Sir John Cass Business School,
City of London – Faculty of Finance

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VALUATION BIAS IN THE STOCK MARKET

- **Valuation Bias and Stock Age:**
  New Stocks versus Survivors
- **Stock Market Levels in the UK:**
  Earnings Yield, Growth, and Return Expectations
- **Investment Knowledge and Stock Price Rationalisation:**
  Evidence from Property Investment Stocks

A thesis presented by

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Dedication

To Everyone In My Family

And Specially Dedicated

To Who Has Entered My Life

And Owned My Heart,

My Wife Ruba

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Thesis Release Form

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Symbols

Symbol	Description	Symbol	Description
A	All stocks (new and survivors together)	*LTD*	Long-term debt (loan capital > 1 year)
AEX	Administrative expenses	*LTDBE*	Long-term debt to book equity
ATU	Asset turnover	*LTDMVE*	Long-term debt to market value of equity
BE	Book equity	*LTDTA*	Long-term debt to total assets
BVD	Book value of debt	*M&A*	Merger and Acquisition
BVMI	Book value of minority interests	*MBE*	Market-to-book of equity
CAPM	Capital Asset Pricing Model	*MBF*	Market-to-book of firm
CCGT	Contingent capital gains taxes	*MI*	Minority interests
CE	Capital Employed	*MVE*	Market value of equity (market-cap)
CF	Cash flow	*N or NEW*	New stocks group
CFBE	Cash flow-to-book equity ratio	*NAV*	Net asset value (shareholders funds)
CFP	Cash flow-to-price ratio	*NI*	Net income (earned for ordinary shareholders)
CV	Continuing value (terminal value)	*NNNAV*	Triple-NAV
D	Debt capital	*NOPAT*	Net operating profit after taxes
DISC	Discount-to-NAV (percentage)	*NPM*	Net profit margin
DISC3N	Discount-to-Triple NAV (percentage)	*Obs*	Observations
DPAM	Annual depreciation & amortisation	*OEQ*	Ordinary equity capital and reserves (*NAV*)
DPS	Dividends per share	*P*	Stock price
DR	Discount rate	*P/E*	Price-earnings ratio
DTBS	Deferred taxes (balance sheet account)	*PEX*	Property expenses
DTIS	Deferred taxes for the year (P&L)	*PM*	Profit margin
E	Equity capital	*R*	Stock returns
EBIT	Earnings before interest and taxes	*RE*	Real Estate
EBITA	Earnings before interest, taxes & amortisation	*REBE*	Retained earnings-to-book equity
EGS	Earnings	*REIT*	Real estate investment trust
EP	Earnings-price ratio (inverse of *P/E*)	*RENT*	Rental income
EPS	Earnings per share	*REP*	Retained earnings per share-to-share price
ERP	Equity risk premium	*REPS*	Retained earnings per share
EXOR	Extraordinary items	*REVAL*	Property revaluation reserve
EY	Earnings yield (same as *EP*)	*RF*	Risk-free rate
FCF	Free cash flow	*RM*	Expected return on the market
FRS	Financial Reporting Standard(s)	*ROE*	Return on equity
FVAD	Debt fair value adjustment	*ROEC*	Return on capital employed (same as *ROIC*)
FVD	Fair value of debt (MV estimate)	*ROIC*	Return on invested capital (same as *ROCE*)
G (or g)	Growth rate	*RPI*	Retail price index
GDP	Gross Domestic Product (nominal)	*RY*	Rent yield
GEBIT	Growth in *EBIT*	*S or SUR*	Survivor stocks group
GEGS	Growth in earnings	*T*	Tax rate
GEPS	Growth in earnings per share	*TA*	Total assets
GTU	Growth in turnover	*TABE*	Total assets to book equity (leverage)
HBETA	Historic leveraged beta	*TAX*	Tax charge
IC	Invested capital (capital employed)	*TD*	Total debt (long- and short-term)
INVP	Investment properties market value	*TRS*	Total return to shareholders
IPD	Investment Property Databank Index	*TUR*	Turnover (total trading income)
KD	Cost of debt capital	*WA*	Weighted average
KE	Cost of equity capital	*WACC*	Weighted average cost of capital

Abstract[1]

In our first study (Chapter 3) we investigate valuation bias in the UK stock market by examining the valuation of new stocks relative to survivor stocks as new stocks have relatively higher valuations with the valuation gap increases in bullish markets and vice versa. The value explanatory model and individual fundamental factor tests developed provide evidence of a negative significant relation between age and value. This does not seem to be backed by any known economic rationale given that new stocks showed lower profitability levels, no concrete evidence of materialised higher growth or lower risk which is inconsistent with their relatively higher valuations indicating that valuation bias could well be present.

The evidence in the first study does not imply that valuation of survivor stocks is rational or otherwise. Hence, in our second study (Chapter 4), we seek evidence on valuation bias at the stock market aggregate level where the occurrence of major divergences between stock prices on one side and economic growth and equity invested capital on the other, followed by subsequent price falls (corrections) is evident. The evidence obtained shows: (a) low earnings yields using theoretical and empirical models under plausible scenarios, (b) no changes in corporate profitability pattern that could explain stock price levels, (c) a cyclical gap between implied growth and economic growth, (d) that implied growth was almost always higher than both economic and earnings realised growth, and finally (e) the implied average equity risk premium compared with the evidence in the literature and the market unbiased expected return appears to underestimate risk revealing a paradox of high return expectations driving prices up implying lower equity risk premium. The evidence on balance, suggests that stock price levels in the UK during 1989-2002 cannot be explained by fundamentals and the idea of temporary mispricing is not supported by strong evidence leaving the door open to argue the presence of overvaluation on average during 1989-2002.

One of the implications of valuation bias and stock age is that investors are relatively more limited in exaggerating the potential of survivor stocks because of the better investment knowledge available about them compared to new stocks. Thus, in our third study (Chapter 5), we seek evidence for the role of 'investment knowledge' in 'stock price rationalisation' from property investment stocks exploiting the special investment characteristics of their underlying assets and operations. We establish the presence of a significant and enduring market discount to the underlying value for property investment stocks. We test the hypothesis that property investment stocks discount is a reflection of investment knowledge-based rationality that limits valuation bias for these stocks. In testing the hypothesis, we establish knowledge-based rational explanations for property stocks market valuation or discount. The evidence from return differential, operating expenses, capital gains risk, leverage risk, and the stability of property stock prices, unlike the overall stocks market, relative to the economy and the underlying value leads towards not rejecting the null hypothesis.

[11] Each of the three main chapters 3, 4, and 5 has its own more comprehensive abstract at its outset.

1 Chapter One: Introduction

1 Chapter One: Introduction

Bias as a notion can be found in too many areas and walks of life. Bias in equity valuation would be one type of investor behavioural biases that would fit under behavioural finance.[2] Valuation bias would exist if equity valuations were different for different groups of stocks in a way that is inconsistent with, or unsubstantiated by, the differences between their underlying corporate and economic fundamentals that determine value. Bias would also exist if overall stock market levels were inconsistent with the underlying economic and corporate fundamentals of value.

Therefore, for this thesis, *valuation bias* is defined as *the case when valuation levels or differences are driven by investor expectations that are inconsistent with fundamental corporate and economic factors.*

It is important to clarify that valuation bias in this thesis deals with (a) bias in valuing a category of stocks relative to other stock categories, such as the market valuation of new stocks relative to older stocks (Chapter 3), and (b) bias relative to value fundamentals, such as on the overall stock market levels (Chapter 4).

The reader's attention is drawn to the specific meaning and interpretation of the term valuation bias in this thesis. Of course, as with many terms, the use of the term valuation bias is not perfect or free from abuse. However, the research tackles investor behaviour with respect to valuation emphasising behavioural bias explanations for valuation differences and value levels amongst stock age groups and against fundamentals. Thus, the term would fit this context given the wide use of the term bias in behavioural finance literature (behavioural biases) especially that using mis-valuation or mis-pricing is problematic too as fair value levels are unknown and they do not emphasise the behavioural aspects explicitly.

[2] Valuation bias should not be mixed with survivorship bias, as the former is related to market behaviour and not to performance measurement in research. The idea of survivorship bias is not new, it is known as a technical or statistical measurement issue in empirical research.

Valuation bias would be a systematic tendency for mis-valuation. The evidence of this thesis, as shown later, would suggest that for the period understudy. Mis-valuation is due to investor behaviour, hence, while the term bias conveys this message, the degree and persistence of bias will always be debatable. The length of the period for which unexplained value levels, fluctuations and differences 14 years is reasonably long for the modern economic era. The long-standing evidence on IPOs systematic long-term underperformance that our evidence meets, as shown in Chapter 3, backs the use for the term bias as far as persistency is concerned. Also, some researchers such as Sougiannis and Yaehura (2001) used similar term 'Bias of Equity Values' in the context of stock valuation.[3]

Figure 1-1 illustrates the process of market valuation/stock pricing based on basic economic and investment logic. It shows equity valuation as an ex ante estimate for the values of firms based on conditional expectations. The process is built on translating available relevant information into forecast and then into value estimate through a valuation model, and with supply and demand forces the market price is shaped. The figure shows that errors and bias can occur because of wrong investor expectations, flawed pricing model, flawed model interpretation, and mainly because human behaviour is involved in the entire process.

Therefore, it is not difficult to agree that this market process, by its very nature and structure, is susceptible to biased behaviour in pricing and trading different stock categories, leave alone aggregate market mispricing.

[3] Bias in life could be in one/several position(s), one/several case(s), some period(s)... or systematic/persistent. Bias in this thesis is clearly different from the statistical reference to bias. The reference to bias in the thesis is limited to the above clarification presented in this Introduction.

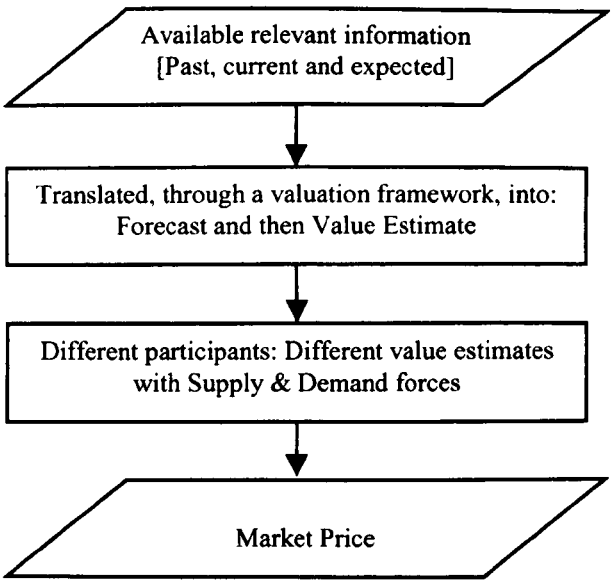

Figure 1-1. The Process of Equity Pricing

An important part of the motivation for this work is the severe fluctuation in stock market levels that do not seem to accord with any robust economic explanation. We sympathise with Shiller (2001) that the stock market ups and downs over the last century have made virtually no sense ex post, because we initially believe that stock prices are often driven by complex investor expectations rather than by the underlying corporate and economic fundamentals.

This thesis covers three main studies:

- Valuation Bias and Stock Age: New Stocks versus Survivors. Under which we investigate the presence of valuation bias through examining whether differences in fundamentals can explain the evident differences in market valuation between new and older stocks as the former have relatively higher valuations. Chapter 3.

- Stock Market Levels in the UK: Earnings Yield, Growth, and Return Expectations. The first study does not address whether survivor stocks' valuation or overall stock market levels are reasonable. Therefore, the second study deals with valuation bias at stock market level by investigating whether stock market levels in the UK during the period 1989-2002 can be explained

by fundamentals such as reasonable expected profitability, expected growth and/or risk levels or whether stock prices on average over time are correctly valued against fundamentals with occasional mispricing. Otherwise, stock market levels in the UK could be overvalued, on average, relative to fundamentals. Chapter 4.

- Investment Knowledge and Stock Price Rationalisation: Evidence from Property Investment Stocks. The third and final study in this thesis starts from one of the implications of the first study that investors might have been more able to exaggerate the potential of new stocks relative to survivor stocks as the market knows relatively more about older stocks. Hence, in the context of 'valuation bias in the stock market' we study the role of 'investment knowledge' in 'stock price rationalisation' exploiting the special investment characteristic of property investment stocks because such knowledge about them is available and reliable. In particular, we explore whether valuation bias is less for property investment stocks relative to non-financial stocks (as per Chapters 3 and 4) because of the greater investment knowledge about the former. Chapter 5.

We believe it is appropriate to comment at this stage on the cornerstone of our methodology. The premise on which the research method is built for this work is derived from standard finance theory and practice and common sense of investment and economics. That is, the value of a business is a function of its prospective profitability, growth potential and risk. Hence, when we value companies, small or large, we need to learn about their prospective profitability, growth and risk. From profitability and growth, cash flows can be derived and from understanding the risk of the business, whether operational, financial, or other such as political risk of some operations in a foreign country, the required rate of return can be estimated and hence the business can be valued. These factors are what we really need to value a business. These are the proxies of real value fundamentals bearing in mind that eventually these factors capture the impact of both unique and systematic factors (micro and macro) on the business.

The remainder of this thesis is structured as follows: Chapter 2 presents the literature review for the whole thesis under suitable headings, Chapter 3 covers valuation bias and stock age, Chapter 4 deals with stock market levels in the UK, Chapter 5 covers investment knowledge and stock price rationalisation, and Chapter 6 concludes the thesis and presents prospects for future research.

Each chapter of the main studies (Chapters 3, 4 and 5) is structured as follows: A chapter abstract is presented at the outset, followed by a chapter introduction covering motivation, objectives, hypotheses, and method. Data are then discussed followed by the empirical analysis and results. Then a chapter conclusion summarises the findings and finally a chapter appendix.

2 Chapter Two: Literature Review

2 Chapter Two: Literature Review

2.1 Introduction

This chapter presents a review of related literature divided into four categories:

(a) Fundamental valuation, covering the economic fundamental explanations for market valuations. Chapters 3, 4 and 5, the three empirical studies presented in this thesis, examine whether fundamentals can explain observed stock market values.

(b) Behavioural bias, reviewing behavioural explanations of stock market valuation. It will be argued that the results presented in this thesis are consistent with the hypotheses of *behavioural finance*, in particular *behavioural bias*, not with *fundamental valuation*.[4]

(c) The literature on stock market levels, in particular excess volatility and overvaluation. Chapter 4 examines, empirically, valuation bias relative to fundamentals at stock market overall level in the UK.

(d) The literature related to property investment stocks. These are the subject of the third empirical study presented in this thesis. Chapter 5 uses property investment stocks to examine the role of investment knowledge in stock price rationalisation. Some relevant articles on real estate investment trusts and closed-end funds are reviewed in this section too.

[4] Behavioural bias, the subject of this thesis, is not to be confused with survivorship bias. The latter is just a statistical and measurement issue concerned with representation of a sample, e.g., the impact of excluding dead stocks on stock return measurement. For survivorship bias literature, see for example Ball and Watts (1979), Brown, Goetzmann, Ibbotson, and Ross (1992), Brown, Goetzmann, and Ross (1995), and Jorion and Goetzmann (1999). Also, see for example, on corporate survival Evans (1987), Dunne and Hughes (1994), Audretsch and Mahmood (1995), and Koke (2001).

2.2 Fundamental Valuation

Equilibrium models such as the Capital Asset Pricing Model (CAPM), the single risk factor model of Shapre (1964) and Lintner (1965), and the Arbitrage Pricing Theory (APT), the multi-risk factor model of Ross (1976) are classical efficient markets models to asset pricing.[5] In the 1970s, the efficient markets theory related asset prices to economic fundamentals, using rational expectations to link finance and the entire economy. The models of Merton (1973), Lucas (1978), and Breeden (1979) of efficient markets concluded that stock prices are the expected present value of future dividends relating the discount rate to the utility of consumption. [6]

Standard finance theory postulates that the value of a capital asset should be equal to the present value of its expected future outcome stream (e.g., dividends, cash flow, and earnings). Hence, fundamental approaches to stock valuation are used to estimate the fair or intrinsic value of companies based on key fundamentals. Popular standard fundamental approaches to equity valuation such as the Enterprise DCF, the Equity DCF (or Dividends Discount Model), the Adjusted Present Value (APV), and the Economic Value Added (EVA) use the key fundamental variables of *profitability*, *growth* and *risk* to derive and value future outcomes.[7] Profitability and growth determine cash flow (or earnings) and understanding business and financial risk is required to estimate the cost of capital to value future cash flows (or estimate and value EVA stream). These four approaches are all mathematically equivalent. The standard textbook of Copeland,

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[5] One could dwell too much on asset pricing theory. However, focus is kept on valuation bias, the subject of this thesis. For discussion and tests of CAPM and APT, see for example, Fama and MacBeth (1973), Dybvig and Ross (1985), Gultekin and Bulent Gultekin (1987), Wei (1988), and Fama, and French (1996), also Elton and Gruber (1995) is a standard textbook that covers these asset pricing theories

[6] Merton (1973): An Intertemporal Capital Asset Pricing Model (ICAPM) that generalizes the original CAPM. According to the Lucas (1978) model, in a rational expectations general equilibrium rational asset prices may have a forecastable element that is related to the forecastability of consumption. According to the Breeden (1979) model, a stock's beta is determined by the correlation of the stock's return with per capita consumption.

[7] The concept of EVA was developed by Stern Stewart, a major consulting firm. APV is based on the famous Modigliani & Miller propositions on capital structure developed in the late 1950s and early 1960s.

Koller, and Murrin (2000) discusses these valuation approaches in great detail; also Damodran (1996) and Brealey and Myers (2000) deal with the same.

CAPM and APT are classical models that provide the required rates of return for fundamental valuation. In a *theoretical ideal* world, stock prices would represent the present value of future outcomes discounted at a rate of return that can be justified by an equilibrium model where average stock returns are the same as the discount rates. There is sufficient confirmation in the literature for the importance of profitability, growth and risk (discount rates) in equity valuation as shown later in this section. Below is a review of articles relevant to fundamental valuation.

One type of research concentrated on fundamental-based analysis to address *explaining or predicting stock returns*. For example, all of Rosenberg, Reid and Lanstein (1985), DeBondt and Thaler (1987) and Chan, Hamao and Lakonishok (1991), and Fama and French (1992) find a relation between book-to-market equity and stock returns. Other research shows other variables are related to subsequent stock returns, such as earnings yield [Jaff, Keim and Westerfield (1989)], cash flow yield [Chan, Hamao and Lakonishok (1991)] and historical sales growth [Lakonishok, Shleifer, and Vishny (1994)]. Campbell and Shiller (1988) find (a) long moving average of real earnings helps to forecast future real dividends, (b) the ratio of earnings to current stock price is a powerful predictor of the return on stock. Goetzmann and Jorion (1993) find no strong statistical evidence indicating that dividend yields can be used to forecast stock returns. Fama and French (1993) show that size and book-to-market equity ratio are proxies for sensitivity to risk factors that capture strong common variation in stock returns and help in explaining the cross-section of average returns [see also Fama and French (1995) on the relation between average stock returns and size, and average return and book-to-market equity]. Robertson and Wright: (2002) show that Tobin's q strongly predicts stock returns. In their paper on 'the good news and the bad news about long-run stock returns' (2002b), they show that the predictive power of valuation criteria significantly reduces the uncertainty associated with long-run stock market returns. In another paper by them (2003), they provide evidence on the predictive power of dividend yields for aggregate

stock returns in which, following Miller and Modigliani (1961), they construct a measure of the dividend yield that includes *all cash flows to shareholders*. Dupuis and Tessier (2003) show that, for the long-run variance decomposition, 76 percent of the low-frequency dynamics in stock prices are explained by permanent shocks to dividends and the remaining 24 percent are explained by permanent shocks to real interest rates.[8]

Another type of fundamental-based research addresses *direct stock valuation*, and here are some relevant examples. According to Miller and Modigliani (1961), a share value represents the present value of (a) normalised earnings from existing assets, plus (b) the present value of future growth opportunities. Grossman and Shiller (1981) find that the present value of dividends since 1881 had only a thin relation to actual stock prices in the US. Feltham and Ohlson (1999) provide a general version of the accounting-based valuation model that equates the market value of equity to book value plus the risk-adjusted present value of expected abnormal earnings. The risk adjustments consist of certainty-equivalent reductions of expected abnormal earnings. Abnormal earnings are calculated after a capital charge measured on the period opening book equity using the risk-free rate. They show that the traditional risk-adjusted expected cash flow model as a special case of their general model. Schwartz and Moon (2000) apply real-options theory and capital-budgeting techniques to valuing Internet companies. In their valuation approach, the expected sales growth rate follows a mean-reverting process with a time-varying drift. They argue that the value of an Internet stock may be rational if revenue growth rates and their volatility are high enough. Ang and Liu (2001) specify affine processes for selected accounting variables and derive a nonlinear relation between market-to-book ratio on one side and interest rates, profitability, and growth in book value on the other assuming the last three variables are stochastic. Bakshi and Chen (2001) develop a stock valuation model using net earnings-per-

[8] The literature on explaining stock returns is very extensive. For more research, see for example, Day (1984), Restoy and Rockinger (1994), He, Kan, Ng and Zhang (1996), Perez-Quiros and Timmermann (2000), Davis (1994), Fama (1990), and Daniel and Titman (1997). Dimson and Marsh (2001) in their paper "U.K. Financial Market Returns, 1955-2000," present and analyse new monthly index data for the UK financial assets to estimate equity and bond premium and to draw meaningful international comparisons. They also use the data to investigate stock market seasonality, real dividend growth, and small-firm effect and compare with the US.

share, expected earnings growth, and interest rate in which the expected earnings growth rate follows a mean-reverting process. The pricing errors of their model are highly persistent over time and correlated across stocks, suggesting the existence of factors that are important in the market's valuation but missing from the model. Cohen, Polk and Vuolteenaho (2002) conclude that future variation in profits can explain 75 to 80 percent of the cross-sectional variation in book-to-market ratios. Jung and Shiller (2002) show for US stocks that, cross sectionally, the price-dividend ratio is a strong forecaster of the present value of future dividend changes. Smithers and Wright (2004) make an interesting statement reflecting on how the behaviour of the stock market does not seem to accord with fundamental rational valuation, "Two fundamental, and perhaps disconcerting questions, immediately occur when considering how to value stock markets. They are "Why attempt to do it?" and "Can it be done?"

Some literature studies the relation between inflation, as an economic fundamental, and stock prices. Wadhwani (1986) finds some evidence that inflation impacts stock valuation negatively as it increases bankruptcy rates and default premium. Sharpe (2002) finds that the negative relationship between equity valuations and expected inflation is the result of a rise in expected inflation coincides with both lower expected earnings growth and required real returns.[9] Inflation impacts earnings, cost of borrowing, and cost of equity resulting in some offsetting. Therefore, it is believed that inflation per se is unlikely to hold a major part of the explanation for the severe ups and downs in stock market levels in the recent history. That is because of its simultaneous impact across all valuation factors, and because the 1990s onwards were associated with relatively low and stable inflation levels. However, as a final point, high historic inflation memories might have had a psychological impact on investors to expect high stock returns despite the fall in inflation, which might have contributed to driving prices up away from fundamentals.

Central to our first study in Chapter 3, it has been recognized that the valuation of *newly issued stocks* can be difficult to explain using standard

[9] For more about inflation and stock price levels, see Wadhwani, Cecchetti, and Genberg (2002).

valuation tools. Fama and French (2001) documented that, on average, more than 550 new companies were listed every year in the US stock market between 1980 and 2000 compared to less than 150 companies in the previous two decades. The valuations of some of these new companies appear very high to accord with reasonable assumptions about future profitability.[10]

Ayrer, Upper, and Werner (2002) study behavioural differences of market reaction to changes in fundamentals between *new companies* listed on Neuer Market in Germany and o*ld companies* from DAX 100. They find that news impact on stock prices of new and old stocks was asymmetric under different market conditions. In up market, new stocks reacted more strongly to favourable news than old stocks while no significant difference in reaction was found to unfavourable news. In declining market, new stocks reacted more pronouncedly to unfavourable news than old stocks while no significant difference in reaction was found to favourable news. They argue that this was due to behavioural bias in viewing both categories of stocks. Valuation asymmetry between new and survivor stocks, along with the relation between valuation differences and market condition, is the focus of our first study.

Investors are faced with major uncertainty about future profitability when valuing newly listed companies. Pastor and Veronesi (2003), using annual US data for the years 1963 through 2000, [11] argue that this uncertainty contributes to the high valuations of these companies, and that learning about profitability in calendar time resolves this uncertainty and tends to be associated by a decline in the valuation ratios. So, valuations that appear excessively high initially are not necessarily the result of investor irrationality. Their argument is broadly consistent with Lewellen and Shanken (2002), who "emphasize that many tests of market efficiency cannot distinguish between a market with learning and an irrational market".

The work of Pastor and Veronesi (2003) is the closest to our first study on valuation bias and stock age. They develop a learning model for stock valuation focusing on cash flow and modeling it using accounting information such as earnings and book equity. However, they do not focus much on modelling risk

[10] For example, more than 1 in 10 of all companies listed between 1962 and 2000 are traded at a multiple of more than seven times their book value at the end of their year of listing, and almost 1 in 50 companies is traded at more than 20 times its book value.
[11] From the CRSP/COMPUSTAT database.

and its impact on valuation as they deal with risk in fairly standard fashion; once assuming a contact discount rate and then by using a stochastic discount rate. Their model predicts M/B to decline with firm's age due to learning, the predictions of their model are confirmed empirically. The idea of their model is illustrated with the following simple mathematical exposition.

$$\frac{M}{B} = E\{\exp[(g-r)T]\} = \exp[(\bar{g}+\sigma^2/2-r)T]$$

where B is the firm's book equity at time 0 and g is its constant growth rate of book value growth from profitability. Thus, the book equity will be at time T: $B[exp(gT)]$, then they assume as competition eliminates abnormal earnings by T the market value at time T equals its grown book value, discounted to today's value by the discount rate r. The expression to the right assumes that g is unknown and normally distributed.

It is clear that M/B, in the above model, increases with the uncertainty about growth or profitability. They argue that the uncertainty declines over time due to learning and as a result, younger firms have higher profitability or growth volatility and hence higher M/B ratios holding average growth and discount rate constant.

The model is formulated to use average profitability and its volatility in estimating M/B, which led to model predictions that are confirmed by the empirical data. This link between the high volatility of profitability and high valuation could be circumstantial (spurious). Moreover, in their study, risk deferential between younger and older stocks is not addressed, where first the discount rate was left as constant and second modelled as a stochastic variable.

According to Pastor and Veronesi, there is an economic rationale for the higher M/B of new stocks; that is rational learning. However, the long-standing evidence on the long-term underperformance of IPOs would contradict their conclusion [see on IPOs evidence, for example, Gompers and Lerner (2003) and Espenlaub, Gregory and Tonks (2000)]. We show later that our evidence on new stocks and age groups is consistent with the evidence of the IPOs systematic underperformance.

Higher profitability volatility implies higher risk and should lead to lower valuations. Despite their technically impressive work trying to rationalise the behaviour of the market in valuing younger stocks by learning, they do not

address the possibility of bias driven by investor expectations about new stocks that can be exaggerated due to the relatively limited knowledge about them. Producing a model that can predict the patterns exhibited in the data is not necessarily the answer. Some economic rationale or investment logic is still needed to underlie the pattern of the declining M/B with age or it would be due to behavioural bias.[12]

[12] For further literature on *learning* see, for example, Jovanovich (1982), Timmerman (1993), David (1997), Routledge (1999), Veronesi (1999, 2000), and Brennan and Xia (2001), Bernardo and Chowdhry (2002).

2.3 Behavioural Bias

The literature under Section 2.2 covers rational explanations of value by fundamentals and rationalised processes such as learning or mean-reversion. The 1990s witnessed significant research in behavioural finance recognizing the importance of psychology and sociology in finance. That followed the failure of the efficient markets theory and its rational explanations, that dominated the 1970s, to justify stock market levels and its too many anomalies,[13] including the excessive volatility in the 1980s and 1990s and the 1987 crash where fundamental values and explanations were rendered irrelevant.[14] Shiller (2002) emphasises that the collaboration between finance and other social sciences that has become known as behavioural finance has led to a profound deepening of our knowledge of financial markets. Behavioural aspects are important to the explanation especially that behavioural bias is involved in the valuation process in the stock market as long as humans are involved. Below is a summary of relevant literature.

Psychologists Andreassen and Kraus (1988) showed that people tended to behave as if they extrapolate past price changes. Smith, Suchanek and Williams (1988) created experimental markets which generated bubbles that are consistent with feedback trading.[15] According to De Long, Shleifer, Summers and Waldman, (1990), combining feedback traders and smart money in one model, the smart money tended to amplify, rather than diminish, the effect of feedback traders, by buying in ahead of the feedback traders in anticipation of the price increases they will cause. And in a related model, rational expected-utility-maximizing smart money never choose to offset all of the effects of irrational investors because they are rationally concerned about the risk generated by the irrational investors, and do not want to assume the risk that completely offsetting these other investors would entail. Marimon, Spear and Sunder (1993) showed experiments in which

[13] Anomalies such as: Equity premium puzzle (realised equity premium is higher than can be justified by standard efficient markets theories), and Size Effect (smaller firms producing higher returns), etc.
[14] See Shiller (1982), (1989) and (1990) on market volatility.
[15] *Feedback* traders follow trends, while *Smart Money* traders move the other way.

repeating bubbles were generated if subjects were preconditioned by past experience to form expectations of bubbles.

Lakonishok, Shleifer, and Vishny (1994) suggest that *over-extrapolation effect*, a well known form of *behavioural bias* according to which investors tend to over-extrapolate past problems into the future, could be the reason behind the low *P/E* effect, the finding that forms an important support for investing in value stocks being undervalued because of a behavioural bias.

Daniel, Hirshleifer, and Subrahmanyam (1998) propose a theory of securities market under- and over-reaction based on two well-known *psychological biases*. These are: (a) Investor *overconfidence* about the precision of private information. They define an overconfident investor as one who overestimates the precision of their private information signal, but not of information signals publicly received by all. (b) Biased *self-attribution*, which causes asymmetric shifts in investors' confidence as a function of their investment outcomes.[16] Their theory is based on investor overconfidence, and variations in confidence arising from biased self-attribution. They made a reference in their paper to evidence on security returns that has presented a sharp challenge to the traditional view that securities are rationally priced reflecting all publicly available information. They state that, owing to biased self-attribution, those who acquire wealth through successful investment may become more overconfident. They have also shown that the psychological principle of biased self-attribution can also promote feedback.

Scott, Stumpp, and Xu (1999) examine the consequences of behavioural biases in the context of valuation theory. They provide empirical evidence concerning the ability of an array of commonly used active strategies, such as value and growth tilts, to exploit biases. They grouped behavioural biases into two general categories: (a) *overconfidence* and (b) *prospect theory*.[17] Overconfidence

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[16] Biased self-attribution, identified by psychologist Daryl Bem (1965), is a pattern of human behavior whereby individuals attribute events that confirm the validity of their actions to their own high ability, and attribute events that disconfirm their actions to bad luck or sabotage.

[17] Tversky's prospect theory (1979) suggests that individuals are far more upset by losses than they are pleased by equivalent gains; in fact, individuals are so upset by losses that they will even take great risks with the hope of avoiding any losses at all. The effects of this pain of regret have been shown to result in a tendency of investors in stocks to avoid selling losers. But the same pain of regret ought to cause short sellers to want to avoid covering their shorts in a losing situation. People prefer to avoid putting themselves in situations that might confront them with psychologically difficult decisions in the future.

bias means, according to Daniel, Hirshleifer, and Subrahmanyam (1998), that human beings develop, and stick, to stronger views than warranted by impartial analysis of the data. It also suggests that investors adjust their expectations only slowly. Prospect theory posits, according to Kahneman and Tversky (1979) and (1991), that utility depends on deviations from moving reference points rather than on absolute levels of wealth or consumption. Prospect theory predicts that investors will tend to gamble in losses (hold onto their positions) and be risk averse in gains (move quickly to realise their gains). They find that biased responses to news have larger impact on the stock prices of fast-growth companies, and biased estimates of normalised earnings have a profound impact on the stock prices of slow-growth companies but a relatively small impact on those for fast-growth companies.

Goetzmann and Massa (1999) provides evidence that it is reasonable to suppose that there are two distinct classes of investors: *feedback* traders who follow trends and the *smart money* who move the other way.

Massa and Simonov (2002) investigate the way investors react to prior gains and losses and familiarity bias. Familiarity bias means that investors tend to invest in familiar stocks while ignoring the principles of portfolio theory. They focus on the determinants of portfolio choice by testing and comparing different, some are competing, behavioural theories, behavioural and rational explanations to familiarity.[18] (a) *Behavioural theories:* Loss aversion; that is prior losses increase risk taking and vice versa for prior gains. House-money effect; prior gains provide investors with a cushion that makes future losses less painful and hence increase risk taking. Mental accounting or narrow framing; according to which investors, in different categories of wealth, may react differently to gains and losses depending on their categories. For more information, see for example Odean (1998) and Shefrin and Statman (1985). (b) *Behavioural and rational hypotheses*: Pure familiarity; the tendency to focus heavily on information that is salient or is often mentioned rather than on information that is blended in the background. Information-based familiarity; an alternative approach according to which investors buy and hold stocks that they have enough information about. They find that investors react to previous gains and losses according to house-

[18] This paper is briefly presented just as an example to highlight the presence of wide range of complex behavioural biases in investment.

money effect. They find no evidence of mental accounting. With respect to stock picking they provide evidence in favour of the information-based hypothesis.

Some research addresses over-reaction; another form of bias. For example, DeBondt and Thaler (1985) find that subsequently to being classified as loser or winner portfolios, loser portfolios outperform the market and winner portfolios under-perform it, the empirical evidence that is consistent with overreaction hypothesis.[19]

It is worth noting that other research covered biased forecasts of earnings or earnings growth being too optimistic (overestimates) which would affect the market. See for example, DeBondt and Thaler (1990), Trueman (1990), Schipper (1991), Francis and Philbrick (1993), Clayman and Schwartz (1994), Chan, Karceski, and Lakonishok (2000), and Sougiannis and Yaehura (2001).

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[19] Lifetime Planning Concepts, P.C., financial advisors, (2003) as published on their website 18 December 2003 titled 'Behavioural Aspects of Investment Risk' discuss behavioural biases in the context of investment advice. They state that behavioural bias is as real as human nature. The more humans involved in the process, the more impact behavioural bias can have on investment decisions. The typical chain of investor, advisor and mutual fund or money manager make for a dangerous blend of emotions and bias. Here is a summary of the discussion.
a) Under-reaction: A Marriage of Over-confidence and Anchoring: They explain how investor expectations can to a large degree influence stock prices. Since investor expectations are formed by a set of information and a model to process the information, it is clear that errors can occur when either the model or the process of interpreting the model is flawed. As in most areas, the behavioural bias, acquired through life, affects investment decisions and frequently helps create mental mistakes. Investor bias tends to encourage them to over- or under-react to new information and as a result misprice the value of an investment. Under-reaction to new information generally comes from over-confidence or anchoring. At times investors place too much confidence in their existing information or knowledge and thus ignore new information. Examples of those include money managers who avoided the stock market in the US from 1994 through 1999 because they were confident the market was priced too high, i.e. the *P/E* ratio of 23 was overvalued. Anchoring is the process by which investors become tied to a previous view or opinion. Anchoring can apply to an individual stock, a market segment or the market as a whole. On individual stocks, investors tend to anchor to the expected earnings estimate or *P/E* level. When new information becomes available, those who under-react are often anchored to their previous viewpoint of the company. Applied to market segments or the total US market, anchoring keeps investors from seeing the change until it is obvious to everyone else. For example, in the 1980s, America was counted out; the perception of investors was that international investing was the place to make money. Even as America cleaned up its fiscal and monetary policies, the new information was ignored by those anchored to their opinions of America's labour, management, tax system, and debt structure.
b) Over-reaction: Stereotypes and Exaggerating Probabilities: Over-reaction that results in sell-offs can also be caused by investor behavioural bias. Investors overreact as a result of stereotyping (representativeness) and overestimating probabilities. By stereotyping they take a single observation and conclude it is representative of an entire population. A good example of overestimating probabilities is when a plane crash occurs people tend to overestimate another occurrence. When a stock experiences a long period of disappointing news that results in a long period of price under-performance, investors become conditioned to the poor performance and project continued poor performance into the future. Emotions based on behavioural bias create an over-reaction.

2.4 Stock Market Levels

The eighties and the nineties witnessed excessive volatility in stock prices which even went to the extreme of crashing in 1987 [see for example, Seyhun (1990) and Siegel (1992) on the 1987 crash], and to the high levels of 1999 followed by the severe drop in stock prices up to 2002. Campbell and Shiller (1988) find stock prices and returns are too volatile to accord with simple present-value model. Shiller (1988) shows that there is substantial unexplained variation in the log dividend-price ratio. Even for before the eighties, Shiller (1981) shows that measures of stock price volatility are far too high to be attributed to information about future real dividends. The stock market's pronounced volatility triggered a large-scale search to explain stock market fluctuations and levels.[20]

There are many competing explanations proposed in the literature for the excessive volatility in stock prices. Some of those explanations reject the present value model, some reject rational expectations, and some reject the assumption of rational optimising agents.[21]

Consistent with efficient markets, is that stock price movements can be rationalised by fluctuations in discount rates, which have not been correctly modelled [Grossman and Shiller (1981), Mehra and Prescott (1985), Epstien and Zin (1991)]. Cochrane (1994) and Fama and French (2001) argue that the high equity prices were the result of a decline in the equity premium and in the rate at which investors discount expected future real dividends. Consistent with rational expectations, but not with the present value model, is the possibility of rational bubbles in stock prices [West (1988), Flood (1990)], or that price movements may be explained by market frictions [Weil (1989)]. In more recent articles on bubble theory, Youssefmir, Huberman, and Hogg (1993) show that when speculative trends dominate over fundamental beliefs, bubbles form, leading asset prices away

[20] Bulkley and Harris (1997) test whether the documented excess volatility in stock prices in the US can be explained by excess volatility in earnings forecasts. They find no statistically significant correlation between analysts' forecast earnings growth over five years and realised growth and that earnings forecasts are over estimates. This supports their hypothesis of the failure of the market in forming rational expectations. They also find that the market earnings growth expectations and stock prices are positively correlated with analysts' forecasts, which means that analysts contributed to the excess volatility.

[21] Bulkley and Harris (1997) provide a useful survey of these explanations.

from their fundamental value making the system increasingly susceptible to any exogenous shock, thus eventually leading to a crash, Brooks and Katsaris (2002) state that periods where fundamental value was irrelevant, such as stock price levels before 1929 and 1987 crashes, led researchers to look for factors beyond fundamentals such as speculative bubbles that could explain the major deviations from fundamentals.[22]

At the opposite extreme is the idea that irrational fads and fashions may explain stock price fluctuations [Shiller (1989)].

In between these two extremes is the possibility that the market may price stocks by the present value model but not insert into this model rational expectations of future dividends. This in turn may be either because the true dividend model is unknown and must be learnt over time [Bulkley and Tonks (1989) and (1992), Barsky and DeLong (1993)] or because agents simply use irrational and inappropriate mechanisms to forecast dividends, for example by overreacting to current information [DeBondt and Thaler (1985)]. Others argue that innovations in information technology have driven stock prices to historically high levels in the 1990s [Hobijn and Jovanovic (2001)].

More recent research addressed overvaluation in stock prices explicitly. Cole, Helwege, and Laster (1996) report that traditional market indicators have pointed to an overvalued stock market in the 1990s in the US with record low dividend yield and high market-to-book ratio. Though, the stock market has performed well, which leads to question whether the behaviour of these indicators has changed and they became invalid predictors of stock returns. They examined the predictive power of these measures and find that equities tend to perform poorly when dividend yields are low and market-to-book and price-earnings are high and vice versa.

[22] The literature on *rational speculative bubbles* to explain economically unjustified stock market levels and fluctuations is extensive. Brooks and Katsaris (2002) provide a good summary referring to research that concentrated on the presence of: (a) *deterministic bubbles* [Flood and Garber (1980), Flood, Garber, and Scott (1984)], (b) *fads* [Summers (1986), Fama and French (1988), Cutler, Poterba and Summers (1991)], (c) *periodically collapsing speculative bubbles* [McQueen and Thorley (1994), Sornette and Johansen (1997)]. Also see on bubble theory, Diba and Grossman (1988), Froot and Obstfeld (1991), Allen, Morris and Postlewaite (1993), Allen and Gale (2000).

Campbell and Shiller (1998) believe that dividend-price and price-earnings ratios have a special significance when compared with many other statistics that might be used to forecast stock prices. They say "it seems reasonable to believe that prices are not likely ever to drift too far from their normal relations to indicators of fundamental value, such as dividends or earnings. Thus, one might expect that when stock prices are very high relative to these indicators, as they are in 1997, prices will fall in the future to bring the ratios back to more normal historical levels." They show that since 1872 up to 1983 the dividend-price ratio was fluctuating around its historical mean 4.73 percent and after 1983 the ratio has been below its mean ever since. They find the denominator of the ratio (the price) that brings the ratio back to its mean. They state that these ratios in 1997 are extraordinary bearish for the US stock market, and hence they find that US equity market is *extraordinarily overvalued.* They predicted a substantial decline in stock prices and real stock returns close to zero over the next ten years (from 1997), which we have actually witnessed during 2000-2002.[23]

Heaton and Lucas (1999) analyse three broad categories of fundamentals-based explanations for the stock price rise in late 1990s in the US. These are: changes in corporate earnings growth, changes in consumer preferences, and changes in stock-market participation patterns. Otherwise, a bubble is likely to be the cause of the price rise. Using Gordon growth model, they find the value obtained for expected growth is large in historical standards and unlikely to be the sole explanation and it is unlikely that large shifts in the expected rate of return have taken place to justify such stock price levels. They find that changes in the fundamentals can account for perhaps half of the observed increase in price-dividend ratio.[24] They also conclude that changes in stock-market participation patterns over the last decade are unlikely to be a major part of the explanation.

Siegel (1999) suggests that higher value of equity might be stemming from a fall in the required rate of return to equity from its historical average, because new technologies in financial services have lowered transaction costs; and from

[23] They relied on testing the level of each ratio against its historical average and they used some regression analysis for their predication.
[24] These fundamentals were earnings growth and two socio-economic factors.

faster growth. Because fast-growth industries are heavily represented in equity indices and that strong growth in earnings is expected to continue.[25]

Kiley (2000) compares the predictions for the market value of firms from the Gordon growth model with those from a dynamic general equilibrium model of production to explain the skyrocketing stock prices in the US in the second half of the 1990s. His results suggest that this run-up in stock prices is inconsistent with the production performance of the economy in recent years. He showed quantitatively that faster growth is not the explanation of the phenomenon and that a drop in the required rate of return generates an increase in the market value about half that observed in the market.

Shiller (2001) argues in his popular book 'Irrational Exuberance' that in year 2000 the stock market was overpriced and that it is still likely to do poorly. We saw that happening. His confidence surveys showed that despite the poor performance in that year, people confidence in the stock market has declined only a little. This raises the issue of investor expectations role in driving stock prices away from their fundamentals. He reported that there is almost *no historical connection* between major movements in aggregate real stock prices and movements in the present value of real aggregate dividends and also *no substantial relationship* between such movements in real prices and major movements in real earnings. He reported a *huge gap* between economic growth indicators and corporate earnings on one side and stock prices on the other side. He also showed that there is *no substantial long-term historical relationship* between corporate profits and stock prices. He reports that the US stock market ups and downs over the last century have made virtually no sense ex post. He continues saying: it is curious how little known this simple fact is.

Smithers and Wright (2004), being rightly sceptical, say "How can the market be worth five times as much as it was 10 years before? Surely it must have been obvious that it was either too cheap at the start or too expensive at the end? Can it really be claimed that a market that swings around in such a manner is always efficient?" Using the q ratio and the cyclically adjusted price-earnings ratio, they report that at the end of 2003, when the S&P 500 stood at 1058, Wall

[25] Fast growth industries would expose investors to higher risk, which is reflected in higher rates of return demanded by investors. Thus, the two reasons, suggested by Siegel (1999), seem to have some contradiction.

Street was overvalued by at least 60 per cent.[26] They state that it is possible for stock markets to become over- or under-valued, which is consistent with the common sense observation that stock markets rise and fall too much to be justified by changes in fundamentals.[27]

It is worth mentioning that the empirical evidence on the equity premium puzzle is related to the issue understudy. That is, equity returns have been significantly higher than what is consistent with standard finance theories. This high equity risk premium could indicate that stock prices are driven by return expectations rather than by fundamentals. On equity risk premium, see for example, Mehra and Prescott (1985), Weil (1989), Siegel and Thaler (1997), Siegel (1999), Pastor and Stambaugh (2001), Brennan and Xia (2001), Bansal and Lundblad (2002), Fama and French (2002).

In a UK-based research, Brooks and Katsaris (2003) show by applying speculative bubble theory, that UK stocks were overvalued in the late 1990s as they deviated too far from their fundamental values, which was then followed by an eventual and complete correction leading stock price levels back to its fundamental value level. Hence, they conclude that the bubble has fully burst and stocks are no longer overvalued by the time of this article.[28] In a later paper by the same authors (2003b), they find that stock prices in the UK have deviated significantly from their fundamental values during the late nineties, and that this deviation has all the characteristics of a bubble.[29]

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[26] *q* ratio: calculated as the ratio of the market value of companies to the replacement cost of their assets. Cyclically adjusted price-earnings ratio: calculated as the ratio of current stock price to average earnings (on an inflation-adjusted basis) over the past 10 years [Shiller (2001)].

[27] See also "Valuing Wall Street: Protecting Wealth in Turbulent Markets" book by Smithers and Wright (2002).

[28] According the same article by Brooks and Katsaris (2003), "a speculative bubble is marked by a persistent and increasing deviation of actual stock prices from their fundamental values... Early theories of speculative bubbles had two properties that made them fundamentally flawed. First, they implied that bubbles could only be generated by irrational investor behaviour, and second, that bubbles would grow and then collapse completely to zero. However, more recent research has suggested not only that bubbles can be periodically appearing and partially collapsing, but also that the existence of bubbles in asset prices is entirely consistent with rational investor behaviour and efficient markets."

[29] They used three different empirical methodologies to examine whether this deviation can be explained by reference to the presence of a speculative bubble. These are: variance bounds tests, bubble specification tests, and cointegration tests based on both and data.

2.5 Property Investment Stocks Discount: Related Literature

The role of investment knowledge in rationalising stock prices is analysed in our third study (Chapter 5) by exploiting the investment characteristic of property investment stocks.[30] Therefore, it is worth reviewing the related literature on UK property investment stocks and their enduring discount with the related literature on US real estate investment trusts (REITs) and closed-end funds as they also trade at a discount to net asset value.

Some research emphasised the relation between the underlying assets (properties) and the vehicles that hold them (property companies and REITs), which is in the centre of our third study.[31] For example, Barkham and Geltner (1995) examine the securitised (public) and unsecuritiesd (private) commercial property markets in the US and the UK for evidence of price discovery. They find that, over the long-term, the value of property company shares is fundamentally linked to the performance of the underlying property market. They argue that price discovery occurs in the public indirect market in both countries, and that this price information does not fully transmit to the private direct markets for a year or more. However, they find the two markets appear to be more closely linked in the UK than in the US.

Matysiak and Brown (1997) conducted a time-varying analysis of abnormal performance of UK property companies using time-varying measures of Jenen's excess performance and beta. They find that over 1980-1995, the majority of property companies exhibited an enduring risk-adjusted underperformance profile. This underperformance was not statistically significant. Only few

[30] Brooks, Tsolacos and Lee (2000), as an implication of their analysis on the cyclical relations between traded property stock prices and aggregate time-series, refer to a sign of market efficiency for property stocks pricing as they find that information about the economy and the property market conveyed by the variables of gross domestic product, rents, property yields, consumption, dividend yield, and long-term interest rate is incorporated speedily in the prices of property stocks. This conclusion offers some support for using property stocks as a control case to address the role of investment knowledge in rationalizing stock price.

[31] If we know enough about the underlying assets and operations of a company in terms of their values reflecting reasonable information about expected cash flows of these assets and growth, we would be able to rationally price this company's share in the light of market levels of return expectations so this share could deliver investor return expectations.

companies found to have delivered positive abnormal performance, but that was not statistically significant too.

Barkham and Ward (1999) document the parallels between closed-end funds and UK property companies as in both types the market capitalization is commonly below the net asset value of the assets held.[32] They examine two hypotheses to explain the discount of property stocks; (a) the discounts are the result of agency costs, contingent capital gains tax liability, and a number of other firm specific factors, (b) the discounts result from the interaction of noise traders and rational investors. Their evidence suggests that both hypotheses have utility in explaining property company discounts. They rely on the two approaches that were used to investigate the discount of closed-end funds. The first, is the *rational approach* which links the discount-to-NAV to company unique factors (management, tax liability, stock mix, etc) which has not successfully explained the closed-end fund discount or its variation over time. The second, is the *noise trader or sentiment approach.* It posits the existence of two types of investors in the market; rational trader and noise trader where the activities of noise traders provide additional risk that affects stock value and returns. The noise trader model predicts that security prices will deviate from fundamental values over the short term and that securities will be priced below fundamental values in equilibrium. The noise trader approach has been applied with some success to closed-end fund discounts by Lee, Shleifer and Thaler (1991).

Related recent literature on *Real Estate Investment Trusts REITs* is briefly reviewed to complement that on property investment stocks discount as REITs also trade at a discount-to-NAV. But REITs have a very special corporate form different from that of property companies.[33] Gentry, Kemsley, and Mayer (2003) argue that a REIT's price should be below its NAV if its tax basis in its properties is below market value. Also, a REIT would trade below its NAV if operating it

[32] They regard property stocks discount as a very intriguing phenomenon in the market of UK real estate securities. They state it is worth investigating because: (a) Property companies publish both book value and market values of their investment properties annually which implies that the discount is not a pure artifact of accounting standards or practices, (b) The second is that property companies may be regarded as a special case of closed-end fund which trade at a discount to NAV and there is a rich literature about them. (c) The third is the lack of research on the discount of property stocks.

[33] See Campbell, and Sirmans (2002) paper for some background about the debate about REITs as a corporate structure for Europe.

requires additional costs that are not associated with alternative real estate investment structures including the costs of potential conflicts of interest. They exploited the institutional characteristics of REITs for evidence about the capitalisation of dividend taxes impact into share prices trying to avoid some of the complications encountered in previous empirical work with general industries.[34] They test the hypothesis that investors capitalise the shareholder-level tax benefits from tax basis into share prices. They find that the market assigns a positive value to tax basis (that creates future dividends tax deductions), suggesting that REIT prices appear to capitalise future dividend taxes.

Gentry, Jones, and Mayer (2003) start with posing the following question "Do stock prices reflect fundamental values?" They highlight the difficulty of assessing fundamental values for most operating companies because they are dependent on estimating future outcomes and valuing them against appropriate risk levels. They look at REIT premiums and discounts to NAV, and whether they can be used to generate trading profits. They document that REIT stock prices deviate from net asset values (NAV). They find that a strategy of buying REIT stocks trading at a discount to NAV and shorting those trading at a premium would yield significant positive excess returns for little risk exposure. They reported that frictional costs and short-sale constraints are not prohibitive.[35] They find that some variation in price-to-NAV is reasonable as premiums are positively related to recent and future growth in NAV where they find that variation in price-to-NAV predicts future NAV growth. They conclude also that, as aggregate price-to-NAV appears to be stationary and mean-reverting, trading on mean-reversion could be profitable given that there is too much variation in price-to-NAV. Finally, they report that their results, although related to similar findings in the closed-end fund literature, it is unlikely that REIT premiums and discounts reflect the investor sentiment hypothesis of Lee, Shleifer, and Thaler (1991) on closed-

[34] The special characteristics of REITs they exploit for their research, as listed in their paper, are: First, a REIT's tax basis in its assets provides depreciation tax shields and reduces taxable gains on the sale of properties. Second, REITs do not pay corporate taxes, so any benefit they derive from tax basis reduces shareholder-level taxes only. Third, analysts regularly appraise the market value of REIT properties, and the tax basis REITs have in their properties invariably differs from the market value of the assets. Fourth, REITs are required to pay out most of their taxable income as dividends, limiting the extent to which these firms can use dividends for signalling purposes and eliminating the tax benefit associated with share repurchases as a substitute for dividends.

[35] That is surprising! Is it that obvious? What about arbitrage?

end funds, because REITs have much higher institutional ownership compared to closed-end funds stocks that are mainly held by individuals.

It is worth noting that price-to-NAV according to their research was close to one on average for US REITs while UK property stocks price-to-NAV ratio is significantly and persistently below one even after correcting their NAV to liquidation level as shown in Chapter 5. The reason for this difference comes mainly from that US REITs are tax-advantaged vehicles where they almost pay no corporate tax at all while UK property stocks are taxed on operating income and realised capital gains like any other company. At 30 percent UK tax rate for property companies, one could justify the difference in price-to-NAV. In their paper, they use Green Street NAV estimates where analysts compute NAV by determining the fair market value of each property owned by a REIT. However, they do not talk about adjusting for the impact of property contingent capital gains tax as REITs are, subject to specific asset and income tests discussed in Chapter 5, exempt from paying corporate tax on property capital gains. Also, they do not address the impact of debt market value movements on NAV although, according to Gentry, Kemsley, and Mayer (2003), mean (median) Debt-to-NAV ratio is 72 (68) percent.

As some parallels could be drawn between the discount of closed-end fund and property investment stocks discount, a literature review is included here to deal with the *Closed-End Funds Discount.*[36] The literature on closed-end fund discounts is very rich. Therefore, here is a summary review based on a survey by Dimson and Minio-Kozerski (1999) who summarized the findings of more than 70 studies. They sum up by saying that since the many studies attempted to explain the discount-to-NAV and its behaviour by emphasizing biases in calculating NAV, agency costs, tax-timing options, and market segmentation have

[36] Closed-end funds are firms similar to any corporation where they differ as they specialize in investing in other corporations' securities and managing these investments in terms of generating income and capital profits. They are called Closed-end funds because their capitalization (number of shares) is fixed or closed. In contrast, open-end funds are characterised by the continual selling and redeeming of their units at or near to net asset value, and this at the request of any unit holder. Therefore, open-end funds have a variable number of shares in issue. A closed-end fund share price is a direct function of the supply and demand for the fund's shares and has an indirect link to the value of the fund's underlying assets.

not provided a full explanation, some researchers resorted to models of *limited rationality*.

Closed-end funds commonly trade at a discount to their NAV, which is one of the most puzzling phenomena in finance. Shares in US and UK funds are issued at a premium (5 to 10 percent) representing the underwriting fees and start-up costs associated with the flotation. Subsequently, within months, these shares drop in price to trade persistently at a discount fluctuating in a mean-reverting pattern. In cases of fund termination, whether liquidation or open-ending, the discount gap disappears [Brauer (1984), Brickley, and Schallheim (1985)]. The same is observed but in a more pronounced way for property investment stocks in cases of liquidation or take-over.

Explanations in the literature can be classified under two categories: (a) *economic*, and (b) *behavioural*, where the second category emerged after failing to find a full explanation in the first one. The economic explanations for why closed-end fund prices would differ from NAV include, for example, expected future trading and management costs [Malkiel (1977)], the expected performance of fund managers [Chay and Trzcinka (1999)], the impact of tax liabilities and timing [Brickley, Manaster, and Schallheim (1991)], and market segmentation [Bonser-Neal, Brauer, Neal, and Wheatley (1990)]. Nevertheless, it is difficult to properly explain the discount and its behaviour over time without seriously considering the behavioural aspects of irrational investor behaviour [see for example: Lee, Shleifer, and Thaler (1991)].[37]

Here is also a review of some UK-based studies on closed-end funds. Levis and Thomas (1996) using UK and US traded closed-end country funds, investigate the notion of investor sentiment.[38] They find that the prices of these funds are significantly influenced by: (a) price changes in the stock markets of the underlying investments (positive relation), (b) price movements in the World Index (positive relation but much weaker than 'a'), and (d) the discount level at

[37] Closed-end fund discounts are not the subject of this thesis. However, amongst other things covered in the literature, investors could be discounting closed-end fund stocks for the inherent market valuation bias (as discussed for example in Chapters 3 and 4) and for the risks associated with their underlying assets of losing significantly in value because of such biases as was experienced between 1999 and 2002 where the stock market lost over 40 percent of its value.

[38] That is fluctuations in discounts in closed-end fund prices (to NAV) are driven by changes in individual investor sentiment.

the start of the period while movements in the local capital markets mainly influence changes in NAV where the funds invest. Their empirical results strongly support the notion that changes in the level of the discount is influenced by individual investor sentiment, proxied by the volume of unexpected individual-investor money flowing into/out of the corresponding mutual fund sector, as the average discount level narrows when such money flows in. They find no evidence to suggest that changes in the discount level of UK-traded country funds are associated with the activities of institutional investors despite the fact that these investors hold the majority of counrty fund equity.

Fuertes and Thomas (2004) investigate the short-term behaviour of closed-end fund prices following large market-wide shocks. They establish that shocks cause large jumps in fund prices relative to NAVs. They find, after a shock, the discounts to NAVs of small and difficult-to-arbitrage funds take longer to revert to pre-shock levels compared with large and easy-to-arbitrage funds. The discount reversion happens faster for the small funds group when the difficult-to-arbitrage funds are excluded, which imply that the ease-of-arbitrage for small funds is the key factor. For large funds, both ease-of-arbitrage and size are intrinsically linked.

Finally, Gentry, Jones, and Mayer (2003) draw some parallels between their results on REITs and the literature on closed-end funds. They mention for example, that their basic result on excess returns of low Price-to-NAV REITs against high Price-to-NAV REITs is similar that of Thompson (1978) and Pontiff (1994). Chay and Trzcinka (1999) show that Price-to-NAV predicts subsequent changes in net asset value for closed-end funds. They report that REIT premiums and discounts appear to exhibit similar behaviour to closed-end fund discounts, while, in some ways REITs are very different because, for example, REITs pay significantly higher dividends. Pontiff (1996) finds that paying higher dividends leads to higher valuation (lower discounts) for closed-end funds. As another example, REITs have much higher inside ownership. Coles, Suay, and Woodbury (2000) show a negative relation between inside ownership and closed-end fund discounts.

2.6 Conclusion

In this chapter, we have brought together relevant research from different areas to serve our objective of investigating valuation bias via examining relative valuations and the overall stock market levels and fluctuations. The main themes about equity valuation from this review can be summarised under (a) Efficient Markets Theory/Fundamental Explanations, that could not fully justify or explain levels, anomalies, and excess volatility, to which Rational Processes were introduced in some studies (e.g., learning and mean-reversion), (b) Behavioural Explanations to explain what cannot be explained by fundamentals; of those, there are rational explanations (e.g., speculative bubbles) and irrational ones (e.g. behavioural biases).

We have looked at fundamental valuation literature, where the articles reviewed concentrate on efficient markets theory and fundamentals to explain stock valuations. The literature emphasises the importance of growth, profitability and risk as valuation fundamentals. Some research resorted to processes such as learning or addressing uncertainty of some fundamentals to refine valuation models and explanations.

There is an empirical confirmation in the literature about valuation differences between new and older stocks; Pastor and Veronesi (2003) explained that *fundamentally* by learning about profitability. In our first study, we address valuation bias as another explanation or part explanation for the higher valuations of new stocks relative to older ones rather than just learning using UK data. This is broadly consistent with the findings of Ayrer, Upper, and Werner (2002) of biased asymmetric reactions to news for each group, who explained the phenomena by *behavioural bias*. We explore whether these valuation differences can be explained by differences in fundamentals or by bias otherwise. Consistent with the literature, we use accounting information focusing on cash flow through profitability and growth.[39] However, we model and incorporate risk explicitly to take into account industry-specific risk and the impact of firm-specific capital

[39] Profitability and growth determine cash flow. We also decompose profitability into it components: trading profitability, efficiency and leverage.

structure. In addition to incorporating the age factor to study the impact of survival time (age) on valuation, we incorporate the size factor inline with its established importance in the literature.

The literature confirms that fundamental explanations cannot fully account for stock market levels and their changes. Therefore, it is important to turn to behavioural explanations. The literature on behavioural finance clearly agrees that behavioural biases are important to understanding stock pricing and that biases such as over-extrapolation, over-confidence, self-attribution, etc have utility in explaining stock market levels, fluctuations, and valuation differences that do not accord with reasonable economic or fundamental explanations. Obviously, fundamental-based valuation and behavioural finance complement each other.

It is clear that the literature on stock market levels agrees on the presence of economically unexplained stock price levels and fluctuations referring to record low levels of earnings-price ratio and dividend yields, overvaluation, etc. Work by leading researchers, such as Shiller, focuses mainly on macro levels and uses market-based indicators. Our work in the second study, on examining stock market levels against fundamentals, utilises their ideas such as testing the relation between value and profitability and efficiency and the relation with economic growth. However, we focus more on micro/corporate-level on the underlying corporate-based fundamentals on the basis that these variables should capture the impact of the relevant macro and micro factors on value. Consistent with the techniques used in the literature, we test stock market levels concentrating on earnings yield (and its relation with growth and risk), profitability levels, growth expectations, and return expectations versus discount rates. Moreover, most of the literature on stock market levels and valuation uses US data and there is clear shortage of substantial research using data of other countries including the UK, which is one of the motives to undertake this work using UK data.

The article by Gentry, Kemsley, and Mayer (2003) is just one example of exploiting the special characteristics of a special corporate form (REITs) to seek empirical evidence about a certain relation. We also exploit the special investment characteristics of the UK property investment stocks and their underlying assets,

where a reliable investment knowledge is available to investors. We seek evidence about the role of investment knowledge in rationalising stock prices (or limiting valuation bias) and the implication of the absence of such knowledge on behavioural bias. Hence, we have presented a review of the literature on property investment stocks, and the related literature on their closet relatives; real estate investment trusts and the further relatives; closed-end funds. Two types of explanations exist in the literature for the discount-to-NAV; rational and behavioural. We seek the explanation together from (a) company unique factors, such as operating expenses, contingent capital gains tax liabilities, the impact of debt market value movement, capital growth, the risk of the un-crystallised capital gains, and leverage that is consistent with the rational approach referred to in Barkham and Ward (1999), (b) the nature of the economics of property investments themselves in terms of return and growth characteristics and the quality knowledge about these characteristics, and (c) the relative stability of the behaviour of property stock prices relative to the economy, their underlying value, and the overall stock market. This is hoped to explain the discount of property stocks rationally to establish the role of investment knowledge in stock price rationalisation. Unlike the literature reviewed, we correct NAV to its liquidation value by taking into account the impact of debt market value movements and contingent capital gains taxes to test using a more accurate measure of the underlying value.

3 Chapter Three: Valuation Bias and Stock Age: New Stocks versus Survivors

3 Chapter Three: Valuation Bias and Stock Age: New Stocks versus Survivors

Abstract

We investigate valuation bias in the UK market by examining the valuation of new stocks relative to that of older or survivor stocks. We establish the presence of significant differences, with new stocks having relatively higher valuation. We thus confirm the same pattern of declining market-to-book with age for the UK market as has previously been documented for the US market. Moreover, the valuation gap significantly increases in bullish markets and declines in bearish markets, perhaps indicating investor overoptimism about new stocks relative to survivor stocks, i.e. in bullish markets investor overoptimism drives prices too high subsequently leading to severe corrections in down markets when the economy is gloomy and the gap is too apparent to be justified.

We develop a value explanatory model incorporating profitability, growth and risk levels as well as age and size. The value model assigns a significant negative coefficient to age, un-backed with any known economic rationale with relatively lower profitability levels for new stocks that is inconsistent with their higher valuations, with no consistent or concrete evidence of higher earnings growth, and no evidence of lower risk. On the contrary, the evidence, as well as common sense of investment, indicates that new stocks would have higher risk. This evidence is in favour of rejecting the hypothesis that these valuation differences are explained by differences in fundamental profitability, growth and risk factors, which is in favour of the alternative hypothesis that valuation bias does exist. The research also test and reject another competing hypothesis of rational behaviour based on pricing the long-term potential for new stocks. The evidence in this study does not imply that we accepted the valuation of survivor stocks as rational or otherwise as it is a relative analysis.

3.1 Introduction

Previous research by Pastor and Veronesi (2003) has established a negative relationship between market valuation and the survival time (age), i.e. the period that has elapsed since the stock was first issued. Pastor and Veronesi attribute this observation to the market learning about the profitability and growth rates of new stocks, although this theory seems to imply some degree of investor irrationality since investors fail to anticipate the decline in growth rates that occurs as firms mature.

The literature on behavioural finance offers alternative perspectives on valuation differences. For example, Ayrer, Upper, and Werner (2002) argue that the asymmetric impact of news on stock prices of new and old stocks is due to behavioural bias. Daniel, Hirshleifer, and Subrahmanyam (1998) suggest that those who acquire wealth through successful investment may become more overconfident, suggesting that the long-term performance of the stock market might have led investors to be overconfident about their future expectations. This does not however explain why newer stocks are overvalued relative to survivor stocks. Lakonishok, Shleifer, and Vishny (1994) suggest that investors tend to over-extrapolate past problems into the future, an analysis that can explain why survivor stocks are valued below new stocks, simply because new stocks by definition have no bad history. This analysis would suggest that survivor stocks would do well in booms, when history is relatively favourable.

The objectives of the present research are to investigate whether a survival time effect similar to that found in the US is observed in the UK stock market; and to examine if this can be explained by differences or changes in valuation fundamentals, including profitability, growth, and risk. Rejection of these explanations will suggest that stock prices are driven by investor expectations deviating from the underlying fundamental corporate and economic factors, i.e. suggesting the presence of valuation bias. We also examine the changes in the valuation bias between new and survivor stocks in different market conditions (in calendar time).

Our procedure is as follows. Stocks are split every year according to a certain survival criteria into *new* stocks and *Survivor* stocks (or mature stocks). The first objective is to establish and document the presence of differences in market valuations between survivor stocks and newer stocks. Section 3.2 discusses the data. Section 3.3 examines the differences in market valuation between new stocks and survivor stocks using descriptive and weighted average statistics for pooled data (not in calendar time) and for time-series data supported by equality testing, and relating that to the IPO evidence in the literature. We find statistically significant differences in market valuation ratios between new and survivor stocks. More specifically, new stocks have relatively higher market-to-book ratio and lower earnings-to-price and cash flow-to-price ratios. Table 3-2 page 48 and Table 3-3 page 48 present these valuation differences. Section 3.3 further documents the variation of the valuation gap between the two groups over time.

Our second objective is to establish whether these differences reflect fundamental differences or stem from some kind of stock market behavioural bias. This requires establishing the relation between stock valuations and underlying corporate-based value indicators. A substantial part of this exercise is the development of an appropriate supplementary valuation model in Section 3.4. The model is used to: (a) Identify the value-relevant variables that reflect or measure the impact of the underlying corporate and economic factors on value so the research can be based on the relevant variables. (b) Compare model valuations of the new and survivor groups. (c) The model will serve as the joint statistical testing for the profitability, growth and risk factors as to whether the model can explain valuation differences. Model predictions are explicitly used to study stock age effect on market valuation.

Section 3.5 provides a further analysis of the consistency between valuation differences and differences in individual value fundamentals. All tests are performed for the following categories: (a) profitability and efficiency, (b) growth, and (c) risk. Risk is examined through three risk indicators: systematic risk, stock returns volatility and liquidity argument, and finally age and the death of public limited companies.

We use the above empirical analysis to investigate the following null hypothesis:

> ***H_0***: *Differences in fundamentals can explain the differences in market valuation between new stocks and survivor (older) stocks.*

If the research concludes by rejecting H_0, that will be implicitly in favour of H_1.

> ***H_1***: *The stock market is biased in valuing new stocks relative to survivor (older) stocks.*

The research will also look into another version of H_0 (*Competing Null Hypothesis*) in Section 3.6. That is: *The market is rational in valuing new stocks higher than survivor stocks because of pricing the future long-term potential and status of new stocks.* Where future growth is already priced in and hence new stocks do not produce significant positive stock returns until they can be classified as survivors, while their stock price variability in the interim is a combination of noise and revisions of expectations. Section 3.7 concludes this chapter.

Figure 3-1 illustrates the various steps of the analysis, from Section 3.3 to Section 3.6. Following different routes on the flow chart can show other cases in which the research hypotheses would have been rejected or not rejected.

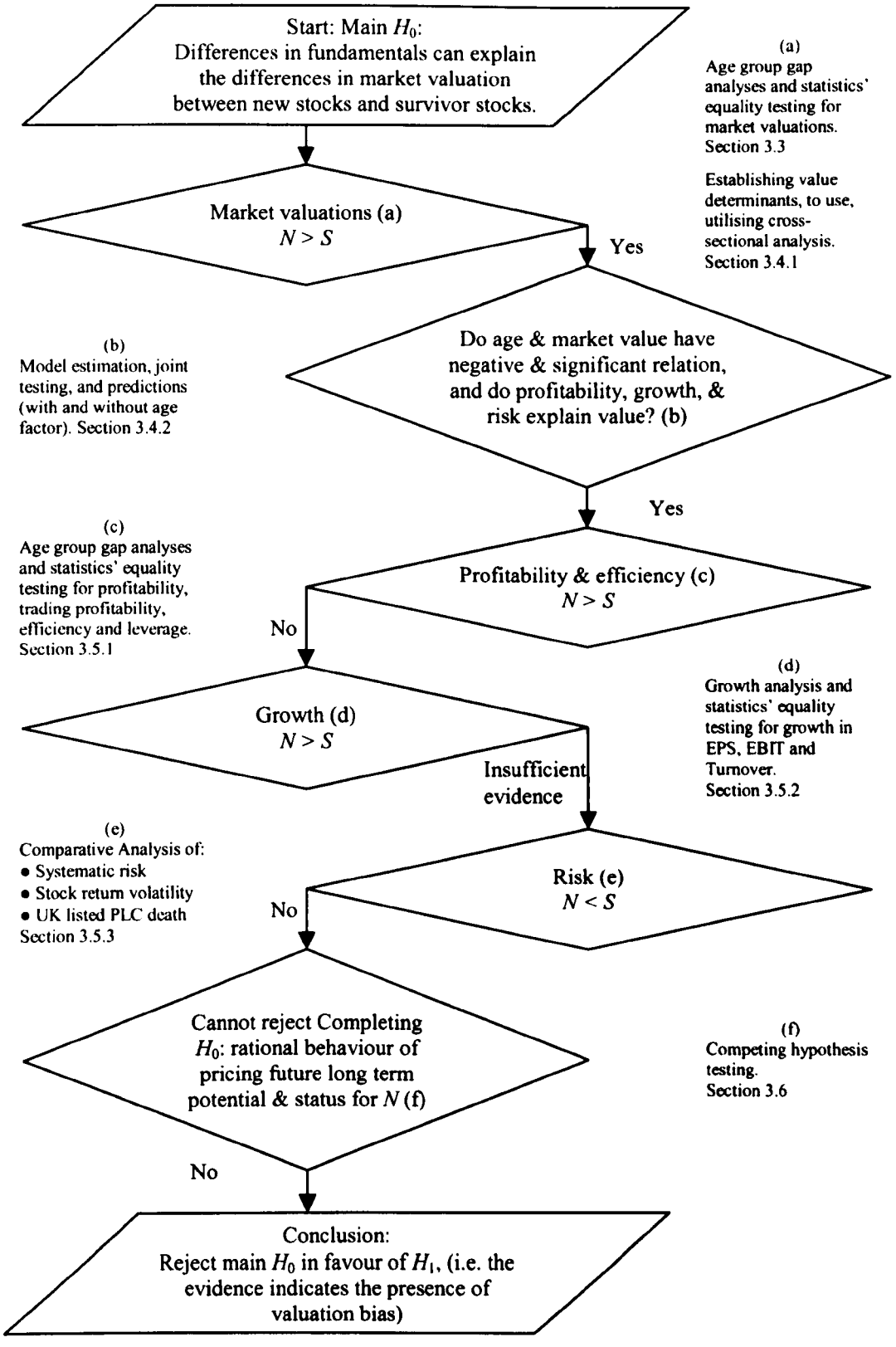

Figure 3-1. Research Method Flow Chart

N and S stand for New and Survivor stock respectively. The figure only contains the main flow chart steps in a question format (for illustration purposes) as followed in this chapter where the sequence of questions and their answers lead to the conclusion. The rectangular boxes marked (a), (b), (c), (d), (e), and (f) briefly refer to the empirical analyses and techniques used to answer the questions in testing the research hypothesis along with the corresponding section number for easy reference.

3.2 Data

This section provides a brief discussion of the data used in this analysis. Further details are provided in the data appendix (Appendix 3.8.1). This research uses annual data from the database of Datastream–Thomson Financial for the years 1989 through 2002.[40] The dataset constitutes of the UK domestic research stocks that are compiled by Datastream in a list called 'FBRIT', which contains all UK traded stocks. Financial stocks are excluded because of their different nature from general industries, for example: regulations, different capital structure, liabilities are part of the operations for banks and not only financing items, different risk-return characteristics, and the different efficiency characteristics. It is common in the literature for this type of analysis to exclude them.

Table 3-1 below presents the number of stocks in the sample every year and the corresponding market-cap.

Year	Number of Non-Financial Stocks	Market-Cap £ billion
1989	465	236
1990	496	225
1991	504	269
1992	513	298
1993	532	380
1994	574	402
1995	619	457
1996	696	537
1997	789	612
1998	852	756
1999	895	996
2000	1012	1290
2001	1121	1060
2002	1179	870

Table 3-1. Stocks in the Dataset and the Corresponding Market-Cap

Number of non-financial stocks is based on stocks with valid share price. The market-cap reported corresponds with the reported number of non-financial stocks. Total market-cap including financial stocks was £347bn and £1116bn in 1989 and 2002 respectively, that means the sample in these two years excluding financials represents 67 and 78 percent respectively of the total market-cap (based on Datastream Total Market-Cap Index TOTMKUK).

[40] Annual frequency is, of course, used because of the use of accounting data.

The data items retrieved include all those required for the construction of the supplementary valuation model i.e., as well as age, book, and market valuations. We thus collect statistics on (a) market valuation measures, (b) profitability, efficiency, & leverage, (c) growth, and (d) several measures of risk. Table 3-17 in Data Appendix 3.8.1 presents the raw data items retrieved from Datastream with the given symbols used in this research besides Datastream codes. The symbols are also listed with their definitions at the beginning of the thesis for all chapters.

Central to our analysis is the division of the sample between new and survivor stocks. There is no standard criteria or definition for firm survivorship.[41] In this study, 'survivor stocks' (*S or SUR*) will be defined as those that have survived in listing for at least 14 years (throughout the whole sample period), i.e. those which were listed since or before the beginning of the sample period 1989 and survived through 2002 and newer stocks, 'new stocks' (*N or NEW*) are those listed after 1989; the beginning of the sample period.[42]

As 14 years cut-off point, selected because it is the sample period, appears a long time for defining survivor stocks, we looked, while working on chapters 3 and 4, at the empirical results with survivors defined as those aged 10 years or more and found that does not change the conclusions. Notwithstanding that, age group analysis was used to overcome the limitations of the 14 years arbitrary cut-off where companies are analysed according to their age every year regardless of calendar time as in Pastor and Veronesi (2003). The two analyses are consistent.

Stocks that have died (went bankrupt) partway during the sample period are excluded due a logistical problem that Datastream does not distinguish in dead lists between bankrupt and taken-over/merged. However, the sample is fairly representative of the market as it contains companies that have survived so far and might still fail without complicating the modelling process with the extreme values exhibited by failing companies. This exclusion should not affect the conclusions of chapters 3 and 4, where the data used, because companies running

[41] Ball and Watts (1979) defined survivorship criterion as firms' that survived, at least, for a specified number of years. Evans (1987) classified a firm as 'survivor' if it was on the dataset in both the beginning and end of the sample period and as a non-survivor if it was on the dataset in the beginning but not in the end.

[42] The terms 'survivor stocks' or 'survivors' are used interchangeably throughout this work.

to bankruptcy display low profitability, low growth, and high risk. Hence, their inclusion could even strengthen the evidence on overvaluation.

In this study, the concentration is on the overall stock market level. However, it is worth noting that there could be sector biases because the typical survivorship rates could vary a lot between sectors. The impact of technology stocks could be the subject of a separate future research to address.

A brief discussion of the construction of the financial indicators (characteristics) is provided below; grouped according the above-mentioned four categories (after a group of some essential items). More detailed discussions are in the Data Appendix 3.8.1.

Book equity *BE* is calculated, as in Pastor and Veronesi (2003) and in Conrad, Cooper, and Kaul (2003), as Ordinary equity capital and reserves *OEQ* plus balance sheet Deferred taxes *DTBS*. Investment tax credit, which appears in US based studies, is not applicable for UK companies. **Earnings *EGS*** are calculated, as in Pastor and Veronesi (2003), as Net income, earned for ordinary *NI* minus Extraordinary items *EXOR* plus Deferred taxes for the year *DTIS*. **Cash flow *CF***, as in Conrad, Cooper, and Kaul (2003), is calculated as Net income; earned for ordinary *NI* minus Extraordinary items *EXOR* plus Depreciation and Amortisation *DPAM*. This cash flow calculation measures just the firm's performance before the major non-cash expense elements (depreciation and amortisation). **Net operating profit after tax *NOPAT*** is calculated as earnings before interest and tax *EBIT* minus taxes *TAX*. Some textbooks and valuation techniques use *NOPLAT* instead; that is net operating profits less adjusted taxes, where taxes are adjusted to cash basis on an unlevered basis while the impact of tax shield is captured by the net of tax cost of debt capital (this is consistent with the traditional definition of the after-tax *WACC*). See for example Copeland, Koller, and Murrin (2000). **Invested capital *IC* (Capital Employed *CE*)** is the sum of all interest-bearing and/or non-current liabilities and capital elements. As in Pastor and Veronesi (2003) who followed Fama and French (2001), **Age** *AGE*, refers to the age of the company in listing. Every single year, age is calculated as the

current calendar year minus the stock trading beginning year (first share price appearance in the database) plus one. For example, the age calculated in 1999 for a company its stock started trading in 1993 is 7 years (1999 – 1993 + 1). log(*AGE*) is used in the statistical model as referred to in Pastor and Veronesi (2003) as appropriate. They also mention that even using *AGE* defined as plain age (number of years) resulted in slightly weaker but still significant results. We tested this too and found the same.

(a) Market-to-book equity *MBE*, is calculated as in Pastor and Veronesi (2003), as the market value of equity *MVE* divided by book equity *BE*. The idea of using market-to-book equity as a valuation measure remains simple and valid. That is relating market capitalisation of future outcomes (future cash flows generated by profitability and growth and assessed according to their risk) to the actual capital physically injected into the business to generate these cash flows (book equity is a proxy). **Market-to-book value of firm *MBF***, is calculated as in Rajan and Zingales (1995), as the book value of total assets *TA* minus book equity *BE* plus market value of equity *MVE* divided by book value of total assets *TA*. **Earnings-price ratio *EP* or Earnings yield *EY* (the inverse of price-earnings ratio *P/E*)** is calculated as earnings *EGS* divided by the market value of equity *MVE* (exactly the same as *EPS*, adjusted as for *EGS*, divided by share price). **Cash flow-price ratio *CFP***, is calculated as in Conrad, Cooper, and Kaul (2003), as cash flow *CF* divided by market value of equity *MVE* to relate the pre-depreciation and amortisation outcome to market capitalisation. **Annualised stock returns *R***, are calculated as the cumulative monthly percentage returns over 12-month period. Dividend-based indicators are not included to keep the research more general to dividend–paying and non-paying firms.

(b) Return on equity *ROE* is calculated as earnings *EGS* divided by book equity *BE*. This is a measure of equity investment profitability as book equity represents the actual equity capital invested in the business. **Return on invested capital *ROIC* (Return on capital employed *ROCE*), after-tax,** is calculated as Net operating profit after taxes *NOPAT* divided by Invested capital *IC*; it measures the profitability to total invested capital from firm or all investors' perspective. **Net**

profit margin *NPM* is calculated as earnings *EGS* divided by turnover *TUR*; it measures the net trading profitability. **Profit margin** ***PM*** is calculated as Net operating profit after tax *NOPAT* divided by turnover *TUR*; it measures the gross trading profitability. **Asset turnover** ***ATU*** is calculated as turnover *TUR* divided by total assets *TA*; this is a measure of the firm's efficiency in using its assets to generate revenues. The profitability on capital is a function of net trading profitability/trading profitability and efficiency. **Leverage** (***LVG***) can be measured in different ways; consistent with Du Pont analysis of the *ROE*, leverage is calculated as total assets *TA* divided by book equity *BE*. Section 3.8.1.4 of the Data Appendix 3.8.1 provides more discussion following the way leverage is defined by Conrad, Cooper, and Kaul (2003), and Pastor and Veronesi (2003). **Cash flow-to-book equity ratio** ***CFBE*** is calculated as cash flow *CF* divided by book equity *BE;* this is similar, in structure, to *CFP* but it uses book equity instead in order to related cash flow to the equity capital that is physically invested in the business rather than to market capitalisation to indicate the firm's underlying cash flow generating ability.

(c) Growth is calculated as both percentage and logarithmic change in *EPS*, *EBIT* and turnover. Growth in *EPS* (called growth in earnings *GEGS*) is the selected measure for historic growth as growth in *EBIT* and turnover, in their absolute monetary values, are affected by growth from external equity capital additions while *EPS* is scaled per share and would reveal the historic growth patterns year on year. Also, growth in turnover does not give a clear idea about growth in earnings; it is rather an indicator for growth in volume, size, or market share.

(d) Annualised stock return volatility ***σ(R)*** is calculated as the monthly standard deviation multiplied by the square root of 12 as while variance is linear with time standard deviation is linear with square root of time. Historic leveraged **beta** *HBETA* is estimated using Datastream. The procedure is the traditional single index model.[43] Historic beta might be a poor approximation for the ex ante beta that should be used in the cost of capital calculation especially that the required

[43] 5-year monthly logarithmic stock returns are used. The stock returns are regressed against Datastream total market index returns. Extreme values are excluded i.e. monthly changes over 41.42 percent. The beta estimate is further modified by a Bayesian adjustment. The procedure is based on Cunningham (1973).

rate of return or the cost of capital is an economic ex ante measure. Therefore, **the ex ante systematic risk** and the cost of capital are estimated based on some well-established thoughts in finance literature. The formula that links the leveraged beta (systematic financial and business risk) to the unlevered beta (systematic business risk), taxation and capital structure, based on Modigliani and Miller (1963) and Capital Asset Pricing Model (CAPM), is given below. See Copeland, Koller, and Murrin (2000) for more details about this formula and for their recommended procedure, described below, to estimate the ex ante beta.[44] The procedure can be summarised in the following three steps.

$$\beta_L = \beta_U[1 + (1-T)\frac{D}{E}] \qquad \text{from which} \qquad \beta_U = \frac{\beta_L}{1 + (1-T)\frac{D}{E}}$$

1. For every year, historic betas were de-geared to isolate business risk (stemming from operational and industrial factors) from financial risk (stemming from leverage) using this formula producing the unlevered beta *UBETA* (beta of the assets or operations; business risk).
2. Unlevered betas were averaged for every sector every year to derive a sector-level systematic business risk measure; sector unlevered beta *SUBETA*.
3. Then, for every year, sector unlevered beta of that year was re-geared for every firm using the above formula applying the firm's own tax rate and capital structure for the same year. This yields an estimate for the ex ante beta *EBETA* that reflects both business and financial risk, which is used in the CAPM formula to estimate the cost of equity.

Cost of equity using CAPM: $K_E = R_F + \beta_L[E(R_M) - R_F]$. The literature is rich with research that used CAPM to estimate the cost of equity and others that discuss and debate CAPM itself. Here, the purpose is to use CAPM, as in too many papers, quoting for example Kaplan and Ruback (1995), so the basis of estimation is well established in finance theory and practice and very familiar. **Risk-free rate**; the rate on the 10-year UK government bond is used as

[44] *Denotation used for beta estimation:* K_E is the cost of leveraged equity. K_U is the cost of unlevered equity. K_D is the cost of debt. *WACC* is the weighted-average cost of capital. β_L is the leveraged beta (beta of equity: reflects business and financial risks). β_U is the unlevered beta (beta of the assets: reflects only business or operating risk). R_F is the risk-free rate. R_M is the expected return on the market. T is the tax rate. D is the value of debt. E is the market value of equity.

recommended in Copeland, Koller, and Murrin (2000) where they argue based on Campbell and Viceira (2001) that the 10-year rate approximates the duration of the stock market index portfolio and its use is therefore consistent with the betas and market risk premiums estimated relative to these market portfolios.[45] As Kaplan and Ruback (1995) did, **the expected return on the market** is also estimated using the general recommendation in finance texts [see for example Copeland, Koller, and Murrin (2000) and Brealey and Myers (2000)]. The procedure: It should be measured on as long period as possible (10-year period is selected) using arithmetic average of rate of return, and adjusting downward by 1.5 percent to account for survivorship bias. Copeland et al. estimated the downward adjustment by 1.5 to 2 percent based on the tables used by Jorion and Goetzmann (1999). **The weighted average cost of capital *WACC*** is calculated using the traditional formula below. For more discussion see the appendix.

$$WACC = K_D(1-T)\frac{D}{D+E} + K_E\frac{E}{D+E}$$

Size is measured in two different ways: Total assets *TA* or log(*TA*) and Market value of equity *MVE*. The total assets measure is a good proxy for firm size as it represents the total size of the operations while the market value of equity reflects the market capitalisation for future outcomes to *equity*.

[45] Just for example, Kaplan and Ruback (1995), in their paper about the valuation of cash flow forecasts, choose to use the rate on the long-term Treasury bond for the risk-free rate.

3.3 Differences in Market Valuation, Valuation Gap Behaviour, and IPO Evidence

This section provides a preliminary descriptive analysis of the data, establishing clear differences in valuation between new and survivor stocks. We examine a number of different valuation measures, market-to-book equity, market-to-book of firm, earnings-price ratio, and cash flow-price ratio. We go on, in the following section, to attempt to build a valuation model that can explain these valuation differences, i.e. to address explicitly the null hypothesis of fundamental valuation.

Table 3-2 shows that the two groups have statistically different market value indicators where survivor stocks have lower market-to-book of equity *MBE* and market-to-book of firm *MBF* and higher earnings-price *EP* and cash flow-price *CFP* (higher *EP* and *CFP* mean lower price-earnings *P/E* and price-cash flow *PCF* respectively) indicating relatively lower valuation for survivors.[46] Table 3-3, where companies are sorted into 13 different age groups, reveals the same. Means confirm the same findings as from medians; they are not reported because the presence of some extreme values that distort them. Therefore, median values are thought to be more meaningful. Both tables below establish the presence of statistically significant valuation differences between survivor and new stocks.

[46] *p*-value of the difference in medians (test of equality) is used, hereinafter. It is calculated using seven different non-parametric tests as provided in the econometrics package EViews 4.1. These tests are Wilcoxon/Mann-Whitney, Wilcoxon/Mann-Whitney (tie-adj.), Med. Chi-square, Adj. Med. Chi-square, Kruskal-Wallis, Kruskal-Wallis (tie-adj.), and van der Waerden. See EViews User Guide or Integrated Help for more information. The highest *p*-value of the above tests is reported. A *p*-value less than 0.01 indicates that the difference is statistically significant at 1 percent level.

Age Group	*MBE*	*MBF*	*EP* *Percent*	*CFP* *Percent*	Obs
All (*A*)	1.81	1.41	5.46	8.71	9893
Survivors (*S*)	1.65	1.33	6.38	10.25	6972
New (*N*)	2.36	1.75	1.77	3.62	2921
S-N	-0.71	-0.43	4.61	6.63	
(S-N)/S Percent	-42.70	-32.05	72.24	64.72	
p-value	0.0000	0.0000	0.0000	0.0000	

Table 3-2. Differences in Market Valuation, Survivor and New Stocks

Survivor stocks '*S*' are those listed since or before 1989 and still traded in 2002. New stocks '*N*' are those listed in or after 1990. '*A*' stands for all (both survivors and new together). *MBE* is market-to-book equity. *MBF* is market-to-book of firm. *EP* is earnings-price ratio. *CFP is* cash flow-price ratio. See Data section 3.2 and Data Appendix 3.8.1 for detailed calculations. The table reports medians, which are calculated from pooled data over the period 1989-2002. The last row reports the *p*-values of the differences in medians between *S* and *N*, a *p*-value less than 0.01 indicates that the difference is statistically significant at 1 percent level. Obs is the average number of observation as available for the calculated measures.

Age Group	*MBE*	*MBF*	*EP* *Percent*	*CFP* *Percent*	*Obs*
Up to 2 (*G2*)	2.87	2.08	1.57	2.65	804
3	2.28	1.68	2.15	4.33	637
4	2.30	1.66	4.01	6.47	533
5	2.28	1.72	4.04	6.59	512
6	1.92	1.49	4.35	7.11	488
7	1.98	1.47	4.24	7.06	432
8	2.02	1.59	5.20	7.92	356
9	2.05	1.58	5.54	8.62	318
10	2.02	1.54	5.62	8.55	278
11	1.81	1.46	5.82	8.64	260
12	1.83	1.47	6.21	9.55	252
13	1.73	1.38	5.49	8.94	247
14+ (*G14*)	1.53	1.26	6.44	10.70	4742
G14-G2	-1.35	-0.82	4.87	8.05	
(G14-G2)/G14 Percent	-88.34	-64.60	75.64	75.24	
p-value	0.0000	0.0000	0.0000	0.0000	

Table 3-3. Differences in Market Valuation, Age Groups

Firms are grouped for the pooled data according to their age regardless of calendar time. For example, a company aged 9 years in 1999 will appear in the 9-year age group while the same company will appear in the 10-year age group in 2000. The last row reports the *p*-values of the differences in medians between the youngest group *G2* and the oldest group *G14*. See Table 3-2 above for other clarifications about the table.

The declining pattern of *MBE* with age is consistent with the predictions of the statistical model estimated later in Section 3.4.2 and with the findings of Pastor and Veronesi (2003) in the US who find that aging in the life of a firm tends to be accompanied by a decrease in *MBE*. The median is one statistical representation for the population understudy. Therefore, to view the pattern of *MBE* at a more representative market level across age groups of all firms a weighted average *MBE* is calculated for common samples of each group. This is to allow the weight of each firm in the stock market to affect the measure. The formula used to calculate this weighted average *MBE* is as follows:

Equation 3-1: Weighted average $$MBE = \frac{\sum_{i=1}^{n} MVE_i}{\sum_{i=1}^{n} BE_i}$$

Table 3-4 shows the weighted average *MBE* and Figure 3-2 plots the paths of median *MBE* and weighted average *MBE* for comparison.

£ billion	*MVE*	*BE*	*MBE*	Obs
Pooled	8280.0	3420.0	2.42	9768
Up to 2	168.1	72.6	2.32	667
3	133.0	45.4	2.93	648
4	169.0	49.3	3.43	534
5	165.0	59.6	2.77	512
6	188.0	75.8	2.48	491
7	205.0	70.2	2.92	438
8	210.0	73.8	2.85	355
9	203.0	72.7	2.79	321
10	191.0	79.5	2.40	278
11	178.0	83.7	2.13	259
12	201.0	83.3	2.41	252
13	367.0	211.0	1.74	248
14+	5900.0	2440.0	2.42	4765

Table 3-4. Weighted Average Market-to-Book Ratio for Age Groups

Weighted average *MBE* is calculated for common samples by dividing the sum of market-cap *MVE* by the sum of book value of equity *BE* for all firms in every age group over the period 1989-2002 regardless of calendar time.

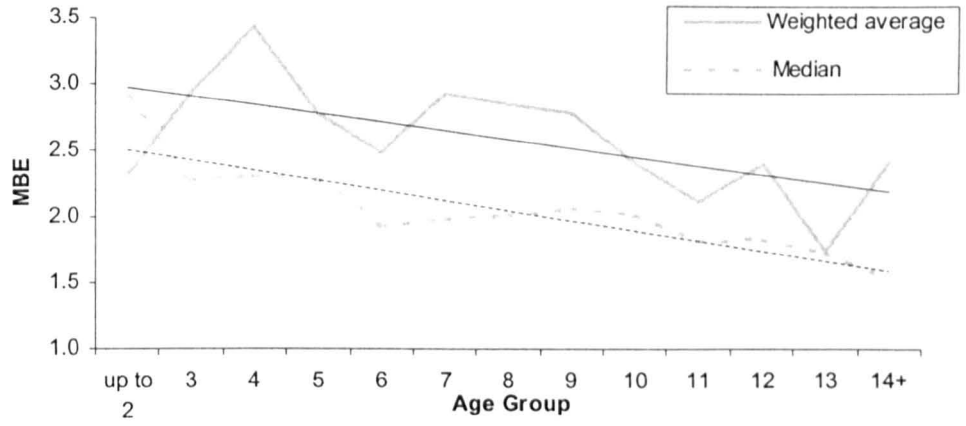

Figure 3-2. Median and Weighted Average *MBE* for Age Groups

Medians and weighted average *MBE's* are calculated in Table 3-3 and Table 3-4 respectively with trend lines (the straight lines) added to show the overall patterns of *MBE* behaviour with age (declining pattern in both; the median and weighted average).

Figure 3-2 reveals some differences between the path inferred from the traditional descriptive statistic, the median, and that of the weighted average. The median *MBE* is declining with age at different rates (with some variability) as in Pastor and Veronesi (2003), while the weighted average *MBE* is changing significantly in both directions with age. Notably, up to group 4 (G4) it is increasing with age and the same for groups 7, 12 and 14+ (G7, G12, and G14 respectively). However, the overall patterns for both are clearly declining as shown by the trend lines.

In general, weighted average *MBE* values are higher than the medians. It can be argued that the weighted average is more representative for market levels. The conclusion derived from medians for the youngest 4 groups and the oldest group is the opposite of that derived from the weighted average measure. The median shows *MBE* of 2.87 for *G2* declining to 1.53 for *G14*, while the weighted average shows *MBE* of 2.32 for *G2* rising up to *G4*, and then fluctuating in a declining trend up to *G14* where the value is 2.42. The significance of this finding is to understand the relation between age and value while accounting for firms' weights in the market. Firm weight is an important factor, while relying solely on the medians leads to overlook some differences due to firm weighting. However, this could be the result of the sample size for young stocks, therefore, exploring

the comparative evolutional patterns of market valuation in calendar time could help to show whether same valuation differences that are found via the age group analyses, not in calendar time, can be confirmed in calendar time (time-series) analysis. The rationale behind this evolution test is to confirm valuation differences taking into account changing market conditions over time rather than only using pooled data over the whole period 1989-2002 and to understand the evolutional patterns of market valuation over time.

Figure 3-3 shows the variation over time in market valuation for both survivor and new stocks, as measured by median *MBE*. New stocks *MBE* has almost always been higher than that of survivors from year to year. *MBE* for survivors seems more stable which is consistent with the declining pattern of *MBE* with age where as firms age and classify as survivors their *MBE's* would have declined to survivors level.

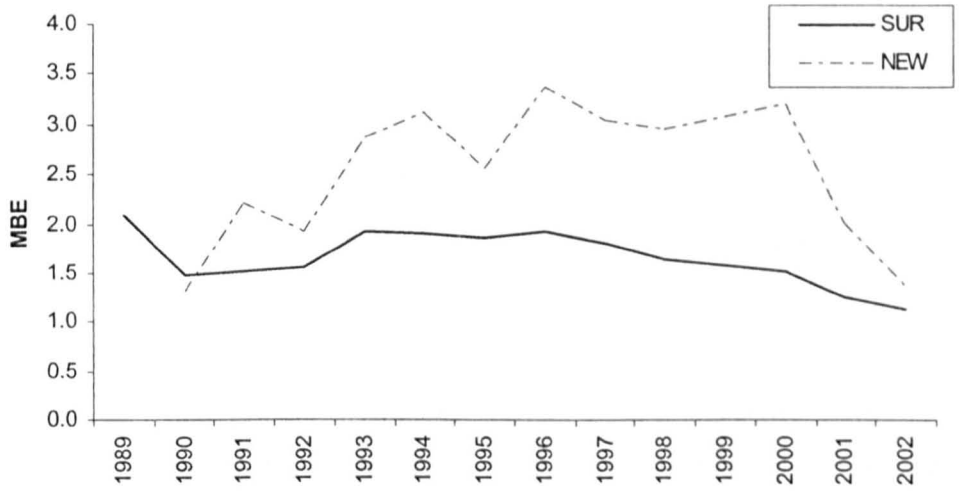

Figure 3-3. Evolution of Median *MBE* Over Time

SUR is for survivor stocks listed in or before 1989 and NEW is for newer stocks listed after 1989. The graph is constructed in calendar time (time series basis). The NEW line starts at 1990 for the gap where the data starts for new stocks.

To evaluate the robustness of this pattern reported in Figure 3-3 derived from medians, an alternative weighted average *MBE* is shown in Figure 3-4. In which, firm specific weights in the market are taken into account (while the median gives all firms the same weight). Figure 3-4 shows a similar pattern to Figure 3-3, again that new stocks' *MBE* is higher than new stocks in most years and rises during the late 1990s.

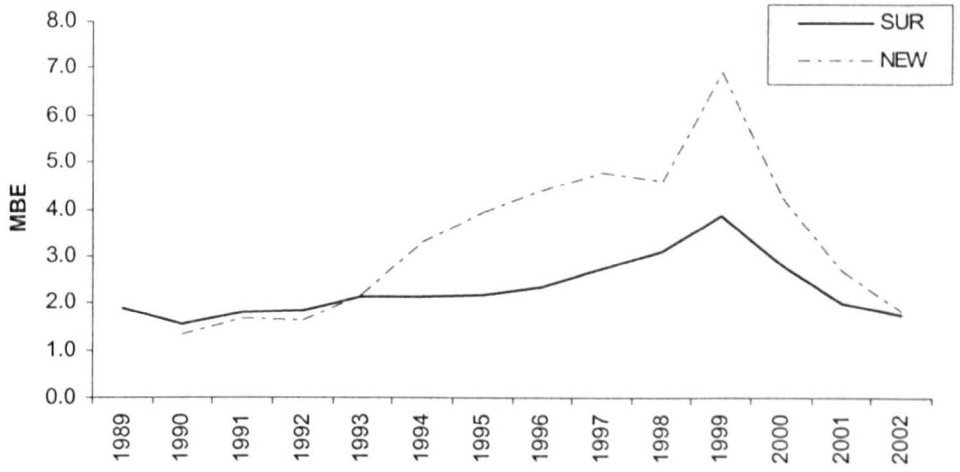

Figure 3-4. Evolution of Weighted Average *MBE* Over Time

SUR is for survivor stocks listed before or in 1989 and NEW is for newer stocks listed after 1989. The graph is constructed in calendar time. Weighted average *MBE* is calculated as the sum of market value of equity for all firms in each group every year divided by the corresponding sum of book equities. The NEW line starts at 1990 for the gap where the data starts for new stocks.

These findings are similar to what can be observed in Pastor and Veronesi (2003), in which new and old stocks are sorted relative to midpoint age using US data covering the period 1965-2000. In either comparison, the same conclusion is evident on market valuation differences (the presence of a gap) where new stocks have relatively higher valuation. However, they also show that valuation of survivors is relatively more stable overall compared to that of new stocks.

An interesting reading of Figure 3-4 above is that market valuation peaked in 1999 for both groups when the valuation gap between them was at its maximum. Then, market values declined sharply towards the end of the sample period 2002 narrowing the gap to an insignificant difference. The pattern of the valuation gap, since 1992, suggests that the gap size overall increases in bullish markets and decreases in bearish markets. This could be driven by investor overoptimism about profitability and growth potential for new stocks relative to survivor stocks in bullish markets. Figure 3-5 clarifies this further by plotting the percentage valuation difference calculated as [(New *MBE* – Survivors *MBE*)/Survivors *MBE*] from Figure 3-4 against the FTSE All Share Price Index. The gap ranged between –15.03 and +86.58 percent closing at just +4.62 percent by the end of 2002. A notable reading of this behaviour is the instability of the valuation gap.

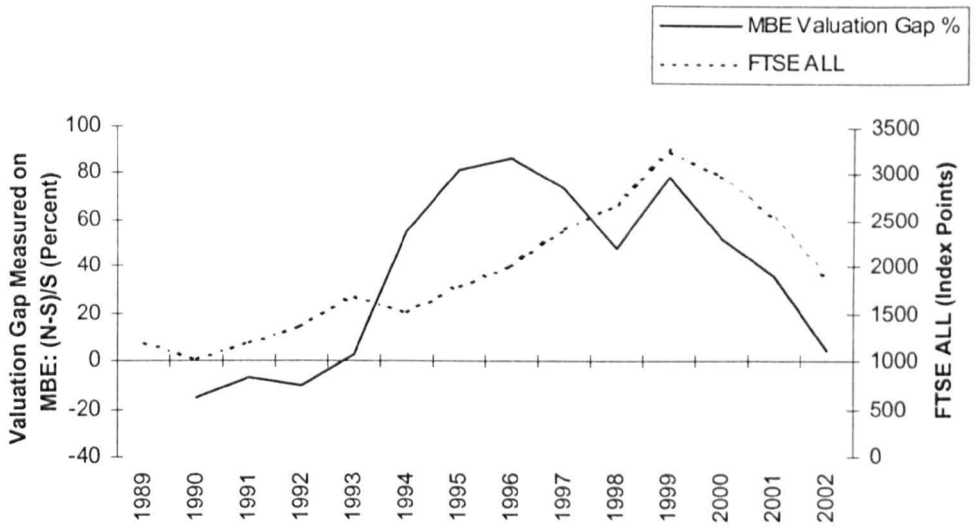

Figure 3-5. Valuation Gap Behaviour and Stock Market Levels

The valuation gap is the percentage valuation difference calculated as [(New *MBE* – Survivors *MBE*)/Survivors *MBE*] from Figure 3-4 and plotted against the FTSE All Share Price Index. The gap ranged between –15.03 and +86.58 percent closing at +4.62 percent by the end of 2002. The line starts at 1990 for the gap where the data starts for new stocks.

That is not to say that survivor stocks are necessarily fairly valued or not. What we have reported here is only a relative comparison where investor expectations appear to be exuberant (biased) for new stocks relative to older stocks. It is possible that investors can have excessively optimistic expectations with regard to new stocks while learning about them over time. The role of investment knowledge in limiting valuation bias is explored in Chapter 5.

Size appears, in the regression model estimated later in Section 3.4, as a significant valuation factor. Therefore, we compare again the valuation of new and survivor stocks, taking size differences into account. We do this using both market capitalisation *MVE* and total assets *TA* for size (both indicators are discussed under the Data Section 3.2). Market-to-book equity *MBE* (for market valuation) is again selected for market valuation. Table 3-5 presents median *MBE* ratios for the different size/age groups where size is defined by market value of equity. Reading the rows, for all size groups *MBE* declines with age, so the finding with respect to age and *MBE* holds regardless of size. Reading the columns, regardless of age *MBE* increases with size.[47]

[47] The same analysis is repeated using total assets to define size in Appendix 3.8.2.2.

£ million/years	*All*	Age<=5	5<Age<=10	10<Age<=13	Age>=14	Obs
All		*2.45*	*2.00*	*1.81*	*1.53*	*9901*
MVE<=1	*0.31*	0.60	0.18	0.25	0.25	95
1<*MVE*<=10	*1.02*	1.50	1.16	0.90	0.75	2231
10<*MVE*<=100	*1.70*	2.91	1.99	1.70	1.19	3844
MVE>100	*2.44*	3.93	2.70	2.57	2.24	3731
Obs	*9901*	2494	1883	759	4765	9901

Table 3-5. *MBE* for Age and Size Groups (Market-Cap for Size)

The table reports median *MBE* for the different size/age groups calculated from the pooled data over the period 1989-2002. Obs is the number of observations represents the sum of observations for all 4 age groups in rows and for all 4 size groups in columns.

The above documentation of relative overvaluation of new stocks tallies with the evidence from **Initial Public Offerings** literature. Looking at the long-term performance of IPOs could give some insight into the above identified valuation patterns. Gompers and Lerner (2003) examine the performance for five years post-listing of 3,661 US IPOs from 1935 to 1972. They find that the sample displays some underperformance when event-time buy-and-hold abnormal returns are used. A UK based study on the long-term underperformance of UK IPOs by Espenlaub, Gregory and Tonks (2000) re-examine the evidence on the long-term returns of UK IPOs over the period 1985-1992. They find substantial negative abnormal returns to an IPO after the first 3 years while the underperformance is still present but less dramatic over the 5-year period after an IPO. Overpricing IPOs (i.e. overpricing new stocks initially) relative to older stocks is a possible explanation for the relative subsequent long-term underperformance when stock valuations are consistent with firm performance and potential in the longer run.

To further confirm the findings and the consistency with the above two papers the median annual stock returns are calculated for the pooled sample over the period 1989-2002 (not in calendar time). The results are consistent with the above inferences where median annual stock returns was 7.8 percent for survivor stocks (6,972 observations) and only 0.4 percent for new stocks (2,921 observations) with a *p*-value of 0.0000 for the difference between the two. The significantly lower stock returns of new stocks which concurs with the long-term underperformance documented in the IPO literature implies that new stocks are overpriced in the early trading period which could explain the declining pattern of market-to-book when valuations are more inline with performance and potential.

3.4 Valuation Model and Joint Testing

3.4.1 Valuation Framework and Model Structure

This study is concerned with mapping differences in market valuation against differences in the underlying fundamentals to establish whether the differences in fundamentals can explain the differences in market valuation. Therefore, a statistical value-explanatory model will be constructed to: (a) first, identify these fundamentals and establish their value-relevance to ensure that all empirical conclusions are derived relying upon value-relevant variables, (b) use model predictions to explicitly study stock age effect on market valuation, and (c) to serve as the joint statistical testing of fundamentals in explaining value and valuation differences besides the individual tests performed in Section 3.5. This section discusses next the valuation framework based on which the valuation model is built followed by the structure of the model.

Standard finance theory postulates that the value of a capital asset is determined by the present value of its future cash flows. For a company, cash flow drives value and cash flow is driven by return on investment (relative to the cost of capital) and growth in income. From this essential premise value fundamentals can be classified into the following three main categories:

1. Profitability,
2. Growth, and
3. Risk.

i.e. equity value is function of profitability, growth, and risk, where profitability and growth determine future free cash flows. The selected factor categories are expected to have sufficient explanatory power to explain value simply because the impact of all systematic and unique factors that are value-relevant to companies will be eventually reflected in those indicators. So, they should serve as good proxies for the underlying value-drivers. If the impact of a systematic or unique value or risk factor does not affect one of the above measures, then such factor is value-irrelevant. Appendix 3.8.2.1 presents a simplified illustration on value, cash flow, income and return on investment.

Utilising the above-discussed basis of finance theory and common practice, value drivers can be identified from two perspectives; *Firm Perspective* and *Equity Perspective*. Figure 3-6 and Figure 3-7 present the two respectively.

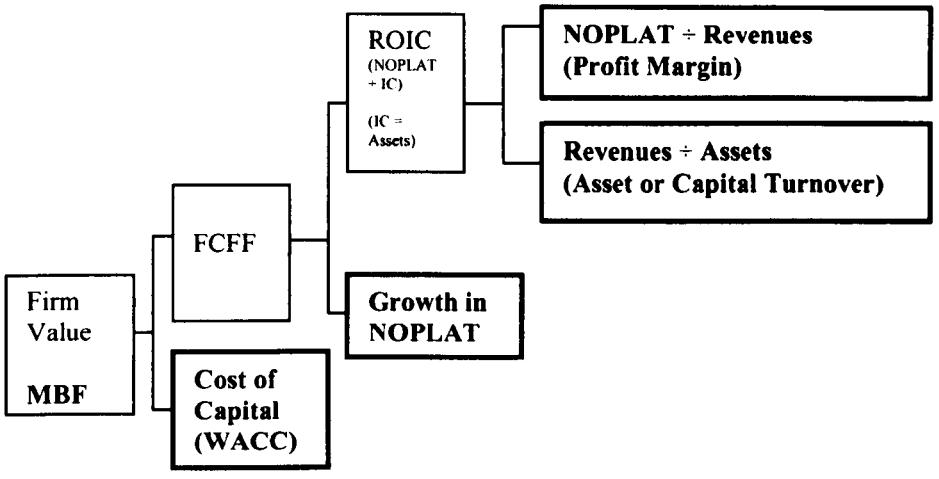

Figure 3-6. Value Driver Tree – Firm Perspective

All indicators are expressed to all capital providers. *MBF* is market-to-book value of firm, *FCFF* is free cash flow to firm, *ROIC* is return on invested capital calculated as *NOPLAT* divided by *IC* (or Assets), *NOPLAT* is net operating profit less adjusted taxes (see Data in Section 3.2 for more details about *NOPLAT* and its consistency with *WACC* construction), *WACC* is the weighted average cost of capital. *ROIC* = Profit margin × Assets turnover. Note that Invested capital (*IC*) = Short-term debt + Long-term debt + Book equity + Minority interest = Assets (A) = Fixed assets + Current assets – Non-interest bearing current liabilities. Model variables are in bold face.

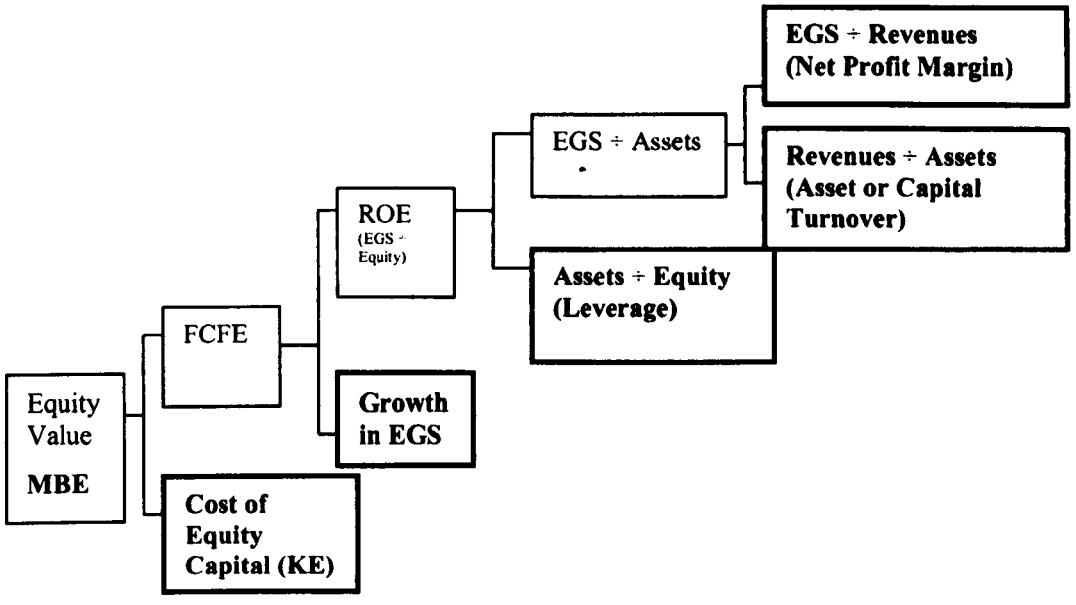

Figure 3-7. Value Driver Tree – Equity Perspective

All indicators are expressed to common-equity-holders. *MBE* is market-to-book value of equity, *FCFE* is free cash flow to equity, *ROE* is return on equity capital calculated as earnings divided by equity capital, *EGS* is net income or earnings, *KE* is the cost of equity. *ROE* = Net profit margin × Asset turnover × Leverage. Model variables are in bold face.

The equity perspective is selected for the analysis. Consistent with equity perspective, market-to-book of equity will be the dependent variable of market valuation and equity perspective variables will form the main explanatory variables. The rationale behind this choice comes from:

1. The objective of this research is to explore market valuation of *equity* and the capitalisation of all factors and information into equity prices;
2. The practical difficulties associated with using firm perspective of value drivers in the analysis, in particular:
   a) Estimating the market-to-book value of firm *(MBF)* is unviable as market values of debt and other non-common equity financing are not available.
   b) As company-specific cost of debt is not available for the sample, estimating the weighted-average cost of capital *(WACC)* is a major difficulty and might introduce significant error into the data.
3. Market-to-book of equity *MBE* as a valuation measure consistent with equity perspective remains simple and valid, as it relates market capitalisation of future outcomes (future cash flows generated by profitability and growth and assessed according to their risk) to the actual capital physically injected into the business (book equity is a proxy). The simple exposition below illustrates the idea and why *MBE* represents equity perspective of valuation:

   $MVE = NAV$ + £Premium, (BE is a proxy for NAV)
   $MVE = BE$ + £Premium, dividing by BE gives:
   $MBE = 1$ + Percentage Premium Rate

4. Other equity-perspective market value indicators such as earnings-to-price *EP* and cash flow-to-price *CFP* are not dissimilar to market-to-book of equity *MBE* in terms of representing market valuation. However, as they have outcome measures in their construction, such as earnings and cash flow, they exhibit major volatility and extreme values, which complicates the modelling process. Therefore, it was decided to model market-to-book *MBE* based on the above and consistent with Pastor and Veronesi (2003) and the discussion of Smithers and Wright (2004).[48]

[48] See Smithers and Wright (2004) for a discussion of five tests "*q*" meets as a useful measure of value. Cyclically adjusted P/E (or its inverse) meets them too. However, there is a practical difficulty for the cyclical adjustment at firm level.

Based on the above, the basic structure of the model is:

$$Equity\ valuation = f(Profitability,\ Growth,\ Risk)$$

The general notion of this structure is similar to that used by Pastor and Veronesi (2003). Size and age are also introduced to the model to examine their impact on value. Hence, the model is specified as follows:

Equation 3-2:
$$\log(MBE)_i = \beta_0 + \beta_1 NPM_i + \beta_2 ATU_i + \beta_3 TABE_i + \beta_4 GEGS_i + \beta_5 KE_i + \beta_6 \log(TA)_i + \beta_7 \log(AGE)_i + \varepsilon_i$$

It reads: $\log(MBE_i) = Constant + \beta_1(Trading\ Profitability) + \beta_2(Efficiency) + \beta_3(Leverage) + \beta_4(Growth) + \beta_5(Cost\ of\ Capital) + \beta_6(Size) + \beta_7(Age) + Disturbances$

where *MBE* is market-to-book of equity. log(*MBE*) is the rate of the value premium assigned by the market to book equity. *NPM* is net profit margin. *ATU* is asset turnover, *TABE* is total assets to book equity (for leverage). *GEGS* is growth in earnings (logarithmic). *KE* is the cost of equity (for risk). *TA* is total assets (for size). *AGE* is the age of the stock in listing. For more details on variable construction, calculation and discussion see Data Section 3.2 and Data Appendix 3.8.1. Note that $ROE = \frac{EGS}{BE} = \frac{EGS}{TUR} \times \frac{TUR}{TA} \times \frac{TA}{BE}$, i.e. *ROE* = Trading Profitability *NPM* × Efficiency *ATU* × Leverage *LVG*.

It is worth discussing briefly the model time lag. As price-sensitive information flows throughout the year into the market, it can be expected that share prices capitalise most information that will be revealed at the financial year end gradually due to interim reports, profit warning, analyst direct relations with companies, etc. Bartov and Goldberg (2001) find similar results when regressing 12-month stock return, measured over the fiscal year, on net income and cash flow realised during the same year to those results when extending stock return window 3 months after the fiscal year end and to those with extending it to the latest month in which annual reports are required to be filed. Old research also supports this, e.g., Ball and Brown (1968) indicate that most of the information in the financial statements is incorporated into share prices prior to their formal release. Hence, the relation is tested in this research between market values at time *t* and financial drivers calculated as published at the same time.

The key papers by Fama and French that addressed size and M/B are "Size And Book-To-Market Factors In Earnings And Returns" (1995), "Common Risk Factors In The Returns On Stocks And Bonds" (1993), and "The Cross-Section Of Expected Stock Returns" (1992). They use Book-to-Market B/M (the inverse of M/B) and MVE for Size. According to them, low M/B signals poor future earnings and vice versa. Our research and models are consistent with these signals because M/B reflects prospective (future) profitability as demonstrated by the theoretical and empirical models presented in this chapter and the following chapter.

F&F argue that size (MVE) and B/M must proxy for sensitivity of common risk factors in returns. F&F (1995): "Size (MVE) and B/M remain arbitrary indicator variables that, for unexplained reasons, are related to risk factors in returns". However, size defined as MVE and B/M is calculated using MVE, subsequent stock returns are calculated from changes in MVE. Thus, they would reflect common risk factors.

MVE (F&F-defined size) and B/M reflect the capitalisation of future outcomes. Two ways of looking at this, Stock price performance or levels against PV[E(Dividends)] and/or E(Price Appreciation) or against underlying corporate performance PV[E(cash flows) or E(earnings)], simply, different sides for the same token. Theoretically, they should yield identical results. We concentrate on the second side: Value = *f*(underlying corporate performance and risk). Stock returns, MVE, B/M are all expressions of market valuations that represent the capitalisation of other underlying fundamentals, so, we use the latter group to explain the former rather than searching for predications or signals that are implied in market indicators. B/M or M/B model is just a variation of the MVE model and stock returns are the percentage changes in MVE.

Our methodology, although not on explaining or predicting stock returns, is still consistent with the foundation of F&F work. It is just another type of research that concentrates on the long-term market value overall levels, while research in stock returns concentrates on MVE dynamics over shorter periods (say monthly or annual stock returns, whether explaining of predicting).

Of course, F&F methodology is different due to their different objectives as they, for example: relate future stock returns to proxies of risk factors (size and B/M), address stock returns and earnings predictability, use size and B/M ranking and study subsequent performance. Our methodology and type of research in this chapter and the following one are closer to the valuation literature rather than F&F type of research [e.g., Miller and Modigliani (1961), Kaplan and Ruback (1995), Pastor and Veronesi (2003), Ang and Liu (2001), Bartov and Goldberg (2001), Clayman and Shwartz (1994), De Heer and Koller (2001), Feltham and Ohlson (1999), Freeman, Ohlson and Penman(1982), Penman and Sougiannis (1998), Sougiannis and Yaehura (2001), Campbell and Shiller (1998), Campbell and Shiller (1988), Cole, Helwege and Laster (1996), Flood and Garber (1980), Heaton and Lucas (1999), Kiley (2000), Lansing (2002), Sharpe (2002), Shiller (1981), Summers(1986)]

3.4.2 Model Estimation and Age Effect: Does the Model Explain Valuation Differences?

Table 3-6 below presents the results of estimating the valuation joint testing model in a pooled regression using pooled data for the period 1989-2002. The reading that stands out is the negative sign and significance of the age coefficient; i.e. the older the company the lower the relative valuation, what kind of economic explanation could justify this! Discussion of the results follows the table below.

Variable Description	Symbol	Coefficient	*p*-value	Expected Sign
Dependent variable	log*(MBE)*			
Constant	*C*	0.07	0.4669	0
Net profit margin	*NPM*	2.04	0.0000	+
Asset turnover	*ATU*	0.21	0.0000	+
Leverage	*TABE*	0.10	0.0000	+
Growth in earnings	*GEGS*	0.18	0.0000	+
Cost of equity capital	*KE*	-1.44	0.0000	–
Size	log*(TA)*	0.07	0.0000	+
Age	log*(AGE)*	-0.25	0.0000	–
R-squared		0.23		
Adjusted *R*-squared		0.23		
p-value (*F*-statistic)		0.0000		
Total number of observations		7,108		

Table 3-6. Value Relevance/Explanatory Model

The dependent variable is the natural log of market-to-book which measures the rate of market value premium/discount over book value; *C* is the constant term; *NPM* is the net profit margin (net trading profitability), *ATU* is asset turnover (efficiency); *TABE* is total assets-to-book equity ratio ≈ 1 + Debt-to-equity ratio (leverage); Note that $NPM \times ATU \times TABE = ROE$. The use of *ROE* instead of its components yields similar results with a higher *R*-squared; *GEGS* is growth in earnings measured as $\log(EGS_t/EGS_{t-1})$. *KE* is the cost of equity capital (risk); *TA* is total assets (size); *AGE* is the firm's age every year. Total number of observations is 7,108 for pooled data for all survivor and new stocks for the period 1989-2002. Method of estimation is least squares pooled regression. Robust estimation technique (White Heteroskedasticity-Consistent Standard Errors & Covariance) is used to correct the standard errors as the model exhibited heteroskedasticity. Firms with *MBE* smaller than 0.01 or larger than 100 were excluded as in Pastor and Veronesi (2003).

As Table 3-6 above shows, the estimated model confirms the expected signs and significance for the selected variables. Below is a discussion for every coefficient.

The Constant term: As the model is structured to explain the rate of value premium or discount the market assigns over the book equity (proxy for equity invested capital) it was expected that the constant should not be statistically different from zero as the premium is expected to be related to the underlying profitability, growth and risk factors and not to be a constant at all. To clarify this, when the same model is estimated using market-to-book as the dependent variable rather than its natural logarithm, the signs and the significance are very similar for all coefficients except for the constant term where it is statistically close to unity (slightly higher) indicating that the constant term reflects the capital physically invested in the business while other variables explain the premium or the discount. The simplified exposition below illustrates this idea.

$MVE = NAV$ + £Premium, (BE a proxy for NAV)

$MVE = BE$ + £Premium, dividing by BE gives MBE:

MBE = 1 + Percentage Premium Rate, by taking the natural logarithm and as (1 + Percentage Premium Rate) = ($e^{\text{Logarithmic Premium Rate}}$):

$\log(MBE) = \log(e^{\text{Logarithmic Premium Rate}})$ = Logarithmic Premium Rate

The fact the constant term is not statistically different from zero provides some comfort about the model structure, specification, and the explanatory power of its variables.

Net profit margin, asset turnover and earnings growth are positive and significant as logically expected.

Leverage is positive and significant indicating that leverage was favoured by the stock market perhaps because of tax shield. This is consistent with standard finance theory especially that the negative impact on value from financial risk associated with leverage is captured by the cost of equity variable as beta was estimated for every company to reflect its specific capital structure every year.

Cost of equity capital: negative and significant, as expected, being the ex ante measure of the investor-required rate of return reflecting the risk of the

investment. This is consistent with standard finance theory and common practice in investment.

Size: positive and significant. This is consistent with Evans (1987) who found that firm failure decreases with size. Similarly, Koke (2001) identifies size as one of corporate failure determinants where small-sized firms exhibit a higher likelihood of failure relative to large-sized firms. This relation between size and age could be the main reason behind the positive market valuation of size information. Also some evidence and contra-evidence are documented in stock return literature with respect to size, for example, Dimson and Marsh (1998) find that in the UK large firms apparently yield higher stock returns than small firms while Downs and Ingram (2000) find that average stock returns and size are not related at all.

Age: negative and significant. This was anticipated given the hindsight of the declining pattern of *MBE* with age and not based on any clear economic rationale. One can argue that lower age is associated with higher value because of the higher expected growth for younger stocks. However, growth was captured with earnings growth factor (positive and significant), realised logarithmic earnings growth and log(*AGE*) have a next to zero correlation –0.02. What about the higher risk of newer stocks in passing the test of time? Could this valuation assigned to the age factor be a false hope about growth? The remainder of this chapter attempts, in its context, to answer these questions.

R-squared: Model explanatory power is good in such a regression analysis. However, the selected explanatory variables with the demonstrated significance and correct signs that explain *MBE* should capture the impacts on value of (a) the systematic factors; as demonstrated by the regression model, while (b) the firm-unique factors are not believed to be captured in such a regression estimation. They would be only captured by firm in-depth analysis. Thus, in this case their impact would appear in the disturbances.

Estimating the same equation over different periods, including for single years, showed that model is stable over time in its ability to explain value by the selected fundamental variables.

The impact of the age factor is highlighted in isolation from other factors in Figure 3-8, which plots a model-generated pattern for *MBE* against the age factor. The model pattern clearly shows how age is factored into market valuation.

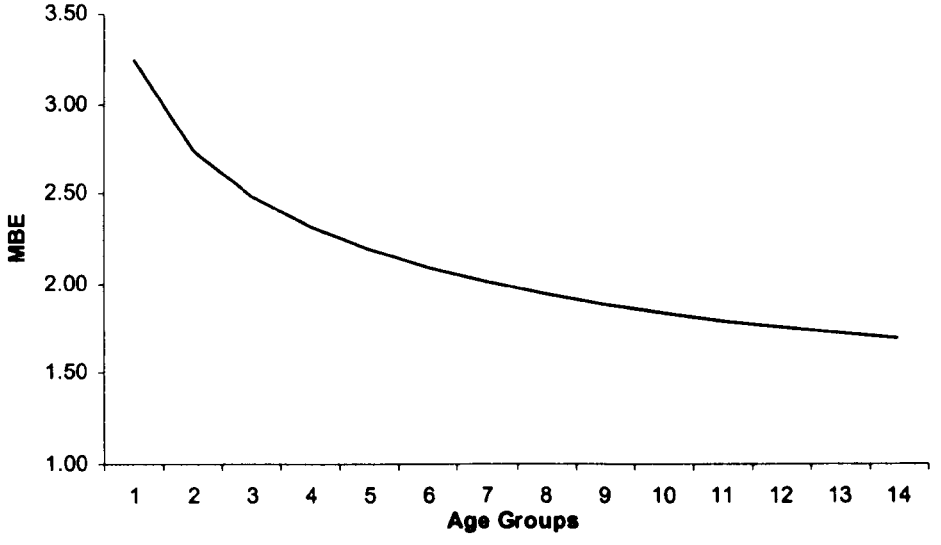

Figure 3-8. Age Impact on Market Valuation

Model predictions for age group valuations (measured by Model *MBE*) are estimated using the overall model estimated on the pooled data shown in Table 3-6. Model log(*MBE*) is first calculated, then Model *MBE* is calculated based on the structure of the model using the following formula: Model *MBE* = exp[Model log(*MBE*)]. All variables, except age, were controlled using sample grand medians 1989-2002. The age variable is varied to illustrate its impact isolated from other factors.

To help answer the question as to whether the model estimated on the entire sample in Table 3-6 predicts differences in market valuation (*MBE*) between new and survivor stocks, model predictions for age group valuations are estimated using the median values for every age group. Figure 3-9 plots the model-generated values (Model *MBE*) versus the Historic median *MBE* showing

that the pattern of historic *MBE* declining with age is matched closely by the model-generated values (in-sample model predictions).[49]

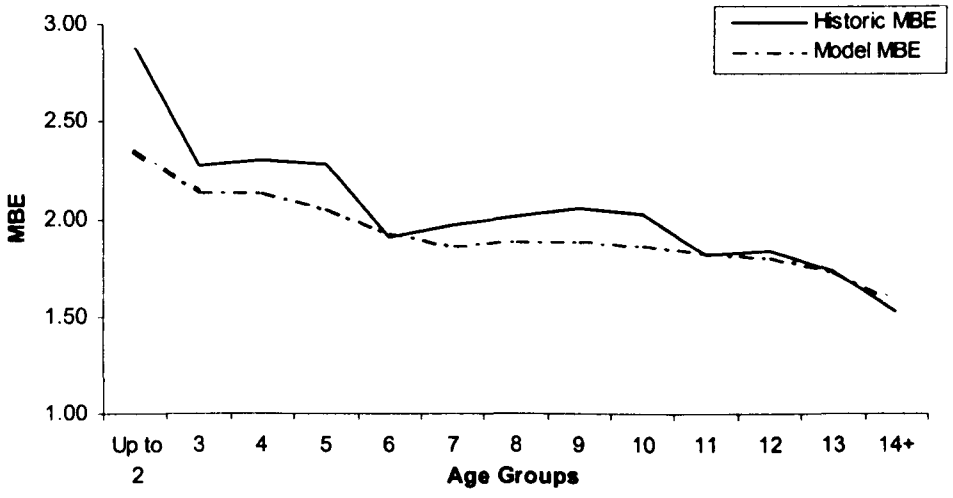

Figure 3-9. Model versus Historic *MBE*; Age Groups

Historic *MBE* is the observed historic median *MBE* for age groups over the period 1989-2002. Model *MBE* is the model-generated *MBE*. Model *MBE* is estimated for every age group using the overall model estimated on the pooled data shown in Table 3-6 where model log(*MBE*) is first calculated and then Model *MBE* is calculated based on the structure of the model using the following formula: Model *MBE* = exp[Model log(*MBE*)]. All variables were controlled using sample medians for every age group 1989-2002.

Next, we estimate the model predicted percentage differences in valuation between survivor and new stocks using the same methodology and model as in Figure 3-9 while model values are calculated separately for each group to understand more about the power of the model in explaining valuation differences.

Figure 3-10 depicts the comparison in a scatter plot format. Observed median *MBE* is 1.65 and 2.36 for survivors and new stocks respectively making the difference in valuation 43 percent above survivors. Model predicted values, including age variable are 1.70 and 2.12 respectively, reducing the gap to 25 percent also explaining 25 percentage points of the 43 percentage points

[49] From Figure 3-9 one can observe that model values suggest overstated *MBE* for age groups up to 10 years, for which model values were almost always below observed values. The model seems to be reducing the level and the slope of the declining *MBE* for these up to 10-year groups. Notwithstanding that, the model is built using historic data, therefore it will not be a perfect correction but can be taken as an indicator. It is interesting that model and observed values are almost the same for firms aged over 10 years.

difference (that is 58 percent of the gap). The remaining 18 percentage points (42 percent of the gap) can be assigned to the disturbances and latent estimation errors. Model predicted values, excluding age variable are 1.76 and 1.48 for survivors and new stocks respectively, inverting the gap to –16 percent. Given the disturbances and latent estimation errors, the version of the model that excludes the age variable (because of the lack of economic rigour) suggests that the valuation of new stocks is biased (upwards) against the valuation of survivor stocks.

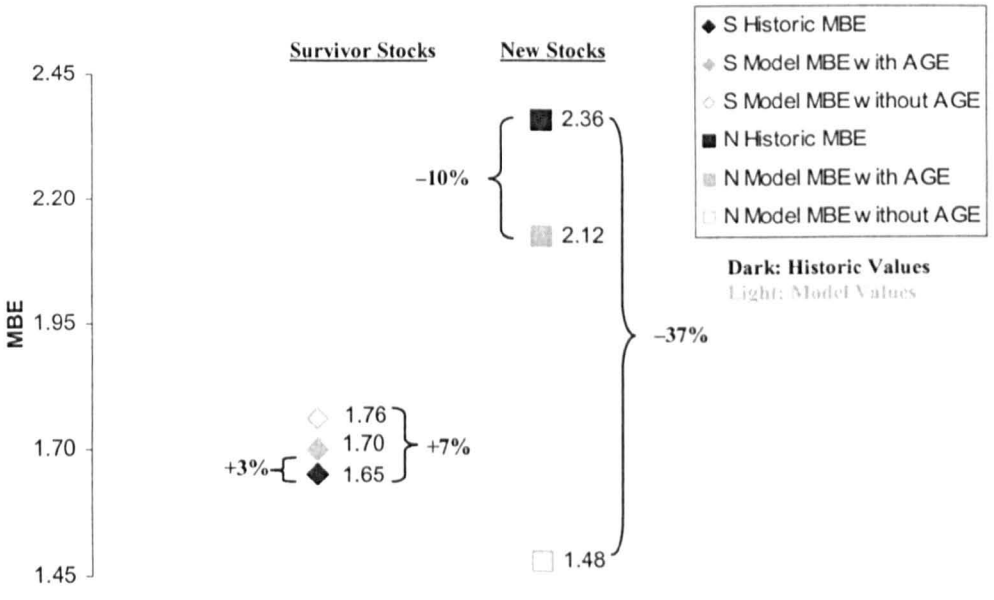

Figure 3-10. Model versus Historic *MBE*; Survivor and New Stocks

S and *N* denote survivor and new stocks respectively. Historic *MBE* is the observed historic median *MBE* over 1989-2002 for each group of the two. Model *MBE* is the model-generated *MBE*. Model *MBE* is estimated using the overall model estimated on the pooled data shown in Table 3-6 where Model log(*MBE*) is first calculated, then Model *MBE* is calculated based on the structure of the model using the following formula: Model *MBE* = exp[Model log(*MBE*)]. All variables were controlled using sample medians for each of the two groups 1989-2002. The same model of Table 3-6 was re-estimated without the age variables. The signs and significance of the re-estimated model are similar to that with age apart from the constant term, which became negative and significant apparently capturing the negative impact of the dropped age factor, Table 3-20 in Appendix 3.8.2.3 reports the re-estimated model. The percentage differences shown on the graph between each two points are calculated as [(Model Value – Historic Median Value)/Historic Median Value].

To further understand the differences in market valuation as revealed by the regression analysis, the same statistical model estimated in Table 3-6 was estimated separately for survivor and new stocks. Table 3-7 presents the results. The estimation for survivor stocks is similar to that of the pooled data. New stocks

model shows the following differences: The constant term is negative but still insignificant. Net profit margin is less significant compared with survivors indicating a weaker link between market valuation and this important profitability indicator, given the higher level of market valuation for new stocks, this indicates the presence of other factors, perhaps behavioural factors that are at work (such as underestimating risk). The cost of equity is positive and significant indicating either a distorted valuation structure for new stocks that contradicts the basics of finance and investment or significantly underestimated risk for new stocks where value is driven more by investor expectations. Size is negative and insignificant, this negative sign was expected for new stocks given they have smaller size with relatively higher valuation compared with survivors. And finally, age is still negative indicating the tendency of market valuation to decline with age but it is insignificant compared to being significant for survivors because age is not yet important at the new stock stage.

	Survivors		*New*	
Variable	Coefficient	*p*-value	Coefficient	*p*-value
Dependent variable: log*(MBE)*				
C	0.00	0.9713	-0.37	0.2657
NPM	2.00	0.0000	2.40	0.0090
ATU	0.18	0.0000	0.25	0.0000
TABE	0.10	0.0000	0.16	0.0000
GEGS	0.16	0.0000	0.25	0.0000
KE	-1.63	0.0000	8.04	0.0004
log*(TA)*	0.07	0.0000	-0.01	0.5815
log*(AGE)*	-0.23	0.0000	-0.07	0.3728
R-squared	0.21		0.23	
Adjusted *R*-squared	0.21		0.22	
p-value (*F*-statistic)	0.0000		0.0000	
Total number of observations	5,394		1,714	

Table 3-7. Value Relevance/Explanatory Model; Survivors versus New

Survivor stocks are those listed since or before 1989 and still traded in 2002. New stocks are those listed in or after 1990. See Table 3-6 for more explanations. Total number of observations is 5,394 and 1,714 for survivors and new stocks respectively from the pooled data over the period 1989-2002. Robust estimation technique (White Heteroskedasticity-Consistent Standard Errors & Covariance) is used to correct the standard errors as the model exhibited heteroskedasticity.

Comparing age coefficients of the two groups indicates that age is a discriminating variable once stocks are old according to the survivorship criteria selected for this research, where the market is not assigning importance to the age of new stocks as for survivors. Overall, the valuation model for new stocks, unlike for survivors, seems inconsistent, in its entirety, with standard finance theory and practice. However, comparing age and cost of equity variables indicates age discrimination without a known economic explanation for this. Perhaps, it is a valuation bias resulting from underestimating risk for new stocks. More detailed analyses follow to explore the possibility of valuation bias further.

The model is reasonably successful in predicting valuation differences between new and survivor stocks and explaining that by age factor and perhaps risk underestimation. These results seem to point into the direction that the presence of such valuation discrepancies between stocks of different age groups is not explained by differences in fundamental factors, which would lead to reject the null hypothesis in favour of the alternative. Therefore, the following analyses concentrate on analysing and comparing stock fundamental characteristics to study this phenomenon and back this possible conclusion.

3.5 Differences in Individual Fundamentals versus Valuation Differences

Following the model joint analysis and testing of fundamentals, we turn in this section to seek confirmation to the inferences drawn above by examining differences in *individual* fundamentals (value determinants: profitability, growth and risk) to establish whether these differences (if any) can explain the documented differences in valuation between new and survivor stocks. The approach here is once again descriptive (like Section 3.3) rather than econometric (like Section 3.4), examining whether there are obvious differences in these fundamental factors between the two groups of stocks, that might not have been captured in the econometric estimates.

3.5.1 Differences in Profitability and Efficiency

The task here is to explore the first possible explanation or part explanation; differences in profitability levels between survivor and new stocks. That is, growth and risk being equal, just for the time being, stocks with higher profitability levels should be valued relatively higher.

Table 3-8 and Table 3-9 show a profitability comparison across age groups using equity perspective (*ROE*) and firm perspective (*ROIC*) and their trading profitability, efficiency and leverage components as discussed before in Section 3.4.1 (Figure 3-6 and Figure 3-7).

$$ROE = f(NPM, ATU, TABE)$$
$$ROIC = f(PM, ATU)$$

Age Group	*ROE* Percent	*ROIC* Percent	*NPM* Percent	*PM* Percent	*ATU* X	*TABE* X	*CFBE* Percent	Obs
All (*A*)	11.03	10.98	4.06	5.42	1.18	2.00	17.86	9893
Survivors (*S*)	12.08	12.01	4.38	5.85	1.25	2.07	19.39	6972
New (*N*)	5.67	6.21	2.47	3.34	0.90	1.80	10.63	2921
S-N	6.41	5.80	1.91	2.51	0.34	0.27	8.76	
(S-N)/S Percent	53.06	48.31	43.60	42.88	27.59	13.02	45.17	
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

Table 3-8. Profitability, Efficiency and Leverage; Survivor and New Stocks

The table reports medians calculated from the pooled data over the period 1989-2002 for *ROE* return on equity, *ROIC* return on invested capital, *NPM* net profit margin, *PM* profit margin, *ATU* asset turnover, *TABE* total assets-to-book equity (leverage), and *CFBE* cash flow-to-book equity ratios. See Section 3.2 for detailed calculations. Other pieces of information in the table are the same as in previous tables. The total number of observations in this table is higher than that reported in model estimation in Table 3-6 and Table 3-7 because of excluded observations where values are unavailable for all variables, for example, there is a loss of observations because of the use of the logarithmic growth rates with negative earnings. This comment applies to different tables in this document.

Age Group	*ROE* Percent	*ROIC* Percent	*NPM* Percent	*PM* Percent	*ATU* X	*TABE* X	*CFBE* Percent	Obs
Up to 2 *(G2)*	5.15	6.23	3.13	4.28	0.78	1.61	8.10	804
3	5.66	6.90	2.62	3.45	0.97	1.82	10.87	637
4	11.86	11.32	4.39	5.06	1.12	1.90	17.49	533
5	10.81	10.80	3.92	4.81	1.14	1.94	17.56	512
6	10.02	10.20	3.71	4.75	1.09	1.87	16.50	488
7	9.52	9.65	3.15	4.21	1.19	1.95	15.95	432
8	11.53	10.84	3.90	4.93	1.18	1.95	18.81	356
9	12.63	11.56	4.51	5.38	1.20	2.02	19.65	318
10	13.52	13.01	4.81	5.89	1.17	2.02	19.92	278
11	13.15	12.23	4.90	5.86	1.18	2.02	19.98	260
12	12.95	13.49	5.32	6.37	1.14	1.99	19.99	252
13	11.64	11.21	4.36	5.43	1.18	1.99	19.77	247
14+ *(G14)*	11.32	11.34	4.11	5.70	1.25	2.11	18.61	4776
G14-G2	6.17	5.11	0.98	1.43	0.47	0.50	10.50	
(G14-G2)/G14 Percent	54.49	45.07	23.89	24.99	37.71	23.70	56.44	
p-value	0.0000	0.0000	0.0000	0.0010	0.0000	0.0000	0.0000	

Table 3-9. Profitability, Efficiency and Leverage; Age Groups

The table reports medians calculated from the pooled data over the period 1989-2002 for *ROE* return on equity, *ROIC* return on invested capital, *NPM* net profit margin, *PM* profit margin, *ATU* asset turnover, *TABE* total assets to book equity (leverage), and *CFBE* cash flow to book equity ratio. Other pieces of information in the table are the same as in previous tables. See Section 3.2 for detailed calculations.

Both tables provide evidence that survivor stocks have statistically higher profitability, efficiency and cash flow ratios over the long run having been estimated from 14-year pooled data. Therefore, differences between profitability and efficiency cannot explain the lower valuation of survivors. On the contrary, if growth and risk *were* the same for both groups, survivors should be valued higher because they offer higher profitability and cash flow generating ability.

Hence, the explanation will be sought next by examining growth differences, where new stocks are expected to have a higher growth consistent with the general notion of younger stocks and growth potential and their higher valuations.

3.5.2 Differences in Growth

Having found that profitability would be priced to result in a higher valuation for survivor stocks and expecting survivors to be perceived as less risky than new stocks, the attention is turned to growth potential to explain the higher valuation of new stocks. Accordingly, new stocks are expected to show a significantly higher growth than survivors to explain value differences after offsetting the impact of profitability and efficiency differences.

Table 3-10 and Table 3-11 show that the differences in medians are not significant for realised growth in earnings per share. However, the differences are statistically significant for the growth in *EBIT* and turnover at 5 percent level in both tables. *At face value,* this could demonstrate that survivors have realised lower growth than new stocks consistent with the general notion and the expectation and their valuation. Nevertheless, the difference between growth in *EBIT* between youngest and oldest groups in Table 3-10 is barely significant at 1 percent level and not statistically significant in Table 3-11 at 1 percent level and barely significant at 5 percent level.

Moreover, an important fact should be clarified in this regard, that *EPS* is a comparable figure (scaled/standardised per share) for growth calculation year on

year while *EBIT* magnitude is affected by profits generated from external capital additions or reductions. Therefore, growth in *EPS* is a more accurate measure for organic growth, while growth in turnover reflects size or market share growth rather than growth in outcome and it is affected by capital changes as well. Hence, *EBIT* and turnover growth would be overstated by external growth from additional capital. All three measures are equally subject to the impact of inflation and thus the comparison remains valid as far as inflation is concerned.

Age Groups		*Growth in*			Obs
Percent		*EPS*	*EBIT*	*TUR*	
All (*A*)		1.30	6.65	8.79	9893
Survivors (*S*)		1.92	6.12	7.52	6972
New (*N*)		-0.20	9.85	16.01	2921
S-N		2.12	-3.72	-8.49	
(S-N)/S	*Percent*	110.28	-60.78	-112.84	
p-value		0.9005	0.0065	0.0000	

Table 3-10. Realised Growth; Survivor and New Stocks

The table presents median realised growth calculated as the annual percentage change calculated from the pooled data over the period 1989-2002. *p*-values of the differences in medians between *S* and *N* lead to the same conclusion on statistical significance of the difference using all the 7 non-parametric tests referred to before.

Age Group	*Growth in*			Obs
Percent	*EPS*	*EBIT*	*TUR*	
Up to 2 *(G2)*	-8.91	15.39	23.80	804
3	8.73	18.38	24.84	637
4	2.37	10.30	16.92	533
5	2.48	8.90	13.48	512
6	1.14	9.76	12.73	488
7	-7.49	0.88	8.31	432
8	3.72	7.11	9.92	356
9	3.01	7.94	8.96	318
10	11.29	15.38	12.53	278
11	4.21	8.28	11.69	260
12	4.21	9.70	9.65	252
13	-5.05	-0.28	7.76	247
14+ *(G14)*	0.36	4.45	6.21	4776
G14-G2	9.28	-10.94	-17.58	
(G14-G2)/G14 Percent	2553.14	-246.08	-283.02	
p-value *(G14 v G2)*	0.5813	0.0439	0.0000	

Table 3-11. Realised Growth; Age Groups

The table presents median realised growth rates calculated as the annual percentage change calculated from the pooled data over the period 1989-2002 for each age group. *p*-values of the differences in medians between *G14* and *G2* lead to the same conclusion on statistical significance of the difference using all the 7 non-parametric tests.

Based on the above and given the mixed readings of different growth measures, it can be concluded that realised growth in earnings (*EPS)* for both groups are not statistically different and hence realised growth fails to provide any sound explanation or part explanation for the differences in market valuation leaving the phenomena perhaps lending itself to valuation bias driven by investor expectations. This is confirmed by the model estimation for survivor and new stocks Table 3-7 where for both groups growth in *EPS* was positive and significant, which is consistent with finding no significant difference between the two median growth rates of the two categories. Notwithstanding that, if the market takes growth in *EBIT* and turnover as differentiating factors, *at face value* as a *misperception*, growth could explain behaviourally, at least in part, the differences in market valuation, which is likely to be the case; knowing the general notion about new stocks and growth potential. Given the above statistical analysis one can conclude that growth is most likely to be *part* of the explanation, but it is unlikely to reasonably account for the whole or majority of the gap in valuation between new and older.

3.5.3 Differences in Risk

Just by thinking from investor perspective it can be argued that new stocks are perceived riskier than survivors and that entails a relatively higher ex ante discount rate for new stocks and hence should lead to lower valuations. This section compares risk using different basic techniques. These are systematic risk, stock returns volatility, and finally age and the death of public limited companies.

3.5.3.1 Systematic Risk

Leveraged beta reflects systematic financial risk (the risk associated with leverage) and systematic business risk (operating risk; the risk of the assets). Beta estimation is covered under Data Section 3.2. The impact of company-specific

leverage was reflected in beta estimation.[50] A simple and quick test for historic beta is carried out to confirm whether new stocks are perceived as riskier than survivor stocks. The weighted average historic beta is calculated for the pooled sample over the whole period understudy where market values of equities are used as the weights to represent what would be the market perception about the systematic risk of each category measured by beta.

The calculations resulted in a weighted average historic beta of 0.92 for survivors and 0.97 for new stocks. As expected, survivor stocks are perceived to have lower risk than new stocks as measured by beta. However, this difference in the weighted average historic beta does not seem to be dramatic. But, at least it indicates that risk for survivors is not higher from that of new stocks. The illustration in Table 3-12 uses CAPM to support this argument; where the difference in beta does not lead to a major difference in the cost of equity. Therefore, based on this CAPM prediction, market risk perceptions do not seem different between the two groups although it indicates that new stocks are riskier.

Description	Survivors	New	Difference
Beta	0.92	0.97	
Percent			
Estimation I:			
Risk-free rate	10.00	10.00	
Expected return on the market	17.00	17.00	
Cost of Equity	16.44	16.79	-0.35
Estimation II:			
Risk-free rate	4.00	4.00	
Expected return on the market	7.00	7.00	
Cost of Equity	6.76	6.91	-0.15

Table 3-12. Difference in Beta and the Cost of Equity

Beta is the weighted average historic beta for each group with market-cap used for weighting. Two estimation scenarios are used; the first is inline with 1989 data (market return level) and the second with those of 2002. CAPM is used to estimate the cost of equity.

[50] Appendix 3.8.2.4 includes a discussion about leverage.

3.5.3.2 Stock Returns Volatility and Liquidity Argument

Another way of looking at market perception about risk is by comparing stock return volatilities of different age groups measuring total risk systematic and unique as $\sigma_i = \sqrt{\beta_i^2 \sigma_M^2 + \sigma_{i,\varepsilon}^2}$. [51]

Table 3-13 shows that survivor stocks median annualised stock return is higher than that of new stocks while survivors exhibit lower annualised stock returns volatility. *p*-values confirm the significance of the difference for both returns and volatility. Again, based on stock returns volatility the data do not seem to support that survivor stocks could be riskier than new stocks, on the contrary the data reveal the opposite. One could introduce a liquidity argument; that is higher volatility means higher liquidity and hence higher value. We know that larger older stocks are more liquid and hence this type of arguments is not promising to pursue.

Age Groups	Stock Returns	Volatility
	Survivors versus New	
Survivors (*S*)	7.77	33.87
New Stocks (*N*)	0.39	48.14
S-N	7.38	-14.28
(S-N)/S	94.99	-42.16
p-value	0.0000	0.0000
	Youngest versus Oldest	
Up to 2 *(G2)*	0.00	48.59
14+ *(G14)*	6.14	32.82
G14-G2	6.14	-15.77
(G14-G2)/G14	100.00	-48.04
p-value	0.0078	0.0000

Table 3-13. Stock Returns and Volatility

Medians are reported. Stock returns are annualised; calculated as the cumulative percentage monthly returns over 12 months. Annualised volatility is measured as the monthly standard deviation multiplied by the square root of 12. Medians were calculated across all observations for the pooled sample 1989-2002 for each group. *p*-values are for the differences in medians.

[51] where $\sigma^2{}_i$ is the variance, β_i is the stock beta against the stock market, σ_M^2 is the variance of market returns, and $\sigma_{i,\varepsilon}^2$ is the variance of the disturbances.

3.5.3.3 Age and PLC Death

To form an idea about the relation between public limited company death and age, the data of UK dead listed public limited companies since 1970 are used to calculate the ex post based death historic probability for different age groups.

Total number of firms in UK Dead Lists from Datastream is 4,174 companies. 164 firms were excluded because their start or end date is not available. This leaves the sample of 4,010 firms. Figure 3-11 shows a histogram with the historic cumulative probability of dead listed companies with respect to age groups. The historic frequency of firm death with respect to age is 54 percent for those below 14 years old and 46 percent for above, implying that there is no substantial reason in the historic data to believe that there are risk differences with respect to the likelihood of death between survivor and new stocks. Another reading from the data supports the same conclusion is that the likelihood of death, in general, declines with age. Note the declining slope of the cumulative probability curve. Stronger evidence is documented by Evans (1987) from examining the US manufacturing industries where he finds that firm failure probability decrease with age.

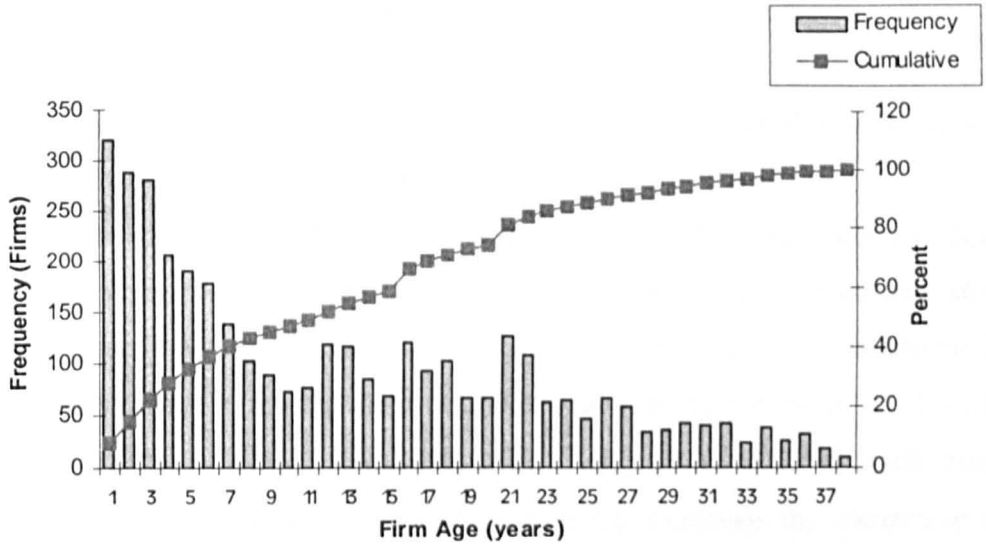

Figure 3-11. Age and Death for Listed Public Limited Companies

This histogram is constructed using UK dead listed public limited companies as compiled by Datastream for the period 1970-2003. Total number of firms in UK Dead Lists from Datastream is 4,174 companies. 164 firms with no available start or end date were excluded leaving the sample of 4,010 firms. The cumulative frequency for companies below the age of 14 year is 54 percent.

3.5.4 Net Effect of Fundamental Differences

Summarising the above evidence and analyses, market valuations, measured by MBE, MBF, P/E and P/CF for new stocks are higher than for mature stocks. One would expect that this should be driven by a favourable combination for new stocks of differences in profitability, growth and/or risk. Otherwise, it could be due to behavioural reasons. We find that profitability for mature stocks is higher than for new stocks and with mixed readings of the data on growth providing insufficient evidence that new stocks have provided higher realised earnings growth. Growth expectations would be part of the behavioural explanation. Moreover; new stocks have higher risk than mature stocks.

Hence, from the above analyses under both Section 3.4 and Section 3.5, we reject H_0 that differences in fundamentals can explain the differences in market valuation between new stocks and survivor stocks. This rejection is implicitly in favour of H_1 that the stock market is biased in valuing new stocks relative to older or survivor stocks. From H_1 perspective, the differences in valuations would be driven by ***investor unrealistic expectations*** about corporate performance and growth for new stocks and perhaps underestimating their risk, we call that ***Valuation Bias*** a form of *behavioural biases* driven by investor irrational expectations rather than by corporate and economic fundamentals.

This is a relative argument between new and survivor stocks and it is not meant to say that survivor stocks are rationally valued.

One last argument here, what if the market is factoring each variable in possibly pricing the very long-term expected profitability (i.e. when new stocks become classified as survivors) while pricing the shorter term growth potential of these new stocks, i.e. pricing the favourable outcome of the two. If it is the case, the impact of risk factor is ignored or even mispriced in an inconsistent market pricing formula. This leads to the next section that examines the competing null hypothesis.

3.6 Competing Hypothesis; Pricing the Long-Term Future

3.6.1 Competing Hypothesis Introduction

This section explores a competing hypothesis to the main valuation bias hypothesis in explaining valuation differences between survivor and new stocks.

The competing hypothesis as introduced in Section 3.1: *The market is rational in valuing new stocks higher than survivor stocks because of pricing the future long-term potential and status of new stocks.*

In simple words, according to this hypothesis, in the early period of the stock trading a new stock is priced according to its future stable status, and up to that time the stock price appreciates at a lower rate relative to book equity growth or does not appreciate at all on average across all young stocks leading the growth in book equity to match, in say 10 to 14 years, the early market-assigned price level. The stage, after which, stock returns are positive matching or exceeding book equity growth as future growth opportunities are to be capitalised too.

Therefore, stock returns for new stocks are supposed to be almost zero, on average, because the initial pricing for stocks in their first age group reflects the long-term future outcome when they are supposed to have survived. Therefore, stock prices do not appreciate much. Price changes before the stock classifies as survivor are either stock trading noise or revisions of investor expectations about future outcomes or a combination of the two. The empirical evidence supports this with, on average, zero stock returns for new stocks as shown earlier in Table 3-13 of Section 3.5.3.2.

The reason for the decline in market-to-book with age is the above stock pricing argument and the growth of book equity from retained earnings at a higher rate than that of the stock price. Of course, improved profitability leads to higher rate

of growth in book equity. This competing hypothesis is illustrated using the simple exposition in Figure 3-12 below.

	Stock Life Classification	
	New	Survivor
Stock price level	Almost the same or rising at a lower rate than *BE* growth	Rising
Book equity per share	Rising	Rising
MBE	Declining	Depends on differential increase rate

Figure 3-12. Competing Hypothesis to Valuation Bias

The major component of book equity growth is retained earnings. Therefore, to test the above competing hypothesis, two tests are carried out as shown below and followed by a simulated illustration.

1. Growth in market value of equity versus growth in book equity
2. Retained earnings and growth
3. Simulating market and fundamental valuations

3.6.2 Competing Hypothesis Testing

3.6.2.1 Growth, Market Value versus Book Equity

To test whether stock prices are growing at a lower rate than book equity for new stocks, consistent with the competing hypothesis, which would explain the declining *MBE* with age, the following procedure is used to perform a calendar time test.

For a common sample, the following sums are calculated separately for all survivor stocks and all new stocks every year to track the growth.

- Sum of equity market values
- Sum of book equities
- Sum of number of shares (for scaling)

The second step is calculating a weighted average market value per share (by dividing the sum of equity market values by the sum of number of shares) and the weighted average book equity per share (by dividing the sum of equity book values by the sum of number of shares). Annual growth rates in both equity market value per share and book value per share are calculated as the annual percentage change in the above calculated weighted averages values per shares. Both market value per share and book value per share are subject to same scaling errors and hence the comparison is expected to be acceptable in relative terms however individual year growth levels per se might not be representative or meaningful.

In order not to reject the competing hypothesis, the rate of growth in equity market value should be lower than of equity book value for new stocks opposite of the case of survivors. Figure 3-13 shows how the growth in equity market value is, in general, higher than that in book equity for new stocks while Figure 3-14 shows the same for survivor stocks as expected. Therefore, this rough test leads to

reject the competing hypothesis as a possible competing explanation to the valuation bias explanation.

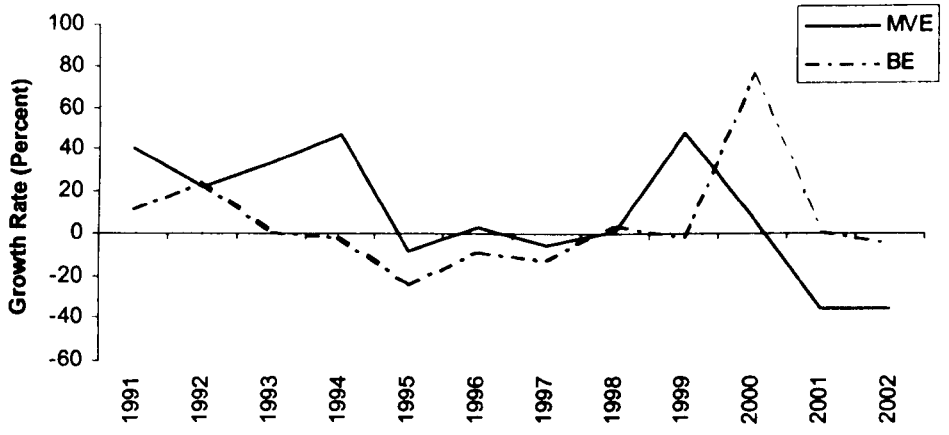

Figure 3-13. Growth in Market Value and Book Equity, New Stocks

New stocks are those listed after 1989. The graph shows annual growth rates in both equity market value per share *MVE* and book value per share *BE* calculated as the annual percentage change in the weighted average values per shares. Total number of observations is 2,919. Both market value per share and book value per share are subject to same standardisation errors and hence the comparison is expected to be acceptable in relative terms however individual year growth levels might not be representative or meaningful.

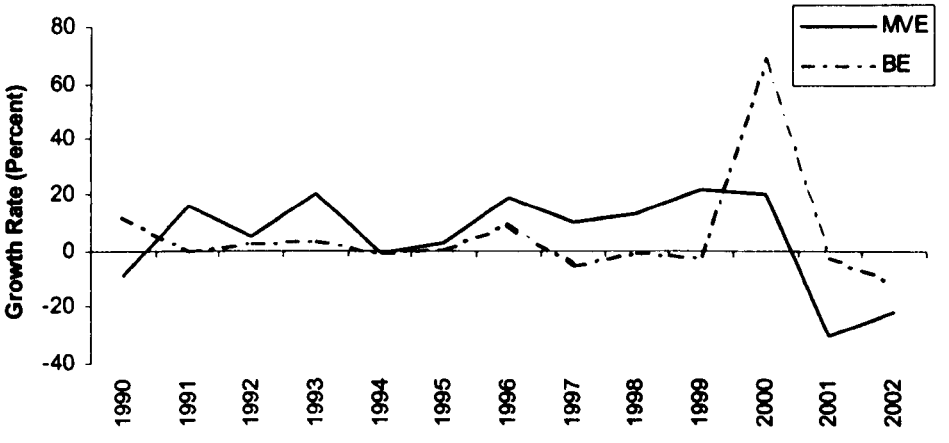

Figure 3-14. Growth in Market and Book Values, Survivor Stocks

Survivor stocks are those listed in of before 1989. The graph shows annual growth rates in both equity market value per share *MVE* and book value per share *BE* calculated as the annual percentage change in the weighted average values per shares. Total number of observations is 6,982. Both market value per share and book value per share are subject to same standardisation errors and hence the comparison is expected to be acceptable in relative terms however individual year growth levels might not be representative or meaningful.

3.6.2.2 Retained Earnings and Growth

The second test to the competing hypothesis examines retained earnings per share to book equity and equity market value, both per share, and compares with stock returns.[52] The rationale behind this test is that retained earnings per share represent the most important item in book equity growth while stock returns represent the growth in the share price.[53] Therefore, comparing retained earnings-to-book equity *REBE* (a measure for book value growth from profit retention) with retained earnings-to-price *REP* and stock returns *R* (all scaled per share for comparability) will help in assessing the competing hypothesis as argued below. If the competing hypothesis is true, retained earnings-to-book equity should be higher than stock returns for younger stocks according to this hypothesis as future stable performance is already priced in and book values are growing from retention so book value level matches market value level at the survivor classification stage.

Table 3-14 depicted in Figure 3-15 shows that stock returns *R* on older groups (12 to 14) and retained earnings-to-book equity *REBE* are inline with each other with *R* slightly higher because of the capitalisation of future growth opportunity. This observation is consistent with the pattern detected via the weighted average *MBE* shown in Figure 3-2 Section 3.3 which showed that contrary to the medians and Pastor and Veronesi (2003) the weighted average *MBE* is changing in both directions with age but declining overall with notable exception for the group aged 14 or more. The table and graph show that the pattern for younger age groups is inconsistent with the competing null hypothesis. Hence, and given the first test, the evidence is weighted more to reject the competing hypothesis. Retained earnings-to-price *REP* is just an additional measure to highlight the inconsistency between old and new stock valuations. Where the *REP* ratio is rising with age adjusting the young-stock overpricing by increasing the book value from retained earnings at an increased rate with age.

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[52] Retained earnings per share = Earnings per share *EPS* – Dividends per share *DPS*.

[53] Other items such as revaluations and goodwill, discussed under Data section, also affect book equity.

While the previous test led to reject the hypothesis, the evidence suggests that this competing hypothesis could be the market misperception about new stocks but cannot be accepted as economically rational investor behaviour.

Age Groups	Stock Returns	Retained Earnings-to-Book Equity	Retained Earnings-to-Price
Percent			
Up to 2 (*G2*)	-0.57	3.58	1.05
3	7.15	3.52	0.94
4	0.58	6.60	2.15
5	4.59	5.97	2.02
6	10.80	4.87	2.20
7	10.40	5.16	2.36
8	10.12	6.07	2.37
9	9.01	6.63	2.55
10	7.57	7.82	2.80
11	14.56	7.55	3.03
12	6.95	7.47	3.11
13	7.12	5.90	2.69
14+(*G14*)	6.14	5.92	3.08
p-value (*G2* v *G14*)	0.0000	0.0000	0.0000
Total Obs	10215	9908	9951

Table 3-14. Value Growth and Retained Earnings

The table reports medians. Retained earnings per share *REPS* is calculated as *EPS* minus *DPS*. Retained earnings-to-book equity *REBE* is calculated as *REPS* divided by book equity per share. Retained earnings-to-price *REP* is calculated as *REPS* divided by stock price.

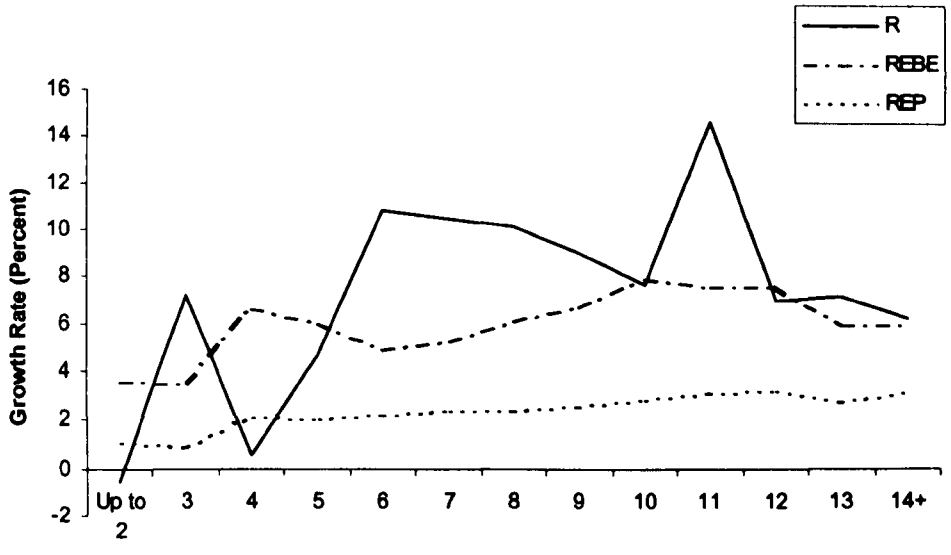

Figure 3-15. Value Growth and Retains Earnings

The figure plots Table 3-14, which reports medians. Retained earnings per share *REPS* is calculated as *EPS* minus *DPS*. Retained earnings-to-book equity *REBE* is calculated as *REPS* divided by book equity per share. Retained earnings-to-price *REP* is calculated as *REPS* divided by stock price.

To further clarify this competing hypothesis and test, a simulated illustration is introduced in the following section.

3.6.3 Market and Cash Flow Simulated Valuations

This section presents simple simulated valuations; one is based on standard finance theory and practice and investment logic and another one based on the pattern observed in market valuation.

The illustration uses a theoretical newly listed company projecting its book equity, profits and cash flows based on realistic assumptions. The company's equities are valued using the standard DCF valuation with a terminal growth of 4 percent, as in Kaplan and Ruback (1995) and Sougiannis and Yaehura (2001). The continuing or terminal value is estimated using the traditional cash flow continuing value formula:

Equation 3-3: $$CV = \frac{FCF_T}{KE - g_T}$$

See Copeland, Koller, and Murrin (2000) for further discussions on estimating the continuing value. The cash flow at the beginning of terminal period FCF_T (ongoing concern) is extrapolated from the cash flow of year n the last year in the explicit forecast period as:

Equation 3-4: $$FCF_T = FCF_n(1 + g_T)$$

Annual free cash flows are calculated as in Copeland, Koller, and Murrin (2000) as follows:

Gross cash flow = Earnings + Depreciation

Gross investment = Depreciation (replacement) + New Investments

Free cash flow = Gross cash flow – Gross investment
= Earnings – New investments

New investments are calculated from the changes in invested capital.

For clarification, some are familiar with another equivalent form of presenting free cash flow calculation. Assuming all equity financing so both cash flow to firm and to equity are the same:

Free cash flow = Earnings + Depreciation
– Changes in working capital
– Capital expenditure

Note that Replacement of depreciated assets + New investments is equal to Changes in working capital + Capital expenditure. See also Damodran (1996).

Simulated market price is calculated to approximate the observed pattern for age groups (consistent with the pattern documented in this study and also with that documented by Pastor and Veronesi (2003) for US stocks) by assuming that market price P grows at an increasing percentage ρ of the growth in book equity BE according to the following formula:

Equation 3-5: $P_t = P_{t-1}(1 + \rho \times g_{BE})$

Table 3-15 shows the results of the simulation and Figure 3-16 plots the patterns of the cash flow generated valuation and that approximating market valuation.

Year	0	1	2	3	...	8	9	10	11	12	13	14
£ million												
Book equity	100	101	102	103	···	114	118	124	130	137	145	154
ROE (Percent)		1.0	2.0	2.0	···	6.0	8.0	9.0	10.0	11.0	12.0	12.0
Earnings		1.0	2.0	2.0	···	6.6	9.1	10.6	12.4	14.3	16.4	17.4
Dividends		0.5	1.0	1.0	···	3.3	4.5	5.3	6.2	7.1	8.2	8.7
Retained earnings		0.5	1.0	1.0	···	3.3	4.5	5.3	6.2	7.1	8.2	8.7
New investments		0.5	1.0	1.0	···	3.3	4.5	5.3	6.2	7.1	8.2	8.7
FCF		0.5	1.0	1.0	···	3.3	4.5	5.3	6.2	7.1	8.2	8.7
Continuing value												302
E(P) [PV(FCF)]	145	154	164	175	···	232	244	256	267	279	290	310
MBE [f(FCF)]	1.45	1.54	1.62	1.70	···	2.04	2.06	2.07	2.06	2.04	2.00	2.02
Initial market *MBE*	2.35											
Book equity growth		0.5	1.0	1.0	···	3.0	4.0	4.5	5.0	5.5	6.0	6.0
ρ *(Percent)*		0.0	7.8	15.5	···	54.4	62.2	69.9	77.7	85.5	93.2	101.0
Market Price	235	235	235	236	···	246	252	260	270	283	299	317
MBE [Market]	2.35	2.34	2.32	2.30	···	2.16	2.13	2.10	2.08	2.07	2.06	2.06

Table 3-15. *MBE* Simulation

The inputs of this table are hypothetical for illustration purposes. Dividends payout ratio is assumed to be constant at 50 percent. The cost of capital used in the present value calculating is 7 percent. The terminal growth used is 4 percent. *FCF* is free cash flow. *E(P)* is the price estimation by discounting future cash flows. *MBE [f(FCF)]* is market-to-book equity simulated as a function of the present value of future cash flows. *MBE [Market]* is the simulated observed pattern of market-to-book equity. The columns for years 4 to 7 are not reported because of the table size. ρ is the percentage of price growth to book equity growth.

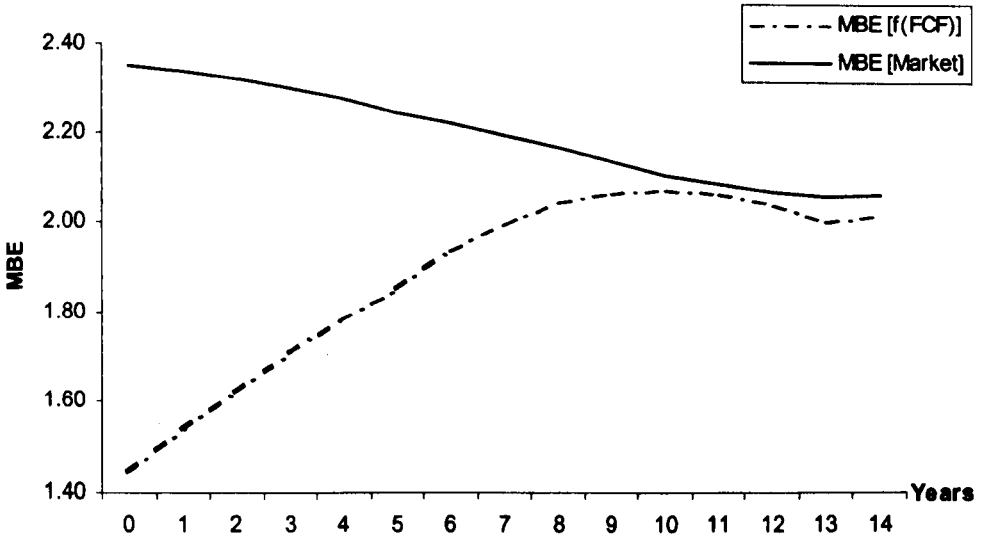

Figure 3-16. *MBE* Simulation

This figure plots the simulated values of *MBE* in Table 3-15. *MBE [f(FCF)]* is market-to-book equity simulated as a function of the present value of future cash flows. *MBE [Market]* is the simulated observed pattern of market-to-book equity.

The striking reading of Table 3-15 and Figure 3-16 is that the present value of cash flow valuation predicts, contrary to market pattern, an increasing *MBE* with age flattening from the age of 9 onwards after which both patterns track each other closely. This standard-theory based simulation is in favour of rejecting this competing null hypothesis.

Finally we comment on the learning model of Pastor and Veronesi (2003), relating M/B to expected profitability and therefore to the volatility of profitability as shown below in the following equation.

$$\frac{M}{B} = E\{\exp[(g-r)T]\} = \exp[(\bar{g}+\sigma^2/2-r)T]$$

where B is the firm's book equity at time 0 and g is its constant growth rate (i.e. book value growth from profitability), so the book equity at time T is $B\ exp(gT)$. They then assume as competition eliminates abnormal earnings by T the market value at time T equals its grown book value, discounted to today's value by discount rate r. the expression to the right assumes that g is unknown and normally distributed. So M/B in the above model increases with the uncertainty about growth or profitability which is their argument that uncertainty declines over time due to learning and as a result, younger firms have higher volatility in profitability or growth and hence higher M/B ratios holding average growth and discount rate constant.

Our analysis provides evidence that, on the contrary, the profitability of survivor stocks is statistically higher than for newer stocks. Moreover, we can question whether it is reasonable that the higher the volatility of the return on equity the higher the value? While this can be expected to be true of un-diversifiable risk, the higher the systematic (beta) and volatility of the profitability the higher the priced risk and hence the higher the required rate of return (discount rate) and hence the lower the value. Our valuation model of Section 3.4 suggests that indeed higher risk should be associated with lower valuation. So, both the level and volatility of profitability of new stocks seem to shed further lights on the analysis of Pastor and Veronesi. In their analysis, they do not focus much on modelling risk and its impact on valuation as they deal with risk in fairly standard fashion; once assuming a contact discount rate and then by using a stochastic discount rate.

According to Pastor and Veronesi, there is an economic rationale for the higher M/B of new stocks; that is rational learning. However, the long-standing evidence on the long-term underperformance of IPOs would contradict their conclusion [see on IPOs evidence, for example, Gompers and Lerner (2003) and Espenlaub, Gregory and Tonks (2000)]. We show later that our evidence on new stocks and age groups is consistent with the evidence of the IPOs systematic underperformance.]

This analysis of the competing rational explanation suggests that if investors are pricing and buying today the future level of performance of new stocks they might be underestimating the risk associated until achieving that maturity status. Hence, this study is in favour of rejecting the competing hypothesis and still reject the main null hypothesis in favour of the alternative hypothesis.

3.7 Conclusion

This work documents that the differences in valuations between UK new and older stocks are evident and persistent. New stocks have relatively higher valuations that decline with age with changing valuation gap size. We examine the hypothesis that these differences can be explained by differences in the underlying fundamentals against an alternative valuation bias hypothesis. Another competing hypothesis of rational behaviour based on pricing the long-term potential is tested too. In the course of this research, explanations are sought in the fundamental value determinants over the period 1989-2002 using the data of all UK traded non-financial stocks. The fundamentals examined in the course of testing the hypothesis are profitability and growth that determine cash flows and risk levels to value these cash flows besides age and size.

The evidence is clearly tilted towards rejecting H_0, that the differences in fundamentals can explain the differences in market valuation between new stocks and survivor stocks in favour of H_1 that the stock market is biased in valuing new stocks relative to older or survivor stocks. Such bias manifested as valuation differences, which could be driven by investor expectations that are inconsistent with the differences between the underlying fundamental corporate and economic characteristics. The balance of this concluding section briefly summarises the particulars behind this conclusion.

A statistical model was built to establish the **value-relevance** of the selected fundamental factors and to serve as the **joint testing** of these fundamentals' ability in explaining the differences in valuation. The estimated model predicts differences in market valuation between new and survivor stocks. The pattern of historic *MBE* declining with age is matched closely by the model-generated values. The model established an inverse significant relation between value and age. The fundamental model explained 58 percent of the valuation gap where the remaining 42 percent is believed to be the result of the disturbances and latent estimation errors. When the age variable is excluded because of the lack of economic rigour, model predicted valuation gap was inverted (–16 percent).

Again, while taking into account the disturbances and estimation errors, this result suggests that the valuation of new stocks is biased upwards relative to the valuation of survivor stocks. Comparing age and cost of equity variables between the two models estimated separately for each group indicates age discrimination without a known sound economic explanation and perhaps risk underestimating for new stocks. The results suggest that the model is reasonably successful in predicting valuation differences between new and survivor stocks and explaining that by age factor and perhaps risk underestimation. These results seem to suggest that the presence of such valuation discrepancies between stocks of different age groups is the result of a behavioural bias rather than an economically rational behaviour.

Then, individual differences in fundamentals were examined. **Profitability** is statistically lower for new stocks than for older stocks providing contrary evidence in explaining valuation differences as to which profitability differences should lead to higher valuations for survivors. Realised **growth** test shows that new stocks have higher growth rates, as expected, the conclusion is not robust as the evidence is not concrete because of the lack of statistical significance in the organic growth measure (growth in *EPS*) and the inconsistent significance levels for the un-scaled growth in *EBIT* that is affected by external growth from additional capital. Hence, this could be affecting market perception and it can be argued that growth is most likely to be *part* of the explanation, but it is unlikely to reasonably account for the whole or majority of the gap in valuation between new and older stocks. Finally, **risk** is examined. It does not require a thorough examination to conclude that new stocks do not have lower risk levels than older stocks. Three risk comparisons are utilised; systematic risk, and stock returns volatility, age and the death of public limited companies, none of which provide evidence that new stocks could be less risky than survivors and hence should, holding other factor the same, command higher valuations. However, the opposite that older stocks should be perceived as less risky would be a more valid argument. **To sum up,** lower profitability levels are inconsistent with the higher market valuation levels for new stocks relative to survivor stocks, with no

consistent or concrete evidence of higher earnings growth, and no evidence of lower risk.

A significant finding with respect to the pattern of the **valuation gap** itself between new and survivor stocks, is that the gap size overall increases in bullish market and decreases in bearish market. The gap ranged between −15.03 and +86.58 percent closing at just +4.62 percent by the end of 2002. This could be driven by investor overoptimism about corporate profitability and growth potential for new stocks relative to survivor stocks in bullish markets where investor overoptimism drives prices too high.

A **competing hypothesis** is formulated and tested too. According to which, the market is rational in valuing new stocks higher than survivor stocks by pricing the future long-term potential and status of new stocks and hence new stocks do not produce positive stock returns till they can be classified as survivors; the stage when stock returns are positive matching or exceeding book equity growth (as future growth opportunities are to be capitalised too). While the variability of share prices for new stocks is a combination of noise and revisions of expectations. And hence the reason for the declining market-to-book with age is the above stock pricing argument and the growth of book equity from retained earnings at a higher rate than that of the stock price, which is at its future level from the start. Three tests are used to examine the competing hypothesis, Growth in market value of equity versus growth in book equity, retained earnings and growth, and simulating market and fundamental valuations of which the evidence suggests that the competing hypothesis can be rejected in favour of the main valuation bias hypothesis because risk differential is ignored. This competing hypothesis can be accepted only if risk were correctly priced where the analysis suggests that it is not the case as the long-term future potential is priced at future risk levels when the firm is more stable and has survived a good test of time.

We also find that our conclusion is consistent with the evidence from **IPOs** long-tern underperformance, that is the significantly lower stock returns of new stocks or the long-term underperformance of IPOs is a result of overpricing new

stocks in the early period of stock trading which is consistent with the subsequent decline in market-to-book to normalise the relation between stock valuations and its performance and potential. We hope that this linkage contributes to the debate about IPOs long-term underperformance and provides supporting evidence that early overpricing is very likely to underlie the subsequent long-term IPOs underperformance.

An important caveat is worth making at the end, that the above conclusion of this work does not imply at all that survivor stocks are fairly valued. It is only a *relative* comparison. **Chapter 4 examines the overall stock market levels in the UK to cover these grounds.**

And finally, it is worth stating that investor expectations about new stocks could be exaggerated relatively more than for older stocks due to the limited knowledge about them, while this exaggeration is relatively more limited for older stocks because of the relatively better knowledge available about them. **Chapter 5 examines the role of investment knowledge in stock price rationalisation, seeking evidence from property investment stocks.**

3.8 Appendix

3.8.1 Data Appendix

3.8.1.1 Sample Period, Excluded Financial Stocks, and Data Items

As of 15 December 2003, the FBRIT list contained 1675 stocks including financial stocks but excluding investment trusts, starting with 151 stocks (117 non-financial) in 1964. Only in 1989 the number of stocks becomes reasonable for research; with 653 stocks (529 non-financial) in existence in or before 1989, those are the 'survivor stocks' or 'survivors' where by 2002 they survived for at least 14 years (1989-2002). 1022 companies (791 non-financial) joined the list during the period 1990-2002; these are the 'new stocks'. Total number of stocks in the sample is 653+1022 = 1675 (529+791=1320 non-financial). Table 3-16 shows the categories of excluded financial stocks.

Description	Number of Stocks	
Total FBRIT List		1675
Excluded financial categories		
Asset managers	17	
Banks	12	
Consumer finance	13	
Gambling	11	
Insurance brokers	8	
Insurance non-life	15	
Investment banks	25	
Investment companies	23	
Life assurance	7	
Mining finance	5	
Mortgage finance	2	
Other financial	90	
Other insurance	1	
Property agencies	7	
Real estate	77	
Real estate insurance	1	
Unquoted equities	5	
Total excluded financial		319
Non-financial		1356
Excluded multi-type stocks		36
Non-financial sample		1320

Table 3-16. Dataset Firms and Excluded Financial Stocks

These categories are as classified in Datastream. Date of list last retrieval/update is 15 December 2003. Multi-type stocks refer to firms with different traded stock issues; they are excluded because their accounting data are reported for all stock issues against market values for every specific issue, which resulted in a technical problem to combine the data (e.g. combined *EPS*).

Symbol	Description	Datastream Code
NAME	Firm name	NAME
INDM	Datastream industry code	INDM
BDATE	Stock trading beginning date	BDATE
YEAR	The year which the data belong to (current year)	YEAR
DPAM	Depreciation and amortisation for the year	136
DPS	Dividends per share	190
DTBS	Deferred taxes (balance sheet account)	311
DTIS	Deferred taxes for the year (P&L)	161
EBIT/EBIT(t-1)	Earnings before interest and taxes	1300
EPS/EPS(t-1)	Earnings per share	254
EXOR	Extraordinary items after tax	193
HBETA	Historic leveraged or geared beta	897E
IC	Invested capital or Total capital employed	322
LTD	Total loan capital (long-term debt > 1 year)	321
MVE	Market value of equity (market-cap)	HMV
NI	Net income, earned for ordinary shareholders	625
NS	Number of shares outstanding	NS
OEQ	Ordinary equity capital and reserves	305
P	Stock price	P
T	Tax rate	202
TA	Total assets	392
TAX	Tax charge	203
TD	Total debt (long and short-term)	1301
TUR/TUR(t-1)	Total trading income (turnover)	107

Table 3-17. Raw Data Items

Data source: Datastream – Thomson Financial. Date of data last retrieval/update: 15 December 2003. The codes under symbols are those used in this document. (t-1) refers to 1-year lagged data used for growth calculations. Beta estimation is described under Section 3.2. Stock prices are retrieved for 13 consecutive months, starting June (t+1) every year, to calculate 12-month cumulative stock returns and annualised stock return volatility.

3.8.1.2 Supporting Calculations

Book equity *BE* is calculated, as in Pastor and Veronesi (2003) and in Conrad, Cooper, and Kaul (2003), as Ordinary equity capital and reserves *OEQ* plus balance sheet Deferred taxes *DTBS*. Deferred taxes are added back because they stem from timing differences to reflect the impact of actual cash taxes on book equity. This calculation excludes preference shares. Investment tax credit, which appears in US-based studies, is not applicable for UK companies.

Equation 3-6: $BE = OEQ + DTBS$

Earnings *EGS*, as in Pastor and Veronesi (2003), are calculated as Net income, earned for ordinary *NI* minus Extraordinary items *EXOR* plus Deferred taxes for the year *DTIS*. Extraordinary items are excluded to arrive at the normalised earnings level and annual deferred taxes are added back to correct for timing differences to reflect actual cash taxes in earnings.

Equation 3-7: $EGS = NI - EXOR + DTIS$

Cash flow *CF*, as in Conrad, Cooper, and Kaul (2003), is calculated as Net income; earned for ordinary *NI* minus Extraordinary items *EXOR* plus Depreciation and Amortisation *DPAM*.

Equation 3-8: $CF = NI - EXOR + DPAM$

This cash flow calculation measures the firm's performance before the major non-cash expense element (depreciation) because of the subjectivity that could be involved in asset depreciation. A full calculation of cash flow to equity for other purposes is different as it also takes into account changes in working capital, capital expenditure and cash flows to non-common equity capital holders as follows:

Cash flow to equity = Net income + Depreciation and Amortisation
– Changes in working capital – Capital expenditure
+ Changes in debt capital
– Net cash flows to other non-common equity holders

However, this cash flow to equity metric is not used in this study as it suits equity valuation using fully projected financial statements (ex ante) for a long-enough period to, at least, encompass a full business cycle of the company's industry and not to evaluate performance on a one-year basis.

Net operating profit after tax *NOPAT* is calculated as earnings before interest and tax minus taxes *TAX*.

Equation 3-9: $NOPAT = EBIT - TAX$

Invested capital *IC* (Capital employed *CE*) is the sum of all non-current liabilities and capital elements, comprising of: Total share capital & reserves, Total long term deferred liabilities, Minority interest, Total long term loans including subordinated loans and all interest-bearing short-term liabilities.

Age, in every single year, *AGE* is calculated as the current calendar year minus the stock trading beginning year plus one. For example, the age calculated in 1999 for a company its stock started trading in 1993 is 7 years (1999 – 1993 + 1). For simplicity, this calculation regards the beginning year as a full year regardless of when the trading started during that year.

3.8.1.3 Market Valuation Indicators

Market-to-book equity *MBE*, as in Pastor and Veronesi (2003), is calculated as the market value of equity *MVE* divided by book equity *BE* (as adjusted under Supporting Calculations).

Equation 3-10: $$MBE = \frac{MVE}{BE}$$

It should be always borne in mind that market-to-book is affected by accounting practices through the denominator. The above calculation adjusts for the impact of deferred taxation on book equity, which were recognised as tax charges in the P&L while they are deferred to a future period to be paid. There are other accounting treatments that could affect book equity. One of the most important ones is the treatment of goodwill. Goodwill amortisation or write-offs affects the book equity and could even lead to negative book equity. The argument to whether goodwill should be amortised or written off whether impaired or not is very extensive and there is no general consensus on how to regard it from an economic or investment perspective.

It can be argued that the goodwill should not be amortised or written off unless it is impaired by the firm's performance. A counter-argument is that the goodwill

should be completely written off so equity capitals for all companies are comparable by reflecting the net asset value excluding acquisition-generated goodwill.

As there is no one correct or wrong answer for that and given the unavailability of all data about cumulative goodwill amortisation and write offs in Datastream, it was decided to carry market-to-book calculation inline with the above mentioned academic papers without adding back cumulative goodwill amortisation and write-offs to avoid distorting the dataset by incomplete goodwill data or wrong adjustment. An example for the latter distortion is adding back a goodwill that was written off because it was impaired by a persistent underperformance of the acquired business.

The idea of using market-to-book equity as a valuation measure remains simple and valid, that is relating market capitalisation of future outcomes (future cash flows generated by profitability and growth and assessed according to their risk) to the actual capital physically injected into the business (proxied by book equity).

Market-to-book value of firm *MBF*, as in Rajan and Zingales (1995), is calculated as the book value of total assets *TA* minus book equity *BE* plus market value of equity *MVE* divided by book value of total assets *TA*.

Equation 3-11: $$MBF = \frac{TA - BE + MVE}{TA}$$

This ratio should be ideally calculated as the market value of firm measured by the market value of all company capital securities (ordinary shares, preference shares, debt, etc) divided by the book value of the same capital elements. Alas, market value is only available for ordinary shares. Therefore, researchers have devised the above calculation as an approximation. This ratio reflects firm perspective, which is discussed under Section 3.4.1.

Earnings-price ratio *EP* or Earnings yield *EY* (the inverse of price-earnings ratio *P/E*) is calculated as earnings *EGS* divided by the market value of equity *MVE* (exactly the same as *EPS* adjusted as for *EGS* divided by share price).

Equation 3-12: $$EP = \frac{EGS}{MVE}$$

Equation 3-13: $$P/E = \frac{MVE}{EGS}$$

Cash flow-price ratio *CFP*, as in Conrad, Cooper, and Kaul (2003), is calculated as cash flow *CF* divided market value of equity *MVE* to related the pre-depreciation and amortisation outcome to market capitalisation.

Equation 3-14: $$CFP = \frac{CF}{MVE}$$

Annualised stock returns *R*, is calculated as the cumulative monthly percentage return over 12–month period.

Dividend-based indicators are not included to keep the research more general to dividend–paying and non-paying firms.

3.8.1.4 Profitability, Efficiency and Leverage Indicators

Return on equity *ROE* is calculated as earnings *EGS* divided by book equity *BE*. This is a measure of equity investment profitability as book equity represents the actual equity capital invested in the business.

Equation 3-15: $$ROE = \frac{EGS}{BE}$$

After-tax return on invested capital *ROIC* (Return on capital employed *ROCE*) is calculated as Net operating profit after taxes *NOPAT* divided by Invested capital *IC*. It measures the profitability to total invested capital from firm or all investors' perspective.

Equation 3-16: $$ROIC = \frac{NOPAT}{IC}$$

Net profit margin *NPM* is calculated as earnings *EGS* divided by turnover *TUR*. It measures the net trading profitability.

Equation 3-17: $$NPM = \frac{EGS}{TUR}$$

Profit margin *PM* is calculated as Net operating profit after tax *NOPAT* divided by turnover *TUR*. It measures the gross trading profitability.

Equation 3-18: $$PM = \frac{NOPAT}{TUR}$$

Asset turnover *ATU* is calculated as turnover *TUR* divided by total assets *TA*. This is a measure of the firm's efficiency in using its assets to generate revenues. The profitability on capital is a function of net trading profitability/trading profitability and efficiency.

Equation 3-19: $$ATU = \frac{TUR}{TA}$$

Leverage (*LVG*) is measured in four different ways:

As in Conrad, Cooper, and Kaul (2003) it is calculated as long-term loan capital *LTD* divided by book equity *BE*.

Equation 3-20: $$LTDBE = \frac{LTD}{BE}$$

As in Pastor and Veronesi (2003) it is calculated as long-term loan capital *LTD* divided by total assets *TA*.

Equation 3-21: $$LTDTA = \frac{LTD}{TA}$$

Consistently with Du Pont analysis of the *ROE* leverage is calculated as total assets *TA* divided book equity *BE*.

Equation 3-22: $$TABE = \frac{TA}{BE}$$

Note that $ROE = \frac{EGS}{BE} = \frac{EGS}{TUR} \times \frac{TUR}{TA} \times \frac{TA}{BE} = NPM \times ATU \times TABE$

according to which, equity profitability is decomposed into its underlying net trading profitability, efficiency and leverage components. Using book values of debt and equity is first justified by the consistency in the above Du Pont analysis and by its use in the capital structure literature, for example Rajan and Zingales (1995) and Booth, Aivazian, Demirguc-Kunt, and Maksimovic (2001) define leverage using book value of liabilities/debt and both book value and market value of equity.

Note that as *TA* ≈ long-term loan capital + book equity, the above formula can be written as:

Equation 3-23: $$TABE \approx \frac{LTD + BE}{BE} = \frac{LTD}{BE} + 1 = LTDBE + 1$$

See Conrad, Cooper, and Kaul (2003) definition of leverage above.

The last one is measured as long-term loan capital *LTD* divided by market value of equity *MVE* (ideally, market value of loan capital should be used). This form is consistent with the estimation of the ex ante beta.

Equation 3-24: $$LTDMVE = \frac{LTD}{MVE}$$

Note how leverage is factored into equity-perspective profitability:

Equation 3-25: $$ROE = \frac{EGS}{BE} = \frac{EGS}{TUR} \times \frac{TUR}{TA} \times \frac{TA}{BE}$$

while it does not appear in firm perspective apart from the impact of tax shield on interest expense reflected in *NOPAT*. Some textbooks and valuation techniques use *NOPLAT* instead. That is net operating profits less adjusted taxes, where taxes are adjusted to cash basis but on an unlevered basis, which means the impact of tax, shield is eliminated as it will be captured through reducing the cost of debt by tax shield. See for example Copeland, Koller, and Murrin (2000).

Equation 3-26: $$ROIC = \frac{NOPAT}{IC} = \frac{NOPAT}{TUR} \times \frac{TUR}{IC}$$

Cash flow to book equity ratio *CFBE* is calculated as cash flow *CF* divided by book equity *BE*. This is similar, in structure, to *CFP* but it uses book equity instead in order to related cash flow to the equity capital that is physically invested in the business to generate these gross cash flows rather than to market capitalisation to indicate the firm's cash flow generating ability.

Equation 3-27: $$CFBE = \frac{CF}{BE}$$

3.8.1.5 Growth Indicators

Growth is calculated as the percentage change for *EPS*, *EBIT* and turnover as follows:

Growth in earnings:

Equation 3-28: $$GEGS = \frac{EPS_t}{EPS_{t-1}} - 1$$

Growth in *EBIT*:

Equation 3-29: $$GEBIT = \frac{EBIT_t}{EBIT_{t-1}} - 1$$

Growth in turnover:

Equation 3-30: $$GTU = \frac{TUR_t}{TUR_{t-1}} - 1$$

They are also calculated using the natural logarithm for the regression analysis, as follows:

Growth in earnings:

Equation 3-31: $$GEGS = \log(\frac{EPS_t}{EPS_{t-1}})$$

Growth in *EBIT*:

Equation 3-32: $$GEBIT = \log(\frac{EBIT_t}{EBIT_{t-1}})$$

Growth in turnover:

Equation 3-33: $$GTU = \log(\frac{TUR_t}{TUR_{t-1}})$$

Growth in *EPS* (denoted *GEGS*) is the selected measure for historic earnings growth as growth in *EBIT* and turnover, in their absolute monetary values, are affected by growth from external equity capital additions while *EPS* is scaled per share and would reveal the historic organic growth patterns. Also, growth in turnover does not give a clear idea about growth in outcome it is rather an indicator for growth in volume, size or market share.

3.8.1.6 Risk Indicators

Annualised stock return volatility $\sigma(R)$ is calculated as the monthly standard deviation multiplied by the square root of 12, as while variance is linear with time, standard deviation is linear with square root of time.

Historic leveraged beta *HBETA* is estimated using Datastream. The procedure is the traditional single index model. 5-year monthly logarithmic stock returns are used. The stock returns are regressed against Datastream total market index returns. Extreme values are excluded i.e. monthly changes over 41.42 percent. The beta estimate is further modified by a Bayesian adjustment. The procedure is based on Cunningham (1973). For more information, see Datastream beta calculations and Cunningham (1973). The idea is to use a well-known traditional method to estimate the historic beta so it is clear what is meant by this measure despite the drawbacks of such an estimate (e.g. beta is time-varying).

Historic beta might be a poor approximation for the ex ante beta that should be used in the cost capital calculation especially that the required rate of return or the cost of capital is an economic ex ante measure. Historic data can be relied upon for estimation, but that should be taken with caution. Therefore, the ex ante systematic risk and the cost of capital are estimated based on some well-established thoughts in finance literature. The formula that links the leveraged beta (systematic financial and business risk) to the unlevered beta (systematic business risk), taxation and capital structure, based on Modigliani and Miller (1963) and Capital Asset Pricing Model (CAPM), is given below. See Copeland, Koller, and Murrin (2000) for more details about this formula and for their recommended procedure, described below, to estimate the ex ante beta.[54]

Equation 3-34: $\beta_L = \beta_U[1 + (1 - T)\frac{D}{E}]$, **from which**

[54] *Denotation used for beta estimation:* K_E is the cost of leveraged equity. K_U is the cost of unlevered equity. K_D is the cost of debt. *WACC* is the weighted-average cost of capital. β_L is the leveraged beta (beta of equity: reflects business and financial risks). β_U is the unlevered beta (beta of the assets: reflects only operating or business risk). R_F is the risk-free rate. R_M is the expected return on the market. T is the tax rate. D is the value of debt. E is the market value of equity.

$$\beta_U = \frac{\beta_L}{1 + (1 - T)\frac{D}{E}}$$

The procedure can be summarised in the following steps:

1. For every year, historic betas were de-geared to isolate business risk (stemming from operational and industrial factors) from financial risk (stemming from leverage) using this formula, which results in the unlevered beta *UBETA* (beta of the assets or the operations; the business risk).

2. Unlevered betas were averaged for every sector every year to derive a sector-level systematic business risk measure; sector unlevered beta *SUBETA*.

3. Then, for every year, sector unlevered betas of that year were re-levered for every firm using the above formula applying the firm's tax rate and capital structure for the same year. This yields an estimate for the ex ante beta *EBETA* that reflects both business and financial risk, which is used in the CAPM formula to estimate the cost of equity.

Cost of equity using CAPM:

Equation 3-35: $K_E = R_F + \beta_L[E(R_M) - R_F]$

The literature is rich with research that used CAPM to estimate the cost of equity and other that discusses and debates CAPM itself. Here, the purpose is not to discuss CAPM, but rather to use it as in too many papers, quoting for example Kaplan and Ruback (1995) so the basis of estimation is well established in finance theory and practice and it is very familiar.

Risk-free rate. The rate of the 10-year UK government bond is used as recommended in Copeland, Koller, and Murrin (2000) where they argue based on Campbell and Viceira (2001) that the 10-year rate approximates the duration of the stock market index portfolio and its use is therefore consistent with the betas and market risk premiums estimated relative to these market portfolios. Just for

example, Kaplan and Ruback (1995), in their paper about the valuation of cash flow forecasts, choose to use the rate on the long-term Treasury bond for the risk-free rate.

Ex ante beta is estimated as described above based on Modigliani and Miller (1963). As Kaplan and Ruback (1995) did, the expected return on the market is also estimated using the general recommendation in finance texts [see for example Copeland, Koller, and Murrin (2000) and Brealey and Myers (2000)]. The procedure is as follows:

- It should be measured on as long period as possible. 10-year period is chosen,
- using arithmetic average of rate of return,
- adjusting the historic arithmetic average downward by 1.5 percent to account for survivorship bias. Copeland et al. estimated the downward adjustment by 1.5 to 2 percent based on the tables used by Jorion and Goetzmann (1999).

The weighted average cost of capital *WACC* is calculated using the traditional formula using the risk-free rate as the cost of debt because of the unavailability of the cost of debt data, which will capture the impact of debt market but not the company-specific credit quality. Therefore, because of the unavailability of market value of debt too besides that this work in concerned with equity valuation, firm perspective which uses *WACC* and requires market value and rate of debt, will not be emphasised.

Equation 3-36: $$WACC = K_D(1-T)\frac{D}{D+E} + K_E\frac{E}{D+E}$$

3.8.1.7 Size Indicators

Size is measured in two different ways: Total assets *TA* and log(*TA*) and Market value of equity *MVE*. The total assets measure is a good proxy for firm size as it represents the total size of the operations (asset or operating side of the balance sheet) while the market value of equity reflects the market capitalisation for future outcomes to *equity*.

3.8.2 Empirical Analysis Appendix

3.8.2.1 Value Drivers – Illustration

A and B are two companies with the same forecast net income each year, same expected growth rate in net income, but different net investment requirement each year (i.e. different rates of return on investment). To check how these facts impact value, a discount rate of 10 percent is used. Table 3-18 below shows the valuation for the outcome of each company over a period of five years.

Year of Forecast		0	1	2	3	4	5	*6*
£ Million								
Company A								
Net income			100.0	104.0	108.2	112.5	117.0	*121.7*
Net investment[1]			-20.0	-20.8	-21.6	-22.5	-23.4	
Cash to shareholders[1]			80.0	83.2	86.5	90.0	93.6	
Growth in net income[2]	*(percent)*			4.00	4.00	4.00	4.00	
Return on incremental investment[3]	*(percent)*		20.0	20.0	20.0	20.0	20.0	
Present value of 5-year cash flows		326						
Company B								
Net income			100.0	104.0	108.2	112.5	117.0	*121.7*
Net investment[1]			-40.0	-41.6	-43.3	-45.0	-46.8	
Cash to shareholders[1]			60.0	62.4	64.9	67.5	70.2	
Growth in net income[2]	*(percent)*			4.00	4.00	4.00	4.00	
Return on incremental investment[3]	*(percent)*		10.0	10.0	10.0	10.0	10.0	
Present value of 5-year cash flows		245						

Table 3-18. Value, Cash Flow, Income and Return on Investment

[1] Gross cash flow = Net income + Depreciation
Gross investment = Depreciation (replacement) + Net investment (New investments)
Cash flow = Gross cash flow – Gross investment
= (Net income + Depreciation) – (Depreciation + Net investment)
= Net income – Net investment

[2] Growth in net income $=[NI_t - NI_{t-1}] \div [NI_{t-1}]$ = Return on incremental investment × Investment rate

[3] Return on incremental investment $_t$ = Incremental income $_t \div$ Incremental investment $_{t-1}$

From the above illustration:

1. Both companies have the same forecast net income and both are forecasted to maintain 4 percent growth rate in net income. Should they be worth the same? A has higher return on incremental investment than B. Hence, company A requires less incremental investments (20 percent of net income) than B (40

percent of net income) to maintain the growth in net income. Intuitively A should be worth more.

2. Regardless of the same net income, A generates more cash flow *(CF)* than B, because of different incremental investment needs to maintain the level of net income and its growth.
3. The above is translated into a higher present value of cash flows for A for the 5-year period than for B. For illustration purposes, the above was by valuing only the outcomes of five years rather than on ongoing concern with continuing value, the comparison remains the same.
4. What can be inferred from the above illustration:
    a) Cash flow drives the company's value (it is the value driver);
    b) Return on investment (of course, relative to the cost of capital) and growth drive cash flow (they are the drivers of the value driver);
    c) Future cash flowed would be assessed according to their risk level reflected in the cost of capital.

3.8.2.2 Supplementary Analysis for Section 3.3

The same analysis in Table 3-5 under Section 3.3 is repeated using total assets to define size especially that *MBE* is calculated using market-cap. Table 3-19 reports the results. Reading rows, overall similar to the conclusion from market-cap size definition in Table 3-5 apart from size 1 that showed mixed readings. However, size 1 does not have a large number of observations). This is also consistent with the regression analysis discussed later in Section 3.4. Reading columns, age 1 *MBE* declines with *TA* size (unlike with *MVE* size), age 2, apart from size 1, size groups have similar *MBE*. Age groups 3 and 4, apart from size 1, *MBE* increases with *TA* size (similar to *MVE* size). The conclusion for *MBE*-size relation derived from *TA* size is just slightly different from that with *MVE* because *MBE* size is highly positively correlated with *MVE* by construction.

£million/years	*All*	Age<=5	5<Age<=10	10<Age<=13	Age>=14	Obs
All		*2.45*	*2.00*	*1.81*	*1.53*	*9901*
TA<=1	*3.34*	5.37	-0.03	15.68	2.05	129
1<*TA*<=10	*1.98*	2.73	2.06	1.39	1.06	1709
10<*TA*<=100	*1.66*	2.49	1.95	1.83	1.21	4365
TA>100	*1.86*	1.97	2.02	1.86	1.82	3698
Obs	*9901*	2494	1883	759	4765	9901

Table 3-19. *MBE* for Age and Size Groups (Total Assets for Size)

The table reports median *MBE* for the different size/age groups calculated from the pooled data over the period 1989-2002. Obs is the number of observations represents the sum of observations for all 4 age groups in rows and for all 4 size groups in columns.

This appears in the regression (estimated in Table 3-7 Section 3.4.2) as a positive significant relation between *MBE* and *TA* size overall and for survivors and in a negative insignificant relation for new stocks.

3.8.2.3 Re-Estimated Value Explanatory Model without Age

Variable Description	Symbol	Coefficient	*p*-value
Dependent variable	log*(MBE)*		
Constant	*C*	-0.28	0.0024
Net profit margin	*NPM*	2.51	0.0000
Asset turnover	*ATU*	0.22	0.0000
Leverage	*TABE*	0.11	0.0000
Growth in earnings	*GEGS*	0.17	0.0000
Cost of equity capital	*KE*	-1.27	0.0002
Size	log*(TA)*	0.03	0.0000
R-squared		0.18	
Adjusted *R*-squared		0.18	
p-value (*F*-statistic)		0.0000	
Total number of observations		7,108	

Table 3-20. Re-Estimated Value Explanatory Model without Age

This is the same estimation as in Table 3-6 with *AGE* the firm age dropped from this estimation. The dependent variable is the natural log of market-to-book which measures the rate of market value premium/discount over book value; *C* is the constant term; *NPM* is the net profit margin (trading profitability), *ATU* is asset turnover (efficiency); *TABE* is total asset-to-book equity ratio ≈ 1 + Debt-to-equity ratio (leverage); Note that *NPM* x *ATU* x *TABE* = *ROE*. The use of *ROE* instead of its components yields similar results with a higher *R*-squared; *GEGS* is growth in earnings measured as $\log(EGS_t/EGS_{t-1})$. *KE* is the cost of equity capital (risk); *TA* is total asset (size); Total number of observations is 7,108 for pooled data for all survivor and new stocks for the period 1989-2002. Method of estimation is least squares pooled regression. Robust estimation technique (White Heteroskedasticity-Consistent Standard Errors & Covariance) is used to correct the standard errors as the model exhibited heteroskedasticity. Firm with *MBE* smaller than 0.01or larger than 100 were excluded as Pastor and Veronesi (2003).

3.8.2.4 Leverage

Leverage, on one hand, exposes firms to financial distress and bankruptcy risk, while on the other hand firms benefit from leverage by shielding their profits from taxes because as cash payments to shareholders are not tax-deductible interest expenses are. Therefore, standard finance theory and practice suggest that stable profitable firms should borrow to some extent to enhance value creation from tax shield, see Brealey and Myers (2000) for further discussions.

Table 3-21 and Table 3-22 show that older stocks have higher leverage ratios than new stocks regardless of the measure used. Which is expected. This could lead to think that survivor stocks are more exposed to financial risk relative to new stocks. However, that was reflected in leveraged beta and this relatively higher financial risk exposure taken by survivor firms is more than offset by two factors, (a) the benefits from tax shield, and (b) the relatively higher profitability and cash flow generating ability of survivor firms to justify shielding profits and the higher capability to service debt. Hence, it is believed that survivor firms are naturally capital structure optimisers and leverage would not contribute to risk differences between survivor and new stocks.

Age Groups	*LTDBE*	*LTDTA*	*TABE*	*LTDMVE*	Obs
Percent			*Times*		
All (*A*)	10.18	5.49	2.00	5.54	9893
Survivors (*S*)	13.04	6.52	2.07	7.32	6972
New Stocks (*N*)	3.76	2.74	1.80	1.78	2921
S-N	9.28	3.79	0.27	5.54	
(S-N)/S Percent	71.19	58.05	13.02	75.68	
p-value (*S v N*)	0.0000	0.0000	0.0000	0.0000	

Table 3-21. Leverage, Survivor and New Stocks

This table reports median leverage ratios expressed in four different ways as discussed in Data Appendix Section 3.8.1.4. *LTDBE* is long-term debt-to-book equity. *LTDTA* is long-term debt-to-total assets. *TABE* is total assets-to-book equity. *LTDMVE* is long-term debt-to-market value of equity. *p*-value is for the equality test of medians.

Age Groups	*LTDBE*	*LTDTA*	*TABE*	*LTDMVE*	Obs
Percent			*Times*		
Up to 2 (*G2*)	1.50	1.04	1.61	0.45	804
3	2.77	1.99	1.82	1.39	637
4	6.31	3.74	1.90	3.05	533
5	6.12	3.58	1.94	2.90	512
6	7.48	4.37	1.87	3.92	488
7	8.59	4.42	1.95	3.54	432
8	7.13	4.75	1.95	4.11	356
9	7.41	4.18	2.02	3.67	318
10	6.99	4.16	2.02	4.16	278
11	7.57	4.22	2.02	4.66	260
12	5.93	3.35	1.99	3.25	252
13	8.64	4.45	1.99	4.00	247
14+(*G14*)	16.43	7.91	2.11	9.74	4776
G14-G2	14.93	6.87	0.50	9.29	
(G14-G2)/G14 Percent	90.88	86.87	23.70	95.34	
p-value (*G14 v G2*)	0.0000	0.0000	0.0000	0.0000	

Table 3-22. Leverage, Age Groups

This table reports median leverage ratios expressed in four different ways as discussed in Data Appendix Section 3.8.1.4. *LTDBE* is long-term debt-to-book equity. *LTDTA* is long-term debt-to-total assets. *TABE* is total assets-to-book equity. *LTDMVE* is long-term debt-to-market value of equity. *p*-value is for the equality test of medians.

4 Chapter Four: Stock Market Levels in the UK: Earnings Yield, Growth, and Return Expectations

4 Chapter Four: Stock Market Levels in the UK: Earnings Yield, Growth, and Return Expectations

Abstract

Having concentrated on relative bias in the previous chapter, we investigate in this chapter stock market overall bias (against fundamentals) by examining stock market levels in the UK. We first establish the occurrence of major divergences between soaring stock prices and economic growth and equity invested capital followed by subsequent price falls (corrections). We examine the hypothesis that stock market levels in the UK during 1989-2002 can be explained by fundamentals (reasonable expected profitability, expected growth and risk) (H_0), along with a variation of this hypothesis that stock prices on average over time are correctly valued against fundamentals with temporary mispricing periods (H_{0a}), against the alternative that stock market levels in the UK were overvalued on average relative to fundamentals during that period (H_1). On the balance of evidence, we believe the conclusion is tilted towards rejecting H_0 and H_{0a} in favour of H_1.

For hypothesis testing, we develop a theoretical earnings yield model validated by an empirical model to examine stock market levels. We document that the spread between earnings yield and the risk-free rate is almost stable on average. To explain this negative spread, we explore plausible scenarios for earnings yield, earnings yield predictions, corporate profitability, growth expectations, and return expectations.

The theoretical earnings yield model was successful in predicting in-sample the severe fall in stock prices after 1999 peak during 2000-2002 to a very good extent and the part recovery to end of 2003 level. The low levels of realised earnings yield relative to the risk-free rate and to those obtained from the theoretical and empirical models under plausible scenarios imply overvaluation. There were no changes in corporate profitability pattern that would explain the soaring stock prices such as those to the of end 1999.

We also examine implied growth and discount rates. We establish the presence of a gap between implied growth and economic growth against stock market levels with a cyclical behaviour in terms of growth expectations where the gap size has a direct positive relation with stock price levels. Market expected growth rates as implied in market valuation have almost always been higher than both economic growth and realised earnings growth suggesting investor overoptimism. An unbiased estimation for the expected returns on the stock market is developed and checked for robustness. The implied discount rate in market valuation shows that average equity risk premium underestimates risk when compared with the evidence in the literature and market unbiased expected return.

Finally, the relative valuation bias analysed in Chapter 3, between new and older stocks, correlates with the aggregate valuation bias of this chapter as demonstrated by the behaviour of the valuation gap between new and mature stocks and the market implied growth gap, where both gaps widen in bullish markets and diminish in bearish markets supporting the refutation of the hypothesis that new stocks higher valuation is due to learning.

4.1 Introduction

Chapter 3 on valuation bias and stock age was a *relative* analysis, finding that investor expectations for new stocks appear to be biased relative to older stocks. Although Chapter 3 explored the valuation of new stocks relative to survivor stocks, it did not address the valuation levels of survivor stocks themselves or the overall price levels of the stock market.[55] Therefore, in this chapter, we expand the research into another dimension to study valuation bias at the stock market overall level. Valuation bias in this chapter refers to *overall bias* against fundamentals, while the previous chapter tackled *relative bias* between stock categories divided by age.

Equity valuation continues to puzzle both academics and market practitioners.[56] Standard finance theory postulates that the value of any capital asset is measured by the present value of its future outcomes. This premise or theory is one of the most important corner stones in investment and finance. But, often the observed behaviour of stock prices, especially the unexplained significant ups and downs, does not seem to accord with this theory.[57]

Market behaviour shown in Figure 4-1 and Figure 4-2 below provide sufficient motivation to explore the area of equity valuation and to seriously question market value levels attempting to develop a thorough understanding of equity valuation. Both figures compare UK equity prices with major fundamental determinants. The difference between these two figures is that in Figure 4-1 the comparison is with the underlying economy, while in Figure 4-2 the comparison is with the book value of equity.

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[55] The conclusion of Chapter 3 ended with a caveat that it does not imply that older stocks were fairly valued.

[56] The complexity of the research in this area stems from the unknown fair value levels, which makes it difficult to work in this area. Nevertheless, researchers always work to at least thoroughly understand the problem.

[57] For example, Grossman and Shiller (1981) find that the present value of dividends since 1881 had only a thin relation to actual stock prices in the US, Campbell and Shiller (1988) find that stock prices and returns are too volatile to accord with simple present-value model. Smithers and Wright (2004) say, "Two fundamental, and perhaps disconcerting questions, immediately occur when considering how to value stock markets. They are "Why attempt to do it?" and "Can it be done?"

Figure 4-1 below shows that the stock market was not in tandem with the economy, with major divergences followed by severe stock price corrections (e.g. 1993-1994, and 1999-2002). Locating the end of the Cold War late 1991 on the lower chart reveals possible market over-optimism followed the end of this prolonged conflict. FTSE All Share Price Index (FTSE All) closed at an all-time year-close high at 3,242.06 by the end of 1999. Since then, the index has declined by 41.6 percent to 1,893.73 by the end of 2002, roughly 120 points below its level at the end of 1996. What drove stock prices to that high level of 1999 and what drove them down to below 1996 level?

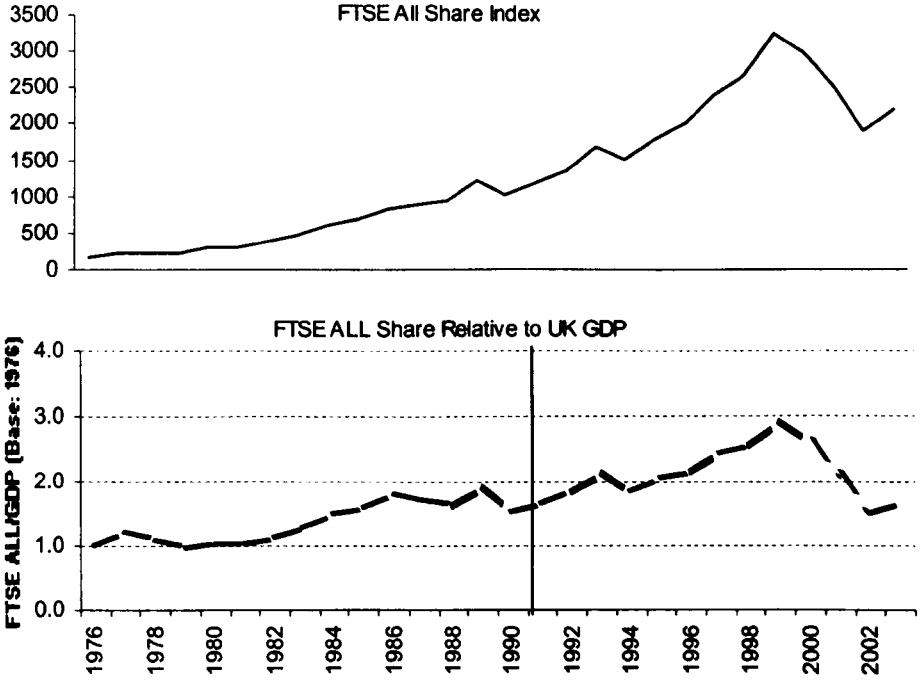

Figure 4-1. Stock Market levels versus the Economy

The upper chart shows FTSE All Share Price Index in index point. The lower one plots the ratio of FTSE ALL (index points) divided by UK nominal GDP then all re-based to 1976 ratio to show comparative paths or growth patterns. If the stock market and the economy grew at the same rates then this ratio would have been constant around 1.00 on the Y-axis. The vertical line at 1991 indicates the end of the Cold War era. Nominal or inflation-corrected graphs will show the same pattern as the same correction multiple (say based on 1976 price level) will be applied to the numerator and the denominator.

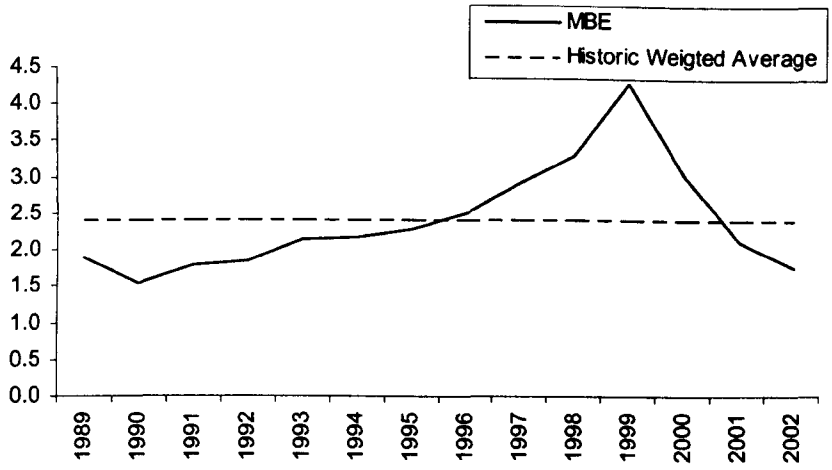

Figure 4-2. Market-to-Book Ratio, UK Non-Financial Sector

MBE is market-to-book ratio of equity calculated at aggregate level for all UK non-financial traded companies by dividing the sum of market value of equities by the corresponding sum of book equities every year. The historic weighted average *MBE* is calculated by dividing the sum of market value of equities for all companies by the corresponding sum of book equities pooled for the entire period 1989-2002.

Figure 4-2 illustrates the major divergence when relating stock prices to book equity capital (a good proxy for actual shareholders funds invested in the operations), while Figure 4-1 illustrates the divergence relative to the economy. Both figures confirm the occurrence of major deviations and corrections.

Similar divergence has been observed in the US. Alan Greenspan, Chairman of the Board of Governors of the US Federal Reserve System 1996 has talked about *irrational exuberance* in equity prices.[58] Shiller (2001) reported that the US stock market ups and downs over the last century have made virtually no sense ex post. He continues saying: it is curious how little known this simple fact is. Another quote from Shiller's book implies some questions that are both worrying and fascinating: "We are unsure whether the market levels make any sense, or whether they are indeed the result of some human tendency that might

[58] Alan Greenspan said, "...how do we know when irrational exuberance has unduly escalated asset values, which then become subject to unexpected prolonged contractions..." At that time the forward price-earnings ratios on the S&P and Nasdaq were 15 and 19 respectively, while they were 21 and 31 respectively in April 2002 (CNN, 2002; Greenspan, 1996). Also, The Board of Governors of the Federal Reserve System in its Monetary Policy Report to the Congress dated February 27, 2002 highlighted the exceptional volatility of equity prices in 2001. Literally: "The exceptional volatility of equity prices in 2001 likely reflected the dramatic fluctuations in investors' assessment of the outlook of the economy and corporate earnings. Share prices tumbled early last year, as pessimism and uncertainty about the direction of the economy were intensified by a spate of negative earnings announcements and profit warnings in April and March."

be called irrational exuberance. We are unsure whether the high levels of the stock market might reflect unjustified optimism, an optimism that might pervade our thinking and affect many of our life decisions. We are unsure what to make of any sudden market correction, wondering if the previous market psychology will return".

Some years ago, Bernstein (1985) summed it up saying "...investors forecast stock prices instead of company earnings. More precisely, today's is a forecast of what investors expect tomorrow's price to be, rather than as estimate of present value of future payment streams". The above statements express well why someone would really be willing to explore the area of equity valuation bias at the absolute level and keep working in the field although it looks a very open-ended problem.

The objective of the present research is to investigate whether stock price levels in the UK can be explained by fundamentals. The rejection of this hypothesis will suggest that valuation bias (mispricing relative to fundamentals) exists at market overall level implying that stock prices are driven by investor expectations rather than by fundamentals.

Specifically we test the following null hypothesis:

> H_0: *Stock market levels in the UK during the period 1989-2002 can be explained by fundamentals such as reasonable expected profitability, expected growth and/or risk levels.*

We also test a variation of H_0:

> H_{0a}: *Stock prices on average over time are correctly valued against fundamentals, but sometimes there is temporary mispricing.*

If the research concludes by rejecting H_0 and its variation H_{0a}, that will be in favour of the alternative hypothesis H_1:

> H_1: *Stock market levels in the UK were overvalued (biased upwards) on average relative to fundamentals during the period 1989-2002.*

The two hypotheses H_0 and H_1 are closely related. The method we adopt is essentially testing H_0 as to whether it is possible to develop a sensible explanation of the levels and movements of stock prices as shown in Figure 4-1 and Figure 4-2 above using fundamentals.

The selected method goes through exploring rationalised scenarios for earnings yield; earnings yield predictions, corporate profitability, growth expectations, and return expectations. Although hard to quantify, the possible outcomes of the analyses will be represented by one of the cells on the matrix presented in Figure 4-3. The conclusion will be located onto the same matrix in the conclusion section.

		Pricing Risk		
		Overestimated **A**	**Rational** **B**	**Underestimated** **C**
Pricing Growth	**Underestimated 1**	Undervalued	Undervalued	Offsetting
	Rational 2	Undervalued	Rational	Overvalued
	Overestimated 3	Offsetting	Overvalued	Overvalued

Figure 4-3. The Matrix of Growth and Risk Pricing Impact on Stock Valuation

A1 (top left) and C3 (bottom right) represent the most severe undervaluation and overvaluation levels respectively. A3 and C1 have an offsetting impact, the underestimation/overestimation extent of each variable could result in rational (for the wrong reasons), overvalued, or undervalued levels. The relative severity level of B1 v A2 and C2 v B3 are dependent on the extent of one variable under-/over-estimation. Changes in profitability patterns will be rolled out of the explanation as shown later under Section 4.5.

This chapter is organised as follows. Following a description of our data in Section 4.2, section 4.3 discusses (a) fundamental drivers of market valuations, and (b) the issue that some key drivers such as growth expectations and risk perception are not directly observed. This section then presents two earnings-yield valuation models (one theoretical, the other empirical) to examine earnings yield levels and the prediction capability of the model. The theoretical model is based on standard finance theory and common sense of investment and economics, while the empirical model is built from historic experience contained in the data, the empirical model validates the theoretical one. This will be the initial hypothesis testing.

Section 4.4 then tests the maintained hypothesis that economic fundamentals, as captured by this valuation model, can explain aggregate stock market valuations. In Section 4.5, we examine changes in corporate profitability pattern (to assess their impact on stock market levels) and market growth expectations via implied growth under plausible scenarios against economic growth and realised earnings growth. We then turn to developing an unbiased estimate for return expectations to compare with the risk-free rate and the market implied discount rate under plausible scenarios to evaluate risk-aversion and return-expectations. The robustness of these estimates is tested through the correlation with the risk-free rate that was not part of the estimation processes.

4.2 Data

The same dataset used for Chapter 3 is used for this Chapter. Annual accounting, market, and economic data are taken from the database of Datastream–Thomson Financial for the years 1989 through 2002 on all UK non-financial traded stocks. Financial stocks are excluded, as common in the literature for this type of analysis, because of their different nature from general industries. See Data Section 3.2 and Data Appendix 3.8.1 in Chapter 3 for details on data raw items, codes, construction, calculations and discussions.

In addition to this, the market expectations for inflation rates implied in government bond trading as estimated by the Bank of England are used. These are discussed further under Section 4.5.3.1 where used. These data were retrieved from the Bank of England website (www.bankofengland.co.uk).

4.3 Valuation Framework; Earnings Yield Model

4.3.1 An Earnings Yield Based Model of the Market-to-Book Equity Ratio

George Box said once "all models are wrong but some models are useful".[59] Therefore, a simple earnings capitalisation model based on a well-established framework in finance is used concentrating on investment and economic logic rather than on sophisticated modelling. The purpose of this section is to develop a theoretical earnings-yield model and to estimate an empirical earnings-yield model of the observed market-to-book ratio.

First, it is important to discuss the use of an earnings-based valuation model, from different conceptual and practical angles, and it is shown that this is equivalent to a model of the market-to-book *MBE* (this Section 4.3.1). Then the model itself is estimated (Section 4.3.2). In the following Section 4.4, this model will be used to test hypotheses in which stock market valuations can be explained using this fundamentals-based model. Starting with discussing the use of earnings:

(a) *Finance Literature*: Several contributions to the literature have emphasised the importance of current and future earnings to stock valuation. Miller and Modigliani (1961) introduced a valuation concept according to which a share value represents the present value of normalised earnings from existing assets plus the present value of future growth opportunities in earnings. Campbell and Shiller (1988) stated: "...earnings are constructed by accountants with the objective of helping people to evaluate the fundamental worth of a company." Feltham and Ohlson (1999) analysis "refutes popular notions that a conceptually valid assessment of market value must focus on anticipated cash flows rather than anticipated realizations of accounting data. Current book value plus the present value of future abnormal earnings provides a general framework, and the present value of cash flows formula arises merely as a

[59] George Box is a well-known industrial statistician.

special case". Heaton and Lucas (1999) used earnings arguing that they are likely to be a more stable proxy for long-run payments to shareholders. Shiller (2000) referred to the intrinsic values of businesses 'as measured by the expected discounted value of their future earnings stream'. Bakshi and Chen (2001) developed a valuation model with net earnings per share, expected earnings growth, and interest rate as its inputs. Bartov and Goldberg (2001), using stock return, find that earnings are more important than cash flow metric for equity valuation in three Anglo-Saxon countries; United States, United Kingdom and Canada where capital is traditionally raised in public markets.[60] Others such as Ang and Liu (2001), Scott, Stumpp and Xu (1999) and Sougiannis and Yaehura (2001) used earnings-based valuation model in their work.

(b) The split between retained and distributed earnings is not crucial. Companies distribute part of their earnings as dividends and retain the remaining part. Dividends can be discounted to present value at a discount rate that reflects their risk. Retained earnings increase the value of the business and contribute to growth. Thus, retained earnings that would be reflected in stock price appreciation can be discounted at a rate that reflects the uncertainty of their realisation given that they can be realised by selling the stock.[61] So, it is appropriate to discount earnings (dividends + retained earnings) and their growth at a discount rate that reflects the combined risk of total returns (dividends and capital appreciation from retained profit).

(c) At a single company level the differences between annual cash flows and earnings can be very significant due to timing differences between cash basis and accrual basis of accounting. However, working at market aggregate level timing differences are mitigated if not unimportant.

(d) Also at company level, to some extent, companies can manipulate earnings even within the generally accepted accounting standards and practices. It is not acceptable that value can be impacted via accounting practices–book

[60] But they find in Germany and Japan, where capital is traditionally raised from private sources, that earnings are not superior to cash flows for equity valuation with no significant differences.
[61] Note that if retained earnings are invested in zero NPV projects, the present value of their incremental future outcome will be equal to the retained amount at the time of retaining.

manipulations. These manipulations come in the form of timing differences, and are therefore mitigated at market aggregate level.

(e) Although accounting measures of performance at a company level have many drawbacks for valuation because of timing differences, earnings are still based on sound, logical and consistent basis of accounting. That is accrual basis or matching principle. US Financial Accounting Standards Board (FASB) believes that earnings which are based on accrual basis of accounting provide superior value-relevant information for assessing future cash flows and value estimates than reported historical cash flows.[62]

It is not meant by using earnings that they form the best valuation metric in all circumstances. It is merely used because a metric to measure *annual* performance is needed. Accrual basis and matching principle of accounting make earnings good candidate for this specific purpose *just at market level.*

The derivation below addresses the two fundamental points about the economic value of equities as highlighted by Smithers and Wright (2004), that equities (a) are financial assets, and (b) represent a title to the ownership of real assets. In the following is a brief discussion of the model with the derivation of a theoretical earnings-yield model and an empirical model that validates the theoretical formulation. The following equation is a standard present value model based on earnings.

Equation 4-1: $$MVE_0 = \frac{EGS_1}{(1+KE)} + \frac{EGS_1(1+g_2)}{(1+KE)^2} + \frac{EGS_1(1+g_2)(1+g_3)}{(1+KE)^3} + \ldots$$

where MVE is market value of equity, EGS is earnings, KE is the cost of equity capital, and g_i is the growth rate.

First, there is an essential technical point to clarify. Valuation is an ex ante process where value is the present value of future outcomes (cash flows, earnings,

[62] The Statement of Financial Accounting Concepts (SFAC) number 1 (1978) explains that the accrual basis underlying earnings aims at recording the financial effects of transactions and other relevant events and circumstances on an enterprise in the periods in which they occur rather than in the periods in which cash is received or paid.

etc). However, using analysts' earnings forecasts or estimating future earnings for the market is both subjective and unviable. Therefore, the model will extrapolate from the market's aggregate prior year's earnings into the following year's forecast and so on reducing the subjectivity by relying on a hard fact as follows.

$$EGS_{t+1} = EGS_t(1 + g_{t+1})$$

What also justifies this technical solution, is that for a single company actual earnings might differ significantly from forecast ones, but aggregate realized earnings for a large number of companies is a representative and acceptable measure for valuation at market level. Combining all analysts' forecasts for the market, if of any good, should be close to the realized aggregate earnings.

There are two more technical problems that could lead to errors in using the model at aggregate level. These are (a) having different number of companies from year to year, and (b) companies' capital base could change from year to another, so relating one year's market-cap to the next year's earnings would be inconsistent. These technical problems were overcome by re-writing the model in Equation 4-1, for market level, with the earnings of year t+1 growing from those of year $t = 0$ as follows:

Equation 4-2: $$MVE_0 = \frac{EGS_0(1+g_1)}{(1+KE)} + \frac{EGS_0(1+g_1)(1+g_2)}{(1+KE)^2} + \ldots$$

A reduced form of this model is needed to make it usable. A terminal growth figure, i.e., a long run growth rate can combine an explicit short term forecast with a judgement about future growth rates, into a single rate. Hence, the alternative used for the present analysis, is a single practically comparable perpetual growth rate that applies from year one onwards.[63] Table 4-1 illustrates how the use of perpetual growth can be representative for more detailed explicit growth rates and helps to derive a practically single comparable figure.

[63] It is not practically possible to derive and compare implied explicit growth rates for long period. Although at a company individual level forecast explicit growth rates could be different from year to year, it is fair to assume that earnings growth at market aggregate level can be expressed in a single growth rate. Also, even at a single company level it is not practically possible to use/estimate and compare multiple growth rates. Moreover, estimating a perpetual growth rate is a transformation of multiple future growth rates pattern into a single geometric perpetual growth rate.

		Historic	Forecast					
Year		$t=0$	1	2	3	4	5	Terminal
Earnings £m		95	100	115	95	120	115	1,993
Growth rates	*Percent*		5.0	15.0	-17.0	26.0	4.0	4.0
Cost of capital	*Percent*	10.00						
Present value of earnings			91	95	71	82	71	1238
Market value estimate £m		1,648						
Equivalent single implied perpetual growth rate		3.93						

Table 4-1. Perpetual Growth Substituting Detailed Growth Rates

The terminal value is estimated at the end of year 5 assuming 4 percent perpetual growth from year 6 onwards by using Gordon model. The perpetual growth rate that singles out all detailed growth rates can is calculated by inverting the Gordon model ($g = KE - EGS_t/MVE_0$). This growth rate gives, of course, the same market value estimate as derived from explicit growth rates.

Based on the above discussion, the explicit growth rates g_1, g_2, *etc* in Equation 4-2 are replaced with their representative constant geometric growth rate g:

$$MVE_0 = \frac{EGS_0(1+g)}{(1+KE)} + \frac{EGS_0(1+g)^2}{(1+KE)^2} + \frac{EGS_0(1+g)^3}{(1+KE)^3} + \ldots$$

$$MVE_0 = \frac{EGS_0(1+g)}{(1+KE)}\left[1 + \left(\frac{1+g}{1+KE}\right) + \left(\frac{1+g}{1+KE}\right)^2 + \ldots\right]$$

The expression in square brackets is a declining infinite geometric progression where its sum is given by the expression shown below in square brackets (for $KE > g$):

$$MVE_0 = \frac{EGS_0(1+g)}{(1+KE)}\left[\frac{1}{1-\frac{1+g}{1+KE}}\right] = \frac{EGS_0(1+g)}{KE-g}$$

in a generalised form:

Equation 4-3: $$MVE_t = \frac{EGS_t(1+g)}{KE-g}$$

In the following section, we validate, empirically and statistically, the model presented in Equation 4-3. Earnings yield *EY* was not used as the dependent variable in the regression. Instead, a mathematically equivalent transformation of *MBE* was used because ex post earnings yields at company level

are very unstable.[64] For this task, the model is re-written using market-to-book equity ratio by dividing both sides of Equation 4-3 by book equity *BE* at time *t*:

$$\frac{MVE_t}{BE_t} = \frac{\frac{EGS_t(1+g)}{BE_t}}{KE-g}, \text{ yielding:}[65]$$

Equation 4-4: $$MBE_t = \frac{ROE_t(1+g)}{KE-g}$$

It is worth showing how the theoretical earnings yield model is derived from the valuation model in Equation 4-3 (*EY* is earnings yield, *RF* is the risk-free rate, *RM* is the expected return on the market):[66]

$$MVE_t = \frac{EGS_t(1+g)}{KE-g}, \text{ re-arrange}$$

$$\frac{MVE_t}{EGS_t} = \frac{1+g}{KE-g} = PE = \frac{1}{EY}, \text{ of which}$$

Equation 4-5: $$EY = \frac{KE-g}{1+g}.$$

For stock level, Equation 4-5 can be re-written using CAPM cost of equity as in Equation 4-6. For market level, beta equals one and the equation becomes as in Equation 4-7.

Equation 4-6: $$EY = \frac{RF+\beta(RM-RF)-g}{1+g}$$

Equation 4-7: $$EY = \frac{RM-g}{1+g}$$

[64] The issue here is that there are substantial short-term variations in earnings yield, driven by short-term earnings fluctuations. The objective is to estimate a long-run valuation model, without having to model the dynamics of short-term earnings growth. Therefore, it is better to use market-to-book which bears a simple clear relationship with earnings yield, and is less affected by short-term earnings fluctuations. Moreover, earnings yield can be derived from the *MBE* empirical model; see the derivation of Equation 4-19 in Appendix 4.7.1.

[65] Wright (2004) discusses market-to-book as an indicator for market value levels. He refers to market-to-book equity *MBE* as 'equity *q*' as a variation of Tobin's *q*. He defines Tobin's *q* as [(Market value of equities + Liabilities)/Total assets] and equity *q* as [Market value of equities/Net worth], where net worth is defined as [Total assets – Liabilities]. However, Wright use assets' replacement cost in his calculations as produced by statisticians in the US.

[66] Lansing (2002) used earnings yield (the inverse of price-earnings ratio) in examining stock market levels in the US. Wright (2002) referred to earnings yield calculation as earnings divided by market value of equities.

4.3.2 Estimating the Empirical Model

This subsection now presents an estimated version of the *MBE* model. To implement Equation 4-4, an empirical model is adopted in which market-to-book equity *MBE* (market valuation) is the dependent variable, with return on equity *ROE* (profitability), *g* (growth), and cost of equity *KE* (for risk) are the explanatory variables. The idea is to establish empirically the statistical relations between market valuation, profitability, growth and risk because the earnings yield model will be a variation of the valuation model presented in Equation 4-3 or Equation 4-4.[67]

Equation 4-8: $\log(MBE)_i = \beta_0 + \beta_1 ROE_i + \beta_2 GEGS_i + \beta_3 KE_i + \varepsilon_i$

It is worth noting how the theoretical and the empirical model reflect that stock prices or stock returns should be determined by the underlying ***profitability***, ***growth*** potential and ***risk*** factors. Any other factors such as explicit macro-economic and sector factors are relevant to corporate valuation as far as they impact the above three factors. Thus, the explanatory variables on the right hand side of a value model should be proxies for all fundamental underlying factors. The literature has mainly used market-based explanatory variables in explaining stock returns such as price-earnings P/E, dividend yield DY, market-to-book M/B and Tobin's *Q*. These variables are manifestations of value rather than value-explanatory variables. Therefore, they fall in the same category of stock returns. In the context of searching for value-relevant factors these factors are better used as the dependent variable on the left hand side of value models leaving the right hand side to the underlying corporate factors that eventually capture the impact of both unique and systematic factors that affect corporate performance and potential.

Table 4-2 shows the estimation outcome of the regression.

[67] log(MBE) is used as it represents the logarithmic rate of the premium that is to be explained by profitability, growth and risk levels. See Section 3.4 of Chapter 3 for further clarification.

Variable description	Symbol	Coefficient	*p*-value
Dependent variable	log*(MBE)*		
Constant	*C*	0.45	0.0000
Return on equity	*ROE*	2.61	0.0000
Growth in earnings	*GEGS*	0.07	0.0005
Cost of equity capital	*KE*	-2.14	0.0000
R-squared		0.36	
Adjusted *R*-squared		0.36	
p-value (*F*-statistic)		0.0000	
Total observations		7108	

Table 4-2. Empirical Verification for *MBE/EY* Theoretical Model

The dependent variable is the natural log of market-to-book which measures the rate of market value premium/discount over book value; *C* is the constant term; *ROE* is the return on equity; *GEGS* is growth in earnings measured as $\log(EGS_t/EGS_{t-1})$. *KE* is the cost of equity capital (risk) estimated using CAPM as discussed in detail in the data section in Chapter 3. Total number of observations is 7,108 for pooled data for all survivor and new stocks for the period 1989-2002. Method of estimation is least squares pooled regression. Robust estimation technique (White Heteroskedasticity-Consistent Standard Errors & Covariance) is used to correct the standard errors as the model exhibited heteroskedasticity. Firm with *MBE* smaller than 0.01or larger than 100 were excluded as in Pastor and Veronesi (2003).

Estimating the same equation over different periods, including for single years, showed that model is stable over time in its ability to explain value by the selected fundamental variables. The statistical significance and signs of the empirical model provide comfort to use the theoretical *MBE* model to derive the earnings yield model. It is worth commenting on the sizes of the coefficients. If all coefficients have zero value then the estimated premium rate [log(*MBE*)] will be the value of the constant term 45 percent. *ROE* has a coefficient of 2.61; at an average *ROE* of 9.80 percent its contribution will be 26 percent. The growth coefficient is 0.07; at 2 percent growth rate its contribution will be minimal at 0.14 percent reflecting the weak link between realised growth and market value. Cost of equity (risk) has a coefficient of –2.14; at an average of 9 percent its contribution will be –19 percent. Clearly with the disturbances, all coefficients are within the overall historic average market premium log(*MBE*) (or roughly *MBE*-1 of 144 percent) and do not show insensible values and hence we can rely on the sensibility of the signs and significance of the established relations between *MBE* and the explanatory variables for our analysis. This statistical confirmation was introduced as earnings yield model is derived from the theoretical *MBE* model where an empirical earnings yield model will also be derived from the empirical *MBE* model of Equation 4-8 as shown in Appendix 4.7.1.

4.3.3 The Sensitivity of Earnings Yield to Growth and Risk

It is important to clarify the sensitivity of earnings yield to growth and risk before moving, in the next section, to analyse the plausibility of earnings yield levels. The earnings yield model indicates that the higher the expected growth the lower the earnings yield, and the higher the expected rate of return the higher the earnings yield, and vice versa.

Figure 4-4 and Figure 4-5 illustrate these relations where changes in EY are calculated by taking the first derivative of EY from Equation 4-7 with respect to g and RM respectively, and then applying finite changes as follows:

with respect to g: $\frac{\partial EY}{\partial g} = -\frac{1+RM}{(1+g)^2}$, applying finite changes:

Equation 4-9: $\Delta EY \approx -\frac{1+RM}{(1+g)^2} \times \Delta g$

with respect to RM: $\frac{\partial EY}{\partial RM} = \frac{1}{1+g}$, applying finite changes:

Equation 4-10: $\Delta EY \approx \frac{1}{1+g} \times \Delta RM$

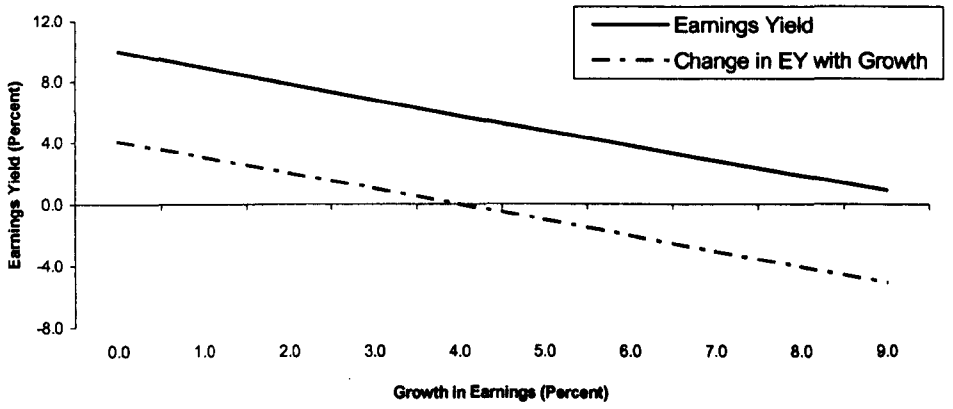

Figure 4-4. The Sensitivity of Earnings Yield to the Level of Expected Growth

$EY = (RM - g)/(1+g)$ and $\Delta EY \approx -(1+RM)/(1+g)^2 \times \Delta g$ controlling for expected return RM at 10 percent for illustration purposes.

Other things being equal, the higher the expected growth the lower the earnings yield. No growth means that earnings yield would be equal to the required rate of return.

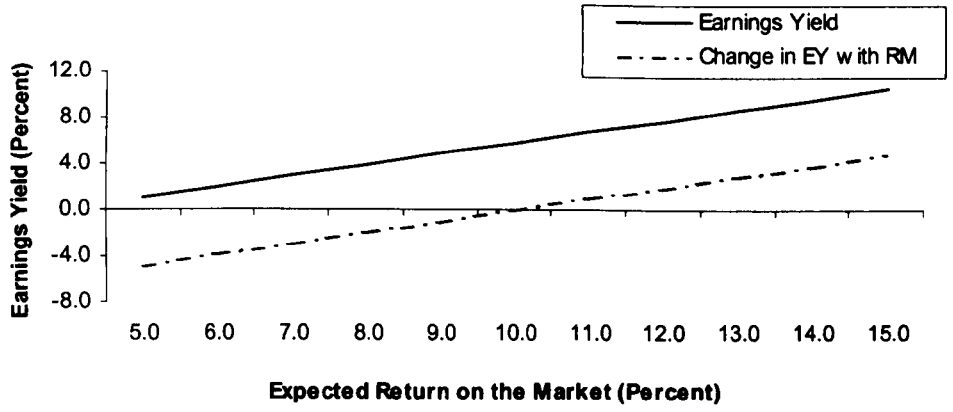

Figure 4-5. The Sensitivity of Earnings Yield to the Level of Expected Return

$EY = (RM - g)/(1+g)$ and $\Delta EY \approx 1/(1+g) \times \Delta RM$ controlling for growth rate g at 4 percent for illustration purposes.

Other things being equal, the higher the required rate of return the higher the earnings yield.

Expected return on the market *RM* and the risk-free rate *RF* are the same for all stocks. Hence, risk (say as measured by beta according to CAPM) and growth determine the deviation of a single stock's earnings yield from that of the market. Figure 4-6 shows the relation between stock's earnings yield and its beta. The higher the risk (beta) the higher the earnings yield.

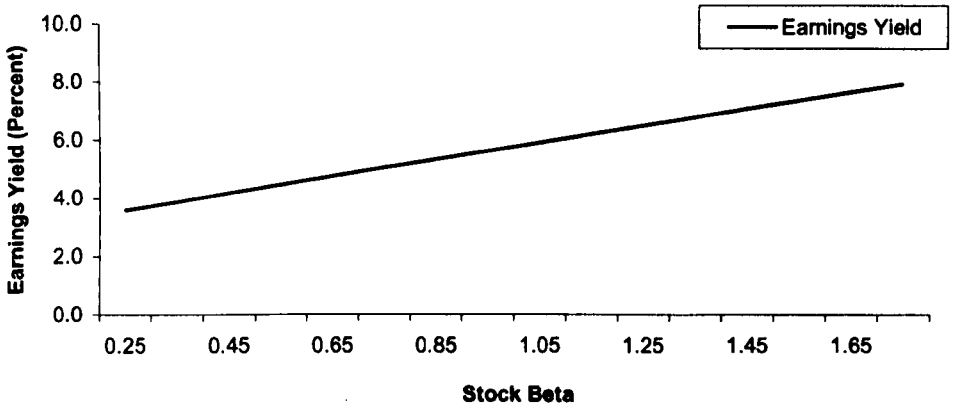

Figure 4-6. The Sensitivity of Stock *EY* to Risk as Measured by Beta

$EY = [RF + \beta(RM - RF) - g]/(1+g)$ controlling for *RM* at 10 percent, *RF* at 7 percent, and g at 4 percent for illustration purposes only.

The interpretation of Figure 4-6 in conjunction with Figure 4-4 and Figure 4-5 highlights how although higher expected growth lead to a lower *EY*, higher risk leads to the opposite. Implication for possible behavioural bias: a combination of optimistic growth expectations and underestimated risk?

4.4 Examining Earnings Yield Levels

This section uses earnings yield (the inverse of the price-earnings ratio) to examine the stock market aggregate level to identify possible mispricing by (a) comparing with the risk-free rate documenting the behaviour of the spread to test whether this spread is consistent with fundamental valuation in terms of growth expectations and risk perception, (b) comparing with theoretical and empirical model values for earnings yield derived from plausible assumptions about growth expectations and risk perception, and (c) examining in-sample earnings-yield predictions that would detect mispriced levels indicating major corrections under plausible assumptions.

4.4.1 Earnings Yield, Risk-Free Rate, Risk, and Growth

Growth and risk are important factors to stock valuation. The problem in studying them is that they are not directly observed. Therefore, the relation between earnings yield and the risk-free rate is utilised to test stock market levels to analyse the combined impact of growth expectations and risk perception implied in earnings yield levels (as in the empirical research, e.g. Asness (2000) and Lansing (2002)). Here is the logic behind this analysis. If stocks *were* risk-free like the short-term discount government bonds with no growth potential, then investors would expect earnings yield to be close to the risk-free rate.[68] Taking one factor at a time: (a) Stocks are riskier than risk-free assets; hence earnings yield would be higher than risk-free rate as market valuation should reflect negatively the risk differential into stock prices. (b) Stocks have growth potential unlike bonds; therefore, earnings yield would be lower as market valuation should reflect growth potential positively. This discussion is simply expressed in Equation 4-5:

$$EY = \frac{KE - g}{1+g}, \qquad KE = RF + \text{Equity Risk Premium } (ERP)$$

Equation 4-11: $$EY = \frac{(RF + ERP) - g}{1+g}$$

[68] To overcome the issue of expected inflation implied in the risk-free rate, we used the short-term interest rate on the 3-month UK Treasury Bill (government discount bonds) in addition to the government bonds' 10-year redemption yield.

If the expected benefits from future growth outweigh risk differential between stocks and risk-free assets then earnings yield should be lower than the risk-free rate and vice versa. Table 4-3 and Figure 4-7 below show how earnings yield was always, apart from 1998, below the risk-free rate, which highlights market perception that growth potential benefits outweigh risk differential. An important reading of Table 4-3 and Figure 4-7 below is the semi-stable spread between earning yield and the risk-free rate (circa 2 percent on average). The big question to ask is: Are these implied growth and risk levels consistent with fundamental valuation, in particular that growth potential outweighs risk exposure?

To try to answer this question, the balance of this section explores plausible (rationalised) scenarios for earnings yield and earnings yield predictions for stock market levels. We then test the hypothesis from a different angle via directly examining corporate profitability patterns, growth expectations, and return expectations.

Year	Earnings Yield	10-Year Risk-Free Rate	3-Month Risk-Free Rate	Obs
Percent				
1989	7.72	10.26	14.50	451
1990	9.38	10.95	13.41	488
1991	8.38	9.73	10.13	501
1992	6.44	8.26	6.53	507
1993	3.91	6.10	5.00	524
1994	5.08	8.71	6.19	551
1995	5.77	7.42	6.22	590
1996	5.52	7.51	6.16	657
1997	5.27	6.29	7.34	753
1998	4.64	4.36	5.94	825
1999	3.42	5.48	5.63	872
2000	3.10	4.88	5.88	933
2001	2.23	5.05	3.86	1088
2002	0.27	4.37	3.88	1151
Weighted average	4.05	--	--	--
Simple average	5.08	7.10	7.19	--

Table 4-3. Earnings Yield versus Risk-Free Rate

Earnings yield is calculated as the sum of earnings for all companies every year divided by the corresponding sum of market value of equities. The risk-free rate uses, (a) the redemption yield on the 10-year government bond benchmark, (b) the interest rate on the UK discount 3-month Treasury Bill. The choice of the 10-year bond was discussed under the Data Section 3.2 in Chapter 3. The use of the 3-month rate was introduced to overcome the impact of expected inflation in longer term bonds distorting the comparison as discussed at the outset of this section. Obs is the number of observations (stocks).

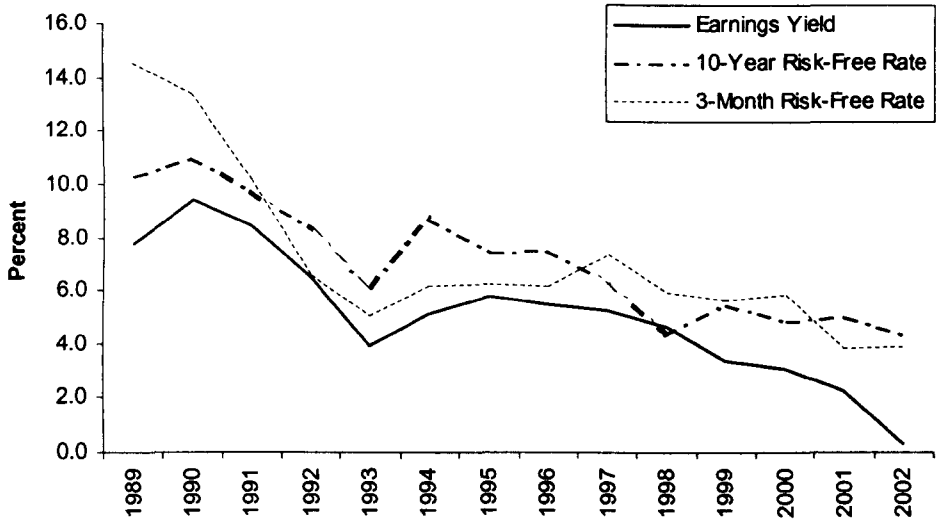

Figure 4-7. Earnings Yield versus Risk-Free Rate

This graph plots the figures calculated in Table 4-3. Earnings yield is calculated as the sum of earnings for all companies every year divided by the corresponding sum of market value of equities. The risk-free rate uses, (a) the redemption yield on the 10-year government bond benchmark, (b) the interest rate on the UK discount 3-month Treasury Bill.

4.4.2 Plausible Scenarios for Earnings Yield

This exercise aims at examining stock market valuation at aggregate level for the whole period 1989-2002 using earnings yield to form an idea on whether the market is fairly priced on average over time. This test uses the theoretical model introduced earlier and compares with the empirical model. The theoretical model $EY = (RM - g)/(1+g)$ is from Equation 4-5 and the empirical EY model comes from Equation 4-8 where $EY = ROE/MBE = ROE/\exp[\log(MBE)]$, with $\log(MBE)$ provided by the empirical model of Equation 4-8 estimated in Table 4-2: $\log(MBE) = 0.45 + 2.61 \times ROE + 0.07 \times GEGS - 2.14 \times KE$. Table 4-4 presents plausible scenarios for EY derived from both models followed by interpretation.

Assessment Scenarios (*ex post*)	1	2	3	4
Percent				
Required total return on the market *RM*	14.92[1]	10.18[2]	8.21[3]	9.25[3]
Expected growth	5.89[4]	5.89[4]	4.00[5]	5.00[5]
EY (theoretical model)	8.53	*4.05*	*4.05*	*4.05*
EY (empirical model)	6.63	5.99	5.75	5.88
Realised *EY* (pooled weighted average)	4.05	4.05	4.05	4.05
Percentage difference:				
Theoretical *EY* versus Realised *EY*	111	N/A	N/A	N/A
Empirical *EY* versus Realised *EY*	64	48	42	45
Implied *RM* in *EY* of 4.05 percent using the empirical model at the given *g* scenarios		–8.12[6]	–8.19[6]	–8.16[6]

Table 4-4. Plausible Scenarios for Earnings Yield 1989-2002

(1) Average unbiased required return over the period. Expected return on the market is calculated every year using total returns (capital appreciation and dividends) on the FTSE All Share Index on the following basis: real TRS, 10-year rolling average, add expected inflation, and finally adjusted downwards by 1.5 percent for survivorship bias. See Section 4.5.3.1 later.
(2) Implied in 4.05 percent *EY* level at 5.89 percent growth rate using the theoretical model.
(3) Implied in 4.05 percent *EY* level at 4 (then 5) percent growth rate using the theoretical model.
(4) Compound average growth of the UK nominal *GDP* for the period.
(5) Widely used and generally accepted growth assumptions in the literature and by practitioners.
(6) These illogical negative implied values for the cost of capital could indicate: (a) that the disturbances (in part) is affecting the implied value, (b) partly the disturbances to a degree that makes these readings positive and partly underestimated risk.

ROE figure used for all scenarios is calculated by dividing pooled earnings by pooled book equities for the common sample over 1989-2002 resulting in a realised pooled weighted average *ROE* of 9.80 percent, i.e. assuming profitability is mean-reverting consistent with the existing empirical literature [e.g., Beaver (1970), Lookabill (1976), Freeman, Ohlson, and Penman (1982), Penman (1991), and Fama and French (2000)]. Earnings yields are estimated using the theoretical and empirical models. Theoretical $EY = (RM\text{-}g)/(1+g)$, Empirical $EY = ROE/\exp[\log(MBE)]$. Realised *EY* is calculated by dividing pooled earnings by pooled market-caps for common sample over 1989-2002. The percentage difference is calculated as [(Model *EY* – Realised *EY*)/Realised *EY*]. All variables and their calculations are discussed further after the results interpretation below.

Below are the different readings from the scenarios in Table 4-4 linking their interpretations to the hypotheses presented in Section 4.1:

1. Scenario 1 suggests that realised earnings yield is understated under both models and hence implies overvalued levels of stock prices on overage. If growth is reduced below 5.89 percent, the indication of overvaluation will be more apparent under the theoretical model, and given a median realised growth of 1.30 percent. Although this cannot be conclusive evidence, it provides an indication for the possibility of overvaluation. The evidence of this scenario is consistent with H_1.

2. Scenarios 2, 3, and 4 under the theoretical model at the set growth and discount rate levels, show that earnings yield matches the realised level for the period. Growth and cost of capital scenarios are not implausible. Annual growth rate of 5.89 percent is the historic compound *GDP* growth for the period. 4 and 5 percent are plausible assumptions too. Average cost of capital between 8.21 and 10.18 percent is not implausible given that the average 10-year risk-free rate for the period is circa 7 percent. In this case, the results suggest that the stock market is reaching efficient pricing over the long-term. The important implication of this is that severe fluctuations reflect temporary periods of mispricing where exuberant high levels are subsequently corrected. This evidence is consistent with H_{0a} but does not say much about H_0.

3. Scenarios 2, 3 and 4 under the empirical model, show an illogical negative implied values for the cost of capital which might be the results of the disturbances in part to a degree to make these readings positive but still below the risk-free rate (remains implausible) indicating that the balance of the explanation of these negative readings implies underestimated risk. This evidence is consistent with H_1.

4. All scenarios, under the empirical model, indicate understated realised earnings yield level implying overvalued stock price levels. This evidence is consistent with H_1.

On balance of the above, the evidence seems consistent with H_1.

Below is a further discussion for the variables of Table 4-4 and their calculations.

Earnings Yield EY:

Realised *EY* that is compared with model-generated *EY* is calculated for the pooled data over the whole period as a weighted average to be as representative as possible according to the following equation:

Equation 4-12: Realised weighted average 1989-2002 $$EY = \frac{\sum_{t=1989}^{2002} \sum_{i=1}^{n} EGS_{t,i}}{\sum_{t=1989}^{2002} \sum_{i=1}^{n} MVE_{t,i}}$$

where n is the number of companies every year for a common sample where both earnings and market value of equity data are available, and t is the year. Applying Equation 4-12 resulted in 4.05 percent weighted average earnings yield.

The Expected Return on the Market RM:

It was estimated as the average of the individual 14 years expected return on the market estimated using the procedure described in Table 4-10(a) Section 4.5.3.1 where individual years' expected rates of returns are estimated using total returns (capital appreciation and dividends) on the FTSE All Share Index using real TRS, 10-year rolling average, adding expected inflation, and finally adjusting downwards by 1.5 percent for survivorship bias.

Growth g:

Median realised earnings growth for the entire period was 1.30 percent. Therefore, economic growth would be more representative to use for the aggregate expected growth level. The compounded *GDP* nominal growth rate was calculated at 5.89 percent for the period 1989-2002 using Equation 4-13 (a re-arrangement of the usual discrete compounding formula).

Equation 4-13: $$GDP_{2002} = GDP_{1988}(1+g_{GDP})^{14} \text{ of which } g_{GDP} = \left[\frac{GDP_{2002}}{GDP_{1988}}\right]^{\frac{1}{14}} - 1$$

The simple average *GDP* growth rate is 5.90 percent. This level of economic growth seems reasonable given that part of that is inflation and the remaining part is real growth. Compounded annual inflation rate on *RPI* for the same period is

3.63 percent (simple average 3.66 percent) leaving realised average annual real *GDP* growth at 5.89 – 3.63 = 2.26 percent. Using the median realised earnings growth 1.30 percent will just enlarge the gap between model and realised earnings yields in the same direction.[69] It is worth noting that the theoretical model is more sensitive to growth rate than the empirical model given that the empirical model is based on the relation between value and realised earnings growth which is not very strong, acknowledging that realised growth is far below the expected growth built into market valuation. Even using growth rate of 4 or 5 percent (the widely used assumptions by academics and practitioners) leads to a stronger indication for overvaluation.

Return on Equity ROE:

Realised *ROE* is calculated for the pooled data over the whole period as a weighted average to be as representative as possible according to Equation 4-14 below.

Equation 4-14: Realised weighted average 1989-2002 $$ROE = \frac{\sum_{t=1989}^{2002} \sum_{i=1}^{n} EGS_{t,i}}{\sum_{t=1989}^{2002} \sum_{i=1}^{n} BE_{t,i}}$$

where n is the number of companies every year for a common sample where both earnings and market value of equity data are available, and t is the year. Applying Equation 4-14 resulted in 9.80 percent weighted average return on equity.

[69] Average earnings growth was not used because earnings fluctuations for some companies can distort the whole average severely. Examples, one company (DS number 900909) has EPS1988: 1.19p, EPS1989: 923.6p which results in a growth rate of 77,513 percent. Another type of severe distortions (DS number 361085) has EPS2001: -0.29p, EPS2002: -8.15p which results is a *positive* growth rate of 2710 percent.

4.4.3 Earnings Yield Predictions

This exercise aims at testing the predictive power of the earnings yield and providing a procedure for predicting stock market levels on FTSE ALL and FTSE 100 indices providing some evidence about stock market levels form two tested periods. Table 4-5 shows that the introduced earnings yield model and prediction procedure can be useful when rational plausible assumptions are used.[70] The results are followed by a discussion about the plausibility of the key assumptions.

Percent unless stated otherwise		
Risk-free rate [(1)]		5.00
Equity risk premium [(1)]		4.00
Expected return on the market (*RF+ERP*)		9.00
Expected growth		4.00
Rationalised earnings yield $EY = [(RF+ERP) - g]/(1+g)$		4.81
Book equity *BE* 2002 for 1151 companies	£ billion	491.00
ROE (reverting to weighted average historic mean) [(2)]		9.80
Normalised earnings *NEGS* for 2003 (*BE*×*ROE*)	£ billion	48.12
Actual market-cap 2002 for 1151 companies	£ billion	864
Market-cap at *EY* for 2003 (*NEGS/EY*)	£ billion	1001
Predicted percentage change in stock prices *PC* [(3)]		**+15.84**
FTSE ALL		
Realised 2002	index points	1893.73
Predicted 2003 [Index 2002(1+*PC*)] [(3)]	index points	2193.69
Realised 2003	index points	2207.38
Prediction error (percent)		**-0.62**
FTSE 100		
Realised 2002	index points	3940.36
Predicted 2003 [Index 2002(1+*PC*)] [(3)]	index points	4564.50
Realised 2003	index points	4476.87
Prediction error (percent)		**1.96**

Table 4-5. Procedure for Predicting stock Market Levels Using EY Model

(1) Damodaran of Stern Business School (January 2004) used 4.25 percent risk-free and 4.82 percent equity risk premium for the European market that is 9.07 percent market discount rate. http://pages.stern.nyu.edu/~adamodar. Pastor and Stambaugh (2001) estimated the equity premium for US stocks since 1834 to have fluctuated between 4 and 6 percent.

(2) Consistent with the existing empirical literature [e.g., Beaver (1970), Lookabill (1976), Freeman, Ohlson, and Penman (1982), Penman (1991), and Fama and French (2000)].

(3) The reason for using book equity and market-cap of the sample is the unavailability of good quality data for UK indices on book equity and earnings per index. This was confirmed with FTSE International Limited.

[70] However, small changes (say by ±1 percent) in the assumptions or applying to different years other than extreme points (peak and bottom of the market) would change the prediction significantly. As prediction is not the subject of this study, this is left to develop in future research.

The cost of capital was used at a 4 percent risk premium over the risk-free rate. Using an unbiased expectation as introduced later in Section 4.5.3.1 would lead to a major deviation because an unbiased return expectation would be the cost of capital only in a strong-form efficient market.

Nominal growth rate of 4 percent is both plausible and widely acceptable assumption in investment and economic sense. Using a 5 percent rate will predict the right price direction but at a price higher rate.

Overall weighted average *ROE* for 2002 was extremely low 0.47 percent due to the continuing negative impact of the business cycle on one hand and the impact of massive asset write offs charged against earnings.[71] Therefore, consistent with the literature, it was assumed that the historic mean would be at least achievable in the future (mean-reversion). On one hand, 9.80 percent historic weighted average *ROE* seems low being affected by the very low performance of 2001 and 2002, the average excluding both years is 12.74 percent and excluding only 2002 is 11.37 percent. On the other hand, it is highly likely that higher *ROE* level associated with higher *ROE* volatility would increase both profitability and the cost of capital to account for the increased risk of the increased profitability.

Could this model predict the severe fall in stock prices after the 1999 peak? Table 4-6 shows that the model at the plausible inputs was able to predict the severe price fall of 2000-2002 to a good extent. Note that same equity risk premium and growth rate were used in Table 4-5, while the risk-free rate and the return on equity were updated by those of year 1999 to match current market parameters on such variables.

[71] This refers to billions of write offs of assets (such as natural reserves or licences) charged to P&L. See for example: BP, BT, Vodafone, Shell Transport & Trading, BHP Billiton, Cable & Wireless in 2002.

Percent unless stated otherwise		
Risk-free rate		5.48
Equity risk premium		4.00
Expected return on the market (*RF+ERP*)		9.48
Expected growth		4.00
Rationalised earnings yield $EY = [(RF+ERP) - g]/(1+g)$		5.27
Book equity *BE* 1999 for 872 companies	£ billion	228.00
ROE as realised in 1999		14.59
Earnings *NEGS* for 1999	£ billion	33.26
Actual market-cap 1999 for 872 companies	£ billion	974.00
Corrected Market-cap at *EY* for 1999 (*NEGS/EY*)	£ billion	631.27
Predicted percentage correction for 1999 stock price level *PC*		**-35.19**
FTSE ALL		
Realised 1999	index points	3242.06
Corrected 1999 [Index 1999(1+*PC*)]	index points	2101.25
Realised 2002 (end of fall)	index points	1893.73
Prediction error (percent) [1]		**10.96**
FTSE 100		
Realised 1999	index points	6930.20
Corrected 1999 [Index 1999(1+*PC*)]	index points	4491.62
Realised 2002 (end of fall)	index points	3940.36
Prediction error (percent) [1]		**13.99**

Table 4-6. Predicting Stock Price Fall After 1999 Peak

(1) Error difference could be due to assumption error and/or market overreaction. If 13 percent *ROE* was used instead of the realised one the error will be significantly lower (-1.13 and 1.57 percent respectively). Nevertheless, realised *ROE* was used to avoid subjective inputs.

If equity risk premium was increased by 1 percent (to 5 percent) accounting for the interaction of *ROE* level and its volatility with the cost of capital discussed above the predicted price fall would have been 45.19 percent which would reduce prediction errors significantly.

Predicting the price fall from 1999 level to 2002 level (Table 4-6) and the recovery from 2002 level to 2003 level (Table 4-5) under plausible assumption can be construed as evidence consistent with H_{0a}.

4.5 Testing the Fundamental Valuation Hypotheses

As earnings yield testing evidence points towards overvaluation, this section, in testing the research hypotheses, investigates whether the fluctuations or levels of individual valuation fundamentals, i.e. profitability, growth expectations, and investor attitudes towards risks, can explain the observed levels in stock prices.

4.5.1 Can Changes in Profitability Explain Stock Price Fluctuations?

Before going onto examining growth expectations and return expectations, we first examine the relation between stock price levels and corporate profitability, to establish whether there were significant changes in its pattern over the period under study that could explain the fluctuations in stock price levels in full or part. See Figure 4-1 and Figure 4-2 in Section 4.1 for stock price fluctuations.

Figure 4-8 below shows that corporate profitability, measured by return on equity *ROE*, has not improved in any form that would explain the soaring stock prices up to 1999. Save for the exceptional decline 2000-2002, profitability almost has a constant level. The period 1989-1999 seems to be representative for a full *ROE* cycle producing a historic weighted average at 12.74 percent while the weighted average over 1989-2002 is 9.80 percent affected by the severe decline over 2000-2002. The very low profitability figure in 2002 is due to the continued negative impact of the business cycle in that year where corporate earnings were very poor on one hand and the impact of the massive asset write offs charged against earnings by companies on the other hand. This refers to billions of write offs of assets (such as natural reserves and licences) charged against earnings. Examples of some companies that made major write offs in 2002: BP, BT, Vodafone, Shell Transport & Trading, BHP Billiton, Cable & Wireless.

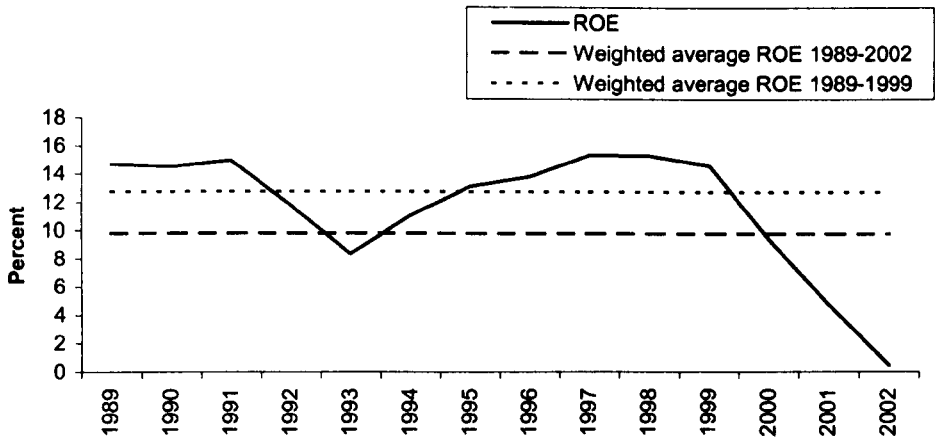

Figure 4-8. Corporate Profitability, *ROE*

ROE is calculated at aggregate level every year as the sum of earnings for all companies divided by the corresponding sum of book equities. The dashed lines represent historic weighted average return on equity for the whole period 1989-2002 at 9.80 percent and 1989-1999 at 12.74 percent respectively calculated as the sum of earnings for all companies all years divided by the corresponding sum of book equities. The very low *ROE* in 2002 is due to poor corporate earnings (continued bad business cycle phase) and the massive asset write offs charged against earnings that year (e.g. BP, BT, Vodafone, Shell Transport & Trading, BHP Billiton, Cable & Wireless).

What is the relation between stock prices and corporate profitability? Part of earnings is distributed to shareholders and the other part is retained. The retained part contributes to organic growth and is reflected in stock price capital appreciation. *ROE* is calculated using those earnings. Hence, it represents corporate performance with respect to both elements (dividend and capital growth). Therefore, for a consistent comparison between corporate performance and stock market levels, weighted average *ROE* is compared with FTSE ALL Share Total Return Index that reflects capital appreciation and dividends. What can this comparison depicted in Figure 4-9 tell us? First, what is the sensitivity of stock market level to changes in profitability? Using a simple single variable regression of Total Return to Shareholders *TRS* on *ROE* using 14 annual data points (time-series analysis) gives some idea as shown in Equation 4-15.

Equation 4-15: $TRS = \beta_0 + \beta_1 ROE + \varepsilon$

Table 4-7 presents the results of this estimation. For *ROE* at time *t* and lagged by one year, at 5 percent level: the constant term was insignificant while the slope was positive and significant. Clearly, the positive direct relation represented by the value and significance of the slope indicates that stock prices are sensitive to current and recent profitability levels. This is confirmed cross-sectionally with the

significant positive relation between market value indicator log(*MBE*) and profitability (presented in Table 4-2 Section 4.3.2). The slope and the whole regression were insignificant when *ROE* was lagged by two years.[72]

Description	Symbol	*ROE* at time *t*	*ROE* at time *t*-1	*ROE* at time *t*-2
Dependent variable	*TRS* at time *t*			
Constant	*C*	-0.21	-0.30	-0.09
(*p*-value)		(0.0779)	(0.0987)	(0.7682)
Return on equity	*ROE*	2.74	3.16	1.48
(*p*-value)		(0.0090)	(0.0354)	(0.5248)
R-squared		0.45	0.34	0.04
Adjusted *R*-squared		0.40	0.28	-0.05
(*p*-value: *F*-statistic)		(0.0090)	(0.0354)	(0.5248)
Total observations		14	13	12

Table 4-7. TRS against ROE Regression

This simple regression is meant to only give a rough quantified description for the sensitivity of stock prices to profitability. *TRS* is total percentage returns to shareholders (dividends and capital growth) calculated on FTSE All. *ROE* is the weighted average *ROE* on equity calculated across the sample every year.

Back to visually examine the relation between stock market levels and corporate profitability presented in Figure 4-9 and followed by the analysis of the graph.

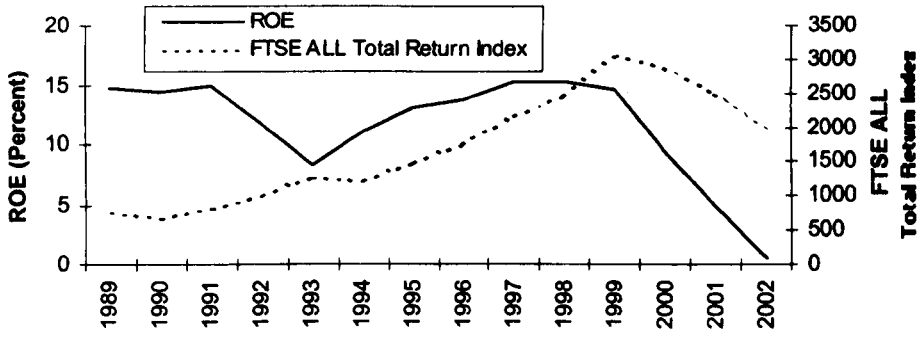

Figure 4-9. Stock Market Levels versus Corporate Profitability

ROE is calculated at aggregate level as the sum of earnings for all companies every year divided by the corresponding sum of book equities. FTSE All Share Total Return Index represents capital appreciation with dividends income.

1989-1993: From 1989 to 1991 profitability was almost flat, then declined to 1993 while FTSE All was rising on the overall over the period 1989-

[72] Data issue could be a possible explanation as not all companies have their year-ends aligned to the end of December besides that FTSE All includes financial stocks.

1993. There was a lagged response for the declined profitability 1991-1993 where stock prices FTSE All responded negatively only by 1994.

1994-1999: Profitability was recovering between 1994 and 1997 while FTSE All was rising. Profitability was almost flat with slight decline after that until 1999 while the stock market kept rising. The market only responded to the sign from flat then slight profitability decline after 1999 when the market has peaked.

2000-2002: Severe decline in profitability and severe decline in stock prices.

As if the market was hopping that the declined profitability is temporary until it is evident over at least 2 years before it responds.

Back to the original question, did corporate profitability pattern change in any way that can explain in full or part the severe changes in stock market levels? Despite the clear sensitivity of stock prices to profitability levels, the increase in profitability after 1993 to 1997 (which was then almost flat to 1999) was not an improvement in profitability; it was rather a recovery to post 1992 level. So, this does not explain why stock prices should soar as they did up to 1999. Did this *ROE* recovery mislead investors as a profitability improvement, which did not last anyway? Perhaps yes! It is worth noting that we have compared like with like, total profitability with total return index. But, investors do not pay only for one or two-year profitability; they should be investing in the longer-term sustainable profitability! Apparently, psychological behavioural factors are at work magnified by speculative activities. This is confirmed by the demonstrated sensitivity of stock prices to profitability. See the Literature Review in Chapter 2 on behavioural explanations in support of this inference.

To sum up, stock prices are sensitive to profitability; profitability pattern did not improve in a way that can justify the soaring stock price levels that were followed by correcting price falls (the latest 1999-2002 is so dramatic). Hence, this evidence is leading to reject H_0 only as far as the profitability factor is

concerned, but the explanation could be in other factors. Nevertheless, this evidence does not per se imply rejecting H_{0a} or otherwise.

Caveat on Inflation:

Did inflation have a significant impact on *ROE* pattern? Here is a brief discussion: *ROE* is calculated as earnings divided by book equity. Earnings are almost in current prices for the year except for annual depreciation of fixed assets in historic prices and the impact of price inflation throughout the year. Book equity = Fixed assets + (Current assets – Current liabilities) – Long-term liabilities. Current assets and total liabilities consist of monetary items and other items that are being replaced regularly; therefore they are almost in current year prices. The part that is subject to inflation is fixed assets. Properties are being re-valued regularly by companies. The problem remains with plant and equipment till fully depreciated and/or replaced. It does not seem that inflation would have been a significant factor in impacting *ROE* pattern.[73]

We turn in the next section to growth expectations. Would the market growth expectations be the main culprit?

[73] It is worth noting that standard theoretical valuation models are models of prospective values or ratios. But estimated models are based on current, not prospective, figures. For example, inflation can affect the relationship between current year earnings and next year earnings, so altering the observed relationship between *ROE* and *MBE*.

4.5.2 Expected Growth; The Main Culprit?

The objective of this section is to estimate and study, at aggregate market level, the expected growth implied in market valuation as a proxy for investor growth expectations and to compare against economic growth and realised earnings growth to evaluate the plausibility of market expectations. Our principal difficulty here is that, unlike the case of profitability (*ROE*) examined in the previous subsection, long-term expected growth is not directly observed. There will always be some implied long-term expected growth of earnings that is consistent with observed market valuations. The question we examine, in order to test our null hypotheses, is whether these implied growth expectations are reasonable.

Smith (1924), in his book "Common Stocks as Long Term Investments" that was reviewed by John Maynard Keynes in 1925, said: "Why do stocks typically outperform bonds? A major reason is that businesses retain earnings, with these going on to generate more earnings--and dividends, too." According to Buffett (2001) this finding ignited an unprecedented bull market the US, for the American public, this new understanding was like the discovery of fire.

Investors pay a price for expected future growth and accept a lower yield today. If growth potential were under-/over-estimated by investors then stocks would be under-/over-valued as far as growth is concerned. Equation 4-4 and Equation 4-19 (repeated below) illustrate the relation between market valuation (measured by *MBE* or *EY*, etc) and expected growth:

$$MBE = \frac{ROE(1+g)}{KE-g} \quad \text{[Equation 4-4]}, \qquad EY = \frac{ROE}{MBE} \quad \text{[Equation 4-19]}$$

Market valuation (say measured by *MBE* as expressed in Equation 4-4) is determined by:

1. Profitability level (discussed in Section 4.5.1 earlier);
2. Expected growth (the subject of this section); and
3. Risk (discussed later in Section 4.5.3).

Table 4-8 illustrates this relation through a simple numerical example.

Common Inputs:	
Equity capital investment in a business	£100
Earnings	£10
ROE	10 percent
Required rate of return (market rate)	10 percent
Valuation	
Case 1:	
Expected growth	Nil
Value or price $=EGS_t(1+g)/(KE-g)$	£100
EY (as *EGS/Value* or *ROE/MBE*)	10 percent
MBE	1.00
Case 2:	
Expected growth	4 percent
Value or price $=EGS_t(1+g)/(KE-g)$	£173
EY (as *EGS/Value* or *ROE/MBE*)	6 percent
MBE	1.73

Table 4-8. The Impact of Growth on Market Valuation (*EY, MBE*) – Illustration

Also, take this analogy: a corporate bond issued at a coupon of current market rates and therefore sold at par value.[74] Book equity: £100 (par value), *ROE*: 7 percent (£7/100 coupon/par value), *MBE*: 1.00 (price/par value), *EY*: 7 percent (£7/100 coupon/price). If rates do not change *EY* = *ROE*. If interest rates fall, bond price will rise say to £110: *ROE*: 7 percent (the same), *EY*: 6.36 percent (£7/110), *MBE*: 1.10 (110/100), and *EY* = *ROE/MBE* = 0.07/1.10 = 6.36 percent. In this analogy, given that income from bonds is fixed, *MBE* is only affected by changes in redemption yield, the discount rate, reflecting risk due to market rate changes and changes in default risk. For stocks, it is more complicated as *MBE* reflects expected future growth in addition to market rates and risk, and also income level is not fixed as with bonds. Holding income level and risk the same for the time being, stock prices will be higher for higher growth potential and hence lower earnings yield.

Consistent with the literature, e.g., Heaton and Lucas (1999), the structure of Gordon Constant Growth model is used. However, it is used at aggregate market level and not at firm level. The reduced form below has been inverted to estimate the growth rate implied in market valuation: $MVE_t = \frac{EGS_{t+1}}{KE-g}$, of which

[74] Even if not at par, consider the price as par and hence current redemption yield as coupon rate.

$g = KE - \frac{EGS_{t+1}}{MVE_t}$. This formulation of growth has few technical issues to justify or overcome: (a) the use of earnings in this valuation model, (b) how a terminal growth figure can reduce detailed future explicit growth rates into a single practically comparable and representative rate,[75] and (c) the changing number of companies and their capital from yea to year which makes relating time t+1 earnings to the valuation at time t inaccurate. These technical issues are discussed, justified or overcome in detail in Section 4.3.1. Hence, using Equation 4-4 from Section 4.3.1 overcomes the above issues.

$$MVE_t = \frac{EGS_t(1+g)}{KE-g}, \qquad \text{[Equation 4-4] re-arrange:}$$

Equation 4-16: $$g = \frac{MVE_t \times KE - EGS_t}{MVE_t + EGS_t}$$

Note that Equation 4-16 can be also written as a function of *MBE* and *ROE*, by either dividing the numerator and denominator by book equity *BE*, or by re-arranging Equation 4-4 leading to implied growth expressed as:

Equation 4-17: $$g = \frac{MBE_t \times KE - ROE_t}{MBE_t + ROE_t}$$

One of the advantages of the above formulation is that the inputs of earnings *EGS* and market value of equity *MVE* in Equation 4-16 (or *MBE* and *ROE* in Equation 4-17) are the actual realised values. The only estimate is the cost of capital; the required rate of return on the market *KE*. The market would look at this as a risk premium over the risk-free rate. It is difficult to estimate the size of the premium. In a liquid efficient market such as the government bond market, the discount rate and internal rate of return IRR are almost the same.[76] Therefore, we need to estimate implied growth under a robust unbiased and plausible estimate for the required return on the stock market to hopefully have an unbiased estimate for implied growth. Section 4.5.3.1 deals with the cost of capital estimation in detail, where the required rate of return on the market is calculated using total returns (capital appreciation and dividends) on the FTSE All Share Index on the

[75] Because it is not practically possible to derive and compare implied explicit growth rates say for long period.

[76] The redemption yield and *IRR* are mathematically the same thing.

following basis: real TRS, 10-year rolling average, adjusted downwards by 1.5 percent for survivorship bias, and finally add expected inflation, which in our view forms an unbiased investor expectation for total returns.

Earnings could be unrepresentative for valuation models when profitability is very low or very high. Therefore, implied growth is calculated using normalised earnings (book equity × period weighted average *ROE*). Assuming profitability is mean-reverting consistent with the existing empirical literature [e.g., Beaver (1970), Lookabill (1976), Freeman, Ohlson, and Penman (1982), Penman (1991), and Fama and French (2000)]. Table 4-9 and Figure 4-10 present the calculations and results, followed by a growth gap presentation in Figure 4-11, and then by the conclusion of the analysis in this section.

Year	Required Rate of Return *RM* *Percent*	Earnings *EGS* *£ Billion*	Market-Cap *MVE* *£ Billion*	Annual *ROE* *Percent*	Implied Growth at annual *ROE* *Percent*	**Implied *g* at weighted average *ROE*** ***Percent***	GDP Growth *Percent*	Realised Earnings Growth *Percent*
1989	16.36	18	234	14.69	8.03	**10.67**	9.77	17.42
1990	22.31	21	224	14.49	11.82	**15.02**	8.39	8.05
1991	20.56	23	269	14.93	11.24	**14.28**	5.18	-13.42
1992	18.34	19	298	11.77	11.18	**12.32**	4.21	-13.56
1993	15.94	15	371	8.35	11.58	**10.85**	5.15	4.84
1994	14.21	20	400	11.05	8.69	**9.29**	6.07	10.20
1995	11.64	24	420	13.09	5.56	**7.03**	5.56	9.87
1996	13.44	30	535	13.80	7.50	**9.16**	6.13	7.79
1997	11.38	32	602	15.33	5.81	**7.75**	6.24	8.11
1998	13.70	35	752	15.30	8.66	**10.43**	5.98	10.48
1999	14.38	33	974	14.59	10.60	**11.81**	5.17	-2.77
2000	11.92	40	1280	9.38	8.56	**8.41**	5.24	-0.41
2001	14.45	24	1060	4.71	11.96	**9.39**	4.50	-11.55
2002	10.25	2	864	0.47	9.96	**4.44**	5.02	-24.70
Avg.	14.92	--	--	11.57	9.37	**10.06**	5.90	0.74
Period weighted average *ROE*:				9.80				
Compound average GDP growth:							5.89	
Grand median realised earnings growth:								1.30

Table 4-9. Implied Growth in Stock Market Valuation

The expected return is the unbiased estimate discussed in Section 4.5.3.1 and presented in Table 4-10, the estimate (a) that used previous year inflation as the expected inflation is presented in this table. However, using the market expected inflation implied in the government bond trading (index-linked) estimated by the bank of England (b) leads to the same as shown below in Figure 4-10. Implied growth is calculated using Equation 4-16: $(MVE_t \times KE - EGS_t)/(MVE_t + EGS_t)$. As earnings or *ROE* are not representative for some years (e.g. 1993 and 2000-2002), Implied growth at weighted average *ROE* is calculated either using the same formula of Equation 4-16 with actual earnings replaced with normalised earnings (book equity for the year × period weighted average *ROE*), or by using Equation 4-17: $(MBE_t \times KE - ROE_t)/(MBE_t + ROE_t)$ applying period weighted average *ROE*. All figures are nominal. Realised earnings growth figures are the historic medians. Number of observations ranged between 451 in 1989 and 1151 in 2002.

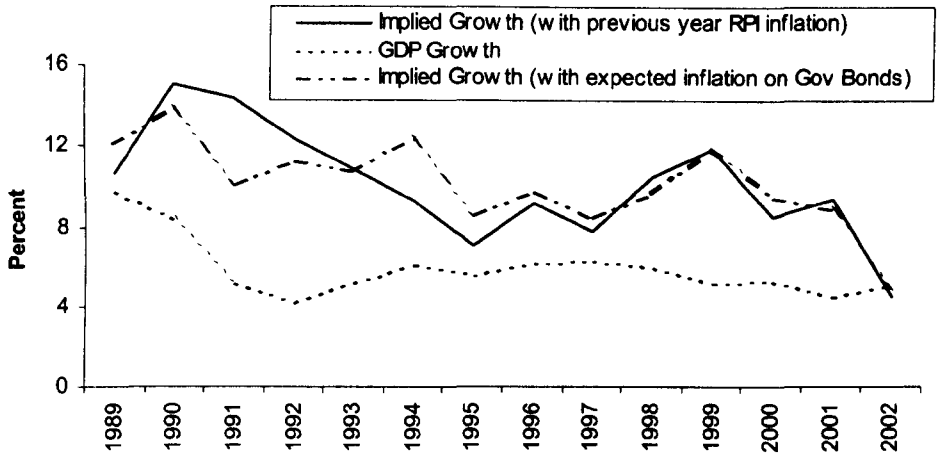

Figure 4-10. Implied Growth v Economic Growth

This graph depicts implied growth (calculated at weighted average *ROE*) versus GDP growth. All data obtained from Table 4-9 above. Implied growth was calculated using different inflation expectation estimates, one from previous year RPI and the other is the market expected inflation implied in the government bond trading (index-linked) estimated by the bank of England. Both lead to the same as shown. Similar pattern is observed if implied growth is calculated on actual earnings was plotted instead of using weighted average *ROE*.

Before stating the conclusion of the above analysis, for a good insight, Figure 4-11 plots the gap between implied growth and economic growth against stock market levels revealing a cyclical behaviour in terms of growth expectations. Up to 1991 the gap was widening with rising stock prices. After that, there was a correction continued up to 1995 accompanied with a slow down in stock price increase. Again the gap was widening with the steep increase in stock prices up to 1999 where the correction started again with steep fall in stock prices. There seem to be two distinct cycles for expected growth, 1989-1995 and 1996-2002.

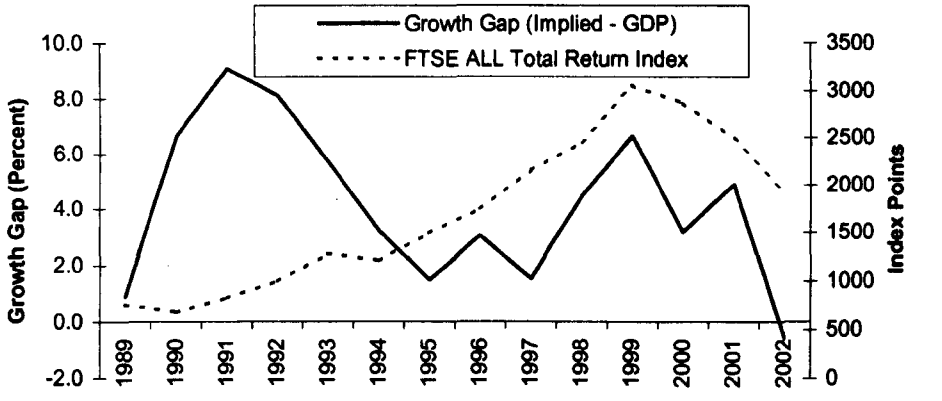

Figure 4-11. Growth Gap against Stock Market Levels

The solid line is calculated as the growth rate implied in market valuation as calculated in Table 4-9 using normalised earnings as explained in the same table *minus* GDP growth. Same pattern is observed if actual earnings are used.

One could argue that the reason for the major gap between implied growth and current GDP growth in around 1990-1992 was presumably in part because of the depth of the early 1990s recession in the UK, which is not reflected in long-term expectations of growth. Besides, the first gap peak up to 1991 is affected by the high cost of capital; driven by high average realised real total returns over each past 10-years and high expected inflation. Hence, the early 1990s might not be overvaluation. Of course, the same explanation cannot apply to the gap in the late 1990s, because this was a boom, not a recession.

It is also noteworthy that the valuation bias uncovered in Chapter 3, between newly issued and mature stocks, correlates over time with the aggregate valuation bias in this chapter as demonstrated by the behaviour of the valuation gap between new and mature stocks where it widens in bullish markets and diminishes in bearish markets as shown in Figure 3-4 and Figure 3-5 of Section 3.3 in Chapter 3. This seems to support the refutation of the hypothesis that new stocks higher valuation is due to learning, why should learning mechanisms be any different in late 1990s than in previous periods.

All the results above show that growth rates implied in market valuation (in both calculations) have almost always been higher than actual economic growth and realised earnings growth suggesting that investors might have been overestimating growth potential and have paid, until recently, too much for future growth levels that have never materialised on economic or corporate levels.[77] This

[77] Calculating the number of years needed to organically double corporate earnings in size gives some indication as what could be realistic growth rates. If earnings to double in size in n years we can replace EGS_n with $(2 \times EGS_0)$ in the usual discrete compounding formula and take the natural logarithm of both sides, then re-arrange to calculate the number of years needed as below:

Calculation Formula	Growth Rate Scenario%	Years to Double in Size
$EGS_n = EGS_0(1+g)^n$	3.00	23
	4.00	18
$EGS_n = 2 \times EGS_0$	5.00	14
	6.00	12
$n = \frac{\log(2)}{\log(1+g)}$	7.00	10
	8.00	9
	9.00	8
	10.00	7

People have different views about realistic long-term growth, assuming that earnings and hence the market will roughly double in size in less than 18 or even 14 years could be seen as unrealistic. The 4 percent terminal growth level was frequently referred to in the literature and by market practitioners, see for example Kaplan and Ruback (1995) and Sougiannis and Yaehura (2001) and compare with the implied growth rates for both groups in Table 4-9 since 1997 onwards.

evidence supports rejecting H_0 and H_{0a} in favour of H_1. Although shifting the cost of capital downwards from its unbiased estimation would change this conclusion, the strong support of the weak realised earnings growth and the weaker case of a lower cost of capital compared to an unbiased estimate suggest that the rejection of H_{0a} is reasonable. This evidence on growth is consistent with Bulkley and Harris (1997) who, by studying earnings forecasts, find evidence to support their hypothesis of the market's failure to form rational expectations. Their evidence shows positive correlation between stock prices and earnings forecasts while forecasts were overestimates with respect to realised earnings.

Caveat on Inflation:

All figures in this section, earnings implied and realised growth and GDP growth are in nominal values (real growth + inflation). Inflation affects all numbers with the same impact or multiple. Hence, repeating the same analysis with real rates does not change the identified patterns or conclusion.

The next sub-section turns to the risk factor in examining the research hypothesis.

4.5.3 Can The Explanation Be in Risk Aversion Levels?

We learn at business schools that the rate of return required by investors is the discount rate to convert future outcomes into present value terms. Is it the case in the stock market? Again, we face a similar problem as arises with long-term expected growth rates, the appropriate discount rate, i.e. the cost of equity *KE*, is not directly observed and so market valuations will always be consistent with some discount rate.

This sub-section has two objectives. The first objective is to establish an unbiased estimate for the required rate of return every year based on information available to investors at the time avoiding processes or inputs that could be biased or subjective to evaluate investor return expectations in isolation of fundamentals. Second, controlling for growth rate, we examine whether the discount rates implied in market valuation are plausible against the unbiased estimate and the risk-free rate, should they be relatively too low, this would imply underestimated risk and hence overvaluation and vice versa.

4.5.3.1 Unbiased Return Expectations

We first need to develop this measure. For an unbiased estimation, the impact of historic inflation should be eliminated and replaced with unbiased expected inflation because historic inflation might be irrelevant for future economic eras. Therefore, real total returns will be used. Also, returns will be adjusted for the impact of survivorship bias embedded in return calculation. Below is a procedure we believe would produce a reasonable unbiased estimate.

***Step* 1**: Nominal Total Returns to Shareholders (*TRS*)

Data for FTSE ALL are used. Price index data start 1962. Dividend yield data start 1964. Total return index data start 1985. The Total Returns Indices (Datastream code: RI) measure the total return on the underlying indices, combining both capital performance and dividends income. They are calculated using declared dividends. (*FTSE International Limited, 2003*). Total returns to

shareholders (*TRS*) are calculated as the percentage change in the total return index. Where the total return index is not available (before 1985), *TRS* is calculated as percentage price change in the usual capital price index plus dividend yield (up to 1985).[78]

***Step* 2**: Real *TRS*

Real *TRS* is calculated as nominal *TRS* minus realised inflation. Historic inflation is isolated in this manner to be replaced by expected inflation, as the impact of historic inflation will distort return expectation because historic inflation might be irrelevant for future economic eras. Therefore, real returns are used and adjusted later upwards by expected inflation instead. Inflation rates (identifier: CZBH) are calculated as the percentage annual change in the All-Items *RPI* (identifier: CHAW). Data are available since 1949 from the Office for National Statistics.

***Step* 3**: Expected Real *TRS*

Expected real *TRS* is calculated as the 10-year rolling average real *TRS*, where every year the preceding 10 years are used so the estimation is based on the information available to investors at any given year. As dividend yield data start only in 1964, the first 10-average can be calculated for 1974 over 1964-1973. The 10-year basis was selected based on the general recommendation in finance texts [see for example Copeland, Koller, and Murrin (2000) and Brealey and Myers (2000)], which was used in the literature as well as in practice [see for example Kaplan and Ruback (1995)].

***Step* 4**: Survivorship Bias

The figure arrived at by Step 3 is still biased as the data used (on the index) is inherently conditioned on survivorship. Therefore, it is adjusted downwards by 1.5 percent for survivorship bias. Copeland, Koller, and Murrin (2000) estimate

[78] To ensure that percentage price change plus dividend yield is a reasonable calculation, we compared *TRS* calculated in both ways for the period 1986-2003 where the data were available. Average *TRS* as the percentage change in total return index is 12.14 percent and as the percentage change in capital price index plus dividend yield is 11.61 percent. The difference is small; and therefore using price index and dividend yield for before 1985 would be acceptable.

the downward adjustment by 1.5 to 2 percent based on the tables used by Jorion and Goetzmann (1999).

***Step* 5**: Expected Inflation

Expected inflation every year is then added to the survivorship bias-adjusted expected real *TRS*. Two estimates were used for expected inflation. The choice between the two does not have a major impact on the estimation as shown later. However, it served as robustness check for our estimation procedure. These are:

a) Previous year's inflation figure on *RPI* (Retail Price Index) is used, as we believe is not subjective and therefore is an unbiased expectation for the year in question being the most recent evidence and memory investors have (e.g. the expected inflation for 1995 is the realised inflation for 1994).
b) Market expected inflation from the index-linked gilt market (implied in government bond trading) estimated by the Bank of England. Inflation rate implied in the 10-year maturity is used (inline with the 10-year rolling average basis and the 10-year risk-free rate used throughout this thesis). This estimate is explained in the footnote.[79] This explanation was taken from Bank of England's "Notes on the Bank of England UK Yield Curves".

Figure 4-14 in Appendix 4.7.2 compares the two inflation measures where the average expected inflation set as the realised inflation rate in the previous year on *RPI* over 1985-2003 is 4.35 percent and the average of that estimated by the Bank of England as implied in government bond over the same period is 3.94 percent. This comparison and Figure 4-12 below show how both estimates track one another. Hence, relying on either will not lead to differences in the conclusion.

[79] The Monetary Instruments and Markets Division of the Bank of England estimates yield curves for the United Kingdom on a daily basis. One set is based on yields on UK government bonds and on yields in the general collateral repo market. It includes nominal and real yield curves and the implied inflation term structure for the UK. The methodology used to construct the yield curves is described in the Bank of England *Quarterly Bulletin* article by Anderson and Sleath (1999). *Implied inflation rates:* the index-linked gilt market allows obtaining real interest rates and the conventional gilt market allows us to obtain nominal interest rates. These nominal rates embody the real interest rate plus a compensation for the erosion of the purchasing power of this investment by inflation. The Bank uses this decomposition (commonly known as the Fisher relationship) and the real and nominal yield curves to calculate the implied inflation rate factored in to nominal interest rates. This is often interpreted as a measure of inflation expectations, although some care is required in doing so (illiquidity in the conventional and index-linked gilt markets could distort this measure, and in practice there will be an 'inflation risk premium' incorporated in the implied inflation rate). As with nominal and real interest rates, 'spot' implied inflation rates (subject to the above liquidity caveats) can be seen as the average rate of inflation expected to rule over a given period. Similarly forward implied inflation rates can be interpreted as the rate of inflation expected to rule over a given period which begins at some future date. These estimates are only available from 1985. This information is available on the Bank of England website.

To sum up, the ex ante unbiased expected return on the stock market is estimated as the survivorship bias-adjusted expected real total returns to shareholders adjusted by expected inflation using information available to investors at the time of estimation. Table 4-10 and Figure 4-12 present the outcome of this estimation followed by a robustness check.

Year	Nominal TRS	Realised Inflation	Real TRS	10-Year Average Real TRS	Expected Inflation Previous Year RPI	Unbiased Expected Returns	Expected Inflation Implied in Gov Bond	Unbiased Expected Returns
(Percent)					(a)	(a)	(b)	(b)
1974	-43.63	16.00	-59.63	5.00	9.20	12.70		
1975	141.80	24.20	117.60	-0.45	16.00	14.05		
1976	2.55	16.50	-13.95	10.59	24.20	33.29		
1977	46.46	15.80	30.66	9.94	16.50	24.94		
1978	8.44	8.30	0.14	9.92	15.80	24.22		
1979	11.22	13.40	-2.18	5.74	8.30	12.54		
1980	33.27	18.00	15.27	7.20	13.40	19.10		
1981	13.04	11.90	1.14	9.68	18.00	26.18		
1982	27.33	8.60	18.73	6.21	11.90	16.61		
1983	27.72	4.60	23.12	7.20	8.60	14.30		
1984	30.44	5.00	25.44	13.09	4.60	16.19		
1985	19.52	6.10	13.42	21.60	5.00	25.10	6.47	26.57
1986	27.23	3.40	23.83	11.18	6.10	15.78	6.28	15.95
1987	8.44	4.20	4.24	14.96	3.40	16.86	5.91	19.36
1988	11.53	4.90	6.63	12.31	4.20	15.01	5.98	16.79
1989	36.09	7.80	28.29	12.96	4.90	16.36	6.40	17.86
1990	-9.72	9.50	-19.22	16.01	7.80	22.31	6.51	21.03
1991	20.80	5.90	14.90	12.56	9.50	20.56	5.02	16.08
1992	20.49	3.70	16.79	13.94	5.90	18.34	4.71	17.14
1993	28.39	1.60	26.79	13.74	3.70	15.94	3.59	15.83
1994	-5.85	2.40	-8.25	14.11	1.60	14.21	4.76	17.37
1995	23.85	3.50	20.35	10.74	2.40	11.64	4.03	13.27
1996	16.70	2.40	14.30	11.44	3.50	13.44	4.06	13.99
1997	23.56	3.10	20.46	10.48	2.40	11.38	3.09	12.07
1998	13.77	3.40	10.37	12.10	3.10	13.70	2.31	12.92
1999	24.20	1.50	22.70	12.48	3.40	14.38	3.42	14.40
2000	-5.90	3.00	-8.90	11.92	1.50	11.92	2.54	12.96
2001	-13.29	1.80	-15.09	12.95	3.00	14.45	2.47	13.92
2002	-22.68	1.70	-24.38	9.95	1.80	10.25	2.23	10.68
2003	20.86	2.90	17.96	5.84	1.70	6.04	2.83	7.17

Table 4-10. Unbiased Return Expectations – *Ex Ante* Estimation

Annual data for FTSE ALL Share Index are used. Nominal total returns to shareholders (*TRS*) are calculated as the percentage change in total return index from 1986 onwards, and as the percentage change in price index plus dividend yield before 1986 (the start of the total return index data). Inflation rates are calculated as the percentage annual change in All-Items Retail Price Index *RPI*. Real *TRS* is calculated as Nominal *TRS* minus inflation. Expected real return is calculated as the 10-year rolling average real *TRS*. Expected inflation: (a) every year is set to prior year's inflation figure calculated on *RPI* as its unbiased expectation, (b) The expected inflation rate implied in the 10-year government bonds (index-linked) as discussed above under Step 5, estimated by the Bank of England, their series goes back only to 1985. Unbiased Expected Return on The Stock Market is then calculated as: Expected Real Return – 1.5 percent Adjustment For Survivorship Bias + Expected Inflation (a) or (b).

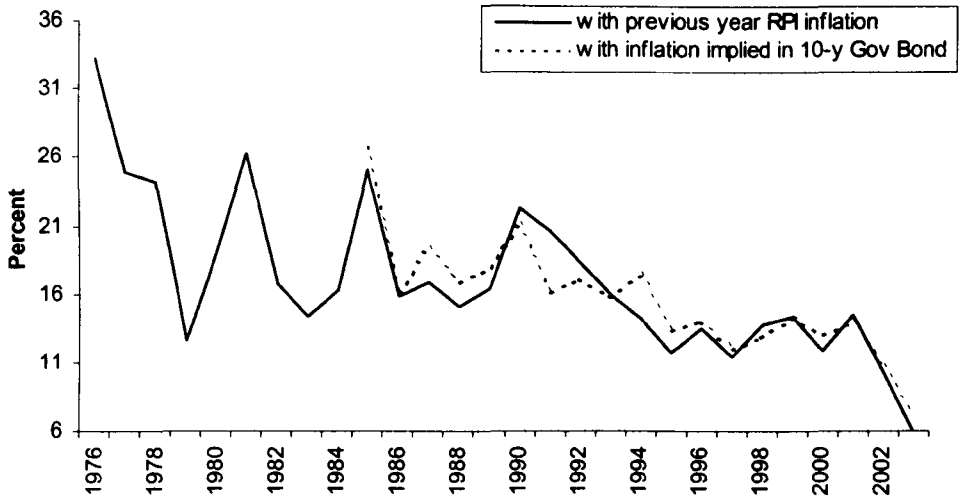

Figure 4-12. Expected Return on the Stock Market

The solid line represents the expected returns on the stock market estimated using a 10-year rolling average real *TRS* adjusted downward by 1.5 percent for survivorship bias plus expected inflation from previous year *RPI*. The line starts from 1976 because the dataset imposed a start by 1974 to accord with the rolling 10-year average (from 1964 the of the index total return data) where 1974 was a hangover from the oil shock and 1975 was a recovery year. The doted line represents the same with expected inflation replaced by the market expected inflation implied in the 10-year government bond as estimated by the Bank of England, the estimates are only available from 1985. This comparison shows that relying on either estimate will not lead to differences in the conclusion.

The correlation between the risk-free rate (redemption yield on the 10-year government bond benchmark) and the unbiased estimate for the expected return is 0.74. This is a robustness test for the above estimation given that the risk-free rate was not used in the estimation process while the estimation captures the important relation between interest rates and expected returns on stocks.

6 to 7 percent expected nominal returns on the stock market, as per the above estimate, seem a reasonable range for this economic era (2003 onwards) based on real return in the region of 4 to 5 percent, which is also affected by the level of survivorship bias adjustment. Warren Buffett, the world's most celebrated investor – according to Fortune Magazine, (2001) expected in 1999 that the American public should expect equity returns over the next decade or two (with dividends included and 2 percent inflation assumed) of perhaps 7 percent gross and might be 6 percent after frictional costs such as commissions and fees.

4.5.3.2 Implied Discount Rate

The objective of this exercise is to estimate the discount rates implied in market valuation and compare them with the unbiased return expectations to assess whether return expectations were different from discount rates and whether implied discount rates are plausible relative to the risk-free rate.

The same valuation model of Equation 4-4 that was inverted to calculate implied growth is used for this exercise. Growth rate was controlled at 4 percent; a plausible assumption as (inflation + real growth components), changing this assumption to 5, or 6 percent does not change the conclusion. Table 4-11 shows the results followed by a robustness check and a discussion.

$$MVE_t = \frac{EGS_t(1+g)}{KE-g}$$ [Equation 4-4], of which:

Equation 4-18: $$KE = \frac{EGS_t(1+g)}{MVE_t} + g$$

Year (*Percent*)	Implied Discount Rate *KE*	Implied *KE* at WA *ROE*	Unbiased Expected Return	Risk-Free Rate *RF*
1989	12.03	9.35	16.36	10.26
1990	13.75	10.59	22.31	10.95
1991	12.71	9.72	20.56	9.73
1992	10.70	9.57	18.34	8.26
1993	8.07	8.78	15.94	6.10
1994	9.28	8.69	14.21	8.71
1995	10.00	8.49	11.64	7.42
1996	9.74	8.07	13.44	7.51
1997	9.48	7.50	11.38	6.29
1998	8.82	7.09	13.70	4.36
1999	7.55	6.38	14.38	5.48
2000	7.22	7.37	11.92	4.88
2001	6.32	8.81	14.45	5.05
2002	4.28	9.79	10.25	4.37
Average	9.28	8.59	14.92	7.10

Table 4-11. Discount Rate Implied in Market Valuation

Implied discount rate is calculated as $KE = EGS_t(1+g)/MVE_t + g$ Equation 4-18 with growth controlled at 4 percent. Implied discount rate at weighted average (WA) *ROE* is calculated using the same formula with actual earnings replaced with normalised earnings (book equity × period weighted average *ROE*) to overcome when earnings are not representative, i.e. assuming profitability is mean-reverting inline with the existing empirical literature [e.g., Beaver (1970), Lookabill (1976), Freeman, Ohlson, and Penman (1982), Penman (1991), and Fama and French (2000)]. Unbiased expected return is calculated as 10-year rolling average real TRS adjusted downward by 1.5 percent for survivorship bias plus expected inflation as estimated in Table 4-10. Risk-free rate is the redemption yield on the 10-year government bond benchmark.

The correlation between the risk-free rate (redemption yield on the 10-year government bond) and the implied discount rate is 0.90. This is a robustness test for the valuation model used and the estimation of implied growth rate given that the risk-free rate was not an input in the estimation process. It seems that the estimation strongly captures the important relation between interest rates and expected returns on stocks. Also, the correlation between the implied discount rate and the unbiased expected return estimation at 0.76 provides another comfort. The reason why the correlation is higher for the implied discount rate and the risk-free rate could be due to that the implied rate is estimated using one year's market value level which reflects interest rate levels of that year with a controlled growth rate and a single year's earnings while the unbiased estimation uses 10-year rolling average real returns and expected inflation with adjustment for survivorship bias which affect this correlation. Table 4-12 shows the correlation matrix.

	Implied DR	Implied DR at WA *ROE*	Unbiased Exp. Return	Risk-Free Rate
Implied Discount Rate	1.00			
Implied DR at WA *ROE*	0.40	1.00		
Unbiased Expected Return	0.76	0.58	1.00	
Risk-Free Rate	0.90	0.62	0.74	1.00

Table 4-12. Rate of Returns Correlation Matrix

DR: is Discount Rate for short. WA is short for Weighted Average.

Figure 4-13 plots a comparison between the implied discount rate, the unbiased expected return and risk-free rate followed by analysis of the results.

It is an interesting and important observation that the pattern of the risk-free rate and the implied discount rate are not very different in terms of the direction. Does equity cost of capital always track interest rates? It should! Obviously that reflects the correlation between stock prices and interest rates given that the implied discount is estimated from stock market levels.

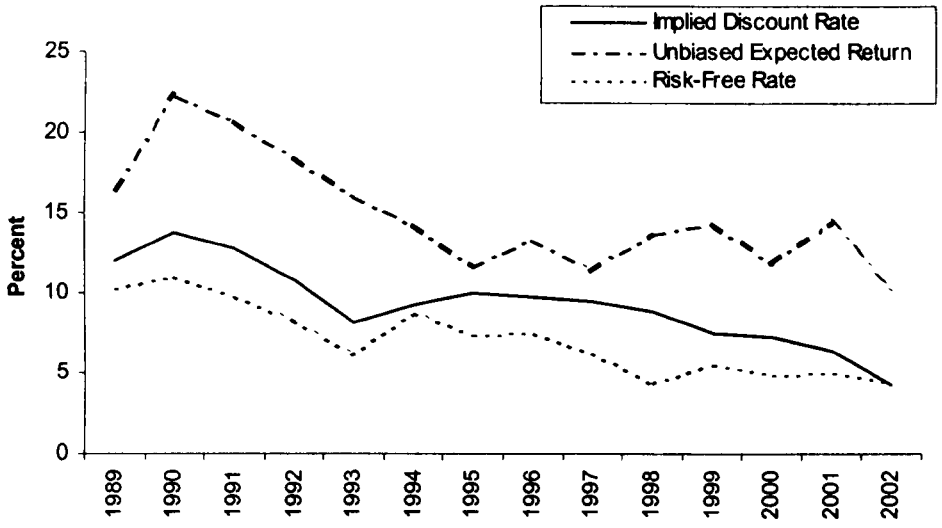

Figure 4-13. Discount Rate Implied in Market Valuation – Comparison

Implied discount rate is calculated as $KE = EGS_t(1+g)/MVE_t + g$ (Equation 4-18) in Table 4-11 with growth controlled at 4 percent. Controlling for growth at 5, or 6 percent or plotting the implied discount rate using normalised earnings/weighted average *ROE* does not change the conclusion drawn in this section. Unbiased expected return calculated as 10-year rolling average real TRS adjusted downward by 1.5 percent for survivorship bias plus expected inflation as estimated in Table 4-10. Risk-free rate is the redemption yield on the 10-year government bond benchmark.

Are the discount rates that justify market value levels, at a plausible 4 percent expected growth (or even 5 or 6 percent), plausible on average when compared to the risk-free rate; implying average equity risk premium for 1989-2002 of 2.18 percent (1.49 percent using normalised earnings)? Pastor and Stambaugh (2001) estimate that the equity premium for the US market fluctuates between 4 and 6 percent since 1834 with its sharpest drop in the last decade. Fama and French (2002) estimate the equity premium for the US market for 1951 to 2000 at 2.55 and 4.32 percent, where equity premium produced by the average stock return was 7.43 percent.[80] On balance of this evidence from the literature and the above results, one can argue that equity premium and hence risk might have been understated.

The significant difference between the implied discount rates and the unbiased expected rates of return reveals a possible important *paradox* in investor behaviour. High return expectations should mean high discount rates and hence lower values. Implied discount rates significantly below the unbiased estimates

[80] See Bansal and Lundblad (2002) for more about risk premium in the global equity markets.

for return expectations. Add to that the high likelihood that investors tend also to ignore survivorship bias when looking at expected returns, we argue that investor high return expectations might have been driving stock prices to meet these expectations not in tandem with economic and corporate fundamentals. This is also confirmed by testing profitability and growth in Sections 4.5.1 and 4.5.2. Moreover, these high return expectations did not translate into higher discount rates. It could be a vicious circle where high required rates of return drive prices to high value levels to yield these return expectations where such value levels imply lower discount rates and lower values. This seems to continue until the economy is gloomy and the gap is too apparent between fundamentals and market levels, where then severe corrections are inevitable.[81]

In conclusion, based on the above one can think of two possible interpretations. The first, if one can accept that implied equity risk premium was reasonable compared to both risk-free rate and unbiased expected returns, then risk-aversion did not lead to equity mispricing, which is in favour of not rejecting H_{0a} and not enabling us to reject H_0. We do not believe the evidence gathered supports this conclusion. The second one, given that risk or equity risk premium is underestimated and the paradox between investor return expectations that are driving stock prices and the lower discount rates, risk might have been underestimated and therefore value overestimated by investors. The latter concurs with our personal belief about this matter, this evidence would lead to rejecting H_0 and H_{0a} in favour of H_1. This analysis suggests that when overvaluation is present, it is due either to expected growth or a combination of high expected growth (that is inconsistent with economic growth and realised earnings growth) and underestimated risk.

[81] This broadly compares with over-extrapolation bias, discussed in Chapter 3. Investors are influenced by historic performance, which in turn is affected by survivorship bias and high historic inflation that is highly unlikely to be relevant for future economic eras. Quoting Warren Buffett (2001) again to support the above argument: "People are habitually guided by the rear-view mirror and, for the most part, by the vistas immediately behind them." Also, John Maynard Keynes in his review in 1925 for Smith's book of 1924 wrote: "It is dangerous ... to apply to the future inductive arguments based on past experience, unless one can distinguish the broad reasons why past experience was what it was." He continues to say "if you cannot do that, you may fall into the trap of expecting results in the future that will materialise only if conditions are exactly the same as they were in the past."

4.6 Conclusion

Chapter 3 documented differences in valuations between the UK new and older stocks where new stocks have relatively higher valuations that decline with age. That did not shed any lights on whether older stocks or the stock market overall has a tendency to be biased. This chapter attempted at exploring bias at the overall stock market level.

This chapter documents the occurrence of major divergences capital growth in stock prices (soaring to high levels) against economic growth and book equity (equity invested capital), which are then followed by stock price corrections (falls). The severity of the correction seems to depend on the size of the preceding divergence. Hence, we examine the hypothesis that stock market levels in the UK during the period 1989-2002 can be explained by fundamentals such as reasonable expected profitability, expected growth and risk perception (H_0), along with another variation of this hypothesis that stock prices, on average, over time, are correctly valued against fundamentals, but sometimes there is temporary mispricing (H_{0a}), against the alternative hypothesis that stock market levels in the UK were overvalued (biased upwards) on average relative to fundamentals during the period 1989-2002 (H_1). In testing the hypothesis, we use the data of all UK traded non-financial stocks with other market and economic data to analyse earnings yield levels, changes in corporate profitability pattern and the sensitivity of stock prices to profitability, expected growth and the impact of return expectations and risk aversion on stock valuations.

For this exercise, we develop a theoretical earnings yield model validated and supported by an empirical valuation model. The model is used to examine stock market levels concentrating on income yield, growth and return expectations benchmarking against risk-free assets and economic growth. The one thing we endeavoured to maintain in this analysis is simplicity and investment logic.

As shown below, on balance, we believe the evidence is tilted towards rejecting H_0 and rejecting H_{0a} (however, not as strongly as in rejecting H_0) in favour of H_1. Further discussions detailing this summary conclusion follow this table.

Hypothesis Testing	H_0	H_{0a}
Changes in profitability Patterns	Reject	Cannot reject or otherwise
Expected growth	Reject	Reject
Risk aversion/Return expectations	Reject	Reject
Balance of evidence, in favour of:	***Reject***	***Reject***

We document that the **spread between earnings yield and the risk-free** rate is almost stable (*EY* is below *RF* by circa 2 percent on average). The big question: is this spread reasonable, or in other words, were growth and risk rationally priced to produce this negative spread? To answer that, we investigate: plausible or rationalised scenarios for earnings yield, earnings yield predictions, corporate profitability, growth and return expectations.

Earnings yield was estimated using the theoretical and empirical models under **plausible scenarios** for profitability, growth and cost of capital. (a) The first estimate, produced under period averages of profitability, GDP growth and cost of capital, suggests that realised earnings yield is understated under both models and hence implies overvalued levels of stock prices on the overall. This was derived from a theoretical and an empirical model, which gives some credit for this indication. Moreover, if growth is reduced below 5.89 percent, the overvaluation will be more apparent, and given a median realised growth of 1.30 percent, it could be argued that overvaluation is a reasonable candidate explanation. (b) The other three scenarios, under the theoretical model, show that at the set growth and discount rate levels earnings yield matches the realised level for the period. These growth scenarios (5.89, 4, and 5 percent) and cost of capital scenarios (10.18, 8.21 and 9.25 percent) are not implausible relative to economic

growth and risk-free rate. These results suggest that the stock market could be pricing stocks correctly on average over the long-term with an important implication, that severe fluctuations reflect temporary periods of mispriced levels/market irrationality where unreasonable high levels are corrected by subsequent severe price falls. (c) Under the empirical model, all four scenarios indicate understated realised earnings yield level implying overvalued stock price levels. (d) Under the empirical model, implied cost of capital implies understated risk and hence overvalued stock price levels.

We test the earnings yield model capability in **predicting stock market levels** in-sample to evaluate stock price levels. A test on FTSE ALL and FTSE 100 indices for 2003 levels is undertaken under a cost of capital of 4 percent risk premium over the risk-free rate, a nominal growth rate of 4 percent, and the weighted average historic mean *ROE* of 9.80 percent. The predicted levels deviated by just –0.62 and 1.96 percent respectively from end of 2003 realised level. The second prediction test was to examine whether the model could have predicted the severe fall in stock prices after 1999 peak. The model at the plausible inputs was able to predict the severe price fall of 2000-2002 to a good extent where it predicted 35.19 percent price fall against realised fall of 46.15 and 49.18 respectively. These results can be construed as evidence consistent with H_{0a}. These tests suggest that the introduced earnings yield model and prediction procedure can be useful when *rational* assumptions are used.

The evidence shows that **corporate profitability** has not improved over the period 1989-2002. It almost has a constant trend. The period 1989-1999 seems to be a representative for a full *ROE* cycle producing a historic weighted average at 12.74 percent while the weighted average over 1989-2002 is 9.80 percent affected by the severe decline over 2000-2002. We find that that stock prices are sensitive to profitability levels on same year and 1-year lagged data. There seems to be a delay before the market responds to declined profitability. By comparing total profitability with total return index, for consistency, we find the increase in profitability after 1993 to 1997 (which was then almost flat to 1999) was not an improvement in profitability; it was rather a recovery to post 1992 level. So, profitability cannot explain why stock prices should soar as they did up to 1999.

Market expected growth rates were estimated by **growth rates implied in market valuation**, which have almost always been higher than economic growth and realised earnings growth suggesting that investors might have been overestimating growth potential and have paid too much for expected growth. The work also establishes and reveals the **gap between implied growth and economic growth against stock market levels** documenting a cyclical behaviour in terms of growth expectations. Where the gap size used to increase inline with rising stock prices to a certain extent where a major correction occurs over a period of time in the form of slowing or falling stock prices closing the gap down. The period 1989-2002 seem to have two distinct cycles for the gap; 1989-1995 and 1996-2002.

Market **return expectations** and **risk aversion** are studied through an **unbiased estimation for expected returns** on the stock market and **discount rates implied in market valuation**. The former is estimated as the expected real total returns to shareholders adjusted for survivorship bias and by expected inflation. The correlation between the risk-free rate and the unbiased estimate for the expected return is 0.74 and between the risk-free rate and the implied discount rate is 0.90 percent, which is a robustness test for the estimations.

Comparing the implied discount rate with the evidence from the literature, average equity risk premium would imply underestimated risk. Comparing the same with the unbiased expected return estimation, implied discount rates are significantly lower indicating a possible *paradox* in investor behaviour because high return expectations should mean high discount rates and hence lower values. Hence, we argue that investor high return expectations might have been driving stock prices to meet these expectations not in tandem with economic and corporate fundamentals and where these high return expectations did not translate into higher discount rates.

With corporate profitability dropped out as a significant part of the explanation, the following matrix illustrates the possible valuation outcomes

resulting from different behavioural scenarios in pricing risk and expected growth. This matrix was introduced as part of method illustration in the Introduction, Section 4.1.

			Pricing Risk		
			Overestimated **A**	***Rational*** **B**	***Underestimated*** **C**
Pricing Growth	**Underestimated**	**1**	Undervalued	Undervalued	Offsetting
	Rational	***2***	Undervalued	***Rational***	***Overvalued***
	Overestimated	**3**	Offsetting	***Overvalued***	***Overvalued***

The Matrix of Growth and Risk Pricing Impact on Stock Valuation
A1 (top left) and C3 (bottom right) represent the most severe undervaluation and overvaluation levels respectively. A3 and C1 have an offsetting impact, the underestimation/overestimation extent of each variable would result in rational (for the wrong reasons), overvalued, or undervalued levels. The relative severity level of B1 v A2 and C2 v B3 are dependent on the extent of one variable under-/over-estimation.

To sum up the conclusion, on the balance of the evidence there are two arguments to stand as suggested candidate explanations for stock market aggregate levels. (1) **Overvaluation on the overall** where stock prices are driven by investor exuberant expectations on returns and future growth with possibly underestimated risk, where high overvaluation levels are reduced/corrected with severe price falls, that would be B3/C2 or even C3 on the matrix. (2) **Correct pricing, on average over the long run,** associated with severe economically unjustifiable fluctuations or levels due to periodic exuberant expectations leading to overvalued periods corrected when economic gaps are too apparent to expose that these expectations are unrealistic. That would be, on the matrix, B2 over the long run and B3, C2 or C3 over shorter periods. And while neither of the above two results could be conclusive, both indicate the possibility that mispricing, namely overvaluation, is present. The levels and periods are highly disputable. We believe the first explanation makes a stronger case. The evidence did not support any of the undervaluation scenarios A1, B1, and A2. C1 was rolled out, as the evidence of exaggerating growth potential is fairly strong and also A3 as the evidence suggested either proper risk pricing or underestimation.

On the balance of evidence obtained through this research, we are at least able to join Shiller in his view (2001), on the US stock market, that its ups and downs over the last century have made virtually no sense ex post, and the views of others such as Cole, Helwege, and Laster (1996), Campbell and Shiller (1998), Heaton and Lucas (1999), Kiley (2000), and Smithers and Wright (2004), as these US-based views are applicable to the UK stock market at least over the recent history 1989-2002 given the high correlation between the two markets. And we are, of course, able to join those who worked on the UK stock market such as Brooks and Katsaris (2003, 2003b) in their conclusion, using speculative bubble theory, that UK stocks were overvalued in the late 1990s as they deviated too far from their fundamental values.

Finally, it is noteworthy that the valuation bias uncovered in Chapter 3, between newly issued and mature stocks, correlates over time with the aggregate valuation bias in this chapter as demonstrated by the behaviour of the valuation gap between new and mature stocks where it widens in bullish markets and diminishes in bearish markets. This seems to support the refutation of the hypothesis that new stocks higher valuation is due to learning.

4.7 Appendix

4.7.1 Deriving Empirical Earnings Yield

This appendix shows below how to move to the empirical *EY* using the empirical *MBE* model.

$$\log(MBE)_i = \beta_0 + \beta_1 ROE_i + \beta_2 GEGS_i + \beta_5 KE_i + \varepsilon_i \quad \text{[Equation 4-8]}$$

$$MBE = \frac{ROE(1+g)}{KE-g} \quad \text{[Equation 4-4], with}$$

$$\frac{1+g}{RM-g} = \frac{1}{EY} \quad \text{[from Equation 4-5], gives:}$$

$$MBE = \frac{ROE}{EY} \quad \text{from which:}$$

Equation 4-19: $$EY = \frac{ROE}{MBE} = \frac{ROE}{\exp[\log(MBE)]}$$ where $\log(MBE)$ from Equation 4-8

Or, in a simpler exposition:

$$ROE = \frac{EGS}{BE},\ EY = \frac{EGS}{MVE},\ MBE = \frac{MVE}{BE} \text{ of which } EY = \frac{ROE}{MBE}$$

where *EY* is earnings yield, *RF* is the risk-free rate, *RM* is the expected return on the market. It is worth noting that earnings yield is inflation-adjusted by construction as earnings and market value of equity are subject to the same inflation impact.

4.7.2 Expected Inflation – Measures' Comparison

The figure in this appendix compares the two expected inflation measures; the expected inflation set as the released inflation rate in the previous year on *RPI* and that estimated by the Bank of England as implied in government bond trading.

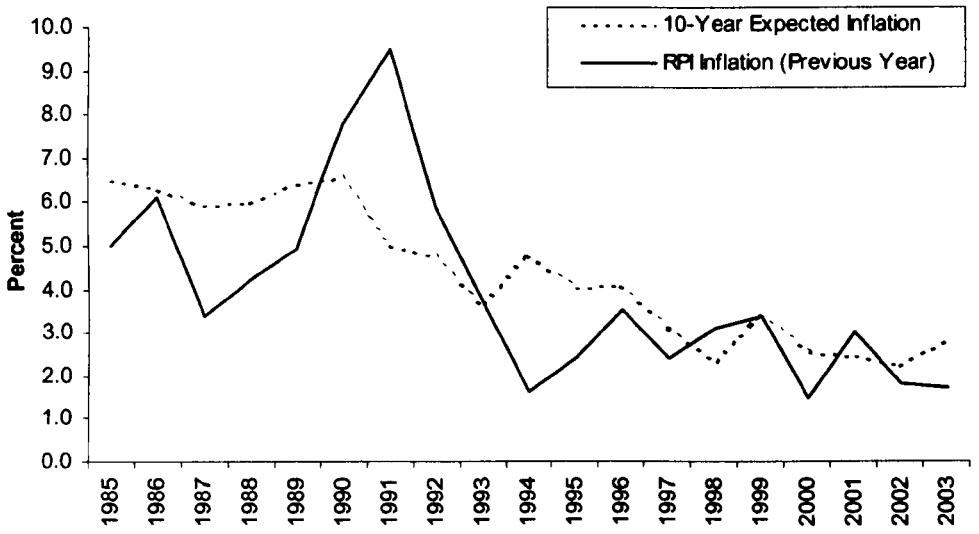

Figure 4-14: Expected Inflation Estimation - Comparison

The solid line represents expected inflation set as the released inflation rate in the previous year on RPI (average 1985-2003: 4.35 percent). The doted line represents expected inflation estimated by the Bank of England as the market expected inflation implied in the 10-year government bond (average 1985-2003: 3.94 percent), the estimates are only available from 1985. This comparison shows that relying on either estimate will not lead to differences in the conclusion given their tracking pattern.

5 Chapter Five: Investment Knowledge and Stock Price Rationalisation: Evidence from Property Investment Stocks

5 Chapter Five: Investment Knowledge and Stock Price Rationalisation: Evidence from Property Investment Stocks

Abstract

In the context of 'valuation bias in the stock market' we seek evidence for the role of 'investment knowledge' in 'stock price rationalisation' from property investment stocks exploiting the special investment characteristics of their underlying assets and operations. We establish the presence of a significant and enduring market discount to the underlying value for property investment stocks on ongoing concern even after correcting the accounting NAV to liquidation value (called Triple-NAV). We test the hypothesis that property investment stocks discount is a reflection of investment knowledge-based rationality that limits irrationality or valuation bias for these stocks H_0. The null hypothesis is tested by establishing knowledge-based rational explanations for property stocks market valuation or discount. The evidence suggests that we cannot reject H_0.

We find that the percentage return differential between the expected return on property stocks and the underlying return on actual capital employed in property companies explains market value discount. Market capitalisation of property stocks adjusts down from NAV first to account for debt fair value movements and contingent capital gains tax liabilities to Triple-NAV and further to produce the required rate of return demanded by investors. Consistent with this conclusion, we establish, statistically, a strong positive direct relation between the discount and operating expenses.

The evidence shows that unrealised capital gains are very significant in the underlying value. Hence, investor perceptions about the risk of realising these gains could be one of the factors behind the discount fearing property prices falling or even crashing. This is confirmed in closing the discount gap when liquidation is assumed because of the higher level of certainty. Leverage has a negative direct relation with market valuation for property stocks contributing to the discount while it has a positive impact on value for the non-financial sector. The interpretation for this opposite impact of leverage on property stocks is that property has a moderate income yield which makes leverage riskier.

Consistent with the null hypothesis, (a) our regression analysis supports the argument of knowledge-based rationality providing rational explanations for market valuation and the discount, and (b) the evidence confirms the stability of property stock prices relative to the economy and fundamental value, unlike the overall stock market, to accord with property-specific factors rather than with the direction of the overall stock market.

5.1 Introduction

The study in Chapter 3 on valuation bias and stock age established the presence of valuation *bias* for new stocks relative to older stocks. The research in stock market levels in Chapter 4 suggests that the market has a tendency for upward *overall bias* relative to fundamentals. The motivation for the present chapter stems from these results and namely from one of the implications of Chapter 3. The implication that investors could overvalue new stocks by exaggerating their potential relative to older stocks because the market knows relatively less about new stocks.

To explore the role of investment knowledge in rationalising stock prices, the key issue in this chapter is establishing whether the deviation from fundamental value (the persistent discount) for property investment stocks can be explained rationally because of the greater "investment knowledge". This idea of behaviour rationalisation by knowledge will be explored by exploiting the special investment characteristics of UK property investment stocks. For this category of stocks, the values of the underlying assets are fairly well understood by investors.

Figure 5-1 illustrates the distinct difference in behaviour of property and non-financial stocks. The sample of property investment stocks used for this figure and for the empirical research reported in this paper, consists of all publicly traded real estate stocks with property investment activities. As shown in this figure, the overall non-financial sector of the stock market *always* traded at a *premium*-to-NAV, with a weighted average premium over the full sample 1990-2002 of 144.35 percent, i.e. market-to-book of 2.44. Property investment stocks traded *almost always* at a *discount*-to-NAV, with a weighted average discount over 1990-2002 of 21.31 percent, i.e. market-to-book of 0.79. [82]

[82] Appendix 5.6.1 presents quartile statistics for property stocks discount-to-NAV.

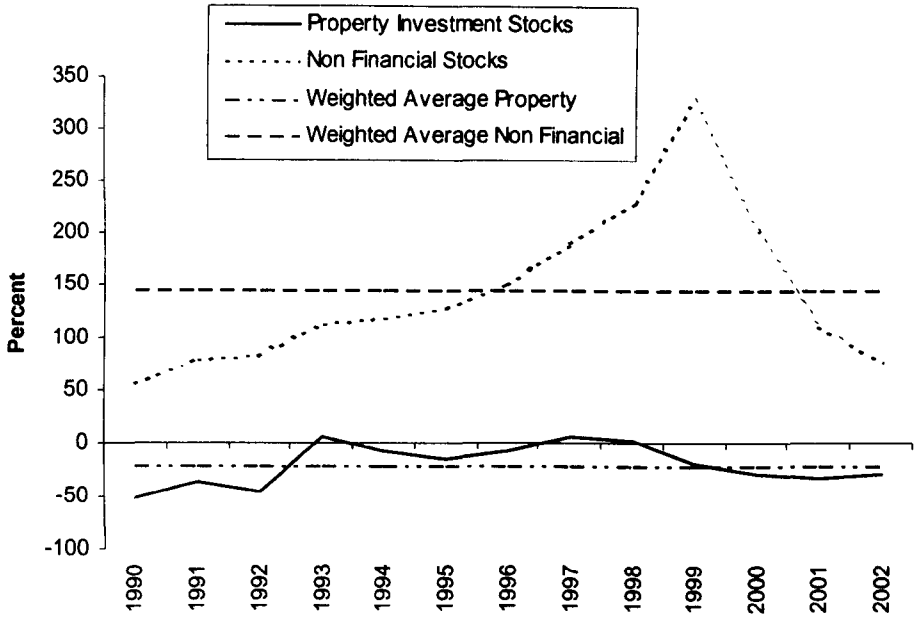

Figure 5-1. Premium/Discount-to-NAV

Premium and discount-to-NAV are represented with positive and negative signs respectively. They are calculated as (MVE – NAV)/NAV, where MVE is market value of equity and NAV is net asset value of the accounting balance sheet. In the case of property investment stocks, the principal assets on the balance sheet that determine net asset value are commercial properties. These are valued, for accounting purposes, using surveyors' valuations of current market value while the assets for non-financial stocks assets are valued according to the standard accounting criteria, usually historical cost. Property investment stocks sample contained all publicly traded real estate stocks with rent to total property revenues in excess of 20 percent (i.e. those with significant property investment activities).[83] Note that unrealised capital gains are transferred direct to the reserves. The sample starts in 1990 because of the small number of property companies listed before that year. Observations for property stocks and non-financial stocks ranged between 24 and 51 per year (average 40) and 488-1151 (average 726) respectively. Weighted average *discount* for property stocks is 21.31 percent and *premium* for non-financial stocks is 144.35 percent calculated over 1990-2002 by dividing the aggregate discount (premium) by the aggregate NAV for all companies over all years in each sample. For the most recent history, discount-to-NAV for property companies over 2001-2002 for companies with over 70 percent rent to total property revenues is higher (34.05 percent).[1]

Assuming that surveyors' valuations used to compute net asset value are a reliable measure of the realisable value of the underlying property assets given the use of comparable market evidence, then the ongoing value of property investment stocks is lower than the break up value that would be achieved by dissolving the property investment companies and selling all their commercial property holdings. This fact, that they trade at a discount to their liquidation values, makes property stocks a special case, somehow similar perhaps to investment trusts (closed-end

[83] Barkham and Ward (1999) stated that the majority of property companies listed in the UK are property *investment* companies. Although a few of them have some non-property activities, these activities make a very small contribution to the profits of those companies.

funds) that also trade at a discount to realisable value and also to real estate investment trusts.

Matysiak and Brown (1997) find that the majority of the UK property companies exhibited an enduring risk-adjusted underperformance profile over the period 1980-1995. This underperformance was not statistically significant. Barkham and Ward (1999) examine two hypotheses to explain the discount of the UK property stocks; (a) the discounts are the result of agency costs, contingent capital gains tax liability, and a number of other firm specific factors, (b) the discounts result from the interaction of noise traders and rational investors. Their evidence suggests that both hypotheses have utility in explaining property company discounts. On US Real Estate Investment Trusts (REITs), Gentry, Jones, and Mayer (2003) conclude that aggregate price-to-NAV appears to be stationary and mean-reverting and that their results although related to similar findings in the closed-end fund literature, it is unlikely that REIT premiums and discounts reflect the investor sentiment hypothesis of Lee, Shleifer, and Thaler (1991). In this study, we investigate whether property investment stocks discount is a reflection of the reliable investment knowledge about these stocks leading to limited irrationality and limited valuation bias compared to the overall stock market.

Based on the above introductory discussion, we formulate and investigate the following null hypothesis:

> H_0: *Property investment stocks discount is a reflection of investment knowledge-based rationality that limits irrationality or valuation bias for these stocks.*
>
> In other words, *valuation bias is less for property investment stocks relative to non-financial stocks (as per Chapters 3 and 4) because of the greater investment knowledge about the former.*

Against the alternative:

H_1: The investment knowledge about property investment stocks has no distinctive role in rationalising their prices or limiting their valuation bias.

The null hypothesis will be tested by examining rational explanations for property stocks discount (or their pricing). Investment-knowledge about property stocks (or their investment characteristics) means the specific information about the levels and limits of future potential of income, income growth, capital growth, risk, and other firm specific factors such contingent capital gains taxes and debt market value impact. This knowledge is derived from the knowledge about the underlying assets (property investments) and operations.

We first documented in Figure 5-1 above the phenomena of the persistent property stocks discount-to-NAV. This discount appears relatively stable when compared with the behaviour of the premium of the non-financial sector. An important element of the analysis is to derive as accurate measure as possible for the discount. For various reasons the raw accounting NAV, as reported in Figure 5-1, is not completely accurate. Therefore, NAV is corrected, for robustness check, later to liquidation (break up value using the so-called Triple-NAV) to take into account the impact of debt market value movements and contingent capital gains taxes on properties.[84]

Section 5.2 discusses the investment characteristics of property stocks, distinguishing them from the tax-efficient real estate investment trusts (REITs). The analyses and tests are carried out using two datasets. One is retrieved from Datastream for the period 1990-2002 and the other collected by hand for the period 2001-2003. The latter includes property specific information that is not available on the usual financial databases like Datastream and is used for a more detailed analysis especially to derive a more accurate measure of the discount in Section 5.4. The data are discussed in Section 5.3.

Our procedure is as follows. Section 5.4 presents the key results of this chapter. It tests the hypothesis that property investment stocks discount is the result of

[84] See definition and calculation of Triple-NAV in Table 5-4 page 189.

knowledge-based rationality by examining: (a) return differential between the required rate of return on property stocks and that delivered on the actual capital employed of the companies holding the underlying properties, also examining the impact of operating expenses, (b) other contributing factors to the discount such as the risk associated with the unrealised capital gains, and (c) statistical evidence, from regression analysis, for rational explanation of the market valuation and the discount. We then examine whether, consistent with the null hypothesis, property stock price behaviour is relatively more stable compared with fundamental value, the economy, and the overall stock market. This is done by examining over time: (a) the behaviour of property stocks discount versus the premium of non-financial stocks, (b) stock price behaviour relative to the economy and implied growth testing, (c) comparative earnings yield behaviour, and (d) the evolution of property stock beta. Section 5.5 concludes.

5.2 Definition of Property Investment Stocks; Why they are Different from REITs

Real Estate umbrella covers *property* investment, development, trading, agency, consultancy, management, etc. Construction companies come under a separate category. This chapter deals only with property investment stocks. UK property investment stocks are those of real estate companies that *mainly* specialise in holding properties as their investment or operating assets. In the UK, they have a normal corporate structure like most general industries.[85]

Scott (1996) states that property companies have been a part of the real estate scene in the UK for more than a hundred years and represent the dominant vehicle by which property is securitised in the UK. Currie and Scott (1991) updated by Barkham and Geltner (1995) document that the market capitalization of property companies in the UK is about 2 percent of the total market-cap and that they hold about 12 percent of the real estate in the UK institutional property market. Barkham and Ward (1999) note that property companies are subject to no special tax treatment and that they have their investment properties re-valued every year. The revaluation of properties to open market value is undertaken by specialist valuation surveyors based on comparable market evidence according to the Red Book of the Royal Institute of Chartered Surveyors (RICS). The revaluation is reflected in the balance sheet providing a market value estimate of their total and net asset values.[86]

At this early stage, it is worth clarifying the differences and similarities with the Real Estate Investment Trusts.[87] Real Estate Investment Trusts (REITs for short, pronounced "Reets"), a form of corporate structure, first created in the

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[85] Most UK listed property investment companies hold commercial properties in their portfolios; very few of them have some residential property element (e.g. key worker accommodation). Also, Barkham and Ward (1999) stated that the majority of property companies listed in the UK are property *investment* companies. Although a few of them have some non-property activities, these activities make a very small contribution to the profits of those companies.

[86] Of course, as asset values are updated annually for property investment stocks, that makes them more accurate than historic cost valuations used for the assets of most non-financial companies.

[87] Source for information about REITs: Campbell and Sirmans (2002), Gentry, Jones, and Mayer (2003), and also the website of the National Association of Real Estate Investment Trusts.

US in 1960, with key tax advantages. A *REIT* is a company that owns, and in most cases, operates income producing real estates. Some of them finance real estate. They are similar to other companies as they often fund their operations by raising capital from external markets. They usually take the form of public companies (usually traded on major stock exchanges) where investors can buy shares in them to make indirect property investments. They are similar to European unit trusts and US mutual funds, but different from European listed property companies.

REITs own and often operate relatively illiquid real estate assets unlike closed-end funds. The similarity between the two is the ability to gauge the market value of the REIT by valuing its underlying assets like for closed-end funds. In Europe they have been only authorised in the Netherlands, recently Belgium and very recently France. The authorisation of REITs is also being discussed in the UK, though the Government did not address them in 2005 budget as was anticipated. REITs are classified in the following categories: (1) Equity REITs, own and operate income-producing real estate; (2) Mortgage REITs, lend money direct to real estate owners and their operators, or indirect through acquisition of loans or mortgage-backed securities; and (3) Hybrid REITs, are companies that both own properties and make loans to owners and operators.

To qualify as a REIT in the US, a firm must meet certain asset and income tests to prevent them from using their tax-advantage status in other business areas. They must earn at least 75 percent of their income from real estate-related investments and 95 percent of their income from these sources as well as dividends, interest and gains from securities sales. In addition, at least 75 percent of their assets must be invested in real estate, mortgages, REIT shares, government securities, or cash. They must distribute at least 90 percent (was 95 percent before 2000) of their taxable income to shareholders annually in the form of dividends every year. This distribution requirement is based on taxable income rather than financial reporting income.

The benefit of qualifying as a REIT is avoiding the double taxation of equity-financed investment. Unlike regular companies, they receive an annual tax deduction for dividends paid out to shareholders. REITs often distribute all of their taxable income to shareholders each year, which eliminates the corporate tax completely, where of course it is taxed at the shareholders level. Advocates of REITs argue that these vehicles: (a) improve liquidity in local real estate markets; (b) reduce cost of capital; and (c) promote more efficient allocation of capital. REITs allow individual and institutional investors to make equity investments in real estate without incurring the high transaction costs that are related to direct property investments while avoiding the burden of double taxation.[88]

It is worth noting that price-to-NAV according to Gentry, Jones, and Mayer (2003) was close to one on average for US REITs while UK property stocks price-to-NAV ratio is significantly and persistently below one even after correcting their NAV to liquidation level as shown later. The reason for this difference comes mainly from that US REITs are tax-advantaged vehicles where they almost pay no corporate tax at all while UK property stocks are taxed on operating income and realised capital gains like any other company. At 30 percent UK tax rate for property companies, one could justify the difference in price-to-NAV.

[88] Property transaction costs: Agency commissions, legal fees, due diligence costs, and stamp duty.

5.3 Data

This research uses annual data from the Datastream – Thomson Financial database for the years 1990 through 2002. The dataset constitutes of all the UK listed Real Estate companies (518 observations). Table 5-1 below presents the data items retrieved. The dataset of the UK non-financial stocks used for chapters 3 and 4 (of which 9440 observations were included here for 1990-2002) is used for this chapter too. Data on Investment Property Databank Index (IPD), GDP, Interest Rates, different stock indices (capital indices, dividend yield, and total return indices), etc were all retrieved from Datastream. Property Sector bids 1999-2002 data were obtained from a Merrill Lynch report of 2002. Appendix 5.6.1 shows a list of all publicly traded property companies in the UK.

Datastream and similar sources do not provide property company specific disclosures. Therefore, a more detailed analysis sample 2001-2003 was introduced using data collected by hand from the annual reports of property companies to refine and test the robustness of the analysis based on the Datastream's 1990-2002 data. Thus, for example, the discount and return on capital for these companies are measured more accurately taking into account tax and debt market value impact on NAV and the discount. All the data are used to explain the discount. Most annual reports were requested direct from the companies or their agents. Available reports for the detailed analysis were 100, distributed into 27 observations in 2001, 48 observations in 2002, and 25 observations in 2003. Table 5-2 below shows the items obtained for this property-specific detailed dataset with their calculations where relevant.

It is worth pointing out that small-size sample has been encountered by previous research looking into the UK property stocks. For example, Barkham and Ward (1999) conducted their research using three years worth of property stock-specific data containing only 87 observations. Even research on US REITs has encountered the same, for example Gentry, Kemsley and Mayer (2003) used a sample of just 85 REITs with 389 observations for the period 1992-1999.

Symbol	Description	Datastream Code
NAME	Firm name	NAME
YEAR	The year which the data belong to (current year)	YEAR
CE	Capital employed or Invested capital	322
DTBS	Deferred taxes (balance sheet account)	311
DTIS	Deferred taxes for the year (P&L)	161
EBITA	Earnings before interest, taxes, and amortisation	1502
EMPCOSTS	Employee costs	117
EXOR	Extraordinary items after tax	193
INVP	Investment properties in market value estimate	863
MVE	Market value of equity (market-cap)	HMV
NI	Net income, earned for ordinary shareholders	625
OEQ	Ordinary equity capital and reserves	305
RENT	Rent income	106
REVAL	Property revaluation reserve	397
TPREV	Total property revenues	805

Table 5-1. Datastream Raw Data Items 1990-2002

Data source: Datastream – Thomson Financial. The codes under symbols are those used in this document. Book equity BE and Earnings were adjusted for deferred taxation and extraordinary items as in Chapter 3 to obtain NAV and EGS respectively.

Description (Symbol)	Notes / Calculation
Property investment company name	--
Administrative expenses (*AEX*)	£
Book value of debt (*BVD*)	£
Book value of minority interests (*BVMI*)	£
Capital Employed or Invested Capital (*CE*)	Equity capital + debt + minority interests
Contingent capital gains taxes (*CCGT*)	Contingent capital gains tax liability on properties if they were sold at the reported value (as per the independent professional valuation at the balance sheet date inline with the Red Book of the Royal Institute of Chartered Surveyors).
Debt fair value adjustment (*FVAD*)	FRS 13: (debt fair or market value including the related derivative securities – debt book value) × (1 – Tax rate)
Discount-to-NAV (*DISC*) percent	(NAV – MVE)/NAV
Discount-to-NAV £	NAV – MVE
Discount-to-Triple NAV (*DISC3N*) percent	(Triple NAV – MVE)/ Triple NAV
Discount-to-Triple NAV £	Triple NAV – MVE
Earnings (*EGS*)	Net income – Extraordinary items + Deferred taxes for the year
Earnings yield (*EY*)	*EGS/MVE*
EBITA	Earnings before interest, taxes and amortisation
Fair value of debt (*FVD*)	Debt market value estimate disclosed according to FRS13. This includes the MV of debt-related derivative securities.
Investment properties (*INVP*)	Open market value of the investment properties at the balance sheet date according to the Red Book of the Royal Institute of Chartered Surveyors (RICS). Values are provided as an independent professional valuation.
Market-cap or Market value of equity (MVE)	Shares outstanding × Share price at the balance sheet date
Net asset value (NAV or BE)	Shareholders funds or OEQ + Balance sheet deferred taxes DTBS
Property or Portfolio expenses (*PEX*)	£
Property revaluation reserve (*REVAL*)	Cumulative unrealised capital gains
Rent	Rent income (from P&L)
Rent yield (*RY*) or Property yield	Rent/ Investment properties market value
Return on capital employed (*ROCE*)	EBITA/Capital Employed (before-tax)
Share price (*P*)	As of balance sheet date
Shares outstanding	As of balance sheet date
Triple-NAV (or NNNAV)	NAV – (*FVAD* + *CCGT*)

Table 5-2. Property Stocks Detailed Hand-Collected Dataset 2001-2003

5.4 Property Investment Stocks Discount: Is it Knowledge-Based Rationality?

This section presents the core analysis of this chapter. It aims at providing explanation for why property investment stocks trade persistently at a discount to net asset value. Having documented the relative stability of property stock prices, this investigation is about whether property stock prices are less subject to valuation bias than other stocks. Explaining the discount and the behaviour of property stocks over time will provide evidence that property investment stocks are priced according to knowledge-based rationality, not valuation bias.

The section is arranged as follows.

1. Section 5.4.1 examines the difference between the expected return on property stocks and the underlying return on actual capital employed in property companies (i.e., Does return differential justify the discount?). This reveals empirical evidence about the impact of operating expenses, as a major factor, on the discount.

2. Section 5.4.2 deals with other contributing factors to the discount. This addresses, briefly, the materialisation risk of the unrealised capital gains, mismanagement risk (agency costs), and the financial risk of leverage.

3. Section 5.4.3 deals with explaining market valuation of property stocks (or their discount) rationally in a cross-sectional analysis to support the argument of knowledge-based rationality.

4. Section 5.4.4 examines in more detail the relative stability of property stock prices against fundamental value, the economy and the overall stock market.

5.4.1 Does Return Differential Justify The Discount?

In this sub-section, we first establish empirically the level of the required total rate of return on property investment stocks with reference to the underlying property investment asset class. Then, we compare this total required rate of return with the total return on capital employed of the property companies (the vehicles holding the underlying investment properties). The percentage difference between the two is called "*Return Differential*".

Total returns are compared between the overall stock market, property stocks, direct property investments and government bonds to establish the level of return expectations for property stocks investors based on empirical realised levels. Figure 5-2 below shows how close is the total return on the direct Property Investments and FTSE Real Estate indices. The capital growth on the property stocks in the FTSE Real Estate is higher than on properties themselves as in the case of property stocks capital gains reflect retained earnings as well as the capital growth in the underlying properties.[89]

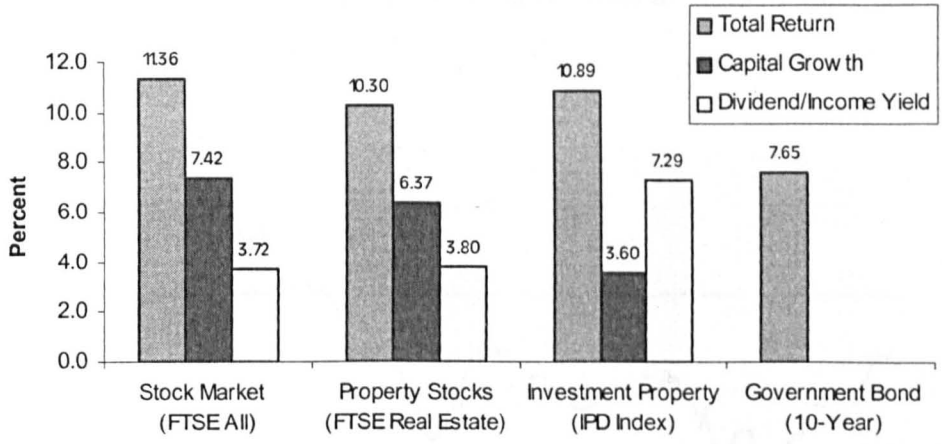

Figure 5-2. Comparative Total Return[90] – Average 1986-2002

FTSE Real Estate Index is only available from 1985, therefore the period used is 1986-2002 to show comparative returns for as long period as possible. IPD Index is the Investment Property Databank Index (direct property investment). All returns are annual nominal as inflation-adjustment applies equally to all and hence does not affect the comparison. Total return is calculated as the annual percentage change in the total return indices for the first three categories (capital growth + dividend or rent yield) apart from government bond where the redemption yield on the 10-year government bond benchmark is presented.

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[89] The accounts of property companies show clearly, up to the end of the sample period, that property unrealised capital gains are transferred directly to the reserves.

[90] It is worth noting that total returns on the stock market and property stocks are geared returns. The same is applicable to property investments as they are indirectly geared where held by geared companies or investment vehicles or where directly geared (e.g. direct mortgage). This keeps the three measures comparable. Also, note that renal income yield on property is close to the yield on government bond – slightly below for the balance of risk/growth differences.

As a start point to understand return expectations; working backwards: How total return on property stocks compares to that of the overall stock market? Figure 5-2 above shows that the difference in average total return terms (stock price change and dividend income) between FTSE All and Property Stocks over 1986–2002 is about 1 percent. This is attributable to the difference in stock price appreciation (capital gains) as dividend yields are very similar. Over this period property stocks have under-performed the overall stock market. Figure 5-3 below shows that property stocks have systematically under-performed the overall stock market as measured by total returns to shareholders. Annualised volatility measured by the standard deviation over the period 1986-2002 for total returns on FTSE ALL and FTSE Real Estate is 16.94 and 20.47 percent respectively. The monthly mean abnormal return of –0.15 percent has a monthly standard deviation of 4.2 percent and a *t*-statistic of –0.04 indicating that the underperformance of real estate stock index, although is in existence, is not statistically significant. Replicating the same analysis over the period 1990-2002 leads to the same conclusion. This is consistent with the findings of Matysiak and Brown (1997).[91] Hence, total returns, on average, between the overall stock market and property stocks are not so different.

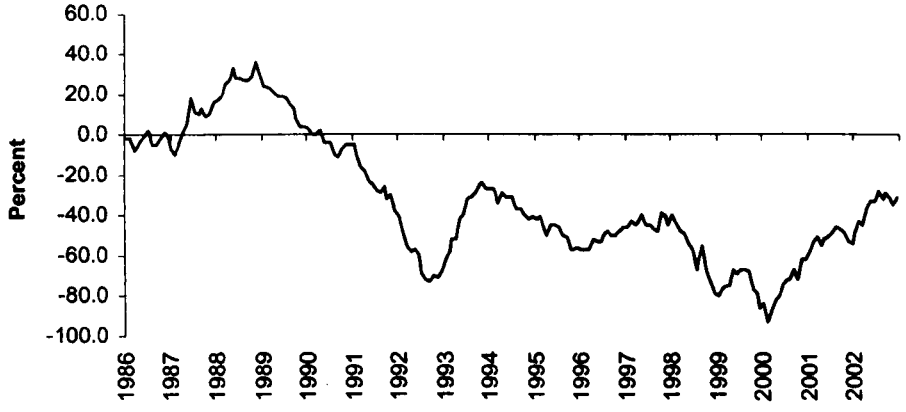

Figure 5-3. Market-Adjusted CAR: FTSE RE v FTSE ALL 1986-2002

Market-adjusted Cumulative Abnormal Returns (CAR) are calculated using monthly total return (capital appreciation and dividends) of FTSE Real Estate Index against FTSE ALL Share Index. FTSE Real Estate Index is only available from 1985, therefore the period used is 1986-2002 to show comparative returns for as long period as possible.

[91] Matysiak and Brown (1997) find that although the majority of property companies analysed over the period 1980-1995 exhibited an enduring underperformance, this was not found to be statistically different from zero. For the few companies delivering a positive abnormal performance, it did not prove statistically significant.

The second question working backwards: How total return on property stocks compare to that of direct property investments? Figure 5-2 above shows that over 1986-2002, total returns, on average, are similar for property stocks and property direct investments (gross returns). Bearing in mind that capital growth on property stocks reflects both retained earnings and property unrealised capital gains. In a time-series fashion, Figure 5-4 below shows a comparison between total returns on direct property investments and property stocks confirming the close link and averages between the two. One argument about the higher volatility of property stocks total returns could be the result of speculative activities in stocks as they have more liquid market relative to properties and because of property significant transaction costs. Given the significant bid/ask spread on property stocks, this argument is not strong and might not be valid. A stronger more correct explanation is that direct property investment figures are just made up! They are artificially smoothed as a result of the surveyor valuation process. The measured returns on direct property investment are actually not attainable. Also, This volatility could be also affected by the lead/lag in reaction and/or over-/under-reaction of property stock prices to changes in the underlying property returns. However, there are no dramatic differences in their pattern of tracking or average returns.

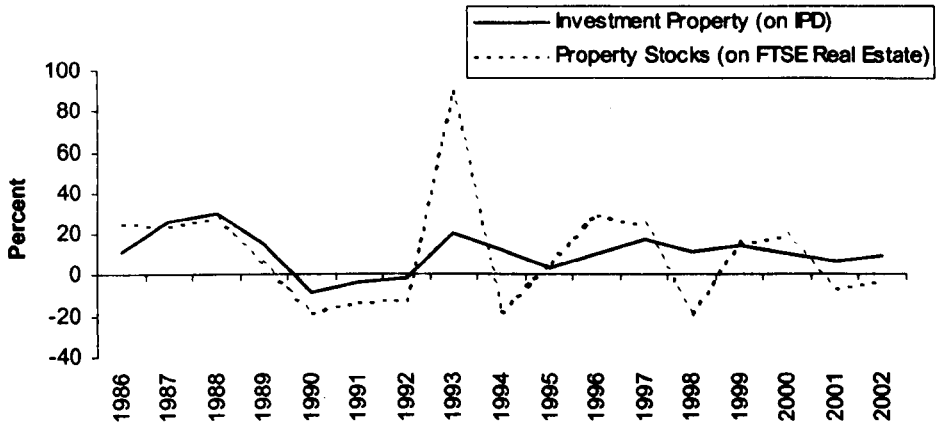

Figure 5-4. Comparative Total Return – Time Series 1986-2002

Property Stocks: FTSE Real Estate Index is only available from 1985. Therefore, the period used is 1986-2002 to show comparative returns for as long period as possible. Property Investment: IPD Index is the Investment Property Databank Index (direct Investment in property). All returns are annual nominal as inflation-adjustment applies equally to all and hence does not affect the comparison. Total return presented is calculated as the annual percentage change in the total return indices reflecting capital appreciation and dividend/rent income.

The conclusion from the above empirical observations is that the realised required total rate of return on property investment stocks matches the total return on direct property investments.

While property stocks and direct property investments have, despite the noise, similar average total returns, how could property stocks returns be similar to the total returns of the underlying assets while the latter are still subject to operating expenses while earnings growth is limited by the rent income levels and their growth?

Total returns on direct property investment are 'gross' before property and corporate administrative expenses. Therefore, the fact that total return of property stocks is close to that of direct investment would be consistent with the discount these stocks trade at. That is because for total return on property stocks to be, on average, similar to that on the underlying assets, market-cap has to adjust below the NAV. It is important to clarify that the return on real estate stocks is also measured gross. The spread, stamp duty and brokers fees could all reduce returns. If these stocks are small, the spreads could be very wide (e.g. 10 percent). Valuing the underlying property investments according to the Red Book of the Royal Institute of Chartered Surveyors (RICS) requires subtracting purchaser's costs from gross value (typically 5.75 percent being 4 percent stamp duty, and 1.75 percent for agent and legal fees) and reporting net values leaving the underlying property gross returns (rent and capital growth) subject to operating expenses on the corporate level and frictional costs on property stock transactions which is consistent with the presence of a discount. The return simulation in Figure 5-5 below clarifies this further. Refer to Appendix 5.6.3 for the detailed simulation. This applies to the ongoing concern status. Soon liquidation is assumed, the discount gap would narrow down to reflect the net realisable values as discussed later in Section 5.4.2.

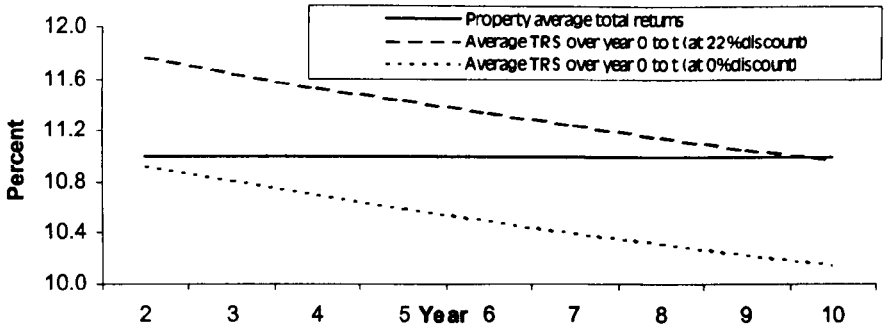

Figure 5-5. Total Return Simulation for Property Stocks

This simulation uses a single hypothetical property investment company where the P&L and Balance Sheet are projected for 10 years using, for simplicity, constant assumptions about rental yield, property capital growth, expenses ratios, etc to track average total stock returns under two scenarios of discount to liquidation value; called Triple-NAV (22 and 0 percent). See the definition and calculation of Triple-NAV in Table 5-4 page 189. See Appendix 5.6.3 for the detailed simulation. TRS is Total Return to Shareholders on property stocks (price appreciation plus dividend yield).

Figure 5-5 above shows that at zero percent discount to liquidation value property stocks will under-perform the gross returns of direct property investments almost immediately. While when priced at 22 percent discount, average total stock return over 10 years will match that of gross property average total return.[92] Note that property companies have refurbishment and redevelopment cycles, which besides engaging in new investments, will improve the mature performance so it does not have a declining trend as Figure 5-5 might suggest based on its simplified assumptions.

We have established, in the above, that the required total rate of return on property investment stocks matches the total return on direct property investments. The second step is to show empirically, using property specific disclosures, whether there is a *return differential* between the required rate of return (as on the underlying property assets) and the vehicles (property investment companies) that could justify the discount. Return differential is calculated as:

[92] By looking at Table 5-16 in Appendix 5.6.3 it is clear that dividend yield is the key, where stock price appreciation would be the same in percentage terms year-on-year for any same discount level while dividend yield with same monetary amounts will increase with the discount and vice versa. The numbers appeared in Table 5-16 for the percentage stock price appreciation will not change if the discount level was different while maintained the same from year to year. Note that these numbers are the same whether discount was at zero or 22 percent. Dividend size (in £ terms) is bound by rental income, property and administrative expenses, interest charges, taxation and payout ratio, i.e. (Rent – PEX – AEX – INT – TAX) × Payout ratio.

Equation 5-1: $$RD = \frac{PTR - TROCE}{TROCE}$$

where *RD* is return differential, *PTR* is property total return (the total return on the underlying property investment portfolio made up of rent yield and capital growth), *TROCE* is total return on capital employed in the property company, that is *ROCE* after adding the annual unrealised capital gains on the underlying property portfolio.

Using the 1990-2002 sample, in Table 5-3 compares property pre-tax total returns with property corporate vehicles' pre-tax total *ROCE* (return on capital employed) to estimate the discount based on return differential and compare that to market value discount. Both pre-tax total *ROCE* and property pre-tax total return are on a firm or enterprise basis for consistency.[93] The main result of this analysis is in the comparison between return differentials and property stocks discounts. Table 5-3 shows on a pre-tax basis, in weighted averages, gross total property return over 2001-2003 of 7.08 percent (total returns on property direct investments including capital growth), the accounting-based *ROCE* is calculated after adding estimated unrealised capital gains. That resulted in *TROCE* of 5.78 percent. The percentage return differential between the underlying assets' total return and the vehicles' total returns is 22.49 percent compared to the actual discount-to-NAV of 21.31 percent.[94] Consistent with the null hypothesis, this evidence suggests that, on ongoing concern, market value discounts can be justified by return differential as the latter predicts the actual discount very closely to produce the rate of return demanded by investors.

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[93] Although, the discount is expressed on equity basis where leverage is part of the equation with interest as tax-deductible generating tax shield, we still relied on firm perspective as it is more consistent. Property current returns are moderate and debt servicing could prove difficult with small adverse changes in the debt market. Therefore, factoring the extra financial risk makes debt almost value neutral and renders its use just as a funding facility that might not create much value to shareholders. Historically, borrowing helped in making property empires because of the impact of high inflation on transferring wealth in real terms from lenders to borrowers. Also, using *ROE* will be problematic as it on after-tax basis and capital gains need to be adjusted for leverage.

[94] Other contributing factors to the discount could affect the accuracy of return differential such as the risk of the unrealised capital gains, agency costs, and leverage, besides other minor factors, for example, the estimated annual unrealised capital gains added to *ROCE*, besides being an average estimate, was effectively applied to the whole capital employed while in fact it is only applicable to the majority of capital employed in the investment properties and not to the elements of working capital. Another example, the positive impact of property trading and development profits on *ROCE* for the few companies that have them.

Period: 1990–2002		*Percent (pa)*
Underlying Property Investment Returns (pre-tax)		
Rental yield (RY)		7.04
Unrealised capital gains (CG)		0.04
Property total return (PTR = RY+CG)		**7.08**
Property Investment Companies Return on Capital Employed (pre-tax)		
Before unrealised capital gains ROCE		5.74
After unrealised capital gains TROCE = ROCE + CG		**5.78**
Return Differential: Properties versus Property Stocks (This is the discount as predicted by return differential)	*Percent*	**22.49**
Actual period weighted average Discount-to-NAV	*Percent*	**21.31**

Table 5-3. Property Stocks Discount v Return Differential 1990-2002

The sample consists of 518 observations as available from Datastream. The sample covers 1990-2002. All numbers are in pooled weighted averages for the period for all companies. Rental yield is calculated by dividing rent income by the value of the property portfolio. Unrealised capital gains rate is estimated as the compound annual capital appreciation on IPD for the period as the accounts do not show consistently annual capital growth. ROCE is calculated as EBITA/Capital employed. Total ROCE (denoted TROCE) is calculated after adding the unrealised capital gains to compare on total return basis. Return differential is calculated as (PTR – TROCE)/TROCE. All are before tax for consistency. Actual discount-to-NAV is calculated as (NAV – MVE)/NAV. Using arithmetic averages instead of weighted averages gives similar results.

Notwithstanding the above conclusion, there is a problem with the measurement of the *ROCE* and the discount using the usual NAV with other capital elements in the calculation. Accounting NAV is not a very accurate measure economically for the underlying value of property stocks mainly because of tax and debt implications. Therefore, we use the so-called 'Triple-NAV' to correct for the impact of property contingent capital gains taxes and debt market value adjustments. Triple-NAV is one of the most important indicators used in the market for this sector and its analysis is the most widely used for researching property investment companies. It is calculated as shown in Table 5-4 below.

AV	Assets value (total)
(1st N)	*Less* book value of total liabilities and other non-equity capital
NAV	Net asset value, (i.e. shareholders funds)
(2nd N)	*Adjusted* for marking debt to market value (net of tax[95]) according to the disclosure required by FRS 13 where debt is valued by the present value of future cash flows at market yield (Debt FVAD) [96]
(3rd N)	*Less* contingent capital gains tax (CCGT) on properties if they were sold at their market value at the balance sheet date; disclosed by property companies based on tax-specialist advice
Triple-NAV	Also referred to as NNNAV by some analysts [97]

Table 5-4. Triple-NAV Calculation

Since January 2002, there is another adjustment according to the disclosure required by FRS 19. That relates to timing differences on potential tax liabilities. All companies are required to make full provision for differences, which are not expected to be permanent, i.e. to treat them as some form of deferred taxation. This means that property companies must make provision for tax allowances that they have claimed (mainly on capital allowances), as they have to repay the tax if they sell the relevant property. This could be the 4th 'N' but we choose to ignore it as many market analysts do to ensure consistency in the data, as the information was not available before January 2002.

Unfortunately, property specific data are not available to correct the NAV to its realisable or liquidation level for the period 1990-2002. Therefore, we rely on a dataset we collected by hand, as described in the data section, for the period 2001-2003 to correct the measurement of net asset value, the discount, and the capital employed. Then we can assess the robustness of the conclusion from return differential derived from the period 1990-2002.

Table 5-5 shows a descriptive comparison between the discount-to-NAV and the discount corrected to Triple-NAV using the hand-collected data for property investment companies from their annual reports as was available over the period 2001-2003. The discount gap was reduced from 34.64 percent weighted average discount-to-NAV to 21.86 discount-to-Triple NAV after NAV was corrected to its realisable level.

[95] *Net of tax* debt market value adjustments because if debt is to be settled at market value then the premium paid (discount received) will be tax deductible (taxable).

[96] Falling interest rates over 1990-2002 resulted in negative impact on NAV for the period.

[97] The proportion of minority interests in property companies is minimal (average over 2001-2003: 0.85 and 0.46 percent of NAV and capital employed respectively). Therefore, we ignore the insignificant impact of minority interests NAV adjustments on common equity Triple-NAV. This would insignificantly increase the discount-to-Triple NAV if their related adjustments (debt FVAD and CCGT) were excluded from total adjustments.

Percent	Discount-to-NAV	Discount-to-Triple NAV
Weighted Average	**34.65**	**21.86**
Mean	32.50	23.40
Median	34.38	23.39
Standard Deviation	14.51	17.87
Obs	100	100

Table 5-5. Discount-to-NAV v Discount-to-Triple NAV 2001-2003

Sample period is 2001-2003 (hand-collected data). Discount-to-NAV is calculated as (MVE – NAV)/NAV. Triple-NAV = NAV – (Debt fair value adjustment + CCGT). Discount-to-Triple NAV is calculated as (MVE – Triple-NAV)/Triple-NAV. The weighted averages are calculated using the corresponding sums of NAV, Triple-NAV and MVE for the aggregate sample .

Before proceeding to repeat the test using Triple-NAV on the 2001-2003 detailed dataset, we study the relationship between Triple-NAV and ordinary NAV to examine the stability of this relationship to rely on where Triple-NAV is not available. Figure 5-6 shows a strong stable relation between the two measures offering some comfort for the use of only NAV for the period 1990-2002 in the above analysis. Nevertheless, return differential analysis is repeated below using the 2001-2003 data after correcting the NAV.

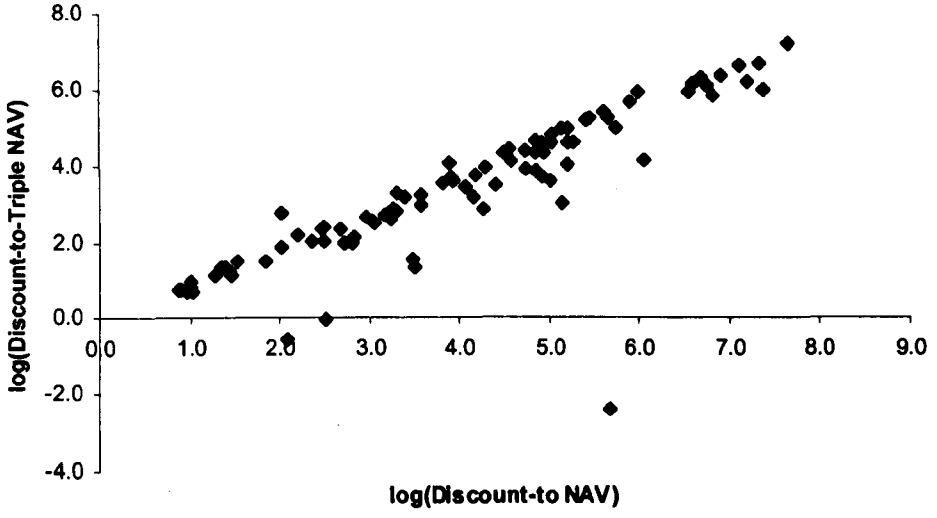

Figure 5-6: Discount-to-NAV versus Discount-to-Triple NAV 2001-2003

Discount-to-NAV is calculated as [NAV – MVE]. Discount-to-Triple NAV is calculated as [Triple-NAV – MVE]. Triple-NAV is calculated as [NAV – Debt fair value adjustment net of tax (marking debt to market value disclosed according to FRS13) – Contingent capital gain tax (disclosed in the annual report)]. Natural logs were used. Correlation is 0.86.

We now repeat the return differential analysis using the detailed sample 2001-2003 to establish the robustness of the conclusion from the 1990-2002 sample after correcting the NAV to the Triple-NAV (liquidation value). The results in presented in Table 5-6 below confirm that return differential using both NAV and Triple-NAV do explain the discount to a good extent. However, when correcting to Triple-NAV, return differential is a better estimate for the discount-to-Triple NAV than without the correction. Either way, this does not alter the conclusion.

So the gross total return on property investment that matches, historically, the required rate of return on property stocks is subject to operating expenses (property and administrative expenses). With other working capital requirements and other fixed assets, this leads to a gap between property total return and return on capital employed in property companies (the vehicles) where the latter is lower. Hence, for property stocks to produce total returns as demanded by investors inline with risk-free rate and other asset classes, market capitalisation of these stocks adjusts down from NAV first to account for debt fair value adjustments and contingent capital gains tax liabilities to Triple-NAV and further from that to produce the required rate of return by investors in these stocks. This is consistent with one of the two fundamental points about the economic value of equities [Smithers and Wright (2004)] that equities are financial assets. Hence, the rate of return is the start and end point in this case.

Period: 2001-2003	*£ Billion*	*Percent (pa)*
Net asset value (NAV)	57.2	
Market value of equity (MVE)	37.4	
Discount-to-NAV	19.8	**34.65**
Debt fair value adjustment	2.8	
Contingent capital gains taxes (CCGT)	6.5	
Triple-NAV	47.8	
Discount-to-Triple-NAV	10.5	**21.86**
Underlying Property Investment Returns (pre-tax)		
Rental yield (RY)		6.50
Unrealised capital gains (CG)		2.00
Property total return (PTR = RY+CG)		**8.50**
Property Investment Companies Return on Capital Employed (pre-tax)		
Before unrealised capital gains		
ROCE (NAV-based CE)		4.58
ROCE (Triple NAV-based CE)		5.03
After property unrealised capital gains		
TROCEa (NAV-based CE)		**6.58**
TROCEb (Triple NAV-based CE)		**7.03**
Return Differential: Properties versus Property Stocks (This is the discount as predicted by return differential)		
Using NAV (comparable to Discount-to-NAV)		**29.02**
Using Triple-NAV (comparable to Discount-to-Triple NAV)		**20.82**

Table 5-6. Property Stocks Discount and Return Differential, Corrected NAV 2001-2003

The sample consists of 100 observations as available from property investment companies which provided copies of their annual reports. The sample covers 2001-2003, the years contained 27, 48 and 25 companies respectively. The property specific data was extracted by hand. Discount-to-NAV is calculated as (NAV – MVE)/NAV. Triple-NAV is calculated as [NAV – Debt fair value adjustment net of tax (marking debt to market value disclosed according to FRS13) – Contingent capital gain tax (disclosed in the annual report)]. Discount-to-Triple NAV is calculated as (Triple-NAV – MVE)/Triple-NAV. Rental yield is calculated by dividing rent income by the value of the property portfolio. Unrealised capital gains rate was estimated as the compounded annual capital appreciation on IPD for the period 2001-2003 as the accounts do not show consistently annual capital growth. Pre-tax ROCE is calculated as EBITA/Capital employed defined in two ways in the table. Return differential is calculated using NAV as (Property gross total return – TROCEa)/TROCEa and using Triple-NAV as (Property gross total return – TROCEb)/TROCEb. All are before tax for consistency. Using arithmetic averages instead of weighted averages gives similar results.

It appears that because of property investment knowledge about income and growth levels investors are limited in their ability to exaggerate say growth potential and reflect that in price appreciation to match return expectations like the general case of most stocks. Where instead, the opposite happens, where they are priced on ongoing concern at a discount to their liquidation value to yield the

required rate of return guided by investment knowledge. This evidence suggests that we cannot reject the null hypothesis.

As the obvious main reason for return differential is Operating Expenses, we show below the relation between the discount and operating expenses using scatter plots. We use logs as the discount and the expenses are not in comparable levels (the discount is a stock-based measure reflecting the present value of future expenses, while expenses are the flow-based annual charge).

Datastream does not provide data on operating expenses (save for employee costs) or on contingent capital gains taxes or debt fair value adjustments for property stocks. Therefore, we use the 2001-2003 detailed sample to examine the relation between the discount-to-Triple NAV and operating expenses. We then test the robustness of that by examining the relation between the discount-to-NAV and Employee Costs for 1990-2002 (available from Datastream) given that employee costs are the major part of the administrative expenses for a property company. Based on 2001-2003 detailed sample, the ratios of staff costs to administrative expenses and to total operating expenses are 77 and 39 percent respectively. Figure 5-7, Figure 5-8, and Figure 5-9 confirm a clear direct positive relation between the discount and operating expenses consistent with the conclusion from return differential and the null hypothesis.

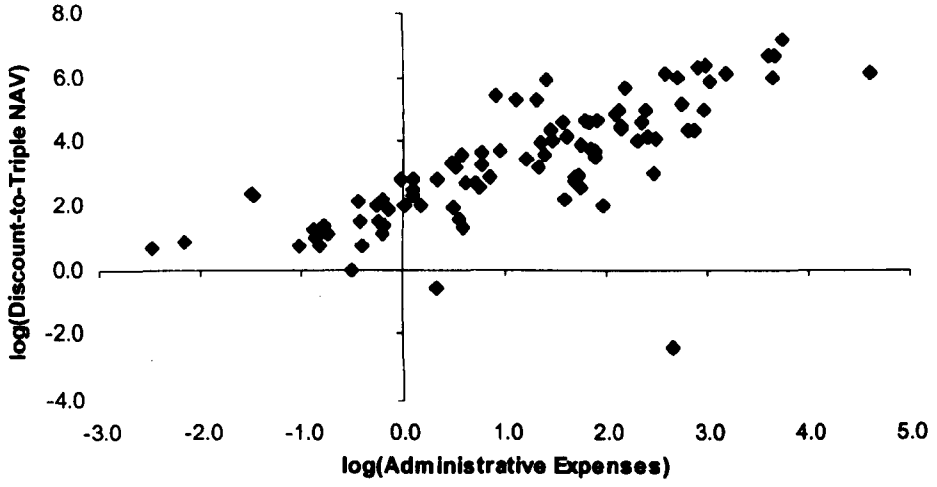

Figure 5-7: The Discount-to-Triple NAV and Administrative Expenses 2001-2003

Discount-to-Triple NAV is calculated as [Triple-NAV – MVE]. Triple-NAV is calculated as [NAV – Debt fair value adjustment net of tax (marking debt to market value disclosed according to FRS13) – Contingent capital gain tax (disclosed in the annual report)]. Natural logs of £millions were used for comparability. Correlation is 0.75.

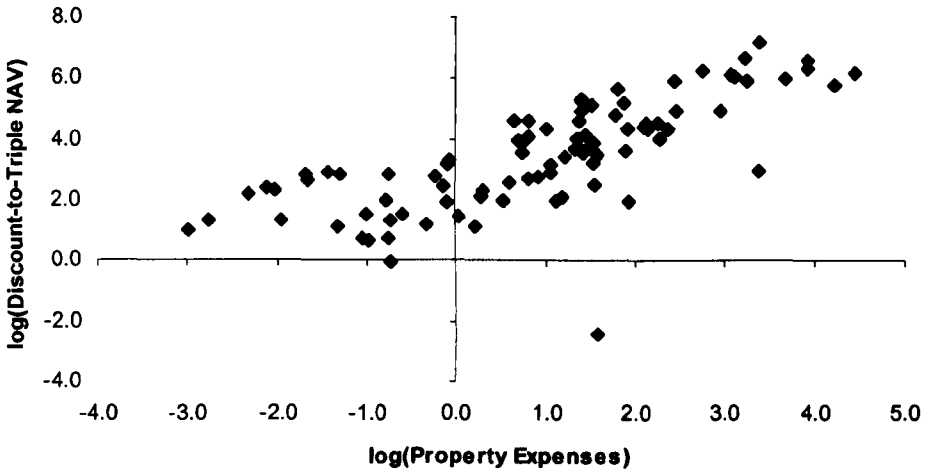

Figure 5-8: The Discount-to-Triple NAV and Property Expenses 2001-2003

Discount-to-Triple NAV is calculated as [Triple-NAV – MVE]. Triple-NAV is calculated as [NAV – Debt fair value adjustment net of tax (marking debt to market value disclosed according to FRS13) – Contingent capital gain tax (disclosed in the annual report)]. Natural logs of £millions were used for comparability. Correlation is 0.74.

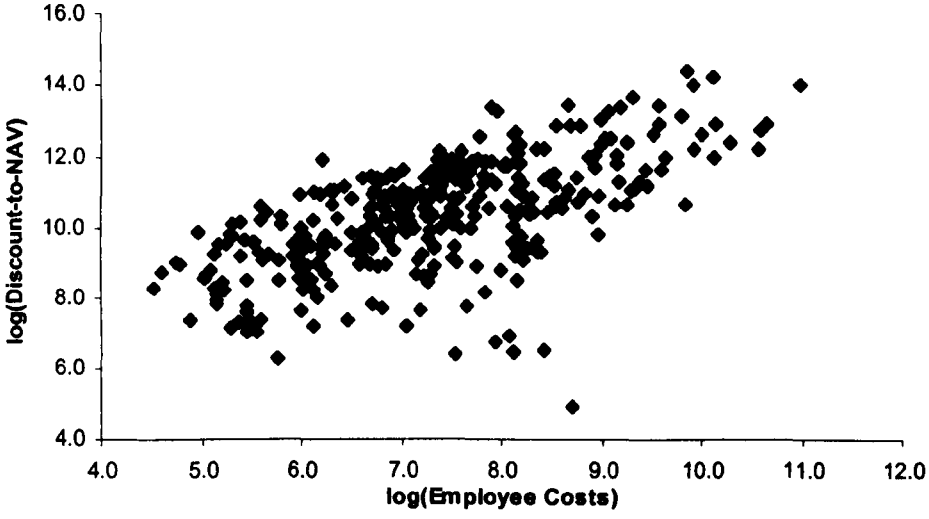

Figure 5-9: The Relation between the Discount-to-NAV and Employee Costs 1990-2002

Discount-to- NAV is calculated as [NAV – MVE]. Natural logs of £thousands were used for comparability. Correlation is 0.62. Based on 2001-2003 detailed sample, the ratios of staff costs to administrative expenses and to total operating expenses are 77 and 39 percent respectively

5.4.2 Other Contributing Factors to the Discount

Operating expenses, although a major factor, are not the only one that contributes to the discount. Other factors such as mismanagement risk (agency costs), leverage, and the materialisation risk of the unrealised capital gains will have an impact.

This study does not test for agency costs due to data availability. Leverage has a direct negative relation with value, i.e., positive relation with the discount. That is, the higher the leverage the lower the value and the higher the discount. This is confirmed by the regression analysis in Section 5.4.3 later. In Chapter 3 we saw a positive relation between value and leverage inline with standard finance theory in terms of taking leverage by companies to the extent tax shield benefits overweigh the additional financial risk associated with leverage. The interpretation for this opposite impact on property stocks is that property has a moderate income yield which makes leverage very risky where small changes in interest rates could yield to financial distress coming from short and medium term debt servicing obligations. Besides, finance costs are being incurred during the time period needed to develop or redevelop without income.

As for the materialisation risk of property unrealised capital gains, property stocks liquidation value grows with the unrealised property capital gains. Therefore, investors, on ongoing concern, where companies continue holding the properties, might view these unrealised gains as more risky compared to dividends (the risk of property crash for example). This means that part of the discount could be attributable to this risk perception. To support this argument, Table 5-7 below shows the significance of the cumulative unrealised capital gains as a percentage of the property portfolio value, NAV and Triple-NAV.

Percent	1990-2002	2001	2002	2003
	Pooled			
Cumulative revaluation reserve/Investment property value	30.04	28.02	37.08	37.18
Cumulative revaluation reserve/NAV	44.55	46.28	57.44	63.32
(Cumulative revaluation reserve – CCGT)/Triple-NAV	--	40.55	54.47	65.17
Observations	463	27	48	25

Table 5-7. The Significance of Property Unrealised Capital Gains

The ratios are calculated using the aggregate figures for all companies, i.e. a representative weighted average. 2001, 2002, and 2003 numbers are based on the detailed dataset. 1990-2002 numbers are based on Datastream dataset. CCGT is contingent capital gains taxes if properties were sold at their valuation at balance sheet date. Triple-NAV is calculated as [NAV – Debt market value adjustment – CCGT].

This leads to the scenarios where these capital gains are considered realisable (M&A and liquidation) at or close to their Triple-NAV in known property market conditions over very short horizon (could be just days). Merger & Acquisition activities test Triple-NAV in limiting market value movements. In cases of M&A, liquidation value is assumed as investors can either sell the company or break it up. From a basic *arbitrage* argument, if the break up value is greater than the value of the sale as a company, investors will choose the former. Therefore, the ongoing concern, where equities are valued as financial assets on ongoing concern returns, becomes irrelevant and liquidation valuation becomes more relevant to reflect the realisable liquidation returns, which is consistent with the second fundamental point about the economic value of equities [Smithers and Wright (2004)], that equities represent a title to the ownership of the real assets of their firms.

One example of just a bid announcement for illustration, 06 June 2003 Canary Wharf Group was trading before lunchtime at 180p for a Triple-NAV of 288p per share (37.50 percent discount to Triple-NAV). After lunch it announced that it has received a takeover bid. Its share price jumped by 49.44 percent (to 269p) narrowing the discount-to-Triple NAV down to 6.60 percent. A report by Merrill Lynch (2002), presented in Table 5-8 below, shows how the significant discount gap for property stocks does narrow down to a much smaller discount or some times to a small premium following M&A completed deals. The report covers deals between 1999 and 2002. The same is documented for by Brauer (1984), and Brickley and Schallheim (1985) for closed-end fund termination cases.

Therefore, Triple-NAV can be viewed as a *valuation boundary* for property stocks, which are economically and commercially ascertainable given the reliable information about the break up value of property companies and their ongoing-concern returns from the good quality information about their underlying assets demonstrating again that specific reliable knowledge drives the valuation and controls it even in the break up scenarios. This M&A evidence supports the knowledge-based rationality hypothesis.

Target	Date	Equity Value	Gross Property	NNNAV /share	Bid Price	Discount-to-NNNAV	Comments
		£m	*£m*	*p*	*p*	*percent*	
	1999						
Evans	May	164	294	123	125	-2	Private by the family
Greycoat	May	282	400	295	260	12	Mercury, auction after Delancey attempted bid
Chesterfield	July	139	382	491	453	8	Quintain after a management break-up attempt
Hemingway	July	119	269	41	40	3	Pricoa backing management
Milner	Oct	169	330	367	350		Delancey (Ritblat link); part paper
	2000						
Allied London	Feb	135	280	142	125	12	JER with management
Scottish Met	Apr	153	247	132	117	11	Rodamco UK- Initially hostile, quickly agreed
MEPC	May	1924	3488	569	550	3	Leconport with mgt/Hermes/GE
Eskmuir	Jul	144	306	247	230	7	Laing Family
Raglan	Jul	51	85	45	40	12	Management
Dencora	Aug	58	109	318	307	4	Knowle Hill
Prestbury							Liquidation
Wates	Nov	373	600	141	141	0	Pillar/CLOUT
Frogmore	Nov	293	440	627	612	2	Management/Trefick/RboS
Burford	Dec	498	950	127	121	5	Mgt/Lehmans
	2001						
BPT	Mar	477	800	312	321	-3	Grainger/Pricoa after board put co in play
Warnford	Mar	190	226	517	495	4	Tender prior to delisting
Regalian	Mar	84					David Goldstone 'independent'
Delancey	Apr	255	400	123	117	5	Soros/Ritblat 'committed' shareholders
Asda Property	Jul	228	478	308	300	3	Davidson/British Land
	2002						
Haslemere	Mar	987	€1500	72.10	€63.7	11	Brack Capital
Saville Gordon	May	191	552	118	121	-3	Morgan Stanley Real Estate
Green Property	Jun	€1000	€2200	10.50	€9.80	7	MBO
Grantchester	Sep	173	235		250		Hammerson counterbid to MBO

Table 5-8. Property Sector Bids 1999-2002, Merrill Lynch Report 2002

Triple-NAV (NNNAV) = [NAV – (Debt fair value adjustment + CCGT)]. Discount-to-Triple NAV is calculated as [(MVE – Triple-NAV)/Triple-NAV×100]. Negative discount means a premium. The numbers are rounded to the nearest penny or percentage point.

The previous analysis shows that property stocks have two different bases for valuation: (a) on *ongoing concern* basis at a *discount* for the usual day-to-day stock trading (consistent with equities as *financial assets*), and (b) *liquidation* or *break up* basis at virtually/close to the *liquidation realizable value* for cases such as takeover or liquidation (consistent with equities as *title to real assets*).

5.4.3 Can the Discount Be Explained Rationally in Cross-Sectional Analysis?

This section presents a regression model for the market valuation of property investment stocks, of course, explaining at the same time the discount. The objective is to support the analysis in the previous section by explaining the discount rationally because the presence of rational explanations of the discount provides the evidence to support the conclusion of not rejecting the null hypothesis.

The data are collected by hand for the years 2001-2003 as described in the data section because UK databases do not provide the special details required to carry out this detailed analysis for property stocks. We use a model structure similar to that used by Gentry, Kemsley and Mayer (2003). Many variants of this model were tested before arriving at the reported form, which is first, consistent Gentry, Kemsley and Mayer (2003) and second successfully explain the market valuation of property investment stocks in a simple linear formulation. Other variants did not contradict the reported model. However, the reported model was the most successful one. The model of Gentry, Kemsley and Mayer (2003) is similar in structure but different in specification due to their different objective (examining dividend taxes and share prices, obtaining evidence from REITs). The explanatory model is structured, consistent with the null hypothesis, as follows:

Market Value of Equity = *f*(Constant, Net asset value, Debt fair value adjustment, Contingent capital gains tax liability, Capital Growth, Leverage, Property expenses, Administrative expenses)

Equation 5-2: $$MVE[Company\ i] = \beta_0 + \beta_1 NAV_i + \beta_2 FVAD_i + \beta_3 CCGT_i + \beta_4 REVAL_i + \beta_5 BVD_i + \beta_6 PEX_i + \beta_7 AEX_i + \varepsilon_i$$

Note that the Discount-to-Triple NAV = MVE – (NAV + FVAD + CCGT), and the above model can be re-arranged as such. All variables are explained below in the estimation table. Variables are at their monetary values as in the above article. Table 5-9 presents the estimations.

Dependent Variable Market-cap:	MVE						
	Method:	Least Squares		Firm Fixed Effects		Random Effects	
Variable	Code	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
Constant	C	-1.27	0.8717	--	--	-2.94	0.7903
Net asset value	NAV	0.68	0.0000	1.97	0.0000	0.71	0.0000
Debt fair value adjustment	FVAD	-0.96	0.0046	-2.01	0.0028	-1.28	0.0013
Contingent capital gain taxes	CCGT	-0.39	0.0059	-1.97	0.0001	-0.48	0.0032
Revaluation reserve (unrealised capital gains)	REVAL	0.17	0.0002	-0.57	0.0152	0.18	0.0027
Book value of debt	BVD	-0.18	0.0000	-0.37	0.0005	-0.18	0.0000
Property expenses	PEX	2.17	0.0311	10.84	0.0101	3.30	0.0148
Admin expenses	AEX	6.44	0.0000	4.09	0.3465	5.24	0.0049
R-squared		0.9925		0.9986		0.9949	
Adjusted R-squared		0.9920		0.9965		0.9945	
p-value (*F*-statistic)		0.0000		0.0000		--	
Total observations		100		100		100	

Table 5-9. Explaining Market Valuation and the Discount

The table reports the results from ordinary least squares, firm specific effects, and random effects regressions of the market value of equity on seven explanatory variables. The specifications use Pound Sterling values similar to the model of Gentry, Kemsley and Mayer (2003). The data were collected by hand for property investment companies over the period 2001-2003, as their annual reports were available. Total panel (unbalanced) observations: 100. NAV is net asset value from the balance sheet. FVAD is calculated as [(Fair value of debt – Book value of debt) × Tax rate]. CCGT is as calculated and disclosed by the companies. REVAL is the property revaluation reserve from the balance sheet (for unrealised capital gains, the realized parts are transferred to the P&L Reserve). BVD from the balance sheet. Property expenses are those related directly to the property portfolio. Coefficients with *p*-value below 0.01(0.05) are significant at 1(5) percent level.

The constant in the least squares and the random effects is insignificant with good model explanatory power for all estimations. The high R-squared and adjusted R-squared are similar to Gentry, Kemsley and Mayer (2003). Net asset value is positive and significant as expected and as in Gentry, Kemsley and Mayer (2003) on US REITs. Debt fair value adjustment (net of tax) resulting from marking debt

to market value is as expected negative and significant. The higher the increase in debt market value the lower the equity value and the higher the discount. Contingent capital gains taxes (CCGT) is, as expected, negative and significant. The higher the potential tax liability (if properties were sold at their estimated market value at the balance sheet date) the lower the value and the higher the discount.

Revaluation reserve (cumulative unrealised capital gains) is positive and significant, except for the fixed effects estimation where it is negative and only significant at 5 percent level). Overall, the higher the accumulated capital growth the higher the market value and the lower the discount.

Book value of debt (for leverage) is negative and significant. The higher the leverage the lower the market value and the higher the discount. Similar relation is established on US REITs by Gentry, Kemsley and Mayer (2003). Barkham and Ward (1999) find that leverage is not related to the discount of the UK property stocks. Barkham and Ward finding could be due to model misspecification as key discount variables were missing from their model (contingent capital gains taxes and debt market value adjustments).

Property and Administrative expenses variables are positive, not as expected, but with mixed significance. Barkham and Ward (1999) find that operating expenses are not related to the discount of the UK property stocks. Although this appears confusing when compared with evidence in Section 5.4.1, the reason for our findings and those of Barkham and Ward (1999) could be technical. That is because all variables in the estimations are stock-based (market value and balance sheet values) expect expenses are the annual flow-based charges. This variable inconsistency could be distorting the relation. To verify this, we run the following regression using logs to test more comparable levels of the discount and the operating expenses. The estimation in Table 5-10 below confirms a direct positive relation with the discount (negative with equity value) as with the scatter plots in Section 5.4.1.

Equation 5-3: $\log(\text{Discount-to-Triple NAV})i = \beta_0 + \beta_1 \log(\text{PEX})_i + \beta_2 \log(\text{AEX})_i + \varepsilon_i$

Variable	Code	Coefficient	*p*-value
Dependent Variable:	log(Discount-to-Triple NAV)		
Constant	C	2.37	0.0000
log(Property expenses)	log(PEX)	0.40	0.0062
log(Administrative expenses)	log(AEX)	0.57	0.0018
R-squared		0.60	
Adjusted R-squared		0.59	
p-value(*F*-statistic)		0.0000	
Total observations		89	

Table 5-10: Discount-to-Triple NAV on Operating Expenses Regression

Total observations in the sample are100, of which, 11 were excluded because of the use of logs. Coefficients with *p*-value below 0.01(0.05) are significant at 1(5) percent level.

In summary, the estimations of the above two models complement each other and confirm the finding of the previous sections that the discount has rational explanations. In particular, specific knowledge, on key variables such as operating expenses, debt market value movements, contingent tax liability, cumulative property unrealised capital growth, and leverage does explain the discount rationally. This evidence supports not rejecting the knowledge-based rationality hypothesis.

5.4.4 The Relative Stability of Property Stock Prices against Fundamental Value and the Overall Stock Market

The above analysis suggests that the valuation of property investment stocks is rationalised by investment knowledge. If so, and in the light of Chapters 3 and 4 results, one would expect, relatively, more stable stock price behaviour of property stocks compared with fundamental value and the overall stock market. Therefore, in this section we investigate whether the behaviour of property investment stock prices is relatively more stable or more rationalised to complement the conclusion of above analysis. We examine this through the following tests over the period 1990-2002:

1. The behaviour of property stocks discount versus the premium of non-financial stocks.
2. Stock price behaviour relative to the economy: The relative behaviour of FTSE All Share Index and FTSE Real Estate Index versus the economy (GDP) and implied growth testing.
3. Comparative earnings yield behaviour of property investment stocks and non-financial stocks.
4. Beta evolution for property stocks.

Behaviour of Property Stocks Discount versus Non-Financial Stocks Premium

NAV corrected to Triple-NAV represents very important measure for the fundamental value of property investment stocks. We established in Section 5.4.1 a stable relation between NAV and Triple-NAV and showed that relying on NAV alone (because of the unavailability of long-history data to correct to Triple-NAV) does not alter the conclusion fundamentaly.

Figure 5-1 presented in page 171 of the Introduction, Section 5.1, shows how during the period 1990-2002 the overall non-financial sector of the market *always*

traded at a weighted average premium-to-NAV of 144.35 percent while property investment stocks traded almost always at a weighted average discount-to-NAV of 21.31 percent (Gentry, Jones, and Mayer (2003) conclude also that, as aggregate price-to-NAV appears to be stationary and mean-reverting). Barkham and Ward (1999), who also defined the discount on property stocks as (NAV – MC)/NAV where MC is market-cap, report that the average property sector discount to NAV over the period 1977-1994 was 22.4 percent. The same (Figure 5-1) shows a clear relative stability of the persistent property discount compared with the very unstable level of the non-financial stocks premium. This relative stability of the property stocks discount is consistent with the rational explanation for property stocks pricing and discount and with not rejecting the hypothesis of knowledge-based rationality.

Stock Price Behaviour Relative to the Economy

This section compares the behavioural patterns of the overall stock market and property stocks with the economy showing that FTSE Real Estate price index is more restrained in its fluctuations relative to the economy when compared to the overall stock market. The overall stock market diverges significantly from the economy leading to severe corrections to narrow down this divergence gap. Figure 5-10 below presents the comparison. Which is again consistent with not rejecting the knowledge-based rationality hypothesis.

To confirm this further, Figure 5-10 is followed by a test for growth expectations as implied in market valuation for property stocks and non-financial stocks compared with economic growth. Where following the same procedure of estimating implied growth in market valuation for non-financial stocks in Chapter 4 (Section 4.5.2), Figure 5-11 presents a comparison between growth implied in property stocks market valuation, growth implied in non-financial stocks market valuation and GDP growth. The comparison clearly shows how implied growth for property stocks is reasonably inline with economic growth (with similar period average) unlike the rest of the stock market (non-financial sectors). Obviously, the lower implied expected growth for property stocks relative to non-financial stocks

is consistent with why the former commonly trade at a discount-to-NAV while the latter commonly trade at a premium. So growth expectations for property stocks appear more rationalised and plausible compared with the rest of the stock market.

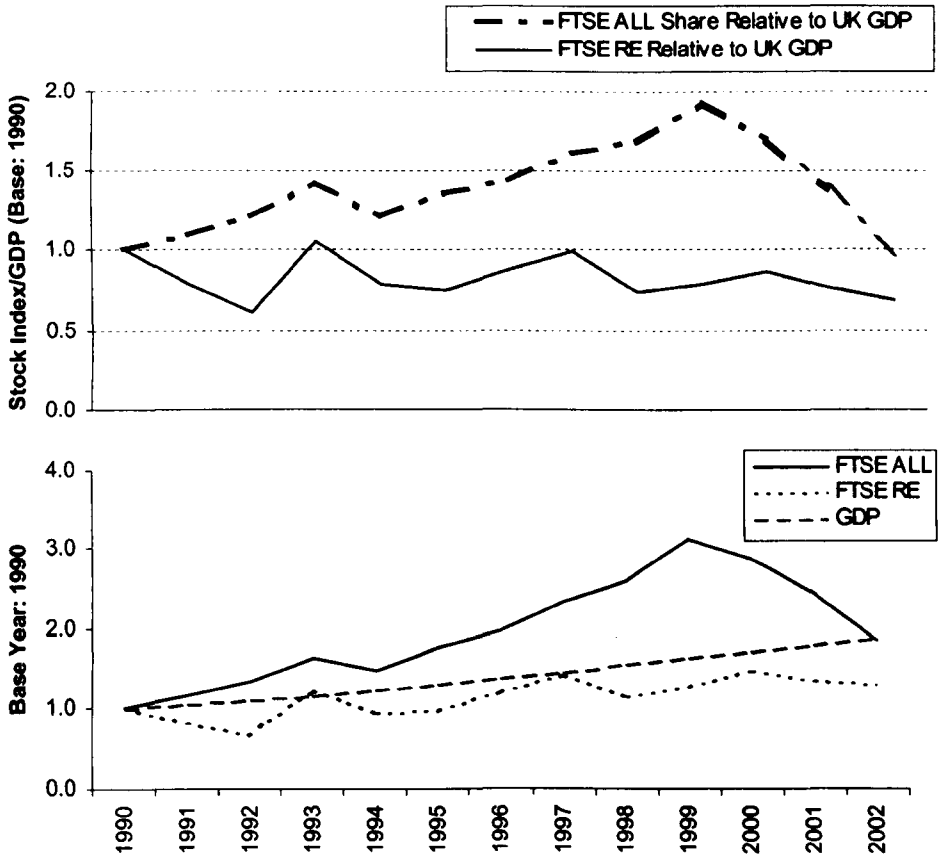

Figure 5-10. The Stock Market and Property Stocks Levels v The Economy

The upper chart plots the ratio of FTSE ALL and FTSE Real Estate (in price share index points) divided UK nominal GDP then all re-based to the 1990 ratio. If the indices and the economy grew at close rates, the relative lines would have been straight around 1.00 on the Y-axis. Nominal or inflation-corrected graphs will show the same pattern as the same correction multiple (say based on 1990 price level) will be applied to the numerator and the denominator. The lower chart presents the same as the upper one using the same data, where all data points are just re-based to 1990 levels to simplify the comparison between FTSE All and FTSE Real Estate behaviour relative to the economy.

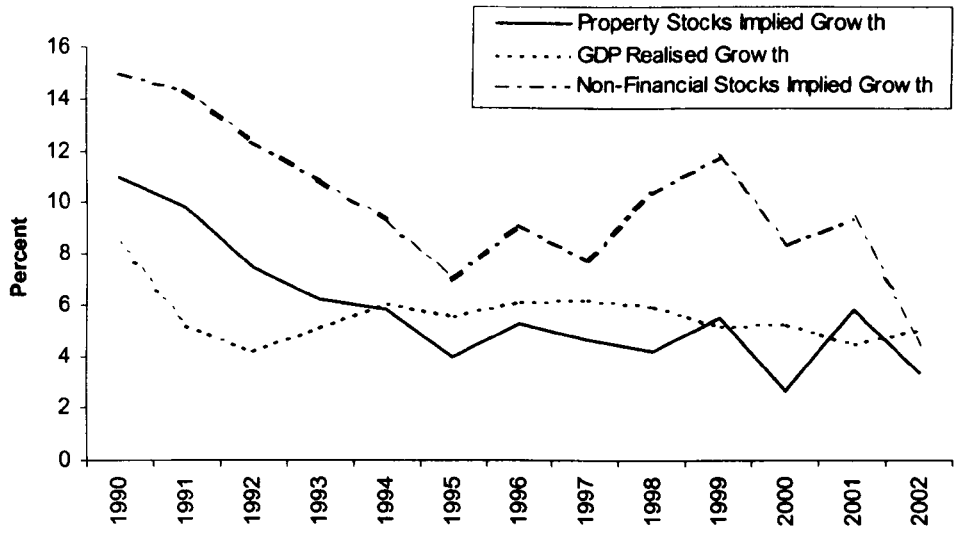

Figure 5-11. Implied Growth in Market Valuation – Comparison

Implied growth for property stocks is calculated using the same procedure and formula derived in Section 4.5.2 Chapter 4. That formula is presented as Equation 4-16: $[(MVE_t \times KE - EGS_t)/(MVE_t + EGS_t)]$. Where *MVE* is market-cap, *KE* is the cost of equity. *KE* is estimated using CAPM: 10-year yield to maturity on the government bond for the risk-free rate, expected return on the market as per the unbiased estimation in Table 4-10 in Section 4.5.3.1, Chapter 4, beta is estimated by regressing the monthly stock returns of 60 data points of the FTSE Real Estate Index against those of FTSE ALL. *KE* is also estimated on the FTSE Real Estate index using the same estimation procedure for the unbiased expected return referred to above in Chapter 4. Both *KE* estimations yield similar conclusions about implied growth rate. *EGS* is earnings and calculated as in Data Section 3.2 of Chapter 3 as [net income minus extraordinary items + deferred taxation]. All figures are nominal. Number of property stocks observations ranged between 38 and 84 (all property companies). Average implied growth over 1990-2002 for property stocks and non-financial stocks are 5.81 and 10.01 percent respectively compared with 5.60 percent average realised growth on GDP.

Earnings Yield Behaviour of Property Stocks and Non-Financial Stocks

Comparing property stocks earnings yield with those of the overall stock market discussed in Chapter 4 shows some important differences between property stocks and the rest of the stock market. Figure 5-12 below shows the relative stability of earnings yield levels for property stocks compared to the pronounced instability of the earnings yield of rest of the stock market suggesting that property stock prices are more stable. The most important reading of this is that the stock market perceptions about growth potential and risk of property stocks are stable and consistent over time keeping earnings yield stable as earnings yield is determined by growth expectations and risk as shown in Chapter 4. Also, as shown later, beta of property stocks has changed to be very low after

the overall stock market soared from 1996 onwards then severely declined after 1999. Hence, the stability of earnings yield is consistent with the levels of beta in different stock market phases. This stability is consistent with the knowledge-backed rational pricing hypothesis.

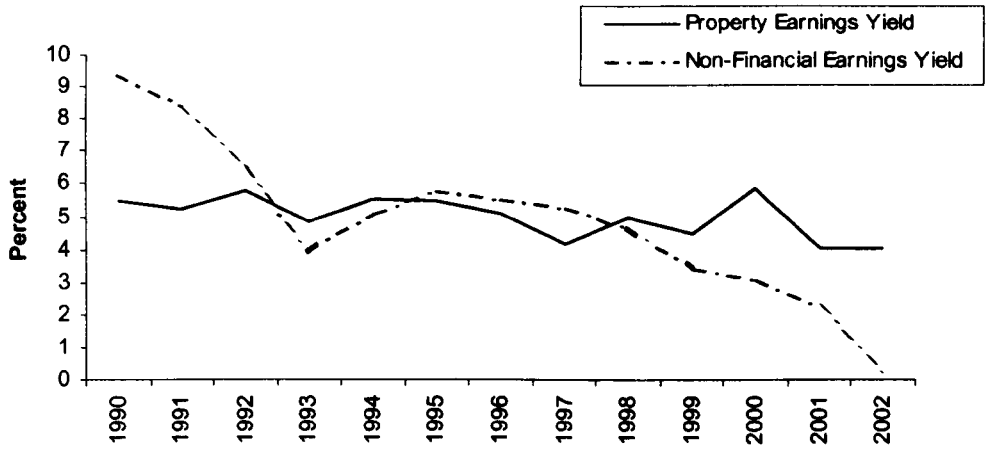

Figure 5-12. Earnings Yield Comparison

Earnings yield (*EY*) is a weighted average calculated as the sum of earnings for all companies every year divided by the corresponding sum of market value of equities. Weighted average earnings yield 1990-2002 across all companies for property stocks is 4.83 percent and for non-financial stocks 3.94 percent. Non-financial data is taken from Chapter 4. The severe drop in non-financial *EY* in 2002 is due to massive assets write offs against earnings (see Chapter 4 Section 4.5.1

Return on equity *ROE* is significantly lower for property stocks as shown in Figure 5-13, which is consistent with their lower valuation and the stability of their earnings yield, so, again, investment knowledge is clearly and effectively being capitalised for property stocks. The reason for the low property *ROE* is that property investment is, by nature, a relatively moderate-return with relatively lower risk type of investments given the real asset protection.

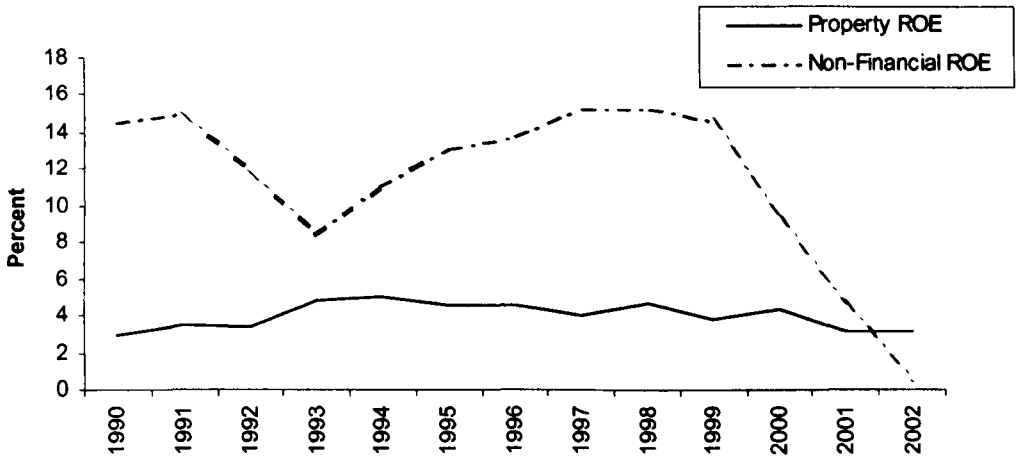

Figure 5-13. Return on Equity Comparison

Return on equity (*ROE*) is a weighted average calculated as the sum of earnings for all companies every year divided by the corresponding sum of book equities. Weighted average *ROE* 1990-2002 across all companies for property stock is 3.93 percent for non-financial stocks 9.62 percent. Non-financial data is taken from Chapter 4. The severe drop in non-financial *ROE* in 2002 is due to massive assets write offs against earnings (see Chapter 4 Section 4.5.1

Beta Evolution for Property Stocks

The evolution of property stock beta has a story to tell about the comparative behaviour of property stocks relative to the overall stock market in support of not rejecting the null hypothesis. The analysis of the time-varying beta of property stocks against stock market levels shows how the nature of beta changed to become more defensive to accord with property investment characteristics rather than with the overall stock market fluctuations. Figure 5-14 shows how beta for property stocks was close to unity (slightly aggressive) up to 1997. From 1997 where stock market levels soared up to 1999 and then declined severely to pre-1996 level, property stock beta moved to the defensive nature and gradually became very defensive. This shows that property investment specific factors are at work where their impact is translated into property stock prices via the reliable investment knowledge about the underlying assets and operations creating some kind of *valuation boundaries* that control or rationalise property stock price levels.

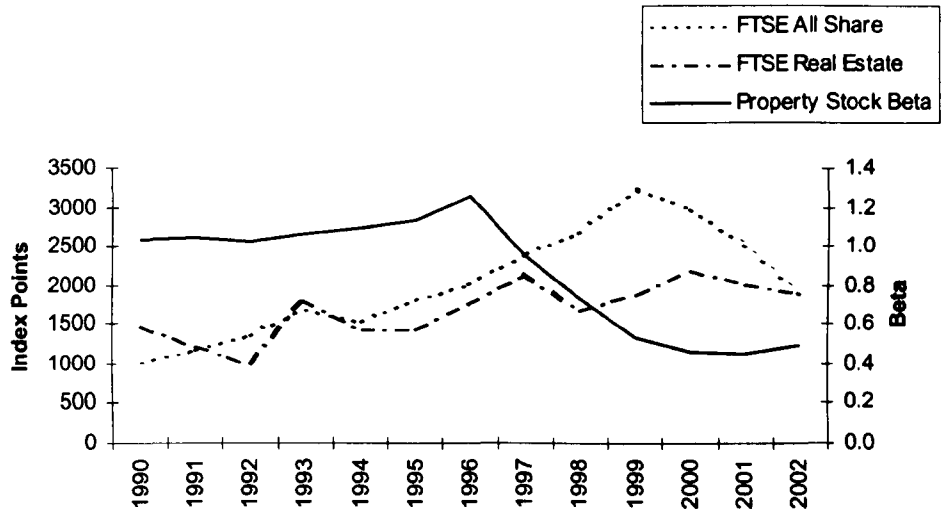

Figure 5-14. Evolution of Property Stock Beta

Beta for property stock is estimated using a standard technique of regressing the monthly logarithmic stock returns of the FTSE Real Estate Index against those of FTSE All Share Index using every year the previous 60 data points (the FSTE Real Estate series starts end of 1985).

In summary, the above tests in this section confirm the stability of property stock prices relative to the economy and the overall stock market, which is consistent with not rejecting the null hypothesis of investment knowledge-based rationality for property stock pricing.

5.5 Conclusion

This chapter, first, establishes the presence of a significant and enduring market discount to the underlying value for property investment stocks on ongoing concern even after correcting the accounting NAV to liquidation value (called Triple-NAV). We test the hypothesis that Property investment stocks discount is a reflection of investment knowledge-based rationality that limits valuation bias for these stocks H_0, against the alternative that investment knowledge about property investment stocks has no distinctive role in rationalising their prices or limiting their valuation bias H_1. The null hypothesis is tested by examining and establishing knowledge-based rational explanations for property stocks market valuation and their discount. According to the evidence, we cannot reject H_0. Our evidence supports Barkham and Ward (1999) rational hypothesis but implicitly not that related to noise traders. The evidence is also broadly consistent with Gentry, Jones, and Mayer (2003) that it is unlikely that REIT premiums and discounts reflect the investor sentiment hypothesis of Lee, Shleifer, and Thaler (1991). However, behavioural factors would appear in property stock price volatility. Below is a discussion of the conclusion.

This investment knowledge is derived from the knowledge about the underlying assets and operations (property investments) in terms of property investment characteristics such as income levels, income growth, capital growth, (including the limits of their potential), risk, and other firm specific factors such as contingent capital gain taxes and debt market value impact. The results of this study suggest that investment knowledge rationalises market valuations for these stocks inline with realisable total returns and investor return expectations. Hence, property stock price behaviour is rationalised by this knowledge, whether under the ongoing concern or the break up scenarios. Where, unlike the rest of the stocks market, property stocks are priced on ongoing concern at a discount to their liquidation value to yield the rate of return required by investors.

We first establish that the total return on the underlying property investments matches, empirically, the required rate of return on property stocks.

We then examine the **difference between the expected return on property stocks and the underlying return on actual capital employed** in property companies. We find that the percentage return differential between the two explains market value discount to produce the total returns demanded by investors consistent with risk-free rate and other asset classes. Market capitalisation of property stocks adjusts down from NAV first to account for debt fair value movements and contingent capital gains tax liabilities to Triple-NAV and then further to produce the required rate of return by investors on ongoing concern. To support this evidence, we establish a significant direct positive relation between the discount-to-Triple NAV and operating expenses with a correlation coefficient of 0.74 to 0.75. This significant direct relation is also confirmed by regression results.

In addition to operating expenses, the analysis looked at **other contributing factors to the discount-to-Triple NAV** addressing the materialisation risk of the unrealised capital gains and the financial risk of leverage. We show that unrealised capital gains are very significant in the underlying value. Hence, investor perceptions about the risk of realising property capital gains, on ongoing concern, could be one of the factors behind the discount fearing property price falling and even crashing. This is confirmed in closing the discount gap when liquidation is assumed where then there is a higher level of certainty about realisable gains. Leverage has a direct positive relation with the discount, the higher the leverage the higher the discount (the lower the value). This is confirmed by the regression analysis. In Chapter 3 we saw a positive relation between value and leverage for the non-financial sector inline with standard finance theory. The interpretation for this opposite impact of leverage on property stocks is that property has a moderate income yield which makes leverage riskier. Small changes in interest rates could yield to financial distress coming from debt servicing obligations.

Consistent with the null hypothesis, our **regression analysis supports the argument of knowledge-based rationality**. We regress market valuation of property stocks on several rational explanatory variables including the elements that correct NAV to Triple-NAV. The results show high explanatory power and

insignificant constant term. They also show that the following variables explain market valuation of property stocks. These are net asset value (positive and significant), debt fair value adjustment (negative and significant), contingent capital gains tax (negative and significant), revaluation reserve (positive and significant, except for the fixed effects), and leverage (negative and significant). Finally, property and administrative expenses (in a separate regression for consistency in model specification) have a negative significant relation with market value (positive significant relation with the discount).

Consistent with the null hypothesis of investment knowledge-based rationality for property stock pricing, one would expect, relatively, more stable stock price behaviour of property stocks compared with fundamental value, the economy, and the overall stock market. So, we test **the relative stability of property stock prices**. We examine: (a) the behaviour of property stocks discount versus the premium of non-financial stocks, (b) stock price behaviour relative to the economy and implied growth testing, (c) comparative earnings yield behaviour, and (d) the evolution for property stock beta. All of which confirm the stability of property stock prices relative to the economy, unlike the overall stock market, to accord with property-specific factors rather than with the direction of the overall stock market.

Finally, although property stocks discount to liquidation value could appear to some as an indicator about market inefficiency. This research provides evidence for the contrary! That it is an indicator of market efficiency guided by investment knowledge about the underlying assets and operations. Hence, good quality investment knowledge could create some kind of economically and commercially ascertainable *valuation boundaries* that limit valuation bias. Meanwhile, for many sectors there are not similar boundaries that limit exaggerating corporate potential in stock pricing and trading leading to major deviations from fundamental value levels.

One final (side) point, property stocks can be seen as less risky investments compared to general stocks given the downside protection of real estates with liquidation value exceeds market-cap. The investor is buying a stock

at a price below its downside protection. The discount-to-Triple NAV can be regarded as a safety net or buffer. Hence, the presence of this systematic discount would lead to some extra volatility. Consistent with this explanation, the annualised stock return volatility for FTSE All Share Index and FTSE Real Estate Index is 15.07 and 18.35 percent respectively over 1990-2002 and 16.94 and 20.47 percent respectively over 1986-2002.

5.6 Appendix

5.6.1 Quartile Statistics for Property Stocks Discount

Table 5-11 below presents quartile statistics for property stocks discount to NAV.

Quartile	Weighted Average Discount-to-NAV *Percent*	Observations in Quartile
1	-14.43	127
2	13.50	127
3	30.07	127
4	55.85	129
Grand Weighted Average/Total Obs	21.35	510

Table 5-11. Property Stocks Discount-to-NAV; Quartile Statistics

Sample period is 1990-2002. 8 Observations were excluded because of their negative equities. Discount-to-NAV is calculated as (MVE – NAV)/NAV×100 using the corresponding aggregate sums of MVE and NAV for each category. Negative discount means a premium.

5.6.2 List of Public Property Companies Traded in the UK

Abraxus Investments	Freeport	Panther Securities
Ashtenne Holdings	Grainger Trust	Pathfinder
Asite	Great Portland Estates	Peel Holdings
Basepoint	Grosvenor Land Holdings	Pillar Property
Benchmark Group	Halladale Group	Primary Health Properties
British Land Company	Hammerson	Probus Estates
Brixton	Hampton Trust	Propan Homes
Caledonian Trust	Headway	Quintain Estates & Development
Canary Wharf Group	Helical Bar	Rugby Estates
Capital & Regional	Highcroft Investments	Safeland
Cardiff Property	Hurlingham	Savills
Chelsfield	Intl. Real Estate	Shaftesbury
Chesterton International	J. Smart & Co. Contractors	Slough Estates
City North Group	Land Securities	Smith (James) Estates
Clan Homes	Liberty International	Solitaire Group
CLS Holdings	London & Associated Prop	St. Modwen Properties
Comland Commercial	London Merchant Securities	Stewart & Wight
Compco Holdings	London Town	Stonemartin
CW Residential	Marylebone Warwick Balfour	Terrace Hill
Daejan Holdings	McKay Securities	Tops Estates
Derwent Valley Holdings	Merivale Moore	Town Centre Securities
Development Securities	Minerva	Unite Group
DTZ Holdings	Mountview Estates	Vebnet Holdings
Estates & Agency Holdings	Mucklow (A & J) Group	Warner Estate Holdings
Estates & General	Newport Holdings	Workspace Group
Eurocity Properties	NHP	Wynnstay Properties
First Property Online	Northacre	Your Space
Fletcher King	OEM	
		Total: 83 Companies

Table 5-12. UK Real Estate Publicly Traded Companies at The End of 2002

5.6.3 Total Return Simulation for Property Stocks

The simulation starts with a hypothetical property investment company with an investment property portfolio of £1,000 million at the end of year one. The P&L and balance sheet are projected under the assumptions shown in Table 5-13. Table 5-14 and Table 5-15 present the projected P&L and Balance Sheet respectively. Table 5-16 shows market values and return information under two different discount scenarios.

Items	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Percent										
Rental yield	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Property capital growth	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Property total returns	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Property expenses/Investment properties	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Admin expenses/Investment properties	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Interest rate	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Debt/Investment properties (start/calc)	50.0	47.1	44.3	41.6	38.9	36.2	33.6	31.0	28.5	26.0
Debt fair value adj net of tax/Book debt	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Marginal and capital gain tax rate	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Effective income tax rate	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Dividends payout ratio	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0
Fixed assets/Investment properties	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Current assets/Investment properties	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Current liabilities/Investment properties	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Table 5-13. Property Stock Return Simulation – Projection Assumptions

PROFIT & LOSS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
£ Million										
Rent income	75.0	77.6	80.3	83.2	86.1	89.1	92.2	95.4	98.8	102.2
Property expenses	-8.0	-8.3	-8.6	-8.9	-9.2	-9.5	-9.8	-10.2	-10.5	-10.9
Administrative expenses	-8.0	-8.3	-8.6	-8.9	-9.2	-9.5	-9.8	-10.2	-10.5	-10.9
Operating Profits	59.0	61.1	63.2	65.4	67.7	70.1	72.5	75.1	77.7	80.4
Interest	-25.0	-24.4	-23.8	-23.1	-22.3	-21.5	-20.7	-19.7	-18.8	-17.7
Earnings before taxation	34.0	36.7	39.5	42.4	45.4	48.6	51.9	55.3	58.9	62.7
Taxation	-8.5	-9.2	-9.9	-10.6	-11.3	-12.1	-13.0	-13.8	-14.7	-15.7
Net income	25.5	27.5	29.6	31.8	34.0	36.4	38.9	41.5	44.2	47.0
EQUITY ACCOUNT										
Opening equity	463.5	510.0	557.4	606.9	658.7	712.8	769.4	828.5	890.2	954.6
Net income	25.5	27.5	29.6	31.8	34.0	36.4	38.9	41.5	44.2	47.0
Dividends	-14.0	-15.1	-16.3	-17.5	-18.7	-20.0	-21.4	-22.8	-24.3	-25.9
Property annual revaluation	35.0	35.0	36.2	37.5	38.8	40.2	41.6	43.0	44.5	46.1
Ending equity	510.0	557.4	606.9	658.7	712.8	769.4	828.5	890.2	954.6	1,021.8
Revaluation reserve	35.0	70.0	106.2	143.7	182.5	222.7	264.3	307.3	351.8	397.9
Contingent capital gain tax (CCGT)	10.5	21.0	31.9	43.1	54.8	66.8	79.3	92.2	105.5	119.4
Debt fair value adjustment (net of tax)	27.5	26.8	26.1	25.4	24.5	23.7	22.7	21.7	20.6	19.5

Table 5-14. Property Stock Return Simulation – Projected P&L & Equity

BALANCE SHEET	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
£ Million										
Investment properties	1,000.0	1,035.0	1,071.2	1,108.7	1,147.5	1,187.7	1,229.3	1,272.3	1,316.8	1,362.9
Fixed assets	10.0	10.4	10.7	11.1	11.5	11.9	12.3	12.7	13.2	13.6
Total fixed assets	1,010.0	1,045.4	1,081.9	1,119.8	1,159.0	1,199.6	1,241.5	1,285.0	1,330.0	1,376.5
Current assets	5.0	5.2	5.4	5.5	5.7	5.9	6.1	6.4	6.6	6.8
Less: Current Liabilities	-5.0	-5.2	-5.4	-5.5	-5.7	-5.9	-6.1	-6.4	-6.6	-6.8
Total assets less current liabilities	1,010.0	1,045.4	1,081.9	1,119.8	1,159.0	1,199.6	1,241.5	1,285.0	1,330.0	1,376.5
Debt	500.0	488.0	475.0	461.1	446.2	430.2	413.1	394.8	375.4	354.7
Equity (NAV)	510.0	557.4	606.9	658.7	712.8	769.4	828.5	890.2	954.6	1,021.8
Total debt and equity	1,010.0	1,045.4	1,081.9	1,119.8	1,159.0	1,199.6	1,241.5	1,285.0	1,330.0	1,376.5
Check: (D + E) - A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 5-15. Property Stock Return Simulation – Projected Balance Sheet

The debt was the item used to balance the balance sheet as equity replaced debt over time. Optimisation procedure was used to solve for the circular reference between the P&L and Balance Sheet (interest expense–retained earnings–equity and debt).

OUTCOME RATIOS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Percent										
Property average total returns	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
At 22 percent discount-to-triple NAV:										
Market-cap (£m)	368.2	397.4	428.2	460.4	494.2	529.6	566.6	605.5	646.1	688.7
Stock price appreciation	--	7.95	7.73	7.53	7.34	7.16	7.00	6.85	6.72	6.59
Dividend yield	3.81	3.81	3.80	3.80	3.79	3.78	3.78	3.77	3.76	3.75
Total stock returns	--	11.76	11.53	11.32	11.13	10.95	10.78	10.62	10.48	10.34
Average total stock return 0 - t	--	11.76	11.64	11.54	11.43	11.34	11.24	11.15	11.07	10.99
Discount-to-NAV	27.81	28.69	29.45	30.11	30.68	31.17	31.60	31.98	32.31	32.60
At 0 percent discount-to-triple NAV:										
Market-cap (£m)	472.0	509.5	548.9	590.2	633.5	678.9	726.5	776.3	828.4	882.9
Stock price appreciation	--	7.95	7.73	7.53	7.34	7.16	7.00	6.85	6.72	6.59
Dividend yield	2.97	2.97	2.96	2.96	2.96	2.95	2.95	2.94	2.93	2.93
Total stock returns	--	10.92	10.69	10.49	10.29	10.11	9.95	9.79	9.65	9.51
Average total stock return 0 - t	--	10.92	10.81	10.70	10.60	10.50	10.41	10.32	10.24	10.16

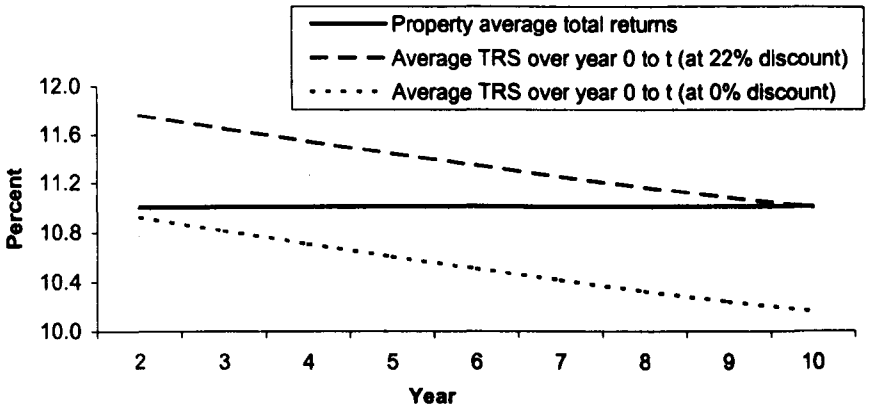

Table 5-16. Property Stock Return Simulation – Valuation & Return Outcome

6 Chapter Six: Conclusion

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Given that stock valuation and pricing deal with expected future outcomes, research in this area proves difficult to reach clearly conclusive results in the absence of any known fair value levels to benchmark against, leave alone model limitations. Therefore, in this research we try to understand, to gather evidence, and to make reasonable conclusions to contribute to the debate.

In this work we tackle valuation bias in the stock market. We ***first*** looked for forms of bias by dividing stocks population into survivors and new stocks and examine market behaviour in treating both groups (relative valuation bias). Which ***then*** led us to move from examining relative bias (new versus survivors) into exploring overall valuation bias tendency at stock market aggregate level. The research in valuation bias both relative and overall opened ***another research lead*** taking the work into another dimension. This being whether the availability of reliable investment knowledge about some stocks and their underlying operations in terms of income, growth potential, and risk could control valuation bias. We select property investment stocks, exploiting their investment characteristics, to examine the role of the good quality investment knowledge in rationalising their stock prices and even leading them to trade them persistently at a discount to liquidation value unlike the rest of the stock market (not to include closed-end funds). Below is a summary conclusion of the above-mentioned three studies in turn. More detailed conclusions are presented in each individual chapter.

The first study (Chapter 3) documents persistent differences in valuations between UK new and older stocks where new stocks have relatively higher valuations that decline with age confirming for UK stocks the same pattern of declining market-to-book with age documented by Pastor and Veronesi (2003) in the US. We examine the hypothesis that these differences are explained by differences in fundamentals (H_0) against an alternative valuation bias hypothesis that the stock market is biased in valuing new stocks relative to survivor stocks (H_1). Another competing hypothesis of rational behaviour based on pricing the long-term potential and status for new stocks is tested too. In the course of this

research, explanations are sought in the fundamental value determinants over the period 1989-2002 using the data of all UK traded non-financial stocks. The fundamentals examined in the course of testing the hypotheses are profitability and growth, that determine cash flows, and risk levels to value these expected cash flows besides age and size. The research evidence leads to rejecting H_0 in favour of H_1 that the stock market is biased in valuing new stocks relative to mature stocks. Such bias manifested as valuation differences, believed to be driven by investor expectations that are inconsistent with the differences in the underlying fundamental corporate and economic characteristics. We also reject the competing hypothesis after examining growth in market value of equity versus growth in equity book value, retained earnings and growth and simulating market and fundamental valuations. We believe that this competing hypothesis cannot be rejected only if risk is correctly priced where the analysis suggests that it is not the case as the long-term future potential is priced at future risk levels when the firm is more stable and has survived the test of time.

In testing the hypotheses, we built a value explanatory model with the main fundamental value drivers (with and without the age factor) for variable joint testing to explain and predict valuation differences. The results suggest that the model is reasonably successful in predicting valuation differences between new and survivor stocks and explaining the phenomena by age factor (age discrimination) and perhaps risk underestimation for new stocks. The pattern of historic *MBE* declining with age is matched closely by the model-generated values. Failing to find a known economic explanation for the role of age, we argue that our results suggest that the presence of such valuation discrepancies between stocks of different age groups result from valuation bias.

The evidence from testing the differences in individual fundamentals shows that: a) profitability is statistically lower for new stocks than for older stocks providing contrary evidence in explaining valuation differences, b) insufficient and inconsistent evidence that new stocks have statistically significant higher realised earnings growth, however, we cannot ignore that growth expectations are most likely to be *part* of the explanation, but unlikely to reasonably account for the

majority of the gap, c) comparative analysis of systematic risk, stock returns volatility, and age and the death of public limited companies provide no evidence that is consistent with higher valuation; that new stocks could be less risky than survivors while the contrary is a more valid argument. To sum up, lower profitability levels are inconsistent with the higher market valuation levels for new stocks relative to survivor stocks, with no consistent or concrete evidence of higher earnings growth, and no evidence of lower risk.

But, new stocks become survivor stocks; this could be the reason! Hence, comes the explanation in the competing rational valuation hypothesis, referred to earlier, and in the unstable behaviour of the valuation gap. A significant finding with respect to the pattern of the valuation gap itself between new and survivor stocks, where the gap size overall increases in bullish market and decreases in bearish market. This instability of the valuation gap is consistent with the valuation bias inference, as with an economically justified valuation differences one would expect some kind of stability in the behaviour of the valuation gap. This could be driven by investor overoptimism about corporate profitability and growth potential for new stocks relative to survivor stocks in bullish markets where investor overoptimism drives prices too high. We also find that our evidence is consistent with the evidence from IPOs long-tern underperformance in the literature.

The above conclusion does not imply at all that survivor stocks are fairly valued as it is a relative comparison where investors expectations appear to be exuberant for new stocks relative to older stocks which also implies that could be because the market knows more about survivor stocks investors irrationality is limited to some extent by this knowledge. From which, we follow two research leads; the overall stock market levels in the UK and the role of investment knowledge in stock price rationalisation.

The second study (Chapter 4) starts where the first one finished off as that did not shed any light on whether older stocks or the stock market overall has a tendency to be biased. We first document the occurrence of major divergences between soaring stock prices and economic growth and book equity followed by corrections in the form of stock price falls where the severity of the correction appears to depend on the size of the divergence. Hence, we examine the hypothesis that stock market levels in the UK during the period 1989-2002 can be explained by fundamentals such as reasonable expected profitability, expected growth and risk levels (H_0), along with another variation of this hypothesis that stock prices on average over time are correctly valued against fundamentals with temporary mispricing periods (H_{0a}), against the alternative hypothesis that stock market levels in the UK were overvalued (biased upwards) on average relative to fundamentals during the period 1989-2002 (H_1). In testing the hypothesis, we use the data of all UK traded non-financial stocks with other market and economic data to analyse earnings yield levels, changes in corporate profitability pattern and the sensitivity of stock prices to profitability, expected growth, and the impact of risk aversion on stock valuations. On the balance, we believe the evidence is weighted towards rejecting H_0 and H_{0a} in favour of H_1.

For hypothesis testing, we develop a theoretical earnings yield model validated and supported by an empirical valuation model. The model is used to examine stock market levels concentrating on income yield, growth and return expectation benchmarking against risk-free assets and economic growth. We document that the spread between earning yield and the risk-free rate is almost stable (*EY* is below *RF* by circa 2 percent on average). To explain this negative spread, we explore plausible scenarios for earnings yield; earnings yield predictions, corporate profitability, growth expectations, return expectations and risk aversion.

The earnings yield model was successful in predicting, in-sample, the severe fall in stock prices after the 1999 peak during 2000-2002 to a very good extent and the part recovery to end of 2003 level. Earnings yield using the theoretical and empirical models under rationalised plausible scenarios for profitability, growth and cost of capital, on balance, indicate that the level of earnings yield is low implying overpricing. No changes in corporate profitability patterns over the

whole period would justify the major changes in stock price levels. We establish the gap between implied growth and economic growth against stock market levels documenting a cyclical behaviour in terms of growth expectations, where the gap size increases with rising stock prices then closes down with major corrections of subsequent falling stock prices. Market expected growth rates were estimated by growth rates implied in market valuation, which have almost always been higher than both economic growth and realised earnings growth suggesting that investors might have been overestimating growth potential and have paid too much for stocks. Market return expectations were studied through developing an unbiased estimation for expected returns on the stock market, where its correlation with the risk-free rate confirms its robustness. We estimate the implied discount rate in market valuation where we find that the average equity risk premium underestimates risk when compared with the evidence from the literature and market expected return. The significant difference between the implied discount rates and the unbiased expected returns indicates an important paradox in investor behaviour, where stock prices might have been driven by investor high return expectations and not by economic and corporate fundamentals where these high return expectations did not translate into higher discount rates. It could be a vicious circle where high required rates of return drive stock prices up where such value levels imply lower discount rates until the economy is gloomy the gap is too apparent between fundamentals and market levels, then severe corrections are inevitable.

On the balance of the evidence, we are at least able to join Shiller in his view (2001), on the US stock market, that its ups and downs over the last century have made virtually no sense ex post, and the views of others such as Cole, Helwege, and Laster (1996), Campbell and Shiller (1998), Heaton and Lucas (1999), Kiley (2000), and Smithers and Wright (2004), as we believe that these US-based views are applicable to the UK at least over the recent history 1989-2002. And we are, of course, able to join those who worked on the UK stock market such as Brooks and Katsaris (2003, 2003b) in their conclusion, who used speculative bubble theory, and concluded that UK stocks were overvalued in the late 1990s as they deviated too far from their fundamental values.

The third and final study in this thesis (Chapter 5) starts from one of the implications of the first study, namely that investors might have been more able to exaggerate the potential of new stocks relative to survivor stocks as the market knows more about older stocks. Hence, in the context of 'valuation bias in the stock market' we seek evidence for the role of 'investment knowledge' in 'stock price rationalisation' from property investment stocks exploiting their special investment characteristic where such knowledge is available and reliable. This study, first, establishes the presence of a significant and enduring market discount to the underlying value for property investment stocks on ongoing concern even after correcting the accounting NAV to liquidation value (called Triple-NAV). We test the hypothesis that Property investment stocks discount is a reflection of investment knowledge-based rationality that limits valuation bias for these stocks H_0. The null hypothesis is tested by examining and establishing knowledge-based rational explanations for property stocks market valuation and discount. According to the evidence, we cannot reject H_0 and below is a discussion of this conclusion.

We first establish that the total return on the underlying property investments matches, empirically, the required rate of return on property stocks. We then examine the difference between the expected return on property stocks and the underlying return on actual capital employed in property companies. We find that the percentage return differential between the two explains market value discount. Market capitalisation of property stocks adjusts down from NAV first to account for debt fair value movements and contingent capital gains tax liabilities to Triple-NAV and then further to produce the required rate of return by investors on ongoing concern. To support this evidence, we establish a strong direct relation between the discount-to-Triple NAV and operating expenses.

In addition to operating expenses, the analysis shows that unrealised capital gains are very significant in the underlying value. Hence, investor perception about the risk of realising property capital gains, on ongoing concern, could be one of the factors behind the discount fearing property price falling and even crashing. This is confirmed in closing the discount gap when liquidation is assumed where then

there is a higher level of certainty about realisable gains. Leverage has a direct positive relation with the discount, the higher the leverage the higher the discount (the lower the value). In Chapter 3 we saw a positive relation between value and leverage for the non-financial sector inline with standard finance theory. The interpretation for this opposite impact of leverage on property stocks is that property has a moderate income yield which makes leverage very risky. Small changes in interest rates could yield to financial distress coming from debt servicing obligations.

Consistent with the null hypothesis, our regression analysis supports the argument of knowledge-based rationality. We regress market valuation of property stocks on several rational explanatory variables including the elements that correct NAV to Triple-NAV. The results show high explanatory power and insignificant constant term. They also show that following variables explain market valuation of property stocks. These are net asset value (positive and significant), debt fair value adjustment (negative and significant), contingent capital gains taxes (negative and significant), revaluation reserve (positive and significant, except for the fixed effects), and leverage (negative and significant). Finally, property and administrative expenses (in a separate regression for consistency in model specification) have a negative significant relation with market value (positive significant relation with the discount).

Consistent with the null hypothesis of investment knowledge-based rationality for property stock pricing, one would expect, relatively, more stable stock price behaviour of property stocks compared with fundamental value and the overall stock market. So, we test the relative stability of property stock prices against fundamental value and the overall stock market. We examine: (a) the behaviour of property stocks discount versus the premium of non-financial stocks, (b) stock price behaviour relative to the economy and implied growth testing, (c) comparative earnings yield behaviour, and (d) the evolution for property stock beta. All of which confirm the stability of property stock prices relative to the economy, unlike the overall stock market, to accord with property-specific factors rather than with the direction of the overall stock market.

We finally conclude by drawing attention to some **prospects for further research** following on from this work:

(a) While our work suggests the presence of behavioural bias in stock market valuations rejecting fundamental explanations; it does not suggest any particular behavioural reasons for this bias. Hence, further research is needed to see what type of behavioural explanations best fit with these empirical findings linking the work to the existing literature on psychological and behavioural theories and explanations.

(b) The research on valuation bias and age showed that profitability, efficiency, growth, and risk differences indicate that mature stocks should be valued relatively higher than younger stocks. An expansion for this research would be to attempt to quantify the impact of each individual fundamental variable on valuation differences. For example, examining the difference in profitability between the two stock groups and quantifying the respective impact on valuation difference that fundamental profitability difference should translate into.

(c) A side expansion of the first study was the brief introduction and testing of a competing hypothesis (*the market is rational in valuing new stocks higher than survivor stocks because of pricing the future long-term potential and status of new stocks*). According to which, in the early period of the stock trading a new stock is priced according to its future stable status, and up to that time the stock price appreciates at a lower rate relative to book equity growth or does not appreciate at all on average across all young stocks leading the growth in book equity to match, in say 10 to 14 years, the early market-assigned price level. The stage, after which, stock returns are positive matching or exceeding book equity growth as future growth opportunities are to be capitalised too. This competing hypothesis can be developed to a stand-alone paper by improving the existing tests and developing other tests and concentrating on how risk is being priced.

(d) The research in the first study concentrated on all sectors combined. An expansion of this work would be to address the impact of sector biases, as they could be important because the typical survivorship rates will vary a lot between sectors. Some sectors could be of a particular interest such as the high-tech sector from mid to late 1990s. Also, one can look at using a rolling window in defining survival to examine the impact of that on the results.

(e) Searching for other forms of valuation bias between different stock categories (other than between age groups). For example, examining the market comparative behaviour in valuing different sectors studying market value indicators and fundamentals to gain insight into the cause of any differences and similarities in market behaviour and the relation with sector and fundamental differences. This could help to understand and adjust for sector specific factors and understand the rationality or irrationality of some valuation differences.

(f) The theoretical earnings yield model derived in the second study was validated by an empirical regression where the signs and significance of all its variables were confirmed inline with its formulation. The model was also successful predicting the fall after the 1999 peak and the recovery after the 2002 bottom. An expansion of this work will be developing this earnings yield model for out-of-sample prediction purposes at market level applying to all years and developing the determination process for its plausible inputs to reduce subjectivity. Most importantly, the prediction should be based on the underlying corporate and economic fundamentals.

(g) The evidence in the literature confirms that corporate profitability is mean reverting. Thus, it is worth exploring the use of normalised earnings yield at company level to detect mispricing to use in forming long portfolios (of undervalued stocks) and short portfolios (of overvalued stocks) studying the performance over different holding horizons. Perhaps, the process of normalising earnings yield would require thorough investigation rather than just simple mean-reversion basis, as at corporate level earnings volatility is

significant. In this context, the investment holding horizon would be important for the profitability of the strategy.

(h) The concept of unbiased market return expectation was introduced in the second study. It was called 'unbiased' because it is (1) unconditioned on historic inflation, (2) unconditioned on survivorship, (3) based on information available to investors at the point of estimation, (4) not based on a disputed model or theory. The estimation showed robustness in terms of its relation with interest rates and implied discount rates and produced return expectations for the current market era consistent with what is expected in today's markets and going forward. This notion of unbiased return expectation is worth developing with its estimation procedure and testing further in the light of the evidence on equity premium puzzle with the objective of developing a robust procedure of estimating expected returns on the market given the importance of this estimation (e.g. for pension plans). For example, the correction for survivorship bias and expected inflation can be addressed in more depth.

(i) Property investment stocks discount was explained by knowledge-based rationality where this knowledge, for example about ongoing concern returns and break-up values, limits investor irrationality from exaggerating the potential of these stocks. It is worth investigating whether some valuation boundaries do exist, could exist, or should exist for different sectors. The regulated utilities sector would be a good start given the reasonable knowledge about consumer demand and it growth, and the constraints of the regulations while addressing the variable elements on their inputs (e.g., energy prices).

(j) Studying the possibility of formulating profitable trading and investment strategies from identifying valuation biases whether relative or overall relying on fundamental characteristics to formulate *fundamental strategies* or *fundamental portfolios* where the concentration is on the long-term underlying corporate fundamentals rather than just on inferring market expectations implied in market values and trading.

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