.
Open Market Operations	<u>Auction Treasury Bills</u> This was introduced in early 1980's with the maturity of 7, 14, 28 and 56 days. The sales were discontinued in mid-1995 and continued operation in 1999 with a cap of $30 million facilitates by CBSI. In 2010, the cap increases to $40 million as well as the maturities were now 28, 56 and 182 days. CBSI continues to facilities these instruments while the Government still meets the cost. <u>Bokolo Deposit Facility</u> This facility was introduced in June 2008 by CBSI mainly to absorb the excess liquidity in the banking system. The maturities fixed terms were 12, 18 and 24 months with interest rates of 4%, 4.25%, and 4.5%. This sale was closed in June 2010 due to the introduction of the Auction Bokolo Bills facility. <u>Auction Bokolo Bills Facility</u> CBSI Auction Bokolo bill facility was re-introduced in June 2008 with a short-term maturity of 28 days. This facility was developed as one of the monetary policy tools to absorb the excess liquidity in the banking system. The total stock held by the commercial banks stood at the end of 2012 at SBD500 million at 0.47%.
Standing Facilities	<u>Primary Credit Facility</u> This facility is intended to support the source financing to commercial banks deemed by CBSI to be in a sound financial condition. This is an overnight basis and the interest rate is set at a premium above the CBSI policy rate. An extension for this facility is possible under a standard reverse repo transaction. <u>Secondary Credit Facility</u> The CBSI will extend secondary credit facility ranging from overnight to up to five businesses days as a supportive source of financing to commercial banks. Requests for extension of credit under this facility are at the initiative of commercial banks. This facility is through a standard reverse repo transaction and the interest rate is set above the CBSI policy rate.
Emergency Liquidity Assistance Facility	Effective as of 1st February 2011, this facility is mainly intended to extend credit by CBSI in exceptional circumstances as a supporting source of financing to the financial institution, if judged by CBSI to be solvent and provides adequate collateral. Granting such assistance is mainly to improve the liquidity position of the applying financial institution. The maturity term is no more than 30 days. The interest rate applied is set a specific premium about the weighted average rate on the commercial banks loans and advances.
Exchange Rate	CBSI uses the fixed exchange rate arrangement, where the value of domestic currency is linked to the trade–weighted basket of major currencies linked to the stabilisation against the USD. From the period 2002 – 2011, adjustments were implemented to manage a stable bilateral exchange rate with the SBD against USD. In 2002, a 25% depreciation was announced but it was reversed the next day. In June 2011, a 5% revaluation occurred to keep the real exchange rate stable. From 1st October 2012, the value of the domestic currency (SBD) was linked to the invoice-basket of currencies free to move within a narrow band of ±1% of the base rate.

Source: Authors' own compilation, various CBSI Annual Reports

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