

UOB SGS INDEX

TECHNICAL MANUAL

1 OVERVIEW

1.1 Summary

The UOB SGS Index is designed to provide Singapore fund managers and interest rate market participants with a Singapore government bond index calculated using internationally accepted practices. The Index is an accumulation index incorporating price and income components covering only Singapore government bonds.

This Index will allow treasurers, fund managers, plan sponsors (or trustees) and consultants the first consistent way to measure the performance of the Singapore fixed interest market.

1.2 Benefit To Fixed Interest Market Participants

Treasurers

The UOB SGS Index provides an independent benchmark by which to measure performance of treasury operations.

Plan Sponsors or Trustees

It provides a means for the comparison of manager performance in the same way equity indices may be used.

Fund Managers

It provides managers with an index that can be used as an acceptable benchmark against which to measure performance.

1.3 International Practice

The UOB SGS Index follows international convention with respect to:

- **Coverage Of Index:** The Index, currently comprising three sub-indices, is representative of the market in terms of weights and coverage.
- **Ability To Replicate:** The Index contains bonds that can be dealt in the market and are known in advance. This ensures that a portfolio which will track the Index can be constructed.
- **Release Times:** Values are available shortly after the market closes each day.
- **Market Movements:** Return calculations are based on changes in the value of a portfolio so that the Index will reflect market movements.
- **Accurate Data Source:** The Index uses market closing prices as the basis of calculation.

- **Choice Of Maturity:** Apart from the All Series Sub-Index, there is also a choice of two other sub-indices to ensure that the specific needs of market participants are met. Only bonds with outstanding maturities of one year or longer are included in the Index.

2 DETAILS OF INDEX CALCULATIONS

The UOB SGS Index is jointly developed by UOB and Quant Shop to measure the performance of Singapore government bonds in the fixed interest market. Details of the Index are set out below:

2.1 Coverage

Bonds The face value of the bonds on issue is reconciled with the list of book entry government bonds as at each month-end issued by the Monetary Authority of Singapore.

Maturities All outstanding maturities of one year and longer.

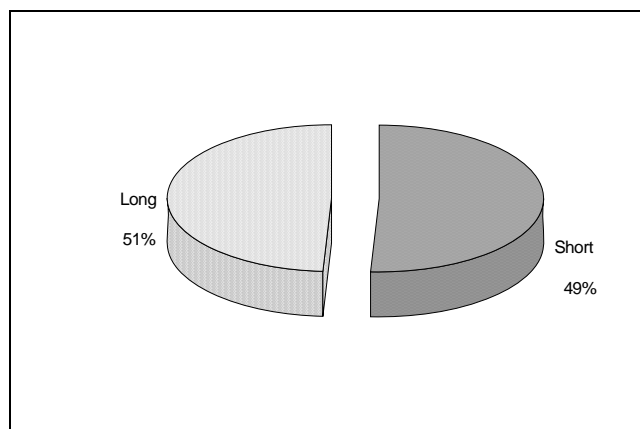
Types There are three separate indices created under the UOB SGS Index covering three distinct time periods. The breakdown allows market participants to better target their portfolio requirements with a benchmark. The indices are:

All Series: This covers government bonds with outstanding maturities of one year or longer and represents the total market.

Short: This covers government bonds with outstanding maturities of one year or longer but less than three years – suitable for short-term investors to use as a benchmark.

Long: This covers government bonds with outstanding maturities of three years or longer – for those investing at the longer end of the curve.

Graph 1: Proportion In Each Index



The relative weighting at end-November 1998 can be seen in Graph 1 above.

2.2 Characteristics

Start Date	January 1995
Start Level	100.00
Revaluations	Daily, at close of business prices using the formula shown in Section 5 herein.
Pricing Basis	Market quoted clean prices.
Weightings	Gross market value on date of revaluation.
Reinvestment	Coupons are added on coupon payment dates. Effectively, the cash is reinvested in proportion to the market value of each bond.
Rebalancing	Occurs when a bond is no longer eligible for inclusion or there has been a change in the bonds on issue.

2.3 Inclusion And Exclusion Of Bonds

2.3.1 Daily Index

Inclusion	When there is a new issue or reissue of bonds, it is included in the All Series Sub-Index as well as either of the other two Sub-Indices, i.e., Short or Long, on issue date.
Exclusion	A bond is excluded whenever there is reason to do so, e.g., early redemption, or when it is no longer eligible for inclusion, i.e., has outstanding maturities of less than one year for the All Series and Short Sub-Indices and less than three years for the Long Sub-Index.
Between Sub-Indices	When a bond reaches the point where it has an outstanding maturity of less than three years, it moves from the Long to the Short Sub-Index. What is included in the Short Sub-Index is removed from the Long Sub-Index.

2.3.2 Historical Monthly Data

Inclusion	New issues or reissues of bonds are added to the Index on the last day of the month in which the issue or reissue takes place.
Exclusion	A bond is excluded from the valuation on the last day of the month whenever there is reason to do so or it is no longer eligible for inclusion.

Between Sub-Indices When a bond reaches the point where it has an outstanding maturity of less than three years, it is moved from the Long to the Short Sub-Index at the end of the month when the change in outstanding maturity takes place.

2.4 Duration

In addition to maturity of a bond portfolio, the most common guide to the impact of time on a portfolio is Macaulay's modified duration. This shows the approximate percentage change in a bond's price for a 100 basis point parallel shift in the yield curve assuming that the bond's cash flow does not change when the yield curve shifts. So, a bond with a modified duration of five years will change by approximately 5% for a 100 basis point parallel shift in the yield curve.

Table 1 compares the average maturity and modified duration of the three Sub-Indices at the end of November 1998.

Table 1: Modified Duration

	Maturity	Modified Duration
All Series	4.0	3.5
Short (1 to < 3 years)	1.9	1.8
Long (3 years or more)	6.1	5.2

3 PERFORMANCE CHARACTERISTICS

3.1 Risk And Reward

The performance of the UOB SGS Index is shown in Graph 2 below and the Appendix provides the monthly historical index levels. The weakness in the bond market during the second half of 1998 is clearly evident in all Sub-Indices – although long-dated bonds, which are the most volatile, showed the largest losses.

Graph 2 Historical Performance

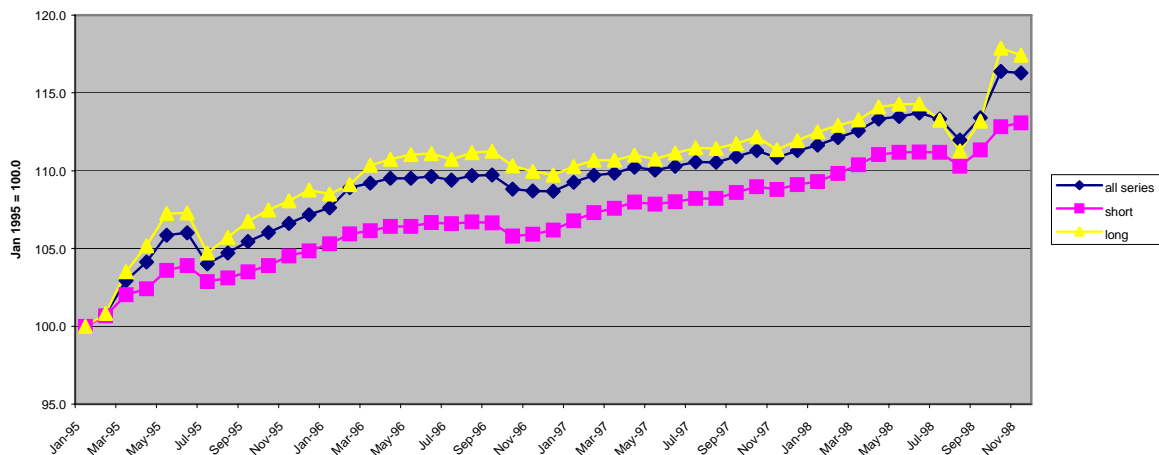


Table 2 below describes the risk and return characteristics of the three Sub-Indices over the period January 1995 to end-November 1998.

Table 2: Risk And Return Characteristics

	Annual Return	Annual Risk
All Series	4.0	2.6
Short (1 to < 3 years)	3.3	1.6
Long (3 years or more)	4.3	3.5

The table shows that risk rises with increasing maturities, that is, longer-dated bonds have higher risks and higher returns.

3.2 International Comparisons

In comparison with international markets, the UOB SGS Index has had relatively low risk and returns. Table 3 below compares the UOB SGS Index with the risk and return characteristics of the Salomon Country Indices over the period January 1995 to November 1998 in local currencies.

**Table 3: Risk And Return In Terms Of The Respective Local Currencies
January 1995 to November 1998**

	Return	Risk
Singapore	4.0%	2.6%
Australia	14.4%	5.2%
Austria	10.0%	2.5%
Belgium	11.7%	3.0%
Canada	12.9%	5.1%
Denmark	12.2%	3.3%
France	11.9%	3.3%
Germany	9.9%	2.8%
Italy	16.2%	4.0%
Japan	7.9%	4.2%
Malaysia	6.6%	4.3%
Netherlands	10.8%	3.3%
New Zealand	11.1%	4.9%
Sweden	15.1%	4.4%
Switzerland	8.2%	3.1%
United Kingdom	14.1%	4.6%
United States	9.9%	4.1%
World	8.5%	6.1%

Source: UOB SGS Index, Salomon Composite Bond Index, Quant Shop MGS Index

Table 4 reworks the information in Table 3 to adjust for movements in the Singapore Dollar. So the higher figures for risk reflect currency changes. For example, the risk on US bonds has increased from 4.1% to 8.7% because the currency has a risk of 7.3% (figures do not add up because they are standard deviations).

**Table 4: Risk And Return In Singapore Dollar Terms
January 1995 to November 1998**

	Return	Risk
Singapore	4.0%	2.6%
Australia	12.6%	9.5%
Austria	10.3%	9.7%
Belgium	12.1%	9.7%
Canada	14.2%	8.9%
Denmark	13.7%	8.8%
France	13.4%	9.6%
Germany	10.3%	10.0%
Italy	18.7%	10.2%
Japan	5.3%	14.5%
Malaysia	-9.5%	22.7%
Netherlands	11.1%	9.9%
New Zealand	9.1%	8.5%
Sweden	16.4%	10.2%
Switzerland	9.3%	12.4%
United Kingdom	19.1%	9.8%
United States	13.5%	8.7%
World	12.1%	7.2%

Source: UOB SGS Index, Salomon Composite Bond Index, Quant Shop MGS Index

From Table 4, it can be seen that the Singapore figures are unchanged because no currency adjustment is necessary. On a risk-adjusted basis after currency adjustment, the Singapore government bonds are now middle-ranked.

4 ABOUT BOND INDICES

4.1 Causes Of Index Level Changes

- **Accrued Interest:** With the passage of time, the accumulation Index will steadily increase due to the interest earned on the bonds in the index portfolio. Since the Index includes the value of accumulated interest, this effect occurs day by day, rather than just on coupon payment days. This impact must always be positive.
- **Changing Yield:** These are the major source of movements. A rise in yield implies a fall in prices and the Index. A fall in yield, all other things being equal, implies a rise in the Index.
- **Reducing Maturity:** The closer the bond is to maturity, the smaller will be the impact of differences between yield (market price) and coupon (determined at issue). So, bonds priced at a discount will slowly increase in value over time, all other things being equal, while *those* priced at a premium will slowly decrease in value.

4.2 Weights In The Index

The UOB SGS Index is market weighted. That is, the weight of a bond in the Index is the market value of that bond divided by the total value of all bonds on issue:

$$\text{Market Value Of Bond} / \text{Total Value Of All Bonds On Issue}$$

4.3 Rebalancing

The Index automatically rebalances for price changes. A rise in the price of a particular bond will increase its weighting in proportion to the rise in market value.

So, the portfolio representing the Index only needs to be revalued to provide a new index value.

Rebalancing takes place when one of the following occurs:

- Coupon payment (on the coupon payment date);
- Bond is no longer eligible for inclusion (e.g., less than three years or less than one year);
- New issue of a bond; and/or
- Any other change in the amount of bonds on issue.

At the end of each day, the portfolio is:

- Revalued to provide the Index figure;
- Rebalanced for the next period.

As the number and volume of the bonds on issue change, the Index is not distorted by changes in composition of the Index. Essentially, this is because all the bonds in the Index at the end of a given day are sold for their end-of-day prices. The proceeds are then used to purchase a new set of bonds in their market value proportions.

4.4 Reinvestment

All coupons and maturities are reinvested in bonds at their market value proportions on valuation day.

So, coupon income from a bond is reinvested across the whole portfolio. This takes place on the coupon payment date as the coupon cash would not be available until the payment date in a real portfolio.

5. INDEX INFORMATION

5.1 Source Of Daily And Monthly Index Data

Information on the UOB SGS Index is readily available to the public. On a daily basis, the UOB SGS Index is available from the following sources:

- UOB's web site at www.uob.com.sg
- Quant Shop's web site at www.quantshop.com (monthly data only)
- Reuters
- Bloomberg
- Datastream

In addition, major newspapers in Singapore, e.g., The Straits Times, The Business Times and Lianhe Zaobao carry the UOB SGS Index.

5.2 Relevant Formula

5.2.1 Index value

Index value at time t is given by :

$$I_t = \sum_{i=1}^n (P_{it} + A_{it} + C_{it})$$

Where :

I_t = Index at time t

P_{it} = Price of i th bond at time t

A_{it} = Accrued interest on i th bond at time t

C_{it} = Coupons received on i th bond this period

i = Number of bonds on issue

5.2.2 Modified Duration

$$\text{MDuration} = \frac{\text{Duration}}{1 + \left(\frac{\text{Market Yield}}{\text{Coupon payments per year}} \right)}$$

6. FURTHER INFORMATION

For further information, please contact:

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