Is Sri Lanka Ready for Inflation Targeting?

by
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Abstract

Inflation targeting has become the most popular and widely discussed policy framework in the contemporary monetary policy practice. The success of inflation targeting has been proved by a number of advanced and emerging countries and hence, most of the monetary authorities around the globe have paid attention on the feasibility of adopting such frameworks. However, a country needs to fulfill several prerequisites to adopt inflation targeting in terms of institutional setup, legal framework and the efficacy of policy transmission mechanism. Since the controllability of operating targets and its impact on the ultimate target of inflation is considered as one of the important prerequisites in inflation targeting, this paper attempts to examine the statistical relationships between operating targets and inflation rates in Sri Lanka. At the same time, it is intended to provide a framework for institutional, legislative and operational arrangements with a view to facilitate adopting inflation targeting. This study finds that statistical relationships between operating and final targets are not sufficiently strong, persistent and significant in the Sri Lankan context; however there are signs of emerging relationships. Those would persist with matured economic structure and developed financial markets, enabling adopting inflation targeting in Sri Lanka in future.

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1. Background

Amongst several monetary policy regimes those used for achieving price stability, inflation targeting (IT) has become increasingly popular among monetary authorities across the globe. In the 1990s, several countries shifted to IT monetary policy regime with an announced quantitative inflation target mainly due to the unsatisfactory performance under previous regimes (Svensson, 1998). Since the maiden initiative taken by the Reserve Bank of New Zealand to adopt IT framework in 1989, several industrial countries[1] have adopted and some countries like Japan have opted to adopt[2] IT as the monetary policy regime. Even in the United States and in Europe, it was debated as a possible monetary policy strategy for the Federal Reserve System[3]

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1/ Canada (1991), United Kingdom (1992), Sweden, Finland and Australia (1993), Spain (1994), Korea (1998), Norway (2001)

2/ Speech of Toshihiko Fukui, 'Inflation Dynamics and Monetary Policy in Japan', 2007

3/ Speech of Ben S Bernanke, ' A Perspective on Inflation Targeting', 2003

and the European Central Bank, respectively (Svensson, 1998). In recent years, several emerging market economies have also joined industrial countries in adopting monetary policy frameworks of formal, explicit or full-fledged IT.[4] As of 2007, IT regime had been adopted by more than 20 industrial and non-industrial countries.

The increasing interest in emerging economies has led by the successful lessons of lower inflation after adopting IT, which previously known as high inflation countries. An IT framework essentially makes inflation-rather than output or unemployment - the primary goal of monetary policy. It also tempts a central bank to predict the future behaviour of prices, giving the opportunity to tighten policies before sustained inflationary pressures develop (Agénor, 2000). IT is also characterized for a system that has high degree of transparency and accountability as it makes central banks publicly accountable for their decisions and induces to achieve the inflation targets. Further, it is an important force for implementing and expediting structural reforms (Feldman, 2006).

However, a country needs to fulfil several prerequisites to adopt IT in terms of institutional setup, legal framework and the efficacy of policy transmission mechanism. As such, one of the most important necessary conditions for effective IT is the controllability of monetary instruments mainly over interest rates (operating targets) and effective channel of interest rates on prices. This simply means that there should be a stable and significant relationship between the measure of inflation to be controlled and short-term interest rates.

Since the Central Bank of Sri Lanka (CBSL) has expressed its interest to move towards IT in the medium term (CBSL, 2007), a greater need exists in examining the relationship between short-term interest rates and inflation while fulfilling the other prerequisites. Accordingly, the main objective of this paper is to identify the relationship between interest rates to final targets in monetary policy in order to establish the conducive background for adopting IT in Sri Lanka. It is also intended to identify the related issues and concerns over adopting IT framework. Hence, alternatively, this paper intends to provide a framework in terms of institutional, legislative and operational arrangements to facilitate the adopting IT framework.

The remainder of this paper is organized as follows: Section II presents an introduction to IT and Section III explores the reasons and rationale of adopting IT in Sri Lanka. Section IV reviews the theoretical underpinnings, empirical studies and international and Sri Lankan evidence on the link between monetary instruments, particularly interest rates and inflation. The feasibility of adopting IT with a reference to the link between monetary policy instruments and inflation based on econometric analysis is presented in section V and the findings and observations are presented in Section VI followed by the conclusion.

2. Introduction to Inflation Targeting (IT)

2.1 Significance of Inflation Targeting

IT is a monetary policy framework, which is characterized by a public announcement of official quantitative inflation targets (or target ranges) within a pre-designated one or more time horizons, and the using of the available policy instruments pre-emptively to attain such targets (Bernanke, 2001). Hence, IT can be defined as a framework for policy decisions in which central banks make an explicit commitment to conduct monetary policy to meet a publicly announced numerical inflation target within a particular time frame. By definition, it is a monetary policy strategy aimed at maintaining price stability by focusing on deviations in published inflation forecasts from an announced inflation target.

A full-fledged IT framework has three main characteristics: (i) an inflation target is designed in a medium to long-term perspective, (ii) a future inflation rate is forecast[5], and (iii) a short-term interest rate is used as an operating target, without any explicit intermediate target to achieve the announced inflation target.

4/ Mexico (1995), Israel and Czech Republic (1997), Poland, Brazil, Chile and Colombia (1999), South Africa and Thailand (2000), Hungary and Iceland (2001), Peru and Philippines (2002), Indonesia (2005), Ghana (2007)

5/ In this context, IT framework is refereed as "inflation forecast targeting" instead "inflation targeting" (Svennson, 1997). Agénor argues that, in particular, because interest rate changes affect inflation with a lag, monetary policy must be conducted in part on the basis of forecasts; the larger the amount by which the current inflation rate exceeds the forecast, the higher the interest rate. He also argues that the use of conditional inflation forecasts as intermediate targets in the policy rule is optimal, given the quadratic structure of policy preferences (Agénor, 2000).

The need and the discussion for IT begins with the principle that the main goal of monetary policy in any country must be to attain and preserve a low and stable rate of inflation, i.e. achieving and maintaining price stability. This premise is widely accepted in contemporary economic thinking because of general agreement on the following four basic propositions:

(i) An increase in the money supply has a neutral impact in the medium-to-long run, i.e. long-run neutrality of money which means that money supply increases have lasting effects only on the price level, not on output or employment,
(ii) High and variable inflation is costly, in terms of either the allocation of resources or long-run growth in output, or both,
(iii) Money is not neutral in the short – run, or in other words, monetary policy has important transitory effects on a number of real variables, including output and unemployment, and
(iv) Monetary policy affects the rate of inflation with lags of uncertain duration and varying strength and such lags make it difficult, if not impossible, for monetary authorities to control inflation (Masson, *et al*, 1997).

The rationale behind adopting an IT system can be cited as (i) rapid financial innovation across the globe, (ii) detrimental effects of high inflation on economic variables, and (iii) formation of a mechanism for central banks to combine rules and discretion in pursuing monetary policy. Accordingly, an ideal IT system works as a blend of discretion and rule. Precisely, in most of the cases, IT serves as framework for monetary policy conduct rather than a rule (Bernanke, *et al*, 2001). More distinctively, by imposing a conceptual structure and its inherent discipline on the central bank, however without eliminating all flexibility, IT combines some of the advantages assigned to rules with those ascribed to discretion (Bernanke, *et al*, 2001).

2.2 Advantages and Disadvantages of Inflation Targeting

Countries, which have adopted IT as the monetary policy regime had proved the success to a greater extent than monetary aggregate and exchange rate anchors[6]. According to the International Monetary Fund's studies, such advantages include the following:

- IT supports in shifting the public's attention away from short-term interventionist policies for which monetary policy is ill-suited, toward low and stable inflation that ultimately helps macroeconomic stability and economic growth,
- IT greatly enhances the accountability and discipline of monetary policy and fiscal policy,
- A well established IT framework provides the central bank with the scope to respond to short-run developments, but with less of a threat to its long-run, inflation fighting credibility, and
- IT helps in motivating institutional reforms of the central bank and provides an impetus for structural reforms, especially in the context of disinflation (Schaechter, *et al*, 2000).

The establishment of price stability through IT framework as the primary long run goal of the monetary policy provides a key conceptual element in the overall framework of policy making. Therefore, IT serves as a better nominal anchor, i.e. nominal macroeconomic variable anchoring price developments for monetary policy than monetary targeting and exchange rate targeting frameworks due to a number of reasons.

First, IT imposes some degree of discipline and accountability on the central bank and especially on the government itself. As inflation is primarily a monetary phenomena, containing inflation greatly relies on controlling monetary expansion. It is evident that in many countries, excessive monetary expansion is mainly driven by imprudent monetary and fiscal polices, which tend to increase the net domestic asset component of central banks and commercial banks. This is basically due to the monetization of the huge government deficits. Hence, implementation of supportive fiscal measures as complementary policies to monetary policy is critical to combat inflation, particularly when the excessive monetary expansion is caused by excessive government borrowings. In many cases, IT regimes provide a greater authority to central bank to pursue independent monetary polices by statutes and practice, and thereby limiting or prohibiting the excessive money printing at the requirement of governments.

6/ *"The performance of inflation-targeting regimes has been quite good. Inflation-targeting countries seem to have significantly reduced both the rate of inflation and inflation expectations beyond that which would likely have occurred in the absence of inflation targets."* (Mishkin, 1999).

Second, IT ensures the autonomous conduct of monetary policy, even in a world of continuing globalization, financial innovation and liberalized capital flows.

Third, IT operates with a medium-term to long-term focus, consistent with the relatively long lag between monetary policy measures and their impact on inflation and inflation expectations. Hence, inflation target enables central banks to supplement the traditional transmission channels more explicitly with the expectation mechanism (Berg, 2005).

Fourth, an IT framework would serve policy makers to communicate their intentions to the general public in a more convincing manner. Hence, IT ensures monetary policy transparency that makes policy more clarity, which is understandable to the public and allows for better prediction of the central bank's intentions.

Fifth, the multi-criteria nature of IT allows the optimum amount of information to be incorporated into the decision-making process. In the decision-making process, IT involves the use of much more information than do the exchange rate or monetary aggregate targeting regimes. This ensures that no information is lost in the decision making process.

Sixth, some researchers have found the convergence effect of IT frameworks (Neumann and von Hagen, 2002). Accordingly, due to the better performance of macroeconomic variables in a stable environment, IT helps poorly-performing countries catch up with countries that are already doing well (Ball and Sheridan, 2003).

Seventh, some of the countries prefer adopting IT framework in view of financial stability considerations[7]. By establishing and maintaining financial stability, the monetary authorities make their unique contribution to general economic developments in an economy. If financial institutions and markets are uncertain and instable, decisions on production, consumption and investment would largely get affected. As a result, it would hinder the employment creation process. The lessons of the emerging market financial crisis in 1997 illustrated that foreign investments can also be withdrawn easily and largely from countries that investors perceive as high-risk destinations aggravated by high inflation and expectations (Lehohla and Myburgh, 2002).

IT framework has some potential drawbacks as well. First, the need for fulfilling prerequisites in adopting IT is itself a drawback. Even though there is a possibility of adopting IT framework within the existing macroeconomic environment, an urgent need exists in ensuring prerequisites in order to receive better deliverables. However, it is very difficult to make institutional arrangements and establish other pre-conditions in shorter periods of time in most of the countries.

Second, monetary instrument instability if the IT framework is overly rigid, the need for a strong fiscal position and hardly exist-prudent fiscal management and possible exchange rate volatility rate are amongst the other drawbacks (Schaechter, *et al*, 2000).

Third, the central bank is not as a rule able to influence all the items included in the consumer price index, which is the primary anchor of inflation expectations. Also, the success of the inflation forecast depends on exogenous international factors and other domestic factors such as changes in administered prices and indirect taxes. This is the reason for using core inflation as the final target by some countries.

Fourth, some research however suggests that there is no evidence that IT improves performance as measured by the behaviour of inflation, output, or interest rates. Although such research findings are not against the beneficial (future) impact of IT, those suggest, however, that no major benefits have occurred so far. Ball and Sheridan have presented two arguments in this regard, (i) aspects of IT may be desirable for political rather than economic reasons, and (ii) IT might improve economic performance in the future in the wake of events such as 1970s supply shocks, or strong political pressures for inflationary policies (Ball and Sheridan, 2003).

Also, there are claims against the inflation - containing ability of an IT system. Countries have introduced IT when the inflation rates were already low and hence, some argue that IT has contributed to build the credibility of the monetary mechanism and maintaining a low rate of inflation rather than bringing down inflation on its own (Jha, 2006).

7/ For instance, the introduction of IT is South Africa was motivated by the desire for financial stability, which they considered as an important precondition for sustainable high growth and employment creation (Lehohla and Myburgh, 2002).

3. Reasons and Rationale for Adopting IT in Sri Lanka?

3.1. Feasibility of Adopting IT in Developing Countries

Some argue that in most developing countries, preconditions for adopting IT framework are not yet present (Masson, *et al*, 1998). Accordingly, improving monetary and inflation performance of developing economies should probably continue to rely on simpler and less demanding, however, not necessarily less effective monetary policy frameworks. It is also argued that strengthening of institutions and increasing market orientation overtime could make IT as an attractive option for a number of countries at a relatively more advanced stage of development. Countries have adopted IT when the rate of inflation was already low (less than 10 per cent) and hence this has contributed to the initial credibility of the framework. In this respect, aspects of the conduct of monetary policy in developing countries are least consistent with IT (Masson, *et al*, 1998).

However, some contrasting views can be observed in this regard. According to research, New Zealand, Canada, Australia, and Spain all had introduced inflation targets under persistently high inflation eras. Further, United Kingdom, Sweden, and Finland did so after having abandoned fixed exchange rates, which had failed to achieve low and stable inflation and had been subject to dramatic speculative attacks (Svensson, 1998).

Batini and others argue that it does not appear to be necessary for emerging market countries to meet a stringent set of institutional, technical, and economic preconditions prior to the successful adoption of IT (Batini, *et al*, 2006). Instead, the feasibility and success of IT appear to depend more on the authorities' commitment and ability to plan and drive institutional change after the introduction of IT. Once they adopted the IT framework, authorities could focus on the institutional and technical goals that they should strive for during and after the adoption of IT.

However, it is widely agreed that countries should fulfil requirements at least after the implementation of IT strategy to maximize its potential benefits.

3.2. Monetary Policy Framework in Sri Lanka

The Monetary Law Act (MLA) empowers the CBSL to pursue the function of safeguarding the value of the currency in Sri Lanka. Since the inception of the CBSL, efforts have taken to preserve the internal value of the domestic currency and the absence of even a single episode of hyper-inflation or crises of monetary nature during the history of CBSL is testimony to the efficacy and prudence monetary management (Wijewardena, 2007). However, as a country with relatively high and volatile inflation, there exists a need to revisit and reformulate the monetary policy strategy of the CBSL in order to further strengthen its efforts on achieving and maintaining economic and price stability and to reap benefits out of the stable macroeconomic environment.

At present, monetary management and monetary policy conduct of CBSL is based on the monetary targeting (MT) framework. It follows an operational targeting approach and hence, specifies a target amount and growth of reserve money as the operating target, which is compatible with other macroeconomic variables[8]. Under the MT framework, broad money[9] is used as the intermediate target. Accordingly, price stability is to be achieved by influencing changes in broad money supply linked to reserve money through money multiplier assuming the demand for money as reflected by the velocity, remains stable.

3.3. Adopting IT in Sri Lanka

Although the MT framework has served well for decades in monetary management in Sri Lanka, several researchers have articulated the need for adopting IT in Sri Lanka. In fact, the CBSL has also been modifying and developing the MT framework with a view to moving towards IT framework in the medium term[10]. The

8/ Monetary targeting framework is operated through a monetary programme, which interconnects all the major sectors in the economy.

9/ Currently, M_{2b} (Consolidated broad money), which includes operations of offshore banking units (OBUs) is used for the conduct of monetary policy.

10/ The possibility of moving towards IT framework in the medium term was stated in the CBSL's Monetary and Financial Sector Polices for 2008 and beyond (Road Map) and in the Strategic Plan: 2008 – 2012. Also, the CBSL has taken several initiatives with a view to move towards IT framework as outlined in the Box Article, "Moving towards to Inflation Targeting from a Monetary Targeting Framework" in the CBSL Annual Report, 2007.

enhanced interest in adopting IT in Sri Lanka is pronounced due to several (i) economic and (ii) technical reasons.

(i) Economic Considerations:

Interest rate and exchange rate were the main anchors in the implementation of monetary policy in Sri Lanka for a considerable period. The country however had been facing several difficulties in supporting the crawling peg exchange rate regime and thereby to defend the exchange rate until 2001. In January 2001, Sri Lanka adopted a floating exchange rate regime and due to this transformation, CBSL had to abandon one of its monetary policy anchors requiring the adoption of an alternative anchor. Therefore, there exists an important need for CBSL to consider the feasibility of adopting an IT monetary framework to achieve price stability (Jayamaha, *et al*, 2002). Precisely, the technical and operational conditions suggest that implementation of IT is needed to fulfil the need for a new core anchor.

The fiscal dominance on monetary policy in Sri Lanka has been continuously criticised and analysed. Although the CBSL has given an adequate level of independence in terms of goal, institutional, financial, instrumental and operational aspects under the MLA, and the CBSL has maintained amicable cohesive relationships between the governments, fiscal operations still have a greater impact on effective conduct of monetary policy. Since the CBSL has to ensure the availability of reasonably priced borrowings to the government by pursuing the agency function of public debt management and maintain the interest rate stability in the markets, the CBSL occasionally intervenes in the primary Treasury bill market and thereby finances the government. The borrowings by the government by way of subscribing Treasury bill auctions and disbursing provisional advances[11] by the CBSL and also borrowings from the commercial banks by way of subscribing to Treasury bill auctions and granting overdraft facility by commercial banks impact on money and credit levels thereby generating inflationary pressures in the economy. In that context, the commitment and the legal obligation of the CBSL in achieving the objective of price stability may be affected. Hence, there is a greater need exist in creating a disciplinary environment and ensure the commitment and supportive stance of the government to pursue CBSL's core functions more objectively. This mainly includes the creation of a framework for more prudent fiscal management and establishment of legal commitment for low and stable inflation.

Practical experience across countries suggests that this is more permissible and possible within the IT framework than any other monetary policy framework. Hence, IT framework is needed to ensure the Central Bank's commitment and government's discipline and boost the public confidence on low and stable inflation.

(ii) Technical Considerations:

Significant structural changes in the financial sector also raise a concern whether stable relationship between monetary aggregates and price levels exist or not. Financial innovations through introducing new service channels and instruments, financial deepening, financial sector liberalization and improved competitiveness have significant impacts on the relationship between money and inflation.

MT framework presumes the existence of a stable relationship between one or more monetary aggregates and the general level of prices and hence MT requires adequate knowledge of the parameters characterizing the demand for money. When an economy undergoes rapid financial liberalization, these parameters (notably the interest elasticity of money demand) may be highly unstable. In such conditions money ceases to be a good predictor of future inflation because the relation between the intermediate target and the final objective becomes unstable (Agénor, 2000). Hence, the veracity and accuracy as well as the stability and predictability in money multiplier and velocity are considered as compulsory prerequisites in effective MT. If there is no stability for demand for money, there may also be instability in velocity, and hence money supply may not be controllable (Jha and Rath, 2003).

In most economies, however it has been observed that the relationship between monetary aggregates and inflation weakened resulting from the instability in the money demand function during the past few decades (Moinuddin, 2007). Such weaker relationships, in fact made it difficult to target monetary aggregates (Maravic and Palic, 2005).

11/ As stipulated in the MLA, the CBSL provides to the government provisional advances amounting to 10 per cent of government's estimated annual revenue.

Table 1: Money Multiplier and Velocity in Sri Lanka

	2001	2002	2003	2004	2005	2006	2007
Broad Money Multiplier	4.88	4.92	5.08	5.02	5.16	5.02	5.31
Velocity	2.76	2.69	2.74	2.68	2.61	2.65	2.71

Source: Central Bank of Sri Lanka

As per Table 1, it is noteworthy that the demand for money as reflected by the velocity has shown some volatility in the recent past. This may be perhaps due to the changes in demand for money resulting from the developments in financial markets and financial instruments. In such context, the volatility in velocity raises concerns over the effectiveness of the present monetary targeting framework.[12] The probability of deviating from the final target by achieving a specific intermediate monetary target is significantly increases with such instability and this is observed in the recent years' performance when actual monetary expansion exceeded the targets with wider margins as reflected in Table 2.

Table 2: Targeted and Actual Monetary Aggregates in Sri Lanka

	2001	2002	2003	2004	2005	2006	2007
Reserve Money Target							
Rs. Bn	118.6	126.1	142.9	163.2	196.5	227.6	267.6
Growth (%)	13.0	12.0	13.0	15.4	15.0	15.0	11.6
Reserve Money Actual							
Rs. Bn	112.5	126.4*	142.0	171.0*	197.9*	239.8*	264.4
Growth (%)	7.0	12.3	11.9	20.9	15.8	21.2	10.2
Broad Money Target							
Rs. Bn	549.1	617.8	701.2	814.8	987.4	1,175.6	1,382.5
Growth (%)	14.0	12.5	13.5	13.5	15.0	15.0	14.8
Broad Money Actual							
Rs. Bn	549.0	622.5*	717.9*	858.6*	1,022.3*	1,204.6*	1,404.0*
Growth (%)	13.6	13.4	15.3	19.6	19.1	17.8	16.6

* instances of deviations

Source: Central Bank of Sri Lanka

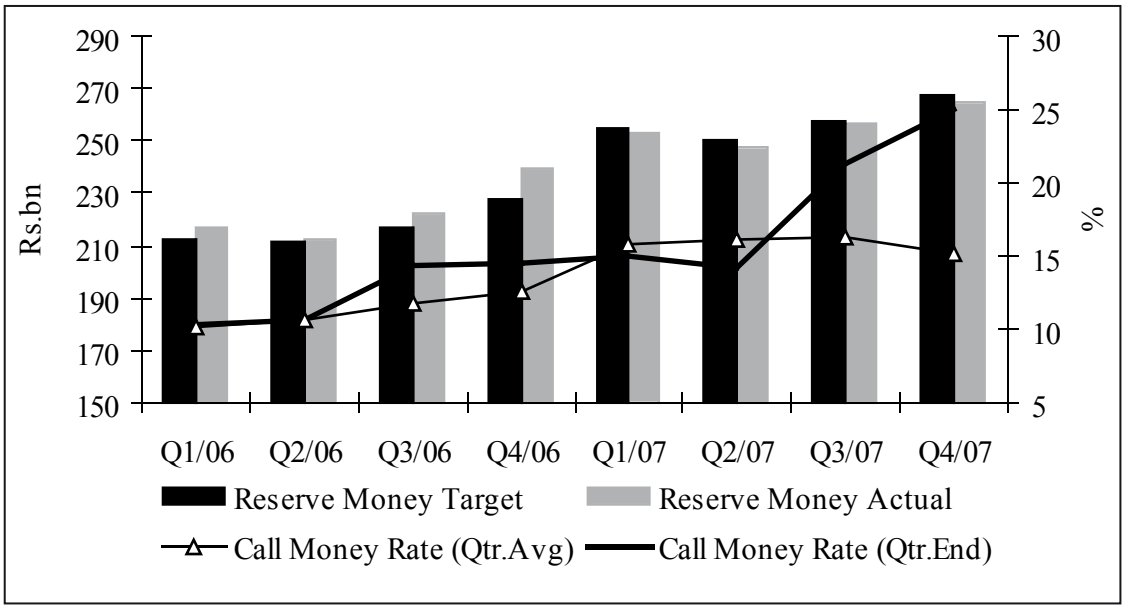
Achieving quantitative monetary targets also affects the interest rate stability in the market. It has been observed wider fluctuations in short-term market interest rates towards the end of months/ quarters as a result of focusing on the quantitative (reserve money) targets[13]. This is visualised in Figure 1.

Considering the above, a greater need exists to examine the feasibility of adopting IT in Sri Lanka. As stated by the CBSL, several initiatives has been taken in view of adopting IT in the medium-term, however it is required to examine the prevalence of necessary technical relationships of major macroeconomic variables in order to facilitate the successful implementation of the IT framework.

12/ However, the stability of money demand function in Sri Lanka needs to be studied extensively with a view to explore short-term and long-run dynamics.

13/ Wijesinghe, D S, "Do Central Banks have a Direct Control on Reserve Money?" Presentation at the Central Bank of Sri Lanka, 2008 (unpublished).

Figure 1: Reserve Money and Market Interest Rates



4. Literature Review

4.1. Prerequisites for IT

A country needs to fulfil several pre-requisites in order to establish a successful IT framework and the discussion is being undertaken for a number of years at different dimensions. Theoretically, there are some important fundamentals need to be fulfilled before adopting the full-fledged IT framework. However, practical experience suggests that those fundamentals could be in place when a country begins the transitions toward full-fledged IT (Schaechter, *et al*, 2000). Irrespective the appropriate time, prerequisites are important to have an effective IT framework and also to deliver results within a particular period of time. In general, a successful full-fledged IT framework needs to be built on the following:

- central bank's instrumental independence and an explicit mandate to achieve price stability,
- a strong fiscal position with freedom from fiscal dominance (low and stable fiscal deficits) and entrenched macroeconomic stability,
- reasonably well understood channels between policy instruments and inflation,
- a flexible exchange rate regime,
- a sound methodology for devising inflation forecasting which ensures the accuracy of forecasts, and
- a well developed financial system and transparent policies to build accountability and credibility of the monetary authority/ central bank (Schaechter, *et al*, 2000).

The detailed and widespread list of prerequisites for IT can be divided into two basic areas (Masson, *et al*, 1998). The first requirement for any country considering the adoption of IT is that the considerable degree of independence of the central bank. Practically, it is not necessary for the central bank to have full legal independence; however, it must have the freedom to gear the instruments of monetary policy towards its objective. In this endeavour, the conduct of monetary policy should not be dictated or constrained by fiscal considerations or so called "fiscal dominance". The implication is that public sector borrowing from the central bank and the banking system should be low or nonexistent. In other words, the government should have a broad and sufficient revenue base that is adequate to meet majority of its expenses. It should also have ways and means of non-inflationary and non-bank financing, and should not rely on the revenues from seigniorage generated by excessive money printing.

Also, domestic financial markets should have enough depth to absorb the placement of public and private debt instruments; and the accumulation of public debt should be sustainable. If such conditions were not met, fiscal imbalances will boost inflationary pressures and undermine the effectiveness of monetary policy. The adversity on monetary policy would drive through the distortion of interest rates and damaging the policy transmission. In the worst case, it would induce the central bank to pursue an accommodative and relax monetary policy despite the high rates of inflation. In such situation, it is evident that once a country has experienced annual inflation rates of 15–25 per cent for several years, it will be unable to rely on monetary policy alone to target any lasting reduction in the rate of inflation.

The second main requirement for adopting IT is that the authorities should refrain from targeting of any other nominal variable, such as wages or the nominal exchange rates. For instance, a fixed exchange rate system that subordinates the monetary policy to the exchange rate objective would not effectively able to target directly any other nominal variable, such as the rate of inflation[14].

The guarantee of the controllability of monetary policy instruments over operating targets and the effective channel of interest rates on prices have also been observed by most of the proponents as well as opponents of IT. Batini and others explain these preconditions under two broad categories, (i) economic structure and (ii) a healthy financial system. As such, although they have not mentioned about the monetary instruments directly, economic structure and healthy financial system include the effect of monetary instruments and transmission process. Under the economic structure criterion, prices should be fully deregulated, economy should not be overly sensitive to commodity prices and exchange rates, and dollarization should be minimal for effective inflation control. Under the criterion of a healthy financial system, the banking system should be sound and capital markets well developed in order to minimize potential conflicts with financial stabilization objectives and guarantee effective monetary policy transmission.

A special survey was conducted on 21 inflation targeting central banks and 10 non-IT emerging market central banks[15] to assess the role of preconditions for the adoption of IT (Batini, *et al*, 2006). The survey was focused particularly on how policy was formulated, implemented, and communicated and how various aspects of central banking practice had changed both during and prior to the adoption of IT. According to the survey, the evidence indicates there was no inflation targeter had all these preconditions or ideal economic conditions in place prior to the adoption of IT[16]. At the adoption, most inflation targeters gained relatively poorly score in the area of healthy financial and banking system. Also, it was indicated that the consumer price index in a number of IT countries included at the time of adoption a significant share of administered prices. However, industrial economy inflation targeters were generally in better shape than emerging market inflation targeters in terms of pre-conditions.

This suggests that the absence of such pre-conditions is not by itself an impediment in the adoption and success of IT (Batini, *et al*, 2006). However, as already argued in this paper, it is a must to fulfill those conditions at least after the adoption and when IT is in practice.

4.2. Role of Monetary Instruments in IT

Policy makers are interested in observing and knowing the characteristics of the linkages between monetary policy instruments and the rate of inflation. Understanding the strength of such relationships would help them to better calibrate monetary policy actions and decisions, improve timing and ensure the achieving of inflation targets (Christofferson and Wescott, 1999). An IT central bank should also select appropriate monetary instruments and operating guides to pursue the inflation target. Such instruments must be controllable by the

14/ However, most of the central banks intervene in the foreign exchange market in order to prevent excessive volatility in the exchange rates. For examples, the Bank of Thailand's overriding objective of monetary policy is maintaining inflation target and the Bank Indonesia's IT Framework is designed to achieve the goal of rupiah stability, which is reflected in the inflation rate and exchange rate. Both central banks intervene in the foreign exchange market to prevent excessive and persistent volatility in the exchange rate. Accordingly, inflation target performs the role of a nominal anchor for monetary policy while flexibility in exchange rates helps to absorb shocks to the economy.

15/ Botswana, Guatemala, India, Indonesia, Malaysia, Pakistan, Russia, Tanzania, Turkey, and Uruguay

16/ This is proved by the fact that the Reserve Bank of New Zealand had no clear understanding about transmission mechanism (Moinuddin, 2007) and their macro-econometric model was inadequate (Brash, 2002).

central bank and the transmission of adjustments in the instrument to the operating guide and ultimately to inflation should be as reliable as possible (Carare, *et al,* 2002).

Since there is no hard rule in selecting the instruments and the operating guides as they all depend on the structure of a country's financial system, policy makers may select either a short-term interest rate or a monetary aggregate, which is an aggregate liquidity indicator as its operating guide. However, in most cases, short-term interest rate, such as overnight interest rates in the inter-bank market is considered as the ideal operating target[17].

IT countries adjust short-term interest rates in response to the deviations of actual inflation or expected inflation from the target and also the output gap. Such interest rates behaviour can be characterised as a Taylor Rule[18] under which interest rates are adjusted in response to deviations of current and lagged variables. Under IT framework, interest rate response functions are more forward-looking than in other policy frameworks, due to the lags between policy actions and the inflation outcome (Israd, *et al,* 2002).

As such, the first step in understanding the nature of an IT framework is to analyze the relation between explicit policy goals, policy instruments, and preferences of the central bank (which affect the form of its reaction function). In this context, Agénor examined the link between inflation targets and the nominal interest rate (viewed as the main instrument of monetary policy) when the central bank is concerned only about deviations of actual inflation from its target value. His findings revealed that the central bank controls directly the interest rate, and hence that affects aggregate demand (Agénor, 2000).

Agénor examined the interest rates rule under two scenarios, (i) Strict Inflation Targeting and (ii) Flexible Inflation Targeting. Under Strict Inflation Targeting the optimal rule is to set the interest rate so as to bring expected inflation in line with the inflation target at the control horizon. According to Agénor, a closed economy, which produces one good, can be characterized by the following:

$$\pi_t - \pi_{t-1} = \alpha_1 \gamma_{t-1} + \varepsilon_t \qquad (1)$$

$$\gamma_t = \beta_1 \gamma_{t-1} - \beta_2 (i_{t-1} - \pi_{t-1}) + \eta_t, \ \beta_1 < 1 \qquad (2)$$

Where

$\pi_t \equiv p_t - p_{t-1}$: inflation rate at t ($p_t$ denotes the logarithm of the price level)

γ_t: output gap (logarithm of actual to potential output)

i_{t-1}: nominal interest rate (which is under the direct control of the central bank)

ε_t and η_t: independently, identically distributed random shocks

As given in this model, the central bank controls directly the interest rate that affects aggregate demand. Policy actions i.e. change in the nominal interest rate affect output with a one-period of lag, and inflation

17/ Every full -fledged IT central bank except Mexico uses a short - term interest rate as its operating guide. Hence, almost all the central banks have employed market based indirect instruments of monetary policy. Such indirect instruments are useful for managing liquidity on daily basis, responding quickly to inflationary pressures, signaling the policy intentions of the central bank while minimizing credit risk and developing financial markets (Alexander, *et al,* 1995). Direct instruments such as loan assets and liquidity asset ratio requirements are rarely used in IT since they can only be adjusted infrequently. Quantity targets, such as liquidity indicators are useful and successful when the central bank and the financial system are sophisticated enough to influence conditions in the money market through control of bank reserves and settlement balances held at central bank (Carare, *et al,* 2002).

18/ Taylor Rule is a monetary policy rule proposed by economist John B. Taylor that would stipulate how much the central bank should change the interest rates in response to real divergences of real GDP from potential GDP and divergences of actual rates of inflation from a target rate of inflation:

$$i_t = \Pi_t + r^*_t + \alpha^*_\pi (\Pi_t - \Pi^*_t) + \alpha_\gamma (\gamma_t - \bar{\gamma}_t)$$

Where i_t is the target interest rate, Π_t is the rate of inflation as measured by the GDP deflator, Π^*_t is the desired rate of inflation, r^*_t is the assumed equilibrium real interest rate, γ_t is the logarithm of real GDP, and $\bar{\gamma}_t$ is the logarithm of potential output, as determined by a linear trend (Taylor, 1993).

with a two period lag. The lag between a change in the policy instrument and inflation is referred to in what follows as the control lag or control horizon.

As proved by Agénor based on the Svensson's work, monetary policy must be conducted in part on the basis of forecasts as interest rate changes affect inflation with a lag. Accordingly, it is optimal for the central bank to adjust the nominal interest rate upward to reflect current inflation, the difference between current and desired inflation rates and increases in the output gap as indicated by the central bank's reaction function given below.

$$i_t = \pi_t + b_1(\pi_t - \tilde{\pi}) + b_2\gamma_t \qquad (3)$$

Where $b_1 = \dfrac{1}{\alpha_1\beta_2}$, $b_2 = \dfrac{1+\beta_1}{\beta_2}$

Under flexible inflation targeting, the optimal rule is to close less than fully any gap between expected inflation and the inflation target. Equation (4) indicates that the optimal instrument rule requires the nominal interest rate to respond positively to current inflation and the output gap, as well as the excess of current inflation over the target.

$$i_t = \pi_t + b_1'(\pi_t - \tilde{\pi}) + b_2'\gamma_t \qquad (4)$$

Where $b_1' = \dfrac{1-c}{\alpha_1\beta_2}$, $b_2' = \dfrac{1+c+\beta_1}{\beta_2}$

$b_1' = b_1$

$b_2' = b_2$

$\lambda = 0$ (and thus $c = 0$)

An important difference between reaction functions (3) and (4) is that the coefficients of (4) are smaller, due to the positive weight attached to cyclical movements in output in the policy loss function. This more gradual response implies that the (expected) length of adjustment of current inflation to its target value (following a disturbance) would take longer than the minimum (two) periods given by the control horizon. The time that it takes for expected inflation to return to target after a permanent-unexpected shock is known as the implicit targeting horizon or the target horizon. The length of the implicit target horizon is positively related not only to the magnitude of the shock and its degree of persistence but also to the relative importance of output fluctuations in the central bank's objective function.

As explained in this model, the central bank's output stabilization goal has a crucial effect not only on the determination of short-term interest rates but also on the speed at which the inflation rate adjusts toward its target after a shock. Also, policy preferences affect the variability of output and inflation. As such, in the existence of supply shocks, flexible inflation targeting entails a trade-off between inflation variability and output-gap variability.

In practice, however, it can be observed that IT central banks have attempted to practice simple feedback interest rate rules rather than complicated optimal targeting rules as simple rules have clear benefits such as the robustness when there is uncertainty about the true structure of the economy and advantageous on ability of monitoring and ensuring credibility (Agénor, 2000).

As Carare and others highlighted, monetary authority needs two major requirements in order to use the interest rate instrument successfully:

- As a net supplier of funds to the money market (i.e. liquidity shortage in the market) central bank has more influence on the interest rates, and
- The stability of the demand for payment settlement balances is required in the design of monetary policy.

The process of transmitting impulses of interest rate adjustment to the ultimate inflation target is called as the transmission mechanism. Hence, the transmission mechanism of monetary policy is the connection between changes in the monetary policy stance and their effect on the operating target, and ultimately, inflation (Carare, *et al*, 2002).

The monetary transmission process from an interest rate operating guide to inflation operates through several channels. Broadly these described as, interest rate, asset price (foreign exchange and equities) and credit (bank lending and balance-sheet) channels (Mishkin, 1996). Precisely, a monetary policy action, for instance, an increase in the operating interest rates in an open economy, can be expected impact on inflation by appreciating the exchange rate and thereby lowering the prices of imported goods, raising the cost of bank and non-bank borrowing thereby reducing bank lending, dampening investment and consumption, and anchoring expectations (Carare, *et al*, 2002).

The link between the policy instruments and inflation and the transmission process from policy actions to inflation is much clear and effective in advanced countries due to improved macroeconomic conditions and structural reasons. However, the inherent uncertainty in the transmission of monetary policy to inflation is a principal challenge faced by IT central banks in emerging market economies and such challenges hinder the desired result of the ultimate expectancy. For example, the impact of an increase in the policy interest rate on commercial bank interest rates is lower in countries where the banking system is less competitive, more rigid and money markets are more volatile. Also, countries with high inflation rates suffer with downward price stickiness and rapid pass-through from the exchange rate to inflation (Carare, *et al,* 2002).

Exchange rate also plays a crucial role in exercising interest rate rules under an open economy IT regime. It is important under IT in an open economy, both in transmitting the effects of changes in policy interest rates and in transmitting various disturbances. Since the external shocks are transmitted through the exchange rate, and they affect consumer price inflation, stabilizing exchange rates remains an important consideration under IT (Agénor, 2000).

4.3. Research Evidence: International Context

The stable and significant relationship between the measure of inflation and short-term interest rates has been examined extensively by several researchers as an important requisite for adopting IT framework in countries concerned. In this section, some of the research findings would be explored.

Christofferson and Wescott examined the feasibility of adopting IT framework in Poland. They observed that statistical relationships between various representations of consumer price index and various leading indicators of inflation are beginning to emerge in Poland. Although there were some reasonable linkages between some monetary policy instruments such as broad money and exchange rate and inflation, those were not strong and tight enough. In particular, they pointed out that the linkage between the short-term policy interest rates and changes in inflation was weak and somewhat disappointing. They concluded that since the Polish economy continue to mature in coming years, it is likely that the relationship between the policy interest rates and inflation will also become more regular. Hence, they were opposing the adoption of IT in Poland until the system matures (Christofferson and Wescott, 1999)[19].

Oh and Ahn observed that call rate has unilateral causality over long-term interest rates and real economic variables in Korea. Oh observed that the repurchase rates of the central bank significantly Granger causes the call rate while there is a bilateral causality between the issue rate of monetary stabilisation bonds and the call rate in Korea. He had also examined the transmission effects of the interest rates on prices using Structural Autoregression (SVAR) models. The results of Impulse Response Function have showed that an increase in the call rate begins to reduce prices from three quarters out and its effect persists over the long-run. The results of Variance Decomposition analysis showed that the effects of a call rate increase both on consumer prices and on underlying consumer prices calculated by the method of adjustment by exclusion also begin to appear in the third quarter and persist over the long-run. In particular, the effect of a call rate increases on prices relatively stronger than that of a money stock. Hence, Oh concluded that the call rate would be the most appropriate operating target in terms of controlling inflation in an IT framework in Korea (Oh and Ahn, 1998).

19/ Poland however adopted IT in 1999 despite those views and findings. The gradual transition from the system of one nominal anchor, fixed exchange rate to another one, the full fledged IT (FFIT) embodied the transitory period of the IT Lite (ITL) in Poland. This intermediary stage in the evolution of monetary policy was characterized by increasing inconsistency of the multiple objectives and monetary policy instruments. It allowed for more flexible monetary policy and what is more important it ensured necessary time to carry out structural and institutional reforms. With the passage of time the ITL in Poland became increasingly incompatible with the more mature market economy. Its diminishing efficiency and increasing inconsistency led to the implementation of the FFIT in Poland in 1998.

Oh re-examined several aspects of IT since Korea has had accepted as the new monetary policy framework in 1998. According to Oh's analysis, a short-term interest rate selected as an operating target must satisfy certain conditions: first, there must exist exogeneity such that the short-term interest rate unilaterally cause long-term interest rates or real variables, but not vice versa; second, controllability is necessary, so that the central bank can adjust the short-term interest with appropriate policy instruments; and third, a signalling effect is also important so that the central bank can signal its intentions effectively to the public in such ways that a change in an operating target will affect short-term interest rates and long-term interest rates through a change in inflation expectations. The importance of the interest rate channel is widely pronounced by Oh since IT is operated only through an operating target and without any explicit intermediate target. Also, developed money and capital markets, zero intervention by government in the market and no distortion in the structure of interest rates are important to enhance the effectiveness of the transmission mechanism of monetary policy (Oh, 2000).

Jha focused on issues and prospects in IT in the context of India. He, however, argues that inflation control cannot be an exclusive concern of monetary policy in a country like India with a substantial poverty problem and elaborates on the reasons why India is not ready for IT. Given the lack of favourable conditions for adopting IT such as independence of the central bank, use of other nominal anchor like the exchange rate, predominance of demand shocks as opposed to supply shocks, Jha argues that India principally is not ready for adopting IT as the overriding monetary policy framework. Engaging in checking the viability of IT in India, Jha examined for stable and significant relationship between the measure of inflation and short-term interest rates. His results indicated a weak relation between the short - term interest rats (call money rate) and the measures of inflation. On the other hand, links between the measure of inflation and index of industrial production, narrow money, exchange rate and real exchange rate appeared to be much stronger. Hence, Jha argues that results of the causality tests do not provide support for using interest rates as instruments in a policy of IT. According to him, the absence of fully integrate financial markets suggests that the interest rate transmission channel of policy is rather weak and yet to be evolved fully. He reasoned that the lags in the pass-through from the policy rate to bank lending rates constrain the adoption of IT (Jha, 2006).

Chaudhry and Choudhary attempted to examine the determinants of inflation and output growth for Pakistan. The results presented in their paper indicated that the growth rate of import price is the most important determinant of inflation in Pakistan, both the short-run and long-run followed by growth rate of output. They also found that effect of monetary policy on inflation is negligible and statistically insignificant, both the short-run and long-run. Hence, they suggested that monetary authorities in Pakistan should not switch to IT because any attempt to reduce inflation through monetary policies will push the economy into severe recession (Chaudhry and Choudhary, 2006).

4.4. Research Evidence: Sri Lankan Context

Over the time, several research activities have been undertaken to identify the issues and prospects in adopting IT framework in Sri Lanka. Most of them had attempted to examine the transmission process, inflation measurement related issues and the required institutional and legal setup in order to introduce IT for monetary policy conduct in Sri Lanka.

In 1998, Thenuwara evaluated the feasibility of IT in Sri Lanka as an alternative to the existing monetary policy regime. His research had mainly addressed the issue of transmission mechanism specifically and hence, the research was focused to examine the impact of the intervention in interest rates to the inflation. The transmission was traced using the four-stage mechanism as explained in the Bank of Canada in 1996.

- *Stage I – central bank actions and the impact on very short-term interest rates*: the banking sector liquidity is examined to administer the statutory liquidity ratio (SRR) and not with the intention of influencing very short-term interest rates (call money rates). Such administration on SRR imposes an impact on banking sector liquidity and a pressure on call money rates. This is obvious as the central bank does not focus on maintaining liquidity at any particular level or range and such practice contrasts with the practices of IT countries.
- *Stage II – from short-term interest rates to other interest rates and exchange rates*: the determination of interest rates beyond the overnight rate is partly market oriented and partly influenced by

CBSL. The discount and rediscount window (repurchases and reverse repurchases) opened at CBSL influences the interest rates of all Treasury bills and also they follow the call money rate closely. Some other short-term rates such as prime lending and 3-month fixed deposit rates show some relationship with the call money rate. However, long-term interest rates show no causal relationship with the call money rate and this lack of causal relationship indicates banking sector inefficiencies.

The relationships suggest that central bank's policy of stabilising the exchange rate through short-term interest rate has been successful. This relationship arises as CBSL uses the short-term interest rates to confront any adverse expectations of the exchange rate.

- *Stage III – from interest rates and exchange rates to aggregate demand and supply*: a change in interest in the interest rate on deposits may affect inter-temporal substitution and any change in interest rates will have a larger impact on the aggregate supply. Movements in exchange rate could also have an impact on output and this area needs to be further analysed.
- *Stage IV – from aggregate demand and supply to output and prices*: the impact of short-term rates on inflation does not show any statistically significant results. However, when the lag length is increased to 24 months, a weak relationship from short-term rates to inflation emerges. Data shows a positive relationship between inflation and growth. However, econometric results show that there exists some feedback from inflation to growth, but not from growth to inflation.

Thenuwara concluded that Sri Lanka confronts several difficulties in adopting IT. There are issues with independence of the central bank (in view of its role as provider of liquidity to the government), focus on narrower range of targets and improving financial sector efficiency in order to interest rates are market determined.

Accordingly, the absence of some important causal relationships among variables hinders the setting up of an IT framework in Sri Lanka. Mainly, the causal relationships from short-term interest rates to long-term interest rates are absent due to either excessive intervention by the CBSL in a wider spectrum of interest rates or financial sector inefficiency mainly due to operations of state owned banks. In addition, resolving issues in the inflation and target value of inflation, choosing of a price index and revising the underlying consumer basket, rectifying inefficiencies of the system and incorporating capital account liberalisation considered as the basic infrastructure for adopting IT (Thenuwara, 1998).

Thenuwara and Mahadeva further examined the scope for IT in Sri Lanka. Their research was focused on the money market efficiency and existence of administered prices. At the outset, they illustrated several problems with regard to central bank's controllability of interest rates and efficacy of transmission mechanism and thereby concluding the existence of money market inefficiency. They employed several econometric tests to substantiate the claim of money market inefficiency at three steps.

- *Test I – financial market ability to complete arbitrage if they were efficient*: this test indicated that fixed deposit interest rates do not move together in the long-run, perhaps due to financial market inefficiency. This however may not be true of all interest rates and that does not mean that interest rates may not be affected by monetary policy.
- *Test II – co-integration properties of market interest rates and monetary policy rates*: this test allows seeing how market rates respond to monetary policy rates in the long-run. Results showed that call money rates are not co-integrated with any of the deposit rate. The lower coefficients indicate significant inefficiencies in Sri Lanka's money market.
- *Test III – ability of the market to transmit policy impulses to other interest rates*: It is noted that the relationship between longer-term deposits and Treasury bill rate (market discount rate) exhibited less inefficiency. This indicates that monetary policy still has some effect even though the financial sector is not competitive enough because Treasury bills are closer substitutes those other deposits of short-term.

Thenuwara and Mahadeva reported that exclusion of administered prices from the overall price index does not improve the volatility of free prices. Also, they found that there is a significant two way causality between administered prices and free prices. Thus, the exclusion of administered prices may not be helpful in defining

a targetable price index. They concluded that there are two serious difficulties in adopting IT as the monetary policy framework in Sri Lanka. First, financial markets seem inefficient, imposing serious drawbacks in the propagation of policy changes to the final target variable. Second, choosing prices, as the final target seems to face difficulties since free prices respond to administered prices and vise-versa. Also, CBSL will have difficulties in choosing an appropriate index to represent targetable prices due to this feedback effect. In addition, CBSL needs to address other issues relating to IT such as central bank independence, frequency of monetary accommodation to the fiscal policy, government intervention in the financial markets through state owned banks and oligopoly in the banking sector (Thenuwara and Mahadeva, 2000).

Jayamaha and others examined the feasibility of adopting IT in Sri Lanka soon after the adoption of free floating exchange rate regime and had focused mainly on the following areas:

- *Measuring inflation in Sri Lanka and the selection of a price index*: tests on inflation measured using three price indices namely, Greater Colombo Consumers' Price Index (GCPI), Colombo District Consumers' Price Index (CDCPI), and Colombo Consumers' Price Index (CCPI) show significant linear relationships. This implies that although CCPI overestimates inflation, it significantly captures variations of inflation measured by other indices as well.
- *Measuring core inflation*: two measures of core inflation (removing components with administered prices, thus only isolating only free prices and removing most volatile items, thus trimmed mean measure) were examined. Trimmed mean measure was unsuccessful due to technical problems and exclusion method also had several drawbacks. Free prices respond not only to monetary policy measures, but also to administered price changes.
- *Choosing a target variable and a band*: headline inflation is a good candidate for targeting inflation as core inflation has two way causality effects between the free prices. Also, people are less responsive to core inflation. If Sri Lanka chooses headline inflation, the target would be a band as headline inflation fluctuates due to factors other than variations in the policy instrument. The compromising target would be 7 per cent inflation with a band of 1.5 percentage points based on the past inflation experiences.
- *Forecasting inflation*: alternative techniques such as spreadsheet analysis and medium and long-run models such as output gap model and error correction model have been attempted. Spreadsheet analysis yielded fairly accurate results in the very short-run but it cannot be used to obtain structural breaks or medium and long-run forecasts. The output gap model assumes that prices are affected by the difference between potential output and actual output. Money as an indicator model is built on the long-run causality running from money to inflation. Only the money as an inflation indicator model was found feasible in obtaining forecast.
- *Measuring expected inflation*: this is very significant in IT as it signals the credibility of monetary policy and inflation inertia. Also a credible IT framework would result in the convergence of the targeted inflation and expected inflation after a reasonable time.
- *Policy transmission mechanism and target horizon*: the interest rate channel is found to be the most effective channel in Sri Lanka. There is a close relationship between the central bank policy rates and call money market rates; however pass-through effects from call money market rates to other market rates virtually nonexistent. However, according to monetary conditions index (MCI) measured as a combination of real interest rates (based on 3 month- Treasury bill rate) and the real exchange rate, exerts an impact on inflation with a lag of 9 months. The relationships and dynamics of the monetary transmission mechanism between short-run interest rates and inflation are distorted by the interference in the market determination of interest rates.
- *Choice of policy tools*: a very short-term interest rate such as repurchase rate or call money rate is used as the operating target and open market operations conducted on an outright or repurchase basis are the prevalent monetary instruments. The repurchase and reverse repurchase facilities allow banks to manage their daily liquidity surpluses or deficits and also serve as the main technique of shifting interest rates in accordance with CBSL's objectives.
- *Fiscal situation and implications on IT*: CBSL has been financing the budget deficit at various magnitudes and it appears that without a binding agreement with the government to refrain from

financing the budget deficit through CBSL funds, implementation of an IT framework would not be successful.

- *Organizational implications and legal framework*: prior to adopting IT CBSL requires professional standards, instrumental independence, i.e. free from the burden of monetization of the budget deficit and generating a political business cycle and necessary amendments to the relevant legislation.

In view of above considerations, Jayamaha and others suggested the following recommendations for adopting IT in Sri Lanka:

- CBSL should develop an implicit IT framework prior to adopting an explicit IT framework,
- Target inflation could be 7 per cent with a band of +/- 1.5 percentage points,
- Target horizon should be at least two years,
- Broad money is a good predictor of medium-term inflation,
- Expected inflation does not seriously differ from actual inflation, and
- CBSL needs to resolve technical and institutional problems, prior to seriously adopting the IT framework.

This research also suggested that further research is necessary to effective implementation of an IT framework in Sri Lanka (Jayamaha, *et al*, 2002).

5. Examining the Feasibility of Adopting IT in Sri Lanka

In this section, the viability of adopting IT in Sri Lanka would be examined with a special focus on the link between short-term interest rates and inflation rates. Accordingly, the link between interest rates, leading indicators and inflation, i.e. the policy transmission would be examined at two steps, (i) the controllability of monetary policy instruments over market interest rates and (ii) the impact of interest rates and leading indicator variables of inflation on inflation. Such linkage between interest rates and inflation would be explored by using bivariate causality testing and multivariate modelling.

5.1. Policy Transmission

5.1.1. Controllability of Monetary Policy Instruments over Market Interest Rates

A complete and immediate pass-through between policy interest rates and market interest rate is considered as a compulsory prerequisite to pursue a successful IT regime. Accordingly, a change in policy interest rates of CBSL is expected to reflect in other short-term market rates, particularly call money market rates followed by other market rates such as yields on government securities, prime lending rates and deposit rates.

In Sri Lanka, a change in policy interest rates of the CBSL is usually reflected immediately in market interest rates, particularly weighted average auction rates, call money market rates, weighted average prime lending rates and Treasury bill rates. In Sri Lanka, it is reported that there is a rapid and almost complete pass through from the central bank policy rates to call money market rates. It is also known that the pass-through from call money market rates to commercial bank retail interest rates is sluggish and incomplete (Amarasekara, 2005).

CBSL conducts open market operations using repurchase and reverse repurchase transactions to manage overall market liquidity in line with the pre-determined monetary targets. Hence, these transactions are used for the overall adjustment of liquidity in the banking system. Such transactions affect the call rate and hence, auction rate pertaining to repurchase transactions and call rates are ideal for testing the pass-through effect from policy rates to other market rates.

Table 3: Descriptive Statistics of Selected Interest Rates

Table 3

Descriptive Statistics of Selected Interest Rates

Parameter	REPO	CALLRATEWA	AUCTNRATE	PRIMERATE	TBILL91	AWDR
Mean	8.53	10.39	8.85	12.03	10.25	6.44
Median	8.50	9.60	8.39	11.37	9.10	5.98
Maximum	10.50	21.25	13.83	19.49	18.20	10.31
Minimum	7.00	7.48	7.01	8.94	7.00	4.84
Std. Dev.	1.25	2.88	1.85	2.87	3.35	1.44
Observations	58	58	58	58	58	58

REPO	*: Repurhcase Rate of the Central Bank*
CALLRATEWA	*: Weighted Average Call Money Rate*
AUCTNRATE	*: Weighted Average Auction Rate*
PRIMERATE	*: Weighted Average Prime Lending Rate of Commercial Banks*
TBILL91	*: 91-day Treasury bill Rate*
AWDR	*: Weighted Average Deposit Rate of Commercial Banks*

A higher volatility can be observed in Treasury bill rates followed by call money rates, prime lending rates and deposit rates as shown in Table 3. Recently, particularly during the latter part of 2007, an undue spike in Treasury bill rates was observed and it is reflected by the higher variation. Hence, owing to higher volatility, Treasury bill rates were not included in this model.

It is possible to study the impact of monetary policy adjustments and monetary policy operations using the Granger Causality Test and Unrestricted Vector Auto Regression (VAR) Analysis[20] on four interest rate variables: repurchase (repo) rate, auction rate, call money market rate and prime lending rate. The results of Granger Causality Tests show that the repo rate significantly Granger causes the call rate reconfirming the findings of Amarasekara. It is also found that there is a bilateral causality between the auction rates, call rates and prime lending rates as well.

Table 4: Results of Granger Causality Test - Repo and Call Rates

Sample: 2002M01 2008M02 , Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
REPO does not Granger Cause CALLRATEWA	74	8.28725	0.00527
CALLRATEWA does not Granger Cause REPO		4.04295	0.04815

Table 4 shows the causality between the repo rate and the call money rate. The probability value is less than 5 per cent significance level rejecting the null hypothesis and hence, the results of Granger Causality Test clearly show that repo rate significantly Granger causes the call money rate. The causality over policy rates and call money rates indicates that the Central Bank has some ability to control the short - term market interest rates, i.e. particularly the call rate. The repo rate also significantly Granger causes the weighted average auction rate at repurchase auctions as shown in Table 5.

Table 5: Results of Granger Causality Test - Repo and Auction Rates

Sample: 2002M01 2008M02, Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
REPO does not Granger Cause AUCTNRATE	74	9.89562	0.00261
AUCTNRATE does not Granger Cause REPO		6.70809	0.01212

In the meantime, as per Table 6, it is also possible to identify the bilateral causality between auction rates and call rates.

20/ The theoretical explanation on the Granger Causality Test and Unrestricted Vector Auto Regression Analysis is given in the Appendix I.

Table 6: Results of Granger Causality Test - Auction Rates and Call Rates

Sample: 2002M01 2008M02, Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
AUCTNRATE does not Granger Cause CALLRATEWA	74	24.9354	0.00005
CALLRATEWA does not Granger Cause AUCTNRATE		9.77023	0.00277

Commercial banks use the repurchase window of the Central Bank depending on funds availability, i.e. liquidity position. If banks are at a surplus position, they would lend (deposit) at the CBSL at the repo rate and if banks are at a deficit position, they would borrow from the CBSL at the reverse repurchase rate. Naturally, call money market rates vary according to liquidity position of banks. The causality between call rate and auction rates reflect the impact of monetary policy operations and liquidity conditions of commercial banks. The prime lending rate and call money rates have a strong causality. The results clearly indicate that call rate significantly Granger causes the prime rate.

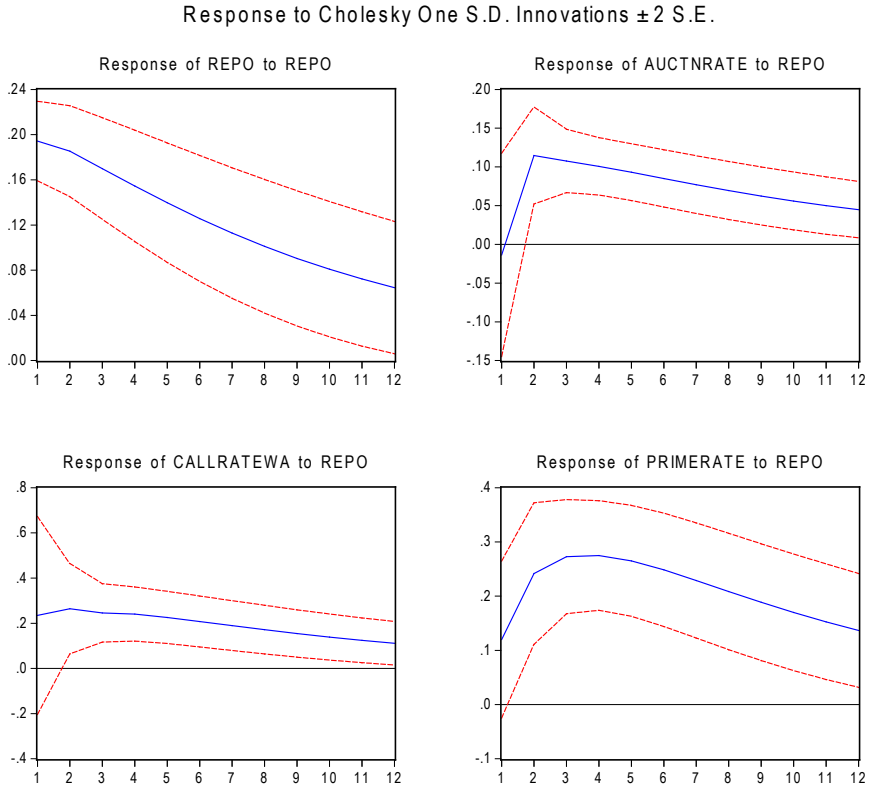
Table 7: Results of Granger Causality Test - Call Rates and Prime Lending Rates

Sample: 2002M01 2008M02, Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
CALLRATEWA does not Granger Cause PRIMERATE	74	25.7299	0.00000
PRIMERATE does not Granger Cause CALLRATEWA		38.4612	0.00000

Impulse Response Function of the VAR model composed for four variables shows that repo rate affect the auction rate, call money market rate and prime lending rate.

Figure 2 - Impulse Response Function of Interest Rates



The effect of repo rate on auction rates, call money rates and prime lending rates persists longer. This indicate that the change in policy rates and auction rates at open market operations have an impact on movement in short-term market interest rates.

5.1.2. Impact of Interest Rates and Leading Indicator Variables on Inflation

The interest rate channel is important in an effective IT system, since IT is a system where a short-term interest rate is used as the operating target, without any explicit intermediate target, to achieve the final inflation target. Hence, in this section, statistical linkages between monetary policy instruments and inflation are examined. These are also identified as the linkages between various so-called leading indicators of inflation and inflation (Christofferson and Wescott, 1999). Variables investigated in this section are listed in Table 8. This list includes monetary aggregates, interest rates, exchange rates, real activity variable, and various inflation measures.

Table 8: Variables Included in Tests

Name	Definition	Logs
Measures of Inflation		
ccpi	Colombo Consumers' Price Index*	x
ccpin	New Colombo Consumers' Price Index	x
ccpincore	New Colombo Consumers' Core Price Index	x
wpi	Wholesale Price Index	x
Monetary Policy Instruments and Leading Indicators of Inflation		
indprodinx	Industrial Production Index **	x
exrate	US dollar/rupee Nominal Exchange Rate (Average)	x
m1	Narrow Money	x
riceprice	Average Rice Price	x
callrate	Weighted Average Call Money Rate	

Properties

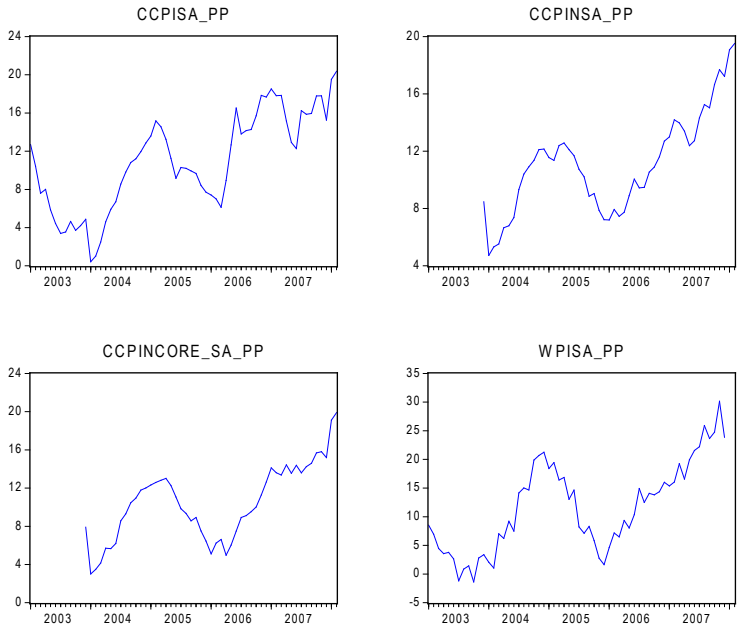
- § Sample range: 2003: 01 to 2008: 02 (All variables are at the monthly frequency)
- § Variables are transformed to logarithms except the call money rate
- § Variables except the average exchange rates and average call money rates are seasonally adjusted to capture seasonality
- § Based on unit root tests using the Augmented Dickey-Fuller Test (which are given in the Appendix II), inflation indices, industrial production index, exchange rate, narrow money and rice prices are applied in the first differences
- § Call money rate is considered as I(0) stationary variable

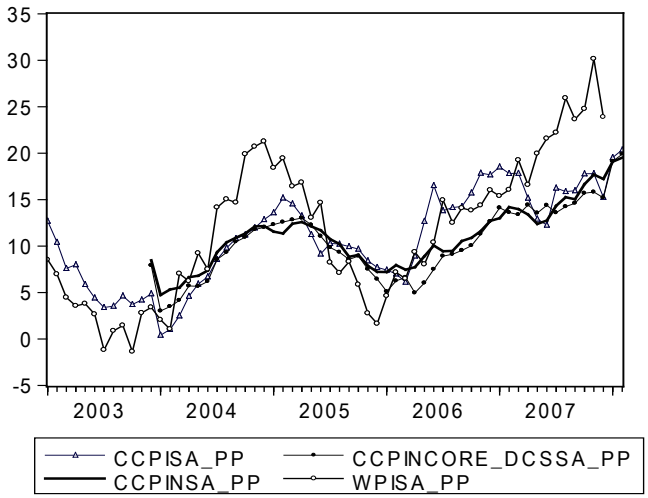
* This index was abandoned by 2008 as a New CCPI was introduced as a more representative index

**Monthly Industrial Index compiled by CBSL

Figure 3 shows the movements of selected consumer price indices.

Figure 3: Movements of Different Inflation Measures (Seasonally Adjusted Point-to-Point Changes)





Accordingly, four inflation measures were used in this exercise namely CCPI, CCPIN, CCPIN Core[21] and WPI show quiet similar trend albeit some volatility.

5.1.2.1 Bivariate Causality

The probability values (P- values) from bivariate Granger Causality Test are observed in order to examine the bivariate relationships between inflation measures, interest rates and leading indicator variables. The results of Granger Causality Tests are shown in Table 9 to 12.

Each of the panels represents to one of the four inflation measures, and each column to an economic indicator. Each panel contains twelve rows corresponding to "n" lags in the bivariate regressions, where n = 1, 2,.., 12. Each entry in the table gives the P-values for the null hypothesis that the indicator does not Granger-cause the inflation measure, i.e. the probability of obtaining a sample, which is even less likely to conform to the null hypothesis of no Granger Causality than the sample at hand. Values that are smaller than 5 per cent are given in bold figures.

Table 9: Probability Values of Bivariate Granger Causality Test - CCPI

	Industrial Production Index	Exchange Rate	Narrow Money	Rice Price	Call Rate
Lags					
1	0.61	**0.05**	0.07	**0.04**	**0.01**
2	0.61	0.15	0.17	0.20	**0.00**
3	0.44	0.26	0.17	0.45	**0.00**
4	0.16	0.29	0.21	0.57	**0.00**
5	0.12	0.32	**0.05**	0.72	**0.01**
6	0.08	0.08	**0.00**	0.66	**0.02**
7	0.19	0.19	**0.00**	0.74	**0.04**
8	0.25	0.26	**0.00**	0.72	**0.04**
9	0.31	0.38	**0.00**	0.73	**0.02**
10	0.43	0.18	**0.00**	0.13	0.06
11	0.56	0.15	**0.00**	0.19	0.06
12	0.47	0.13	**0.00**	0.36	0.09

Table 10: Probability Values of Bivariate Granger Causality Test - CCPIN

	Industrial Production Index	Exchange Rate	Narrow Money	Rice Price	Call Rate
Lags					
1	0.62	**0.02**	**0.00**	**0.03**	**0.02**
2	0.72	0.14	**0.00**	**0.02**	**0.02**
3	0.17	0.34	**0.00**	**0.01**	**0.01**
4	0.47	0.56	**0.00**	**0.05**	**0.04**
5	0.34	0.63	**0.00**	0.08	**0.01**
6	0.53	0.35	**0.00**	0.10	**0.02**
7	0.56	0.35	**0.05**	0.09	**0.03**
8	0.87	0.52	**0.04**	0.08	**0.05**
9	0.62	0.58	**0.03**	**0.03**	**0.05**
10	0.59	0.52	**0.02**	**0.01**	0.11
11	0.77	0.38	**0.02**	**0.03**	0.11
12	0.84	0.56	**0.02**	**0.00**	0.11

21/ Core Inflation Index based on the CCPI(N), which is compiled by the Department of Census and Statistics with a view to be used for monetary policy purposes. It excludes items covered under Consumer Protection Act (wheat, milk powder and gas), National Transport Commission Act, Telecommunication Regulatory Commission Act and the Post Office Act and the items with some Government intervention in pricing, to obtain a measure of underlying trend in inflation.

Table 11: Probability Values of Bivariate Granger Causality Test - CCPIN Core

	Industrial Production Index	Exchange Rate	Narrow Money	Rice Price	Call Rate
Lags					
1	0.75	**0.02**	**0.00**	**0.02**	**0.00**
2	0.80	0.13	**0.00**	**0.01**	**0.00**
3	0.94	0.36	**0.00**	**0.00**	**0.00**
4	0.97	**0.01**	**0.00**	**0.00**	**0.00**
5	0.91	**0.04**	**0.02**	**0.00**	**0.00**
6	0.99	0.09	**0.01**	**0.01**	**0.01**
7	0.99	0.15	**0.04**	0.07	**0.01**
8	0.98	0.29	**0.02**	0.12	**0.03**
9	0.88	0.32	**0.02**	0.11	**0.04**
10	0.64	0.36	0.07	0.18	0.10
11	0.44	0.36	0.07	0.26	0.18
12	0.60	0.34	0.17	0.24	0.33

Table 12: Probability Values of Bivariate Granger Causality Test - WPI

	Industrial Production Index	Exchange Rate	Narrow Money	Rice Price	Call Rate
Lags					
1	0.19	**0.00**	**0.04**	**0.00**	0.40
2	0.37	**0.00**	**0.00**	**0.01**	0.13
3	0.37	**0.00**	**0.02**	0.06	0.11
4	0.45	**0.00**	**0.03**	0.19	0.20
5	0.55	**0.00**	**0.02**	0.06	0.14
6	0.72	**0.00**	**0.04**	**0.02**	0.14
7	0.59	**0.02**	**0.02**	**0.01**	**0.03**
8	0.68	**0.02**	**0.05**	**0.00**	**0.05**
9	0.67	**0.05**	0.08	**0.01**	0.11
10	0.49	0.15	0.20	**0.01**	0.17
11	0.47	0.10	0.31	**0.00**	0.28
12	0.70	0.10	0.35	0.06	0.41

A few features can be observed across inflation measures:

- § Industrial production (proxy for real output) does not indicate causality with inflation measures.
- § Exchange rate (variable for external impact) has an immediate causality on CCPI, CCPIN and CCPIN Core whereas a strong causality can be observed with the WPI.
- § Narrow money (variable for demand pressure) is significant across lag orders for all inflation measures.
- § Average rice price (variable for the impact of the supply side factors) indicates causality with inflation measures.

More importantly, the results of the Granger Causality Tests indicate a significant relationship between the call money rate, which is the representative variable for operating target and the most of the measures of inflation except WPI. In fact, WPI seems to have a causal relationship with the call money rate after a period of five to six lags, however, it is not strong enough. Hence, results of causality tests provide a scope for using interest rates as instruments in a regime of IT in Sri Lanka.

5.1.2.2 Multivariate Modeling

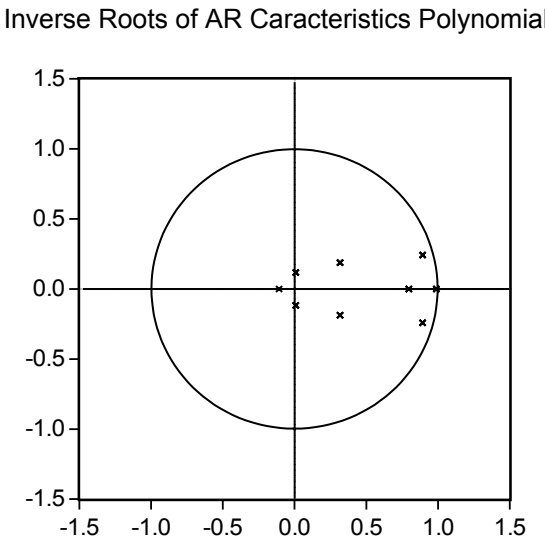
Granger Causality is a (weaker) type of causality that occurs when X changes and changes in Y follow thereafter. Hence, Granger Causality testing is considered as a crude measure of relationships as it does not provide sufficient information about whether the sign of the (dynamic) bivariate relationship is correct from the point of view of economic theory. Therefore, the bivariate analysis gives a rough indication of statistical relationship between inflation and leading indicators of inflation, however omitted variables could distort the estimates significantly.

Accordingly, in this section, a multivariate model for each of the inflation measures would be specified and estimated using VARs. Typically, a VAR allows an immediate assessment of the dynamic relationship between inflation measures and economic indicators using the Impulse Response Functions. Accordingly, the transmission effects of interest rates on prices using auto regression models would be examined.

Economic theory, empirical evidence and econometric modeling suggest that inflation is driven by the pressures in goods markets, labour markets, foreign markets, financial markets and particularly the changes in fiscal policy and monetary policy. Considering such factors, the VAR model is built on appropriate monthly variables, namely industrial production index (proxy for GDP), US dollar/ rupee exchange rates, narrow money, rice prices and weighted average call money rates[22]. Hence, each of the four inflation measures was regressed with industrial production index, exchange rate, narrow money, rice prices and call money rates.

Auto Regressive Roots graphs for VAR models of each inflation measure confirm that all the variables used in the model are in stationary properties.

Figure 4 - Conformity of Stationary Property of Variables



22/ Various research were undertaken at CBSL to identify the most significant leading indicator variables of inflation in Sri Lanka. It was found that GDP, broad money, rice price, 91-day Treasury bill rate and US dollar/ rupee exchange rate are the most significant factors / leading indicators in inflation in Sri Lanka (Weerasinghe, *et al*, 2005). A similar set of variables are used in this paper.

A summary of estimation results are shown in Table 13 and the detailed regression outputs are given in the Appendix III.

Overall, the goodness of the fit seems to be reasonably good as reflected by the R-squared and the Adjusted R- squared considering the amount of variation in monthly variables.

Table 13: VAR Model Estimation Results Summary

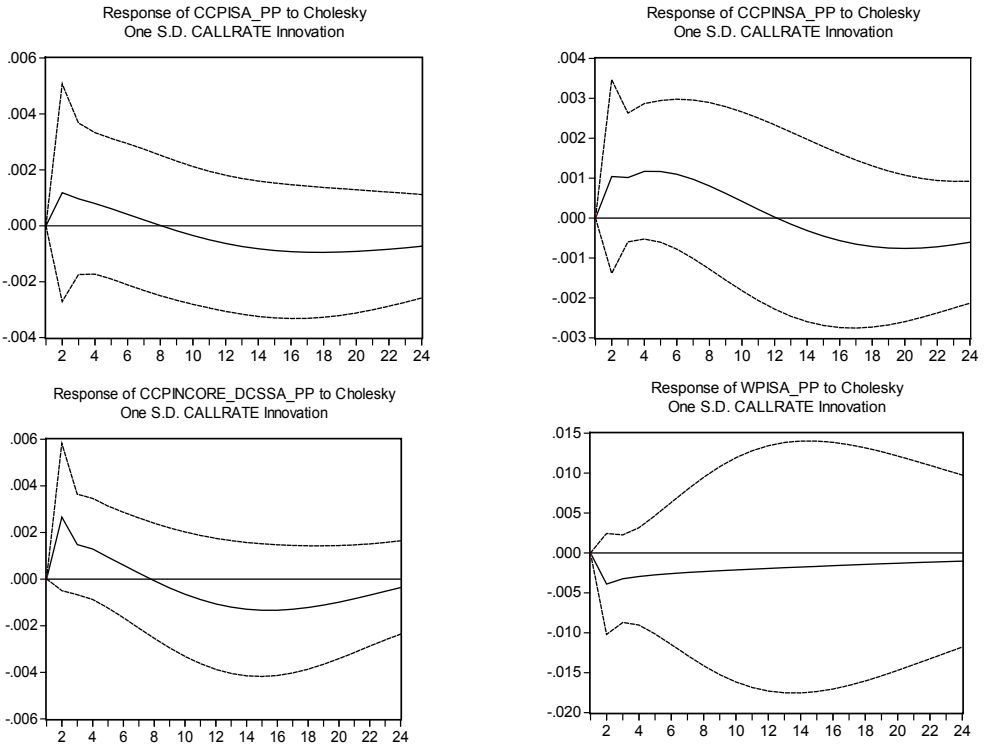
Sample (adjusted): 2003M02 2008M02
Included observations: 61 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	CCPISA_PP	CCPINSA_PP	CCPINCORE_SA_PP	WPISA_PP
EXRATE_PP(-1)	0.033254	-0.017725	0.016567	0.304283
	(0.08234)	(0.04859)	(0.06143)	(0.13868)
	[0.40387]	[-0.36477]	[0.26968]	[2.19406]
INDPRODINXSA_PP(-1)	0.021058	0.006367	-0.020859	0.169676
	(0.08353)	(0.06320)	(0.08210)	(0.10745)
	[0.25211]	[0.10074]	[-0.25406]	[1.57918]
M1SA_PP(-1)	-0.021861	-0.026380	0.029292	-0.113729
	(0.06380)	(0.04264)	(0.05830)	(0.09392)
	[-0.34268]	[-0.61864]	[0.50245]	[-1.21096]
RICEPRICESA_PP(-1)	0.027854	0.044324	0.051361	0.140252
	(0.01646)	(0.01550)	(0.02054)	(0.03795)
	[1.69271]	[2.86030]	[2.49994]	[3.69558]
CALLRATE(-1)	0.000715	0.000594	0.001542	-0.002484
	(0.00118)	(0.00069)	(0.00090)	(0.00200)
	[0.60788]	[0.86150]	[1.70686]	[-1.24061]
C	-0.010718	0.003754	-0.014254	-0.003665
	(0.01752)	(0.01568)	(0.02168)	(0.02484)
	[-0.61157]	[0.23942]	[-0.65764]	[-0.14752]
@TREND	0.000523	0.000402	0.000337	0.001423
	(0.00023)	(0.00024)	(0.00032)	(0.00032)
	[2.28005]	[1.66754]	[1.03799]	[4.41088]
R-squared	**0.913069**	**0.948988**	**0.933071**	**0.938098**
Adj. R-squared	**0.901588**	**0.940486**	**0.921916**	**0.929602**
Sum sq. resids	**0.013722**	**0.003003**	**0.005077**	**0.021799**
S.E. equation	**0.016090**	**0.008455**	**0.010994**	**0.020675**
F-statistic	**79.52578**	**111.6199**	**83.64717**	**110.4117**
Log likelihood	**169.6345**	**172.0594**	**158.9310**	**149.4332**
Akaike AIC	**-5.299492**	**-6.562375**	**-6.037238**	**-4.794345**
Schwarz SC	**-5.022656**	**-6.256451**	**-5.731314**	**-4.512645**
Mean dependent	**0.109147**	**0.111338**	**0.105127**	**0.116951**
S.D. dependent	**0.051291**	**0.034660**	**0.039345**	**0.077921**

The dynamism of the model was captured in the Impulse Response Functions. Basically, the Impulse Response Function traces the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables.[23] The results of Impulse Response Function analysis, particularly inflation to call rate are given in Figure 5. (Results of Impulse Response Function analysis on inflation to leading indicator variables are given in the Appendix IV).

Results of impulse response functions for all inflation measures except the WPI; show that an increase in the call rate has an impact on prices after a certain time lag. As evident from the Figure 5, an increase in call rate impacts inflation after 2- 6 lags and persists over 10-14 lags. However, even though the responses are in the theoretically and empirically consistent direction, those are not significant at a level of 5 per cent given that both the upper and lower bounds of response functions are in different directions from point zero.

Figure 5: Impulse Response Functions (Call Rate on Headline and Core Inflation Measures)



Tests based on headline, official core and alternative core inflation indices[24] indicate that even though there are statistical linkages between inflation and interest rates, those are not strong, significant and persistent enough[25].

23/ A shock to the *i*-th variable directly affects the *i*-th variable, and is also transmitted to all of the endogenous variables through the dynamic structure of the VAR.

24/ Core inflation used in this analysis is derived through the exclusion method, which is the most popular and easily understandable method due to the simplicity. However, given the several criticisms exist against the exclusion method, attempts are being taken by the CBSL to develop alternative core inflation measures for the purpose of monetary policy conduct. Recent research work suggests that core inflation measures based on volatility weights and exponentially smoothed methods would be the most representative core inflation indices in terms of controllability (V S B W Tennekoon, 2008). Accordingly, core inflation indices based on volatility weights and exponentially smoothing were re-regressed with industrial production index, exchange rate, narrow money, rice prices and call money rates to examine the controllability of the ultimate target. Results of Impulse Response Functions for those two core inflation measures again suggest that an increase in the call rate has no significant, persistent and strong impact on prices.

25/ Some researchers have formed Vector Error Correction Models (VECM) due to the existence of co-integrated vectors, which indicate long-run relationships between variables. Such models have considered interest rate as I (1) variables as all the variable need to be in non-stationary property in order to perform a VECM. However, this research activity is not extended to build a VECM due to two main reasons: (1) call money rate is considered as I (0) variable; (2) data included in the model is only for 5 years and those are not sufficient to capture long run dynamics in the economy and the impact of business cycles.

6. Observations

In an effective IT regime, the impact of interest rates should persist over the long run. As is evident, shocks of short-term interest rate show weaker and temporary relationship with inflation raising concerns on the feasibility of selecting short-term interest rate as the operating target under the IT framework in Sri Lanka. However, this factor alone cannot consider as an impediment to adopt IT in Sri Lanka in view of several reasons.

Research activity on the feasibility of adopting IT in Sri Lanka began in late 1990s and all the researchers have pointed out the effective transmission mechanism of monetary policy through the interest rate channel. They also have found that there is a rapid and complete pass-through impact from policy rates to overnight money market rates and an incomplete and sluggish pass-through from policy rates to other market interest rates. Nevertheless, these research activities had emphasised the need for further exploring the impact and the efficacy of short-term interest rates to price movements.

Findings of this research suggest that statistical relationships between various representations of the inflation and interest rate instruments are beginning to emerge in Sri Lanka. Although the relationship is not strong and persistent, the statistical linkage between changes in short-term interest rates and changes in inflation, provide some evidence of the success of the interest rate channel of monetary policy transmission.

Hence, this research exercise confirms that there are improvements in terms of the controllability and affectivity on interest rates and also the impact on prices through the interest rate instrument. Such improvements can be attributed to the following developments:

- Reserve money is considered as the operating target of the monetary policy conduct, and hence the emphasis is placed mainly on the quantity of money. CBSL also moved to active open market operations in 2003 forming an interest rate corridor for overnight policy interest rates and made the call money rate as the implicit operating target of monetary policy conduct. Hence, although CBSL has been focusing on the quantity of money, it implicitly affects on the price of money, i.e. interest rates.
- The financial sector has also developed at a rapid stage in Sri Lanka during the last decade albeit there are some structural deficiencies. Although the commercial banks play a predominant role in the financial system and most of the financial flows are construed to short-term money market transactions, several developments can be observed in terms of other financial institutions such as finance and leasing establishments and venture capital companies. Although, the capital market activity is limited to few institutions and instruments, several initiatives are in place to further develop such markets.
- The improved competitiveness due to the reduction of higher exposure and the share of state owned banks in the financial system, diversification of business activities, financial innovation through new instruments, sophisticated payments and settlements systems and clearing processes have also helped to improve efficacy of financial sector and thereby transmission process.

Hence, there is a scope for using call money interest rate as the operating target under an IT framework in Sri Lanka provided further improvements in the financial deepening, financial instruments, financial infrastructure and effective transmission. As the Sri Lankan economy and its financial market are continuing to mature in line with global and domestic developments, the relationship between interest rates and inflation would become more regular, persistent and strong and will also begin to illustrate the theoretical relationships. Therefore, in order to enhance the effectiveness of the interest rate channel, the CBSL needs to improve the function of the call money rate as the operating target (to make call money rate as the explicit operating target), develop the financial market including the government bond market and private capital market and the long-term yield curve and also develop more useful information variables. Presence of fully integrated financial markets would make the interest rate transmission channel of monetary policy stronger.

However, some of the fundamental requirements need to be fulfilled by Sri Lanka as outlined below.

- **Overriding Objective of Monetary Policy**: Monetary policy has to be conducted focusing on maintaining stable prices mainly in the goods and financial markets, i.e. stable inflation

rates and interest rates , and fundamentally adjusted currency in order to maintain the external competitiveness. Adopting a low and stable inflation rate as the main objective of monetary policy requires, in principle, the absence of any commitment to a particular level of the exchange rate. As an IT framework is highly operative in a liberalized money market and a floating exchange rate regime, the intervention in the money market by the CBSL should be limited to the stabilize short-term money market interest rates and participation in the foreign exchange market should be limited only to prevent the excessive or violent fluctuations as done in many IT countries. In fact, a credible commitment to the IT framework by enhancing macroeconomic and financial stability would well provide a greater degree of stability to a flexible nominal exchange rate than a pegged/managed arrangement.

- **Legal Framework and Fiscal Coordination**: Since the central bank is responsible in achieving inflation target, a substantial degree of independence is required in the formulation and conduct of monetary policy. If the independence of monetary policy instruments is guaranteed in the legal framework, it would enhance the credibility of the central bank and reduce inflation expectations, which is crucial for a successful IT regime. Although the CBSL is independent in selecting operating instruments, setting monetary targets and conducting monetary policy operations, it needs to be further freed from fiscal dominance, mainly through preventing government financing (monetization of deficits). The government borrowings from the CBSL directly contribute to expand reserve money (unless adjusted by foreign assets) thus making it highly inflationary. The government financing from the central bank reduces the Bank's ability to control liquidity, distorts to market interest rates and retards the credibility of the central bank's commitment in containing inflation. Hence, if the CBSL needs to pursue an effective IT regime, it needs to explicitly limit or prohibit financing of government spending through necessary legislative amendments as has been done in IT and also in non-IT countries[26].

- **Operational Issues:** As is evident, in an IT framework, the modalities of the operation of monetary policy follow from the lag between a policy change and its impact on final target of inflation. Therefore, some of the key elements and requirements are required to be in better shape to facilitate the IT regime in Sri Lanka.

  Inflation Index: Consumer Price Index (CPI) fulfils the requirements to qualify as a benchmark to measure inflation in Sri Lanka due to the problems associated with wholesale price index and the GDP deflator. However, given some limitations in the CPI, a greater need exists in developing a CPI based on frequent surveys, enhancing the coverage of different locations and/or developing a harmonised index for regions in order to make CPI a truly representative indicator of inflation in Sri Lanka.

  However, as in the case of other developing countries, weight of food component in CPI basket is more than 40 per cent, which is generally less responsive to monetary policy and largely subject to exogenous supply shocks. Therefore, the impact of policy shocks would be muted and CPI becomes less responsive to policy changes. On the other hand, a policy tightening could create a spurious rise in inflation as measured by the headline CPI.

  In this context, it is required to develop a more representative core inflation index to facilitate the monetary policy conduct of the CBSL. The compilation of non- administered items based core inflation, which is compiled by the Department of Census and Statistics does not show the actual movements in underlying demand pressures and non-food non-energy based core inflation of CBSL excludes a significant portion of the CPI. Hence, it is required to construct a more representative core inflation index isolating the undue volatility in items included in the CPI basket. Consequently, the CBSL can consider targeting a core inflation index as a start to IT in Sri Lanka as it would be freed from seasonality of food prices, administered prices, terms of trade and indirect taxes. However, because expectations are built on the headline CPI and it is

26/ IT countries such as Canada, Czech Republic, South Africa and non-IT countries such as Germany, Nepal, and India limits financing of government deficits. Also, IT countries like Brazil, Chile, Finland, Israel, Poland, Sweden and Spain and non-IT countries like Bhutan prohibits government financing by the monetary authority.

easily understood by the public, the CBSL can consider targeting the headline CPI at a later stage once the credibility and controllability are established by achieving core inflation targets.

Target Value: During last sixty years period, Sri Lanka's average inflation remains in the range of 7-8 per cent. Also, country records an inflation rate of around 12 per cent during last thirty years, particularly during the open economy regime. Given this nature, initially, the CBSL would not be able to target inflation at a level below these historical averages. Hence, if the CBSL is to target the headline CPI, a 10 per cent target seems to be more appropriate and realistic based on the historical experience. Also, given the higher variability in inflation in Sri Lanka, the CBSL can specify a range target rather than a point target. Initially, the CBSL can specify a wider range, i.e. +/-3 per cent to frame the controllability and credibility and can gradually narrow down the range as done in many IT countries.

Internal Capacity: Although a sophisticated macro-econometric model is not a necessary condition for IT, it would be important from the operational and communication point of view. Hence, the CBSL needs to focus on: further developing a comprehensive macro-economic and macro-econometric model, further developing model-based inflation forecasting including conditional forecasting, publishing inflation forecasts regularly, and investing to develop human resources, particularly in technical capabilities as an important initiative in the march towards IT.

7. Concluding Remarks

The statistical relationship between inflation, leading indicators of inflation and short-term interest rates were examined and issues and prospects in adopting IT in Sri Lanka were also assessed in this paper. It was observed that statistical relationships between operating and final targets are not strong, significant and persistent enough in the Sri Lankan context; however, they are beginning to emerge resulting from economic and financial sector developments. However, the CBSL needs to focus on fulfilling several conditions such as setting up required institutional framework in order to facilitate process and also strengthening the interconnection between policy variables and inflation targets. Given the existing conditions and developments, the CBSL could consider adopting an implicit inflation targeting framework or inflation targeting lite[27] as a direct approach towards moving IT. Hence, there is a scope to move towards a country specific IT framework even without the complete pass-through and comprehensive knowledge of transmission mechanism within a stipulated period as done in several advanced and emerging economies.

27/ In a managed exchange rate float monetary policy regime is most appropriately characterized as 'inflation targeting lite.' Inflation targeting lite regimes as ones where the central bank "announce a broad inflation objective but owing to [its] relative low credibility [it is] not able to maintain inflation as the foremost policy objective. Their relatively low credibility reflects their vulnerability to large economic shocks and financial instability and a weak institutional framework." It can be viewed as a transitional regime towards full-fledged inflation targeting (Stone, 2003). Mauritius has widely discussed practice of inflation targeting lite.

References

Agénor, Pierre-Richard, "Monetary Policy under Flexible Exchange Rates: An Introduction to Inflation Targeting", World Bank, 2000.

Akbary, Ather H and Rankaduwa, Wimal, "Determinants of Inflation and Feasibility of Inflation Targeting in a Small Emerging Market Economy, The Case of Pakistan", Background Paper at the Conference on "Monetary cum Exchange Rates: What works Best for Emerging Market Economies, 2005.

Amarasekara, "Interest Rate Pass-through in Sri Lanka", Staff Studies, Vol. 35, Nos 1 and 2, Central Bank of Sri Lanka, 2005.

Ball, Laurence and Sheridan, Niamh, "Does Inflation Targeting Matter?", NBER Working Paper Series : 9577, National Bureau of Economic Research, Federal Reserve Bank of New York, USA, 2003

Bank of International Settlements, "Transmission Mechanisms for Monetary Policy in Emerging Market Economies", BIS Papers, No.35, 2008

Batini, Nicoletta; Kuttner, Kenneth and Laxton, Douglas, "Does Inflation Targeting Work in Emerging Markets?", International Monetary Fund, 2006.

Bernanke, Ben S; Laubach, Thomas; Mishkin, Frederic S and Posen, Adam S, "Inflation Targeting: Lessons from the International Experience", Princeton University Press, 2001.

Bernanke, Ben S, "A Perspective on Inflation Targeting", A Speech made at the Annual Washington Policy Conference of the Natiolan Association of Business Economists, 2003 http://www.federalreserve.gov/boarddocs/speeches/2003/20030325/default.htm#fn1

Berg, Claes, "Experience in Inflation – targeting in 20 Countries", Quarterly Economic Review, 1, 22-47, Sveriges Riksbank, 2005.

Burke, Maureen, "IMF helps Ghana learn from Others on Inflation Targeting", IMF Survey, March 08, International Monetary Fund, 2008.

Carare, Alina; Schaechter, Andrea; Stone, Mark and Zelmer, Mark, "Establishing Initial Conditions in Support of Inflation Targeting", Working Paper, 02/102, International Monetary Fund, 2002.

Carson, Carol S, Enoch, Charles and Dziobek, Claudia, "Statistical Implications of Inflation Targeting: Getting the Right Numbers and Getting the Numbers Right", International Monetary Fund, 2002.

Central Bank of Sri Lanka, "Annual Report", Various Issues

Central Bank of Sri Lanka, "40th Anniversary Commemorative Volume of the Central Bank of Sri Lanka", 1990.

Central Bank of Sri Lanka, "Economic Progress of Independent Sri Lanka", 1998

Central Bank of Sri Lanka, "Objectives, Functions and Organization", 2005.

Chaudhry, Muhammad Alsam and Choudhary, Munis A S, "Why the State Bank of Pakistan Should not Adopt Inflation Targeting", Research Bulletin, Volume 2, Number 1, State Bank of Pakistan, 2006

Chaudhry, Muhammad Alsam and Choudhary, Munis A S, "Why the State Bank of Pakistan Should not Adopt Inflation Targeting", Research Bulletin, Volume 2, Number 1, State Bank of Pakistan, 2006

Christofferson, Peter F and Wescott, Robert F, "Is Poland Ready for Inflation Targeting", Working Paper, 99/41, International Monetary Fund, 1999.

Feldman, Robert Alan, "Inflation Targeting: A Trojan Horse for Structural Reforms", Morgan Stanley Equity Research, Japan, 2006.

Debelle, Guy, "The Case for Inflation Targeting in East Asian Countries", Based on Paper at the Conference at Asia Pacific School of Economics and Management of Australian National University on Financial Markets and Policies in East Asia, 2000.

Government of Sri Lanka, "Monetary Law Act of 1949", Government Printers

Heikenston, Lars and Vredin, Anders, "The Art of Targeting Inflation", Quarterly Economic Review, 4, 5-34, Sveriges Riksbank, 2002.

Heenan, Geoffrey; Peter, Marcel and Roger, Scott, "Implementing Inflation Targeting: Institutional Arrangements, Target Design, and Communications", Working Paper, 06/278, International Monetary Fund, 2006.

Jadhav, Narendra, "Monetary Policy, Financial Stability and Central Banking in India", McMillan Publishers, India, 2006.

Jayamaha, Ranee, Thenuwara, H N, Weerasinghe, P N, Silva, B D W A, Karunatilake, C P A, Ratnasiri, H P G S, Chandrawansa, P H O, Gunaratne, S and Perera, R A, "Feasibility of Inflation Targeting in Sri Lanka", Staff Studies, Vol. 31-32, Central Bank of Sri Lanka, 2002.

Jha, Raghbendra, "Inflation Targeting in India: Issues and Prospects", ___,2006.

Karunatilake, H N S, "Fifty Years of Central Banking in Sri Lanka, 1950-2000", Centre for Demographic and Socio Economic Studies, 2000.

Kohler, Horst, "Inflation Targeting", Remarks by IMF Managing Director at Seminar on the Statistical Implications of Inflation Targeting, Washington D C, 2002 ttp://www.imf.org/exteranl/np/speeches/2002/022802.htm

Mahadewa, Lavan and Thenuwara, H N, "Scope for Inflation Targeting in Sri Lanka - Focus on Money Market Efficiency and Administered Prices", Staff Studies, Vol. 29-30, Central Bank of Sri Lanka, 2000.

Mahadewa, Lavan and Sterne, Gabriel, "Monetary Policy Frameworks in a Global Context", Bank of England, 2000.

Masson, R Paul; Savastano, Miguela and Sharma, Sunil, "The Scope for Inflation Targeting in Developing Countries?", Working Paper, International Monetary Fund, 1997.

Mishkin, Frederic S, "The Channels of Monetary Transmission: Lessons for Monetary Policy Regimes", NBER Working Paper Series: 5464, National Bureau of Economic Research, Federal Reserve Bank of New York, USA, 1996.

Mishkin, Frederic S, "International Experiences with Different Monetary Policy Regimes", Journal of Monetary Economics 43: 579-605, 1999.

Mishkin, Frederic S, "Can Inflation Targeting work in Emerging Market Countries?", NBER Working Paper Series: ___, National Bureau of Economic Research, Federal Reserve Bank of New York, USA, 2004.

Moinuddin, "Choice of Monetary Policy Regime: Should SBP adopt Inflation Targeting", SBP Working Paper Series, July 2007, State Bank of Pakistan, 2007.

Oh, Junggun, "Inflation Targeting: A New Monetary Policy Framework in Korea", Seminar Paper presented at the International Symposium on Practical Experiences on Inflation Targeting, Bangkok, Thailand, 2000.

Paulin, Graydon, "Credibility with Flexibility: The Evolution of Inflation Targeting Regimes (1990-2006)", Bank of Canada Review, Summer 2006, Bank of Canada, 2006.

Schaechter, Andrea, Stone, Mark R and Zelmer, Mark, "Adopting Inflation Targeting: Practical Issues for Emerging Market Countries", International Monetary Fund, 2000.

Svensson, Lars E O, "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets", European Economic Review 41(1997) 1111-1146, 1996.

Svensson, Lars E O, "Monetary Policy and Inflation Targeting", NBER Working Paper -1997/98, National Bureau of Economic Research, Federal Reserve Bank of New York, USA, 1998.

Svensson, Lars E O, "Inflation Targeting", for the New Palgrave Dictionary of Economics, 2nd ed. Edited by Blum, Larry and Durlauf, Steve, 2007.

Thenuwara, H N, "The Scope for Inflation Targeting in Sri Lanka – A focus on the Transmission Mechanism", Staff Studies, Vol. 27-28, Central Bank of Sri Lanka, 1998.

Weerasinghe P N; Silva, B D W A; Ratnasiri H P G S; Wimalasuriya S M and Yatigammana T M R P, "Guide to Forecasting with Autoregressive Models", Based on the Workshop on VAR Modelling at Sveriges Riksbank, 2005. (Unpublished)

Wijewardena W A, "Central Banking Nearly Six Decades after John Exter", Central Bank of Sri Lanka, 2007.

Wu, Thomas Y, "Does Inflation Targeting reduce Inflation? An Analysis for the OECD Industrial Countries", Economics Department, Princeton University, 2003.

Appendix I

Theoretical Explanations

Granger Causality

Granger Causality is used to determine whether one time series is useful in forecasting another.

A time series X is said to Granger-Cause Y if it can be shown, usually through a series of F-tests on lagged values of X (and with lagged values of Y also known), that those X values provide statistically significant information about future values of Y.

The Granger Causality between two variables such as X and Y are said to be:

$$Y_t = \sum_{i=1}^{m} \alpha_i X_{t\text{-}1} + \sum_{i=1}^{m} \beta_i Y_{t\text{-}1} - u_{1t}$$

$$X_t = \sum_{i=1}^{m} \lambda_i X_{t\text{-}1} + \sum_{i=1}^{m} \delta_i Y_{t\text{-}1} - u_{2t}$$

where u_{1t} and u_{2t} are serially uncorrelated random disturbances with zero mean. If X Granger Causes Y;

$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \ldots \alpha_m = 0$ is rejected against the alternative, H_1: not H_0

Similarly if Y Granger causes X;

$H_0^*: \delta_1 = \delta_2 = \delta_3 = \ldots \delta_m = 0$ is rejected against the alternative, H_1^*: not H_0

If better predictors of a given series Y can be obtained by adding lagged values of Y current and lagged values of another variable X, then X is said to Granger Cause Y.

The test works by first doing a regression of ΔY on lagged values of ΔY. Once the appropriate lag interval for Y is proved significant (t-stat or p-value), subsequent regressions for lagged levels of ΔX are performed and added to the regression provided that they 1 are significant in and of themselves and 2 add explanatory power to the model. This can be repeated for multiple ΔX's (with each ΔX being tested independently of other ΔX's, but in conjunction with the proven lag level of ΔY). More than 1 lag level of a variable can be included in the final regression model, provided it is statistically significant and provides explanatory power.

The Granger test can be applied only to pairs of variables, and may produce misleading results when the true relationship involves three or more variables.

Vector Autoregression Model (VAR)

VAR is an econometric model used to capture the evolution and interdependence between multiple time series, generalizing the univariate Auto Regression (AR) models. A VAR model describes the evolution of a set of k variables (called endogenous variables) over the same sample period (t = 1, ..., T) as a linear function of only their past evolution. Hence, a VAR model is a system of equations in which each variable is explained by its own lags, and the current value and lags of other variables. The variables are collected in a k x 1 vector y_t, which has as the ith element $y_{i,t}$ the time t observation of variable y_i.

A *(reduced) p-th order VAR, denoted VAR (p)*, is

$$Y_t = c + B_1 y_{t-1} + B_2 y_{t-2} + \ldots + B_p Y_{t-p} + e_t$$

where *c* is a *k x 1* vector of constants (intercept), A_i is a *k x k* matrix (for every *i* = 1, ..., *p*) and e_t is a *k x 1* vector of error terms satisfying,

1. $E(e_t) = 0$ - every error term has mean zero;

2. $E(e_t \acute{e}_t) = \Omega$ - the contemporaneous covariance matrix of error terms is Ω (a n x n positive definite matrix);

3. $E(e_t \acute{e}_{t-k}) = 0$ for any non-zero k — there is no correlation across time; in particular, no serial correlation in individual error terms.

The ℓ-periods back observation $y_{t-\ell}$ is called the ℓ-th lag of y. Thus, a p-th order VAR is also called a VAR with p lags.

All the variables used in the model have to be of the same order of integration. Hence;

- All the variables are I(0) (stationary): one is in the standard case, ie. a VAR in level
- All the variables are I(d) (non-stationary) with d>1:
  - o The variables are cointegrated: the error correction term has to be included in the VAR. The model becomes a Vector Error Correction Model (VECM) which can be seen as a restricted VAR.
  - o The variables are not cointegrated: the variables have first to be differenced d times and one has a VAR in difference.

A VAR (p) can be written with a concise matrix notation:

$$\begin{bmatrix} y_{1t} \\ \cdot \\ \cdot \\ \cdot \\ y_{nt} \end{bmatrix} = \begin{bmatrix} c_1 \\ \cdot \\ \cdot \\ \cdot \\ c_n \end{bmatrix} \begin{bmatrix} b_{11}^1 & \cdots & b_{1n}^1 \\ \cdot & \cdot & \\ \cdot & \cdot & \\ \cdot & & \cdot \\ b_{n1}^1 & \cdots & b_{nm}^1 \end{bmatrix} \begin{bmatrix} y_{1t-1} \\ \cdot \\ \cdot \\ \cdot \\ y_{nt-1} \end{bmatrix} + \begin{bmatrix} b_{11}^p & \cdots & b_{1n}^p \\ \cdot & \cdot & \\ \cdot & \cdot & \\ \cdot & & \cdot \\ b_{n1}^p & \cdots & b_{nm}^p \end{bmatrix} \begin{bmatrix} y_{1t-p} \\ \cdot \\ \cdot \\ \cdot \\ y_{nt-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \cdot \\ \cdot \\ \cdot \\ \varepsilon_{nt} \end{bmatrix}$$

The model can also be written as;

$$B(L)y_t = c + \varepsilon_t,$$

where,

$$B(L) = I - B_1 L - B_2 L^2 \ \ldots \ - B_p L^p$$

Assuming covariance stationarity, i.e., time independence of the first and second moments of the process - it can be calculated the unconditional mean of this series as;

$$E(y_t) = (I - B_1 - \ \ldots \ - B_p)^1 c = \mu$$

This is a straight forward generalization of the expression for the univariate AR (p) process. Hence, estimation of a VAR is generally straight forward as the model can be estimated with Ordinary Least Squares (OLS), which if ε_t is normally distributed and is also maximum likelihood.

Appendix II

Unit Root Tests – Based on Augmented Dickey-Fuller Test

CCPI

Null Hypothesis: D(CCPISA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.840172	0.0000
Test critical values:	1% level	-4.090602	
	5% level	-3.473447	
	10% level	-3.163967	

*MacKinnon (1996) one-sided p-values.

CCPI N

Null Hypothesis: D(CCPINSA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.902866	0.0000
Test critical values:	1% level	-4.115684	
	5% level	-3.485218	
	10% level	-3.170793	

*MacKinnon (1996) one-sided p-values.

CCPI N Core

Null Hypothesis: D(CCPINCORE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.055702	0.0000
Test critical values:	1% level	-4.115684	
	5% level	-3.485218	
	10% level	-3.170793	

*MacKinnon (1996) one-sided p-values.

WPI

Null Hypothesis: D(WPISA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.891728	0.0000
Test critical values:	1% level	-4.094550	
	5% level	-3.475305	
	10% level	-3.165046	

*MacKinnon (1996) one-sided p-values.

Industrial Production Index

Null Hypothesis: D(INDPRODINXSA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 8 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.570745	0.0000
Test critical values:	1% level	-4.107947	
	5% level	-3.481595	
	10% level	-3.168695	

*MacKinnon (1996) one-sided p-values.

Exchange Rate

Null Hypothesis: D(EXRATE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.010225	0.0000
Test critical values:	1% level	-4.086877	
	5% level	-3.471693	
	10% level	-3.162948	

*MacKinnon (1996) one-sided p-values.

Narrow Money

Null Hypothesis: D(M1SA) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.03149	0.0001
Test critical values:	1% level	-4.090602	
	5% level	-3.473447	
	10% level	-3.163967	

*MacKinnon (1996) one-sided p-values.

Rice Price

Null Hypothesis: D(RICEPRICE) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on SIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.334184	0.0002
Test critical values:	1% level		-4.086877
	5% level		-3.471693
	10% level		-3.162948

*MacKinnon (1996) one-sided p-values.

Appendix III
Vector Autoregression Estimates

CCPI

Vector Autoregression Estimates
Date: 05/03/08 Time: 16:11
Sample (adjusted): 2003M02 2008M02
Included observations: 61 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	CCPISA_PP	EXRATE_PP	INDPROD-INXSA_PP	M1SA_PP	RICEPRIC-ESA_PP	CALLRATE
CCPISA_PP(-1)	0.708924	-0.092850	0.103273	0.066821	-0.538300	10.25842
	(0.07363)	(0.07609)	(0.11694)	(0.10215)	(0.23773)	(8.53156)
	[9.62791]	[-1.22034]	[0.88309]	[0.65415]	[-2.26430]	[1.20241]
EXRATE_PP(-1)	0.033254	0.886009	0.056038	-0.083582	0.588711	-2.088865
	(0.08234)	(0.08508)	(0.13077)	(0.11423)	(0.26585)	(9.54046)
	[0.40387]	[10.4135]	[0.42851]	[-0.73170]	[2.21447]	[-0.21895]
INDPRODINXSA_PP(-1)	0.021058	0.145448	0.087268	-0.097159	-0.045347	-2.505296
	(0.08353)	(0.08631)	(0.13266)	(0.11588)	(0.26968)	(9.67799)
	[0.25211]	[1.68520]	[0.65784]	[-0.83847]	[-0.16815]	[-0.25887]
M1SA_PP(-1)	-0.021861	-0.025035	0.113934	0.690187	-0.321624	-20.15123
	(0.06380)	(0.06592)	(0.10132)	(0.08850)	(0.20597)	(7.39180)
	[-0.34268]	[-0.37977]	[1.12447]	[7.79846]	[-1.56148]	[-2.72616]
RICEPRICESA_PP(-1)	0.027854	0.001435	0.027490	0.000549	0.913561	-0.583508
	(0.01646)	(0.01700)	(0.02613)	(0.02283)	(0.05313)	(1.90662)
	[1.69271]	[0.08442]	[1.05187]	[0.02404]	[17.1954]	[-0.30604]
CALLRATE(-1)	0.000715	-0.001920	-0.000382	-0.005128	-0.001050	0.091410
	(0.00118)	(0.00122)	(0.00187)	(0.00163)	(0.00380)	(0.13625)
	[0.60788]	[-1.58040]	[-0.20480]	[-3.14378]	[-0.27660]	[0.67092]
C	-0.010718	0.000313	0.008184	0.094447	0.033456	5.300903
	(0.01752)	(0.01811)	(0.02783)	(0.02431)	(0.05658)	(2.03056)
	[-0.61157]	[0.01727]	[0.29403]	[3.88474]	[0.59129]	[2.61056]
@TREND	0.000523	0.000418	0.000245	4.27E-05	0.001185	0.096545
	(0.00023)	(0.00024)	(0.00036)	(0.00032)	(0.00074)	(0.02658)
	[2.28005]	[1.76423]	[0.67221]	[0.13429]	[1.59977]	[3.63191]
R-squared	0.913069	0.793917	0.182890	0.832591	0.930698	0.743898
Adj. R-squared	0.901588	0.766699	0.074970	0.810480	0.921545	0.710074
Sum sq. resids	0.013722	0.014651	0.034612	0.026408	0.143037	184.2144
S.E. equation	0.016090	0.016626	0.025555	0.022322	0.051950	1.864334
F-statistic	79.52578	29.16829	1.694680	37.65566	101.6814	21.99273
Log likelihood	169.6345	167.6355	141.4148	149.6659	98.13832	-120.2647
Akaike AIC	-5.299492	-5.233949	-4.374255	-4.644783	-2.955355	4.205398
Schwarz SC	-5.022656	-4.957113	-4.097419	-4.367947	-2.678519	4.482234
Mean dependent	0.109147	0.027443	0.055815	0.139304	0.067005	10.77787
S.D. dependent	0.051291	0.034422	0.026570	0.051275	0.185471	3.462422
Determinant resid covariance (dof adj.)		1.50E-16				
Determinant resid covariance		6.46E-17				
Log likelihood		617.6550				
Akaike information criterion		-18.67721				
Schwarz criterion		-17.01620				

CCPI N

Vector Autoregression Estimates
Date: 05/03/08 Time: 16:20
Sample (adjusted): 2004M01 2008M02
Included observations: 50 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	CCPINSA_PP	EXRATE_PP	INDPROD-INXSA_PP	M1SA_PP	RICEPRIC-ESA_PP	CALLRATE
CCPINSA_PP(-1)	0.655465	-0.665930	0.066769	0.621545	-0.451116	14.08421
	(0.09524)	(0.18160)	(0.22638)	(0.23524)	(0.57092)	(21.0427)
	[6.88235]	[-3.66705]	[0.29494]	[2.64219]	[-0.79016]	[0.66932]
EXRATE_PP(-1)	-0.017725	0.749785	0.081978	0.042444	0.553853	0.641881
	(0.04859)	(0.09265)	(0.11550)	(0.12002)	(0.29129)	(10.7363)
	[-0.36477]	[8.09224]	[0.70973]	[0.35364]	[1.90137]	[0.05979]
INDPRODINXSA_PP(-1)	0.006367	0.126752	0.015638	-0.218170	-0.776075	-6.105255
	(0.06320)	(0.12052)	(0.15024)	(0.15611)	(0.37888)	(13.9648)
	[0.10074]	[1.05174]	[0.10409]	[-1.39751]	[-2.04832]	[-0.43719]
M1SA_PP(-1)	-0.026380	0.012317	0.004352	0.576284	-0.588555	-5.124016
	(0.04264)	(0.08131)	(0.10136)	(0.10532)	(0.25562)	(9.42155)
	[-0.61864]	[0.15148]	[0.04294]	[5.47150]	[-2.30247]	[-0.54386]
RICEPRICESA_PP(-1)	0.044324	0.077699	0.022963	-0.084274	0.897620	1.354692
	(0.01550)	(0.02955)	(0.03684)	(0.03828)	(0.09289)	(3.42388)
	[2.86030]	[2.62956]	[0.62340]	[-2.20174]	[9.66279]	[0.39566]
CALLRATE(-1)	0.000594	-0.001780	-0.000992	-0.003981	0.003158	-0.133047
	(0.00069)	(0.00131)	(0.00164)	(0.00170)	(0.00413)	(0.15237)
	[0.86150]	[-1.35392]	[-0.60544]	[-2.33734]	[0.76399]	[-0.87320]
C	0.003754	-0.005448	0.039760	0.152307	0.220186	-2.508588
	(0.01568)	(0.02990)	(0.03727)	(0.03873)	(0.09399)	(3.46441)
	[0.23942]	[-0.18220]	[1.06678]	[3.93261]	[2.34254]	[-0.72410]
@TREND	0.000402	0.001231	0.000235	-0.001366	-0.001067	0.202510
	(0.00024)	(0.00046)	(0.00057)	(0.00059)	(0.00144)	(0.05321)
	[1.66754]	[2.68032]	[0.41114]	[-2.29597]	[-0.73871]	[3.80557]
R-squared	0.948988	0.824603	0.148561	0.879598	0.935656	0.770464
Adj. R-squared	0.940486	0.795370	0.006654	0.859531	0.924932	0.732209
Sum sq. resids	0.003003	0.010917	0.016966	0.018319	0.107904	146.5863
S.E. equation	0.008455	0.016123	0.020099	0.020885	0.050687	1.868194
F-statistic	111.6199	28.20814	1.046889	43.83289	87.24916	20.13974
Log likelihood	172.0594	139.7888	128.7672	126.8486	82.51652	-97.83670
Akaike AIC	-6.562375	-5.271551	-4.830687	-4.753946	-2.980661	4.233468
Schwarz SC	-6.256451	-4.965627	-4.524763	-4.448022	-2.674737	4.539392
Mean dependent	0.111338	0.032354	0.059461	0.138308	0.103646	11.29580
S.D. dependent	0.034660	0.035641	0.020166	0.055724	0.184998	3.610137
Determinant resid covariance (dof adj.)		2.09E-17				
Determinant resid covariance		7.33E-18				
Log likelihood		560.6792				
Akaike information criterion		-20.50717				
Schwarz criterion		-18.67162				

CCPI N Core

Vector Autoregression Estimates
Date: 05/03/08 Time: 16:22
Sample (adjusted): 2004M01 2008M02
Included observations: 50 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	CCPIN-CORE_DC-SSA_PP	EXRATE_ PP	INDPROD-INXSA_PP	M1SA_PP	RICEPRIC-ESA_PP	CALLRATE
CCPINCORE_DCSSA_PP(-1)	0.676298	-0.468795	-0.016714	0.640267	-0.374553	-4.152834
	(0.09934)	(0.15095)	(0.18178)	(0.17824)	(0.45775)	(16.9583)
	[6.80779]	[-3.10570]	[-0.09195]	[3.59212]	[-0.81825]	[-0.24489]
EXRATE_PP(-1)	0.016567	0.788666	0.064471	0.049448	0.568023	-3.184836
	(0.06143)	(0.09335)	(0.11241)	(0.11023)	(0.28308)	(10.4871)
	[0.26968]	[8.44882]	[0.57353]	[0.44861]	[2.00661]	[-0.30369]
INDPRODINXSA_PP(-1)	-0.020859	0.106721	0.017559	-0.199198	-0.789721	-5.700793
	(0.08210)	(0.12475)	(0.15023)	(0.14731)	(0.37832)	(14.0155)
	[-0.25406]	[0.85546]	[0.11688]	[-1.35222]	[-2.08745]	[-0.40675]
M1SA_PP(-1)	0.029292	0.059670	0.012455	0.491202	-0.544985	-3.288378
	(0.05830)	(0.08858)	(0.10667)	(0.10460)	(0.26863)	(9.95175)
	[0.50245]	[0.67362]	[0.11676]	[4.69604]	[-2.02879]	[-0.33043]
RICEPRICESA_PP(-1)	0.051361	0.069461	0.034399	-0.110341	0.901528	3.871400
	(0.02054)	(0.03122)	(0.03759)	(0.03686)	(0.09467)	(3.50716)
	[2.49994]	[2.22508]	[0.91503]	[-2.99332]	[9.52306]	[1.10386]
CALLRATE(-1)	0.001542	-0.002277	-0.001014	-0.003290	0.002758	-0.138295
	(0.00090)	(0.00137)	(0.00165)	(0.00162)	(0.00416)	(0.15424)
	[1.70686]	[-1.65870]	[-0.61331]	[-2.02965]	[0.66241]	[-0.89663]
C	-0.014254	-0.026701	0.036787	0.188384	0.201223	-3.186073
	(0.02168)	(0.03293)	(0.03966)	(0.03889)	(0.09988)	(3.70010)
	[-0.65764]	[-0.81073]	[0.92752]	[4.84397]	[2.01472]	[-0.86108]
@TREND	0.000337	0.001180	0.000379	-0.001760	-0.000977	0.234250
	(0.00032)	(0.00049)	(0.00059)	(0.00058)	(0.00149)	(0.05536)
	[1.03799]	[2.39482]	[0.63929]	[-3.02524]	[-0.65363]	[4.23135]
R-squared	0.933071	0.811691	0.146969	0.892585	0.935724	0.768347
Adj. R-squared	0.921916	0.780307	0.004797	0.874682	0.925012	0.729738
Sum sq. resids	0.005077	0.011721	0.016998	0.016343	0.107790	147.9386
S.E. equation	0.010994	0.016705	0.020117	0.019726	0.050660	1.876792
F-statistic	83.64717	25.86260	1.033740	49.85804	87.34799	19.90080
Log likelihood	158.9310	138.0130	128.7205	129.7021	82.54300	-98.06628
Akaike AIC	-6.037238	-5.200520	-4.828819	-4.868084	-2.981720	4.242651
Schwarz SC	-5.731314	-4.894596	-4.522896	-4.562160	-2.675796	4.548575
Mean dependent	0.105127	0.032354	0.059461	0.138308	0.103646	11.29580
S.D. dependent	0.039345	0.035641	0.020166	0.055724	0.184998	3.610137
Determinant resid covariance (dof adj.)		3.16E-17				
Determinant resid covariance		1.11E-17				
Log likelihood		550.3063				
Akaike information criterion		-20.09225				
Schwarz criterion		-18.25671				

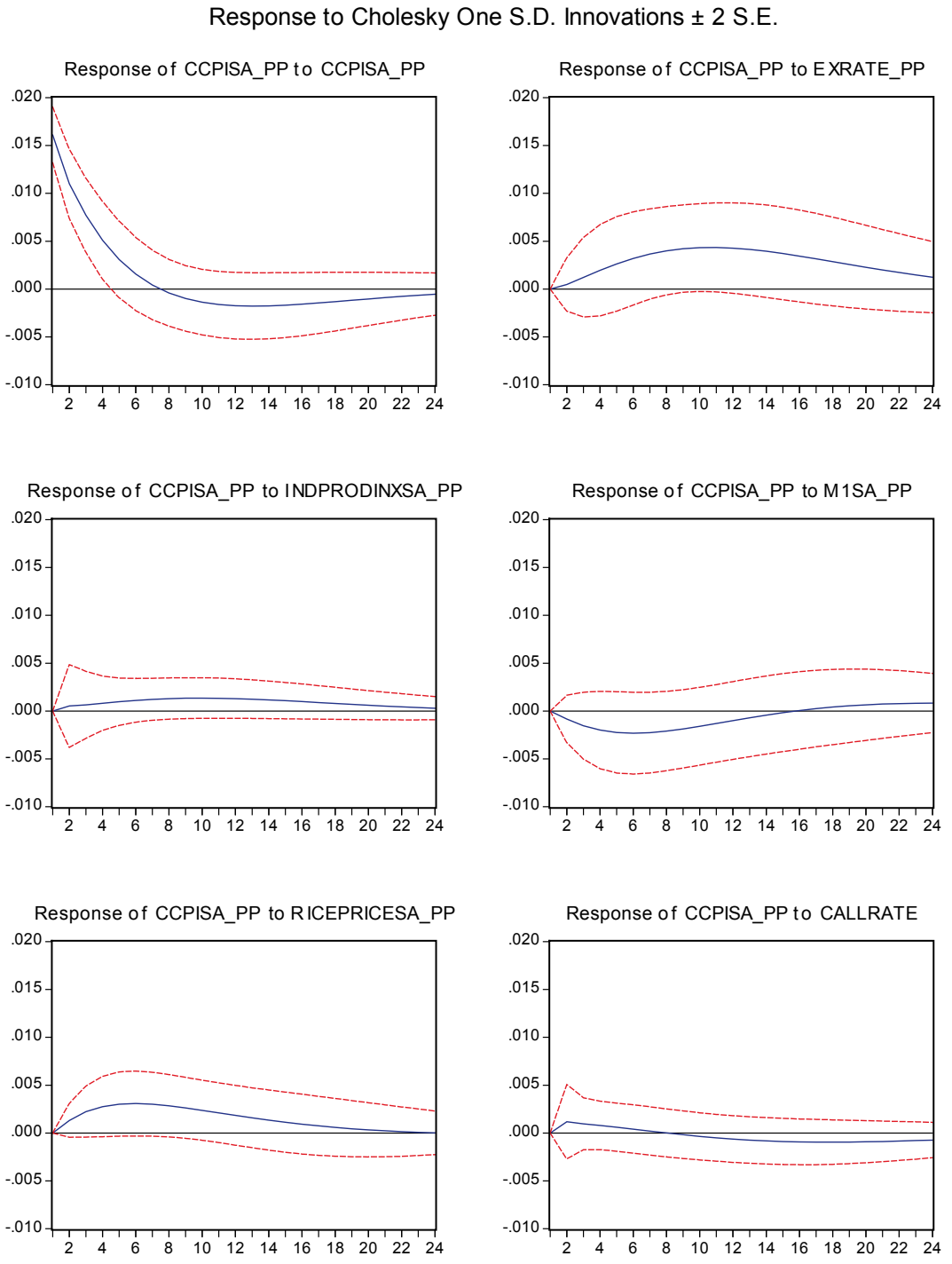
WPI

Vector Autoregression Estimates
Date: 05/03/08 Time: 16:23
Sample (adjusted): 2003M02 2007M12
Included observations: 59 after adjustments
Standard errors in ( ) & t-statistics in [ ]

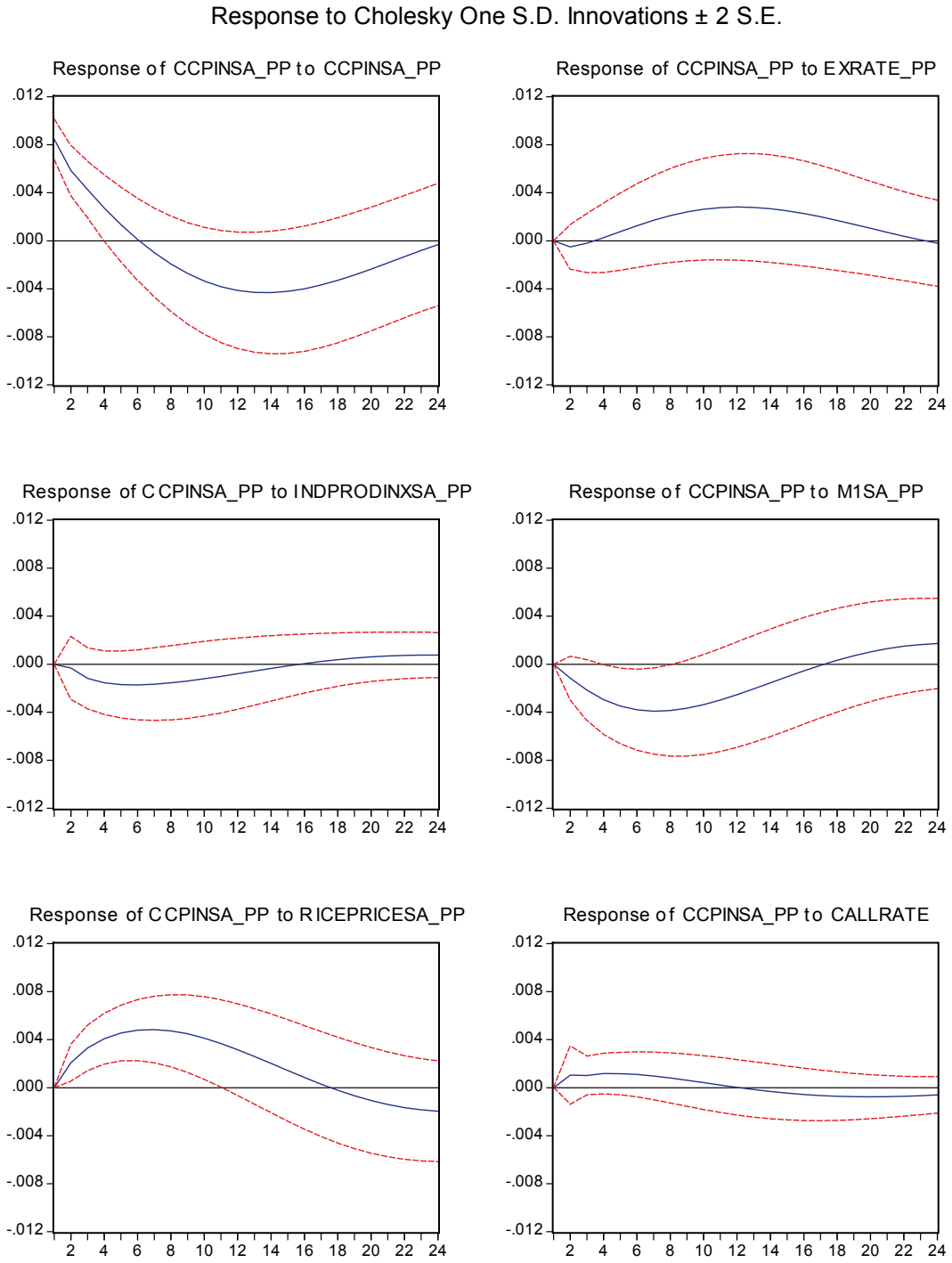
	WPISA_PP	EXRATE_PP	INDPROD-INXSA_PP	M1SA_PP	RICEPRIC-ESA_PP	CALLRATE
WPISA_PP(-1)	0.381851	-0.288389	-0.012141	0.081643	-0.366456	14.64308
	(0.09960)	(0.07182)	(0.12568)	(0.10728)	(0.25343)	(7.84256)
	[3.83366]	[-4.01568]	[-0.09660]	[0.76101]	[-1.44596]	[1.86713]
EXRATE_PP(-1)	0.304283	0.824039	0.137684	-0.077836	0.905169	-24.79064
	(0.13868)	(0.09999)	(0.17499)	(0.14938)	(0.35287)	(10.9196)
	[2.19406]	[8.24097]	[0.78679]	[-0.52107]	[2.56516]	[-2.27029]
INDPRODINXSA_PP(-1)	0.169676	0.172035	0.099895	-0.103038	-0.095027	-1.562482
	(0.10745)	(0.07747)	(0.13558)	(0.11573)	(0.27338)	(8.45992)
	[1.57918]	[2.22069]	[0.73682]	[-0.89035]	[-0.34759]	[-0.18469]
M1SA_PP(-1)	-0.113729	-0.050174	0.121201	0.639006	-0.156504	-27.04149
	(0.09392)	(0.06771)	(0.11850)	(0.10116)	(0.23896)	(7.39467)
	[-1.21096]	[-0.74096]	[1.02275]	[6.31707]	[-0.65494]	[-3.65689]
RICEPRICESA_PP(-1)	0.140252	0.084227	0.027469	-0.019842	0.936980	-0.963753
	(0.03795)	(0.02736)	(0.04789)	(0.04088)	(0.09656)	(2.98817)
	[3.69558]	[3.07811]	[0.57361]	[-0.48540]	[9.70324]	[-0.32252]
CALLRATE(-1)	-0.002484	-0.001464	-0.001164	-0.007267	-0.003489	0.325291
	(0.00200)	(0.00144)	(0.00253)	(0.00216)	(0.00510)	(0.15767)
	[-1.24061]	[-1.01367]	[-0.46057]	[-3.36938]	[-0.68478]	[2.06314]
C	-0.003665	-0.003338	0.006336	0.110081	0.007803	6.274731
	(0.02484)	(0.01791)	(0.03135)	(0.02676)	(0.06321)	(1.95607)
	[-0.14752]	[-0.18635]	[0.20214]	[4.11394]	[0.12345]	[3.20783]
@TREND	0.001423	0.000752	0.000514	0.000238	0.001233	0.062080
	(0.00032)	(0.00023)	(0.00041)	(0.00035)	(0.00082)	(0.02540)
	[4.41088]	[3.23167]	[1.26395]	[0.68382]	[1.50270]	[2.44432]
R-squared	0.938098	0.834629	0.172797	0.800841	0.924494	0.802255
Adj. R-squared	0.929602	0.811931	0.059259	0.773506	0.914130	0.775114
Sum sq. resids	0.021799	0.011333	0.034708	0.025290	0.141130	135.1454
S.E. equation	0.020675	0.014907	0.026087	0.022268	0.052605	1.627854
F-statistic	110.4117	36.77102	1.521932	29.29673	89.20616	29.55832
Log likelihood	149.4332	168.7323	135.7128	145.0521	94.33326	-108.1674
Akaike AIC	-4.794345	-5.448554	-4.329249	-4.645834	-2.926551	3.937877
Schwarz SC	-4.512645	-5.166854	-4.047549	-4.364134	-2.644851	4.219577
Mean dependent	0.116951	0.028636	0.055347	0.143435	0.056606	10.63949
S.D. dependent	0.077921	0.034373	0.026897	0.046791	0.179516	3.432686
Determinant resid covariance (dof adj.)		1.72E-16				
Determinant resid covariance		7.17E-17				
Log likelihood		594.3227				
Akaike information criterion		-18.51941				
Schwarz criterion		-16.82921				

Appendix IV
Impulse Response Functions

CCPI



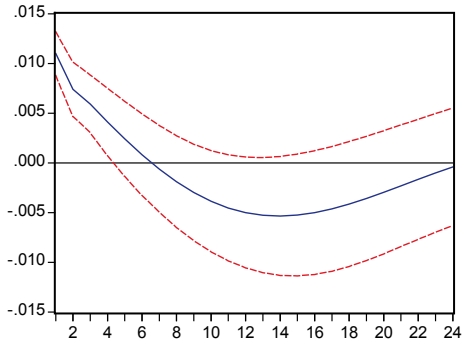
CCPI N


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of CCPINSA_PP to CCPINSA_PP
Response of CCPINSA_PP to EXRATE_PP
Response of CCPINSA_PP to INDPRODINXSA_PP
Response of CCPINSA_PP to M1SA_PP
Response of CCPINSA_PP to RICEPRICESA_PP
Response of CCPINSA_PP to CALLRATE
.012
.008
.004
.000
-.004
-.008
-.012
2 4 6 8 10 12 14 16 18 20 22 24

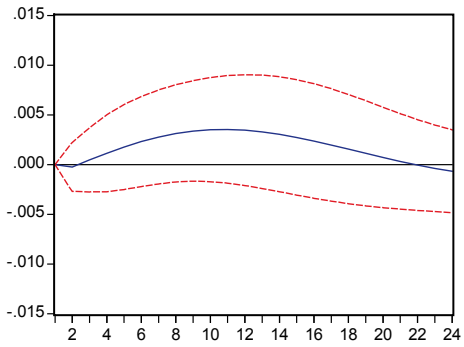
CCPI N Core

Response to Cholesky One S.D. Innovations ± 2 S.E.

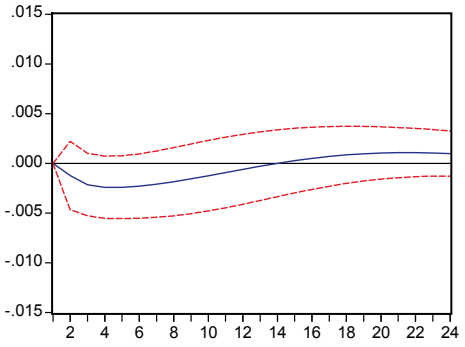
Response of CCPINCORE_DCSSA_PP to CCPINCORE_DCSSA_PP



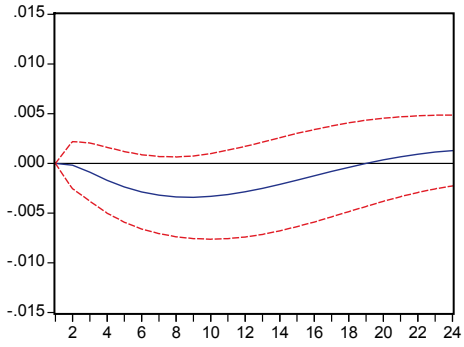
Response of CCPINCORE_DCSSA_PP to EXRATE_PP



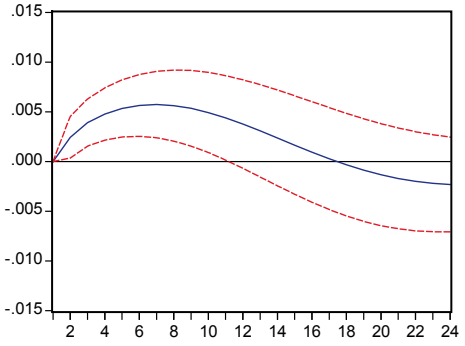
Response of CCPINCORE_DCSSA_PP to INDPRODINXSA_PP



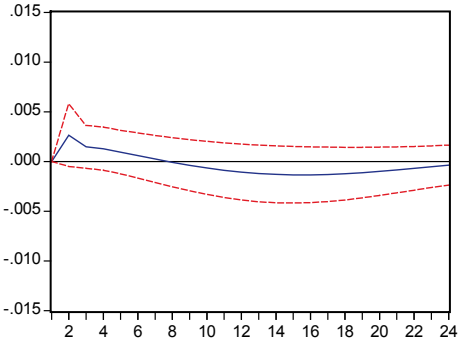
Response of CCPINCORE_DCSSA_PP to M1SA_PP



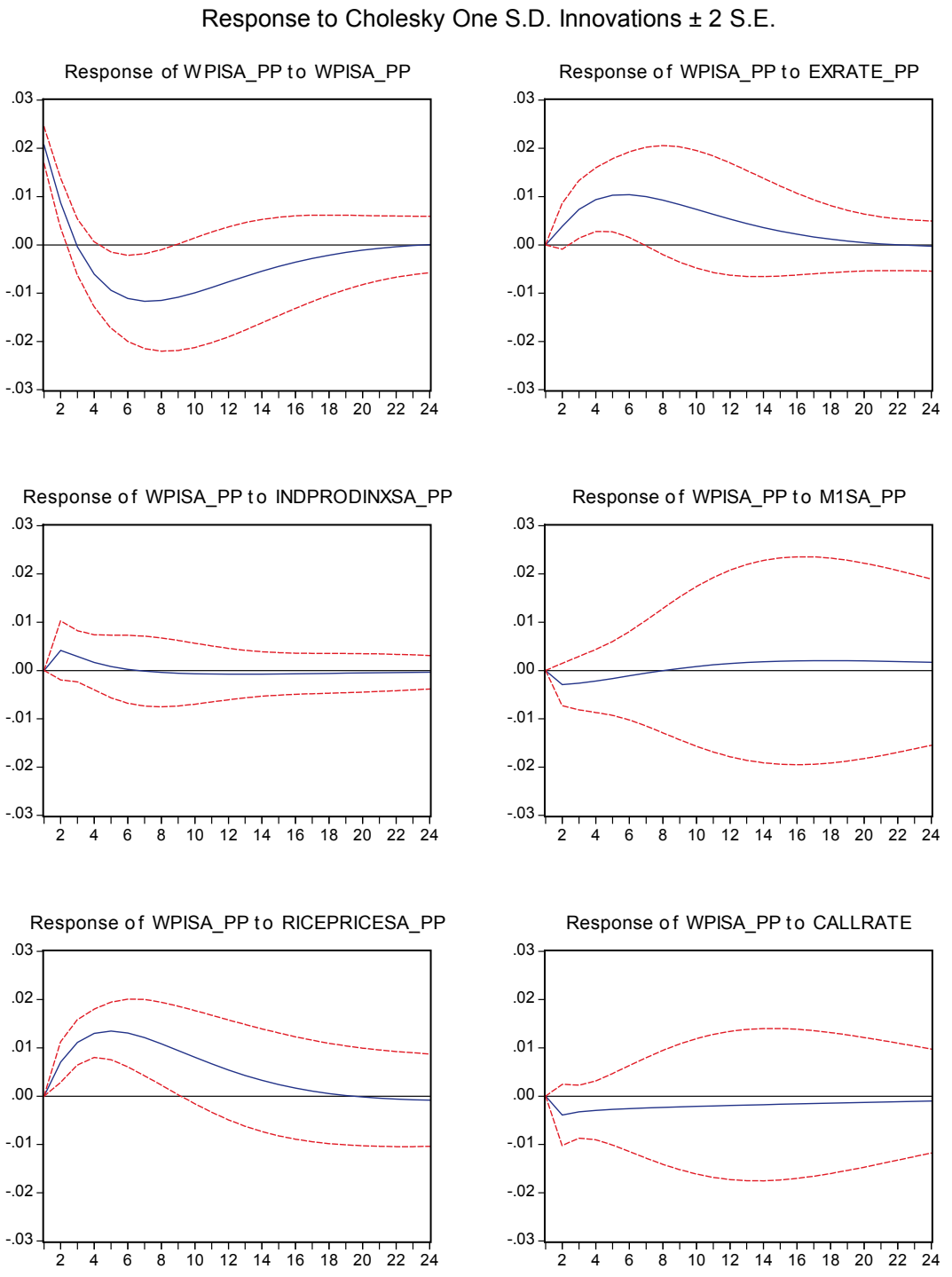
Response of CCPINCORE_DCSSA_PP to RICEPRICESA_PP



Response of CCPINCORE_DCSSA_PP to CALLRATE



WPI


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of WPISA_PP to WPISA_PP
Response of WPISA_PP to EXRATE_PP
Response of WPISA_PP to INDPRODINXSA_PP
Response of WPISA_PP to M1SA_PP
Response of WPISA_PP to RICEPRICESA_PP
Response of WPISA_PP to CALLRATE
.03
.02
.01
.00
-.01
-.02
-.03
2 4 6 8 10 12 14 16 18 20 22 24