Estimating Alternative Monetary Policy Rules for Sri Lanka

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INTRODUCTION

The debate on whether monetary policy should be conducted according to predetermined rules or according to the discretion of policymakers continues to engage both policymakers and academics. In recent times, central banks have increasingly moved towards rule based monetary policy frameworks such as inflation targeting that requires greater discipline and accountability. A good monetary policy rule provides a useful starting point for central bank deliberations. Moreover, a central bank can benefit from having a collection of alternative rules that have optimal properties in a variety of models. This in turn helps to deal with the uncertainty inherent in the monetary policy process (Feldstein, 1999).

Two monetary policy rules have been proposed in the literature. The policy rule proposed by McCallum (1987, 1993) has nominal income growth as its target and the monetary base as the instrument. Adopting a different approach, Taylor (1993) proposed an interest rate based rule, which specifies the setting of the nominal interest rate in response to observed or predicted values of the inflation gap and

the output gap[1]. In proposing these rules, McCallum (1987) and Taylor (1993) attempt to improve the credibility of monetary policy decision making, thereby avoiding inefficiencies of time inconsistency associated with discretionary policies while reducing uncertainty.

A substantial amount of work has been carried out empirically to test the operability of the alternative monetary policy rules for advanced economies. Reflecting improvements in the institutional frameworks of monetary policy regimes there is increasing evidence of the operation of these rules in emerging economies.

In this paper, we seek to characterize monetary policy decision making in Sri Lanka using alternative monetary policy rules. An empirical analysis is conducted to evaluate the operational performance of the McCallum rule, the Taylor rule, and their hybrid variants in the Sri Lankan context, for the period 1996 to 2013. As the objectives of monetary policy and monetary operations of the Central Bank have changed over the period of analysis, this research sheds light on the operational feasibility of monetary policy rules in the Sri Lankan context and how it has changed with the evolution of the monetary policy framework. However, the paper only looks at the past response of policymakers to an identified set of macroeconomic variables. Estimating the optimal policy response to changes in macroeconomic variables is an area for future research.

Section 2 provides an overview of the theoretical and empirical literature relating to monetary policy rules and in section 3 the monetary policy framework in Sri Lanka and its evolution over time are discussed. Section 4 provides a discussion of the methodology adopted and sets out alternative specifications of the monetary policy reaction functions. In section 5 the data used in the estimation are described and the results from the empirical analysis are presented

[1] The inflation gap is difference between actual inflation (or inflation expectations) and the desired level of inflation. The output gap is measured as the gap between actual output and potential output expressed as a ratio of potential output.

and discussed. The final section concludes and discusses some policy implications and areas for further research.

LITERATURE REVIEW

One of the earliest forms of a rule was the Friedman rule (Friedman, 1960), which proposed that the central bank maintain a constant rate of growth of money supply equivalent to the rate of growth of real GDP. The advantage of this constant money growth rule was that only information regarding the economy's natural growth of output was required to operationalize the rule, provided velocity did not exhibit a secular trend. However, high inflation and a breakdown in the stability of the velocity of money with the developments in the financial sector made the Friedman rule difficult to operationalize.

This led to the development of two separate formulations of monetary policy rules which were simple and easy to operationalize. In the McCallum rule the monetary authority sets the growth rate of the monetary base in a feedback rule for nominal GDP in the form:

$$\Delta b_t = \Delta x^* - \Delta v_t + \alpha(\Delta x^* - \Delta x_{t-1}) \quad (1)$$

where Δb_t is the rate of growth of the monetary base; Δv_t is the moving average rate of growth of base velocity averaged over previous four years; Δx_t is the rate of growth of nominal GDP and Δx^* is the targeted rate of growth of nominal GDP, α is the feedback coefficient informing how quickly deviations of output from its target are offset by the central bank. In the original McCallum rule for the US, $\Delta x^*$was assumed to be 5 percent which was the sum of the target inflation rate (2 percent), and the long-run average rate of growth of real GDP (3 percent). Since there could be changes to velocity from year to year due to technological and regulatory changes, $\Delta v_t$was taken as an average over the past four years.

In essence, base money growth must be equal to the targeted growth of nominal GDP. There is a proportional feedback to the growth rate of base money from the gap between nominal GDP growth and its targeted rate. Therefore, if the relationship between the monetary base and nominal income changes (for example on account of financial innovations), the growth rate of the monetary base must be adjusted accordingly.

The McCallum rule prefers nominal GDP over monetary aggregates such as M_1 or M_2as the monetary authority's principal target variable. Under nominal GDP targeting, monetary policy would adjust to offset disturbances to aggregate demand. Another important feature of the nominal GDP targeting is that it would help the policymaker balance the goals of stable output growth and inflation in response to aggregate supply disturbance (Clark, 1994). Furthermore, nominal GDP is preferred to real GDP as the policy target because a central bank cannot control or predict with accuracy how nominal GDP growth is dividing between quarters and between real growth and inflation (McCallum, 1988).

On the other hand, Taylor (1993) proposed an interest rate based rule, which specifies setting of a nominal interest rate instrument in response to observed or predicted values of the inflation gap and the output gap. The original specification of the Taylor rule was as follows:

$$i_t = \pi^* + r^* + \varphi(\pi_t - \pi^*) + \gamma(y_t - y^*)(2)$$

where i_t is the nominal policy interest rate, π_t is the inflation rate, π^* is the targeted or desired rate of inflation, r^* is the average equilibrium real interest rate, y_t is the actual output and y^* is the estimated potential output level. In the original version of the rule for the US economy, Taylor set the average real rate of interest to 2 per cent and also assumed that the targeted rate of inflation was 2 per cent. Further in the original specification, the adjustment coefficients φ and γ, were both set at 0.5 reflecting the behaviour of the Federal

Reserve bank during the late 1980s and early 1990s. Subsequent applications of the Taylor rule have modified or extended the specification in several ways. A lag of the interest rate(i_t)has been included to reflect the interest rate smoothing behavior of many central banks (Clarida, Gali and Gerlter, 2000).Further, exchange rate smoothing has been found to be important particularly in the case of emerging economies (Mohanty and Klau, 2004).

Determining whether the specification of a monetary policy rule should be forward looking, backward looking or contemporaneous would depend on the time horizon adopted by the central bank as well as the identified lags in the transmission of monetary policy. Judd and Rudebusch (1998) and Rotemberg and Woodford (1999) found that backward looking specifications of the Taylor rule were relatively good approximations of optimal policy. In contrast, Clarida, Gali and Gerlter (1998) found that a monetary policy reaction function incorporating forward looking behaviour of agents was the more preferred specification in the case of the US, Japan and the UK.

When the two rules are compared, a major advantage of the McCallum rule over the Taylor rule is that the McCallum rule does not include unobservable variables such as the output gap and the real interest rate. The use of nominal income targeting avoids the need to measure unobservable variables such as the natural rate output (for the output gap) or the real interest rate as required by the Taylor rule (Orphanides, 2003).However, the McCallum rule has been less popular than the Taylor rule, primarily because central banks have been increasingly focusing on the interest rate instead of monetary base growth rates in designing policies (McCallum, 2002).

MONETARY POLICY FRAMEWORK IN SRI LANKA

The mandate of the Central Bank of Sri Lanka has evolved with the economic and financial developments in Sri Lanka as well as the

evolution of central banking around the world. In the Monetary Law Act No. 58 of 1949 (MLA), under which the Central Bank of Sri Lanka[2] was established, the Bank was mandated with multiple objectives of stabilizing the domestic monetary value and the exchange rate of the Sri Lanka rupee vis-à-vis foreign currencies, promoting a high level of production, employment and real income and encouraging and promoting the full development of the productive resources of the country. In 2002, an amendment to the MLA redefined the objectives of the Central Bank whereby the multiple objectives of the Central Bank were replaced with two objectives: economic and price stability and financial system stability.

Similarly the monetary policy framework, in which Sri Lanka has operated, as in the case of most other countries, has evolved over time. From its inception to the early 1980s the Central Bank adopted a dirigisme approach in managing the economy by imposing direct controls on credit and interest rates with a view to encourage identified sectors in the economy and impose strict exchange controls. The focus during this period was economic development even at the cost of high inflation. The liberalization of the economy in 1977 set the stage for the move away from direct instruments to more market oriented monetary policy instruments. The ascendance of Monetarist economics led to an increasing recognition of the long run relationship between monetary growth and inflation. In the 1980s the Central Bank formally adopted a monetary targeting policy framework. Under this policy framework the Central Bank seeks to achieve its final objectives, by conducting monetary policy so as to maintain reserve money, the Bank's operating target, at a level that is consistent with a desired growth of broad money, its intermediate target. The efficacy of this policy framework depends entirely on there being an identifiable relationship between money supply growth and inflation, which is econometrically determined by testing for the stability of the money demand function. The development of the financial system and financial innovations saw many central banks

[2] It was known as the Central Bank of Ceylon until 31 December 1985.

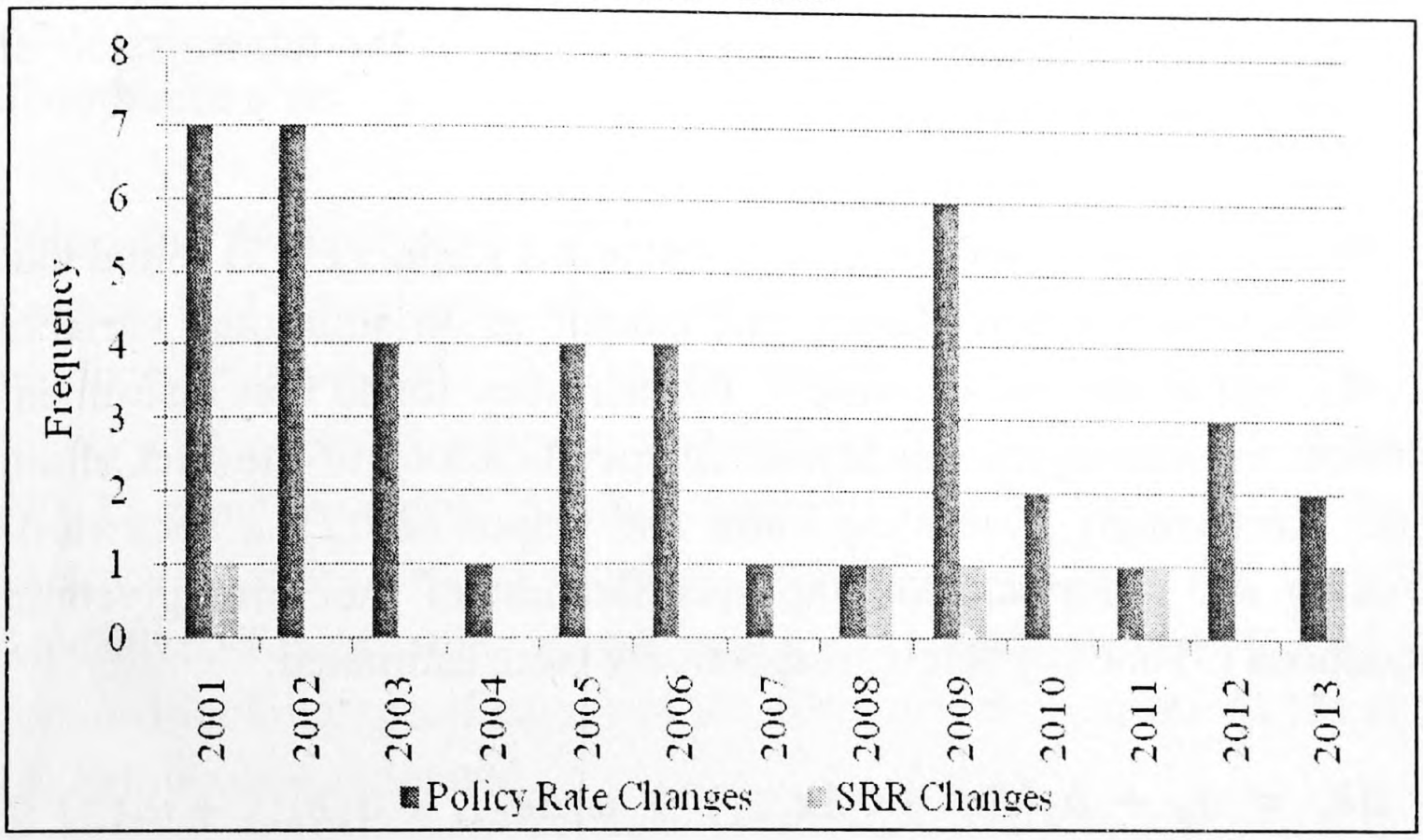
moving away from monetary targeting to inflation targeting policy frameworks. The Central Bank of Sri Lanka has also stated that it is gradually refining its policy framework towards an inflation targeting type monetary policy framework which does not depend on a strict relationship between money and inflation. With the shift from a crawling band exchange rate regime to a floating exchange rate system in January 2001, the role of the exchange rate for stabilization has reduced and reserve money became the nominal anchor of monetary policy.

In the conduct of monetary policy there has been a move away from direct instruments to more market oriented instruments with greater reliance placed on open market operations (OMO) as the main instrument of monetary policy. Although initially OMO were 'passive' in that the Central Bank offered unlimited repurchase (repo) and reverse repurchase (reverse repo) facilities to counterparties which they could avail at their discretion, to improve the conduct of monetary policy the Central Bank moved to a system of more active open market operations in March 2003. In this new system, monetary policy is conducted to maintain reserve money around a targeted level while ensuring that the short term interest rate is maintained at a level compatible with the target of reserve money (Wijesinghe, 2006). A key element of this new system was the establishment of an interest rate corridor formed by the lower bound of the overnight Repurchase (repo) rate and the upper bound of the overnight Reverse Repurchase (reverse repo) rate[3]. Monetary policy operations are conducted to maintain the overnight interest rate (call market rate) at around the middle of the corridor. With the move to more active open market operations the overnight call market rate and consequently the interest rate channel took on a more important role in the transmission of monetary policy. Although reserve money continues to be the operating target of monetary policy, policy interest rates and specifically the policy interest rate corridor are the

[3] The Repurchase rate and the Reverse Repurchase rate were renamed as the Standing Deposit Facility Rate (SDFR) and the Standing Lending Facility Rate (SLFR), respectively in January 2014.

main instruments used to signal the monetary policy stance of the Central Bank of Sri Lanka.

Figure 1: Frequency of Policy Interest Rate and SRR Changes 2000 - 2013



Estimating a monetary policy rule for Sri Lanka is not straightforward given the changes in the conduct of monetary policy. Although reserve money continues to be the target of monetary policy there has been a shift towards the use of the interest rate corridor to signal the stance of monetary policy. Further, with the developments in financial markets there has been an improvement in the transmission of policy rates to other interest rates further justifying the use of the interest rate as the policy instrument. However, difficulties arise in estimating a monetary policy rule for Sri Lanka as it requires measuring potential output which is unobserved and could change due to structural changes taking place in the economy.

METHODOLOGY

Several alternative specifications of the McCallum rule and the Taylor rule as well as hybrid variations of the rule were estimated for

Sri Lanka. In both Taylor and McCallum's formulation of monetary policy rules, the policy instrument was assumed to adjust to lagged or contemporaneous macroeconomic variables. Forward-looking versions of these rules were also evaluated where the policy instrument reacts to expected future behaviour of the respective macroeconomic variables to account for lags in the transmission of monetary policy.

With regard to the McCallum rule, Patra and Kapur (2012) found that the policy rule with exchange rate change as an additional variable works best in the Indian context. Further, they found that instrument smoothing was significant across all specifications of the McCallum rule. Accordingly, following Patra and Kapur (2012), a backward-looking and a forward-looking specification of the form given in equations (3) and (4) below, respectively were estimated:

$$\Delta b_t = a_0 + a_1(\Delta x^* - \Delta x_{t-1}) + a_2\Delta e_{t-1} + a_3 b_{t-1} + u_t (3)$$

$$\Delta b_t = a_0 + a_1(\Delta x^* - \Delta x_{t+1}) + a_2\Delta e_{t-1} + a_3 b_{t-1} + u_t (4)$$

where Δb_t is the rate of growth of the monetary base; Δx_t is the rate of growth of nominal GDP; Δx^* is the targeted rate of growth of nominal GDP;Δe_t is the change in the nominal exchange rate and $u_t$is a random disturbance term.

Following Perera and Jayawickrema (2013), three alternative specifications of the Taylor rule were estimated. Accordingly, a contemporaneous specification of the form given in equation (5), a backward looking specification of the form set out in equation (6) and a forward-looking version of the policy reaction function of the form set out in equation (7) were estimated.

$$i_t = b_0 + b_1(\pi_t - \pi^*) + b_2 ygap_t + b_3\Delta e_{t-1} + b_4 i_{t-1} + u_t (5)$$

$$i_t = b_0 + b_1(\pi_{t-1} - \pi^*) + b_2 ygap_{t-1} + b_3\Delta e_{t-1} + b_4 i_{t-1} + u_t (6)$$

$$i_t = b_0 + b_1(\pi_{t+1} - \pi^*) + b_2 ygap_{t+1} + b_3 \Delta e_{t-1} + b_4 i_{t-1} + u_t (7)$$

where i_t is the nominal policy interest rate, π_t is the inflation rate, π^* is the targeted or desired rate of inflation, $ygap_t$ is the output gap, $\Delta e_t$is the change in the nominal exchange rate and $u_t$is a random disturbance term.

Following the analysis by McCallum (2000), replacing the monetary base in McCallum rule with interest rate as the policy instrument produces a modified rule (hybrid McCallum-Taylor rule) that is highly co-integrated with the standard Taylor rule. Patra and Kapur (2012) provide strong support from the Indian context for both backward and forward looking specifications of the hybrid McCallum-Taylor rule. Accordingly, a backward-looking and a forward-looking specification of the form given in equations (8) and (9) below were estimated:

$$i_t = c_0 + c_1(\Delta x^* - \Delta x_{t-1}) + c_2 \Delta e_{t-1} + c_3 i_{t-1} + u_t (8)$$

$$i_t = c_0 + c_1(\Delta x^* - \Delta x_{t+1}) + c_2 \Delta e_{t-1} + c_3 i_{t-1} + u_t (9)$$

Hall and Mankiw (1994) defined a 'hybrid' target variable $h_t = [(\pi_t - \pi^*) + ygap_t]$ modifying the standard McCallum rule. This hybrid McCallum-Hall-Mankiw rule features responses to the same macroeconomic conditions as in the Taylor's rule but with a base instrument. Accordingly, following Patra and Kapur (2012), a contemporaneous specification of the form given in equation (10), a backward-looking specification of the form given in equation (11) and a forward-looking specification of the form given in equation (12) below were estimated.

$$\Delta b_t = d_0 + d_1[(\pi_t - \pi^*) + ygap_t] + d_2 \Delta e_{t-1} + d_3 b_{t-1} + u_t (10)$$

$$\Delta b_t = d_0 + d_1[(\pi_{t-1} - \pi^*) + ygap_{t-1}] + d_2 \Delta e_{t-1} + d_3 b_{t-1} + u_t (11)$$

$$\Delta b_t = d_0 + d_1[(\pi_{t+1} - \pi^*) + ygap_{t+1}] + d_2\Delta e_{t-1} + d_3 b_{t-1} + u_t (12)$$

Following Clarida, Gali and Gertler (1998, 2000), Generalised Method of Moments (GMM) estimation methodology was used for estimating equations with forward-looking specifications of the monetary policy rules. This is expected to account for possible endogeneity between variables. Estimation of contemporaneous and backward-looking specifications estimation was carried out using ordinary least squares (OLS) regressions.

DATA DESCRIPTION AND ESTIMATION RESULTS

Quarterly data for the period 1996 to 2013 was used for the analysis, as quarterly data for GDP is available only from 1996.In the estimation for the US, McCallum (2000) used the monetary base series computed by the Federal Reserve Bank of St. Louis which incorporates adjustments for changes in reserve requirements. Similarly, Patra and Kapur (2012) used reserve money adjusted for the cash reserve ratio (CRR) impact, in view of frequent changes in the CRR in the conduct of monetary policy in India. However, as the Central Bank of Sri Lanka does not publish a separate series of reserve money adjusted for the changes in Statutory Reserve Requirement (SRR), unadjusted reserve money was used for the analysis.

Nominal income growth was measured by the year-on-year growth of the quarterly GDP. With regard to specifying a nominal income growth target, several alternative approaches were described in literature. McCallum (1987) assumed the nominal income growth target for the United States to be 5 per cent per year. However, McCallum (2000) suggested the sum of the long-run average rate of growth of real GDP and the central bank's target inflation rate be considered as a target growth rate for the nominal GDP. Moreover, the constant trend growth rate assumption for nominal GDP may not hold for emerging countries. Therefore, following Patra and Kapur

(2012) a time-varying trend growth rate for nominal income was specified in line with McCallum (2000). Accordingly, the sum of seasonally adjusted real output passed through a Hodrick Prescott filter and the inflation target announced by the Central Bank, which is 5 per cent, was used to derive a time-varying trend growth rate of nominal income for Sri Lanka. Figure 2 depicts the year-on-year nominal income growth and the time-varying nominal income growth target computed for Sri Lanka.

Figure 1: Reserve Money and Reserve Money Growth (Y-o-Y)

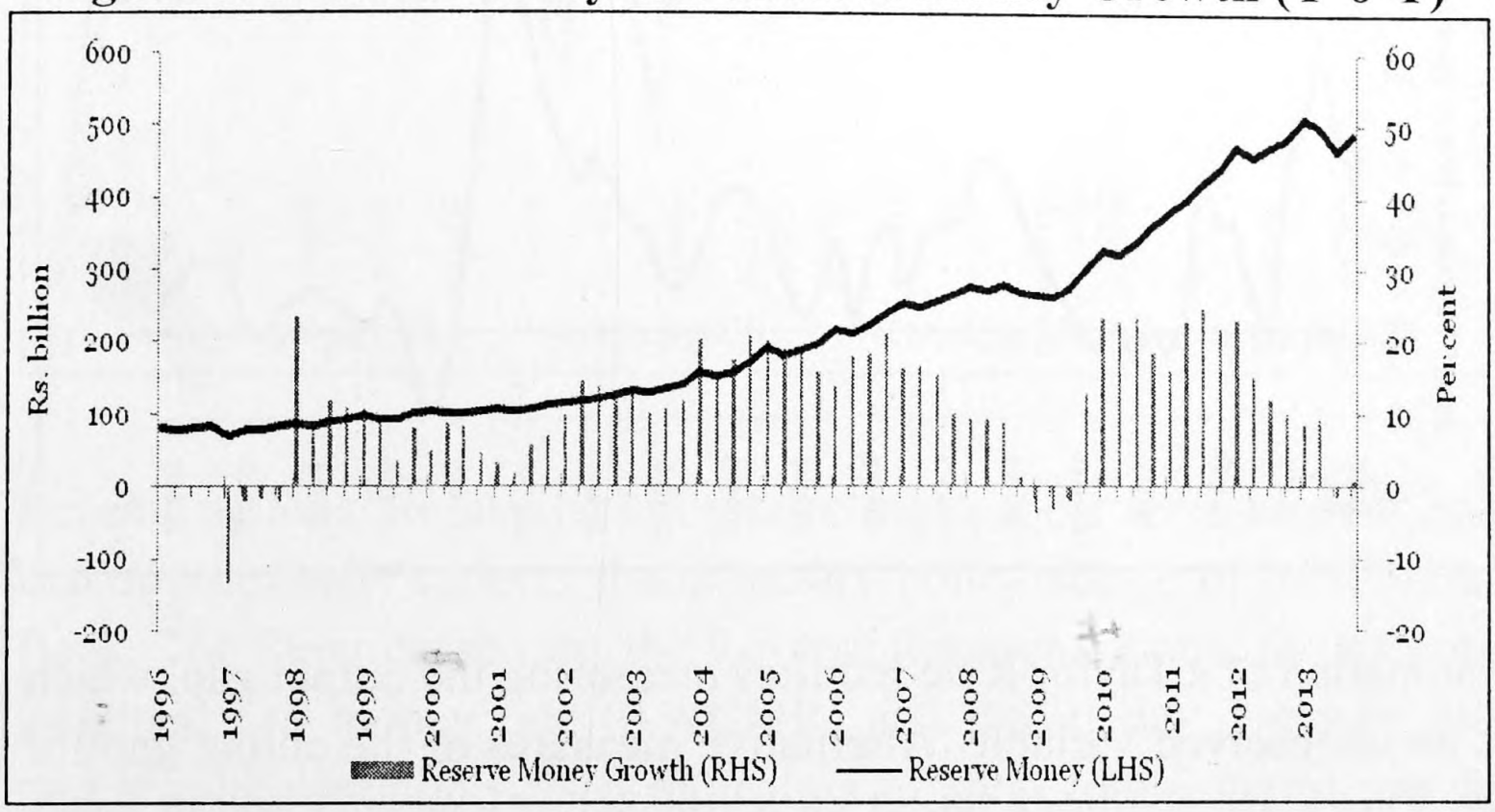
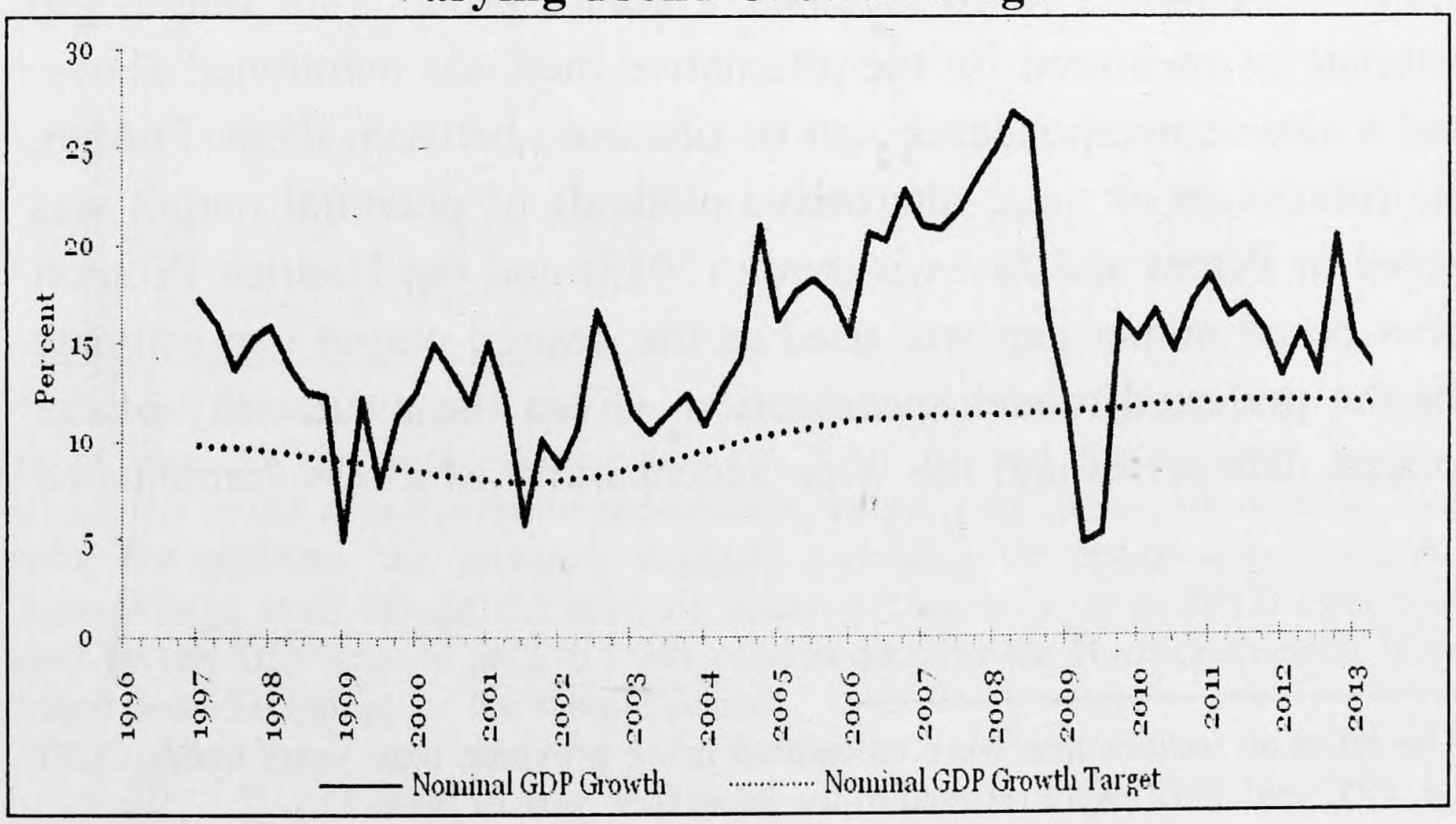
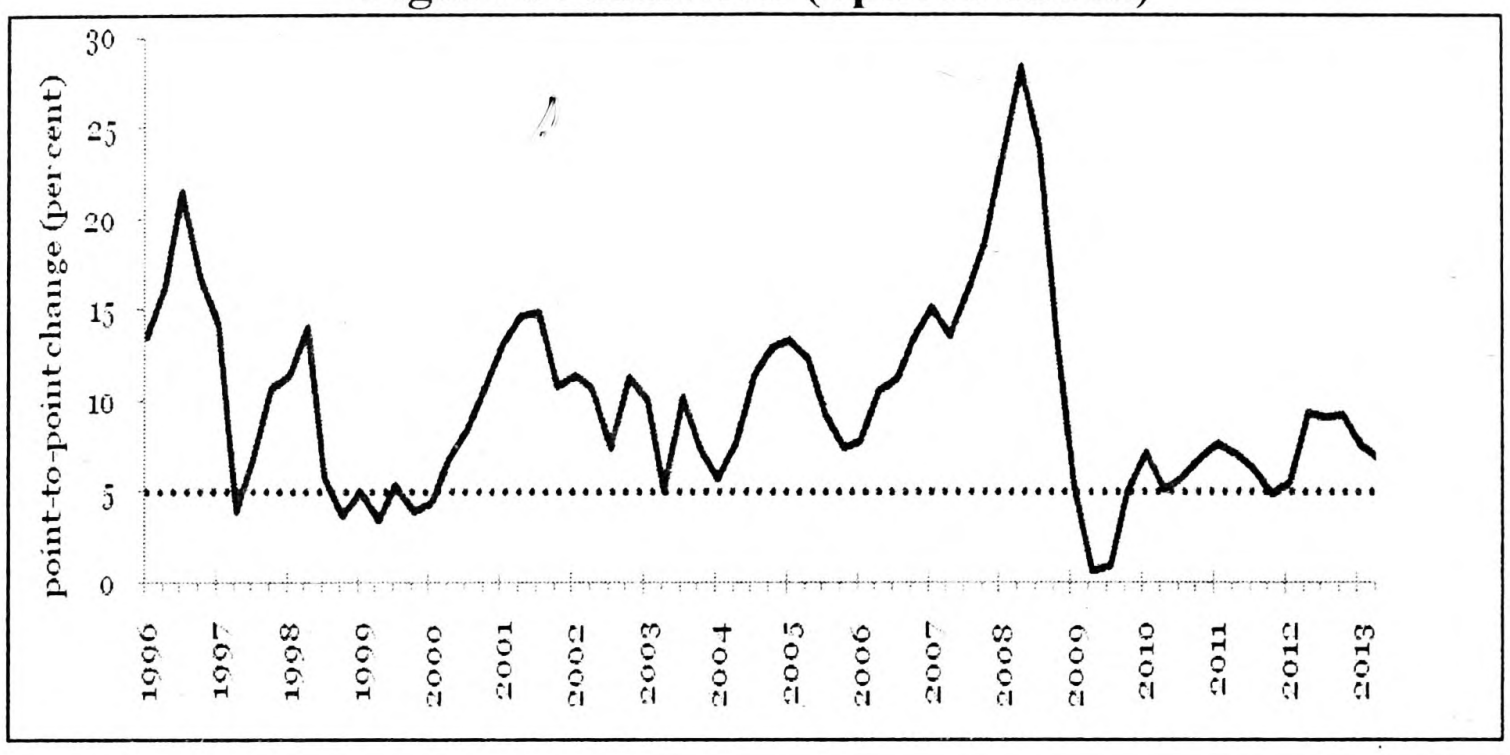


Figure 2: Deviation of Nominal Income Growth from a Time-Varying Trend Growth Target



In estimating the Taylor rule, the Colombo Consumer Price Index (CCPI)[4] was used as the measure of inflation due to its wide acceptability. Since the Central Bank of Sri Lanka has stated its desire to maintain inflation at mid-single digit levels over the medium term in its policy documents, the desired level of inflation was set at 5 per cent for the entire sample period.

Figure 3: Inflation (Spliced Index)

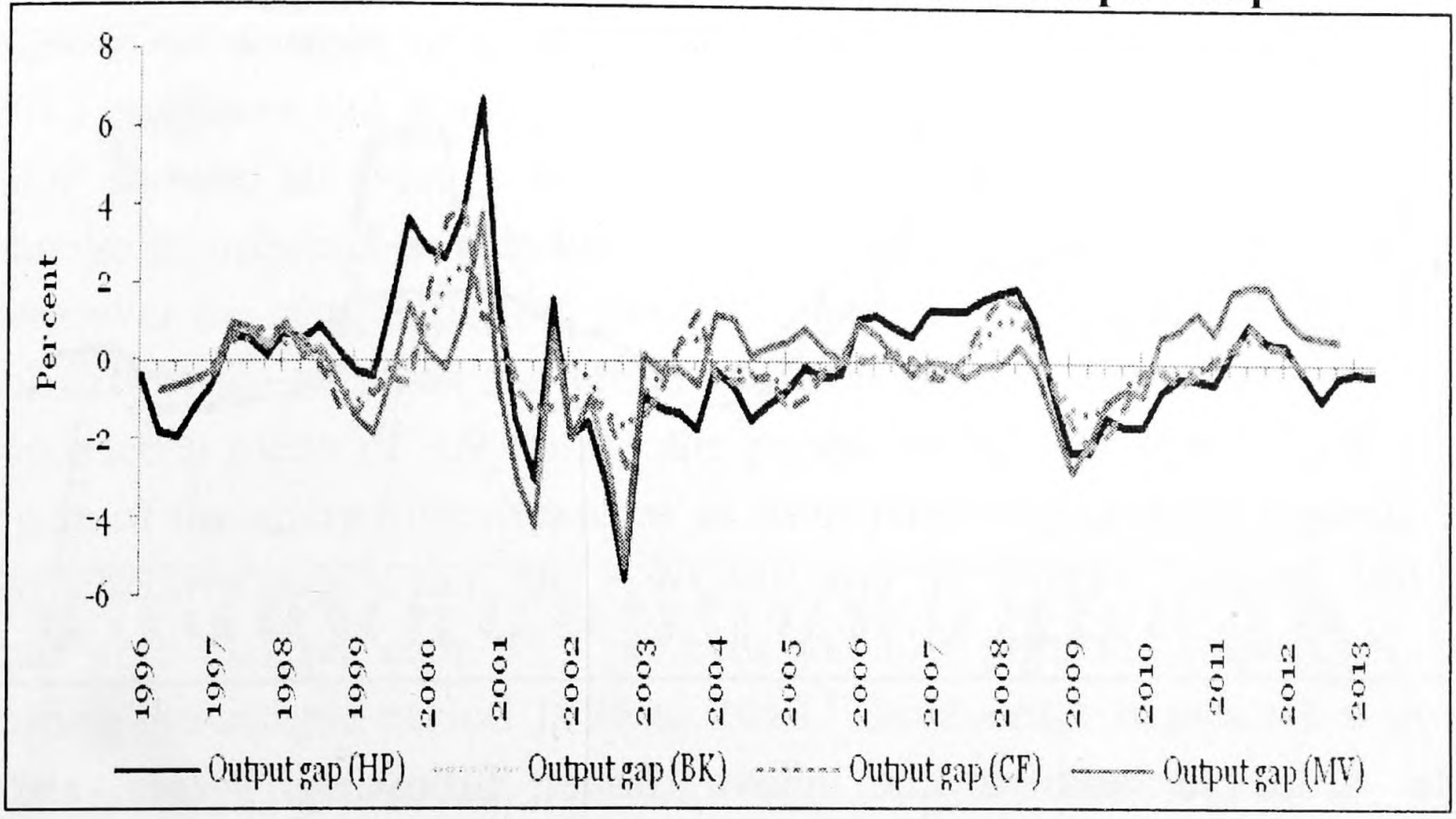


Estimation of a Taylor Rule requires measuring the output gap, which is an unobserved variable. Alternative measures of the output gap for Sri Lanka are available based on estimates of potential output using several alternative methods such as the Hodrick Prescott filter, Baxter King and Christiano-Fitzgerald band pass filters as well as multivariate model based methods. Figure 4 presents the output gap estimate as measured by the alternative methods mentioned above, and a close correspondence can be observed between them. Further, the robustness of these alternative methods of potential output was tested in Perera and Jayawickrema (2013) and the Hodrick Prescott filter based output gap was used as the desired output gap estimate for the preferred model specification. Given the availability of the longest data series and the wide acceptability as a less complicated

[4]The inflation indices that were calculated using previous base years under CCPI (i.e. 1952 and 2002) were rebased to the latest base year of 2006/7.

output gap measure, the Hodrick Prescott filter based output gap was used for this paper as well.[5]

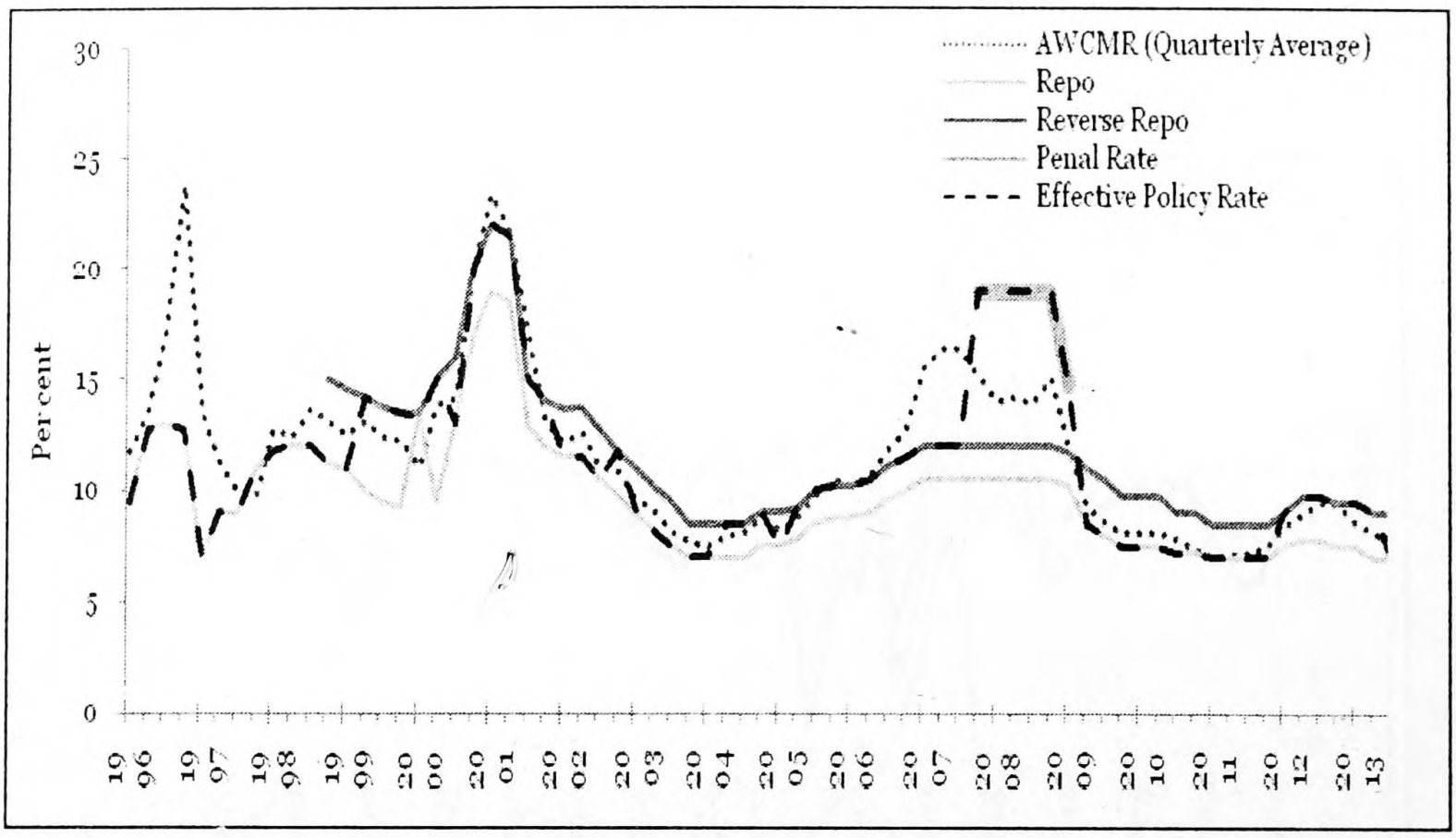
Figure 4: Alternative Measures of the Output Gap



Several options are available in selecting a short term interest rate that appropriately reflects the monetary policy stance of the Central Bank. The Repurchase rate, the Reverse Repurchase rate, the average weighted call money rate (AWCMR) and the 91-day Treasury bill rate are the commonly used indicators of short term interest rate in Sri Lanka. However, the use of a single measure of short term interest rate across a broader time horizon to reflect the policy rate of a central bank has been a concern (Patra and Kapur, 2012).

[5]However, it is well known that the Hodrick-Prescott filter suffers from an end-point bias. This is problematic when the filter is used for economic policy, especially in the case where the end-point is the point of interest. In order to deal with this problem, the literature suggests extending the series with forecasts. Accordingly, even though the analysis is carried out only up to 2013, estimated data on real GDP growth for 2014 was used in deriving the Hodrick-Prescott filter based potential output for the sample period.

Figure 5: Policy Interest Rates and Overnight Short Term Interest Rates



In order to address the above issue, following Perera and Jayawickrema (2013), an 'effective policy rate' was constructed by choosing the policy interest rate that most appropriately reflected the monetary policy stance during each period of analysis. Accordingly, the Repurchase rate was considered as the effective policy interest rate until the commencement of open market operations. Thereafter either the Repurchase rate or the Reverse Repurchase rate was selected as the effective policy rate depending on macroeconomic conditions and liquidity conditions in the market. However, robustness checks were carried out using alternative measures of short term interest rate such as the AWCMR and the 91-day Treasury bill rate.

In all the permutations of monetary policy rules, the exchange rate variation is added as an explanatory variable to assess whether there is exchange rate smoothing by the Central Bank. For this purpose, the annualized quarter-on-quarter change in the nominal exchange rate was used. Accordingly, a positive value represents depreciation of the Sri Lanka rupee against the US Dollar.

Details of the data series used for the analysis, the stylized facts of the variables, their descriptive statistics and the results of the unit root tests are provided in the Annex. Summarising the stylised facts for the entire sampling period, the year-on-year growth of reserve money showed an average of 11.4 per cent for the sample period 1996 to 2013, whereas the corresponding year-on-year growth of nominal GDP showed an average of 15.0 per cent. Meanwhile, year on year change in inflation as measured by CCPI had an average of 9.9 per cent over the sample period. Accordingly, the inflation gap, which is the difference between the actual inflation and the desired inflation, recorded a mean of 4.9 during the period under consideration. The mean of the alternative measures of short term interest rates, namely the effective policy rate, the AWCMR and the 91-day Treasury bill rate were 11.2 per cent, 11.5 per cent and 11.6 per cent, respectively during the sample period 1996 to 2013. The average depreciation in the exchange rate was 5.1 per cent during the entire sample period.

McCallum Rule

The empirical results for the McCallum rule are summarized in Table 1. Even though the original McCallum rule is purely backward looking, both forward looking and backward looking versions of the rule were estimated. Further, the monetary policy response to exchange rate dynamics was also assessed. Accordingly, columns 1 to 5 summarize empirical results for the backward looking specifications which were estimated using OLS, while columns 6 to 8 summarize results for the forward looking specifications that were estimated using GMM.

As the nominal income growth term of the rule is defined as trend growth minus actual growth, the nominal income gap term ($\Delta x_t^* - \Delta x_t$) is expected to have a positive coefficient. Accordingly, when the actual income growth is declining relative to trend growth, monetary policy is expected to be accommodative and base money expands.

The findings reveal that there is a positive and statistically significant reaction of base money growth to deviations of trend growth in

nominal income from its two quarter ago actual growth (Column 3) as well as three quarter ago actual growth (Column 4). The coefficients of the nominal gap term in the above two specifications were 0.38 and 0.48, respectively, in comparison to 0.50 proposed in the original McCallum rule for the United States. However, the expected relationship between base money growth and deviations in nominal income growth does not hold true for the forward looking specifications (column 6, 7 and 8). Even though the coefficient is correctly signed, the relationship is not statistically significant.

All specifications of the McCallum rule indicate a considerable degree of policy smoothing with the coefficient of Δb_{t-1} being larger than 0.6. Meanwhile, the variable to account for changes in the exchange rate was found to have the correct sign in all specifications. However, it was statistically significant only in the backward looking specifications. According to Patra and Kapur (2012), monetary policy reactions through smoothing interventions to large movements in exchange rates could affect net foreign assets and base money.

Since the backward looking specification in column 3 has statistically significant coefficients for all parameters and better model fit, the McCallum rule specified in column 3 was selected as the preferred specification[6]. Accordingly, the actual growth in reserve money was plotted against the growth in reserve money based on the estimates of the McCallum rule from the preferred specification (Figure 6). The reserve money growth estimated from the model appears to closely track the actual growth in monetary base reasonably well.

[6]The selected specification has a Durbin-Watson statistic of 2.4, which is approximately close to the desired level of 2. Therefore the level of serial correlation is not significant. As the values of Ljung-Box Q-statistic are insignificant with large p-values, the autocorrelation problem is not evident.

Table 1: Estimates of McCallum Rule

(Dependent variable: Growth in Base Money (Δb_t))

Column Number	1	2	3	4	5	6	7	8
Constant	3.99	5.13	5.96	7.19	6.64	2.01	3.20	5.97
	(3.31)	(3.94)	(4.37)	(5.02)	(3.73)	(2.03)	(1.40)	(2.94)
Δb_{t-1}	0.72	0.70	0.72	0.65	0.61	0.87	0.82	0.88
	(9.04)	(8.89)	(9.08)	(8.21)	(6.49)	(8.58)	(5.66)	(3.55)
$\Delta x_t^* - \Delta x_{t-1}$	0.11	0.15						
	(0.74)	(0.98)						
$\Delta x_t^* - \Delta x_{t-2}$			0.38					
			(2.72)					
$\Delta x_t^* - \Delta x_{t-3}$				0.48				
				(3.52)				
$\Delta x_t^* - \Delta x_{t-4}$					0.25			
					(1.58)			
$\Delta x_t^* - \Delta x_{t+1}$						0.19	0.16	
						(0.82)	(0.63)	
$\Delta x_t^* - \Delta x_{t+2}$								0.84

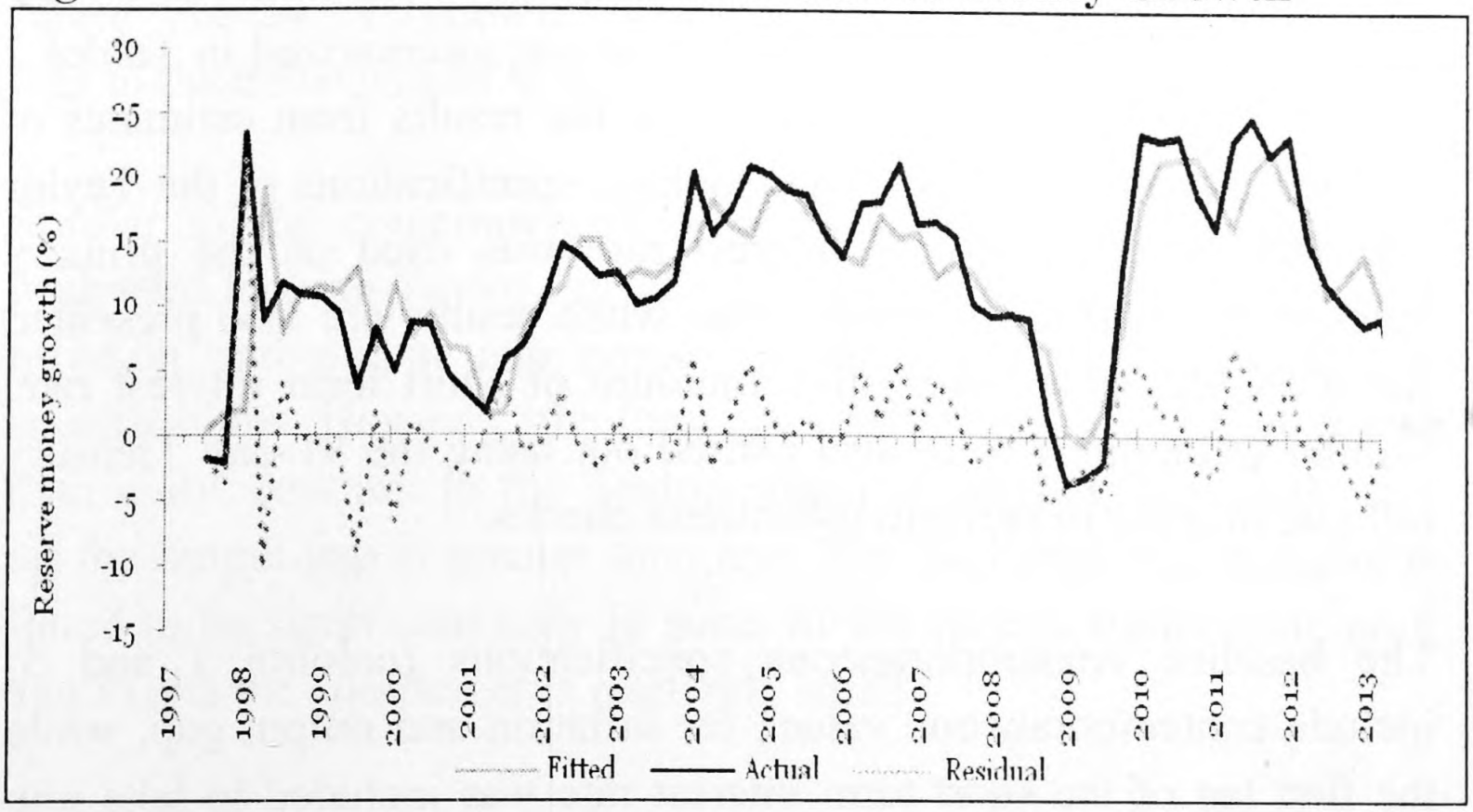
								(0.86)
Δe_{t-1}		-0.14	-0.15	-0.12	-0.12		-0.07	-0.09
		(-2.05)	(-2.28)	(-1.95)	(-1.77)		(-0.56)	(-0.67)
Observations (adj)		67	67	66	65	64	65	65	64
Adjusted R-squared		0.55	0.57	0.60	0.61	0.53	0.46	0.47	0.20
F-statistic/J-statistic		41.91	30.75	33.22	34.17	24.35	3.30	3.11	4.18
S.E. regression	of	5.12	5.00	4.78	4.63	4.98	5.49	5.43	6.53

Notes:

i. *Absolute value of t-statistics is given in parentheses.*

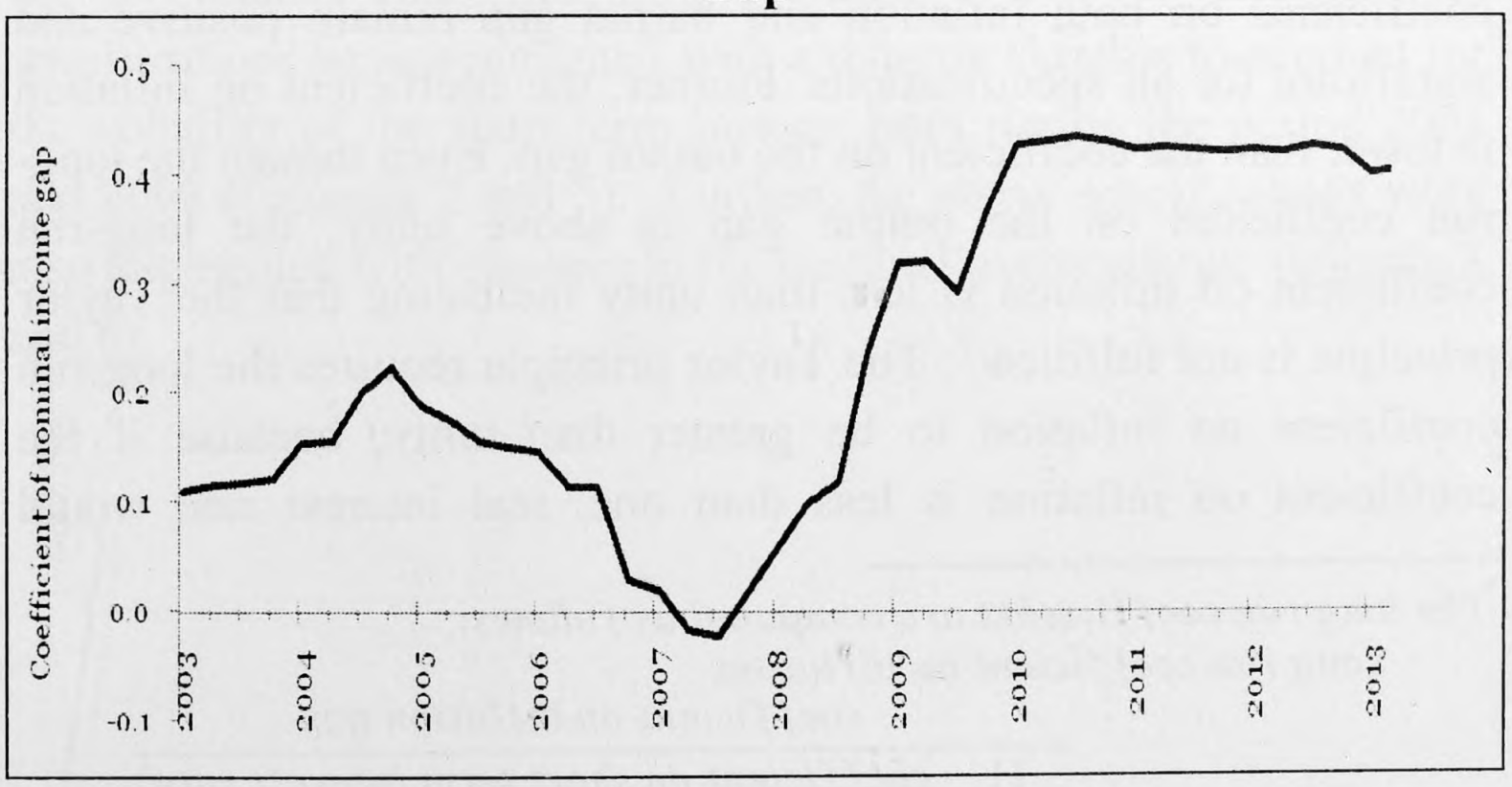
ii. *Forward looking specifications were estimated using GMM methodology. Two lags of Δb_t, $(\Delta x_t^* - \Delta x_t)$ and Δe_t were used as instruments for the GMM estimation*

Figure 6: Actual Versus Estimated Reserve Money Growth



Further, a recursive regression was carried out for the backward looking specification in column 3 to assess the evolution of the coefficient on the nominal income gap. The results are presented in Figure 7. According to the estimates, the response of monetary policy to deviations of trend growth in nominal income from its actual growth has strengthened since 2007, reaching a peak in 2010.

Figure 7: Recursive Estimates of Coefficients of Nominal Income Gap



Taylor Rule

The empirical results for the Taylor rule are summarized in Tables 2 and 3. Table 2 presents a summary of the results from estimates of contemporaneous and backward looking specifications of the Taylor rule. The effective policy interest rate was used as the primary measure of short term interest rate, while results are also presented for AWCMR as an alternative measure of short term interest rate. Similar estimations were also carried out using the 91-day Treasury bill rate in order to perform robustness checks.

The baseline contemporaneous specifications (column 1 and 5) include contemporaneous values for inflation and output gap, while the first lag of the short term interest rate was included to take into account interest smoothing behaviour. These baseline specifications were augmented with changes in the nominal exchange rate (column 2 and 6). Similarly, the baseline backward looking specifications (column 3 and 7) included lagged inflation and output gap, and the short term interest rate with one quarter lag. These baseline specifications were also augmented with changes in the nominal exchange rate (column 4 and 8).

Empirical results from a contemporaneous Taylor rule show that the coefficients on both inflation and output gap remain positive and significant for all specifications. Further, the coefficient on inflation is lower than the coefficient on the output gap. Even though the long-run coefficient on the output gap is above unity, the long-run coefficient on inflation is less than unity indicating that the Taylor principle is not fulfilled [7]. The Taylor principle requires the long-run coefficient on inflation to be greater than unity, because if the coefficient on inflation is less than one, real interest rate would

[7] *The long run coefficients are computed as follows:*

$$\textit{Long run coefficient on inflation} = \frac{\textit{coefficient on inflation gap}}{(1 - \textit{coefficient on short term interest rate})}$$

$$\textit{Long run coefficient on output gap} = \frac{\textit{coefficient on output gap}}{(1 - \textit{coefficient on short term interest rate})}$$

decline with a rise in inflation, leading to higher inflation in the future. The use of a contemporaneous specification which ignores the lags in the transmission of monetary policy could be a reason for this.

Similar to the contemporaneous specification, estimates from the backward looking Taylor rule also show that the coefficients on both inflation and output gap remain positive and significant for all specifications. However, the long-run coefficient on inflation is less than unity, contrary to the Taylor principle, whereas the coefficient on the output gap is greater than one. The exchange rate variable is found to be significant only in some of the specifications (column 6 and 8) and the coefficient is relatively small.

Table 3 presents empirical results from estimates of a forward looking Taylor rule. Similar to the previous specifications, the effective policy interest rate was used as the primary measure of the short term interest rate, while results are also presented for the AWCMR. Estimations were also carried out using the 91-day Treasury bill rate in order to perform robustness checks.

The baseline specifications included one quarter ahead inflation and output gap together with the short term interest rate with one quarter lag for interest rate smoothing (column 1 and 4). The baseline specifications were augmented with a dummy variable to account for the volatility of the short term interest rates during the period 2001 and 2008 (columns 2 and 5). Further, the above specifications were also augmented with changes in the nominal exchange rate (column 3 and 6).

Table 2: Estimates of Contemporaneous and Backward-Looking Taylor Rule

Dependent variable	Effective Policy Rate				AWCMR			
Column Number	1	2	3	4	5	6	7	8
Constant	2.32	2.40	3.24	3.30	2.25	2.57	2.84	3.14
	(3.52)	(3.63)	(4.58)	(4.60)	(2.99)	(3.44)	(3.68)	(4.05)
INFGAP	0.14	0.15			0.13	0.16		
	(3.12)	(3.32)			(2.69)	(3.24)		
INFGAP(-1)			0.11	0.11			0.11	0.13
			(2.25)	(2.33)			(2.11)	(2.61)
YGAP	0.53	0.54			0.36	0.38		
	(4.48)	(4.55)			(2.76)	(2.96)		
YGAP(-1)			0.69	0.69			0.53	0.53
			(5.46)	(5.45)			(3.94)	(4.01)
EFFECTIVE(-1)	0.73	0.71	0.66	0.65				
	(11.72)	(10.69)	(9.57)	(8.76)				
AWCMR(-1)					0.75	0.68	0.71	0.64
					(10.92)	(9.30)	(9.79)	(8.24)
Δe_{t-1}		0.03		0.02		0.06		0.05

		(1.17)	
Observations (adj)	71	71	71
Adjusted R-squared	0.80	0.80	0.80
F-statistic	94.51	71.62	96.69
S.E. of regression	1.73	1.72	1.71
Long-run coeff. on inflation	0.52	0.52	0.31
Long-run coeff. on output gap	1.97	1.83	2.05
Long-run coeff. on exchange rate		0.10	
Neutral policy rate	8.65		9.67

Notes:

i. *Absolute value of t-statistics is given in parentheses.*

ii. *Output gap measure: Hodrick-Prescott filte*

(0.65)		(2.17)		(1.85)
71	71	71	71	71
0.80	0.75	0.76	0.76	0.77
72.00	70.05	56.63	74.02	58.38
1.72	1.93	1.88	1.89	1.85
0.32	0.51	0.50	0.36	0.38
1.97	1.43	1.19	1.79	1.48
0.05		0.19		0.14
	8.88		9.68	

Table 3: Estimates of Forward-Looking Taylor Rule

Dependent variable	Effective Policy Rate			AWCMR		
Column Number	1	2	3	4	5	6
Constant	1.86	0.38	0.36	2.02	-0.61	-0.71
	(2.07)	(0.08)	(0.07)	(2.29)	(-0.16)	(-0.18)
INFGAP(+1)	0.28	0.29	0.32	0.28	0.35	0.42
	(2.61)	(2.03)	(2.17)	(1.86)	(1.75)	(2.02)
YGAP(+1)	0.99	1.00	0.96	0.67	0.72	0.61
	(1.83)	(1.84)	(1.87)	(1.08)	(1.19)	(1.04)
EFFECTIVE(-1)	0.72	0.76	0.73			
	(8.74)	(4.66)	(3.76)			
AWCMR(-1)				0.71	0.75	0.68
				(7.71)	(7.04)	(5.77)
Δe_{t-1}			0.03			0.07
			(0.84)			(1.63)
DUMMY		0.98	1.04		1.95	2.24
		(0.30)	(0.31)		(0.67)	(0.78)

Observations (adj)	70	70	70	70	70	70
Adjusted R-squared	0.61	0.59	0.60	0.63	0.58	0.57
J-statistic	0.00	0.00	0 00	0.00	0.00	0.00
S.E. of regression	2.42	2.46	2.44	2.34	2.48	2.50
Long-run coeff. on inflation	0.98	1.22	1.20	0.97	1.42	1.32
Long-run coeff. on output gap	3.49	4.21	3.60	2.29	2.91	1.90
Long-run coeff. on exchange rate			0.12			0.20
Neutral policy rate	6.58	5.75		6.88	5.38	

Notes:

i. *Absolute value of t-statistics is given in parentheses.*

ii. *Output gap measure: Hodrick-Prescott filter*

iii. *Estimation is by GMM methodology. One lag of INFGAP, YGAP, EFFECTIVE/AWCMR and Δe_t were used as instruments for the GMM estimation.*

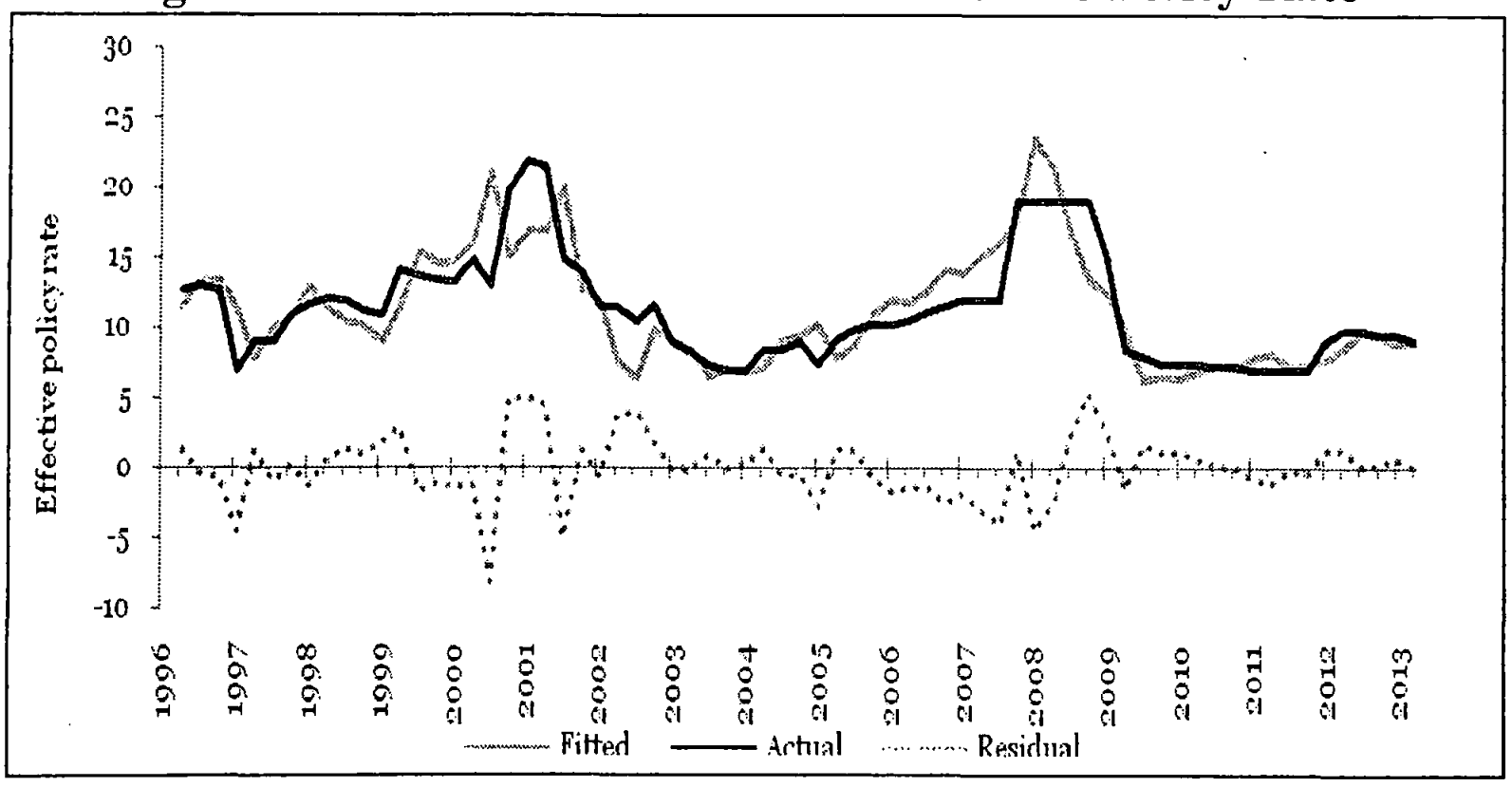
All specifications have coefficients on the inflation gap that are statistically significant and of correct sign. However, the output gap is statistically significant only in the specifications that include the effective policy rate as a measure of short term interest rates. Further, the coefficient on the output gap is found to be larger than the coefficient on inflation gap. Meanwhile, the coefficient on lagged interest rate is large and significant implying a relatively high degree of interest rate smoothing.

The long run coefficient on inflation is greater than or equal to 1 in all forward looking specifications satisfying the Taylor principle. However, the long run coefficient on the output gap is larger than the coefficient on inflation indicating that monetary policy seems to react more strongly to fluctuations in output than to deviations in inflation. In addition, the coefficient on the exchange rate is found to be of the right sign, but the coefficient is relatively small and not significant.

Considering all specifications of contemporaneous, backward looking and forward looking Taylor rules, the forward looking specification augmented with a dummy variable (column 2 of Table 3) [8] is considered as the preferred specification considering its adherence to the Taylor principle of having a long-run coefficient on inflation which is larger than unity and better model fit indices. Figure 8 plots the actual effective policy rate and the policy interest rate based on the estimates of the monetary policy rule from the preferred specification. The policy interest rate proposed by the model appears to closely track the effective policy rate reasonably well.

[8]The selected specification has a Durbin-Watson statistic of 1.7, which is approximately close to the desired level of 2. Therefore the level of serial correlation is not significant. As the values of Ljung-Box Q-statistic are insignificant with large p-values, the autocorrelation problem is not evident.

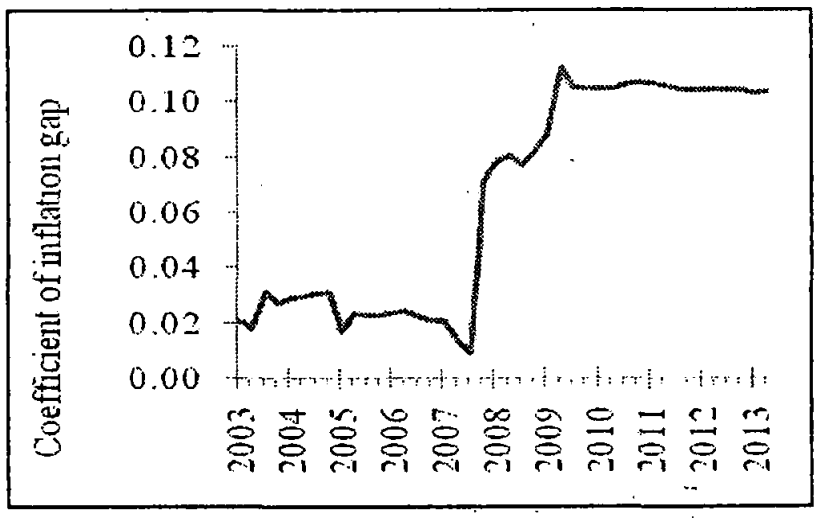
Figure 8: Actual Versus Estimated Effective Policy Rate



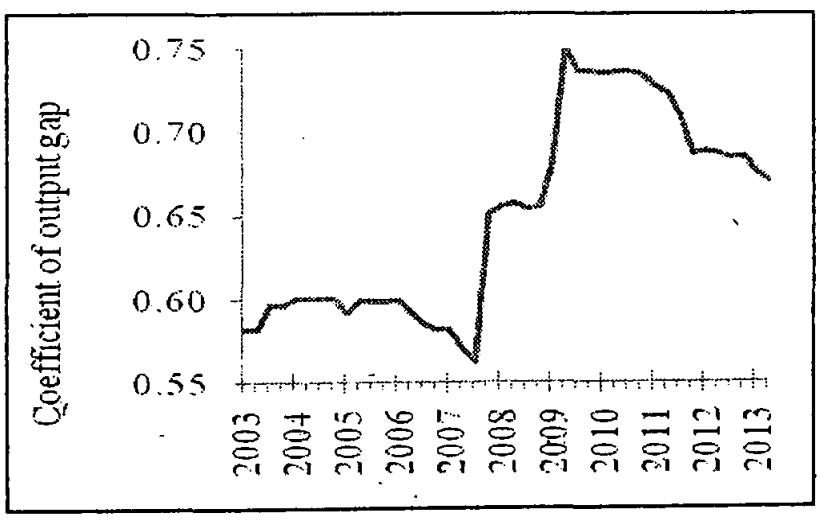
In order to assess the evolution of the coefficients on the inflation gap and the output gap over time, a recursive regression was carried out for the backward looking specification in column 3 of Table 2. The results are presented in Figure 9, according to which the response of monetary policy to deviations of inflation from the desired level and output from the potential level has improved since 2007 reaching a peak in 2009. However, the response of monetary policy to the inflation gap has stabilized thereafter, whereas that to the output gap appears to have gradually declined.

Figure 9: Recursive Estimates of Coefficients of Inflation Gap and Output Gap

a. Inflation Gap



b. Output Gap



Since there appears to be a definite shift in the coefficients on inflation gap and output gap after 2007, the monetary policy reaction function was estimated over two sub sample periods. The first sample period covered the period 1996 Q:1 to 2007 Q:4, while the second sample period was from 2008 Q:1 to 2013 Q:2. Due to insufficient number of observations in the second sample period the results from that period are not reported. However, comparing the results from the first sample period and the entire sample provide some important insights into the changes that have taken place in the conduct of monetary policy. During the first sample period, the long run coefficient on inflation was less than one which was below the threshold prescribed by the Taylor principle, implying that during this period monetary policy has reacted less than proportional to changes in inflation. On the other hand, for the entire sample period, the long run coefficient was above 1, indicating that during the second sample period the Taylor principle was met. With monetary policy reacting more than proportionately to the inflation gap, there is an increase in the real interest rate leading to lower inflation. Further the long run coefficient on output gap is higher during the second period indicating a higher weight on output stabilization.

Hybrid Taylor-McCallum Rule

The empirical results for the hybrid Taylor-McCallum rule are summarized in Table 4. The effective policy interest rate was used as the primary measure of short term interest rate, while results are also presented for AWCMR as an alternative measure of short term interest rate.

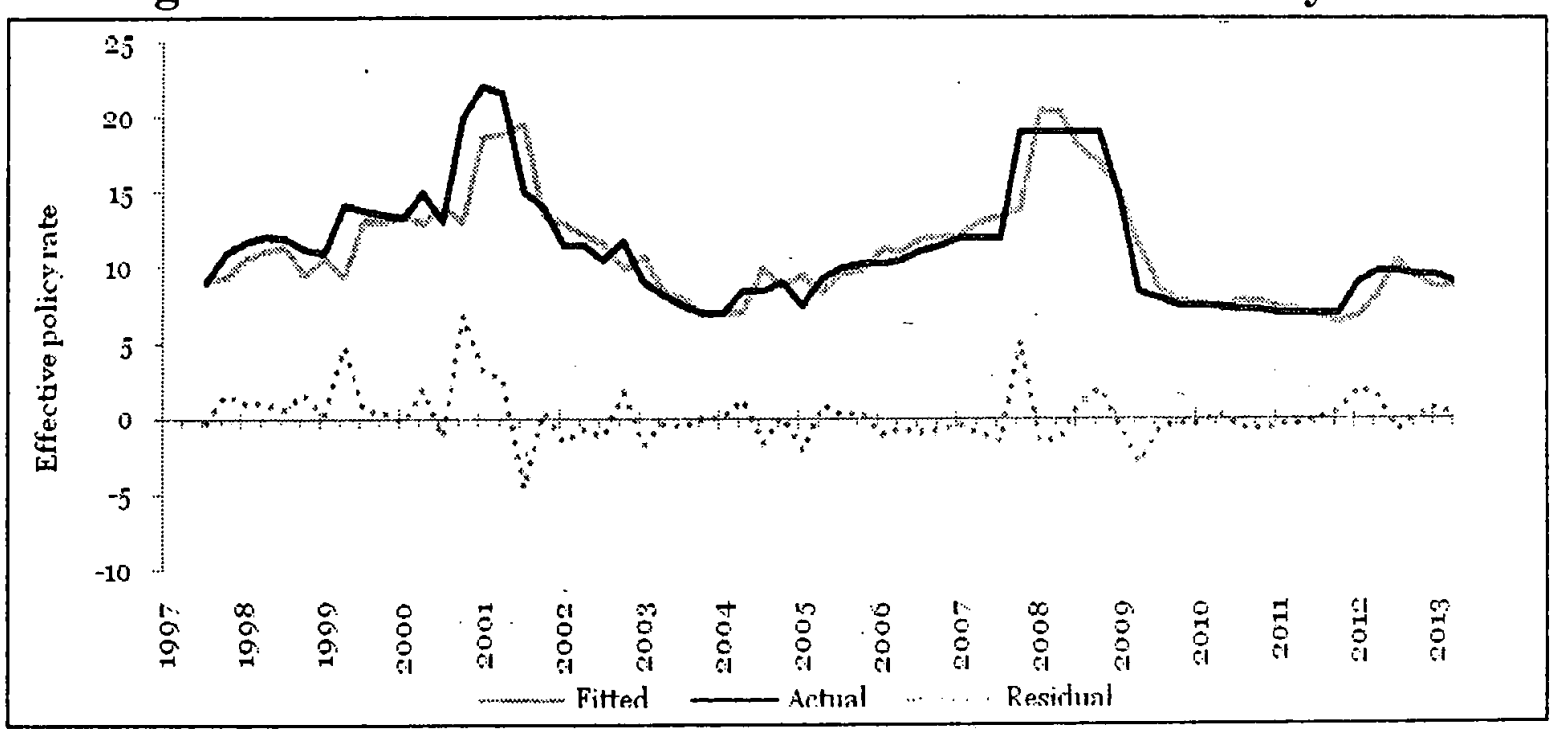
The results are presented for both backward-looking and forward-looking specifications, where the baseline backward-looking specifications (column 1 and 5) included both the nominal income gap and the short term interest rate with one quarter lag, and the baseline forward-looking specifications (column 4 and 8) included one quarter ahead nominal income gap and the lagged short term interest rate.

The expectation is that the nominal income growth deviation will be negatively signed, implying that when nominal output growth is falling relative to trend, monetary policy becomes accommodative and policy interest rates are reduced, and vice versa. The empirical results also reveal that the coefficient on the nominal income growth deviation term is negative in all cases consistent with *a priori* expectations and is also statistically significant in most cases (column 1, 2, 4, 5 and 6).

Further, the baseline specifications were also augmented with changes in the nominal exchange rate (column 2 and 6). However, consistent with the results for the Taylor rule, the exchange rate coefficient is found to be insignificant in all specifications.

Figure 10 plots the actual effective policy rate and the policy interest rate based on the estimates of the monetary policy rule from the forward-looking specification in column 4.[9] As in the case with Taylor rule, the policy interest rate proposed by the model appears to closely track the effective policy rate reasonably well.

Figure 10: Actual Versus Estimated Effective Policy Rate



[9]The selected specification has a Durbin-Watson statistic of 1.9, which is approximately close to the desired level of 2, and the values of Ljung-Box Q-statistic are insignificant with large p-values.

Table 4: Estimates of Hybrid Taylor-McCallum Rule

Dependent variable	Effective Policy Rate				AWCMR			
Column Number	1	2	3	4	5	6	7	8
Constant	1.35	1.37	1.37	-0.14	0.81	0.96	0.89	0.04
	(1.89)	(1.91)	(1.86)	(-0.20)	(1.31)	(1.54)	(1.41)	(0.06)
$\Delta x_t^* - \Delta x_{t-1}$	-0.12	-0.13			-0.09	-0.11		
	(-2.07)	(-2.15)			(-2.04)	(-2.35)		
$\Delta x_t^* - \Delta x_{t-2}$			-0.09				-0.05	
			(-1.40)				(-1.10)	
$\Delta x_t^* - \Delta x_{t+1}$				-0.24				-0.10
				(-2.12)				(-1.35)
EFFECTIVE(-1)	0.83	0.81	0.84	0.89				
	(12.99)	(12.03)	(12.36)	(24.02)				
AWCMR(-1)					0.88	0.85	0.89	0.94
					(16.21)	(14.24)	(15.68)	(16.42)
Δe_{t-1}	0.02				0.03			
	(0.61)				(1.40)			

Observations (adj)	67	67	66	65	67	67	66	65
Adjusted R-squared	0.76	0.76	0.76	0.78	0.82	0.82	0.82	0.83
F-statistic/J-statistic	107.72	71.24	101.92	3.85	152.77	104.02	147.00	6.60
S.E. of regression	1.91	1.92	1.95	1.83	1.50	1.49	1.53	1.48

Notes:

i. *Absolute value of t-statistics is given in parentheses.*

ii. *Forward looking specifications were estimated using GMM methodology. Two lags of* Δb_t, $(\Delta x_t^* - \Delta x_t)$, *EFFECTIVE/AWCMR and* Δe_t *were used as instruments for the GMM estimation*

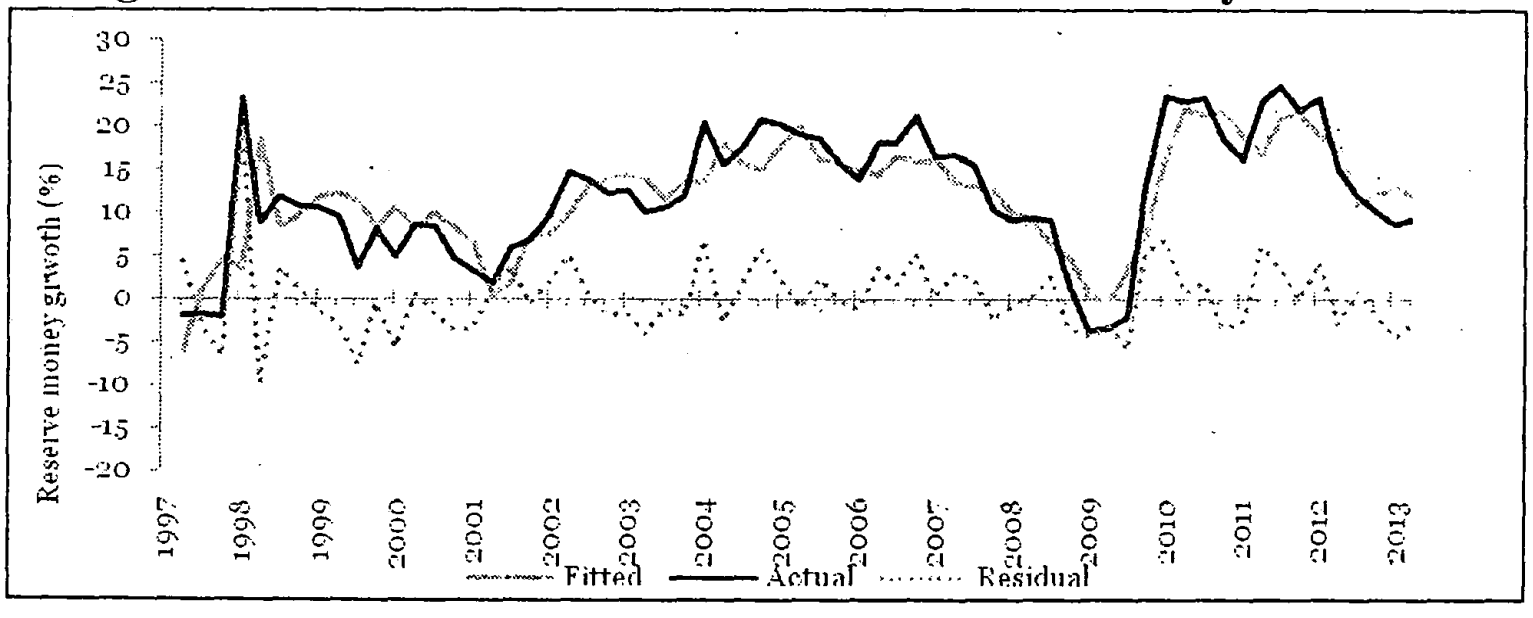
Hybrid McCallum-Hall-Mankiw Rule

The empirical findings with regard to the hybrid McCallum-Hall-Mankiw rule are summarized in Table 5. Accordingly. the response of base money growth to the sum of the inflation gap and the output gap was examined for contemporaneous, backward-looking and forward-looking specifications.

The coefficient on the inflation gap plus output gap term is correctly signed (negative) in all specifications of the rule. However, this coefficient is found to be statistically significant only in certain backward-looking specifications (column 4, 5 and 6). Meanwhile, consistent with the findings for the McCallum rule, the exchange rate coefficient is correctly signed and significant in all specifications.

Since the backward-looking specification in column 4 has statistically significant coefficients for all parameters with better model fit indices, the rule specified in column 4 was selected[10] to analyze the actual growth in reserve money against the growth in reserve money proposed by the hybrid McCallum-Hall-Mankiw rule (Figure 7). In line with the McCallum rule, the reserve money growth estimated from the model appears to closely track the actual growth in monetary base.

Figure 11: Actual Versus Estimated Reserve Money Growth



[10]The selected specification has a Durbin-Watson statistic of 2.2 which is approximately close to the desired level of 2, and the values of Ljung-Box Q-statistic are insignificant with large p-values.

Table 5: Estimates of Hybrid McCallum-Hall-Mankiw Rule

(Dependent variable: Growth in Base Money (Δb_t))

Column Number	1	2	3	4	5	6	7	8
Constant	3.83	4.86	5.29	6.29	7.80	7.14	3.60	5.68
	(3.31)	(3.91)	(4.16)	(4.94)	(5.79)	(4.29)	(2.18)	(2.97)
Δb_{t-1}	0.71	0.69	0.68	0.65	0.57	0.57	0.75	0.70
	(9.11)	(8.88)	(8.95)	(8.82)	(7.58)	(6.34)	(6.33)	(5.79)
[INFGAP+YGAP]	-0.06	-0.08						
	(-0.58)	(-0.70)						
[INFGAP(-1)+YGAP(-1)]			-0.15					
			(-1.39)					
[INFGAP(-2)+YGAP(-2)]				-0.29				
				(-2.79)				
[INFGAP(-3)+YGAP(-3)]					-0.40			
					(-3.89)			
[INFGAP(-4)+YGAP(-4)]						-0.26		
						(-2.12)		
[INFGAP(+1)+YGAP(+1)]							-0.17	-0.28

							(-0.89)	(-1.36)
Δe_{t-1}		-0.13	-0.14	-0.13	-0.12	-0.13		-0.13
		(-1.99)	(-2.03)	(-2.02)	(-1.99)	(-1.97)		(-2.26)
Observations (adj)	67	67	67	67	67	67	65	65
Adjusted R-squared	0.55	0.57	0.58	0.62	0.65	0.60	0.51	0.49
F-statistic/J-statistic	41.67	30.37	31.54	36.28	42.19	33.59	4.14	0.00
S.E. of regression	5.13	5.02	4.96	4.75	4.52	4.87	5.35	5.43

Notes:

i. *Absolute value of t-statistics is given in parentheses.*

ii. *Forward looking specifications were estimated using GMM methodology. One lag of Δbt, (INFGAP+YGAP) and Δe_t were used as instruments for the GMM estimation*

CONCLUSION

This study seeks to characterize monetary policy behaviour in Sri Lanka under different rules by empirically evaluating the operational performance of the McCallum rule, the Taylor rule, and their hybrid variants in the Sri Lankan context for the period 1996 to 2013. By doing so, this research attempts to shed light on the operational feasibility of each rule in the Sri Lankan context and how this has changed with the evolution of the monetary policy framework.

In this paper the McCallum rule and the Taylor rule were assessed as alternatives rather than as competing models for the characterization of the monetary policy decision making process. The McCallum rule proposes a monetary policy rule that features a monetary base instrument and a nominal income growth target while avoiding the issues relating to the measurement of unobservables. The Taylor rule on the other hand, mirroring the practice of modern day central banks, proposes an interest rate based rule, wherein the nominal interest rate is set in response to observed or predicted values of the inflation gap and the output gap. Although Taylor and McCallum rules differ in terms of both instrument and target variables, they are both applicable in the Sri Lankan context given the evolution of the monetary policy framework over time.

In the McCallum rule, a backward-looking specification where reserve money changes with respect to the deviations in nominal income growth with a significant degree of instrument smoothing was found to be more appropriate. With regard to the Taylor rule, a forward-looking specification with the effective policy interest rate reacting to the expected inflation and output gap appears to be best suited to the Sri Lankan context. In general, backward-looking specifications were found to be best suited for monetary policy rules with a monetary base instrument, whereas forward-looking specifications were found to be best suited for interest rate based rules. Meanwhile, exchange rate movements were found to play a significant role in policy rules with a monetary base instrument;

whereas it was found insignificant in interest rate based rules. By conducting simulation exercises it would be possible to identify whether following a McCallum type rule or a Taylor type rule would lead to more optimal monetary policy setting. This is left for future study.

The monetary policy rules evaluated in this paper provide a simple and transparent framework for conducting monetary policy. Moreover, there is a wide consensus that policy rules have major advantages over discretion in improving economic performance (Taylor, 1993). However, mechanically following rule based monetary policy formulation is not recommended as monetary policy rules provide only a guide to policy makers in their decision making process. There will be episodes where monetary policy will need to be adjusted to take account of special factors and therefore judgment is always required when evaluating macroeconomic developments in the decision making process.

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ANNEXURE

Table 1: Data Description

Variable Name	Definition	Period	Source
Δb_t	Growth (y-o-y) in reserve money	1996 – 2013	CBSL[1/]
Δx_t	Growth (y-o-y) in nominal GDP	1996 – 2013	CBSL
Δx_t^*	Trend growth (y-o-y) in nominal GDP	1996 – 2013	Author's estimates
Δe_t	Annualised quarter-on-quarter variation in the monthly average exchange rate	1996 – 2013	CBSL
AWCMR	Average weighted call money rate (quarterly average)	1996 – 2013	CBSL
EFFECTIVE	Effective policy rate	1996 – 2013	CBSL
TBILL	91-day Treasury bill rate	1996 – 2013	CBSL
INFGAP	Deviation of actual inflation (change of the Colombo Consumers' Price Index (CCPI)) from the indicative inflation projection of 5 per cent	1996 – 2013	DCS[2/] Author's estimates
YGAP	Output gap measure (computed using seasonally adjusted GDP)	1996 – 2013	Author's estimates
DUMMY	2001:Q1-Q3 and 2008:Q1-Q3 are set to 0	-	-

1/ CBSL – Central Bank of Sri Lanka

2/ DCS – Department of Census and Statistics, Sri Lanka

Table 2: Unit Root Tests

Variable	Augmented Dickey-Fuller test statistic	
	t-Statistic	Probability
Δb_t	-3.819600	0.0044
Δx_t	-3.323766	0.0176
AWCMR	-2.836805	0.0583
EFFECTIVE	-2.213982	0.2033
TBILL	-2.587934	0.1003
Δe_t	-5.358634	0.0000
INFGAP	-3.897576	0.0034
YGAP	-3.715105	0.0058

Table 3: Stylised Facts (Averge for Period) Per Cent

Period	Reserve Money Growth(Δb_t)	Nominal GDP Growth (Δx_t)	Real GDP Growth	Headline Inflation (CCPI)	Output Gap (YGAP)	Call Money Rate (AWCMR)	Dep. in Rs/US$ Exchange Rate (Δe_t)
1996-2013	11.4	15.0	5.3	9.9	0.0	11.5	5.1
1996-2001	5.6	12.4	4.0	10.1	0.7	14.5	9.3
2002-2007	15.6	16.3	5.4	10.8	-0.6	10.8	3.1
2008-2013	11.9	16.0	6.6	8.8	-0.3	9.3	2.9

Sources: Central Bank of Sri Lanka, Department of Census and Statistics, Author's calculations

Table 4: Descriptive Statistics: 1996 – 2013

	Δbt	Δxt	AWCMR	EFFEC-TIVE	TBILL	Δet	INFGAP	YGAP
Observations	68	68	72	72	72	72	72	72
Mean	11.4	15.0	11.5	11.2	11.6	5.1	4.9	0.0
Median	11.4	15.0	10.9	10.4	11.2	5.1	4.1	-0.3
Maximum	24.8	26.7	23.8	22.0	21.3	37.5	23.4	6.7
Minimum	-13.4	4.8	7.0	6.5	7.0	-18.9	-4.3	-3.6
Std. Dev.	8.2	4.7	3.8	3.8	3.7	9.0	5.3	1.7
Skewness	-0.5	0.2	1.2	1.1	0.8	1.0	1.1	0.5
Kurtosis	2.9	3.3	4.6	3.6	2.7	6.0	4.5	3.9
Jarque-Bera	2.9	0.7	26.1	16.1	7.2	38.8	20.5	27.8
Probability	0.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Sum	773.8	1022.1	829.3	805.0	834.3	368.4	352.3	-2.9
Sum Sq. Dev.	4502.8	1469.5	1029.1	1048.0	954.6	5736.5	2010.1	217.1

Micro Credits and Agricultural Productivity: With Special Reference to Paddy Cultivation in Akmeemana Divisional Secretariat Division

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INTRODUCTION AND RESEARCH PROBLEM

Agricultural contribution to the Gross Domestic Product has significantly declined from 46 % in 1950 to 10% in 2013 (Central Bank of Sri Lanka, 2013). Technological issues, credit availability issues, quality of seeds, etc., have contributed to such low productivity and hence, low contribution to the national output.

Despite the fact that many financial institutions are involved in financing agricultural sector in Sri Lanka, lack of accessibility to finance sources remained as the key constraint to the growth in the agricultural productivity in the country (World Bank. 2009). Inadequate term finance, complex paper work procedures and strict collateral requirements made farmers' limited access to formal financing services. On the other hand constraints such as high transaction cost, lack of tangible security and high repayment risks also reduce the chances of targeting the agricultural sector. Therefore, small farmers largely depend on microfinance, rural cooperatives and Regional Development Banks to get the required financial resources for them.

Microfinance loans are expected to remove those constraints in accessing productive capital sources to the farming community (LMFPA, 2012).

Therefore, this study attempts to examine the relationship between microcredit facilities and agricultural productivity with special reference to the paddy cultivation in the Akmeemana Division of the Galle District. This study has also focused on the differences in sqcio-economic characteristics between ben eiaries and non-beneficiaries.

METHODOLOGY

Walahanduwa and Pilana agrarian service centers in Akmeemana Divisional Secretariat Division, were selected out of eleven agrarian service centers in the eastern division of the Galle District. Study population of the selected area was about two thousand six hundred paddy farmers. The sample consisted equal sizes of both beneficiaries and non-beneficiaries and it is 80 in total. (Ashaolu et al. 2011; Girabi and Elishadai. 2013; Nosiru, 2010; Hasan et al., 2013). Simple random sample method was used for selecting the non-beneficiaries and beneficiaries are selected based on the snowball sampling technique. Primary objective is achieved by calculating productivity differential between credit beneficiaries and non-credit beneficiaries. Agricultural productivity is expressed as the ratio between the input and the output. Total output is the value of the paddy production. This is taken by multiplying total quantity of production with its average market price. Total inputs mean the value of inputs used for the paddy cultivation. However, in this study, it was assumed that the total productivity is the total output per unit of land available. T-test was used to measure the average productivity difference. (Girabi and Elishadai. 2013). Accordingly, following two hypotheses were constructed to achieve the first objective:

Ho: There is no productivity differential between credit beneficiaries (CB) and non-beneficiaries (NCB) of microfinance loans in the Akmeemana Divisional Secretariat Division.

H_1: There is a productivity differential between credit beneficiaries (CB) and non-beneficiaries (NCB) of microfinance loans in Akmeemana Divisional Secretariat Division.

Cobb-Douglas production function proposed to use in this study could be depicted in detail as follows. $\ln Q = \ln S_0 + S_1 \ln X_1 + S_2 \ln X_2 + S_3 \ln X_3 + S_4 D + ú$

RESULTS AND FINDINGS

This study defines productivity as the total output per unit of land available.

Table 1: Productivity Differences between Beneficiaries and Non-Beneficiaries

	Are you a microcredit beneficiary or not?	N	Mean	Std. Deviation	Std. Error Mean
Total Output per Acre	MF Beneficiary	40	50.72	14.158	2.239
	Non Bneficiary	40	49.30	11.041	1.746

Source: Author compilation based on survey data, 2014

As depicted in the above Table 01, average output per acre (50.72 bushels per acre) of microcredit beneficiaries are slightly higher than the average output per acre of non-beneficiaries of the microcredit facility (49.30 bushels per acre). Moreover, the above results show that standard deviation values of the group of beneficiaries and non-

beneficiaries respectively. Those values explained that microcredit beneficiaries' actual output acre can vary among the range of 50.72 +/- 14.15 whereas non beneficiaries' actual outputs per acre vary between 49.3 +/- 11.04.

CONCLUSIONS, IMPLICATIONS AND SIGNIFICANCE

According to the independent sample t-test, the sig value of the t-test statistics when assuming equal variance is 0.617. Since the value is greater than 0.05, null hypothesis is accepted. This concludes that there is no significant differential of average productivity between microcredit beneficiaries and non-beneficiaries.

In terms of differences in socioeconomic characteristics, majority of beneficiaries are female (26 people out of 40) and their participation rate as credit beneficiaries is 65% and from total study sample it is about 32.5%. Highest numbers of farmers are in the age category of 46-60 and as a count it is about 38 respondents out of total sample of 80. The level of education among the beneficiaries is higher (45%) than non-beneficiaries (35%). At all levels of income categories beneficiaries recorded a lower income level compared to non-beneficiaries. However, within the income range of Rs.30,001/= - Rs.50,000/= beneficiaries are only 17%, whereas non-beneficiaries are 47%. The major finding of the above result is majority of non-beneficiaries have earned higher monthly income than the beneficiaries.

Table 2: Independent Sample t-test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total Output per Acre	Equal variances assumed	2.758	.101	.502	78	.617	1.425	2.839	-4.227	7.077
	Equal variances not assumed			.502	7.363E1	.617	1.425	2.839	-4.232	7.082

Source: Author compilation based on survey data, 2014,

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