



DEFINING AND ESTIMATING A MONETARY CONDITIONS INDEX FOR JAMAICA: THEORETICAL AND EMPIRICAL ISSUES

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Abstract

Increased interest in alternative intermediate or operating targets has encouraged the development and estimation of the monetary conditions index (MCI). MCIs were developed in response to a need to identify alternative variables that function as intermediate or operating targets and information variables in the conduct of monetary policy. The development of MCIs has been propelled by two policy issues faced by monetary policy makers. First, financial market liberalization and deregulation has weakened the relationship between monetary aggregates as intermediate targets and inflation, and second, there is frequently a need to explicitly measure the influence of exchange rate developments on the final target – inflation.

The paper explores the development and estimation of an MCI for Jamaica to augment the existing monetary policy framework. MCIs are applicable to the Jamaican economy especially since deregulation and liberalization of the financial sector in 1991. Various works, including the current work, validate the appropriateness of a monetary conditions index within the existing monetary policy decision process.

To estimate the weights of the index for Jamaica, the analysis is couched in a paradigm consistent with that of a small open economy. The standard MCI is a weighted average of changes in an interest rate and an exchange rate, relative to their base period.

The results obtained suggest that the index is most useful when the exchange market exhibits stable conditions, and would be a constructive tool in the simultaneous management of the foreign currency and domestic money markets. The results also suggest that extending the current framework to include the MCI as an auxiliary operating target would be useful since it retains its simple property of ease of calculation and displays close association with domestic inflation.

However, the use of the index is limited to the extent that there needs to be further foundations laid for forecasting inflation six to eight quarters ahead. Despite this, the index still represents a short-term indicator of the stance of monetary policy and its usefulness is not necessarily lessened, since the index broadens interest rate targeting to include the effects of the exchange rate on an open

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economy. This is critical to the policy framework in the Jamaican macroeconomy, since preliminary findings indicate a persistent influence of adjustments in the exchange rate on inflation for at least four months, and relatively short-lived effects attributed to interest rate adjustments.

Key Words: Monetary Conditions Index, Monetary Policy Framework.

Introduction

Central banks of developed countries have included and in some instances fully adopted the use of a monetary conditions index (MCI) in their monetary policy framework. The MCI is a simplified numerical indicator of the relative ‘tightness’ or ‘looseness’ of monetary policy. It captures the degree of pressure that monetary policy exerts through interest rate and exchange rate changes on the economy, and hence inflation. When the index increases, it is interpreted as a loosening of monetary conditions with respect to the defined base period. A MCI is specified as a weighted average of the measured effects of interest rate and exchange rate changes on the final target.

These MCIs were developed in response to a need to identify alternative variables to function as intermediate or operating targets and information variables in the conduct of monetary policy. The search for new variables has been motivated by the weakened relationship between monetary aggregates and inflation and the desirability of explicitly measuring the influence of exchange rate developments on output and inflation.

The current exposition focuses on the development and estimation of an MCI for Jamaica to improve the existing monetary policy framework. The theoretical arguments that justify the examination of alternative information variables are applicable to Jamaica is validated empirically by various works (including the current one) that describe Jamaica’s inflationary process. The conclusions of the paper lend support to the long-standing view of the existence of close contemporaneous relationships between exchange rate changes and domestic inflation, and therefore warrant the current focus of estimating the relative impact of both interest rate and exchange rate changes on inflation.

An MCI has several attractive features. It recognizes the impact of exchange rates in small open economies and focuses analysis on the combination of interest rates and exchange rates that may be

important in understanding the economy's behaviour. Also, an MCI is easy to calculate and is intuitively appealing to central banks as an operational target for monetary policy. Finally, it generalizes interest-rate targeting to include the effects of exchange rates on an open economy.

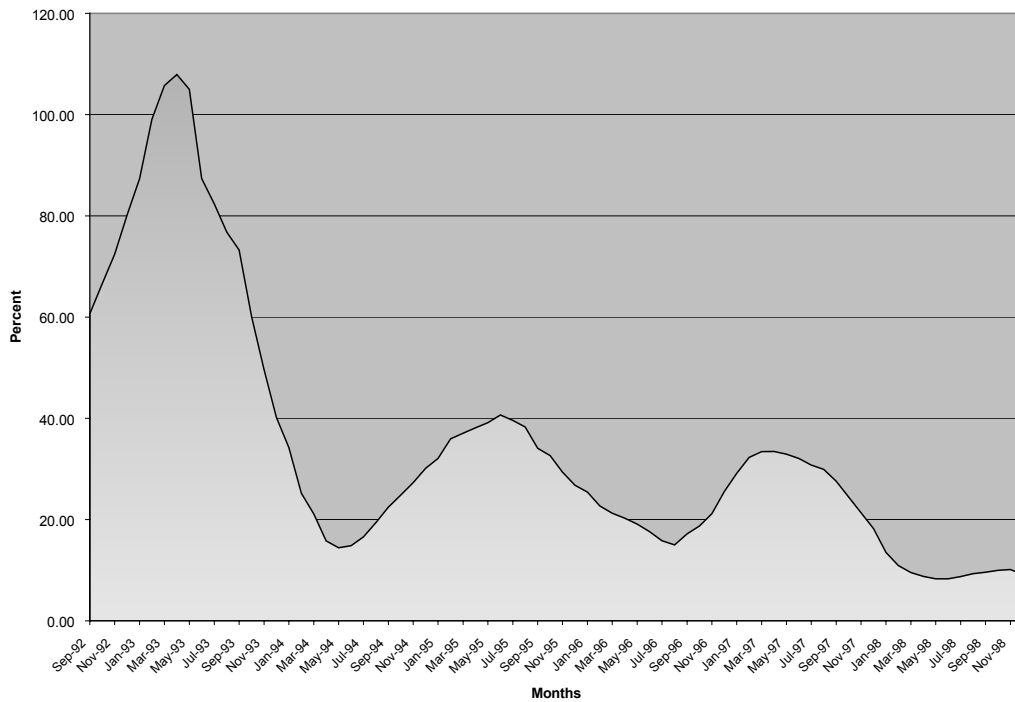
The analysis is developed in three sections. Section I provides an assessment of Jamaica's monetary framework and outlines the thrust to broaden the framework to include a monetary conditions index for Jamaica. Section II outlines some frameworks for the conduct of monetary policy, and provides the foundation arguments for the continued progress towards developing MCIs. Section III gives the empirical estimation and results used for deriving the relative weights of the index. This information is subsequently used to calculate an MCI for Jamaica. In section IV, the computed index is examined in a more intuitive fashion with concluding comments presented in section V. Supplementary notes, tables and charts complete the work.

Section I: Jamaica's Monetary Policy Framework

The evolution of domestic prices and the monetary policy process 1991-1998

Jamaica's experience of inflation has been one of very high annual growth rates in domestic prices, which peaked at a high of over 100 percent in February 1992. Following on the heels of liberalization of the foreign exchange and financial markets in 1991 and within a context where domestic money supply was not under strict control, domestic prices rose sharply to coincide with the sharp depreciation in the exchange rate. The country's inflation problem persisted as the depreciation and inflation spiral permeated the economic landscape, and encouraged the demands for compensating wage claims by the labour force. With monetary policy during the period being largely accommodative, the consequence was a continuation of exchange rate depreciation that influenced further inflation, at least up until mid-1996. Chart 1 below illustrates.

Chart 1: 12-Month Inflation for Jamaica, September 1991-December 1998




The persistent exchange-rate depreciation and high inflation environment created uncertainty within the country's macroeconomic environment. The instability in the foreign exchange market and the associated inflation created incentives for hedging and speculative activity rather than investing in productive real sector activity. This resulted in the blossoming of a 'new' era of financial management, as the opportunities for making capital gains from foreign exchange trading and the domestic money market became evident. With productive activity severely stifled by various competing uses of resources, the central bank embarked on stabilization policies to limit unwieldy exchange rate fluctuations, to reduce the level of liquidity within the system and to achieve low inflation while preserving the value of the domestic currency.

Within the country's monetary policy experience, such stabilization policies marked the beginning of new challenges for monetary policy management. Indirect policy instruments were adopted that required the use of intermediate and operating targets to assess the effects of monetary policy changes on the ultimate inflation objective. This mechanism replaced the monetary targeting

framework that was abandoned with liberalization. The money market represented the channel for transmitting monetary policy decisions, although interest rates in the domestic money market mirrored the past experiences of chronic inflation that influenced inflationary expectations and maintained interest rates exorbitantly high. Empirical evidence that describes Jamaica's inflationary process suggests that disorderly fluctuations in the exchange rate exert a significant influence over domestic prices. Within this context, the central bank envisioned that the control of inflation could only be attained by effecting monetary restraint to reduce the growth in monetary aggregates that has fueled excessive exchange rate volatility. In April 1996, the central bank adopted an alternative monetary policy framework that was based on base money management and money supply targeting.

The monetary policy framework relies on the links between monetary aggregates (as intermediate and operating targets) and inflation. The reliance on the measures of base money and the broader aggregate^[R&EP1] M3² assume that their relationship to inflation is stable and predictable. However, like in other economies that have liberalized and have experienced the transformation of the financial sector, the stability of that relationship cannot be taken for granted. It has in fact been observed that even after the transition from high inflation to lower inflation rates, monetary aggregates continue to expand at a faster rate than prices.³

While the going may be a true monetary phenomenon emerging within the Jamaican economy, the monetary authorities have maintained their vigilance in keeping low and steady inflation. For the first eight months of 1999, monthly inflation averaged 0.51 percent, with a 12 month annual inflation rate of 5.09 percent. This represented a decline in inflation relative to corresponding periods of previous years where the 12-month inflation rate was 8.2 percent and 8.6 percent in 1997 and 1998, respectively.

To underwrite monetary stability in the Jamaican economy, the Central Bank has in practice adopted a combination of approaches. Two important aspects that have contributed to securing this continued low inflation environment are:

² M3 is defined as the sum of currency in circulation, demand, time, savings and other deposit liabilities of the banking system.

³ See Appendix A, which details the evolution of monetary aggregates and inflation since September 1992.

- a) tight base money management, which reflects the continuous reliance on liquidity management to restrict monetary expansion, and
- b) maintaining relative stability in the value of the domestic currency, which in practice has provided a strong nominal anchor for the system.

Further analysis of the effects of changes in base money and M3 on inflation reveals the non-existence of even weak causal relationships. The results of the F-tests of exclusion restrictions of the effects of lagged values of the monetary aggregates and exchange rates on inflation are presented in Table 1. It is observed that, based on the results of the Granger-causality test, the evolution of base money and money supply (M3) aggregates do not Granger-cause the observed changes in CPI inflation or headline inflation. The exchange rate, however, exhibits some causal relationship with inflation.

Table 1: Summary results of F-tests of exclusion restrictions on lagged base money, M2 exchange rates on inflation.

	Test Statistics
Base Money	0.87
Exchange Rate	5.30*
Money Supply (M3)	0.87

* denotes significance at the 5% level.

Sample: 84: 1991(09) to 1998(12)

Empirical justification for broadening Jamaica’s monetary policy framework has emerged from previous work.⁴ Robinson and Robinson (1997) validate the argument for incorporating a monetary conditions index within the Central Bank’s policy framework, as there is evidence that suggests persistent influence of deposit rates and exchange rate on CPI inflation. After examining the transmission process of monetary policy impulses, they suggest that the reverse repurchase rate may be an effective tool in the process since it directly influences deposit rates offered by financial intermediaries. However, the effectiveness of changes in the reverse repurchase rate could be diminished, since it functions through base money that is characterized by exogeneity properties, which make it inefficient to function as a ‘true’ policy lever. Changes in the base predominantly reflect expenditure decisions and therefore mirror the actual transaction decisions with respect to the central bank’s domestic and foreign assets and liabilities. In this regard, Robinson and Robinson conclude that the linkage between base money and inflation is potentially thwarted and would distort the clear transmission of interest rate changes to the inflation target.

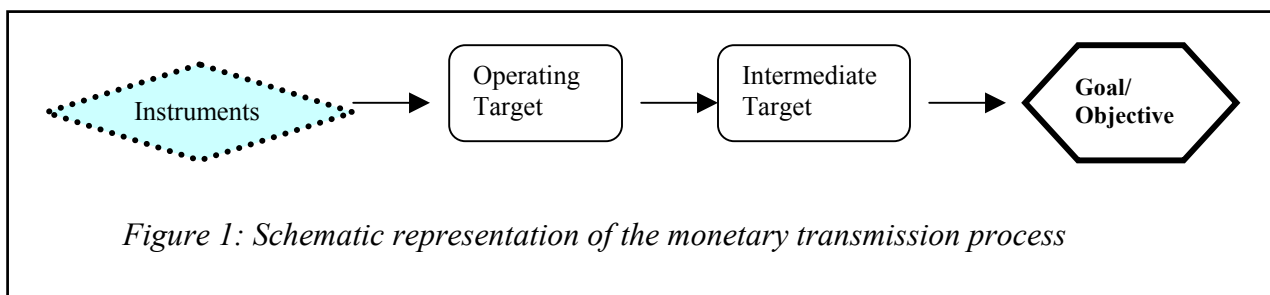
Robinson and Robinson (1997) identify one main transmission path: changes in the reserve repurchase rate exert influence on domestic deposit rates and the effect of this eventually feeds through to the exchange rate to impact the CPI. An alternative transmission is isolated directly through monetary aggregates – base money and money supply- then to deposit rates and finally through the exchange rate to influence domestic prices. More predominantly however, the impulse function shows direct causal influences of exchange rate changes on CPI inflation and real output, and places the exchange rate at the core of the transmission process. It is evident from this that

⁴ From Robinson and Robinson (1996) block exogeneity tests indicate that the reverse repurchase rate and the exchange rate were the only two variables that exerted some causal relationship on the evolution of CPI inflation.

some combination of interest and exchange rates would be beneficial to the policy decision process and this goes a long way in justifying the need to develop a MCI for Jamaica.

Section II: Frameworks for the Conduct of Monetary Policy

The conduct of monetary policy relies on the process of transmission from the policy variable to the final objective. Central banks have assumed the mandate of controlling the rate of growth in prices or some measure of nominal output, which in liberalized economies cannot be directly set. Therefore, the central bank has used a general conceptual framework that relies on economic variables including operating targets, intermediate targets, and information variables to link its policy actions to the ultimate goal.⁵ A schematic representation of monetary transmission is presented in Figure 1, in which it is observed that the set comprises some combination of variables functioning as operating or intermediate targets, through which policy signals are transmitted to the final target. Variables that function as operating targets most often include short-term interest rates and the monetary base, and are variables that the monetary authority can directly influence. The set of intermediate targets predominantly comprises money or credit aggregates, the exchange rate, and the rate of growth of nominal gross domestic product (GDP), variables that can serve as a nominal anchor for the system.



As illustrated in Figure 1, at the beginning of the transmission process are instrument(s) conceptually defined as the variables that the central bank actually manipulates on a daily or weekly basis to achieve its monetary policy target. These instruments may comprise various direct and indirect means of control – namely reserve ratios and, open market-type operations that primarily

⁵ A clear distinction is made in defining the components of a monetary policy framework. ‘Goal’ refers to the ultimate but typically non-operational objective of the Central Bank, while ‘target’ refers to an operational variable that takes precedence in the actual conduct of monetary policy. See the “Introduction to Monetary Policy” for further reference.

influence the availability of domestic liquidity in the money market. Other indirect non-market methods of control that rely on imposing quantity and/or price restrictions are not usually applied in liberalized economies.

Within a liberalized economic framework, since there is no unique link between monetary policy instruments and the final objective, the process assumes a closely linked relationship between the intermediate targets, operating targets, information variables and the final target. In this regard, the key perceived advantage of using intermediate targets is that it enables the authorities to adjust instrument settings faster and more accurately in response to a shock to the system than it could if it focused solely on the final goal. Further, it is believed that the intermediate target variable leads the ultimate target and provides the monetary authorities with some measure for monitoring and evaluating the impact of its actions during the period between policy change and the impact on the final target. A critical assumption in the transmission process, therefore, is that the changes in the policy instrument influence these intermediate variables.

The two most likely contenders as target variables are inflation and growth in nominal spending. An appropriate selection criterion between these two is to choose the variable that corresponds most closely to the central bank's views about social objectives that are influenced by monetary policy. This gives inflation the natural edge, as it is perceived among many central bankers that the best contribution that they can make to long-term economic growth is maintaining orderly price movements. This is also justified because of empirical and theoretical deficiencies in using the nominal income measure. First, a large number of policy makers believe that, in the long run, monetary policy has no substantial effect on adjusting actual output to its desired or full employment level. They believe too that, even if monetary policy influenced the optimal level of output, the effects would be temporary since one-off policy changes will influence liquidity conditions only once and the effects will exhibit diminishing returns to policy. Second, measurement of full employment output creates difficulty and controversy as it relates to defining the adjustment that would be required to bring actual output in line with potential output. Furthermore, the magnitude of measurement errors of output far exceeds the potential measurement errors of changes in relative prices. The third reason stems from the ease with which information on inflation measures may be conveyed to the public, relative to output data.

It is important to distinguish between variables to be selected as an intermediate or operating target. This distinction becomes necessary since the range of options – monetary base, interest rates, exchange rates, and money or credit aggregates - is wide. The selection of intermediate or operating targets is more complicated as the existence or non-existence of a stable and predictable relationship between the choice variable and the ultimate target becomes very crucial. The choice of variables that will represent the intermediate link between the policy instrument(s) and the final objective is primarily dependent on the stability and consistency of the empirical relationship between the variable and the final target. In the case of inflation, the intermediate target should serve as a reliable guidepost to the evolution of prices. In addition, the links between policy instruments and ultimate targets through intermediate channels rely on the assumption that the central bank is able to exert predictable control over the variable. In this regard, appropriateness of the variable rests on the ability of the monetary authorities to guide the intermediate variable towards its target.

Over the years, several choice variables have been identified as appropriate intermediate and operating targets, depending of course, on how the transmission process is conceptualized. On the one hand, if the monetary policy process is characterized by stating the final objectives in general terms, such as low inflation, then the central bank could see the growth in a particular monetary aggregate or the exchange rate as an adequate guidepost for achieving the low inflation objective. In this regard, the broader monetary aggregates, credit growth, or the exchange rate would be intermediate targets that would require changes in the policy instrument to steer the variable to its target. This framework may be broadened to include operating targets, since the central bank identifies the need to monitor a variable that it can observe with a greater frequency and exert control. In this case, a narrow definition of money such as the monetary base, or interest rates, would suffice as an operating target. Several caveats apply to the use of a nominal exchange rate anchor for the system, hence the gravitation towards the use of monetary aggregates⁶, whether as operating or intermediate targets for the monetary policy framework.

The use of monetary aggregates as intermediate targets for monetary policy stemmed from the theoretical arguments that were popular in the 1970's and 80's. Then, scholars and policy makers

⁶ Further reference on the selection of the exchange rate as a nominal anchor is cited in Hoggarth (1996).

advocated the importance of ‘rules’ and the advantages, in particular, of using a money rule instead of an interest rate rule due to the perceived difficulties with precisely identifying which of the credit or money channels of the transmission process exerted the more dominant effect. While this has led most central banks to adopt monetary aggregates as policy targets, another difficulty emerges, as the selection of the aggregate to target becomes the issue. Hoggarth (1996) suggests as a solution that countries target more than one aggregate. In this regard, the intention would be to monitor aggregates that satisfy a range of criteria easily measurable, controllable, and comprehensive enough to capture the effect of movements in bank liabilities on inflation.

Economic thinking in the 1990’s recognises that the advantage of using monetary aggregates as reliable intermediate targets has eroded. The consensus, at least among developed nations, is that the conditions that existed during the 1980’s that warranted adoption of monetary aggregates have long disappeared. This is in light of numerous transformations in financial sectors and of economies as a whole, since the beginning of the century, which have brought into question the empirical relationship between monetary aggregates and the ultimate target – inflation. For example, where the use of monetary aggregates rely on a quantity theory framework, the velocity of circulation could become unstable and unpredictable. This is because of the increased sophistication and innovations in financial markets globally, resulting from financial liberation and macroeconomic stabilization. This would violate the requirement of a stable velocity of circulation for policy decisions structured within the quantity theory framework.¹ Pursuing money growth targets within an environment plagued with uncertainty of money velocity could have the disadvantage of causing frequent short-run swings in interest rates and real output.

The Monetary Conditions Index or Indicator

The framework so far outlined comprises intermediate and operating targets that have been dominated by a select group of money and exchange rate variables. Recent experiences have demonstrated that the set of intermediate parameters is not limited to this defined group as some countries have successfully conducted policy by relying on a single indicator variable or set of information parameters that provide leading or contemporaneous information about the potential movements in the final target. The success of this approach is a reflection of the weakening

relationship between monetary variables and inflation and output, and has led many central banks to calculate a monetary conditions index for use in assessing monetary policy decisions.

The MCI has emerged as an alternative to monetary targeting. While there remains some uncertainty about the relative strengths of the money and credit channels, the monetary conditions index conceptually captures both channels into a single composite relationship. Combining both sides of the transmission process through the incorporation of an exchange rate and interest rate variable, MCIs have been largely accepted as intermediate and indicator variables that have shown significant correlation with final targets. Consequently, MCIs have gained widespread use among developed economies such as Canada, New Zealand, Norway, and Sweden, which publish an index and, to varying degrees, use their respective indexes to inform policy decisions.

The Bank of Canada (BOC) utilizes the index most extensively in its policy framework as changes in the monetary policy stance are, to a large extent, determined by observed shifts in the index. In adopting the MCI as its operating target, the BOC has replaced the short-term interest rate as an operating target. To incorporate the index within the operating framework, an inflation target is announced, and the evolution of the path for the interest rate and the exchange rate is examined to derive the corresponding measure of monetary conditions that would be consistent with achieving this inflation target. Economists from the Bank of Canada note that, while monetary policy is adjusted to bring the actual index in line with its desired level, the process is not mechanical, since initiating the adjustments require tactical timing of policy changes.⁷

Several monetary economists have concluded that both interest rates and exchange rates are relevant where policy changes are transmitted through these variables rather than money and credit aggregates. Freedman (1994) argues for the thrust to broaden the concept of monetary conditions to include the exchange rate. His justifications are embedded in two main spheres of reasoning. First, operating in a flexible exchange rate regime, monetary policy impulses are transmitted directly through two channels – interest rates and exchange rates. Secondly, there is the need for policy makers to offset the effects of exogenous exchange rate shocks on aggregate demand and domestic price changes.

⁷ More detailed exposition of the MCI used by the BOC is presented in Freedman (1994).

The arguments for adopting MCIs are premised on the need to fully encapsulate, within an assessment of the transmission process, the nexus between interest rate and exchange rate changes. Freedman justifies his arguments by suggesting that where policy changes are effected in interest rates, the contemporaneous movement in the exchange rate that results may vary wildly. In this regard, misinterpretation of shifts in economic parameters may result in excessive adjustment in policy levers, exerting adverse influences on other economic sectors. The focus on the combination of interest rate and exchange rate changes enables the central bank to avoid the potential error of implementing inappropriate interest rate policy to influence the economy. His other contention is for a more practical use of the index aimed at facilitating the immediate reaction to changes in monetary conditions due to exogenous shifts in economic variables. The MCI construct allows the central bank to quickly identify changes in monetary conditions, resulting from internal shifts in the domestic economy, or exogenous shocks, and provides a direct mechanism signaling the need to take action to offset the monetary conditions that emerge. Adopting a monetary conditions index, in this regard, helps to ensure that appropriate attention is paid to exchange rate and interest rate changes in the transmission process. It is noted that the index measures the degree of ease or tightening in monetary conditions from an arbitrary date, and no meaning is attached to the *level* of the MCI.

Section III: Econometric Examination and Estimation

The task of defining relative weights for the components of the MCI begins with an examination of the econometric relationships between inflation and other economic variables. The paper adopts a model framework that is consistent with a small open economy and is similar in approach to work on New Zealand done by Nadal-De-Simone (1996).

The selected model is designed to capture the effects of imported inflation on domestic inflation, which stems from changing input costs and the additional component of exchange rate variability. Furthermore, the removal of capital restrictions makes the economy susceptible to free capital movement, and according to theory, the country will experience these effects where interest rate and exchange rate differentials are inadequate to attract and maintain funds within the domestic economy.

The system of equations as specified is intended to capture these issues as a part of the dynamics of monetary management in the Jamaican economy. The system is solved to produce a reduced form price equation which is estimated. The coefficients of concern in this equation are those attached to the exchange rate and the domestic interest rate, and they are used further in the work to calculate the MCI for Jamaica.

The Model

All the variables, except interest rates, appear in the model as logs. Since the economy is described as ‘open’, it produces and consumes goods from domestic and foreign markets, (with ‘*’ indicating corresponding foreign parameters). The model equations are outlined as follows:

$$y_t^d = a_0 - a_1 r_t + a_2 q_t + a_3 y_t^* + v_t \quad [3.1]$$

$$r_t = r_t^* + E_{t-1}(q_{t+1} - q_t) \quad [3.2]$$

$$q_t = e_t + p_t^* - p_t \quad [3.3]$$

$$y_t^s = \bar{y}_t + d(p_t - E_{t-1} p_t) + u_t \quad [3.4]$$

$$P_t = p_t + (1 - \alpha)(e_t + p_t^*) \quad [3.5]$$

$$e_t - e_{t-1} = \{c - E_{t-1}(p_{t+1}^* - p_t^*)\} - \lambda \{E_{t-1}(P_{t+1} - P_t) - c\} \quad [3.6]$$

For completeness the LM equation is added:

$$m_t - P_t = b_0 + b_1 y_t - b_2 i_t + \chi_t \quad [3.7]$$

where: y_t^d = demand for domestic output

r_t = real interest rate

q_t = real exchange rate

y_t^s = supply of domestic output

\bar{y}_t = potential output

e_t = nominal exchange rate

P_t = general price level

y_t^* = foreign output

r_t^* = foreign real interest rate

p_t^* = price of foreign output

p_t = price of domestic goods

m_t = measure of liquidity

i_t = nominal interest rate

u_t and χ_t = disturbance terms for supply and money demand respectively

c = the one-month proportional rate of inflation that gives the centre of the inflation target per annum.

Equation 3.1 represents the equilibrium of the goods market that is supported by the corresponding money market equilibrium defined in equation 3.7. Equation 3.2 posits the condition for uncovered interest rate parity (UIP) and recognises that the foreign interest rate and the exchange rate expectations should play an important part in a small open economy. In this regard, the domestic interest rate is not characterised as an active monetary management tool. The role for interest rates is defined to the extent that free capital movements occur within a context where the interest rate differential across economies and the expected change in the spot rate are equated. Equation 3.5 defines the general price level within the domestic economy as a weighted average of domestic prices and foreign prices. In this regard, it takes into account the pricing of tradeables as well as non-tradeables within the economy. The final equation represents a reaction function for the monetary authority and relies on the monetary model of exchange rate determination. Within this context, having evoked the UIP condition, the transmission process for interest rate changes holds when capital mobility and minimal transaction costs are assumed. In this regard, it is assumed that there is full adjustment in the actual price level to the price expectations within a context of perfect capital mobility.

This structural form is solved to obtain the reduced form equation for the general price level P_t :

$$\begin{aligned}
P_t = & \left[\frac{\alpha a_0}{a_1 + a_2} + c(l + \lambda) \right] \frac{l}{l - \lambda} - \frac{\alpha}{a_1 + a_2} \left(\frac{l}{l - \lambda} \right) \bar{y}_t - \frac{\alpha a_1}{a_1 + a_2} \left(\frac{l}{l - \lambda} \right) r_t^* + \frac{l}{l - \lambda} e_{t-1} + \frac{\alpha a_3}{a_1 + a_2} \left(\frac{l}{l - \lambda} \right) y_t^* \\
& + \frac{2(a_1 + a_2) - \alpha a_1}{a_1 + a_2} \left(\frac{l}{l - \lambda} \right) p_t^* - \frac{\alpha}{a_1 + a_2} \left(\frac{l}{l - \lambda} \right) E_{t-1} e_{t+1} + \left(\frac{\alpha}{a_1 + a_2} - \lambda \right) \left(\frac{l}{l - \lambda} \right) E_{t-1} P_{t+1} \\
& - \frac{2a_1 + a_2 - \alpha a_1}{a_1 + a_2} \left(\frac{l}{l - \lambda} \right) E_{t-1} p_{t+1}^* + \frac{\alpha}{a_1 + a_2} \left(\frac{l}{l - \lambda} \right) v_t
\end{aligned}
\tag{3.8}$$

The reduced form equation offers some intuitive appeal in the context of a small open economy since external shocks will most likely affect these economies. Conceptually, the equation defines the effects of foreign output, prices and interest rates on the domestic price level. Given the underlying economic structure of small open economies, this derivation is consistent with their vulnerability to various external shocks. Interestingly, the inclusion of the effect of the foreign interest rate on the domestic price level would imply that the capacity of the domestic monetary authority to alter domestic monetary conditions is limited, in so far as the foreign interest rate and exchange rate movements are its determinants.

As suggested by the theories on transmission of monetary policy impulses, where interest rate changes occur, the transmission is initially through relative changes in the availability of domestic resources available to acquire goods and services. As interest rates rise and domestic liquidity declines, the impact is a lowering in the rate of increase in domestic prices, as the market reallocates the scarce liquidity resources among its competing end-uses.

Domestic prices also respond to exchange rates changes. Developing economies that have flexible exchange rate regimes inevitably face this type of economic relationship as the patterns of production and consumption frequently reflect the demand for imported goods. It is therefore expected that as the exchange rate depreciates, or there are expectations for depreciation in the domestic currency, domestic prices will move in tandem with the adjustments in exchange rates.

Data Capture

Monthly data for domestic variables for the period September 1991 to December 1998 are obtained from the Bank of Jamaica Statistical Digest and are used in carrying out the estimation. This data period was selected to avoid issues relating to financial liberalisation that may create difficulties of parameter stability and constancy in the estimated weights. Expanding the data set to periods prior to economic liberalization would require alternative specification and estimation of systems of equations that would adequately incorporate the effects of changing MCI ratios in the presence of dynamic multipliers (Eckhold and Beaumont (1994)).

The variables include some measure of the long-run trend for domestic output $y(\bar{y})$. Potential output is derived by applying to the domestic GDP series the Hodrick-Prescott (HP) filter. When using this filter with quarterly data, a smoothing parameter of 1600 is usually employed. Since monthly data are being used here, the smoothing parameter λ is increased to 14,400 to transform current output to its long-run path.

Additional domestic variables include the end of period exchange rate, e , defined as \$J per \$US, and the consumer price index. Foreign variables used are the Federal Reserve discount rate, r^* , US GDP, y^* , and the consumer price index, p^* . Values for these were obtained from the International Financial Statistics (IFS) publications of the International Monetary Fund.

Empirical work in developing economies has been largely constrained by the data deficiency. The current work is limited to the extent that there is no existing measurement for monthly Jamaican output. Monthly data were obtained from the interpolation of quarterly data estimates of the Statistical Institute of Jamaica (STATIN) by assuming a constant growth rate. Statistical biases may be therefore arise in the estimated coefficients and caution needs to be exercised in interpreting regression results and their ultimate use for policy analysis.

Expectations for exchange rates and foreign prices are defined as three-period moving averages and are represented as $E_{t-1}e_{t+1}$ and $E_{t-1} p_{t+1}^*$ respectively. The other expectations variable, $E_{t-1}P_{t+1}$, is defined as the arithmetic mean of the consumer price index for the past three months.

Estimation and Calculation of the MCI ratio

Ordinary Least Squares (OLS) is applied to equation (3.8) to yield:

$$\begin{aligned}
 P_t = & 9.598 + 0.373e_{t-1} + 0.007E_{t-1}e_{t+1} + 0.082p_t^* + 0.001E_{t-1}p_{t+1}^* + 0.429\bar{y}_t \\
 & (0.69) \quad (3.84) \quad (-2.02) \quad (0.03) \quad (-0.30) \quad (7.85) \\
 & -1.08y_t^* - 0.007r_t^* + 0.001E_{t-1}P_{t+1} \\
 & (-2.69) \quad (2.14) \quad (14.45) \quad [3.8'] \\
 & T=84\{1991(12)-1998(12) \\
 & R^2=0.99 \\
 & Q(14)=21.56^*
 \end{aligned}$$

The numbers in parentheses represent the t-statistics of the estimated coefficients. The diagnostic tests on the residuals are summarised in the subsequent lines. The estimated price equation produced an R^2 of 0.99, with statistically significant coefficients on most of the foreign parameters included in the regression equation.

The one-month lagged exchange rate variable has a positive coefficient that is consistent with a priori expectations since any depreciation in the exchange rate is likely to translate into increases in domestic prices (as long as monetary policy does not act through interest rate adjustments to reduce money supply growth). Theory suggests, too, that exchange rate movements should act as a switching mechanism between aggregate demand for locally produced goods relative to foreign goods. If for instance there is a real depreciation in the exchange rate, this should influence lower demand for foreign produced goods by domestic agents, while potentially inducing greater supply, at least in the context where supply is elastic. In Jamaica's case, the indirect effect is often swamped by its direct counterpart and the episodes of depreciation are typically accompanied by increasing inflation, in so far as money supply expansion is not prudently managed.

The results also show that current inflation is fuelled by its own expected value. This is to be expected since episodes of exchange rate depreciation, as occurred in Jamaica over the period, coincide with expectations for higher inflation. This phenomenon is associated with movements in the exchange rate, since depreciation of the rate is immediately incorporated in domestic prices.

It is noteworthy that the foreign interest rate variable is statistically significant which means that it is important in influencing domestic monetary conditions. The UIP condition that defines the dynamics of domestic interest rates in terms of foreign interest rates and exchange rate depreciation, suggests that domestic interest rates adjust through a reactive mechanism to expected changes in exchange rates since it is observed that foreign interest rates exhibit relative stability over time. Within this context, while interest rates are not explicitly reflective of an active monetary policy stance, its role in domestic monetary decisions remains important.

Both domestic and US output are statistically significant but domestic output seems to have an incorrect sign. The latter may be a result of using the interpolated data. Foreign prices are statistically insignificant[CEL2].

Construction of the MCI for Jamaica

a. Defining the index:

The monetary condition index is the weighted sum of changes in the 180-day nominal treasury bill rate (r) and the nominal exchange rate (e), where here both variables are expressed as deviations from their values in a base period. It is noted that while the central bank typically defines an interest rate signal through the reverse repurchases rate, the treasury bill rate represents the most widely or frequently used rate. Algebraically, it is convenient to write the MCI as:

$$MCI (v)_t = 2_{v,r}*(R_t - R_0) + 2_{v,e}*(e_t - e_0), \quad [3.9]$$

where t is a time index ($t=0$ is the base period), 2_r and 2_e are the respective weights on the interest rate and the exchange rate, and variables in lower case denote logarithms.

b. Measuring the relative weights:

The weights are chosen to reflect the effects that changes in the monetary policy instruments have on the final target. In this instance, the weight in the index represents the relative impact of interest

rate and exchange rate changes on inflation. Where the MCI is used as an operational target, the weights are intended to reflect the linkages between the operating target and the final objective, with changes in the index indicating the likely changes in the final target.

The relative weights of the index are measured respectively by the coefficient of the one-month lagged exchange rate and the coefficient on the interest rate variable obtained from the estimated equation in 3.8'. These values are 0.37 and 0.007 respectively. A 1% change in the exchange rate exerts a much greater influence on domestic prices over time than a 1% change in the interest rate.

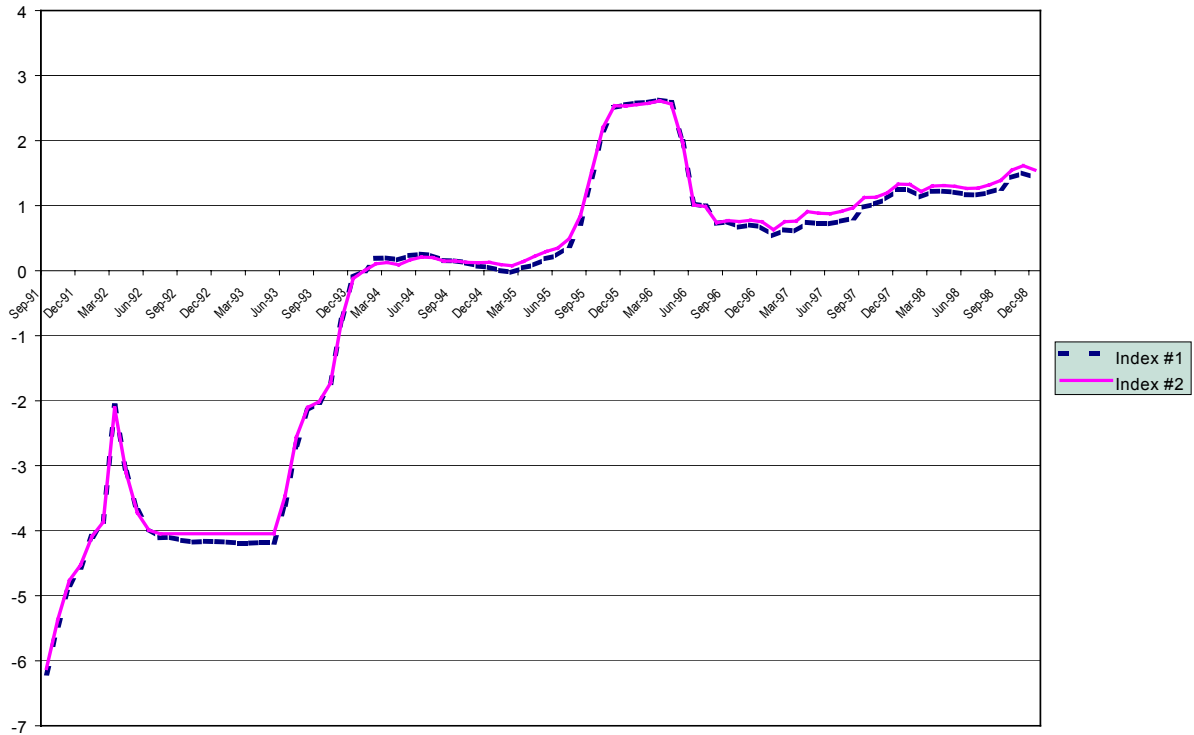
c. Assessing the estimated MCI for Jamaica

The tightening or loosening of monetary conditions within the Jamaican economy is measured relative to January 1994, when conditions in the foreign exchange market settled at a new equilibrium. A decline in the interest rate potentially increases liquidity, and hence exerts upward pressure on domestic prices. Alternatively, for a depreciation in the exchange rate, the impact of increased costs of production is immediate and will create increasing pressure on inflation. So, a rise in the index is interpreted as a loosening of monetary conditions.

Another useful perspective on the movements in the index is that it signifies a change in the relative attractiveness of Jamaican dollar assets relative to foreign currency assets. Thus an increase in the index would be consistent with a weakening in the demand for Jamaica dollars which can be corrected by a combination of exchange rate stabilisation and interest rate increases.

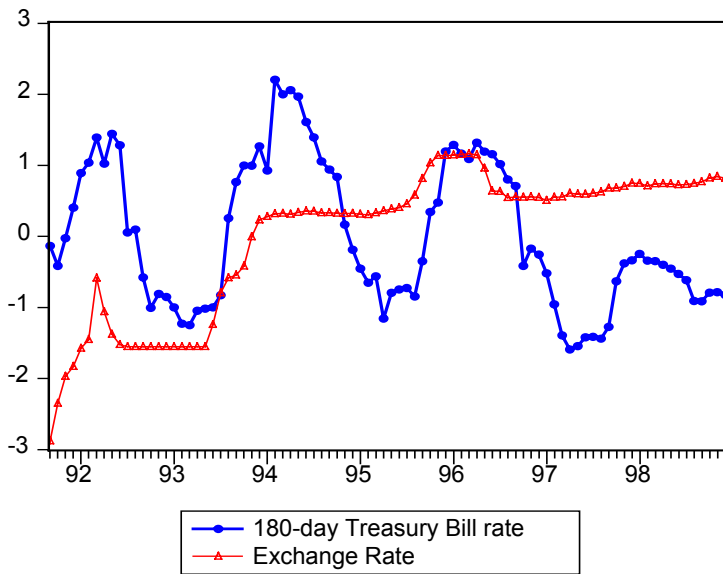
As a policy indicator, the MCI aims at tracking the relative effects of interest rate and exchange rate changes on inflation. In Jamaica's case, movements in the index are symmetrical to the fluctuations in the exchange rate (*Chart 3*). Periods of sharp depreciation exchange rate coincide with the precipitous loosening of monetary conditions, while periods of relative stability produce a stable index.

Chart 3: Monetary Conditions Index



(January 1994=0)

Chart 4: Components of the Monetary Conditions Index for Jamaica: September 1991-December 1998



Section IV: Using the index in the current monetary policy framework

In the existing monetary policy framework, changes in the monetary base and monetary aggregates are used as predictors of domestic inflation. The MCI, at least in a theory, serves to complement this analysis by

- a) allowing timely calculation and examination of its components to examine the imminent effect on domestic inflation
- b) providing information on indicative policy adjustments that would be required to maintain conditions and limit the potential for higher inflation in future periods, and
- c) incorporating both channels of the transmission process – interest rate effects of the domestic economy and exchange rate effects influenced by domestic and foreign conditions.

Since the estimated index mirrors the movements in the exchange rate, the pertinent question at this juncture is whether or not the computed index broadens the information base required for monetary policy formulation.

A response to this question is obtained by examining two calculated MCIs, one defining the effect of interest and exchange rate changes relative to the identified base period (*denoted index #1*), and the other, the pure impact of the changes in the exchange rate from the same base (*denoted index # 2*). *Chart 3* depicts this comparison.

In the first instance, sharp depreciation is observed in the exchange rate from June 1993 to November 1996, with the attendant rise in interest rates not being sufficient and effective in offsetting the impact of an exchange rate rise on the domestic monetary conditions (*see Chart 3 & 4*). As a result, the index increases sharply, creating conditions conducive to maintaining high monthly and annualised inflation rates. Further, it is noted that during this period, there is the marginal difference between the calculated indexes, which suggests that monetary conditions are most likely unaffected by interest rate changes when there exists unstable conditions in the foreign exchange market.

On the other hand, during periods of moderate exchange rate movements (June 92-June 93, and January 1994-January 1995) and with interest rates remaining relatively high; there is some distinction in the calculated indexes. The effect of interest rates becomes clear, as the degree of loosening in monetary conditions (measured by index #1) is not as sharp as that indicated by index # 2. The interest rate effects continue through to the subsequent period, where interest rates remained fairly high during periods of relative stability in the value of the currency, resulting in conditions that reflect some tightening to remain consistent with the creation of the low inflation and interest rate economic environment.

This analysis suggests that there are distinct circumstances where monetary policy directed through interest rate changes were effective or ineffective in controlling inflation, and depended largely on the nature of the adjustments in the exchange rate. During periods with moderate exchange rate changes, monetary policy gains momentum in guiding inflation to the target, while during disorderly exchange market conditions, the role of interest rate adjustments were less effective.

It is indeed clear from the foregoing that domestic interest rates do not exert an overwhelming influence in monetary transmission process. The literature on the transmission process indicates that an increase in interest rates is likely to prove more effective in reducing inflation where the financial system is open and competitive, and with more contracts set on a floating basis. A critical underlying assumption within this context is that the financial system is sound, so that monetary policy signals are appropriately transmitted through the representative money or credit channels, and finally to economic parameters. Typically, a sound banking system (defined in terms of concepts of solvency and liquidity) enhances the monetary policy process, as banks not only interpret, but also act appropriately to alter balance sheets to adequately mirror the prevailing stance of monetary authority.

In a context of a weak banking system, the central bank's expectations of linkages between policy instruments and performance in the economy will become uncertain, rendering it increasingly difficult to set and adjust policy parameters appropriately. Further, the effectiveness of policy instruments will diminish as banks become unable to respond to monetary policy signals through

appropriate and timely balance sheet adjustments. The most obvious result is inefficient credit allocation, which feeds through to have negative impacts on the real domestic economy.

The transmission of monetary policy signals require the underlying support of appropriate micro-economic conditions of the banking system as the effectiveness of policy instruments will be determined by the extent to which banks can effect timely adjustments in their balance sheets. Guitan (1997) concludes that appropriate macro-economic policies are necessary to achieve price stability, but are not sufficient to maintain it unless supported by appropriate micro-economic conditions.

The MCI is by no means a precise measure of the effects that changes in exchange rates and interest rates exert in the domestic economy, but represents a reasonable indicator of future inflation movements. A pure examination of the contemporaneous linkage between the MCI and inflation shows positive correlation in which the MCI acts as a satisfactory information variable in defining future movements of inflation. The test for the association between these variables⁸ indicates that there is strong correlation between inflation and the monetary conditions index, and hence satisfactorily establishes some dependence between both variables.

It is clear that identifying the source of exchange rate shocks is critical to the functioning of Jamaica's monetary policy framework. However, a case is made for using the combined index. Exogenous shocks to the exchange rate, for example, if there are disorderly market conditions that would fuel a sharp depreciation and loosen monetary conditions, would require tactful and timely policy adjustment to maintain a relatively stable monetary index. Focusing on the monetary conditions index, the need for tightening action would show up directly since the index would show the easing resulting from currency depreciation, and immediate action taken to return monetary conditions to their previous level. Note however, that the index cannot define the magnitude of change required, but practically serves as an economic barometer continuously measuring the degree of inflationary pressures within the economy.

⁸ For full discussion on this topic see Kendall and Stuart (1967), p296.

The case is therefore made for adopting the combined index rather than the sole movements in the exchange rate. The focus of monetary policy within the current environment is to achieve simultaneous stability in the foreign exchange and money markets that will maintain the current low inflation environment. To this end, changes in the exchange rate would not be sufficient intermediate target since it only includes one side of the economy, and the central bank would be limited in effecting timely changes in interest rates to temper the effects of exchange rate changes. Index #1 broadens the span of monetary policy assessment to include interest rate and exchange rate targeting to maintain a stable index, and by extension low inflation.

Section V: Concluding Comments

The principal recommendation of this paper is that both the interest rate and exchange rate in should be used in examining the changes in policy and the impact on the final target. Further, in the process of estimating the MCI ratio and then deriving an index, support was obtained for the long-standing view that stability of the exchange rate will create and facilitate better macroeconomic fine-tuning. In the case of Jamaica, like most developing countries the underlying market structures dictate that the effect of exchange rate changes have an immediate and direct impact on domestic prices. In this regard, it is imperative that as soon as exchange rate shifts occur (from whatever source), attendant adjustments should be made in domestic policy to offset the fluctuations. The index facilitates this timely assessment and adjustment since it may be continuously calculated and examined more frequently than other intermediate variables such as M3.

A limitation in using the nominal index as an intermediate target is the relatively short horizon that it covers. To extend the period of focus, an index defined in real terms, measuring the changes in real variables from their base periods, would be more useful, although in the short-term the nominal should serve as well as a real MCI. However, the calculation of a real MCI is going to be hampered even more by the absence of appropriate data.

This paper also highlights the need to adopt an additional operating target to augment the current use of base money. While it may not be superior to using the exchange rate as an intermediate target, as an operating target it is clear that the index provides a basis for the monetary authorities to

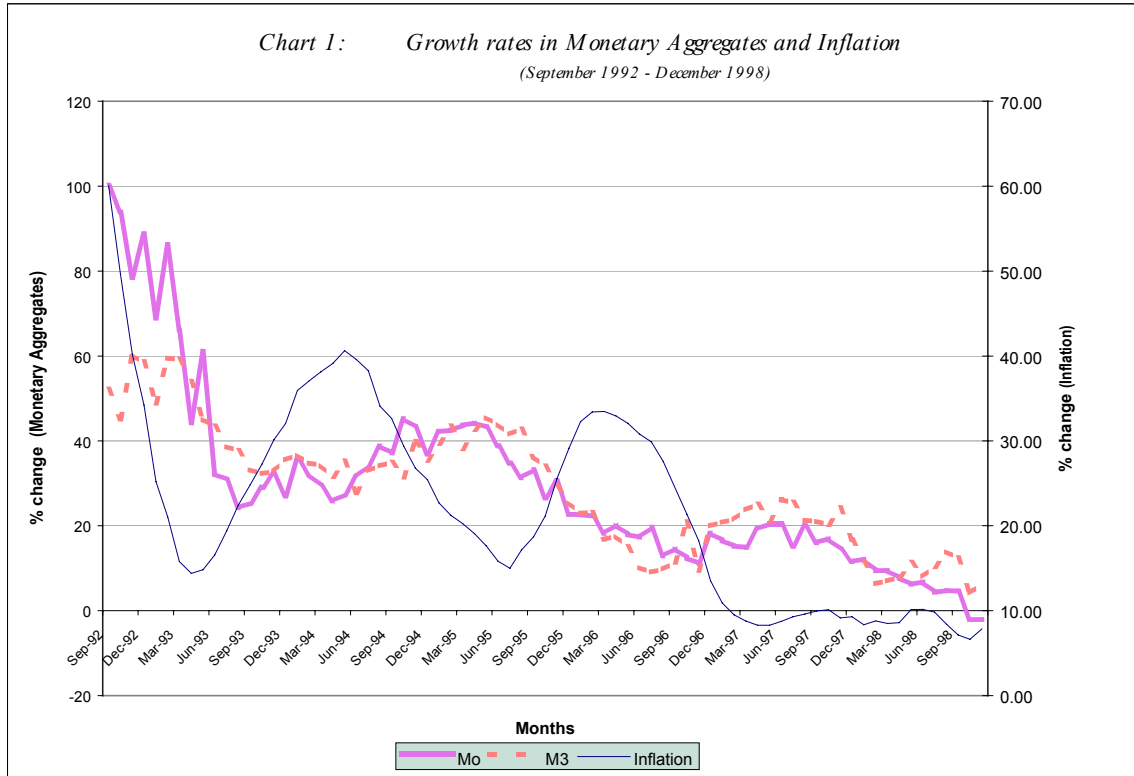
alter market expectations with a time-consistent, transparent operation of monetary policy linked to a single objective.

While the results of this paper support the adoption of the MCI to augment policy decisions, alternative means of assessment may be required to look at other issues. Also, the current work is only the beginning of an ongoing process for defining the relative weights for an MCI and it needs to be supplemented through the examination of alternative estimation methods, accompanied by rigorous tests for stability in weights.

Like other work dealing with the same issue, this one utilizes a traditional method of regression analysis. It has been suggested (Nadal-De Simone and Dennis, (1996)) that studies on MCIs be extended to include explicit testing for cointegration. If the null hypothesis of cointegration were not rejected, the examination of cointegrating relationships would allow a clearer distinction between long run and short-run dynamics of the system.

Lastly, the adoption of the MCI as an operating target would need to be combined with more sophisticated inflation targeting than currently practised. The ability to forecast inflation six to eight quarters ahead and to associate these targets with movements in the MCI would set the stage for elevating the MCI to a more permanent place.

APPENDIX A



Note: variables are measured in percentage changes, with monetary aggregates on the LH axis and inflation on RH axis.

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ⁱ Economies in transition from a high inflation environment to a low inflation environment may experience a shift in the velocity. This may not be a precursor to higher future inflation, which if not recognized may lead policy makers to react unnecessarily.