Australian equity returns: another look at the historical record

History will judge us all and nowhere is this more relevant than in calculating long-term rates of return from Australian equities. RICHARD FITZHERBERT reviews the various studies that have been used to estimate the rates of return and finds that there are flaws in the historical data.

This paper is concerned with the accuracy and quality of Australian historical stock-market return data that is used for a variety of purposes, which include estimating the equity risk premium. According to Bowman (2001), the study by Officer (1989) covering the period 1882–1987 is the “historical evidence that is most commonly referred to”. Less well known is the study by Owen (1962).

Both of these studies rely on pre-1958 price index data compiled under the supervision of Lamberton (1958a). The reliance on Lamberton’s figures was acknowledged by both Owen and Officer but this reliance is often forgotten when the results are quoted by others. For example, Dimson et al. (2004) indirectly rely on Lamberton’s work, but it is necessary to trace back through a number of citations to identify the original source. Pre-1958 Australian data is available in databases but detailed information about the compilation of this data is hard to find.

An important difficulty faced by early researchers such as Owen was the lack of market-weighted dividend data. More recently, the ASX Statistician (1996) compiled a quarterly accumulation index dating back to 1882 which corresponds with the ASX All Ordinaries accumulation index, which has been calculated daily since 1979. The dividend problem identified by Owen has been addressed by the ASX Statistician’s accumulation index, but the availability of an accumulation index dating back to 1882 is relatively recent and not well known.

The separate studies by Owen (1962) and Officer (1989) suggested a historical long-term geometric mean total return (including dividends and capital appreciation) of 11.76% and 11.5% per annum. These estimates are quite close

<table>
<thead>
<tr>
<th>TABLE 1 AVERAGE DIVIDEND YIELDS (% PER ANNUM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years (inclusive)</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>1955–1960</td>
</tr>
<tr>
<td>1965–1972</td>
</tr>
<tr>
<td>1973–1979</td>
</tr>
<tr>
<td>Average</td>
</tr>
</tbody>
</table>
and both include the period 1882–1960, with Officer’s study extending to 1987. However, both of these studies appear to have overestimated the historical geometric mean return by approximately 2% per annum.

When historical data (updated as required) is used to justify cost of capital calculations and asset allocation decisions, then the everyday impact of the accuracy and reliability of this historical information is significant. Given the relatively recent availability of the ASX Statistician’s accumulation index, it is appropriate to reconsider the accuracy and quality of data used to estimate historical rates of return.

GEOMETRIC OR ARITHMETIC MEANS?
It is known that if rates of return in successive time periods are statistically independent, then the arithmetic mean return is more correct than the geometric mean for forward estimates of expected rates of return based on historical data. On the premise that such independence is very close to the truth, many authors prefer to quote arithmetic means of historical rates of return as their primary focus rather than geometric means, leaving those who prefer geometric means to make their own adjustments.

In this paper geometric means are the primary focus because it is now acknowledged that there is an element of mean reversion in stock market returns and we are looking at long-term results. For example, Mehra and Prescott (2003) commented:

“... when stock valuations are high relative to fundamentals, the ex-ante equity premium is likely to be low. However, it is precisely in these times, when the market has risen sharply, that the ex-post or the realised premium is likely to be high. Conversely, after a major correction, the ex-ante (expected) premium is likely to be high while the realised premium will be low. This should not come as a surprise since returns to stock have been documented to be mean-reverting.”

If stock market returns are mean reverting, then long-term investors should be more interested in the geometric mean. To quote Ritter (2002, p. 160):

“Now, if stock and bond returns follow a random walk, the use of annual arithmetic returns is appropriate [for comparing the relative risk of stocks and bonds]. But if there is mean reversion or mean aversion, the use of arithmetic means over longer periods is not appropriate. With mean reversion, the multiperiod arithmetic mean will be closer to the geometric return.”

For this reason – the long-term importance of the error in assuming serial independence of rates of return – the geometric mean is used as the primary basis of estimation. Arithmetic means can be obtained approximately by adding 2% per annum (half the variance) for the stock market as a whole.

PRE-1980 PRICE INDICES
From the beginning of 1958, the Sydney Stock Exchange began calculating its “all ordinaries” and other price indices daily (Lamberton, 1958a). Before the establishment of the national indices at the end of 1979, the “Sydney All
“Ordinaries” was the most recognised benchmark even though other exchanges calculated and published their own price indices.

In the 1950s, the Sydney Stock Exchange and other interested parties had been working with Donald Lamberton, then a lecturer in economics at the University of New England, in redesigning the stock exchange price indices. They also worked on an extensive compilation of historical data. In particular, they recalculated monthly averages of a series of indices from 1937 to 1957. Lamberton also supervised the calculation of monthly average values for a series of three indices from 1875 to 1936: “financial”, “commercial and industrial” and “mining”.

The recognised historical values of the ASX All Ordinaries Index are a blend of four series: Lamberton’s “Commercial and Industrial Index” from 1875 to 1936: “financial”, “commercial and industrial” and “mining”. The pre-1958 price indices may give a reasonable idea of the general rate of capital appreciation using geometric means, but where accurate intermediate figures are required (for calculating arithmetic means and volatility), the pre-1957 data may not be suitable.

PRE-1980 DIVIDEND DATA
The current series of national Australian stock exchange indices began on 31 December 1979, eventually replacing numerous state-based indices such as the Sydney All Ordinaries and the Melbourne 50 Leaders. These pre-1980 indices ignored dividend payments except for the Statex-Actuaries’ indices which started in 1972 and which have also been discontinued. However, the new ASX national indices continued the idea of accumulation indices pioneered by the Statex-Actuaries’ indices.

When there is a need to calculate total return, accumulation indices are invaluable because price indices do not allow for dividend payments which, on a long-term basis, represent roughly half the total return.

In the absence of accumulation indices, price index data needs to be combined with market weighted dividend yields to calculate total return, and the results are not as accurate. Published dividend yields tend to be retrospective, so the calculation of total return over a period requires a combination of capital appreciation over the period and the dividend yield at the end of the period.

Allowance for dividends before 1980 is problematical.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td>1897</td>
<td>5.3</td>
<td>5.9</td>
<td>6.19</td>
<td>6.1</td>
</tr>
<tr>
<td>1907</td>
<td>11.3</td>
<td>13.0</td>
<td>11.33</td>
<td>13.2</td>
</tr>
<tr>
<td>1917</td>
<td>8.4</td>
<td>10.2</td>
<td>7.97</td>
<td>9.6</td>
</tr>
<tr>
<td>1927</td>
<td>14.9</td>
<td>15.6</td>
<td>15.81</td>
<td>17.0</td>
</tr>
<tr>
<td>1937</td>
<td>9.2</td>
<td>11.3</td>
<td>9.81</td>
<td>9.6</td>
</tr>
<tr>
<td>1947</td>
<td>8.0</td>
<td>10.1</td>
<td>8.83</td>
<td>10.2</td>
</tr>
<tr>
<td>1957</td>
<td>8.4</td>
<td>10.4</td>
<td>9.20</td>
<td>10.7</td>
</tr>
<tr>
<td>1967</td>
<td>13.2</td>
<td>15.4</td>
<td>11.49</td>
<td>n/a</td>
</tr>
<tr>
<td>1977</td>
<td>5.0</td>
<td>7.7</td>
<td>0.85</td>
<td>n/a</td>
</tr>
<tr>
<td>1987</td>
<td>20.3</td>
<td>22.2</td>
<td>18.52</td>
<td>n/a</td>
</tr>
<tr>
<td>1888–1987</td>
<td>10.3</td>
<td>12.1</td>
<td>9.9</td>
<td>n/a</td>
</tr>
</tbody>
</table>

\[
\left\{\frac{\text{Price index centred on year end}}{\text{Price index centred on start of year end}} \times (1+\text{dividend yield at year end})-1\right\} \times 100
\]
because (except for the Statex-Actuaries’ index from 1972–1992), accumulation indices were not calculated at the time and the published dividend yields were not market weighted, except for some figures published by the Melbourne Stock Exchange (1980) which were not well known. For example, when Owen estimated the total return over the period 1882–1960 at 11.5% per annum, he noted (p. 63):

“Dividend yields used in the investigation were not directly related to the shares included in the share price index. They were unweighted measures of the yields on all shares.”

With the benefit of hindsight, it is easy to be critical of this approach. However, Owen was working before computers were readily available and at the time there may not have been any reason to suspect (for the period under study) that there might have been a tendency for dividend yields to be inversely related to market capitalisation. This phenomenon would cause the unweighted average dividend yield in such a study, when combined with a capitalisation weighted price index, to over estimate the total return of the index portfolio.

An indication of the effect of using unweighted dividend yields rather than properly weighted accumulation indices can be obtained by comparing the market weighted dividend yield of the Melbourne 50 Leaders index, the unweighted average for the same 50 stocks and the unweighted average dividend yield published by the Sydney Stock Exchange – as used by Owen. The (limited) in Table 1 data shows averages of the values on 30 September for the years shown.

Over the period 1955–1979 (excluding 1961–1965), there was an average difference of 2.3% between the market-weighted average dividend yield of the stocks in the Melbourne 50 Leaders index and the unweighted average of all stocks calculated by the Sydney exchange.

If we assume that the non-50 leaders weighted and unweighted averages are equal and that the 50 leaders represented 70% of the market capitalisation of the price index, this would mean a difference of 1.7% between a market-weighted dividend yield and an unweighted yield for all stocks. This still assumes that there is no inverse relationship between dividend yield and market capitalisation outside the 50 leaders, so the difference was probably a little higher than 1.7% per annum.

Also, it should be noted that this difference is not constant, even when taking averages over the periods shown. So, when assuming a difference of (say) 2% per annum, this would not be correct for individual years, even though it may be reasonably accurate as an average difference over periods of (say) 10 years.

**HISTORICAL TOTAL RETURN ESTIMATES**

In his 1962 study, Owen showed annual total return estimates from 1882 to 1960. At first glance it might appear that corresponding figures can be obtained from the new ASX historical accumulation index. However, Owen used annual average index values, and his results will be inconsistent from year to year with calculations based on the ASX accumulation index, although the results should still correspond approximately over longer periods.

Owen calculated the total return for each year using the approximation set out below Table 2.

He used unweighted average dividend yields (about which he expressed reservations at the time), yearly average price indices and yearly average dividend yields. Owen also used the “All Shares (excluding Financials)” index rather than the “All Shares” data published by Lamberton (1958a).

Officer (1989, p. 211) described his method of estimating the historical total return from ordinary shares as follows:

“The early period made use of data developed by Lamberton [(1958a)] and this was linked to an accumulation index of fifty leading shares from the AGSM price file (1958–1974) and the AGSM Value Weighted Accumulation Index (1975–1987) … A large number of checks were made for consistency and compatibility of indices. All of the checks suggested movements in the above indices were relatively closely and contemporaneously related. …The base data were monthly share price data from which annual indices were constructed adding in dividends.”

It is not clear, from this description, what pre-1958 dividend data was used and exactly how the dividend information was combined with capital appreciation. The use of AGSM data is valuable because it provides an independent check of the generally accepted Sydney All Ordinaries Index over the same period.

Officer provided estimates in five-yearly and 10-yearly intervals. Table 2 compares various estimates of 10 yearly geometric mean total returns using Officer’s time intervals to facilitate comparison with his estimates. Officer’s figures are shown as published. The comparative 10-yearly figures attributed to Owen were not published by him, but calculated from his annual results. Also shown are estimates of total return based on the recently compiled ASX Accumulation Index and a second estimate (column 3) based on the generally accepted historical ASX price index and unweighted dividend yields up to 1987 – remembering that these index values are December monthly averages until the end of 1957 and month-end values since 1958.

A comparison of columns (2) and (3) – the total return of the ASX accumulation index compared to an estimate based on unweighted dividend yields – shows an average (and reasonably consistent) difference in total return of just under 2% per annum. On the basis of the limited comparison between the weighted dividend data from the Melbourne Stock Exchange and the unweighted Sydney data, this suggests that the dividend factor built into the recently compiled ASX accumulation index is more or less correct.

As Owen used weighted yields, annual averages and a slightly different index, it is not surprising that his figures fluctuate about estimates based on monthly ASX price indices and unweighted yields. However, the total return from columns (3) and (5) are both 10.9% per annum over the period 1888–1957, suggesting that the use of annual average indices by Owen was reasonably accurate on a long-term view. Nevertheless, we can now respond to the reservation Owen expressed at the time and report that the use of unweighted dividend yields led to an...
over estimation of total return by approximately 2% per annum.

Officer’s overall result is close to the estimates obtained from the ASX accumulation index in column (2) over the whole 100-year period. However, there are some inconsistencies. In the period 1888–1957, his estimates exceed the total return calculated from the ASX Accumulation Index by 0.5% per annum. This is offset by a difference over the period 1958–1987 where Officer’s results are 2.6% less than returns based on the ASX Accumulation index. We should expect some differences between Officer’s estimates and the ASX Accumulation index because Officer used AGSM data. However, 2.6% per annum compounded over 30 years is more than a factor of 2.

The largest difference occurred over the period 1968–1977, when the Sydney All Ordinaries price index (adjusted to a base of 500 on 31 December 1979) rose by 7% from 301.6 to 322.3 which gives capital appreciation of 0.7% per annum.

The total return over this period should have therefore been mainly determined by dividends, and the figure derived from the ASX Accumulation index of 5% per annum is consistent with the adoption of the Sydney All Ordinaries as the “back-data” for the current ASX All Ordinaries price index. Over the same period, the December averages of the Melbourne 50 Leaders index fell from 230.6 to 165.0, which is more consistent with Officer’s total return estimate of 0.85% per annum.

It is likely that the inconsistencies between Officer and the ASX accumulation index over the period 1958-1987 are due to index composition in a turbulent period that included the Poseidon boom, the extreme volatility in the stockmarket from 1973 to 1975 and the crash of 1987.

Officer quotes a geometric mean rate of return for the whole period 1882–1987 of 11.76% per annum. Using his figures (reproduced in Table 2 and 10.82% for the six years ended December 1887), the 106 year geometric mean is estimated at 10.0% per annum.

CONCLUSION
In 1962, W.D. Owen used historical data over the period 1883–1960 to estimate the total return from Australian equities at 11.5% per annum. He was concerned with an estimate of future long-term returns. Using information that subsequently became available, this estimate should be reduced to 9.5% per annum to allow for his use of unweighted dividend yields. In the 45 years that have elapsed since this paper was written, the geometric mean return has been 10.8% per annum. It is remarkable that an estimate made 45 years ago with the data then available turns out to have been in the right ball-park.

In 1989, R.R. Officer published a more extensive study than Owen, involving a longer period and also showing bond returns and inflation. Officer arrived at a similar historical estimate to Owen for long-term equity returns of 11.76% per annum for the period 1882–1987.
However, there appears to have been an arithmetical error of 1.8% per annum in this overall result, implying an adjusted estimate of 10% per annum. Officer used AGSM data over the period 1958–1987. The equity returns calculated from this data over this period are 2.7% per annum compound less than those based on the Sydney and ASX All Ordinaries indices. This is not necessarily “wrong”; the use of AGSM data has become inconsistent with the acceptance of the combined Sydney and ASX All Ordinaries indices as the historical “market” index over the period 1958–1987.

The historical accumulation index compiled by the ASX Statistician in 1996 deals with the lack of market-weighted dividend data before 1980. It is also consistent with the acceptance of the Sydney All Ordinaries over the period 1958–1979 as “back-data” for the ASX All Ordinaries. The retrospective calculations of Lamberton for pre-1958 data provide the only practicable option for obtaining historical price data over the period 1882–1957.

As a source of total return data for Australian ordinary shares over the period 1882–1979, the retrospective quarterly accumulation index – compiled by the ASX statistician in 1996 – seems to be the best historical data available. While this index is compatible with an index that has been calculated daily since 1980, there are significant differences between pre-1980 data and today’s accumulation indices that need to be kept in mind.

References
ASX Statistician (1996), Quarterly Accumulation Index, Australian Stock Exchange.