

AN INDEX TO MEASURE THE PERFORMANCE OF THE SRI LANKAN TREASURY BOND MARKET

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ABSTRACT

This paper develops an index to measure the overall performance of the Sri Lankan Treasury bond market. The index, named as the Sri Lanka Treasury Bond Index, is value-weighted, assumes monthly portfolio rebalancing, and takes into account capital appreciation as well as income components of bond returns. It includes all the outstanding Treasury bonds having a remaining maturity of more than one year. This index represents the performance of the risk-free benchmark portfolio, provides an indicator of the movements of aggregate long-term interest rates in the economy, and gives a standard for evaluation of the performance of managed portfolios.

Introduction

The Government of Sri Lanka commenced the issuance of Treasury bonds in March 1997. By August 1999, it had raised Rs. 100.85 billion through bonds, and the aggregate market value of bonds outstanding as at October 1999 amounted to Rs. 65.6 billion. In a few years, the Treasury bond market is expected to surpass the Colombo Stock Market, which has a market capitalization of Rs. 106.3 billion.

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A second article by the same writer is included as they deal with the subject of construction of indices in two markets-the Corporate Bond Market & the Treasury Bond Market.

The purpose of this paper is to develop an index to measure the overall performance of the Treasury bond market in Sri Lanka. The index constructed in this paper has been named as the Sri Lanka Treasury Bond Index (SLTBI). At present, there is no such indicator on the Sri Lankan Treasury bond market, and the index developed here marks the first Treasury bond index in Sri Lanka. The absence of an index severely limits the ability to precisely analyze the performance of the overall Treasury bond market. In this context, this paper fulfills an important informational requirement of the Sri Lankan capital market.

The Sri Lanka Treasury Bond Index developed in this paper will serve many useful purposes. A Treasury bond index represents the performance of the risk-free benchmark portfolio. All other risky securities such as corporate bonds and interest-linked securities in the economy must be priced on the basis of the yields on Treasury securities. Hence, an indicator of the overall performance of the Treasury bonds is an essential informational need of financial market participants in pricing securities. A Treasury bond index also provides an indicator of the movements of aggregate long-term interest rates in the economy. For investment portfolios with fixed-income orientation, bond indices provide benchmarks or standards for performance evaluation and attribution. The Treasury bond index developed here, along with indices measuring corporate bond and stock markets, provides information needed by investors in forming expectations regarding the future performance of different asset classes in their asset allocation decisions.¹ Thus, a Treasury bond index is a key economic and a capital market indicator that is required by investors, fund managers, and economists.

The rest of the paper is organized as follows. Next section provides a description of the Treasury bond market of Sri Lanka. This is followed by the methodology employed in this paper for constructing the SLTBI. Thereafter, the paper presents the values and the movements of the index over time. A comparative analysis of the Treasury bond market, as reflected by the index developed in this paper, is provided next. The paper ends with a summary.

¹ See Samarakoon (1998) for an exposition of Sri Lanka corporate bond indices.

Description of the Treasury Bond Market of Sri Lanka

Table 1 lists Treasury bonds issued from March 1997 to August 1999. During the period, the Treasury has sold a total of 47 series of bonds with a total principal value of Rs. 100.85 billion. Coupon rates of these bonds have varied between 11 percent and 14 percent per year. As Figure 1 shows, in terms of the maturity profile of the principal value of bonds issued, 40 percent of these bonds are 2-year bonds, most of which were issued in 1997 and 1998. Three-year maturity bonds constitute 34 percent while 4-year bonds account for 22 percent of the total principal value of bonds issued. There has been only one issue of a 5-year bond. Thus, the Treasury bonds in Sri Lanka are predominantly short-term bonds.

The Government of Sri Lanka sells Treasury bonds through a tender-basis, primary auction conducted by the Central Bank of Sri Lanka. The primary auction is held every Thursday.² The primary dealers appointed by the Monetary Board of the Central Bank are allowed to submit bids.³ The general public has to channel their bids through primary dealers. Bids should be in multiples of Rs. 1 Mn. with the minimum bid amount being Rs. 5 million. Dealers can submit multiple bids at different bid prices. The bid price must be in Rupees and cents for each Rs. 100 principal value, and can be at par, at premium or at discount. Primary dealers submit bids by placing their sealed tender envelopes in the Treasury Bond Tender Box at the Department of Public Debt by 10 a.m. on the date of the auction. The settlement is T+1, the auction day plus one business day.

A bond series is defined by two parameters; coupon rate and issue date. Two series differ either in terms of the coupon rate or the issue date or both. Once the total amount to be offered under a given series is determined by the Department of Public Debt, the total amount may be offered in more than one auction. Since a given series has a defined issue date, the issue dates for all auctions under a given series are the same. The issue date is fixed as either the first or the fifteenth calendar day of a month.

² Sometimes, auctions are also held on Mondays.

³ As of October 1999, there were 18 primary dealers; 11 commercial banks, 4 merchant/investment banks, a savings bank, a unit trust, and a money brokering company. The Central Bank is expected to streamline the operation of primary dealership by requiring that separate companies be formed for the purpose of dealing with government securities with an increased share capital.

Primary auction bids are made on the basis of clean prices.⁴ In the event the issue date falls earlier than the auction date, successful bidders will have to pay accrued interest for the period from the issue date to the settlement date excluding the issue date. The basis for calculating accrued interest is actual/actual, which means that the calculation is based on actual number of calendar days in both the accrued interest period and the relevant semi-annual interest period. Treasury bonds always pay interest semi-annually, and hence an interest period is of six-month duration.⁵ The amount of interest paid for a given interest period is always one-half of the annual interest regardless of the actual number of days in the interest period. Therefore, when calculating the accrued interest, one-half of the annual interest is prorated on the basis of the actual number of days in the accrued interest period and the relevant semi-annual interest period.

The secondary market trading in Treasury bonds is conducted through the same primary dealers. Dealers quote both buying (bid) and selling (ask) prices on the basis of clean prices. In addition to clean price, buyer has to pay accrued interest for the period from the last interest payment date to the settlement date. Treasury bonds are transferable by endorsement.



⁴ Clean price is price exclusive of accrued interest.

⁵ The interest payments dates are the same date of the month as the date of the month of the issue separated by six-month intervals beginning from the date of the issue.

Table 1: TREASURY BONDS ISSUES¹

Bond Series (Coupon %, Maturity)	Principal Value (Rs. Mn.)
2-Year Bonds ²	
14.00% 1999A	500
14.00% 1999B	500
13.75% 1999A	500
13.50% 1999A	500
13.00% 1999A	500
12.75% 1999A	500
12.75% 1999B	500
12.75% 1999C	500
12.75% 1999D	500
12.75% 1999E	500
12.50% 1999A	500
12.00% 1999A	500
12.00% 1999B	500
11.00% 2000A	2,000
11.00% 2000B	1,815
11.00% 2000C	2,000
11.00% 2000D	2,000
11.00% 2000E	3,000
11.00% 2000F	2,250
11.00% 2000G	4,000
11.00% 2000H	3,500
11.00% 2000J	2,500

Contd.

Bond Series (Coupon %, Maturity)	Principal Value (Rs. Mn.)
11.00% 2000K	2,000
11.00% 2000L	1,000
11.00% 2001A	5,000
11.00% 2001B	3,000
Sub Total	40,565
3-Year Bonds	
12.00% 2000A	500
11.75% 2000A	500
11.50% 2001C	2,250
11.50% 2001D	2,500
11.50% 2001E	3,500
11.50% 2001F	1,200
11.25% 2002A	6,000
11.25% 2002B	5,000
11.25% 2002C	5,000
11.25% 2002D	3,500
11.25% 2002E	4,435
Sub Total	34,385

Contd.

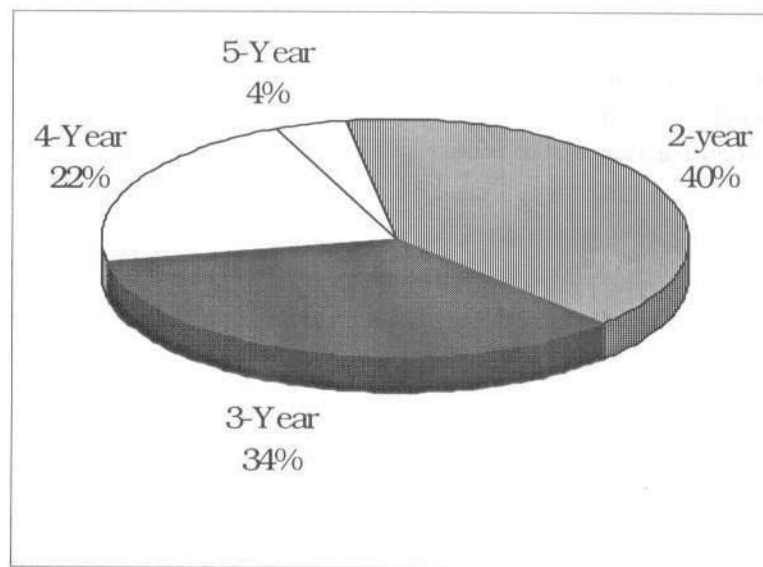
Bond Series (Coupon %, Maturity)	Principal Value (Rs. Mn.)
4-Year Bonds	
11.50% 2001A	500
11.50% 2001B	500
12.25% 2001A	500
12.00% 2002A	2,000
12.00% 2002B	2,400
11.50% 2003A	5,500
11.50% 2003B	4,000
11.50% 2003C	4,000
11.50% 2003D	2,500
Sub Total	21,900
5-Year Bonds	
11.75% 2004A	4,000
Sub Total	4,000
Grand Total	100,850

Notes:

1. Issues up to August 1999.
2. Maturity refers to the original maturity of the series.

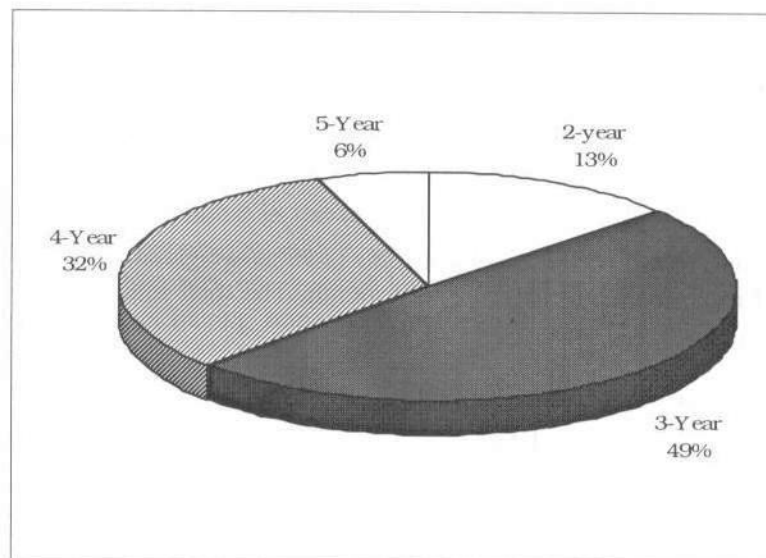
Source: Department of Public Debt, Central Bank of Sri Lanka

Figure 1: MATURITY PROFILE OF TREASURY BOND ISSUES AT PRINCIPAL VALUE



1. Issues up to August 1999.

Figure 2: MATURITY PROFILE OF TREASURY BOND ISSUES AT MARKET VALUE¹



1. As of the end of October 1999.

Methodology

The Treasury bond index reflects the return performance of a portfolio of Treasury bonds. Equation (1) specifies the methodology employed in this paper for the construction of the index.

$$V_T = V_0 \times \prod_{t=1}^T \left(1 + \sum_{i=1}^N w_{i,t-1} r_{i,t} \right) \quad (1)$$

where,

- V_T = the index value at the end of month t ,
- V_0 = the base value of the index,
- $r_{i,t}$ = the total return of issue i for month t ,
- $w_{i,t-1}$ = the relative market capitalization of issue i at the end of month $t-1$,
- N = the total number of issues comprising the index.

The value of the index at time T is equal to the product of one plus the periodic total return of the bond portfolio over successive periods from the base period. The base period is chosen as 31st December 1997, and the index value on that date is set at 100. The first Treasury bond was issued in March 1997, and hence, December 1997, which is the first year-end since the commencement of the issuance of Treasury bonds, is chosen as the base period.

The total return of the bond portfolio is value-weighted, and rebalanced at the end of the last trading day of every month. The total return is calculated as given in equations (2) and (3).

$$R_{i,t} = \left(\frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \right) + \left(\frac{AI_{i,t} - AI_{i,t-1} + C_{i,t}}{P_{i,t-1}} \right) \quad (2)$$

$$R_{i,t} = CAR_{i,t} + IR_{i,t} \quad (3)$$

where,

$P_{i,t}$	= the clean price of issue i at the end of month t ,
$P_{i,t-1}$	= the clean price of issue i at the end of month $t-1$,
$AI_{i,t}$	= the accrued interest of issue i at the end of month t ,
$AI_{i,t-1}$	= the accrued interest of issue i at the end of month $t-1$,
$C_{i,t}$	= the coupon cash flow of issue i received in month t ,
$CAR_{i,t}$	= the capital appreciation return of issue i for month t , and
$IR_{i,t}$	= the income return of issue i for month t .

The total return for a given month consists of capital appreciation return (CAR) and income return (IR). The total return is the change in full price plus any coupon received during the month.⁶ The capital appreciation return is the change in the clean price between two successive months, and represents the capital gain or loss caused by changes in interest rates. The income return is defined as the change in accrued interest plus any coupon received during a monthly holding period. Thus, in any given month, the sum of the capital appreciation return and the income return will equal the total return.⁷ The monthly change in the index indicates the total return that would have been earned by a portfolio, which invested in all the constituent bonds according the market value weights at the end of the previous month.

The month-end clean price represents the average of the bid and ask secondary market quotes of primary dealers for each bond on the last trading day of the month. These two-way quotes are obtained from the Department of Public Debt. A bond is included in the index from the first month in which secondary market quotes become available, and dropped from the index when its remaining maturity becomes one year or less. Thus, at any given point, the index would include bonds having remaining maturity of more than one year.

⁶ Full price is the clean price plus accrued interest.

⁷ See Ibbotson Associates (1998) for details regarding computation of bond returns.

Sri Lanka Treasury Bond Index

The values of the Sri Lankan Treasury Bond Index, developed using the above methodology, are shown in Table 2 and Figure 3. Both the capital appreciation and the total return are shown. By the end of October 1999, SLTBI reached a value of 121.59 indicating a cumulative gain of 21.59 percent in relation to the base value of 100 as at the end of 1997. In other words, Rs. 100 invested at December 1997 in the SLTBI grew to Rs. 121.59 by October 1999. The capital appreciation index, however, has depreciated to 98.92 reflecting a loss of Rs. 1.08 per each Rs. 100 invested in the SLTBI during the same period.

The use of quotes rather than actual transactions prices may be viewed as one of the drawbacks of SLTBI. Secondary market trading in Treasury bonds is very low, and as a result transactions prices are not generated for most issues. This is a problem germane to any index when constituent securities are illiquid. The same problem exists in regard to the Colombo Stock Market as well as the Sri Lankan corporate bond market.

Figure 3: SRI LANKA TREASURY BOND INDEX (SLTBI)

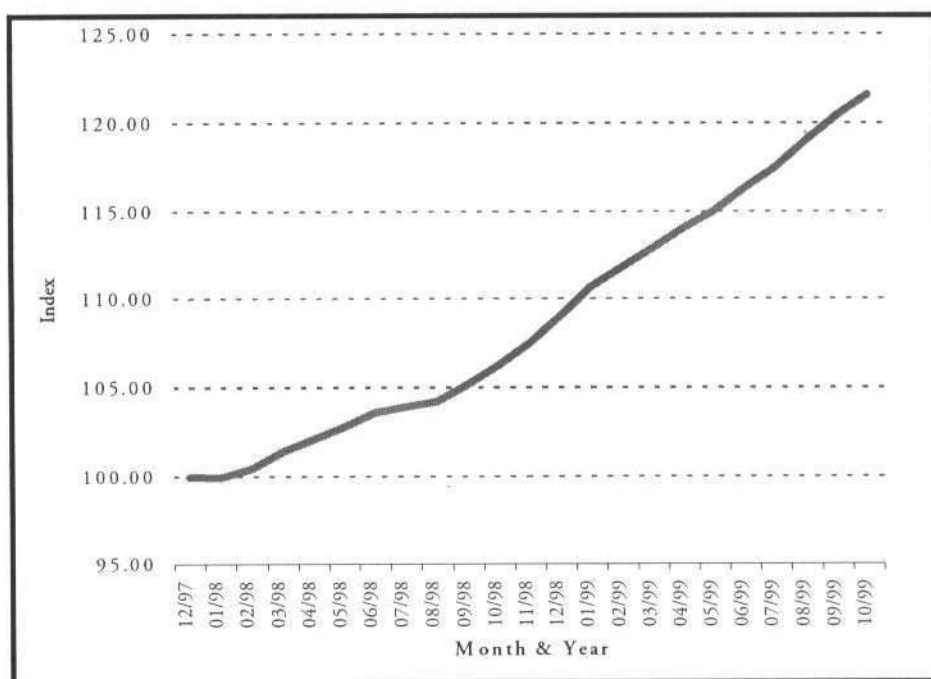


Table 2: INDEX VALUES OF THE SRI LANKA TREASURY BOND INDEX (SLTBI)

Month-Year	Capital Appreciation Index ¹	Total Return Index ²
Dec-97	100.00	100.00
Jan-98	98.98	99.96
Feb-98	98.51	100.46
Mar-98	98.50	101.42
Apr-98	98.26	102.09
May-98	98.07	102.80
Jun-98	97.91	103.61
Jul-98	97.29	103.92
Aug-98	96.65	104.21
Sep-98	96.68	105.19
Oct-98	96.79	106.28
Nov-98	96.91	107.49
Dec-98	97.35	109.01
Jan-99	97.96	110.69
Feb-99	98.09	111.80
Mar-99	98.07	112.88
Apr-99	98.15	114.03
May-99	98.13	115.01
Jun-99	98.25	116.34
Jul-99	98.34	117.50
Aug-99	98.78	119.04
Sep-99	98.89	120.43
Oct-99	98.92	121.59

Notes:

1. Capital Appreciation Index indicates capital gains and losses.

2. Total Return Index indicates the sum of capital appreciation return and income return

Comparative Performance of the Treasury Bond Market

Investment managers constantly perform comparative analysis of the performance of the major asset classes in their asset allocation decisions. The Sri Lanka Treasury Bond Index developed in this paper along with indicators of Treasury bill, stock and corporate bond markets can be used for this purpose. This requires the computation of total annual returns using monthly indices for each asset class. While the Treasury bond market is represented by SLTBI, the Treasury bill market is represented by a Treasury Bill Index (BILLS).⁸ The All Share Price Index (ASPI), which is the broadest measure of the Colombo Stock Market, is used to assess the performance of equities.⁹

Total annual return is the change in the bond index, which is formed in the following manner:

$$r_{t-12,t} = \left[\frac{V_t}{V_{t-12}} \right] - 1 \quad (4)$$

where,

- $r_{t-12,t}$ = the total annual return from month t-12 to t,
- V_t = the index value at the end of month t, and
- V_{t-12} = the index value at the end of month t-12.

The total annual return of a bond consists of three components; capital appreciation returns (CAR), income returns (IR), and reinvestment returns (RR).¹⁰ The annual capital appreciation return is computed using equation (4), where the index used is the capital appreciation index. The annual income return is calculated as the sum of the interest cash flows of each month during a 12-month period divided by the price at the beginning of the 12-month period. The reinvestment returns reflect the income from investing monthly coupon cash flows in the total return index in subsequent months. This component of

⁸ Treasury Bill Index (BILLS), constructed by the author, measures the movements of a portfolio invested in 12-month primary market Treasury Bills with monthly rebalancing. The base value is set at 100 at December 1997.

⁹ All Share Price Index (ASPI) does not include dividends. Hence, changes in ASPI indicate capital gains/losses only. ASPI has been rebased at 100 as at 31st December 1997.

¹⁰ Since ASPI does not include dividends, decomposition into three return components is not possible.

returns arises only when total returns are calculated for more than one holding period since coupon cash flows in a given period have to be reinvested in subsequent periods in order to earn reinvestment income. The computations assume that periodic coupon cash flows are reinvested at the rate of total returns in each of the subsequent periods. The annual reinvestment return is the difference between the annual total returns and annual income returns.¹¹

Figure 4 shows the movements of the indices that track the performance of Treasury bills, Treasury bonds and stocks. As shown in Table 3, SLTBI has a correlation of 0.66 with Treasury bills, while its correlation with ASPI is 0.25. ASPI and BILLS are not correlated in any significant manner.

Table 4 provides return and risk of the SLTBI with comparative figures for the Treasury Bills (BILLS) and the stock market (ASPI). The SLTBI produced an annual total return of 9.01 percent in 1998; it consisted of -2.65 percent capital depreciation, 11.10 percent income return, and 0.56 percent reinvestment return. This total return was less than those yielded by Treasury bills. In the period up to October 1999, SLTBI has given a total return of 11.54 percent, which is higher than that earned by Treasury bills. In both years the share market declined. The risk of Treasury bonds, as measured by the standard deviation of Treasury bond returns, was 1.55 percent in 1998, and it has declined to less than one percent in 1999.

Table 3: CORRELATION AMONG TOTAL RETURNS OF INDICES

	SLTBI	ASPI
ASPI	0.25	
BILLS	0.66	0.06

¹¹ See Ibbotson Associates (1998) for details.

Figure 3: COMPARATIVE PERFORMANCE OF TREASURY BILLS, TREASURY BONDS AND STOCKS

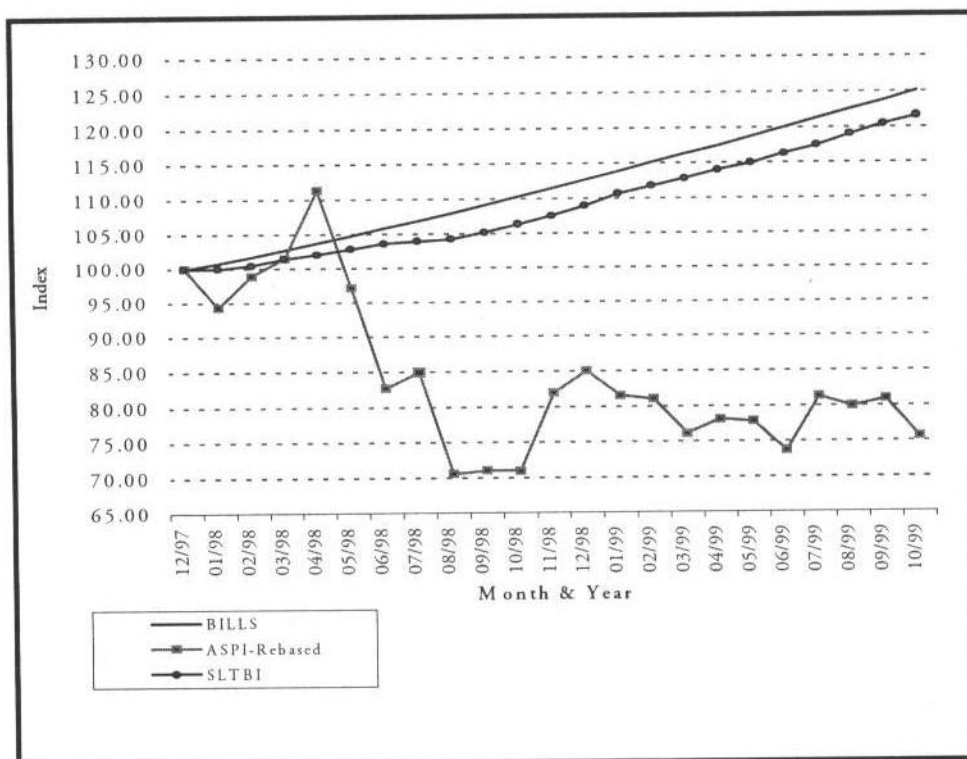


Table 4: COMPARATIVE PERFORMANCE OF TREASURY BONDS AGAINST TREASURY BILLS AND STOCKS

Index	Total Return	Total Return Components			STD ¹
		CAR	IR	RR	
1998					
BILLS	12.73	-	-	-	0.31
SLTBI	9.01	-2.65	11.10	0.56	1.55
ASPI	(14.94)	(14.94)	-	-	31.90
1999 ²					
BILLS	10.94	-	-	-	0.04
SLTBI	11.54	1.62	9.46	0.46	0.78
ASPI	(11.05)	(11.05)	-	-	15.84

Notes:

1. Annualized Standard Deviation.

2. Returns data are only for the first 10 months of 1999.

Summary

This paper developed an index to measure the overall performance of the Sri Lankan Treasury bond market. The index, named as the Sri Lanka Treasury Bond Index, is value-weighted, assumes monthly portfolio rebalancing, and takes into account capital appreciation as well as income components of bond returns. It includes all the outstanding Treasury bonds having a remaining maturity of more than one year. This index represents the performance of the risk-free benchmark portfolio, provides an indicator of the movements of aggregate long-term interest rates in the economy, and gives a standard for evaluation of the performance of managed portfolios.

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