A Review of the Methodology of Forecasting Long-term Equity Returns

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Abstract

There are two main approaches to forecasting the long-term return from equities as an asset class. The first is to assume a premium over interest rates or bond returns, justified by the risk-averse behaviour of portfolio investors. The second approach is to project dividend income assuming a link with inflation and/or parity with gross domestic profit.

Except for GDP parity, these methods are all supported, superficially, by historical data. However the causal justifications for either the risk premium or the inflation link are dubious - which reduces the status of these assumptions from laws of nature to historical regularities upon whose future we can only speculate. In a business environment in which historical cost accounting prevails, return-on-shareholders' equity is the key variable which determines the underlying long-term return from equity portfolio investment which is monetary and not real in nature. Adjustments are required when historical cost accounting is not strictly applied.

Key words: Equity premium, return on shareholders' equity, inflation, long-term equity return forecasting

Executive Summary

1 Introduction

The introduction identifies the main methods used for projecting long-term equity returns and summarises their main underlying assumptions.

2 Criteria determining model validity

Here we discuss criteria that have been suggested for validating these types of models. This section briefly reviews the philosophical debate about regularities versus laws of nature and the crucial role played by causality. In predicting the future, causal laws offer a much more reliable basis than historical regularities.

3 The equity premium - law or regularity?

The causal link between risk-averse investor behaviour and the historical equity premium has not been established, leaving the equity premium as a regularity. Nevertheless it is often simply assumed that an equity premium exists as a law of nature.

4 Dividend growth rates.

Very long-term "buy-and-hold" returns can be estimated from the current dividend yield and an estimated dividend growth rate. There are two main methods of estimating future dividend growth: inflation and GDP parity. These methods take no account of the effect, if any, of retained profits. In this respect, the statistical evidence is ambiguous.

5 The nature of company profits: real income or monetary income?

The nature (ie real or monetary) of company profits depends on the prevailing accounting system. When historical cost accounting is applied, company earnings and dividends are monetary and not real in nature. Consequently the long-term growth of earnings and dividends is caused by retained profits. Adjustments are required when historical cost accounting is not strictly applied. With this exception, any historical link between earnings and/or dividends with inflation is a regularity, not a law of nature.

6 The shareholders' equity framework.

Starting with the "accounting equation" we develop the equations required for estimating long-term equity asset class returns when historical cost accounting prevails. The key variables are return on shareholders' equity and overall price/book ratios. Price/book ratios give the same answers as the more normal price/earnings ratios under the shareholders' equity estimation framework.

7 Illustrative calculations

This section illustrates the use of the shareholders' equity framework by estimating 10 and 20 year rates of return for Australian equities under two scenarios - a continuation of current return on shareholders' equity and a reversion to historical norms.

8 The relative merits of price/book and price/earnings ratios

There is a link between price/book ratios, price/earnings ratios and return on shareholders' equity. If we know any two of these variables, the third is also known.

9 Discussion

Initial conditions, the unit of measurement used in company accounting and future return on shareholders' equity largely determine the nature (ie real or monetary) and size of long-term equity asset class returns. Because successive changes in market index levels are not independent, there are serious problems applying a mean-variance framework to long-term returns. The "risk" averse behaviour of portfolio investors, inflation and real economic growth generally have little or no direct influence on long-term equity returns.

1 Introduction.

This paper reviews the methodology of estimating long-term equity returns and the soundness of commonly used underlying assumptions. When mathematical models are used, we are concerned with both the form of the model as well as the numerical values of key parameters. For a methodology to be reliable, the underlying assumptions need to be appropriate before we can select numerical values for key variables.

We therefore begin by identifying the main assumptions on which methods of projecting long-term equity returns are based and the criteria that should be used to discriminate between reliable and unreliable methodology. As far as reliability is concerned causation is crucial. We then consider the main methods of projecting equity returns in the light of this more general discussion of how to discriminate between competing methods. Here we assess the causal impact of volatility, inflation, economic parity and internal corporate returns on long-term equity portfolio returns.

Making reliable *ex-ante* estimates of long-term returns from equities as an asset class has long been an issue of interest to the actuarial profession. One of the earliest Australian papers was Owen (1962). Based on an examination of the historical record over the period 1882-1960 and the assumption that the future would be like the past Owen estimated the future long-term return for Australian equities would lie between 9.5 and 13.5% per annum.

> *"There is little evidence that the yield pattern exhibited over the last 80 years will not continue and it seems appropriate to assume that for the long-term investor the expected future yield [ie geometric mean total return per annum] from ordinary shares will be 11.5% ± 2%."*

Based on pre-1980 figures calculated by the ASX Statistician (1996), the ASX Accumulation index has risen from 165.9 to 39,070 over the 46.5 years since the end date of Owen's calculations, or 12.5% per annum. With the benefit of hindsight, it is remarkable how accurate Owen's forecast proved to be in the half-century since given the poor quality, by today's standards, of the data at his disposal.

Graham (1973) used return on shareholders' equity to estimate future dividend income and capital growth from US index portfolios in a way that was closely related to the framework outlined by Hemsted (1962). Under this approach dividends grow at a rate determined by return on shareholders' equity and the proportion of profits not distributed in dividends. Return on shareholders' equity is rarely mentioned in discussions of prospective long-term equity returns. Perhaps the approach never became popular because it treats company profits as monetary income and ignores inflation and real economic growth.

Wilkie (1986) proposed a comprehensive stochastic investment model involving bonds and cash as well as equities. The module dealing with equities was based on a dividend stream that matched price inflation, subject to lags and random fluctuations. This was combined with a model of dividend yields which fluctuated in a stationary manner. Stripped of its stochastic features, the equity module of this model therefore assumed a dividend stream which grew with inflation in the long-term. Wilkie argued at the time (p343):

> *"It is clear that dividends, which are measured in money terms, ought, other things being equal, to be related to the general level of money prices elsewhere in the economy. Both are measured by the same numeraire of current pounds. It is, therefore, appropriate to relate company dividends directly in some way to the index*

being used as a measure of general prices, which for my purposes is the Retail Prices Index, or its predecessors."

With a stationary dividend yield, it follows that the long-term return from a portfolio conforming to the Wilkie model will be approximately equal to the initial dividend yield plus the future average rate of inflation. (It is possible to disable the inflation matching feature of the standard Wilkie model, but this would eliminate one of its key features.)

In the broader financial community, it has become common to estimate "expected" total return as the sum of a fixed interest return and an equity "risk" premium. In the standard finance text by Brealey and Myers (2003), we read (in the context of calculating the cost of capital on page 157):

"Remember that [the currently expected rate of return on the market portfolio] is the sum of the risk-free rate .. and a premium for risk."

Another popular approach outside the actuarial profession is to assume that dividends grow with Gross Domestic Product based on general economic reasoning without making any assumptions about future market prices. For example, Ritter (2002, p163) argues that:

"For predicting future dividend growth rates, all one has to do is to assume an economywide growth rate and assume that the ratio of labor income to capital income is constant."

If we assume that dividends grow indefinitely with GDP and/or inflation, then we can find the rate of return that equates the present value of future dividends with current market prices.

Thus we see two main approaches to forecasting the long-term return from equities as an asset class:

(a) the first approach is to use different versions of a total return model, often based on historical stock price and dividend data. Such models can either relate directly to total return (ie income and capital appreciation), historical values of a premium over bond returns or historical values of a "real" return (ie total return adjusted to exclude inflation).

(b) the second approach is to project dividend income assuming growth from inflation, parity with Gross Domestic Profit or growth from retained profits.

Where total return is estimated from an assumed dividend growth rate and the current dividend yield, this is sometimes described as a dividend discount model or a dividend growth model. Dividend growth models are normally deterministic in nature, although the shares module of the Wilkie model could be regarded as a stochastic dividend growth model.

The actuarial profession's own early educational material endorses both the equity premium approach and the idea that a dividend stream should grow by more than the rate of price inflation, representing real growth in companies' profits although this source of growth is not specified. For example in the Faculty and Institute of Actuaries (2006, Unit 10 page 4) we read:

"The initial running [dividend] yield on ordinary shares is low but dividends should increase with inflation and real growth in a company's earnings.

The expected overall future return on ordinary shares ought to be higher than for most other classes of security to compensate for the greater risk of default and for the variability of returns."

From this illustrative (but by no means exhaustive) description of examples of forecasting, or modelling, equity returns we can classify these approaches according to their underlying assumptions and methods of implementation as shown in Table 1. However, we need to recognise some variations on these four basic methods. For example, the earnings growth model described by Yakoubov *et al* (1999) could be regarded as a stochastic dividend growth model because there is an underlying reliance on the argument that earnings (and consequently dividends) move with inflation even though it recognises significant variations in payout ratios.

Table 1
Methods of estimating future long-term equity returns

Approach	*Underlying assumption*	*Method of implementation*
Historical	Equity premium, rate of return, or real rate of return are independent random variables with constant mean and variance.	Estimate parameters from historical data and then assume they will apply in future adding in an assumed risk free return or rate of inflation as required
Constant real dividend stream	Company earnings and dividends are real income and should move broadly in line with a general price index.	Prospective return is equal to the current dividend yield plus the future rate of inflation
GDP parity	Company earnings and dividends are a roughly constant proportion of GDP and should grow with both inflation and real economic growth.	Prospective return is equal to the current dividend yield plus the rate of growth of nominal GDP
Return on shareholders' equity	Company profits are paid in dividends or retained as the source of corporate growth. Inflation and real economic growth are not relevant.	Prospective return is equal to the current dividend yield plus the retained proportion of future return on shareholders' equity

A few years' ago, Barker (2003) addressed the question of forecasting the long-term return that investors could expect from Australian equities. Using most of these methods, he estimated a very long-term *"underlying rate"* of 9% per annum and a somewhat lower 10 year return from investments made at the ASX All Ordinaries index level of 3300 points in March 2002. At the time, Barker was able to reconcile the conflicting answers arising from different approaches. But, what do we do when different methods produce wildly different answers?

Forward estimation of the equity premium, a problem often related to forecasting equity returns, has recently thrown up a wide divergence of opinion in the USA with large discrepancies emerging from different methodology. In an extensive review of research literature on the equity premium, Derrig and Orr (2004) note *ex-ante* estimates which *"vary widely from about [minus] 1% to about 9% [per annum], ... ".*

These differences can sometimes be attributed to different values for key variables such as assumed rates of future inflation or interest rates. Such differences of opinion on future parameter values are commonplace. However we are first concerned with fundamental differences in methodology from which large divergences in opinion can emerge. For example, in regard to the problem of forward estimation of the equity premium, Ritter (2002) provides an example of the extent to which divergent opinion can arise from different methods:

> *"Many textbooks encourage students to use the historical arithmetic average equity risk premium of 9% [per annum] for computing the cost of equity capital. ... The numbers I am about to compute using forward looking estimates suggest that 1% is a more defensible number."*

Such discrepancies lead naturally to challenging questions. Does it remain valid to apply the historical approach using the equity premium if the resulting numbers do not make sense when compared with a dividend discount model? Or is there something seriously flawed with the methodology of using historically based estimates at any time? Was Owen (1962) just lucky, or was there some hidden and valid assumption that made his estimate reliable?

Is it valid to use the historical average risk premium as an estimate of the future risk premium or should we use a dividend discount model to estimate total return and deduct inflation and/or bond rates to estimate the future equity risk premium? If we are interested in total return, why use a dividend discount model to estimate total return, deduct a riskless rate of return to estimate the equity premium and then add back a riskless rate of return to estimate total return?

It is relatively simple to create a stochastic model using either yearly returns or the annual equity premium as a series of independent random variables. Including stochastic features in dividend projection models is more complicated. At the very least such models require a stochastic model of the dividend yield as well as any random features that may be built into the basic dividend projection. Also, an argument can be advanced for using earnings rather than dividends in such models as suggested by Yakoubov *et al* (1999):

> *".. [P/E] ratios are widely accepted as a better indicator of equity valuation than dividend yields. …*
>
> *Earnings growth as a time series is easier to model than dividend growth, as earnings growth is more reactive to changes in the economy whilst dividend growth is smoothed by company directors."*

The methods summarised in Table 1 have quite different underlying assumptions. Consequently, if one method is universally valid, then presumably other methods are not. Alternatively one set of assumptions may be more suitable for short-term problems and a different set of assumptions for longer-term questions. For example a random walk model may be suitable for short-term modelling of share returns, but for evaluating adequate reserves for long-term guarantees, the random walk may be quite unsuitable. (See, for example, Maturity Guarantees Working Party, 1980.)

How do we decide which models are valid to use in a particular situation, given a set of models with completely different, and potentially incompatible, underlying assumptions?

The relative merits of stochastic and deterministic models are discussed by Whitelock-Jones (2003). It is naturally difficult to compare models of these two different types and there

seems to be a natural tendency to assume that stochastic models provide more information than deterministic ones.

> *"Stochastic models are quite different from deterministic models and can provide much more useful information.*
>
> ..
>
> *There are many questions that can be asked with a stochastic model but not with a deterministic model."*

However, the same assumptions often underlie both deterministic and stochastic models, emerging as fixed parameters in deterministic models and mean parameters of key random variables in stochastic models. If any of the implicit assumptions are invalid, a stochastic model will not necessarily be any better than a deterministic one and vice-versa.

For example, the use of historical equity return data as a basis for a simple mean-variance model for equity returns will generally rely on the stated, but sometimes implicit, assumption that rates of return are independent and identically distributed (IID) random variables with constant mean and variance. If either the independence or constant mean assumptions are invalid, the stochastic model is clearly invalid. However a deterministic model which uses an estimate of expected future rates of return based on the historical arithmetic average rate of return will not be valid either. When we are dealing with future long-term returns the invalidity of these assumptions cannot be dismissed lightly because the effect is likely to be cumulative.

In some cases, there may be some feature of a stochastic model which makes it inferior to, say, a long-term deterministic approach. Suppose annual rates of return depend on some other factor - such as book-market ratios. Rates of return in successive years are then neither independent nor identically distributed. When book-market ratios are unusually high or low at the start date, a model which ignores this factor will produce unreliable results. In such circumstances, a mean-variance stochastic model relying on the IID assumption could be less valid than a simple deterministic model which allows for mean reversion in book-market ratios.

2 Criteria determining model validity

Although there is a vast literature in the history and philosophy of science dealing with the validity of scientific theories, there has not been much attention to the identification of criteria for distinguishing between valid and invalid methods of modelling investment returns within the actuarial profession. In one of the few papers that touch this subject, Huber and Verrall (1999) argue the need for an underlying theory in *"actuarial economic models"* as distinct from *"purely data-based methods of developing economic models"*.

In a standard actuarial text, Whitelock-Jones (2003, p155) discusses the actuarial modelling process and emphasises the importance of ongoing comparison of output and model forecasts:

> *"The feedback component of the modelling process is crucial. We must subject all our models to regular and thorough evaluation by comparing model output with real-world experience."*

A similar comment was made by Hardy (1996, p963) in her written contribution to the discussion of a paper that was critical of financial economics:

> *"[The author] misunderstands the modelling process. He is critical of models where the assumptions used to derive results do not, in fact, hold; but this is exactly how much modelling is conducted; we make simplifying assumptions to construct a model; we get results; we test the results against the real world to assess whether the underlying simplification has invalidated the results. We try to develop better models which do not require the strong assumptions which we started with."*

With investment returns, particularly equities, large variations would make it extremely difficult, if not impossible, to discover that a model was invalid without many years of data. Consequently, while this feedback approach may be adequate for models of (say) the incidence of motor vehicle damage, the feedback monitoring process is unlikely to be adequate for models of investment returns because the answers will become known too late. A second objection is that the "feedback" mechanism adapts models to regularities, it is not normally concerned with establishing laws of nature by independent analysis of causation. As we shall see, the question of causation and the distinction between regularities and laws of nature is a key determinant of validity with models that try to predict future long-term equity returns.

The methods of estimating future returns from equities described in Table 1 involve some sort of econometric model although the "accounting equation" is initially more important in the case of the return on shareholders' equity approach. Huber (1997, p186) suggested that:

> *"The main criteria by which econometric models should be evaluated include whether the model is consistent with prior economic theory, satisfies various goodness-of-fit tests, is parsimonious and has constant parameters historically."*

Huber later acknowledged that consistency with prior economic theory was *"not decisive"*. However, consistency with theory and satisfying goodness-of-fit tests are not necessarily valid criteria anyway for two reasons.

First, as a standard text such as Chalmers (1999) points out, how we interpret data is heavily influenced by what we already accept. The second issue, particularly relevant with statistical tests, is that methods of measurement often involve underlying assumptions which are crucial. Failure to pass a statistical test could be due to the inappropriateness of assumptions underlying the test as much as features of the data. For example, many tests of stock-market theories such as the inverse relationship between price/earnings ratios and subsequent relative

stock returns (the "low p/e effect") involve statistical tests which implicitly assume, as a null hypothesis, that we are dealing a sequence of IID random variables and, in this case, that there is no relationship between price/earnings ratios and rates of return. Failure of the null hypothesis could be due to failure of the IID assumption rather than the presence of a *low p/e* effect. Worse still, we may accept the null hypothesis because a *low p/e* effect and non-IID returns create compensating errors in our test.

Even when statistical tests indicate the existence, or absence, of particular features in historical data, the job is only partly done. With actuarial models, such as those used to estimate investment returns, the real issue is not whether a model fits the past, but whether it will fit the future as well. For example, historical data demonstrates both an equity premium and long-term returns that exceed inflation. Is it valid to assume that future long-term equity returns will exceed bond returns and inflation?

Graham (1973) was possibly ahead of his time when he argued that it was not appropriate to assume a link between inflation and future stock returns unless it was possible to establish a direct link (which could now be interpreted as causality) between inflation and earnings (and in consequence share prices):

> *"The reader will object that in the end our calculations make no allowance for an increase in common-stock earnings and values from our projected 3% annual inflation. Our justification is the absence of any sign that the inflation of the past has had any* ***direct*** *effect on per-share earnings."*

This specific question of a link between inflation and equity returns is discussed in more detail in section 5.

In a way, we are interested in theories tested against the historical record as the basis for forecasting the future. In science there is a similar problem of establishing, through experiment and observation, what will happen in out-of-sample periods. Some philosophers of science (see, for example Chalmers, 1999) argue that identifying causation is a necessary condition for establishing a sound scientific theory. Historical data can often be used to suggest scientific hypotheses to explain phenomena such as the equity premium; but until a satisfactory explanation for its cause has been established, the phenomenon remains a regularity rather than a law of nature.

A phenomenon that is a law of nature is a natural outcome of, in this case, the financial system. Consequently a law of nature identifies a tendency which will remain present in the future. A regularity is a phenomenon that we have observed, perhaps on numerous occasions, where there is nothing but historical correlation to justify that it will continue. Chalmers argues (pp291-220) that *"causes and laws are intimately linked"* and it is laws (and not regularities) that can be relied upon to apply in out-of-sample periods:

> *"Once the assumption is made that entities in the world are what they are by virtue of the powers and capacities they possess, and I claim that that assumption is implicit in scientific practice as well as everyday life, then the laws describing those powers and capacities, identified in experimental situations, can be presumed to apply outside of those situations too."*

Therefore, if we are to adopt a method of forecasting which assumes a link between equity returns and inflation, we first need to establish a causal link. Unfortunately, conducting experiments to establish laws of nature is not possible in capital markets in the same way that experimentation can be conducted in (say) physics. In capital markets we do not have the luxury of holding all but one variable constant while we examine the effect of changing the one variable in which we interested, nor do we have the facility to repeat history with (say) a

different level of inflation. The best we can hope for is historical data where one potential causal factor (eg inflation) is absent or abnormally high and other causal factors (eg investor behaviour, real GDP growth) are stable. Even then, we are limited to confirmation of a regularity, not a cause.

Observing that stock returns have exceeded inflation in the past, even if the statistical evidence passes the most exhaustive goodness-of-fit tests, only establishes a link between inflation and stock prices as a regularity - not a law of nature. The argument that company earnings and dividends are real rather than monetary in nature, if it is true, identifies the cause necessary to link long-term stock returns and inflation as a law of nature. We therefore need to carefully clarify the real or monetary nature of company profits. Such an analysis needs to be independent of historical time-series data because standard analysis of such data usually makes assumptions (eg statistical independence) that may be relevant to the way the data is interpreted.

Similarly historical studies suggest an equity premium as a statistical regularity. If we can establish that the equity premium is caused by "risk-averse" behaviour of investors, then the equity premium becomes a law of nature. There is a great deal at stake in the "equity premium puzzle" posed by Mehra and Prescott (1985), because it challenges the causal nature of the equity premium and the ontological question as to whether the equity premium really exists (ie as a law of nature) is far from resolved. This is discussed in more detail in section 3.

It is not possible, here, to adequately cover the general philosophical argument about causalism and the reader is referred to Chalmers (1999) as a starting point. A more substantial discussion appears in *"Causation and laws of nature"* edited by Sankey (1999). At a meeting of the UK Institute to debate the role of financial economics in actuarial investment work 15 years ago, Pemberton (1993, p408) said:

> *"A new orthodoxy within scientific methodology is causalism, which rejects Humean attempts to reduce causes to regularities, and insist [sic] that causes be taken seriously. We need causes and not just correlations. … This debate is not well known amongst actuaries - many of the ideas seem arcane to members of our profession …"*

The discussion which follows relies on the proposition that a model used to generate a reliable estimate of long-term *future* rates of return from equities must establish the cause(s) of any of its essential features. While historical data can be used to suggest suitable models, back-testing historical data without *independently* establishing causation is inadequate. (Perhaps we should not profess to be able to *"make financial sense of the future"* until the causes of relevant historical phenomena are identified.)

We may, for example, notice that historical long-term rates of inflation, increases in dividends and capital appreciation in stock prices have all averaged 4-6% per annum. Such an observation naturally suggests a possible link between dividend growth and inflation but this evidence is only circumstantial. If dividends have historically grown at 4-6% per annum for other reasons, they may continue to do so, irrespective of what happens to inflation in future. If, however, we can establish a causal link between inflation and dividend growth, then we have every reason to believe that 10% annual inflation will be accompanied by a similar growth in dividends and we can confidently build such an assumption into a forecasting model or investment policy.

Similarly, if risk averse behaviour causes equities to be priced at levels which ensure a premium over bond returns, then we have every reason to believe that such a premium will continue unless there is a change in investor behaviour. However, if the historical equity

premium is due to other factors, then these factors - and not investor behaviour - will determine the future performance of equities relative to cash and/or bonds.

Whether the equity premium is due to risk-aversion and/or whether there is a direct link between inflation and stock returns are therefore questions of the utmost importance when it comes to producing reliable long-term forecasts of future equity returns. The question of the inflation link becomes even more important where equities are held as inflation matching assets in defined benefit pension funds. If there is a causal link then errors in forecasting future inflation on one side of the balance sheet will be compensated by a corresponding error on the other side. If there is no causal link then it is quite speculative to invest in equities as a long-term hedge against inflation because this strategy relies on historical regularities.

3 The equity premium: law or regularity?

The equity risk premium (broadly speaking, the extent to which stocks outperform bonds) has attracted a considerable amount of research interest since the appearance of the well-known paper by Mehra and Prescott (1985) entitled *"The equity premium: a puzzle"*. This paper challenged the generally accepted justification for the existence of the equity premium – that it was caused by risk averse investor behaviour - on the grounds that the historical level of the equity premium was too large to be explained by risk aversion.

In a retrospective review of research published since their 1985 paper, Mehra and Prescott (2003, p911) reflected on their formulation of what has become known as the equity premium puzzle:

> *" ... standard theory is consistent with our notion of risk that, on average, stocks should earn more than bonds. The puzzle arises from the fact that the quantitative predictions of the theory are an order of magnitude different from what has been historically documented."*

There have been two relatively recent reviews of the subsequent research into this puzzle – Mehra and Prescott (2003) and Derrig and Orr (2004). These reviews were written for slightly different audiences - respectively academic financial economists and practicing actuaries - but they essentially agreed on two crucial observations:

(a) the equity premium puzzle has not been solved 20 years after its formulation, and

(b) widely diverging estimates of the prospective (or *ex ante*) equity premium are being published in respected journals.

Both of these points are important matters if we are making estimates of total return that involve the equity premium as a building block.

The importance of failing to identify causation was not lost on Mehra and Prescott (2003) in their retrospective review of academic research. They conceded (p911) that failure to establish a causal link between investor behaviour and the equity premium would render invalid some of the central paradigms of financial economics:

> *"The [equity premium] puzzle cannot be dismissed lightly because much of our economic intuition is based on the very class of models that fall short so dramatically when compared to financial data. It underscores the failure of paradigms central to financial and economic modeling to capture the characteristic that appears to make stocks comparatively so risky. Hence the viability of using this class of models for any assessment ... is thrown open to question."*

Mehra and Prescott (p921) then seemed ready to concede that the causal relationship, which has been taken as self-evident for so long, may not exist:

> *"The difficulty that, collectively, several model classes have had in explaining the equity premium as a compensation for bearing risk leads us to conclude that perhaps it is **not** a 'risk premium' but rather due to other factors."*

Another review of the equity premium research that adopts a slightly different perspective was written for the actuarial profession by Derrig and Orr (2004). They observe (p47) that research into the cause and/or size of the equity premium seems to have been proceeding on two fronts. First, there is an attempt to explain the size of the historical premium in terms of *"new models and different assumptions about investors"*. This research is essentially looking

for a causal explanation based on factors such as borrowing constraints, taxes and liquidity preference as well as risk-aversion.

On the second research front, there is a concerted effort to obtain *"estimates of the [equity risk premium] that are derived from historical data and/or standard economic models."* This research is concerned with future levels (or *ex-ante* estimates) of the equity premium. Authors of texts and academic papers advocate and/or explore a variety of methods. Some estimates are simply adjusted values based on the historical record which, more or less, retain the concept of the equity premium as a law of nature. For example, Brealey and Myers (2003 pp157-160) suggested estimates based on the historical record with some adjustments to allow for identified changes in circumstances. They concluded *"we believe that a range of 6 to 8.5% is reasonable for the United States"*.

The approaches in the literature surveyed by Derrig and Orr seem consistent with the conclusions of Mehra and Prescott (2003) who, having acknowledged that the equity premium may not be a *"risk"* premium then argue that *"a span of 100 years is a long series when it comes to economic data … over the long-term the equity premium is likely to be similar to what it has been in the past"*. In terms of any debate over whether the equity premium is a law of nature or a regularity, Mehra and Prescott suggest, in effect, that in the absence of a *"plausible explanation as to why the future is likely to be any different from the past"*, we have sufficient supporting data to assume that the equity premium will continue as a reliable regularity, even if it is not a law of nature.

If philosophers of science such as Chalmers are correct in suggesting that regularities cannot be assumed to repeat themselves in out-of-sample periods it is quite significant that some people are beginning to suggest that the equity premium is not a law of nature. For example, Derrig and Orr acknowledge: *"No simple model of the [equity risk premium] has been universally accepted."*

If the premium is a law of nature then the historical record is a valid method of estimating future values with or without minor adjustment. On the other hand, estimates close to Ritter's *"defensible number"* of 1% per annum often use methodology that is independent of the historical record – thereby abandoning any pretence that the equity premium is a law of nature. At the very least, some of these approaches to estimating the *ex-ante* equity risk premium demonstrate a lack of faith in basing future estimates on the assumption that risk-averse investor behaviour will continue and that this behaviour causes the equity premium. The mere publication and debate over such *ex-ante* estimates demonstrates widespread acceptance of Mehra and Prescott's conclusion that the equity premium may not be a risk premium after all.

A second aspect of this debate is evident in the methodology used to derive some of the *"forward looking"* estimates of the future equity premium. The justification that is often given for *ex-ante* estimates differing significantly from the historical record has a significant bearing on market efficiency in both weak and semi-strong forms. Implicitly or explicitly, some of these justifications accept the idea that hindsight is no longer required to assess markets as high or low. This judgement can be based on *"fundamentals"* or some sort of mean reversion following either a substantial rise or fall in the stock market. Consider, for example, this argument from Mehra and Prescott (2003, p927):

> *" .. 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."*

To retain the concept of the equity premium, are financial economists prepared to concede the truth of phenomena that are inconsistent with market efficiency as well as a future "risk" premium that no longer has anything to do with risk?

The argument that low markets are associated with high equity premiums and vice-versa illustrates yet another feature of regularities, as distinct from laws of nature. With statistical regularities, we do not know the direction of the causation. Has the equity premium fallen because markets have risen or have markets risen because the equity premium has fallen? If, however, we are dealing with a causal relationship, changes in outcomes naturally follow from changes in the causal variable, but not the other way around. To use the example cited by Chalmers (p215): "[if smoking causes lung cancer] *we can hope to decrease the occurrence of lung cancer by eliminating smoking but cannot hope to combat smoking by finding a cure for cancer."*

Notwithstanding the debate about the cause of the equity premium and, perhaps without noticing that many *ex-ante* estimates have deserted the equity premium as a law of nature, it still seems common practice to simply assume that the equity premium exists as some sort of market price of risk even if *ex-ante* estimation is extremely difficult. For example, Derrig and Orr (2004, p45) observe:

> *"the equity risk premium (ERP) is an essential building block of the market value of risk. ... Risky discount rates, asset allocation models and project costs of capital are common actuarial uses of ERP as a benchmark rate".*

Similarly Brealey and Myers (2003, p157) imply that the future value of the equity premium, while difficult to estimate, remains a law of nature because it will still be determined by the reward for bearing risk required by portfolio investors. As a law of nature, caused by risk aversion, it is difficult to make *ex-ante* estimates because we do not know if the future risk-averse behaviour of investors will be different from what has been observed in the past:

> *"Even with 75 years of data we can't estimate the risk premium exactly, nor can we be sure that investors are demanding the same reward for risk as they were 60 or 70 years ago."*

The implicit assumption that the equity premium exists, and its widespread adoption in a variety of situations, seems to ignore the fact that the crucial ontological question - *does the equity risk premium exist as a reward for risk?* - is far from resolved. Two recent surveys of published academic and practitioner research by Mehra and Prescott (2003) and Derrig and Orr (2004) demonstrate very deep and fundamental disagreement about both the causes and level of the equity premium.

4 Dividend growth rates.

If we solve a mathematical equation linking the current price of a stock or index level to the discounted present value of all future dividends we obtain an estimate of the very long-term return achieved by a buy-and-hold investor. As a rough rule of thumb, the total return is equal to the current dividend yield plus an assumed dividend growth rate. This formula may need slight adjustments for the timing of dividend payments, whether the dividend yield is historical, current or prospective, etc.

The main difficulty in applying this formula lies in obtaining a reliable forecast of future long-term dividend growth. There have been four basic approaches to this problem and the debate between regularity and causality lurks below the surface. There are significant differences of opinion as to the causes of growth in company earnings and dividends.

One approach to estimating future dividend growth is to assume that dividends will grow in parity with nominal GDP. A second approach is to assume that earnings and dividends are more or less constant in real terms and simply grow with inflation. These two approaches seem to be the most common. However, Graham (1973) argued that the retention of earnings, and not inflation, was the underlying driver of growth in earnings (and presumably therefore dividends) in the constituents of the Dow Jones index. Excluding its stochastic features, the UK Maturity Guarantees Working Party (1980) model assumed a constant rate of growth with this parameter based on the historical record.

If dividends remain a roughly constant proportion of GDP, then they grow with both inflation and real growth in GDP. From the perspective of the economist trying to forecast tax revenues, the "GDP parity" assumption may be quite sound. However, the perspective of the portfolio investor is quite different. Even if dividends do maintain approximate parity with GDP at a national economic level, assuming portfolio investors enjoy the same rate of growth in dividend income ignores the fact that investors in stocks have to pay cash for any new shares created and an adjustment is required. If investors do not take up a pro-rata entitlement of all new shares as they become available, then their share of underlying profits and dividend income will decline relative to GDP. To quote Bernstein and Arnott (2003, p48)

> *"The problem with this assumption [that stock prices grow with GDP] is that per share earnings and dividends keep up with GDP* ***only*** *if no new shares are created."*
>
> (Whether discussing individual companies or indices, earnings and dividends adjusted for the issue of new shares are generally described as *per-share* earnings and dividends.)

Bernstein and Arnott compare earnings growth with GDP growth in a number of countries over the 20th century based on the data appearing in Dimson et al (2002). They reported that there had been an average dilution, compared to GDP, of 2.3% per annum in *"non-war-torn"* countries and 4.1% in *"war-torn"* countries. Bernstein and Arnott also note that this dilution of 2.3% per annum corresponds with the "*net new share issuance*" in the US over the period 1926-2001 which they estimate by comparing growth in market capitalisation with changes in stock price indices. Bernstein and Arnott conclude that:

> *"In stable nations, a roughly 2 percent net annual creation of new shares – the Two Percent Dilution – leads to a separation between long-term economic growth and long term-growth in dividends per share, earnings per share, and share price."*

So, any estimate of long-term future stock returns that assumes dividends, earnings and stock prices will maintain parity with GDP must allow for the dilution effect of net share issuance

which, according to the historical record, has been approximately 2% per annum in countries not seriously affected by war. Why then has this dilution averaged 2% per annum?

One possibility is that GDP grows in real terms whereas it is often claimed, at least implicitly, that we should expect companies to simply sustain their earnings (and dividends) in real terms. This was the assumption behind Wilkie's model and also the model of Yakoubov *et al*. However, this view is not confined to the actuarial profession. For example, the argument that companies should be expected to sustain their earnings in real terms is implicit in the remarks of Ritter (2002, p165):

> *"Adjusted for business cycle effects, the earnings yield on stocks is an estimate of the real return on stocks. The earnings yield is not an estimate of the expected nominal return on stocks."*

In his calculation of price/adjusted 10-year earnings ratios in *Irrational Exuberance*, Shiller (2000, p7), used *"the ten-year average of real earnings for the denominator, along the lines proposed by Benjamin Graham and David Dodd in 1934."* Thus, Shiller's calculations contained an adjustment for inflation only, not GDP parity. Although not discussed, this method of calculation therefore involved the implicit assumption that sustainable earnings per share (ie adjusted for the net issue of new shares) could be estimated from a 10-year average of earnings per share adjusted for inflation only without allowing for any extra growth.

The reason behind the common assertion that company earnings, dividends and share prices should grow with inflation in the long-term is not always clear. However, there appears to be a "common sense" view that company earnings and dividends are real in nature, in much the same way that operating costs such as wages and raw materials are also real. Consider, for example, the following recollection of Marshall (2004) in *The Actuary*:

> *"The letter from [a previous correspondent] presents a challenge to those of us who argued nearly 40 years ago that the natural home for pension fund assets was in equities. … in my case, this was … based on the sound actuarial basis of matching in the belief, supported by common sense and history, that incomes and dividends would be correlated as closely as is as likely between a monotonic and a cyclical series."*

Benjamin Graham, however, (1973, p21) had very different ideas about the cause of growth of per-share earnings (and therefore also dividends and stock prices in the long-term). He went to some length to point out that the growth in per-share earnings of the constituents of Dow Jones Industrial Averages over the period 1950-1970 were due to retained profits increasing shareholders' equity and that inflation was not a factor:

> *" … all the large gain in the earnings of the DJIA unit in the past 20 years was due to a proportionately large growth of invested capital coming from re-invested profits. … The only way that inflation can add to common stock values is by raising the rate of earnings on capital investment. On the basis of the past record this has not been the case".*

At the discussion of the Wilkie model, Plymen (1986, pp390-391) echoed one of Graham's comments when he said:

> *" .. Surely the whole point of the concept of the equity method of financing is that dividends are distributed much below the earnings, every year there is a certain amount of plough-back which surely earns a reasonable rate of return and builds up the underlying strength of the business and makes for higher dividends in future."*

Notwithstanding the inclusion of basic accounting in the actuarial education system, the retention of profits is not often recognised as relevant to the growth of earnings, dividends and, in the long-term, stock prices. In this respect the report of the UK Maturity Guarantees Working Party (1980, p143) is very interesting:

> *"It is clear that dividends and company earnings, on which they depend, are expressed in money terms and, other things being equal, should rise pari passu with other prices. Experience however has not borne this out. There is some correlation … the combination of irregular inflation and an irregular influence of inflation on dividends leads to the same stochastic model for dividends as we have chosen."*

We note the preconceived belief that dividends and earnings are real in nature, acknowledgement that this is not supported by *"experience"*, no mention of retained profits and no causal explanation for the dividend growth component of the Maturity Guarantees Working Party model other than a very indirect link with inflation.

We can discard the GDP parity approach for projecting dividend income on the ground that it does not allow for new share issues (net of buy-backs) and that the *"two per-cent dilution"* suggested by Bernstein and Arnott is a regularity. This shortcoming was evident in all countries with established stock markets in the 20th century.

This leaves us with two potential causal factors for long-term dividend growth - inflation and retained profits. The available historical data is not much help in clarifying this matter. In Australia, there are serious doubts about the accuracy of dividend data available before 1980. (It is now believed that frequently cited historical studies in Australia have overstated total return and the equity premium by approximately 2% per annum. See Fitzherbert, 2006 and Brailsford *et al*, 2007.)

Nevertheless with a long enough time frame we can use historical price index data to estimate historical dividend growth because, over a very long period, growth in dividends, earnings and stock prices should be roughly the same. Over 100 years a change in dividend yields by a factor of 1.5 would lead to a difference of 0.4% between dividend growth and capital appreciation. (If the dividend yield underlying a market index increases from 4% to 6% over 100 years the rate of capital appreciation would be 0.4% per annum less than would have been the case if the dividend yield had been the same at the beginning and end of the period under review. If the dividend yield falls from 4% to 2.67%, the rate of capital appreciation would be 0.4% per annum more.) In Australia at least, historical stock price index data extending back 100 years seems more reliable than earnings or dividend data over this period. We therefore take stock price growth as a rough indicator of dividend growth and compare this with inflation over the 20th century as shown in Table 2 for the US, the UK and Australia. These figures were calculated from data given in Dimson *et al* (2002).

Table 2

Share Price index growth 1900-2000 (logarithmic)

	Australia (% pa)	*UK (% pa)*	*USA (%pa)*
Capital growth	5.8	5.0	5.3
Inflation	4.0	4.0	3.1

In these three countries, we see that capital growth, and therefore dividend growth over this 100 year period, has at least matched inflation, suggesting that there may be some additional

benefit from retained profits or real economic growth. This presents us with one possible explanation for long-term dividend growth - inflation plus some benefit from retained profits and/or real economic growth. An alternative explanation is that long-term growth in earnings and dividends (and therefore share prices) is driven by retained company earnings of 4-6% per annum of shareholders' equity, possibly with some additional benefit from inflation or real economic growth. (The available data on retained earnings over this extended historical period is very limited, except for some US data.)

Insofar as deciding whether long-term growth in share prices (and therefore dividends and earnings) is driven by inflation, economic growth or retained profits, the available historical data is therefore capable of a multitude of plausible interpretations. Perhaps, however, we should note that the effects of retained profits of 4-6% per annum of shareholders' equity and inflation cannot be additive to their full extent. If they were, then the long-term rate of growth of earnings (and in consequence dividends and stock prices) over the 20th century in these three countries would have been approximately 8-10% per annum rather than 5-6% per annum.

However, even if the historical evidence were less ambiguous any relationship remains a regularity rather than a law of nature. To devise a valid model of the future, we still need to establish causation. Having done so, it will be evident that retained profits is the only direct cause of long-term growth in the underlying per-share earnings of a market index portfolio when historical cost accounting prevails. Inflation is only a factor to the extent that it possibly leads to a higher return on shareholders' equity (thereby also increasing retained earnings as a percentage of shareholders' equity) or that historical cost accounting is not strictly followed.

5 The nature of company profits: real income or monetary income?

Stock indices such as the ASX All Ordinaries are carefully adjusted to eliminate the effect of net share issues. A similar adjustment needs to be made when dividends or earnings are modelled as part of a process for deriving long-term stock returns. The argument that *per-share* earnings (ie company profits after adjustment for the issue of new shares) can only grow in the long-term from retained profits directly contradicts the widely-held view that company capital is predominantly held in real assets and, in consequence, company profits can also grow with inflation without any additional equity capital. If, on the other hand some profits are retained and company capital is held in real assets, then company profits should grow in the long-term with both inflation and retained profits. In Australia, the UK and the US, the available data suggests the rate of long-term growth is considerably less than the combined potential impact of both inflation and partial profit retention.

A possible answer to this riddle lies in the almost universal adoption of the historical cost accounting convention. This convention ensures that the money value (and not the real value) of shareholders' equity is maintained before counting the surplus as profit. In other words, companies may invest in real assets but, as a general rule, their financial statements treat real assets as monetary ones. (There have been some exceptions in Australia and the UK, notably some permanent fixed assets such as trademarks, land and intangibles that are bona-fide *real* assets – but not depreciable plant and equipment.)

Here is a simplified example: a small consulting firm issues $100,000 in shares to its directors to fit out a small office; the directors pay all of the profits to themselves and they depreciate the cost of the fit-out over the terms of the lease and do not buy any more assets. Their initial balance sheet would then be:

Balance sheet at commencement of lease

Liabilities		Assets	
Shareholders' equity	$100,000	Fixed assets	$100,000

As they depreciate their fit-out over the term of the lease, their fixed assets at the end of the lease will be zero, but their equity will still be $100,000 and this will now be in cash. So the firm's balance sheet at the end of the lease will be:

Balance sheet at conclusion of lease

Liabilities		Assets	
Shareholders' equity	$100,000	Fixed assets	Nil
		Cash	$100,000

If, say, this fit-out had a terminal value greater than zero and the assets were sold, this would give rise to a profit which would appear in the profit and loss account, not the balance sheet. Consequently any benefit from inflation in relation to depreciable fixed assets will appear in reported earnings where it will be reflected in the reported return on shareholders' equity.

While this illustration relates to just one simplified example, company accounts show the combination of a number of individual assets for which the same argument applies. Consequently the argument that historical cost accounting preserves the monetary value (and not the real value) of depreciable plant in company balance sheets applies quite generally.

A second class of real assets treated as monetary ones under historical cost accounting is inventories of finished and partly finished goods. To illustrate this argument we revert again to a simplified example. Suppose a company manufactures "widgets" and does not retain any profits. It starts the year with $100 in shareholders' equity which has been spent buying raw materials. The completed goods are sold at $120. In relation to this line of business, its opening balance sheet will show $100 of inventory and $100 of shareholders' equity. Its profit will be $20 which is paid in taxes and dividends. Once the goods are sold and profits are distributed $100 in equity will remain – irrespective of the rate of inflation. If the cost of raw materials has risen, the company will need to borrow or raise additional equity for the next cycle. However, the ability of companies to increase debt is constrained by gearing ratios and, sooner or later, additional equity will be required.

If we now consider the company's balance sheet at two times - at the start of the manufacturing cycle and after the goods are sold and profits are distributed, then we see (as with depreciable plant) that it is only the money value of shareholders' equity that is maintained.

Balance sheet at commencement of "widget" cycle

Liabilities		Assets	
Shareholders' equity	$100	Inventories	$100

Balance sheet at conclusion of cycle

Liabilities		Assets	
Shareholders' equity	$100	Inventories	Nil
		Cash	$100

These two examples can be criticised as oversimplifications that ignore debt finance. As far as oversimplification is concerned company operations are the combination of very large numbers of such simple transactions, which can be added together and the oversimplification does not invalidate the argument that can be made from such micro-transactions. The additional complication of debt, or cash balances, merely adds fixed monetary assets to one or both sides of a balance sheet and does not alter the proposition that shareholders' equity is accounted for in money terms.

When historical cost accounting applies to all company assets and liabilities, inflation is not a factor and it is fairly straightforward to show that given a constant return on shareholders' equity and a constant proportion of profits paid in dividends, then per share earnings, dividends and shareholders' equity should all increase at the same rate calculated from the retained proportion of return on shareholders' equity. A demonstration of this growth rate formula appears in Hemsted (1962). Where historical cost accounting is strictly applied, this growth rate should apply, irrespective of the rate of inflation.

In both Australia and the UK in much of the 20th century, the application of the historical cost accounting convention was modified in relation to permanent fixed assets such as land and buildings. These assets were periodically written-up in company balance sheets and the consequent changes in asset values were treated as an "abnormal" or "extraordinary" item and excluded from the normal profit calculation. This has been less prevalent in the USA where the historical cost convention has been more rigidly applied. Another issue with both Australia and the UK is the limited availability of return on shareholders' equity data.

In more recent times, historical financial data has become more complicated by the distribution of profits in share buy-backs in lieu of dividends, the telecom-media-technology bubble and the historically high levels of return on shareholders' equity. It is difficult to place a precise date on these developments, but restricting the period to 1920-1989 should avoid these issues in US data.

The data shown in Table 3 has been copied and calculated from data that appeared in Value-Line (1990) relating to the Dow Jones Industrial Average over the period 1920-1989. Return on book value (as shareholders' equity is often called by US security analysts) and payout ratios both fluctuate from year to year. What we require is an estimate of the retained profits as a percentage of shareholders equity for which there is no perfect method of calculation. Given the wide variation in pay-out ratios, the product of (1 minus average payout-ratio) and average return-on-book-value seems prone to error. From the average earnings and dividend yields of 7.8% and 4.7% respectively we can indirectly estimate an average payout ratio of 4.7 ÷ 7.8 or 60%, so that roughly 40% of earnings were retained over this period. The average *"return on book value"* was 11.6%, so the average value of retained earnings as a percentage of shareholders' equity was 11.6% × 40% or 4.6% per annum.

If earnings growth in the long-term is driven by retained profits, then the long-term rate of growth of earnings over the period 1920-1989 should therefore have been approximately 4.6% per annum. As can be seen from Table 3, this is more or less what happened.

Table 3
Growth in per share values of Dow Jones Industrial Averages
Earnings, Book value and Dividends 1920-1989

DJIA	1920	1989	Compound Growth rate (% pa)
Book value	48.2	1206	4.8
Earnings	9.1	224	4.8
Dividends	5.8	103	4.3
DJIA average	90	2510	4.9

When considering stock price returns over any period, the question of changes in the market valuation of earnings needs to be considered. However, the price/earnings ratio at the beginning and end of this period were roughly the same. As already noted, this observation also applies to return on book-value. Consequently the average compound rate of growth of per-share earnings, book value (ie shareholders' equity) and the index were all roughly the same and what we would expect from growth was driven by the retention of earnings.

It could, of course, be argued that the dividend growth rate of 4.3% per annum is also consistent with GDP parity or inflation assuming no added benefit from retained profits. This argument is contradicted by Hemsted's elementary demonstration of what happens under historical cost accounting. It is impossible for company profits not to grow in the long-run from the partial ploughback of profits unless return-on-shareholders'-equity tends to zero. Also, there is a stunning counter-example to this criticism in the history of Berkshire Hathaway Inc over the period 1964-2005. With minor exceptions, Berkshire Hathaway has not issued nor repurchased any of its stock, nor has it paid dividends. This simplifies our calculations because all of its return on shareholders' equity has been reinvested and we do not need to worry about the difference between *per-share* data and unadjusted data. It also follows that the average rate of growth of "book-value" should be approximately the same as average return on book-value.

If long-term growth in earnings is due to inflation, then we would expect earnings growth to be around 4% per annum. However, if growth is due retained profits then the historical growth in earnings and the company's stock price (assuming roughly comparable price/earnings ratios as the beginning and end of the study period) should be commensurate with the average return on its shareholders' equity, which can be estimated from the average increase in per-share book value of 21.5% per annum. (Berkshire Hathaway, 2006 p2.) After allowing for the effect of a modest re-rating of the company over 41 years (as shown in an improvement in the company's price/book ratio), the total return, as a stock investment, has been 23% per annum. This rate of capital appreciation makes some sense in relation to the likely level of return on shareholders' equity achieved by this company, but it is not in the same ball-park as the rate of inflation.

These case studies, the Dow-Jones constituents over the period 1920-1989 and Berkshire Hathaway over the period 1964-2005 relate to situations where the historical cost convention is applied. The data is consistent with the argument which follows directly from historical cost accounting and fluctuating return-on-shareholders'-equity that long-term growth in *per-share* earnings is caused by the retention of profits. The data is inconsistent with the idea that inflation is an additional or substitute causal factor. The reason that inflation is not directly relevant is the widespread adoption of the historical cost accounting convention.

We now consider the opposite case where there is negligible retention of profits, shareholders' equity is predominantly invested in income producing real property and historical cost accounting has been modified to the extent these real assets are treated as real items in balance sheets.

Subject to cyclical fluctuations and the deterioration of buildings with age (and the rentals they can command), we should therefore expect the underlying *per-share* distributable income of the ASX Listed Property Trust index portfolio to move with inflation. As a general rule, this is real income because the changing values of the underlying assets have, in the past, been written up in balance sheets as extraordinary items and not distributed as profit. This is beginning to change as these trust units become "stapled" to management companies or development arms and tax rules make it beneficial to distribute realised capital gains; but for most of the period since inception of the ASX indices in 1979, the historical cost accounting convention has been modified to preserve the underlying nature of their property assets in the accounting treatment of unitholders' equity. If a building were revalued upwards by (say) $10 million, this bypassed the income statement and unitholders' equity increased by the same amount. (It is only fairly recently that realised capital gains have been distributed to unitholders.)

From these accounting considerations we would therefore expect to see growth in income and capital values from inflation alone, provided the underlying capital values were reflected in unit prices and the underlying rentals maintained some parity with inflation. As the data shown in Table 4 demonstrates, this is more or less what has happened. (Although the 26 year growth rates are calculated correct to one basis point, the closeness of the results is probably accidental and we should not read too much into this close correspondence beyond support for the general argument that inflation is the main cause of long-term growth in income and the two growth rates should be roughly the same.)

Table 4
ASX Listed Property Trusts 1980-2006 (S&P 200 since 2002)

Date	31/12/79	31/12/80	31/12/05	31/12/06	26 year growth rate
Price index	500	491.7	1931.9	2431.0	
Accumulation index	1000	1064.2	31876.8	42725.7	
CPI (June quarter)	47.0		154.3		4.68% pa
Index portfolio income distributions	41.6		137.8		4.71% pa

(To calculate the income derived in 1980 from an investment of 500 on 31/12/1979 we use the accumulation indices to calculate that the index portfolio, with income reinvested, would have grown to 500 × 1064.2 ÷ 1000 = 532.1 compared to 491.7 without income reinvested giving an income of 40.4. This calculation assumes all income accrues on the last day of the year which can be inaccurate when there have been significant changes in levels, as in 2006. The results shown in Table 4 are derived by the same method using month-end indices for greater accuracy.)

Based on the nature of accounting, we argue that the nature of business income, whether real, monetary or a mixture of real and monetary, depends on the prevailing accounting conventions and the proportion of a balance sheet held in permanent real assets. Historical cost accounting, when strictly applied, measures money income not real income. If there are retained profits, long-term per-share profits and dividends will rise as an inevitable consequence of such profit retention. Whether there is any additional benefit from inflation depends on the proportion of the balance sheet invested in real assets **and** the way accounting conventions are applied.

6 The shareholders' equity framework.

We now consider, in more detail, the shareholders' equity framework for estimating long-term equity returns. An early formulation was published by Hemsted (1962) who showed that with a constant return on shareholders' equity and a constant payout ratio, the very long-term buy-and-hold return achieved by an investor was equal to the dividend yield at the time of purchase plus the rate of growth of dividends. This growth rate was determined by retained profits in relation to shareholders' funds. Hemsted was interested in individual companies, whereas we are concerned here with an asset class or market index portfolio.

Return on shareholders' equity, as reported by listed companies, is normally defined as the net profit after tax divided by *average* shareholders' equity. Hemsted, on the other hand, simplified his algebra by defining a variable he called ***PR*** as net profit divided by shareholders' equity at the *beginning* of the year. Also, if we are to develop a more sophisticated model, we need values for the key variables that can change from year to year. Most dividend discount models, of which Hemsted's algebra is an example, assume indefinite retention of a portfolio. If we wish to calculate an *n- period* return, we also need a method of calculating market values from projected values of dividends, earnings or shareholders' equity. (By *n-period return*, we mean the internal rate of return assuming disposal at time *n* including dividend income.)

The shareholders' equity framework, extended to provide estimates of *n- period* returns, requires four basic ideas, equations or procedures:

(i) We begin with the so-called *accounting equation* which says that shareholders' equity at the end of a year is equal to shareholders' equity at the beginning of the year plus profits earned during the year less dividends paid (or provided for) out of these profits:

$$ShEq_t = ShEq_{t-1} + NPAT_t - D_t$$

where $ShEq_t$ is the total shareholders' equity of the constituents of the market portfolio at time t, $NPAT_t$ is the total after tax profits of all companies in the portfolio in the time interval $(t-1, t)$ and D_t is the total dividends paid or provided for from these profits. This equation assumes, for the time being, that there are no capital transactions or balance sheet adjustments that do not pass through profit and loss accounts.

With half-yearly company reporting, as is normal in Australia, roughly equal half-yearly dividends tend to be paid approximately three months after the end of each six-monthly financial reporting period. It follows that approximately $0.5 \times D_t$ will be paid at $t - 0.25$ and $t + 0.25$. Consequently it is reasonably accurate to assume that all of the dividends due in respect of profits earned in a financial year are paid at the end of the year, ie that D_t will be paid at time t. (A slightly different assumption may be required where dividends are not normally paid half-yearly - for example in the USA where dividends are normally paid quarterly.)

(ii) We recognise *return on shareholders' equity* as an important causal variable:

As noted, companies normally calculate their return on shareholders' equity by dividing their net profit by their average shareholders' equity. However, under the

shareholders' equity framework, return on shareholders' equity is a key causal variable, consequently, the total net profit after tax (***NPAT***) of all companies in the market index portfolio is the product of the return on shareholders' equity of the "market" portfolio (***RoSe***) and the average shareholders' equity:

$$NPAT_t = RoSe_t \times 0.5 \times \left(ShEq_{t-1} + ShEq_t \right)$$

where the subscripted vales for ***NPAT*** and ***RoSe*** relate to their values over the time interval between ***t - 1*** and ***t***.

(iii) We need an algorithm for determining dividends:

When companies report their profits they normally also declare their dividends. The percentage of profit distributed in dividends is usually called the *pay-out* ratio. Traditionally, payout-ratios have been around 60%; however companies often maintain dividends when they have incurred losses and do not necessarily increase their dividends when the have just *"had a very good year"*. Consequently, if earnings fluctuate (as they should in a stochastic model), there is a need for an algorithm for projecting dividends rather than the application of a fixed payout ratio of (say) 60%. (It is for this reason that Yakoubov *el al* preferred to base their stochastic model on a projection of earnings rather than dividends to avoid what they described as *"smoothing by company management"*.)

If the payout ratio is assumed to be constant over time at PoR then it can be shown that:

$$ShEq_t = ShEq_{t-1} \times \frac{\left\{1 + 0.5 \times RoSe_t \times \left(1 - PoR\right)\right\}}{\left\{1 - 0.5 \times RoSe_t \times \left(1 - PoR\right)\right\}}$$

$$NPAT_t = RoSe_t \times 0.5 \times \left(ShEq_{t-1} + ShEq_t \right), \text{ and}$$

$$D_t = PoR \times NPAT_t$$

(iv) For finite ***n***-*period* time-frames, we also need a method for estimating market value at time ***n***.

The shareholders' equity framework provides a method for projecting earnings, dividends and shareholders' equity for the market index portfolio. Any of these three variables can be used to generate a market value and the values of this pricing mechanism can be a stochastic process. For example, the UK Maturity Guarantees Working Party (1980) projected dividends as a stochastic model and generated market prices using a dividend yield. The logarithm of the dividend yield was modelled using a first order autoregressive process.

If we decide to use a price/book ratio for the purpose of generating market values, then we now define an aggregate price/book ratio as $PB_t = MV_t / ShEq_t$ where MV_t is the total capitalization of all companies in the market index portfolio at t and $ShEq_t$ is the total shareholders' equity of the same companies. To complete the estimation of an ***n***-*period* asset class return under the shareholders' equity framework we need the initial price/book ratio PB_0 and algorithms or stochastic models for projecting the following items:

(a) the return on shareholders' equity for the period ($t-1$, t), $RoSe_t$ for values of $t = 1, 2 \ldots n$:

(b) the price/book ratio at time n, PB_n, and

(c) the total dividends paid in respect of the period ($t-1$, t), D_t (assumed payable at time t) for values of $t = 1, 2 \ldots n$. (In an Australian context where half-yearly dividends are standard practice, we can improve our calculations slightly by assuming that $0.5 \times D_0$ is paid just after time 0 and $0.5 \times D_n$ is paid just before time n.)

While we need a starting value for total shareholders' equity at time 0, $ShEq_0$, we are interested in rates of return rather than the dollar value of aggregate profits etc, so the results of our calculations do not depend on this number, which can be set to some convenient figure such as 1 or 100.

The basic accounting equation assumes that none of the constituent companies of the index portfolio issue or buy back any shares during this period. There is no completely satisfactory way of dealing with new issues or buybacks. This is a complex issue. If, as is usually the case, the price of new shares or buybacks is close to the market price then the value of such entitlements may be sufficiently small to ignore when modelling a "market" portfolio. As a first step in correcting this error the issue and repurchase of shares has therefore been ignored. This is not to deny that such transactions take place but, as a first step, the most suitable accounting framework adjustment is to ignore issues and buybacks on the grounds that this corresponds, reasonable closely, with the way stock market index portfolios are adjusted.

The acceptability of the basic accounting equation does not depend on companies not issuing or repurchasing shares, but the way the market index portfolio is adjusted to allow for these transactions. (What is wrong, implicit in the GDP parity argument, is to accept undiluted earnings figures and ignore the cost of new equity issues.)

The methodology described above projects accounting variables on the assumption that the historical cost accounting convention is strictly applied except for inflation induced revaluations of permanent fixed assets which, until recently, used to bypass the profit and loss account as abnormal or extraordinary items. When the resulting rate of return is calculated its units are those of the accounting system, which may be partly real. So, if the constituents of the market index portfolio hold (say) 10% of their stated shareholders' equity in genuinely real assets that are treated as real assets we need to recognise the resulting rate of return as 10% real and allow for 10% of the projected rate of inflation to obtain a final result.

The question of profits bypassing profit and loss accounts is a complex issue. Apart from the subtleties of the definitions, the rules determining the classification of profits have been inconsistent over time. Conceptually, we can rewrite the accounting equation:

$$ShEq_t = ShEq_{t-1} + NPAT_t + XPAT_t - D_t$$

where $NPAT_t$ denotes aggregate profits appearing in companies' profit and loss accounts and $XPAT_t$ represents after tax profits and other adjustments to asset values that are not included in $NPAT_t$. When the ASX indices commenced (in 1979), such adjustments to permanent asset values (both realised and unrealised) were often excluded from $NPAT_t$, but

this is no longer normally the case. In projecting the ASX All ordinaries index portfolio forward, therefore, this adjustment has not been taken into account, however care would be required in some specialised sectors.

7 Illustrative calculations.

A simple scenario approach is now used to produce illustrative 10 and 20 year total return estimates for the ASX All Ordinaries Index portfolio. The raw data is taken from the information provided by AspectHuntley which is readily accessible to registered customers of at least one online broker. These figures are used for illustrative purposes. While they are believed to be reliable, AspectHuntley (2004) emphasise that anyone " .. *acting on such information do[es] so entirely at their own risk".*

We establish initial values for return on shareholders' equity by dividing the market aggregate price/book ratio by the market aggregate price/earnings ratio. We also estimate the latest payout ratio as the product of the dividend yield and the price/earnings ratio. The raw data and the implied return on shareholders' equity and payout-ratios are shown in Table 5.

Table 5
Estimation of "initial conditions"

As at 30/6/2007	ASX All Ordinaries
Price/earnings ratio	18.01
Price/Book ratio	2.68
Dividend yield	3.4%
Initial RoSe	14.9%
Pay-out ratio	61%

Using these initial values and the equations shown in section 6, we now project shareholders' equity, dividends and terminal market values over 10 and 20 years under two different scenarios and then calculate the internal rate of return achieved by an investor buying at market levels ruling on 30 June 2007 and holding the index portfolio.

In *Scenario A* it is assumed that current levels of return on shareholders' equity continue and price/book ratios are the same in 10 or 20 years time as they are today. This scenario also implicitly assumes that the price/earnings ratios are the same in 10 or 20 years' time as they are today. Fluctuations in price/book or price/earnings ratios in the intervening period over the next 10 years or between 10 and 20 years do not affect these calculations.

In scenario B, we assume that return on shareholders' equity reverts to a more traditional level of 9% per annum for the ASX All Ordinaries Index portfolio over the next 5 years and that the price/book ratio reverts to 1.5. (This implicitly assumes a terminal price/earnings ratio of 16.7.)

In both scenarios, inflation is assumed at 3% per annum and the "real" content of the index portfolio is taken as 10%. Of less importance, these calculations assume a constant payout ratio throughout as calculated in Table 5. The resulting estimates of rates of return for 10 and 20 year holding periods are shown in Table 6.

Table 6
Estimated 10 and 20 year annualised rates of return

As at 30/6/2007	ASX All Ordinaries
Scenario A 10 or 20 years	9.6%
Scenario B 10 years 20 years	1.6% 4.1%

8 The relative merits of price/book and price/earnings ratios.

The use of price/book ratios in modelling usually attracts criticism on the grounds that the book value of shareholders' equity is just an accounting number relating to the historical cost of balance sheet items and is irrelevant. Also, a more widely accepted valuation yardstick is the price/earnings ratio. However, under the shareholders' equity framework models based on price/book and price/earnings ratios produce almost the same answer because the price/book ratio is equal to the price/earnings ratio multiplied by return on shareholders' equity and the ratio of average to year end shareholders' equity:

$$PB_t = \frac{MV_t}{ShEq_t} = \frac{MV_t}{NPAT_t} \times \frac{NPAT_t}{ShEq_t} = PE_t \times RoSe_t \times \frac{0.5 \times \left(ShEq_{t-1} + ShEq_t \right)}{ShEq_t}$$

where PE_t is the price/earnings ratio at time t. The final term in this formula will be close to one for an index portfolio, so that:

$$PB_t \approx PE_t \times RoSe_t$$

There are two further reasons for using price/book rather than price/earnings ratios in long-term equity return modelling, one practical, one theoretical. The practical reason involves calculating market prices when companies are making losses. This is rare in the case of index portfolios, but it has happened. In these circumstances price/earnings ratios based on negative earnings make no sense. However, it does make sense to say that when return-on-shareholders equity is zero, the market aggregate price/book ratio might be one.

The theoretical reason revolves around the prospect that, in more normal times, price/earnings ratios are likely to be positively correlated with return-on-shareholders' equity. If companies are "doing well", this seems likely to affects confidence and be reflected in market valuations of earnings (ie price/earnings ratios).

The use of price/book ratios (in conjunction with return-on-shareholders' equity) is an important improvement because it allows for both factors in estimating market values. For example, in the calculations for scenario B it has been implicitly assumed that if return-on-shareholders'-equity falls, then the price/earnings ratio will fall also. If there is a tendency for return-on-shareholders' equity to mean-revert, then rational informed investors should apply lower price/earnings ratios when return-on-shareholders'-equity is high and vice-versa. However, there is some evidence that instead of anticipating mean-reversion in return-on-shareholders'- equity, investors expect the opposite as Graham (1973, p320) noted many years ago:

> *"If, as many tests show, the earnings multiplier tends to increase with profitability – i.e., as the rate of return on book value increases, then the arithmetical consequence of this feature is that [market] value tends to increase directly as the square of the earnings .."*

Models based on price/earnings ratios (or dividend yields) therefore need to take return-on-shareholders'-equity (and consequently price/book ratios) into account. Consequently, when used in conjunction with return-on-shareholders'-equity, valuations based on price/book ratios indirectly incorporate the more normal yardstick of price/earnings ratios into the calculation.

There will be many instances where the use of price/book ratios makes no sense in relation to individual companies, particularly those who can reasonably expect to sustain a high level of

return on shareholders' equity. However, we are concerned here with modelling the index portfolio, not individual companies or industries.

Within the shareholders' equity framework, the most important variable in very long-term modelling is return-on-shareholders'-equity and, if using a stochastic model, the most important parameter is the mean average value for this variable. This is because $\boldsymbol{RoSe_t}$ determines the rate of growth of shareholders' equity as well as the level of earnings and dividends. When estimating returns over finite periods of (say) 10-20 years, return on shareholders' equity is also important because it seems likely to influence the way such earnings are priced by the market.

Another dimension of this question is that the book value of shareholders' equity ignores individual companies' *"brand value"* - the value of their businesses on an ongoing concern that is not reflected in their accounts. We could perhaps define the *"trade value"* of a company at time $\boldsymbol{t}$ as the sum of the book value of its shareholders' equity plus its "brand value":

$$\boldsymbol{TrV_t = BrV_t + ShEq_t}$$

Having done so, however, how do we adjust our calculations of growth rates, and how do we calculate *brand value* for an index portfolio objectively? If return-on-shareholders' equity is based on companies' *trade values*, rather than the book value of shareholders' equity, it would understate the per-share corporate growth unless it included the growth in brand value over time. Alternatively, we could argue that, adjusted for new share issues, shareholders' equity and *brand value* will tend to grow in parallel and that the correct way to allow for the rate of per-share growth in *brand value* as well as book-value is retained profits in relation to book-value. In any event, "strong brands" help companies (and other organisations) sell their goods and services profitably and are therefore reflected in return on shareholders' equity.

9 Discussion

The shareholders' equity framework.

As can be seen from the above formulation, there are four key unresolved issues with the shareholders' equity framework:

(a) what are the forces that determine return on shareholders' equity for the market index portfolio? Is ***RoSe*** a stationary process over time? What is its long-term mean, if it exists?

(b) how do market index valuations react to changes in return on shareholders' equity? Are return on shareholders' equity, price/earnings ratios and (in consequence) price/book ratios reacting in similar ways to the same economic and financial forces?

(c) how should the "accounting equation" be adjusted to allow for new shares and buybacks?

(d) how should we deal with changes in accounting rules, both in the future and when interpreting historical data?

As an illustration, the calculations in section 7 provide estimates of 10 and 20-year returns on two sets of assumptions: (i) that current levels of return on shareholders' equity and price/book ratios continue and (ii) that return on shareholders' equity and price/book ratios revert to historical norms over five years. It has been assumed that the adjustment to the accounting equation that corresponds with index construction is to ignore new issues and buybacks.

While we are hampered by the lack of quality historical data relating to return-on-shareholders' equity and corresponding market aggregate price/earnings or price/book ratios, there has also been little research into the forces that drive return-on-shareholders'-equity. Is it reasonable to assume that it will fluctuate about (say) 9% in a stationary manner? What is the long-term mean of the process? Or has there been some fundamental change in the economic and financial environment that has led to recent levels that are appreciably higher? Perhaps, more attention would be given to these issues if there were more recognition of the importance of return-on-shareholders'- equity.

It could be argued that these problems are avoided by using an historical approach based on rates of return calculated from stock market data, an estimate of the historical equity premium or a dividend growth model based on GDP parity or company profits being *real* income.

Approaches based on historical index data

Provided there is no change in the mean level of return-on-shareholders'-equity then an historical approach based on rates of return will produce generally the same estimated long-term rate of compound return as the shareholders' equity framework. This is subject to the proviso that there is no large change in return-on-shareholders'-equity and market values in relation to book/value and/or price/earnings ratios over the period of the historical study. Alternatively, the historical period can be long enough for the effect of changes in market valuations to be small.

The implicit assumptions underlying the long-term estimate of Owen (1962) were therefore that future return-on-shareholders'-equity in the future would be the same as that underlying

his observation period and that market levels in relation to earnings would not change markedly from those ruling at the date of his study. Although we know that return-on-shareholders' equity fluctuated around 9% per annum in the period 1957-1980 and has subsequently move higher, we will probably never know what it was between 1875 and 1957 - which is 95% of the period of his study.

It follows from this observation that, sooner or later, the analysis of historical data needs to be reconciled with corporate financial statements if we are interested in reliable long-term rate of return estimates. A related aspect of the use of historical data is the common assumption of statistical independence of successive rates of return. It is usually argued that, while this may only be approximately correct, it is sufficiently correct for most practical purposes. We can relate market levels to shareholders' equity as follows:

$$MV_t = \frac{MV_t}{NPAT_t} \times NPAT_t = \frac{MV_t}{NPAT_t} \times RoSe_t \times \frac{ShEq_{t-1} + ShEq_t}{2}$$

So the price of the index portfolio is equal to the product of its price/earnings ratio, its return on shareholders' equity and average shareholders' equity - it is therefore the product of two terms which are likely to be mean reverting and a third term which is non-stationary, but which changes slowly over time with only a fraction of the variability of the first two terms. From this simple argument we can draw two important conclusions:

(a) successive changes in index levels are not independent, even though they may give that impression in the short-term, and

(b) short-term volatility will grossly overestimate volatility in long-term rates of return because the two factors giving rise to short-term volatility are probably mean-reverting stationary processes.

These observations suggest serious problems in applying a mean-variance framework to long-term return modelling. In this respect Bernstein (1997) made the following comments relating to 200 years of US financial history:

> *"A strange and unexpected conclusion emerges. Stocks are fundamentally less risky than bonds, not only because their returns have been consistently higher than those of bonds over the long run, but also because less uncertainty surrounds the long-term returns that investors can expect on the basis of past history."*

Dividend growth models

Dividend growth models, when based on company profits or dividends being *real* in nature are ignoring the effect of the partial ploughback of profits. Over time periods with inflation of the order of 5% per annum, the denial of ploughback and acceptance of profits as income that is *real* in nature are therefore compensating errors. As the case of Berkshire Hathaway shows, a model based on dividends growing with inflation will not work when the effect of ploughback is not the same as the rate of inflation.

It might be argued that a dividend growth model based on growth arising mainly from retained profits would be reliable, however such a model ignores the possibility that the initial dividend level is, for some reason, unusual. If return-on-shareholders'-equity is unusually high by historical standards (as is currently the case) then such a model will not allow for the risk of dividends being reduced if corporate return on equity were to revert to historical levels. It is possible that current levels of corporate profitability will be sustained, but this

implicit assumption would be hidden in such a dividend growth model at the present time. The shareholders' equity framework makes such an implicit assumption obvious as well as providing a mechanism for considering the alternative scenario that return-on-shareholders'-equity will revert to some lower figure over time.

While we may accept the argument that dividends should maintain broad parity with GDP, this assumes there is no cost in taking up a pro-rata share of any new shares that are issued by all constituents of the market index portfolio. To maintain a dividend stream that maintains parity with GDP, shareholders' equity must also maintain a similar parity and the amount of additional funds required will therefore be equal to the difference between those required to finance nominal growth of GDP and those retained through plowback of retained profits. According to the shareholders' equity framework, this is the cause of the two-percent dilution observed by Arnott and Bernstein (2002). However to adopt a model which assumes that the future dilution will also be 2% per annum, without identifying what caused the historical dilution to have been 2% per annum, is to accept a regularity as a law of nature.

The choice between mean-variance models, dividend growth models and the shareholders' equity framework

As the early educational *"CT1 Core Reading"* from the Faculty and Institute of Actuaries (2006) demonstrates, the factors officially regarded by the actuarial profession as relevant to the long-term return from ordinary shares are dividend yields, inflation, real growth and "risk". These are the only factors mentioned. As the shareholders' equity framework demonstrates, the only one of these four factors of any great direct relevance is the dividend yield. Inflation has a small influence but this has been confused with the effect of plough-back and, in consequence, has been exaggerated.

The models suggested by the Maturity Guarantees Working Party (1980), Wilkie (1986) and Yakoubov *et al* (1999) all allow for changes in market prices relative to dividends or earnings. However return-on-shareholders' equity and the role of retained profits in financing *per-share* growth are barely mentioned. Of comparable importance, it seems to be more or less assumed that earnings and/or dividends will rise with inflation.

Have we in the profession ignored, for too long, the importance of return on shareholders' funds and the implications of historical cost accounting? At times of high inflation, these accounting problems are discussed - see Parker and Gibbs (1974) - only to be forgotten when inflation subsides. Parker and Gibbs made this observation at the time in relation to previous bouts of inflation, and, in this respect, history has repeated itself.

However when inflation is 3% per annum, there is still a considerable long-term difference between 10% return on shareholders' equity being a real return and a monetary one. Those who take a different view and believe that company profits and dividends are real income to investors need to be right. If they are wrong, the widespread presumption of a link between inflation and long-term equity returns eliminates any pressure for the accounting reforms necessary to make company profits and dividends real in nature.

These two issues, the way long-term equity returns are driven by return on shareholders' equity and the fact that this is (with some exceptions) a monetary return under historical cost accounting, are all but ignored by mean-variance and dividend growth models. It might be possible to modify mean-variance and dividend growth models to take these matters into account - but would it not be more straightforward to start with the shareholders' equity framework? With this approach, the implied level of corporate profitability (or return on shareholders' equity) and the way it is assumed markets will be priced relative to "fundamentals" is transparent.

In relation to the ASX All Ordinaries Index at the current time (June 2007), a mean-variance approach might suggest an "expected" long-term rate of return equal to the long-term bond rate approximately (6%) plus a risk premium of 3%, while a dividend growth model might suggest a similar total return equal to the current dividend yield (3.4%) plus a dividend growth rate of approximately 6% per annum. Assuming the data presented in table 5 is correct, these estimates (whether based on the existence of a risk premium or standard assumptions about dividend growth) contain a hidden assumption that current levels of return on shareholders' equity will persist indefinitely. This assumption is not hidden with a model based on the shareholders' equity framework and, as illustrated in Table 6, the answers can sometimes be very different if we allow for mean-reversion in return-on-shareholders' equity and the mean-reversion price/book ratios that is likely to follow.

It might be argued that until we understand the economic forces driving return on shareholders equity long-term forecasts of equity asset class returns based on historical values of return on shareholders' equity are, like the equity premium approach, also based on a regularity. However, unlike the "risk" premium, recognising the importance of return-on-shareholders'-equity and its monetary nature return-on-shareholders' equity is the first step in establishing a chain of causation.

In all the debate about stock market levels and other questions that depend on long-term equity returns (including estimates of the future equity premium and the adequacy of the 9% compulsory superannuation guarantee), there has been little discussion of the sustainability of current levels of return on shareholders' equity, yet this is one crucial variable on which answers to these questions depend. The shareholders' equity long-term modelling framework makes this abundantly clear.

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Appendix

Details of calculations shown in Table 6.

As at 30/06/2007	ASX All Ords
P/E	18.01
PB(0)	2.68
D/P	0.034
RoSe(0)	0.1488
Div/Book	0.0911
PoR	0.6123
PPN real	0.1
Inflation	0.03

	*Scenario A*ASX All Ords				***IRR***	***0.095***	***0.095***
					Incl inflat	***0.098***	***0.098***
t	RoSe(t)	ShEq(t)	NPAT(t)	D(t)	PB(t)	CF10(t)	CF20(t)
0	0.1488	100.00	14.88	4.56	2.68	-263.44	-263.44
1	0.1488	105.94	15.32	9.38		9.38	9.38
2	0.1488	112.23	16.23	9.94		9.94	9.94
3	0.1488	118.90	17.20	10.53		10.53	10.53
4	0.1488	125.96	18.22	11.16		11.16	11.16
5	0.1488	133.44	19.30	11.82		11.82	11.82
6	0.1488	141.37	20.45	12.52		12.52	12.52
7	0.1488	149.77	21.66	13.26		13.26	13.26
8	0.1488	158.66	22.95	14.05		14.05	14.05
9	0.1488	168.09	24.31	14.89		14.89	14.89
10	0.1488	178.07	25.76	15.77	2.68	485.12	15.77
11	0.1488	188.65	27.29	16.71			16.71
12	0.1488	199.86	28.91	17.70			17.70
13	0.1488	211.73	30.62	18.75			18.75
14	0.1488	224.30	32.44	19.87			19.87
15	0.1488	237.63	34.37	21.05			21.05
16	0.1488	251.74	36.41	22.30			22.30
17	0.1488	266.70	38.57	23.62			23.62
18	0.1488	282.54	40.86	25.02			25.02
19	0.1488	299.32	43.29	26.51			26.51
20	0.1488	317.10	45.86	28.08	2.68		863.87

As at ASX All Ords
30/06/2007
Additional Scenario B assumptions
*(reversion in RoSe and Price/book after **m** years.*

m	*5*						
Rose(m)	*0.09*						
P/B(m)	*1.5*						
	Scenario B	ASX All Ords			***IRR***	***0.013***	***0.038***
					Incl inflat	***0.016***	***0.041***
t	RoSe(t)	ShEq(t)	NPAT(t)	D(t)	PB(t)	CF10(t)	CF20(t)
0	0.1488	100.00	14.88	4.56	2.68	-263.44	-263.44
1	0.1370	105.46	14.08	8.62		8.62	8.62
2	0.1253	110.71	13.54	8.29		8.29	8.29
3	0.1135	115.69	12.85	7.87		7.87	7.87
4	0.1018	120.34	12.01	7.35		7.35	7.35
5	0.0900	124.62	11.02	6.75		6.75	6.75
6	0.0900	129.04	11.41	6.99		6.99	6.99
7	0.0900	133.62	11.82	7.24		7.24	7.24
8	0.0900	138.37	12.24	7.49		7.49	7.49
9	0.0900	143.28	12.67	7.76		7.76	7.76
10	0.0900	148.37	13.12	8.04	1.50	226.57	8.04
11	0.0900	153.64	13.59	8.32			8.32
12	0.0900	159.09	14.07	8.62			8.62
13	0.0900	164.74	14.57	8.92			8.92
14	0.0900	170.59	15.09	9.24			9.24
15	0.0900	176.65	15.63	9.57			9.57
16	0.0900	182.92	16.18	9.91			9.91
17	0.0900	189.42	16.76	10.26			10.26
18	0.0900	196.15	17.35	10.62			10.62
19	0.0900	203.11	17.97	11.00			11.00
20	0.0900	210.32	18.60	11.39	1.50		321.18