THE COMMONWEALTH BANK BOND INDICES

by

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While both the USA and Britain have had the benefit of indices of their respective governments fixed interest security markets for some years now, it was not until the Commonwealth Bank Bond Indices were launched (1) in October 1980 that Australia had a similar publicly available index.

Response to the indices by the Australian financial community has been very favourable. As a reflection of this, they are now published every Monday in the Financial Review and they will soon be available on I.P. Sharp Associates computer data base for immediate analysis by any user of this computer bureau’s service.

This article aims to outline in general terms what the indices measure, from where they will be available, and how to interpret and use them.

Coverage of the Indices

The general market for Commonwealth Government bonds is divided into a primary market and secondary market, the latter being in turn divided into “on-change” and “off-change” secondary markets. As the primary market concerns only new issues, it is the secondary market for all existing bond series on issue which constitutes the main market.

Although data on the prices and yields at which transactions in the on-change market have occurred are more readily available, the Commonwealth Bank Bond Indices track the progress of the secondary off-change market only. It is in this market that the vast majority (by volume) of large transactions take place, resulting in this market usually being a more accurate reflection of current yields.

The Commonwealth Bank Bond Indices encompass four different types of index series, each of which has been split into a number of sub-series to cover certain segments of the bond market. The four types of indices are as follows:

1. Price Indices
These index series indicate past movements in the prices of Commonwealth Government bonds. They quantify capital gains or losses from holding bonds in proportion to volumes on issue.

2. Income Indices
These index series quantify the other portion of past returns, namely coupon income. The income indices enable accumulation indices to be computed, which in turn enable the calculation of bond market rates of return over past periods.

3. Accumulation Indices
Accumulation indices quantify total return over the past from both capital gains and income plus the accumulated additional return from the reinvestment of coupon income in bonds. This index therefore measures past compound rates of return in the bond market.

4. Current Yields to Maturity
Yields are quoted for hypothetical bonds of exactly 2, 5, 10 and 15 years to maturity. As such, they can be regarded as theoretical yields as it is possible that no existing stock may currently have one of these quoted yields, since at any one point in time there may not be securities on issue with terms to maturity of exactly these numbers in whole years. Although, the yields do not constitute an index series, they are nevertheless grouped for convenience under the generic heading of Commonwealth Bank Bond Indices.

These indices bear some resemblance to the Financial Times – Actuaries British Government Securities Indices which describe the London market for gilt-edged securities (2).

The first three of the above four types of indices have analogies in share market indices. The Commonwealth Bank Bond Price Indices correspond to the Australian Stock Exchange (ASE) Share Price Indices, with the All Series/All Maturities Bond Price Index corresponding to the ASE All Ordinaries index.

The Commonwealth Bank Bond Accumulation Indices are similar in concept to the ASE Accumulation Indices, in that both series aim to quantify the market return from both capital gain and income. They are also similar in that each quantifies a compound return and each is unaffected by ex-interest (or ex-dividend in the case of share) effects.

The Commonwealth Bank Bond Income Indices have a loose analogy in the ASE Dividend Yield Series.
The Commonwealth Bank Bond Indices

Commonwealth Bank Yields to Maturity are similar in concept to the theoretical yields published monthly in the Reserve Bank of Australia’s Statistical Bulletin. While they are similar in that both sets of yields apply to hypothetical bonds of exactly integer years to maturity, they differ in that the Reserve Bank’s yields are taken from on-‘change transactions, while the Commonwealth Bank’s yields reflect the wider and larger secondary off-‘change market.

The Price Indices

The price indices track the change in the aggregate market value of bonds on issue. In addition to providing a price index for all Commonwealth Government bonds on issue, price indices are provided for 19 sub-sets, or “segments”, of the market. The other types of indices (Income and Accumulation) are also split on this basis. Hence there are 20 different price index series, 20 income index series and 20 accumulation index series.

Figure 1 shows the format in which these sets of 20 indices appear in the Economic Newsletter, using the indices for the four weeks to 13 November 1980 as an example.

All bonds on issue have been classified into 19 segments according to the following three criteria:

1. Term to maturity: Less than 5 years; 5 years to less than 10 years; 10 years or more.
2. Whether they are rebatable or non-rebatable.
3. Size of their coupon (for non-rebatable bonds only). Non-rebatable bonds have been divided into two coupon bands, low and high. Occasional changes have been made to the definition of the low and high coupon bands in order to retain a balance of numbers of bond series in these two categories as old (generally lower coupon) series mature and new (generally higher coupon) series are issued. High coupon bonds are presently defined as bonds with coupon in excess of 9.15%.

Figure 1: Format of Presentation of Commonwealth Bank Bond Indices

Commonwealth Bank Bond Indices

<table>
<thead>
<tr>
<th>PRICE</th>
<th>As at 23/10/80</th>
<th>As at 30/10/80</th>
<th>As at 6/11/80</th>
<th>As at 13/11/80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coupon</td>
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</tr>
<tr>
<td>High</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>All</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>non-rebatables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rebatables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACCUMULATION</th>
<th>As at 23/10/80</th>
<th>As at 30/10/80</th>
<th>As at 6/11/80</th>
<th>As at 13/11/80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
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<tr>
<td>Coupon</td>
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<td>High</td>
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<td>non-rebatables</td>
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<td>Rebatables</td>
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<tr>
<td>ALL</td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YIELDS</th>
<th>As at 23/10/80</th>
<th>As at 30/10/80</th>
<th>As at 6/11/80</th>
<th>As at 13/11/80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
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<td>All</td>
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<tr>
<td>Rebatables</td>
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<tr>
<td>ALL</td>
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</tr>
</tbody>
</table>

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Structure of the Indices

At the simplest level, the price index figure of 98.69 for All Series/All Maturities as at 13 November 1980 (refer Figure 1) is the ratio, expressed as a percentage, of the total gross market value of all bonds on issue as at 13 November 1980 (valued at 13 November prices) to the total gross market value of all bonds on issue as at 1 January 1977, the base date (valued at 1 January prices). Since the gross market value of a bond series is the total face value on issue multiplied by gross price, the price of any one bond has an effect on the index in proportion to the dollar volume of that bond on issue.

In the absence of any new issue or maturities, the price index for period t may be expressed mathematically as:

\[
\frac{\sum_{i=1}^{N} P_i \times FV_i}{100} \times 100 = \frac{\sum_{i=1}^{N} P_i \times FV_i}{100} \times 100
\]

where

- \( P_i \) = Gross price of the \( i \) th bond series at time \( t \)
- \( FV_i \) = Face value on issue of the \( i \) th bond series at time \( t \)
- \( N \) = Number of bond series on issue
- \( t = o \) refers to the base date

The indices cannot be computed from the above equation in practice however because the number and volume of bond series on issue change over time as maturities and new issues occur.

The Commonwealth Bank Bond Price, Income and Accumulation Indices specifically allow for these “discontinuities” in the total market value of bonds on issue. Technical adjustments are made to the Base Market Value (the denominator in the above equation) when any maturity, new issue or other change occurs so that none of these discontinuities will, by themselves, produce a sudden change in the index figures. The adjustments are complicated and are explained in greater detail in (3).

Causes of Changes in the Price Indices

Because the indices are sterilised of any influence originating from new issues etc. (as described above), the indices will change only as a result of factors which reflect the rate of return which accrues to investors in bonds.

More specifically, the price indices will change in value in response to three causes only. These are as follows:

1. Changes in Current Market Yields

The market value of a bond eventually approaches its face value as its term to maturity shortens over time, regardless of current yields.

Most stocks currently on issue are priced at a discount, and therefore in the absence of yield changes they will slowly increase in value over time. Consequently it follows that the price indices will also slowly increase over time. This phenomenon is not a disadvantage, as it is proper that the capital gain which accrues to an investor as a result of shortening maturities should be reflected in the indices.

2. Shortening Terms to Maturity

The price indices are designed to reflect changes in market value and hence use the gross prices of securities. The gross price of a bond includes an accrued interest component which increases linearly in value from the time a coupon is paid until the bond turns ex-interest (15 days before a coupon is paid), after which it decreases linearly (in absolute value).

This causes some minor variations in price index values as the balance changes between the slightly increasing prices of many cum-interest stocks and the suddenly decreased gross prices of a few stocks that have just turned ex-interest. It is appropriate that the price indices should reflect these accrued interest effects however.

3. Accrued Interest and Ex-interest Effects

The price indices are designed to reflect changes in market value and hence use the gross prices of securities. The gross price of a bond includes an accrued interest component which increases linearly in value from the time a coupon is paid until the bond turns ex-interest (15 days before a coupon is paid), after which it decreases linearly (in absolute value).

This causes some minor variations in price index values as the balance changes between the slightly increasing prices of many cum-interest stocks and the suddenly decreased gross prices of a few stocks that have just turned ex-interest. It is appropriate that the price indices should reflect these accrued interest effects however.

Interpretation of the Price Indices

Figure 2 is a quick reference guide on how to interpret the Commonwealth Bank Bond Indices, using the indices for the four weeks to 13 November as an example (refer Figure 1).

The price index figure for a particular segment of the market quantifies the capital gain which has accrued on bond series in that market segment since 1 January 1977. The All Series/All Maturities figure of 98.69 as at 13 November 1980 for example indicates that a capital loss of 1.31% has been made on all bonds since 1977. Figure 2 shows how this figure is computed.
To compute the capital gain which has accrued over a certain period, only the two relevant price index figures as at the beginning and end of the period are needed. For example, the gain made on all bonds in the 3 weeks to 13 November 1980 was −1.23% (refer Figures 1 and 2).

Figure 3 shows the variation of the price indices since the base date. The graph confirms the direct relationship between price volatility and term to maturity.

FIGURE 2

A Quick Guide to the Commonwealth Bank Bond Indices

<table>
<thead>
<tr>
<th>Type</th>
<th>Meaning</th>
<th>Example (Refer Figure 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Indices:</td>
<td>• Are not average bond prices (premium or discount) but are ratios of gross market values today to gross market values at base date (multiplied by 100).</td>
<td>• 105.46 on 13/11/80 for All Series Less Than 5 Years indicates that the market value of these bonds has increased by 5.46% since 1/1/77 (due to shortening despite increases in yields since then).</td>
</tr>
<tr>
<td></td>
<td>• Measure the capital gain from investment in bonds in proportion to face values on issue.</td>
<td>• 98.69 on 13/11/80 for All Series/All Maturities indicates a capital gain since 1/1/77 (base date) of ( \frac{98.69}{100} ) or -1.31% (i.e. a loss)</td>
</tr>
<tr>
<td></td>
<td>• To compute the capital gain which has accrued over a certain period, only the two price index figures at beginning and end of the period are needed.</td>
<td>• The gain made on All Series/All Maturities over the 3 weeks prior to 13/11/80 was 98.69 ( \frac{99.92}{100} ) or -1.23% (i.e. a loss)</td>
</tr>
<tr>
<td>Accumulation Indices:</td>
<td>• Represent the value today of $1000 invested in bonds in proportion to face values on issue.</td>
<td>• $1000 invested in short bonds All Series Less Than 5 Years since 1/1/77 was on 13/11/80 worth $1424.13</td>
</tr>
<tr>
<td></td>
<td>• Indicate the ( \text{compound} ) rate of return from bonds (i.e. in addition to capital gains, include both the return from coupon income and interest on interest from re-investment of that income back into the bond market.</td>
<td>• The compound rate of return from All Non-Rebatables over the 3 weeks to 13/11/80 was ( \frac{1362.43}{1363.21} ) or -0.06%</td>
</tr>
<tr>
<td>Income Indices:</td>
<td>• Measure the return from payment of coupon income on the ex-interest date of 1st of the month.</td>
<td>• Coupons on All Series/All Maturities which accrued on 1/1/78 provided a return of 1.19% on funds originally invested.</td>
</tr>
<tr>
<td>Yields to Maturity:</td>
<td>• Are secondary market yields for ( \text{hypothetical} ) bond series of exactly 2, 5, 10 and 15 years to maturity.</td>
<td>• Yields of 13/11/80 were such that if a non-rebatable bond had existed on 13/11/80 with exactly 5 years to maturity, it would have commanded a market yield of 12.45% p.a.</td>
</tr>
<tr>
<td>One Year Ago:</td>
<td>• This information enables progress over the preceding 1 year to be assessed.</td>
<td>• All Series/All Maturities have return 3.2% from 29/11/79 to 13/11/80 ( \begin{tabular}{l} \hline 1357.30 \ 1314.80 \ -1 \hline \end{tabular} )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The above rate of return is low because of the large increases in yields over the year (about 2%).</td>
</tr>
</tbody>
</table>
**Income Indices**

The Commonwealth Bank Bond Income Indices quantify the return obtained from the payment of coupon income on all bond series which form the basis of the price indices. They are of little direct interest by themselves but are useful in enabling the Accumulation Indices to be computed.

The income indices are the percentage return which the coupons payable this week represent relative to the funds originally invested, as represented by the Base Market Value as it was in the previous week. The income index of 1.19 for *All Series/All Maturities* for the week ending 6 November 1980 (refer Figure 1) represents a 1.19% return as a result of the coupons which accrue to the investor on 1 November 1980 from bond series with maturity dates of November or May.

**Accumulation Indices**

The total growth in value of an initial investment in the Commonwealth Government bond market (or one segment of it) is measured by the accumulation indices. Using the *All Series/All Maturities* Accumulation Index as at 13 November 1980 (1357.30) as an example, $1000 invested on 1 January 1977 in bonds in the same proportion as their face values on issue was worth $1357.30 on 13 November 1980 (refer Figure 1). This growth in market value is the combined result of:

1. Capital gains and losses to date (as measured by the Price Indices)
2. The market value of series purchased with all coupon income received to date. (The coupon income is quantified by the income index described above)
3. The return from the re-investment into the bond market of all coupon income received to date (i.e. interest-on-interest)
4. An “interest credit” for any coupon income which has accrued to an investor as a result of bonds going ex-interest but which has not yet been received. (This interest credit will therefore be non-zero only between the 1st and 15th of the month).

The first two of the above points indicate that the accumulation indices combine the price and income indices together to produce a total return from holding bonds. The third point implies that this total return is a compound one.

By compensating for a small decline in the price index as the gross prices of ex-interest bond series drop, the “interest credit” ensures that the accumulation indices are independent of ex-interest effect (4).

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**Interpretation of the Accumulation Indices**

The accumulation indices were assigned a base value of 1000 compared to a base value of 100 for the price indices. This difference has been introduced to help avoid confusion between the two sets of indices.

Accumulation indices measure the total return from holding bonds. To compute the compound rate of return over any past period, the difference between accumulation index values as at the end and beginning of the period is simply divided by the value at the beginning of the period and multiplied by 100%. Figure 2 shows an example calculation.

Table 1 shows the compound rates of return computed from the *All Series/All Maturities* Accumulation Index during major cycles of the bond market during the past 4 years.

Figure 4 shows the movement of the accumulation indices over time. Longer term bonds provided the greatest return under conditions of decreasing yields until 1979. Under the influence of large upward movements in yields in 1980, short bonds have now emerged as the source of greatest total return since the base date because of their lower price volatility.

**TABLE 1**

Rates of Return (%) During Major Cycles in the Bond Market *

<table>
<thead>
<tr>
<th>Period</th>
<th>Market Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 5 yrs</td>
</tr>
<tr>
<td>Jan '77 to Aug '77 (inclusive)</td>
<td>7.52</td>
</tr>
<tr>
<td>Sept '77 to Dec '78 (inclusive)</td>
<td>15.48</td>
</tr>
<tr>
<td>Jan '79 to Dec '80 (inclusive)</td>
<td>15.11</td>
</tr>
<tr>
<td>Average Annual Return</td>
<td>9.34</td>
</tr>
</tbody>
</table>

* All returns were computed from the Commonwealth Bank Bond Accumulation Indices (All Series)

**Yields to Maturity**

The Commonwealth Bank Bond Yields to Maturity are theoretical yields in the sense that they are yields of hypothetical bonds of exact maturities of 2, 5, 10 and 15 years. They are obtained by fitting curves to observed secondary market yields by the method of weighted least squares. The specific method for deriving these yields is
an original one which is designed to maximise the accuracy and consistency with which they are estimated. (5).

The quoted yields have two advantages. Firstly, they are an accurate view of the yields on Commonwealth Government Bonds as set by the largest market for these bonds. Secondly, they constitute a consistent time series of yields, being an unchanging set of four points on the yield curve.

Figure 5 shows the variation of the quoted yield since the base date of 1 January 1977. As would be expected, their pattern of variation is inverse to that of the price indices.

Data Sources
As no comprehensive and timely statistics of secondary market transactions are collected and published, the only parties with detailed knowledge of secondary market conditions are those participating in the market. The Commonwealth Trading and Savings Banks maintain what is in combination one of the largest bond portfolios in Australia and are consequently recognised as major institutions in the secondary market. This active market participation enables the Commonwealth Banking Corporation’s Investment and Economic Research Department to piece together all the available evidence in order to accurately assess the current market yield for each bond series on issue, and from that its market price.

These pieces of evidence normally include the following:

1. Transactions in which the Corporation has been involved.

2. Quotes and offers which have been made by the Corporation to other market participants, and similarly offers which have been made to the Corporation by other parties.

3. Reports of secondary market transactions which the Corporation may occasionally receive on an informal basis.

4. Secondary market yields as quoted by other market participants in their news sheets to clients.

5. Published details of transactions performed by short term money market dealers.

6. Published details of secondary market transactions done through brokers (tempered with the knowledge that some of these transactions can be over a week old).

7. Published details of large transactions which have been conducted on the Stock Exchange.

No one of the above sources would of course be sufficient in itself. Taken together however, it is felt that they provide a good indication of the position of the secondary market.

Availability of Commonwealth Bank Bond Index Figures
As a reflection of the wide interest which has been shown in the indices since they were launched, they will be available from two sources in addition to the Commonwealth Bank’s monthly Economic Newsletter. The three sources of index figures are as follows:

1. On a weekly basis in the Financial Review. Both Price and Accumulation Indices for All Series/All Maturities plus rates of return computed from each over the past four weeks will be published each Monday on the money market page of the Financial Review. An example of the format in which the indices will be presented is given in Figure 6 (the index figures correspond to those in Figure 1).

FIGURE 6
Commonwealth Bank Bond Indices as at 13/11/80

<table>
<thead>
<tr>
<th>Mat. (yrs)</th>
<th>Price Index*</th>
<th>Return over past 4 weeks</th>
<th>Accumulation Index #</th>
<th>Return over past 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 5</td>
<td>105.46</td>
<td>-1.04 p.c.</td>
<td>1424.13</td>
<td>0.22 p.c.</td>
</tr>
<tr>
<td>5 - 10</td>
<td>95.75</td>
<td>-1.50 p.c.</td>
<td>1333.16</td>
<td>0.03 p.c.</td>
</tr>
<tr>
<td>10+</td>
<td>89.34</td>
<td>-0.63 p.c.</td>
<td>1257.64</td>
<td>-0.21 p.c.</td>
</tr>
<tr>
<td>All Maturities</td>
<td>98.69</td>
<td>-1.11 p.c.</td>
<td>1357.30</td>
<td>0.07 p.c.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Yrs</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-reb.</td>
<td>12.50</td>
<td>12.45</td>
<td>12.45</td>
<td>12.45</td>
</tr>
<tr>
<td>Rebatable</td>
<td>11.90</td>
<td>11.90</td>
<td>11.90</td>
<td>11.90</td>
</tr>
</tbody>
</table>

* Movement in gross prices of bonds on issue since 1/1/77 when index was 100.
# Value of $1000 invested on 1/1/77. Includes return from both capital gain and coupon income.

2. Economic Newsletter
The full set of indices for each of the preceding 4 or 5 weeks plus a commentary on index movements will appear monthly in the Newsletter. As such, the Economic Newsletter will remain the major source of the complete set of indices.

JASSA/1981, No. 1 (April)
3. I.P. Sharp Associates Public Data Base
   The full set of indices will be available on a weekly basis on the data base administered by this computer bureau, access to which is sold by I.P. Sharp Associates as a service to the public.

   Past values since January 1977 of all the indices are contained in an appendix to reference (3).

How the Indices can Be Used

The indices are able to assist anyone who is interested in the progress of the Australian bond market, be it in terms of either past return or future returns. This is because the indices enable the computation of representative past returns which could have been earned in the market, while at any one time the Commonwealth Bank Bond Yields to Maturity indicate the returns available over the future on a hold-to-maturity basis.

Some specific purposes for which the indices are useful are listed below. Details on how to use the indices for these purposes can be found in (3).

1. Tracking the progress of a bond portfolio
2. Measurement of bond portfolio performance
3. The assessment in retrospect of the relative merits of alternative investment strategies.
4. Direct comparisons of rates of return in different security markets
5. Quantification of holding period returns in academic studies which examine the relationship between risk and return.

To take the third point above as an example, consider an investor who as a policy matter has kept his bond portfolio in medium term (5 to 10 years) securities over the 4 years to December 1980. He may consider that the appropriate benchmark against which his portfolio's performance should be measured is the return on the All Series/5 to 10 years index. Using this index, the benchmark return is an average annual return of 7.19% (refer Table 1). With hindsight, however, investment in short term bonds over the whole period would have produced a higher average yield (9.34% p.a.).

Similar exercises can be done to identify better switching patterns between shares and bonds by using the Commonwealth Bank Bond Indices in combination with the Australian Stock Exchange Indices or the Statex-Actuaries Share Indices. Indeed, some portfolio performance measurement services in the UK compare actual performance to that of an "ideal" fund which is distributed over bonds, debentures and shares etc. according to some criterion which conforms to either an industry average, some naive strategy or subjective allocation.

As an example of the fourth point above, Figure 7 compares growth in the Commonwealth Bank Bond Accumulation Index (All Series/All Maturities) with growth in the Statex-Actuaries Accumulation Index. Over the four years 1977 to 1980, the total return from shares has been five times that from bonds (36.86% p.a. as opposed to 7.80% p.a. average return).

NOTES AND REFERENCES

4. A more detailed explanation of the interest credit can be found in (3).
5. A description of the method can be found in (3).
FIGURE 3
Commonwealth Bank Bond Price Indices By Term to Maturity Categories

FIGURE 4
Commonwealth Bank Bond Accumulation Indices by Term to Maturity Category

FIGURE 5
Commonwealth Bank Bond Yields to Maturity For Non-Rebatable Bonds

FIGURE 7
Comparison of the Return from Bonds and Shares since 1977