MONETARY POLICY & YIELD CURVE BEHAVIOUR:

SRI LANKAN CASE UNDER HETEREGENEOUS ECONOMIC ENVIRONMENT

Mohamed Z. M. Aazim[1]

&

N. S. Cooray[2]

Abstract

The question of orderly transmission of monetary policy decisions across the yield curve remain at the forefront of many recent policy debates. Conventional wisdom is that decrease in the monetary policy target rate leads to an immediate decrease in market interest rates, and an increase in bond prices; yet evidence for this view is elusive. The question become profound when financial markets are in transition and swamped with structural impediments. Bringing the foundations of expectation hypothesis to ascertain monetary policy impact on daily market interest rates of Sri Lanka money and government securities market for the period 2000-2009 explains that monetary policy impact monotonically decreases over the yield curve at the short-end and become segmented toward medium to long-term of the yield curve. Analyzed for heterogeneous economic environment, the impact appears to be weaker and increasingly segmented at times of financial and economic uncertainties. This invites policy attention in Sri Lanka in terms of segmented market hypothesis of yield curve behaviour in contrast to standard explanation based on expectation hypothesis.

Keywords*: Yield Curve; Sri Lanka; Monetary Policy; Expectation Hypothesis and Segmented Market Hypothesis*

JEL Classification: E64; E66; E68; G1

---

[1] Corresponding author. Reading for his PhD at the National Graduate Institute for Policy Studies (GRIPS), Tokyo and an Economist by profession working for the Central Bank of Sri Lanka (CBSL).

[2] Associate Professor and the Director of International Peace Studies Program, Graduate School of International Relations, International University of Japan (IUJ).

Authors wish to thank James R. Rhodes, Tatsuo Oyama and Roberto L. Gonzales of GRIPS, and Koichi Hamada of Yale University for their valuable comments and Rizwana Aazim for the editorial support extended. Any errors and omissions are, however, of the authors.

1. Introduction

The question of how do monetary policy (MP) actions being effective, during the periods of financial and economic stress, is at the center of many recent policy debates (Bates and Vaugirard, 2009; Mishkin, 2009; Obstfeld, 2009; Calomiris, 2008). The prominence of MP in resurrecting troubled economies is partly due to the already stretched out fiscal space in both advanced and emerging market economies. The fallout of global economy, which was led by the recent Global Financial Crisis[3], led to a policy environment where unprecedented policy response were tried with the purpose of resurrecting the world economic order. As such, the effectiveness of these policy measures were at the center of policy debates and looked with importance had given impetus to study the effectiveness of policy actions tried in both advanced and emerging market economies. Among the policy choices, the MP took precedence and became increasingly important in emerging market economies (International Monetary Fund; 2009a). Monetary authorities responded with exceptionally large interest rate cuts as well as unconventional measures to inject liquidity, sustain credit and induce market confidence. These measures were aimed at establishing the orderliness in interest rate structure and thereby instilling the market confidence. In other words, MP actions aimed at the shorter-end of the term structure were expected to reflect across the medium to longer-end of the term structure. The medium to longer-end of the term structure is important to activate economic activities.

From another perspective, the assessment of effectiveness of recent aggressive MP measures, central banks are still not conclusive in their assessments (Blinder and Zandi, 2010). For instance,

[3] The financial crisis that arose in the US mortgage market in mid 2007 after a sharp increase in mortgage foreclosures, mainly subprime, collapsed numerous mortgage lenders and hedge funds. The meltdown spilled over into the global credit market as risk premiums increased rapidly and capital liquidity was reduced. The sharp increase in foreclosures and the problems in the subprime mortgage market were largely blamed on loose lending practices, low interest rates, a housing bubble and excessive risk taking by lenders and investors.

Federal Open Market Committee (FOMC) of the Federal Reserve Board of Governors' (FRB), the central bank of US (also known as the Fed), in their October 2008 and September 2009 policy reviews stated that the effectiveness of the MP measures in resurrecting the effected economies and more importantly to build the financial market and economic agents confidence are yet to be realized and also explained that most of the policy measures introduced in the post subprime period are experimental and unprecedented in nature.

Therefore, gauging the efficiency of MP tried became important and YC dynamics outside its traditional role of a leading indicator was taken to measure MP efficiency. The existing studies in MP and YC dynamics exclusively deal with advanced economies with developed financial markets and across a homogeneous time horizon. However, the post subprime world economic and financial markets suggests the requirement to analyze the MP impact on YCs across the emerging market economies and across time horizons identified for economic heterogeneity.

Therefore, the paper remedy the existing vacuum in literature by studying the effectiveness of MP separated for economic heterogeneity of stability and instability by analyzing an emerging market case, Sri Lanka by its influence on the YC. The period 2000-2009 provided both internal and external factors of Sri Lanka to study whether the MP tried across the time horizon enabled to resurrect the YC. The resurrection of YC is important for efficient policy transmission.

The paper is organized as follows. Section 2 briefly discusses the problem at hand and the objective. Section 3 discusses the conceptual framework and literature. The section 4 deals with the standard model (methodology) employed and the model employed under a stochastic environment followed by a brief introduction to the application of time series data in the study. Also, in section 4, the methodology to identify heterogeneous economic environment is

discussed. Section 5 concentrates on empirical results of both standard and stochastic models followed by section 6 to conclude the paper with a discussion on policy recommendations.

2. Problem statement and objectives of the study

The global financial crisis (GFC) of 2007-2008 brought back the memories of great depression and jolted the foundation of modern economic prosperity in both advanced and emerging market economies (International Monetary Fund, 2009a and 2009b). The unprecedented policy response in the post subprime world economy enabled to limit the damage of economic catastrophe and set world economy to rebound but leaving many policy challenges unanswered (Blinder and Zandi, 2010). Among policy responses, the MP interest rates in advanced economies declined by 320 basis points against 300 basis points decline in emerging market economies for the period October 2008 to September 2009 (International Monetary Fund; 2010, pp. 16-17). During this period, apart from conventional interest rate revisions of central banks, quantitative easing strategies including many unconventional measures to inject liquidity, sustain credit and induce market confidence were introduced. By third quarter of 2009, the world economy re-emerged and policy makers debated the efficiency of MP measures introduced in either fine-tuning the policy measures or to design exit strategies.

In conventional economic theory MP actions are reflective in market interest rates. The conventional view rests on three principles[4]. First, the MP target instrument is often the overnight policy interest rate. Second, the changes in overnight policy interest rate is determined by considering the overall direction of the economy and based on information MP authority posits at time of revision of the policy stance. And third, the market determination of medium to long-term interest rates are a function of expected level of overnight policy interest rates over the relevant time horizon. Therefore, market participants expect any MP action which result in change in monetary policy target instrument, often the overnight policy interest rate, to reflect in

[4] See Cook and Hahn (1989, pp. 331-332) for more details.

market interest rates or in other words across the YC. However, the empirical evidence did not necessarily subscribe to the above consensus in conventional economic theory and therefore questioned the validity of MP measures experimented by its influence in shaping the medium to long-term interest rates (Kuttner, 2006). The question of policy efficiency became increasingly important to emerging market economies given their higher resource constraints like in Sri Lanka to attain orderly medium to long-term interest rates to energize economic recovery (Smets and Tsatsaronis, 1997).

The YC became one of the key policy tools in addressing this problem and fast tracked the proximity of YC dynamics to be considered as an operational or intermediary target of MP. The question of YC as an operational or intermediary target can be addressed by the interwoven behavior of interest rates and the proximity of medium to long-term interest rates as the driver of economic activities. The section on literature further enlighten the argument of choosing YC dynamics as a measure of policy efficiency and such acceptance become more prominent when economic environment analyzed is unstable.

In a specific sense, the paper will investigate the MP impact in Sri Lanka to address the following hypotheses.

- Does the MP, changes in MP, impact the YC?
- Has the MP impact similar across the YC or the impact monotonically decrease across the maturity? Does the impact explain the expectation hypothesis?
- Is the MP impact on YC similar in nature across heterogeneous economic environment?

Estimating above hypotheses will enable to assess MP effectiveness in Sri Lanka under a heterogeneous economic environment separated for economic stability. From another perspective, Sri Lankan case will contribute to the existing literature on YC dynamics of an emerging

financial market of different depth and maturity. This will address the objective of undertaking such a study to determine how efficient the MP measures across the time horizon 2000-2009 and approach policy continuation, modification or exit strategies.

3. The conceptual framework and literature

In the analysis of YCs, YC may take the shape of upward slope, downward slope or flat. An upward sloping YC, often the normal case, signals that long-term yields are higher than short-term yields. The foundation of MP impact on YC is well explained providing that the YC is adequately explained by expectation hypothesis (EH)[5]. According to the EH, long-term rates are an average of current short-term rates and expected short-term rates across the time to maturity. Given this scenario, MP authorities could impact the medium to long-term rates by adjusting current short-term rates and alter the market expectations about the expected future short-term rates.

Apart from the EH, the movements in YCs could be explained by theories of segmented markets and preferred habitat which are in fact extensions to the EH. According to the theory of segmented markets, yields on different maturities are determined in separate markets and thus steep upward slope is indicative of investors flock at short-term instruments at times of credit crunch or economic uncertainties. The preferred habitat theory explains that investors have a preferred maturity but they can be induced to purchase other maturities by compensating them for choosing "*n*" period bonds over the yield equal of average of yields of one period bond.

Bindseil (2004, p. 33) states that since late 1990s, the dominant approach of MP implementation is the steering of interest rates where the MP transmission starts with steering of short-term

[5] The concept has roots to the early and mid 20th century and derived from observing the way people commonly discuss choices between purchasing a long or short-term bond as an investments. The more recent empirical work follows the idea that long-term nominal interest rates depend on expectations of future short-term interest rates (Campbell and Shiller, 1991; Cox et al, 1985).

market interest rates. The snap-shot of interest rates is the YC[6]. Although the MP authority targets the short-term interest rate, it is evident that real economic activities are guided by medium to long-term market interest rates (Bindseil, 2004, p. 38 & pp. 77-79; Thornton, 2004, p. 21 & p. 35). Smets and Tsatsaronis (1997) state that real economic activities in the form of consumption and investment typically depend on medium to long-term interest rates. Also, there are many MP episodes of advanced economies that the MP aims at the structure of orderly medium to long-term market interest rates[7]. Therefore, the effectiveness of MP is dependent on whether it can impart any influence on medium to long-term interest rates. In other words, MP should be able to affect the entire maturities of the YC, irrespective of whether it is short-term or medium to long-term, in order to achieve its desired target of influencing the real economic activity or resurrecting the economic order.

The MP authority in Sri Lanka is the Central Bank Sri Lanka (CBSL)[8]. According to the Monetary Law Act (MLA), CBSL aims at maintaining economic and price stability and maintaining financial system stability as its core objectives with a view to encouraging and promoting the development of the productive resources of Sri Lanka. In pursuing these broader objectives, CBSL has the mandate to practice either rule based or discretionary monetary

[6] The YC enables economists to capture the overall movement of interest rates. The YC reflects the investor's expectation of interest rates by plotting yields to maturity of similar financial instruments as a function of maturity.

[7] The introduction of "Quantitative Targeting (easing) Monetary Policy" regime in March 2001 by the Bank of Japan was aimed at facilitating the orderliness in short to medium to long-term interest rate structure in the economy.

[8] The Central Bank of Ceylon was established by the Monetary Law Act (MLA) No.58 of 1949 and commenced operations on August 28, 1950. It was renamed the Central Bank of Sri Lanka in 1985. The original objectives of the Central bank were streamlined into present context in 2002 by an amendment to the original MLA.

policies[9]. Therefore, studying the Sri Lanka case will provide insights into the role of MP in resurrecting the economic order in the development process in an emerging market.

There are two strand of literature that investigated the MP impact on YC. The first is mainly concerned with the dynamics of the EH. The second concentrated on quantifying the MP impact on the YC.

The studies on quantifying the MP impact on YC used mainly the event study analyses (Thornton, 2000; Rudebush, 1995; Cook and Hahn, 1989) or the time series context (Oda and Ueda, 2005; Thornton, 2004; Drakos, 2001; Kuttner, 2001; Balduzzi et al, 1998; Buttiglione et al, 1998). The literature on MP and YC dynamics (Oda and Ueda, 2005; Thornton, 2004; Kuttner, 2001; Balduzzi et al, 1998, Buttiglione et al, 1998; Rudebush, 1995) investigated the time-series properties of the YC and in particular how medium- and longer-term interest rates react to changes in the short-term interest rate target set by the MP authority. Further, many empirical work (Estrella and Mishkin, 1996[10]; Bernanke and Blinder, 1992; Mishkin, 1990) use the slope of the YC as an indicator of the stance of the MP and the health of the economy. These studies concluded that the MP impact exists across the YC and interestingly the impact wanes across as the time to maturity increases. In certain instances, findings support no impact of MP as the YC approaches the long-term. Also, empirical work extends a fractured support for the EH.

[9] The rule based monetary policy is the commitment to follow a "policy rule" instead of picking the appropriate policy at its discretion. The basic intuition under a rule is the credible commitment to a sequence of policy decisions that would bring about the best long-run outcome. Under discretion, the monetary policy would satisfy some short-run objective and thus forming expectations about policy decisions would not be straight forward. Inflation target may be considered as a rule and a policy of low inflation over the medium to long-term could be considered discretionary. However, in recent times, differentiating between types of monetary policy regimes become increasingly harder.

[10] Slope of the yield curve as a reliable predictor of economic activity.

4. The model

4.1. Methodology of monetary policy impact on yield curve

The base of the test of significance or impact of MP on YC comes from the EH. The empirical work on MP impact on YC employs the standard type of regression model used by many scholars (Drakos, 2001, pp. 246-247; Haldane and Read, 2000, pp. 20-21; Buttiglione et al, 1998; Rudebusch, 1995, pp. 247-251; Cook and Hahn, 1989, p. 340).

$$\Delta R_{i,t} = a_i + \beta_{1,i}\Delta R_{0,t} + \varepsilon_t \text{ -----(1)}$$

The regression model of the equation (1), bivariate time series model, explains that β as the response of the change in particular market interest rate *i*, let say 91 day maturity Treasury bill ($\Delta R_{i,t}$), to the change in MP instrument (interest rate), in this instance ΔR_0. The Δ will act as difference operator of the time series. The ε_t is the disturbance term.

The foundation of the regression model of equation (1) is derived from the EH. Walsh (2010) states that under the EH of the term structure, the *n*-period interest rate equals an average of the current short-term rate and future short-term rate over the *n*-period horizon and derives the following testable equation (2)[11] through an iterative process.

$$I_t = \tfrac{1}{2}(i_t + E_t i_{t+1}) \text{ -----(2)}$$

The implication of this relationship for MP is that the current structure of interest rates will depend on current short-term interest rates and on market expectations of future short-term interest rates. Therefore, it is normal and rational to expect the long-term interest rate based on

[11] Details of the iterative process can be found at Walsh (2010, pp. 465-68).

the expectation of future MP actions when short-term interest rate being the MP target instrument.

Subtracting i_t from both sides of equation (2), one could derive a direct and empirically testable equation (3) to test the MP implications on the YC.

$$I_t - i_t = \tfrac{1}{2}(E_t i_{t+1} - i_t) - - - - - (3)$$

This rationale has been employed in equation (1) as a mechanism of monetary transmission with changes to the "one period" interest rate by the MP authority. Based on the model explained in equation (1), the previous studies, by assuming stationary relationship, estimated the impact of MP variable among contemporaneous market interest rates by applying *Ordinary Least Squares (OLS)* approach. The application of OLS is reasonable and simple in order to analyze the impact of change in MP variable on changes in market interest rates.

The study proposes to apply a variant of equation (1) to directly test the empirical application of monetary policy impact on YC.

$$\Delta R_{i,t} = a_i + \beta_{1,i}\Delta R_{0,t} + \beta_{2,i}\Delta R_{0,t-1} + \beta_{3,i}\Delta R_{0,t+1} + \Gamma\Delta R_{i,t-1} + \varepsilon_t - - - - - (4)$$

Accordingly, the equation (4)[12] will be empirically tested where the lag ($\Delta R_{0,t-1}$) and the lead ($\Delta R_{0,t+1}$) of the MP instrument (ΔR_0) is applied to capture the anticipation of MP action and contemporaneous reaction if otherwise not captured by the data, respectively. The lag depended variable ($\Gamma\Delta R_{i,t-1}$) is estimated to address any residual autocorrelation and the impact of

[12] Recent work on MP impact across the YC (Oda and Ueda, 2005; Drakos, 2002 and 2001) uses the variant instead of the basic equation to separate out the lag and lead effect of MP instrument.

'recent event' bias. Also, further tests for first-order autocorrelation in models with a lagged depended variable on explanatory variables is analyzed by applying Durbin h-statistics[13] and corrected, if necessary, to estimate the equation as a first order autoregressive model.

4.2. Methodology under a stochastic environment

The methodology applied by the equation (1) and its variant equation (4) are informative and empirically methodological to infer MP impact on YC. However, when empirically estimating the change in MP instrument's impact on market interest rates (YC), differencing will not take into account the long-term pattern or the relationship exhibit by the MP instrument (often overnight policy interest rate) and market interest rates. In other words, although level differencing achieves stationarity in the empirical work, if the long time series information involves non-stationarity at levels, it would not be optimal to restrict the empirical work to the model explained by equation (1) and its variant equation (4). Therefore, inferring the MP impact on YC by taking difference operator would be sub-optimal and not reflect the true long-term relationship embedded in the history of policy and market interest rates concerned. These concerns have been addressed by taking into account long-term information embedded in variables at levels. The model explained below will address the dynamic co-movement of variables.

---

[13] This test for serial correlation when there is a lagged dependent variable in the equation is based on the **h** statistics. In an OLS model of $Y_t = \alpha + \gamma X_t + \beta Y_{t-1} + \varepsilon_t$, the Durbin-h statistics is defined as $h = \hat{\rho}\sqrt{\frac{T}{1 - T[Var(\hat{\beta})]}}$ where T = the number of observations and $\hat{\rho}$ = the estimated correlation coefficient of the residuals or the autocorrelation coefficient of the residuals. The $Var(\hat{\beta})$ is the variance of the coefficient on the lagged dependent variable. In large samples, h has a normal distribution and hence reject the $H_0 : \rho = 0$ against $H_A : \rho \neq 0$ when $|h| \succ z^*$, critical value of *z* (Durbin, 1970, pp. 420-421). Any misspecifications are corrected by Prais-Winsten and Cochrane-Orcutt procedure (Prais and Winsten, 1954; Cochrane and Orcutt, 1949).

According to the EH, to exert any impact on market interest rates by the MP instrument, a dynamic co-movement among market interest rates, a one to one relationship between policy interest rate and market interest rate of concern, should exist. This condition is nothing but any pair of interest rates should exhibit co-integration and the co-integration vector should be symmetric (1, -1) in coefficients (Drakos, 2001, pp. 250-252). Therefore, the impact of MP, assume overnight policy interest rate, on the YC will be investigated within a co-integrated system.

In this context, to empirically test the stochastic trend of the market interest rates with the MP instrument

a) any linear combination in the form of $(R_{o,t} + \beta_i R_{i,t})$ will be tested for stationarity.

We know that, in the context of EH, the co-integration between MP instrument, overnight policy interest rate $(R_{o,t})$, and the market interest rate $(R_{i,t})$ will be analyzed by the statistical significance of β_i .

Also, to test the EH for a certain segment of the YC

b) the co-integration vector (1, -1), symmetry hypothesis, will be tested.

Not rejecting the hypothesis that the co-integration vector (1, -1) among combination of interest rates establishes the proportionate or parallel impact of the MP variable on the YC. If the co-integration vector (1, -1) is rejected, then the impact of MP action on market interest rates will be examined by monotonically decreasing pattern of the parameter value β_i across the time to maturity on the YC.

Drakos (2001) test the co-integration between MP instrument, overnight policy interest rate $(R_{o,t})$, and the market interest rate $(R_{i,t})$ by applying the Johansen procedure (Johansen, 1992, pp. 313-316). The Johansen procedure starts with applying *n*-dimensional vector of non-stationary variable *X*, which potentially forms a co-integrating set.

The standard model applied by many scholars (Thornton, 2004; Drakos, 2001; Haldane and Read, 2000) to test for co-integrating vectors between MP instrument, overnight policy interest rate $(R_{o,t})$, and the market interest rate $(R_{i,t})$, follow the Vector Autoregressive (VAR) representation of the unrestricted system with error *u* is

$$X_t = A_1 X_{t-1} + A_2 X_{t-2} + \ldots + A_k X_{t-k} + u_t \quad -----(5)$$

where $u_t \approx N(0, \sum)$ and

$X_t \approx (n \times 1)$, $A_i \approx (n \times n)$ are matrix parameters.

The equation (5) could be re-formulated into a Vector Error Correction Model (VECM) in the following equation (6) to test the $\prod$, which determines co-integration vectors between the MP instrument, overnight policy interest rate $(R_{o,t})$, and market interest rates $(R_{i,t})$.

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \ldots + \Gamma_{k-1} \Delta X_{t-k-1} - \Pi X_{t-k} + u_t \quad -----(6)$$

where $\Gamma_i = -(I - A_1 - \ldots - A_i)$

$i = 1, 2, \ldots, k-1$ and

$\Pi = -(I - A_1 - \ldots . - A_k)$.

Based on the rank of matrix $\prod$, if it is zero the matrix is null and that implies the non existence of co-integration among combination of interest rates. If the column rank is non zero, stationary linear combination between the MP instrument, overnight policy interest rate $(R_{o,t})$, and the market interest rate $(R_{i,t})$ correspond to the co-integration vectors and signify the co-movement

among interest rates. The Johansen likelihood ratio (LR) tests, to test the rank of Π , in the form of *trace test* and *maximum eigenvalue test* will be presented for empirical results. The normalized co-integration vectors will be analyzed for proportionate or parallel shift in market interest rates.

Therefore, the standard model applied on the basis of equation (1) and its variants equation (4) and the model under a stochastic environment on the basis of equation (6) will enable to test hypothesis (1) and (2).

4.3. Application of the methodology under different economic environments

Apart from hypothesis (1) and (2), the hypothesis (3), the MP impact on YC under *stable and unstable economic environments* (heterogeneous environment) will require testing the standard and stochastic models separated for different economic environments.

The study proposes to use a market oriented mechanism in defining periods of economic stability and instability augmented by an adjustment to specify an event or an episode of economic stability. The stable and unstable economic periods are recognized by the deviation of comparable market interest rates from the MP target interest rate.

The MP operates within an interest rate corridor in Sri Lanka with an upper, reverse repo rate, and lower bound, repo rate[14]. The MP operational corridor is determined by a meeting of the

[14] Repo is the sale of government securities (or central bank securities) by the central bank or the rate at which counterparty financial institutions park their excess funds with the central bank with the agreement to buy them back at a pre determined date at a pre determined price (at official Repo rate). Reverse Repo is purchase of government securities by central bank with the agreement to sell them back at a pre determined date at a pre determined price (at official Reverse Repo rate) or at the rate at which counterparty financial institutions borrow their fund shortages with the central bank. The Official rates are set for overnight transactions.

members of the Monetary Board[15], apex policy making committee, of the CBSL. Timing of the MP reviews are announced at the beginning of the year with CBSL keeping the discretion to make announcements outside the announcement plan, if necessary. The deviation of the overnight money market interest rate, weighted average call money rate (WACM) from the MP interest rate corridor will be used as the base for identifying stable and unstable economic periods in Sri Lanka (equation 7). When the market interest rate reports a deviation from the MP interest rate corridor, the CBSL acts through the OMO to resurrect the orderliness in the overnight market interest rate. This is similar to FRB guidance in OMO to bring back the orderliness in US money market (Cook and Hahn, 1989, pp. 333-337). Thus the identification of periods of economic heterogeneity by an interest rate departure rule itself a contribution of the study[16].

$$R_{i,t} - R_{o(repo),t} \prec 0.00, unstable$$
$$R_{i,t} - R_{o(rev.repo),t} \succ 0.00, unstable ------(7)$$

In the study, the interest rate departure rule is augmented by identifying an event across the long time horizon of 2000-2009 by persistence of the condition defined by equation (7) to recognize heterogeneous economic environment. For instance, across 2000-2009 period, interest rate

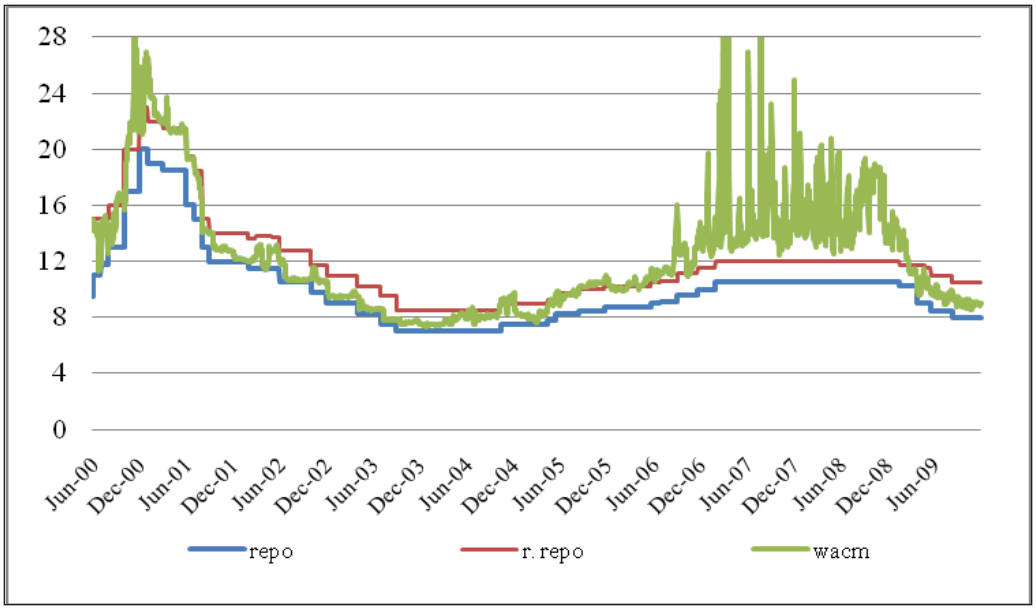
[15] The CBSL has a unique legal structure in which the CBSL is not an incorporated body. In terms of the Monetary Law Act, the corporate status is conferred on the Monetary Board, which is vested with all powers, functions and duties. As the governing body, the Monetary Board is responsible for making all policy decisions related to the management, operation and administration of the CBSL. The Monetary Board consists of five members, the Governor, the Secretary to the Ministry of Finance (ex-officio) and three non-executive members. The Governor is the Chairman of the Monetary Board and also functions as the Chief Executive Officer of the Central Bank. The Governor and the non-executive Board members are appointed by the President, on the recommendation of the Minister of Finance. The approval of the Constitutional Council is also required for the appointment of the non-executive Board members. The term of office of the Governor and the non -executive Board members is six (6) years.

[16] The periods of economic instability is usually recognized by an announcement by a policy authority or by an independent organization. For instance, National Bureau of Economic Research (NBER) of US define a recession in terms of significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales.

departure rule defined by the equation (7) suggest that third quarter of 2005 to first quarter of 2009, the overnight market interest rate $R_{i,t}$, WACM, trade outside the MP operating instrument $R_{o,t}$, policy corridor, allowing that period to be categorized as unstable economic period. In other words, periods where overnight market interest rate $R_{i,t}$, WACM, falls below the lower bound of the MP corridor, repurchase rate, or trade above the MP corridor, reverse repurchase rate, that period can be considered as the unstable economic period. Figure 1 depicts the definition of equation (7) to recognize periods of economic stability and instability where the period of instability is clearly visible from the departure of WACM from the MP corridor.

The methodology identified by equation (7) will be augmented by defining a sub-period in the full time horizon in the form of an event study (Thornton, 2000; Rudebush, 1995; Cook and Hahn, 1989). Such an approach will facilitate testing the hypothesis 3, the MP impact on YC under different economic environments, by following the standard model and the model analyzed under a stochastic environment. Accordingly, the episode of *July 2001 to May 2005* is classified as stable economic event and the episode of *August 2005 to February 2009* is classified as unstable economic event. The figure 1 visualize the definition of periods of heterogeneity in Sri Lanka.

Figure 1: Behaviour of MP Corridor and Overnight Market Interest Rate (WACM)



Source: Own calculation by using CBSL macroeconomic data portal.

The data employed in the study are time series data from Sri Lanka. The MP target instrument, policy corridor in the case of Sri Lanka, repo rate and reverse repo rate data are collected from the CBSL. The overnight interest rate, one-week and one-month interest rates are collected from the Sri Lanka Inter Bank Offered Rates (SLIBOR), online data reporting system of the CBSL reported by the counter party financial institutions (mainly licensed commercial banks). The Treasury bill rates of 91 day, 182 day, and 364 day maturities are used for shorter end of the YC. The long-term interest rates represent 2, 3 and 5 year Treasury bonds. Both Treasury bill and Treasury bond interest rates are reported by the primary dealer data reporting systems of the Public Debt Department (PDD), CBSL.

The frequency of the data is daily. In cases where daily data is not available or not captured the appropriate method of norm to spread them throughout the period on a daily basis is employed. For instance the daily interest rates of Treasury bonds are not regular during the unstable period. In such instances, the last traded Treasury bond daily interest rate is continued till such time data

become available[17]. The time horizon of the study is approximately a decade from mid 2000 to end 2009 where Sri Lanka experienced different economic episodes due to both domestic and international economic developments.

5. Findings of the monetary policy impact across the market interest rates

Estimated standard model by the application of equation (1), bivariate time series model, and by its variant equation (4), assuming a stationary relationship between variations in market interest rates as a function of MP instrument are reported in table 1 and 2, respectively. The interpretation of MP impact across the YC depends upon the assumption that the changes to the MP target instrument cause the changes in market interest rates and not the reverse. In fact it is empirically correct that changes in the market interest rates are often followed by the changes in overnight policy interest rates.

The estimated results of equation (4) for the stable economic period are presented in table 1. The stable period is defined by equation (7) and adjusted for the horizon of *July 2001 to May 2005*. As the CBSL follows a policy corridor, at times of economic stability the MP instrument which guides the market interest rates is the "floor" interest rate of the policy corridor, repo rate.

Accordingly to the table 1, at times of stable economic condition, the MP impact on market interest rates separated for repo rate alone, estimated by β_1 , in Sri Lanka follow the monotonically decreasing pattern over the time to maturity across money and 91 day Treasury bill market and report statistical and quantitative significance. The MP impact still remain significant, once both lag and lead parameter values of the repurchase rate accommodated,

[17] The figure 3 presents overall interest rate behavior. The straight lines of interest rate behavior explains the daily data adjusted for the next reported trade across the time horizon and are few in observations.

$\beta_1 + \beta_2 + \beta_3$, across the money market and gain some strength across Treasury bill maturities with few kinks across market interest rates.

Table 1: MP Impact across Market Interest Rates- Stable Economic Environment

Maturity/ Parameter Values	β_1	β_2	β_3	$\beta_1 + \beta_2 + \beta_3$	β_4	α	Observations
O/N	0.46***	-0.09*	0.02	0.39***	0.14***	-0.01	926
	(0.05)	(0.05)	(0.05)	(0.08)	(0.03)	(0.01)	
Weekly	0.43***	-0.09**	0.01	0.35***	0.20***	-0.01	926
	(0.04)	(0.04)	(0.04)	(0.07)	(0.03)	0.00	
Monthly	0.40***	-0.04	0.00	0.36***	0.17***	-0.01*	926
	(0.03)	(0.04)	(0.03)	(0.06)	(0.03)	0.00	
Quarterly	0.01	0.01	0.13***	0.15***	-0.01	-0.01***	926
	(0.03)	(0.03)	(0.03)	(0.06)	(0.03)	0.00	
Semi Annual	0.01	0.00	0.08***	0.09*	-0.02	-0.01***	926
	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)	0.00	
Annual	0.02	-0.01	0.08***	0.09*	-0.02	-0.01***	926
	(0.03)	(0.03)	(0.03)	(0.05)	(0.03)	0.00	
2 Year	-0.03	0.00	0.01	-0.02	0.00	-0.01	926
	(0.06)	(0.06)	(0.06)	(0.11)	(0.03)	(0.01)	
3 Year	-0.05	0.14*	0.01	0.10	0.19***	-0.01	925
	(0.07)	(0.07)	(0.07)	(0.11)	(0.03)	(0.01)	
5 Year	0.01	0.00	0.03	0.04	0.00	0.00	926
	(0.06)	(0.06)	(0.06)	(0.10)	(0.03)	(0.01)	
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 The stable economic period span across 7/4/2001 to 5/12/2005							

The MP impact extended to Treasury bond maturities and analyzed by both β_1 and $\beta_1 + \beta_2 + \beta_3$ combination do not respond in a monotonically decreasing pattern and also lose steam in statistical and quantitative significance. In mature financial markets, MP impact on YCs show monotonically decreasing pattern and parameter values show statistical and

quantitative significance (Oda and Ueda; 2005, pp. 15-18; Drakos; 2001, pp. 248-250; Kuttner; 2001, p. 526; Cook and Hahn, 1989, 340-345). Therefore, the MP impact analyzed in Sri Lanka for the stable economic condition can be differentiated against mature financial markets in the form of lower quantitative impact and segmented nature across the YC. The impact of lag market interest rate (Γ) across shorter end of the YC appear statistically and quantitatively significant and supportive of the recent event bias in the money market.

Table 2 presents the estimation results of the equation (4) for the unstable economic condition. The unstable economic condition is defined by equation (7) and adjusted for the horizon of *August 2005 to February 2009*. As the CBSL follows a policy corridor, at times of economic instability the MP instrument which guides the market interest rates is the "cap" interest rate of the policy corridor, reverse repo rate.

Accordingly, at times of unstable economic conditions, the MP impact on market interest rates separated for reverse repo rate alone, estimated by β_1 , does not support statistical significance across money and Treasury bill market compared with stable economic period in Sri Lanka although the quantitative impact remain noted for its high value. The MP impact regains significance among few selected benchmark Treasury bond maturities, clearly signaling the segmented nature of MP transmission across the term structure. The incorporation of both lag and lead parameter values with reverse repo rate, $\beta_1 + \beta_2 + \beta_3$, makes MP significance wane out across both money and Treasury bill markets and regain quantitative significance across the Treasury bond maturities. The pattern of impact resembles completely segmented with kinks across the term structure.

Table 2: MP Impact across Market Interest Rates- Stable Economic Environment

Maturity/ Parameter Values	β_1	β_2	β_3	$\beta_1+\beta_2+\beta_3$	β_4	α	Observations
O/N	0.78	-0.52	-1.12	-0.86	0.13***	0.01	844
	(1.91)	(1.89)	(1.89)	(3.60)	(0.03)	(0.07)	
Weekly	0.32	-0.52	-0.39	-0.58	0.12***	0.01	844
	(1.26)	(1.25)	(1.25)	(2.37)	(0.03)	(0.05)	
Monthly	0.33	-0.09	-0.75	-0.52	0.11***	0.01	844
	(0.49)	(0.48)	(0.48)	(0.91)	(0.03)	(0.02)	
Quarterly	-0.03	0.03	-0.02	-0.02	-0.14***	0.01	844
	(0.72)	(0.71)	(0.71)	(1.14)	(0.03)	(0.02)	
Semi Annual	-0.03	-0.02	-0.02	-0.07	-0.01	0.01***	845
	(0.11)	(0.11)	(0.11)	(0.19)	(0.03)	0.00	
Annual	-0.03	-0.03	-0.03	-0.08	-0.01	0.01***	845
	(0.11)	(0.11)	(0.11)	(0.19)	(0.04)	0.00	
2 Year	0.65***	-0.05	-0.02	0.58	0.00	0.01	845
	(0.25)	(0.25)	(0.25)	(0.43)	(0.04)	(0.01)	
3 Year	0.08	0.13	-0.01	0.19	0.00	0.01	845
	(0.19)	(0.19)	(0.19)	(0.33)	(0.04)	(0.01)	
5 Year	0.24	0.37	-0.02	0.60	0.02	0.01	845
	(0.32)	(0.32)	(0.32)	(0.56)	(0.04)	(0.01)	
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 The unstable economic period span across 8/9/2005 to 2/2/2009							

Analyzing the impact of lag parameter of the market interest rate concerned, at times of unstable economic environment in Sri Lanka, the money market interest rate have both quantitative and statistical significance of recent event bias.

Figure 2 exhibits the MP impact across the YC in the parameter values/ term structure (time to maturity) space. Although, the MP impact curve clearly shows the considerably higher impact at the shorter end of the YC during the unstable period and wane out at a faster pace

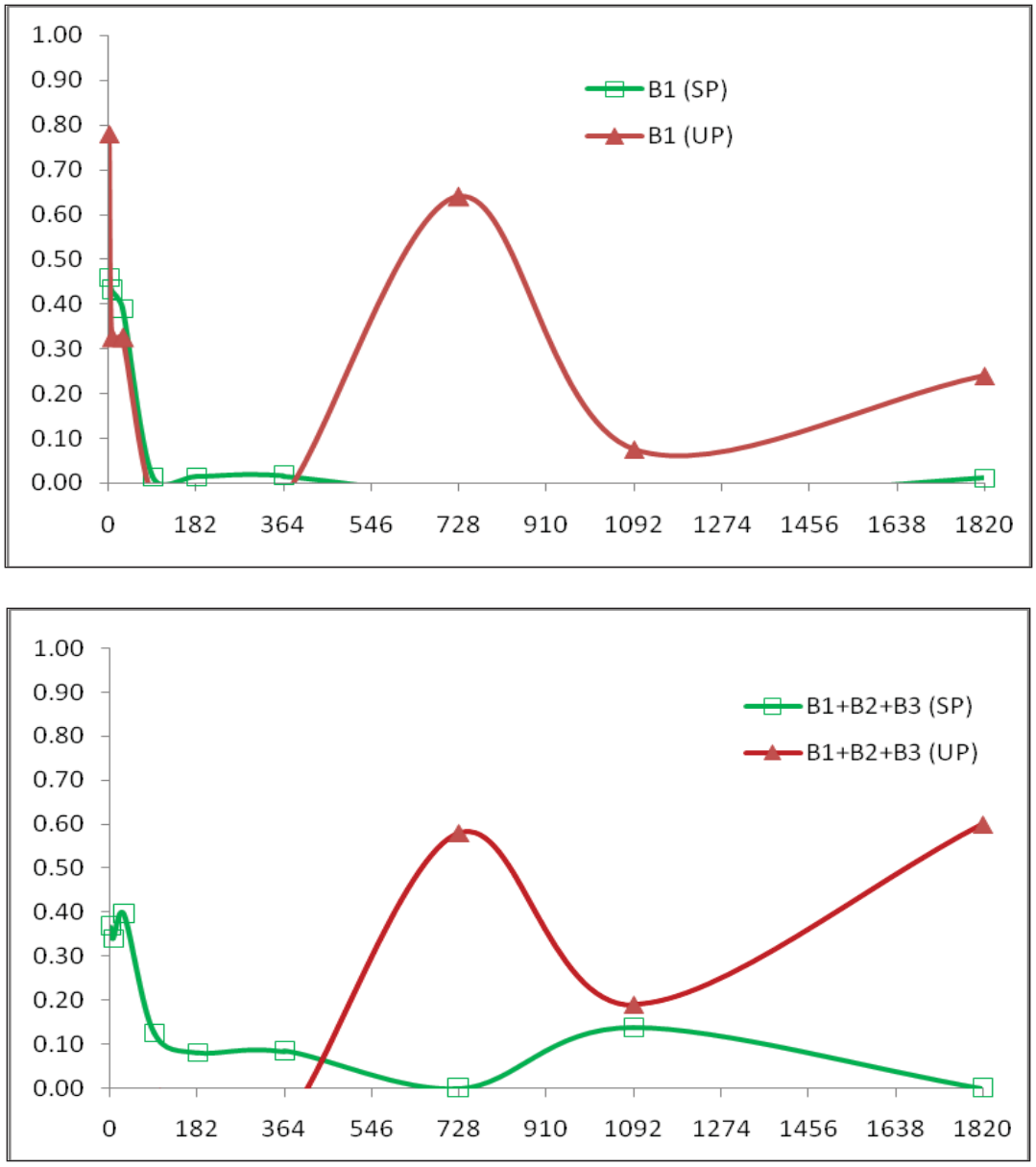
by 91 day Treasury bill maturity, the impact could be discounted for statistical significance and what explain the MP impact in Sri Lanka is the stable period where MP impact remain low across short-term money market interest rates and Treasury bill interest rates analyzed for MP target instrument alone. Once the lag and lead parameter values of the MP target instrument combined shows clear segment MP impact across few selected maturities of market preference.

What would be the MP impact across the YC once long-term pattern of interest rate behaviour is accommodated in to the model?

The analysis of the stochastic environment addresses the concerns of long-term pattern of interest rates data behaviour. The figure 3 shows the co-movement of market interest rates in Sri Lanka. It is evident from figure 3 that the market interest rates exhibit a pattern of co-movement.

Figure 2: MP Impact across the Yield Curve

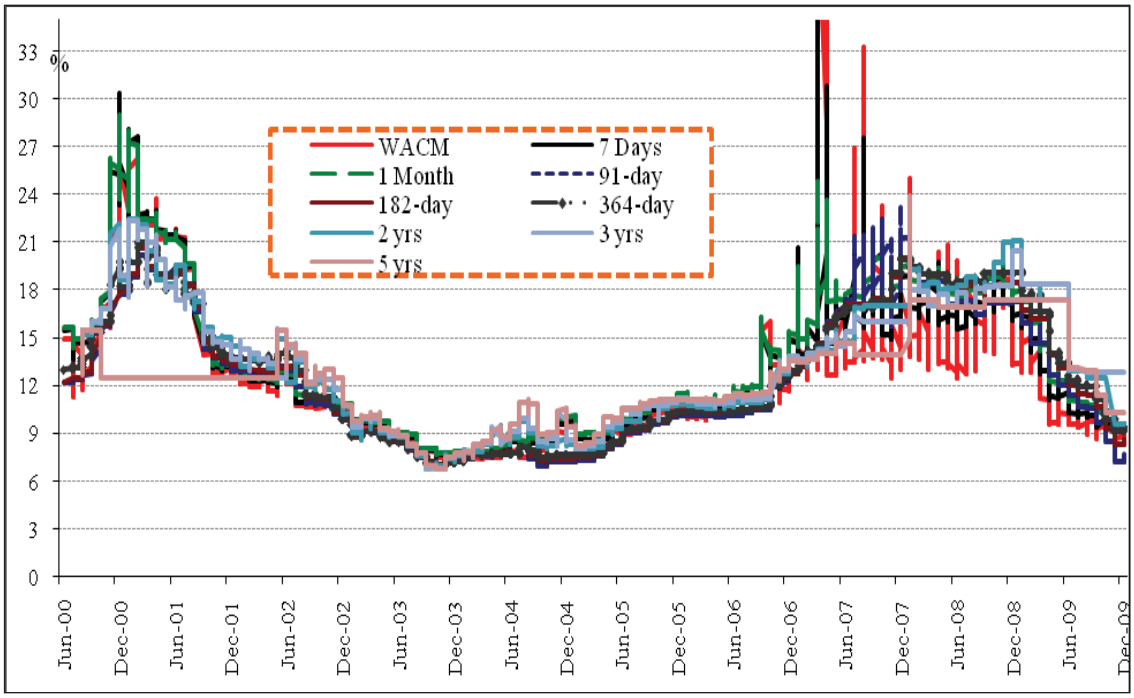
[Stable Period (SP) & Unstable Period (UP)]



Source: Own calculations by using CBSL macroeconomic data portal.

Note: 'B' stands for beta values of the equation (9). The fist figure describes the MP impact alone (B1) across the Yield Curve and the second figure describes the MP impact together with its lag and lead (B2+B3) beta values across the Yield Curve. The 'Y' axis represent values in percentage and the 'X' axis represent maturity in number of days.

Figure 3: Co-movement of Market Interest Rates



Source: Own calculation by using CBSL macroeconomic data portal

.

The estimation of the stochastic time series data over a considerable time length will be adequate to cover long-run relationships between MP target instruments and market interest rates. Also, the existence of co-integration between interest rates is a pre-requisite under the validity of EH to have MP impact across the market interest rates. The estimated results based on Johansen test procedure for the stable economic period are presented in the table 3. The none condition (rank=0) is rejected in all the interest rate pairs supporting co-integration between MP interest rate, $R_{o,t}$, and the market interest rates, $R_{i,t}$, under the stable economic period. The existence of co-integration implies that the MP impacts the market interest rates in line with hypothesis (1). The hypothesis (2) also tested by applying normalised co-integration vectors to see the quantitative impact of MP across the market interest rates.

Table 3: Johansen Bivariate Co-integration Output under Stable Economic Condition

Maturity	Null	Unrestricted Co-integration Rank Test (Trace)		Unrestricted Co-integration Rank Test (Maximum Eigenvalue Trace)		Observations
		Trace Statistics	Critical Value	Max-Eigen Statistics	Critical Value	
O/N	None *	40.70677	15.49471	31.14348	14.26460	924
	At most 1 *	9.563290	3.841466	9.563290	3.841466	
Weekly	None *	38.20333	15.49471	28.46844	14.26460	924
	At most 1 *	9.734894	3.841466	9.734894	3.841466	
Monthly	None *	37.25237	15.49471	27.37917	14.26460	924
	At most 1 *	9.873203	3.841466	9.873203	3.841466	
Quarterly	None *	38.85000	15.49471	26.40460	14.26460	924
	At most 1 *	12.44540	3.841466	12.44540	3.841466	
Semi Annual	None *	40.47228	15.49471	26.88148	14.26460	924
	At most 1 *	13.59080	3.841466	13.59080	3.841466	
Annual	None *	34.21575	15.49471	25.02295	14.26460	924
	At most 1 *	9.192795	3.841466	9.192795	3.841466	
2 Year	None *	36.69109	15.49471	23.57291	14.26460	924
	At most 1 *	13.11818	3.841466	13.11818	3.841466	
3 Year	None *	35.27515	15.49471	23.11144	14.26460	924
	At most 1 *	12.16371	3.841466	12.16371	3.841466	
5 Year	None *	25.66251	15.49471	21.36681	14.26460	924
	At most 1 *	4.295701	3.841466	4.295701	3.841466	

The estimation does not include intercept or trend.

* denotes rejection of the null hypothesis (rank= 0) at the 0.05 level

The stable economic period span across 7/4/2001 to 5/12/2005

The estimated results of normalised co-integration vectors for the stable economic period are presented in the table 4.

Table 4: Normalised Co-integration Vectors under Stable Economic Condition

Maturity	Co-integration Vector (1-B)	Standard Errors
O/N	(1, -0.896949)	(0.05951)
Weekly	(1, -0.835853)	(0.06955)
Monthly	(1, -0.742150)	(0.08352)
Quaterly	(1, -0.578059)	(0.13459)
Semi Annual	(1, -0.318281)	(0.18627)
Annual	(1, -1.998964)	(0.14678)
2 Year	(1, -1.477894)	(0.08462)
3 Year	(1, -1.427302)	(0.08625)
5 Year	(1, -1.455120)	(0.19199)

According to normalised co-integration vectors, symmetry condition (1, -1) is not satisfied supporting breakdown of EH. Another interesting observation is the point estimates of MP impact on market interest rates. The estimated MP impact, though not unity, shows the monotonically decreasing pattern across money and up to 6 month maturity (semi-annual) Treasury bill. The normalised co-integration vectors loose a pattern as the YC approach Treasury bond maturities with skews across the term structure. The patterns of MP impact analyzed resemble similarity to the case of standard model estimated under the equation (4).

The analysis under the stochastic environment for unstable economic conditions is summarized in table 5. The none condition (rank=0) is again rejected in money and Treasury bill market interest rate pairs. This supports the co-integration between MP interest rate, $R_{o,t}$, and the market interest rates, $R_{i,t}$, at the shorter end of the YC at times of unstable economic conditions and the co-integration among interest rate pairs weaken at a faster pace there onwards across the YC. In fact, the co-integration weaken beyond Treasury bill maturities where none

condition (rank=0) is not dismissed across Treasury bond maturities. The existence of no co-integration implies that the MP impact has considerably weakened when tested for hypothesis (1). The hypothesis (2) also tested by applying normalised co-integration vectors to see the quantitative impact of MP across the market interest rates.

Table 5: Johansen Bivariate Co-integration Output under Unstable Economic Condition

		Unrestricted Co-integration Rank Test (Trace)		Unrestricted Co-integration Rank Test (Maximum Eigenvalue Trace)		
Maturity	Null	Trace Statistics	Critical Value	Max-Eigen Statistics	Critical Value	Observations
O/N	None *	86.14189	15.49471	82.16870	14.26460	843
	At most 1 *	3.973191	3.841466	3.973191	3.841466	
Weekly	None *	72.45157	15.49471	68.46908	14.26460	843
	At most 1 *	3.982492	3.841466	3.982492	3.841466	
Monthly	None *	53.79857	15.49471	49.73549	14.26460	843
	At most 1 *	4.063071	3.841466	4.063071	3.841466	
Quarterly	None *	16.39477	15.49471	12.89684	14.26460	843
	At most 1	3.497931	3.841466	3.497931	3.841466	
Semi Annual	None *	22.22351	15.49471	18.53411	14.26460	843
	At most 1	3.689397	3.841466	3.689397	3.841466	
Annual	None *	24.10579	15.49471	20.12639	14.26460	843
	At most 1 *	3.979396	3.841466	3.979396	3.841466	
2 Year	None	12.05291	15.49471	8.214585	14.26460	843
	At most 1	3.838328	3.841466	3.838328	3.841466	
3 Year	None	11.52719	15.49471	7.380742	14.26460	843
	At most 1 *	4.146446	3.841466	4.146446	3.841466	
5 Year	None	14.63098	15.49471	10.55227	14.26460	843
	At most 1 *	4.078707	3.841466	4.078707	3.841466	

The estimation does not include intercept or trend.

* denotes rejection of the null hypothesis (rank= 0) at the 0.05 level

The stable economic period span across 8/9/2005 to 2/2/2009

The estimated results of normalised co-integration vectors for the unstable economic period are presented in the table 6.

Table 6: Normalised Co-integration Vectors under Unstable Economic Condition

Maturity	Co-integration Vector (1-B)	Standard errors
O/N	(1, -3.018194)	(0.28211)
Weekly	(1, -3.620729)	(0.21592)
Monthly	(1, -3.983549)	(0.14128)
Quaterly	(1, -3.863456)	(0.49907)
Semi Annual	(1, -3.958878)	(0.35866)
Annual	(1, -4.171925)	(0.36632)
2 Year	(1, -3.280033)	(0.69074)
3 Year	(1, -3.293519)	(0.56866)
5 Year	(1, -2.591556)	(0.48481)

According to normalized co-integration vectors, symmetry condition (1, -1) is not satisfied supporting weaker EH. The estimated MP impact is farther away from unity compared with stable economic period. The point estimates also appear to be everywhere without resembling a pattern signaling the segmented nature of the impact.

In a nutshell, the findings under both standard and stochastic models suggest that the MP impact favours the stable economic environment and the impact favour shorter maturities. Also, the MP impact across money and Treasury bill maturities at times of stable economic environment wane at a faster speed before segmenting across Treasury bond maturities. The difference noted in the Sri Lanka case compared to advanced economies is the low quantitative and statistical significance, the lasting of the MP impact only up to short-term and few maturities of the medium term maturity horizon, and increasingly segmented impact across heterogeneous

economic environment. The MP impact at times of unstable economic environment loose statistical significance and reflective only on few benchmark Treasury bond maturities.

6. Conclusion and policy recommendations

The study explored a number of questions of MP impact on YC across stable and unstable economic environments in an emerging market, Sri Lanka, perspective. In specific sense, the study explored the impact of overnight MP target interest rate on medium to long-term market interest rates from an outside the standard deep, liquid and mature financial market perspective and studied the impact at different economic horizons.

The empirical evidence for Sri Lanka suggests that MP impacts the whole spectrum of maturities but impact weakens and segmented as the time to maturity increases under both the standard model and under the stochastic environment. Also, the MP impact weakens across the length (maturity) but becomes significant towards very short-term of the YC at times of stable economic condition defined in terms of behaviour of market interest rates. Another interesting finding is the existence of preferred market maturities in Sri Lanka showing segmented impact of the MP against the standard pattern of impact seen in advanced financial markets. When tested for parallel shifts in the YC for MP changes (EH), MP impacts the YC to shift but not in parallel. The high or low magnitude of impact at the short-end of the YC does not support the primacy of EH in explaining the MP impact across market interest rates tested under standard form and through analysis of co-integration in Sri Lanka. The study does not attempt to de-strand the sources which make MP impact to weaken across the maturity and at times of economic instability. Indirect identification suggests structural weaknesses in financial market and MP transmission mechanism.

The findings differ in terms of magnitude of the MP impact across the YC at stable and unstable economic periods, monotonically decreasing pattern of the impact and existence of preferred maturities which makes MP impact to be segmented across the YC compared with advanced financial markets.

Regarding the MP options, as policy considerations, the study enables rethinking the existing modus operandi of the MP and favour addressing concerns of resurrecting economic activities, in particular at times of economic uncertainty, by exploring segmented market hypothesis and preferred habitat hypothesis of YC behavior. The segmented MP impact across the YC observed support series of preference zones; in terms of maturity this could be aligned into the policy direction by policy authority's participation in the market or by cushioning uncertainty among market participants. The preferred habitat view also could be explored by adequately compensating market participants to position themselves across maturities instead of sharp swings in risk premium across term structure which makes investors flock around short end of the YC. Such policy options suggest of highly targeted policy approach than one size-fit-all conventional MP practices. The alternative views of YC dynamics points at structural impediments as a whole in the transmission mechanism to weaken the standard expectation hypothesis view where transmission could be seen declining as the time to maturity move right but on a monotonically decreasing pattern and not as segmented in Sri Lanka.

Also, the weaker response of the MP target instrument at times of economic uncertainties to resurrect the YC brings about the possibility of existence of multiple policy directions. This invites policy attention for cohesiveness in MP signals and communication to the market participants.

References:

Aazim, M. Z. M. (2010). Monetary Policy Effectiveness & Yield Curve Dynamics- US Experience from a Heteregenenous Economic Perspective (2000-2009). *Journal of Academic Research in Economics*, 2 (3).

Aazim, M. Z. M. (2009). Japan's Debt Volcano and its Structural Weaknesses. *Political Economy Journal of India, 18* (3 & 4), 65-76.

Balduzzi, P., Bertola, F., Silverio & Klapper, L. (1998). Interest Rate Targeting and the Dynamics of Short Term Rates. *Journal of Money, Credit and Banking, 30*, 26-50.

Bates, S. & Vaugirard, V. (September 2009). Monetary Transmission Channels around the Subprime Crisis: The US Experience. *Global Economy & Finance Journal, 2* (2), 138-156.

Bernanke, B., & Blinder, A. (1992). The Federal Funds Rate and Channels of Monetary Transmission. *American Economic Review, 82* (4), 901-921.

Bindseil, U. (2004). *Monetary Policy Implementation: Theory, Past and Present.* New York: Oxford University Press.

Blinder, A. S. and Zandi, M. (2010). Stimulus Worked. Finance & Development, International Monetary Fund. December, 14-17.

Board of Governors of the Federal Reserve System (2009). Minutes. Federal Open Market Committee (FOMC). September.

Buttiglione, L., Giovane, Del, Q. & Tristani, O. (1998). *Monetary Policy Actions and the Term Structure of Interest Rates: A Cross-Country Analysis.* : In: Angeloni, I., Rovelli, R. (Eds.) Macmillan Press.

Campbell, J.Y. & Shiller, R.J. (May 1991). Yield Spreads and Interest Rate Movements: A Bird's Eye View. *Review of Economic Studies, 58* (3), 495-514.

Calomiris, C. (2008). The Subprime Crisis: What's Old, What's New, and What's Next?. *Federal Reserve of Kansas City Colloquium on "Maintaining financial stability in a changing financial system",* Jackson Hole, Wyoming, 21-22 August.

Central Bank of Sri Lanka (2000-2009a), *Annual Report*, Various Issues, Colombo: CBSL Press.

Central Bank of Sri Lanka (2000-2009b), *Review of External Sector Developments*, Various Press Releases, Colombo.

Cochrane, D. & Orcutt, G.H. (1949). Application of Least Squares Regression to **...** Error Terms, *Journal of the American Statistical Association, 44,* 32-61.

Cook, T. & Hahn, T. (1989). The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s. *Journal of Monetary Economics, 24* 331-351.

Cox, J.C., Ingersol, J.E. & Ross, S.A. (1985). A Theory of the Term Structure of Interest Rates. *Econometrica, 53* (2), 385-407.

Drakos, K. (2002). A Daily View of the Term Structure Dynamics: Some International Evidence. *De Economist, 150* (1), 41-52.

Drakos, K. (2001). Monetary Policy and the Yield Curve in an Emerging Market: the Greek Case. *Emerging Markets Review, 2* (2001), 244-262.

Durbin, J. (1970). Testing for Serial Correlation in Least Squares Regression When Some of the Regressors Are Lagged Dependent Variables. *Econometrica, 38*, 420-421.

Estrella, A. & Mishkin, F. (1996). The Yield Curve as a Predictor of U.S. Recessions. *Current Issues in Economic and Finance,* Federal Reserve Bank of New York, *2* (7).

Federal Reserve Board of Governors' (2009), Minutes, Federal Open Market Committee, September.

Federal Reserve Board of Governors' (2008), Minutes, Federal Open Market Committee, October.

Fitch Rating Agency (2009), Rating Outlook –Sri Lanka. *www.fitchratings.com*

Haldane, A. & Read, V. (2000). Monetary Policy Surprises and Yield Curve. *Bank of England Working Paper, 106* .

Hardouvelis, G. (1994). The Term Structure Spread and Future Changes in Long and Short Rates in the G7 Countries. *Journal of Monetary Economics, 22* 255-283.

Hsu, C. & Kugler, P. (1997). The Revival of the Expectations Hypothesis of the US Term Structure of Interest Rates. *Economic Letters, 55* 115-120.

International Monetary Fund (2010), How Did Emerging Markets Cope in the Crisis?, *IMF Working Papers, June.* www.imf.org

International Monetary Fund (2009a), World Economic Outlook, April. www.imf.org

International Monetary Fund (2009b), World Economic Outlook, October. www.imf.org

Johansen, S. (1992). Testing Weak Exogeneity and the order of Co-integration in UK Money Demand Data. *Journal of Policy Modelling, 14* 313-334.

Jondeau, E. & Ricart, R. (1999). The Expectations Hypothesis of the Term Structure: Tests on US, German, French and UK Euro-rates. *Journal of International Money and Finance, 18* 725-750.

Kuttner, K. (2006). Can Central Banks Target Bond Prices?. *National Bureau of Economic Research Working Paper,* (12454).

Kuttner, K. (2001). Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market. *Journal of Monetary Economics, 47* 523-544.

Mishkin, F. S. (2009). Is Monetary Policy Effective during Financial Crises?. *National Bureau of Economic Research Working Paper,* (14678).

Mishkin, F. S. (1990). The information in longer maturity term structure about future inflation. *Quarterly Journal of Economics, 105* 815-828.

Obstfeld, M. (2009). Lenders of Last Resort in a Globalized World. *International Conference, Institute for Monetary and Economic Studies,* Bank of Japan, Tokyo, May 27-28.

Oda, N. & Ueda, K. (2005). The Effects of Bank of Japan's Zero Interest Rate Commitment and Quantitative Monetary Easing on the Yield Curve: A Macro Finance-Approach. *Bank of Japan Working Paper Series, 05-E-6.*

Prais, S.J. & Winsten, C.B. (1954). Trend Estimators and Serial Correlation. Cowles Foundation Discussion Paper No. 383

Rudebusch, G. (1995). Federal Reserve Interest Rate Targeting, Rational Expectations and the Term Structure. *Journal of Monetary Economics, 35* 245-274.

Sinclair, P. (2005). *The Transmission of Monetary Policy through Interest Rates: Policy Rate Effects on other Interest Rates, Asset Prices, Consumption and Investment.* In Mahadeva, Lavan and Sinclair (Eds.), How Monetary Policy Works (pp.5-49): Oxon: Routledge.

Smets, F. & Tsatsaronis, K. (1997). Why does the Yield Curve Predict Economic Activity? Dissecting the Evidence for Germany and the United States. *Bank for International Settlements Working Paper, 49*.

Taylor, J. B. (2009). The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong. *National Bureau of Economic Research Working Paper,* (14631).

Thornton, D. L. (2004). Testing the Expectation Hypothesis: Some New Evidence for Japan . *Federal Reserve Bank of St. Louis Review, 86* (5), 21-39., September/October.

Thornton, D. L. (2000). Lifting the Veil of Secrecy from Monetary Policy: Evidence from the Fed's Early Discount Rate Policy . *Journal Money Credit Banking, 32* (2), 155-167.

Walsh, E. C. (2010). *Monetary Theory and Policy, Second Edition.* : Massachusetts Institute of Technology.