8

Persistence in Growth Versus Market Expectations

by
Jason Hall †
Matthew Tochterman †

Abstract:

We measure the persistence and predictability of sales and earnings growth for Australian-listed firms from 1989 to 2006. In contrast to results from the United States, there is evidence of persistence in growth. There is close to a two-thirds chance that a firm reporting growth above the industry median in one year repeats this performance in the following year. However, there is little evidence that valuation ratios—measured as revenue, earnings or book value of equity relative to market capitalisation—are particularly useful in predicting future growth. Instead, they reflect recent historical growth, especially in the case of the book-to-market ratio. Firms with low book-to-market ratios have relatively high growth over the previous five years, but their growth over the subsequent five years is almost indistinguishable from firms with high book-to-market ratios. The results are consistent with the hypothesis that value stocks outperform growth stocks because investors overstate firms' ability to consistently make high-growth investments.

Keywords:

GROWTH; EARNINGS; VALUATION.

† UQ Business School, The University of Queensland, St Lucia, QLD 4072.
Email: j.hall@business.uq.edu.au

Jason Hall is a lecturer in finance at UQ Business School, specialising in Corporate Finance and Investments. Matthew Tochterman graduated from the honours program at UQ Business School in 2004 and now works at Macquarie Bank. We acknowledge the financial support of the UQ Business School Research Fund and appreciate the comments of Clive Gaunt and Shumi Akhtar, discussant at the 2005 *AFAANZ* Conference, and the reviewer and editors of Australian Journal of Management.

Australian Journal of Management, Vol. 33, No. 1 June 2008, © The University of New South Wales

1. Introduction

Investors' growth expectations have a material effect on stock market valuations, and the academic literature has documented a phenomenon whereby portfolios of value stocks have outperformed portfolios of growth stocks (Fama & French 1992; Chan & Lakonishok 2004). Value (growth) stocks are characterised by high (low) ratios of book-to-market equity, earnings-to-price and sales-to-price. Lakonishok, Shleifer and Vishny (1994) contend that the relative outperformance of value stocks is due to investors forming expectations of future growth based largely on past performance. If investors' perception of firms' ability to sustain high earnings growth is overstated, their consequent high valuations will result in underperformance of these stocks.

Two results from a recent study in the United States (US) support this hypothesis (Chan, Karceski & Lakonishok 2003). First, they show that sales and earnings growth is not persistent—future growth is largely independent of past growth. Second, they show that the ratio of book-to-market equity is inversely related to past growth, but *is not* associated with future growth. These results are consistent with the view that equity valuations incorporate expectations of persistent growth which does not eventuate, resulting in underperformance of firms with high past growth and outperformance of firms with low past growth.

However, the US market is characterised by stocks with high reinvestment rates and a high proportion of value comprised of intangible assets. It is arguable that the result of Chan, Karceski and Lakonishok (2003) will be less pervasive in markets where the proportion of value attributable to growth options is lower. Hence, we measure the persistence and predictability in sales and earnings growth for Australian-listed firms. Our intent is to determine whether there is any greater persistence or predictability in sales and earnings growth for stocks in a market weighted more heavily towards high-yielding stocks, and those in the mature financial services and materials industries instead of the rapidly-growing industries of technology and pharmaceuticals.

We find the persistence of growth is greater than we would expect by chance, but present evidence that the market's expectation of this persistence is overstated. There is a significantly more negative relationship between the book-to-market equity ratio and historical earnings growth, compared to the book-to-market equity ratio and future earnings growth. Thus, while our sample selection and research techniques imply greater persistence than reported by Chan et al., they contradict the practitioner use of the book-to-market ratio as a reliable indicator of growth prospects.

Apart from the difference in industry composition in the two markets, there is an alternative explanation for the difference in persistence reported in our study and Chan, Karceski and Lakonishok (2003). Chan, Karceski and Lakonishok implement two statistical procedures designed to maintain sample size and reduce volatility of growth figures. However, these procedures also inhibit their ability to find persistence in growth. First, Chan, Karceski and Lakonishok adjust growth rates for dividend payout ratio, thereby estimating growth rates for all firms under a common payout assumption. We implement a more complete adjustment for reinvestment, allowing for increases in the equity base from both reinvestment of earnings and from the issue of new equity. Second, in order to maintain sample size, Chan, Karceski and Lakonishok substitute inferred growth rates for the cases where growth rates are not meaningful because of negative base-year earnings. We contend that the use of these inferred growth rates introduces data drawn from a different population to loss-making firms and has the potential to militate against the finding of persistence.

The remainder of this paper is organised as follows. In section 2 we provide background and discuss prior research; in section 3 we explain the methodology and data; in section 4 we present our results; and we reach conclusions in section 5.

2. Background and Prior Research

Two opposing positions exist in the academic literature to explain the value versus growth phenomenon as documented by Chan, Hamao and Lakonishok (1991), Fama and French (1992) and Lakonishok, Shleifer and Vishny (1994). The explanation that is consistent with market efficiency is that the additional returns observed for value versus growth stocks can be explained by risk factors (Fama & French 1993). The alternative explanation which provides support for active investing is that these additional returns are a result of the behavioural biases of investors (Lakonishok, Shleifer & Vishny).

Chan, Hamao and Lakonishok (1991) investigated the predictive power of earnings yield, cash-flow yield, size (market capitalisation of equity) and the book-to-market equity ratio in explaining cross-sectional returns of Japanese stocks. The book-to-market equity ratio was statistically and economically the most important of these four variables, followed by cash-flow yield. The study also confirmed the size effect in which small firms tend to outperform large firms, after controlling for market risk and firm characteristics.

Fama and French (1992) challenged the ability of the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964), Lintner (1965) and Black (1972) to explain stock returns. They examined the joint roles of systematic risk, size (market capitalisation), the earnings-to-price ratio, leverage, and book-to-market equity in the cross-section of average stock returns on the NYSE, AMEX, and NASDAQ. They concluded that systematic risk does not explain the cross-section of average stock returns, but that returns are associated with size and book-to-market equity. In addition, the explanatory power of these variables was found to subsume that associated with differences in leverage and the earnings-to-price ratio. They proposed that stock risks were multidimensional with size and book-to-market equity acting as proxies for risk.

In a subsequent paper, Fama and French (1993) built on the results of their 1992 research to create a three-factor asset pricing model, where expected returns were a function of a stock's exposure to market risk, the relative returns of small versus large stocks, and the relative returns of high versus low book-to-market stocks. This model was able to explain almost all of the cross-sectional variation of US stock returns, was confirmed for several international markets in Fama and French (1998) and was verified for Australian stocks in Gaunt (2004). Gaunt found that while the three factor model performed better than the CAPM, the majority of its explanatory power was attributable to the size variable.

Lakonishok, Shleifer and Vishny (1994) extended the research of Fama and French (1992, 1993) specifically focusing on whether value strategies outperformed growth strategies due to fundamental risk factors or sub-optimal practices of investors. They compared returns on portfolios constructed using relative ratios of cashflow-to-price, book-to-market equity, earnings-to-price and sales growth, over holding periods of one to five years.

Of relevance for the present study, they found that the actual future growth rates of earnings and cash flows for glamour stocks—those with low ratios of book-to-market equity or cashflow-to-price—were lower than would be implied by these multiples. Their evidence supports the view that investors consistently overestimate growth rates of glamour stocks and that the excess returns of value stocks are not attributable to higher risk. They argue that this overestimation of growth rates for glamour stocks occurs despite the observation that growth is mean-reverting and put forward the following explanation for the continued excess returns to value-investing:

1. Investors extrapolate past growth too far into the future;
2. Good past performance attracts institutional investors to growth stocks as they are less likely to become financially distressed and can be easily justified to sponsors due to their previous performance; and,
3. Investors' time horizons do not extend to the time horizon needed for these value strategies to pay off. Institutions particularly cannot afford to underperform benchmarks as sponsors will withdraw funds in response to this underperformance.

Lakonishok, Shleifer and Vishny (1994, p. 1576) stated that in their view 'return differences are ultimately explained by the tendency of investors to make judgemental errors and perhaps also by a tendency for institutional investors to actively tilt toward glamour to make their lives easier.'

This explanation of the value-glamour anomaly, which requires a mismatch between the persistence of growth that investors incorporate into asset prices and the persistence which actually occurs, was examined by Chan, Karceski and Lakonishok (2003). They argued that the significant dispersion in five-year growth forecasts reported by the Institutional Brokers Estimate System (I/B/E/S) is evidence that analysts believe that growth is, to a certain degree, predictable. If analysts thought that growth rates of individual firms would be constrained by competitive pressures, there would be significantly lower dispersion in expected long-term growth forecasts.

Given this prima facie evidence that analysts consider growth to be predictable to some extent, the authors examined the growth rates of US firms from 1951 to 1998, to determine whether growth was persistent, and whether it could be predicted by valuation ratios. They found some evidence of persistence in sales growth, but little persistence in income growth. They also report that there was a consistent inverse relationship between the book-to-market equity ratio and historical earnings growth—a relationship that did not hold for future earnings growth. In addition, they found that over long horizons analysts' estimates tended to be overly optimistic and were of little use in predicting realised growth.

As a final test of the predictability of growth, Chan, Karceski and Lakonishok (2003) used a regression model with nine independent variables to assess whether there was any predictability in growth for sales, operating income before depreciation and income before extraordinary items for up to five years. In general, valuation ratios (earnings yield, dividend yield and book-to-market equity) had inconsistent or insignificant relationships with future growth. Earnings yield was inversely related to earnings growth, as the dividend discount model of share valuation would predict. But this result was primarily due to a small number of cases with particularly low earning yields, and there was a direct relationship between earnings yield and sales growth, which is contrary to expectations. Dividend yield had an inverse relationship with growth in sales and growth in operating income before depreciation, but this relationship was not significant at the net income level. Finally, the book-to-market equity ratio had the expected inverse relationship with future growth, but only at the sales level.

The finding of a lack of predictability in growth is consistent with the economic intuition that competitive pressures ultimately work to correct excessively high or low investment returns. This is reinforced by the stronger relationship between dividend yield and the book-to-market equity ratio, compared to valuation ratios based on income. Specifically, valuation ratios tend to incorporate high reinvestment rates resulting in strong sales growth, but at the expense of diminishing returns on investment. Finally, the variable that had the most consistent relationship with growth in sales and earnings was the ratio of research and development expenditure to sales. This means that the factor most consistently related to future growth—research and development intensity—is a variable entirely independent of equity price. This provides support for the view that equity prices incorporate growth expectations which extrapolate past growth too far into the future.

The results of these studies provide the motivation for our paper, in which we distinguish between the two competing explanations for differential returns of value versus glamour stocks. For the US, Australia and other markets, there is clear evidence that the variance in stock returns can be explained by the stocks' systematic risk, size and book-to-market equity ratio (Fama & French 1993, 1998; Gaunt 2004). But only for US stocks is there evidence consistent with the hypothesis that this result is due to mispricing, specifically due to investors' extrapolation of past growth into the future. The results to date can be summarised in table 1, where the empty cell represents the contribution of our paper. The implication for investment decision-making is that, if the sales and earnings growth of Australian firms shows the same lack of persistence and predictability as for US firms, this provides further support for the mispricing explanation for the differential returns of value versus glamour stocks. Conversely, if the sales and earnings growth of Australian firms is more persistent and predictable than that observed in the US, then the risk-based explanation is given additional support, because the same factor model explains returns in both markets.

It is an empirical question whether the growth of Australian stocks is more or less persistent or predictable than their US counterparts, given fundamental differences in market composition. The US market is characterised by stocks with high reinvestment rates and a high proportion of value comprised of intangible assets, as shown in table 2. In this table, we compare the industry breakdown of the US S&P500 index versus the Australian S&P/ASX300 index. While the mature financial services and basic materials industries comprise 60% of Australian market capitalisation, these industries contribute just 24% to US market capitalisation.

Two-thirds of this difference can be attributed to the contribution of Information Technology and Health Care stocks.

Table 1

Stock Returns and the Book-to-Market Ratio

Empirical results of tests of the Fama-French three-factor model, the persistence of growth and its predictability with valuation ratios, in the United States and Australia.

United States	Australia
The cross-section of returns are a function of size, book-to-market equity and market β.	The cross-section of returns are a function of size, book-to-market equity and market β.
R=*f(size, book-to-market equity and* β*)*	*R=f(size, book-to-market equity and* β*)*
The book-to-market equity factor is a function of past growth, not future growth. Growth is neither persistent nor predictable.	?

Table 2

Industry Composition

Market capitalisation (MC), dividend yield (DY), earnings yield (EY) and dividend payout ratio (DPR) of stocks in the S&P500 (US) and the S&P/ASX 300 (Australia) by the industry classification of Thomson Financial, as at 31 December 2006.

Industry	S&P500 (US)					S&P/ASX300 (AUS)				
	MC ($b)	MC (%)	DY (%)	EY (%)	DPR (%)	MC ($b)	MC (%)	DY (%)	EY (%)	DPR (%)
Industries with relatively greater contribution to the Australian market										
Financials	2645	21	2.4	7.1	33	525	42	4.4	5.7	77
Basic Materials	432	3	1.9	6.7	28	226	18	1.9	5.5	34
Consumer Services	1399	11	1.1	5.2	22	141	11	3.3	4.9	68
Telecommunications	621	5	2.7	5.1	52	63	5	5.5	9.8	56
Industries with relatively greater contribution to the US market										
Utilities	461	4	3.1	2.9	106	17	1	3.9	4.2	93
Consumer Goods	1218	10	2.3	5.1	45	39	3	3.9	6.3	61
Oil & Gas	1342	11	1.7	9.1	19	62	5	2.3	5.1	45
Health Care	1405	11	1.8	5.3	34	36	3	1.5	2.2	69
Industrials	1457	11	1.9	4.7	40	137	11	3.2	5.2	62
Technology	1732	14	0.7	4.5	16	7	1	3.7	3.5	107
Total	12710	100	1.8	5.8	33	1253	100	3.5	5.6	64
US dividend yield					1.8					
Difference in dividend yield due to:										
Dividend policy					2.1					
Industry composition					0.1					
Earnings yield					–0.5					
Total yield differential					1.7					
Australian dividend yield					3.5					

Furthermore, the dividend yield on the Australian market is almost double that of the US. On a value-weighed basis, S&P/ASX300 stocks were yielding 3.5% at 31 December 2006, compared to 1.8% for stocks in the S&P500. This differential is attributable to the dividend policy of Australian-listed companies. We estimated the dividend payout ratio as the product of the dividend yield and the price-earnings ratio (dividend/price × price/earnings = dividend/earnings). Australian-listed companies distribute almost twice the proportion of earnings as dividends, compared to US-listed companies, with an estimated dividend payout ratio of 64%. If we apply the same dividend payout ratio by industry for Australian firms to the earnings yield and industry composition of US firms, the dividend yield on US stocks would increase by 2.1%. Differences in industry composition and Australia's slightly lower earnings yield have considerably less impact on the yield difference in these two markets.

The relatively high reinvestment rate in the US suggests that this market consists of a significantly higher proportion of stocks that would intuitively be labelled as growth stocks and a consequently lower proportion of value stocks. Consistent with this intuition, Fama and French (1998) reported that Australian stocks had materially higher book-to-market equity ratios than US stocks. Portfolios of the highest 30% of stocks based on book-to-market equity in the US had a mean value-weighted ratio of 1.63. The average book-to-market equity ratio for the Australian counterpart portfolio was 1.74. This relationship held for portfolios of the middle 40% of stocks (where the ratios were 0.78 for the US market and 0.82 for Australia) and for the bottom 30% of stocks (where the ratios were 0.40 and 0.47, respectively). For the portfolio of low book-to-market firms, the value-weighted average stock in the US traded at a premium of 17.5% over its Australian counterpart, derived from market-to-book equity ratios of 2.50 versus 2.13. For high book-to-market portfolios, this premium falls to just 6.7%.[1]

We argue that these differential characteristics of the Australian market increase the probability of observing persistent and predictable growth. In sum, we test whether: (a) firms are able to achieve persistent growth exceeding the median that would occur by chance; and, (b) valuation ratios are predictive of growth, in a market with comprised of stocks in mature industries with low levels of reinvestment and consequent high dividend yields.

1. An alternative explanation for the relatively higher book-to-market equity ratios in the US is the application of more conservative accounting practices regarding the capitalisation of intangible assets. To address this concern we estimated proportion of tangible assets to net assets for Australian-listed firms from 1989–2006. There were 18,367 firm-years in which there was a positive value reported for both intangible assets and net assets. Of this dataset, 52% of firm-years reported zero intangible assets and the 70th percentile is 11.2%. Even if the figure for the 70th percentile were halved due to the application of more conservative accounting principles, a firm with a market-to-book ratio of 2.13 would have an adjusted market-to-book ratio of 2.26. That is, if a representative firm with a book value of $1.00 per share had its book value reduced by 5.6% due to more conservative accounting principles, its market-to-book ratio would increase to 2.13/(1–0.056) = 2.26.

3. Methodology and Data

3.1 Research Design

In a competitive market with few barriers to entry, consecutive years of growth above that of industry peers is unlikely. The long-run competitive equilibrium model of an industry, commonly upheld in economics describes a small firm entering the market with a new product. Over time the firm gains market recognition and demand increases, raising the profits of the firm. The higher profits bring more firms into the industry, saturating supply and reducing the market share of the participants. Under these circumstances it would be difficult for a firm to maintain consecutive years of above-median growth (Taylor, Moosa & Cowling 2000).

To determine if firms were able to achieve persistent sales and earnings growth, we compared their growth rates to the median of firms in the same industry and year. Specifically, we compared the likelihood that a firm will exhibit consistent growth above or below the industry median for between two and ten years to the proportion expected by chance.

This picture of the actual growth potential of firms can be contrasted with the market's perception, as reflected in ratios of earnings-to-price, sales-to-price and book-to-market equity. Consistent with discounted cash flow valuation models, firms with ratios below market averages are those for which the market's expectations for growth are above-average. If observed values for these metrics are associated with high levels of historic growth, this is evidence that the market expects these high growth rates to persist into the future.

We partitioned the data into three equal-sized groups, based on cumulative growth rates over five-year periods. For each third, we computed the median ratios of earnings-to-price, book-to-market equity and sales-to-price at the beginning and end of each period and then compared these median ratios across groups. If valuation ratios are useful in predicting future growth rates, we would expect to observe an inverse relationship between growth and start-of-period ratios.

The interpretation of end-of-period ratios is different. In theory, valuation ratios should reflect investors' expectations of future earnings growth. So we should only observe an inverse relationship between growth and end-of-period valuation ratios if investors consider past growth to be indicative of future growth.

In addition, we quantified the relationship between the five-year growth rates and valuation ratios using the following regression model:

$$\text{Five-year growth}_i = \alpha + \beta_1 \text{Valuation ratio}_i + \beta_2 \ln \text{BV Equity}_i + \beta_3 \text{Market}_i + \sum_{j=4}^{11} \beta_j \text{Industry}_{j,i} + \varepsilon_i$$

where:

- Five-year growth$_i$ represents five-year compound growth in sales, *EBITDA* or *NPAT* for observation *i*, adjusted for reinvestment and additional equity;
- Valuation Ratio$_i$ is the ratio of earnings-to-price, sales-to-price or book-to-market equity for observation *i*, measured either at the start or end of the period in which growth was estimated;

- *ln* BV Equity_i is the natural logarithm of the book value of equity for observation *i*, measured in real 2006 dollars;
- Market_i is an indicator variable equal to one for observations occurring from 2003–2006 and equal to zero for observations occurring from 1989–2003; and,
- $\text{Industry}_{j,i}$ represents indicator variables for eight industry classifications (Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials and Information Technology).

The inclusion of the natural logarithm of book value of equity is to control for the likelihood that small firms are at an earlier, high-growth stage of development than large firms. We used book value in measuring size rather than market value because this more closely approximates the amount of equity investment, rather than the market's assessment of the value of expected earnings.

We assigned an indicator variable of one to market conditions for observations from the year 2003 onwards—when stock returns have been particularly buoyant—and zero otherwise. From 1989–2002 the annualised return on the S&P/ASX300 was close to 9%, compared to 22% a year from 2003–2006. We also incorporated indicator variables for eight industry groups excluding Telecommunications Services (for which there were no valid observations of five-year growth adjusted for reinvestment and equity issuance) and Utilities (to avoid perfect collinearity). For adjusted growth in sales, *EBITDA* and *NPAT*, six regression models are displayed, one model for each of three valuation ratios at the beginning and end of the five-year period. If valuation ratios are useful in predicting growth, the coefficient on *beginning* valuation ratios should be negative. If the market considers past growth to be indicative of future growth, the coefficient on *ending* valuation ratios should be negative.

3.2 Computation of Adjusted Growth Rates

We computed growth in two ways, reported as g and $\hat{g}$, where $\hat{g}$ adjusts the percentage change in sales, *EBITDA* or *NPAT* for the percentage change in the book value of equity over the year. Specifically, we computed growth in these three operating performance measures as:

$$g_t = \frac{\text{Operating performance}_t - \textit{Operating}\text{ performance}_{t-1}}{\text{Operating performance}_{t-1}} \tag{1a}$$

$$\hat{g}_t = g_t \times \frac{\text{NPAT}_{t-1}}{\text{Book value of equity}_{t-1} - \text{Book value of equity}_{t-2}} \tag{1b}$$

where *Operating performance* = sales, *EBITDA* or *NPAT*.

We computed the adjusted growth rate ($\hat{g}$) to control for firms' changing investment bases over time. This is a more complete adjustment for varying dividend payout ratios to that performed by Chan, Karceski and Lakonishok (2003). They adjusted growth rates under the assumption that all dividends and special distributions are reinvested in new shares, implicitly assuming that this additional capital would have earned the same return as the capital actually invested. Their intent is to provide a basis for comparing the growth of firms with different reinvestment rates. But this adjustment is incomplete in the case where firms issue additional equity. For instance, if the firm pays no dividends, but issues new equity equal to its net income, it essentially has a reinvestment rate of 200%. And a firm with a 100% dividend payout ratio, but which issues new equity equal to this amount, has a reinvestment rate of 100%. By adjusting the growth rates for *all* changes in equity, whether resulting from dividends, buy-backs or new equity issuance, we measure the growth of all firms under the common assumption that the reinvestment rate is 100%.

Adjusted growth $(\hat{g})$ is calculated using changes in book value for the previous period, under the assumption that the level of investment at the end of period $t-1$ determines the growth in operating performance in period t. So the greater the increase in investment over periods $t-2$ to $t-1$, the more growth is expected in period t. Equation 1b is derived as follows. We take equation 1a and multiply and divide by both *NPAT* and changes in book value of equity in the previous period, denoted as $NPAT_{t-1}$ and $(BV_{t-2}-BV_{t-1})$ respectively:

$$g_t = \frac{OP_t - OP_{t-1}}{OP_{t-1}} = \frac{NPAT_{t-1}}{OP_{t-1}} \times \frac{BV_{t-1} - BV_{t-2}}{NPAT_{t-1}} \times \frac{OP_t - OP_{t-1}}{BV_{t-1} - BV_{t-2}} \tag{2a}$$

Looking at the right-hand side of the equation, the second factor is the reinvestment rate of the firm's equity under clean surplus accounting, which we want to normalise to one to consider all firms on an equal basis. Hence, we compute our adjusted growth rate $(\hat{g})$ as presented in equation 2b. In the appendix we provide an example of this adjustment and the distortion which results from only adjusting for dividend reinvestment.[2]

$$\hat{g}_t = g_t \times \frac{NPAT_{t-1}}{BV_{t-1} - BV_{t-2}} \tag{2b}$$

For the most part we report both the adjusted and unadjusted growth rates, because our adjustment implicitly assumes that any amount of reinvestment would have been able to earn the same return as projects actually funded. This is unlikely to hold in reality, but an alternative assumption that investments earn their cost of capital is even more tenuous given the imprecision of cost of capital computations.

---

2. A limitation of our adjusted growth rate computation is that changes in the book value of equity can capture factors other than the retention of profits, equity issuance and capital redemptions. That is, clean surplus accounting does not hold in reality, due to distortions such as asset revaluations. However, alternative measures of equity value changes generated even more potential distortions, due to significant re-classifications amongst reserves in firms' balance sheets. An alternative method of allowing for the impact of reinvestment on growth is to compute growth on a per share basis. However, this calculation is a function of the price at which new shares are issued, while our calculations are independent of issue price. If the share price is the present value of expected future dividends and new shares are issued at the market price of existing shares, the adjustment will be the same. But new shares are not typically issued at current market price, so estimating growth on a per share basis can generate misleading results. An example of this potential distortion is presented in the appendix.

3.3 Descriptive Statistics

The sample consists of 728 firms in the AspectHuntley database from 1989–2006 for which valid growth rates could be meaningfully interpreted for at least two consecutive years. From these firms we were able to compute 3939 observations of growth in sales, *EBITDA* or *NPAT* and 3227 observations of adjusted growth. Of these 728 firms, 29% had available data for 5–9 years, and a further 19% had available data for 10–16 years.

The table below summarises the process behind our sample composition. The database itself consists of 2,238 firms and 17,586 firm-years for which a share price was available. However, 27% of firms did not contain sufficient accounting information for analysis, and a further 28% of firms did not allow for meaningful computations of growth rates. For example, if base-year earnings are negative a growth rate computed from this base is not meaningful. If operations improve and earnings increase, this improvement will be reflected in a negative growth rate. Further deterioration of performance will result in a positive growth rate. We also truncated our sample at the 1st and 99th percentile of each measure of computed growth rates because of the extreme high growth rates which result from low base-year values and the extreme negative growth rates which result from large one-off items. This truncation resulted in the loss of 2% of firms with available share prices. We lose an additional 9% of firms because we could not compute growth rates for two consecutive years. However, these observations are retained in computing median industry growth rates in each year.

Finally, in the computation of adjusted growth rates we lose a further 3% of firms, because the adjusted growth rates are not meaningful. The premise behind the computation of adjusted growth rates is to compare all firms under the assumption of 100% reinvestment. However, our computations become non-sensical in the case where book value of equity declines in the prior year but earnings increase. Suppose in the prior year that book value of equity had declined by \$10.00 but the firm managed to generate an additional \$1.00 of *NPAT*. The firm's operating performance has improved as it has been able to increase earnings on a lower equity base. However, our computations would suggest that the firm has earned a return on reinvested equity of –10%. The impact of this situation is raw and adjusted growth rates of opposite sign. Where this occurs we do not compute an adjusted growth rate.

The most heavily represented firms exhibit diversity of industry and size. There are four firms with 15 valid observations of adjusted growth rates—Hills Industries, a manufacturer with market capitalisation of \$1 billion; Harvey Norman, a \$5 billion retailer; Leighton Holdings, a contract mining and construction firm with market capitalisation of \$12 billion; and Rural Press, a delisted publishing firm. Also heavily represented with 14 observations are Gowing Brothers (Financials; \$200 million), Wesfarmers (Industrials; \$15 billion) and Iluka Resources (Materials; \$1 billion).

Table 3
Sample Composition

The sample consists of 728 firms listed on the Australian Stock Exchange from 1989–2006 and comprises 3939 firm-year observations. The sample is reduced to 703 firms and 3227 firm-years when growth rates are adjusted for reinvestment and equity issuance. Annual growth is calculated for three measures of operating performance—sales, earnings before interest, tax, depreciation and amortisation *(EBITDA)* and net profit before abnormal items *(NPAT)*—using two calculations for growth (g and $\hat{g}$). g is the percentage change in the performance measure (sales, *EBITDA* or *NPAT)* while $\hat{g}$ adjusts this measure for the percentage change in the book value of equity over the prior year, as shown in Equation 2b. In panel A we summarise the impact of data filters on our final sample. In panel B we display the number of firms which contributed particular numbers of firm-years. For example, 150 firms contributed one valid adjusted growth rate, 103 firms contributed two valid adjusted growth rates and so on.

Panel A: Data filters

Data filters	Firms	Firm-years
Firms with a share price recorded from 1989–2006	2238	17586
Accounting information not available	609	5217
	1629	12369
Raw growth rates are not meaningful	637	6712
	992	5657
Truncate sample at the 1st and 99th percentile of growth rates	54	365
	938	5292
Only one year of consecutive growth available	210	1353
Sample firms with unadjusted growth rates	728	3939
Adjusted growth rates are not meaningful	25	712
Sample firms with adjusted growth rates	703	3227

Panel B: Number of sample firms according to number of valid growth rates

Firm-years	Sample of adjusted growth rates		Sample of unadjusted growth rates	
	Firms	%	Firms	%
1	150	21	137	19
2	103	15	88	12
3	96	14	68	9
4	64	9	87	12
5	63	9	68	9
6	40	6	43	6
7	39	6	28	4
8	37	5	38	5
9	28	4	35	5
10	22	3	26	4
11	27	4	36	5
12	19	3	19	3
13	8	1	27	4
14	3	0	8	1
15	4	1	6	1
16	0	0	14	2
Total	703	100	728	100

Table 4

Descriptive Statistics

In panel A we summarise the distribution of growth rates for all measures of operating performance. In panel B we present median growth in *NPAT* (excluding and including the adjustment for reinvestment) by industry and time period. The period 1990–2002 represents a bear market, during which time the Australian sharemarket earned compound returns of 9% per year. From 2003–2006 we observed a bull market in which compound returns were 22% per year.

Panel A: Distribution of growth in sales, EBITDA and NPAT

	Growth in sales (%)			Growth in EBITDA (%)			Growth in NPAT (%)		
	Adjusted growth rates ($\hat{g}$)	Unadjusted rates where adjusted rates meaningful (g)	Unadjusted rates for full sample (g)	Adjusted growth rates ($\hat{g}$)	Unadjusted rates where adjusted rates meaningful (g)	Unadjusted rates for full sample (g)	Adjusted growth rates ($\hat{g}$)	Unadjusted rates where adjusted rates meaningful (g)	Unadjusted rates for full sample (g)
Mean	21	16	18	15	15	15	11	9	10
Median	10	9	10	9	8	10	10	10	11
Std. Dev.	58	42	42	88	61	60	141	143	120
Percentiles:									
Min	–153	–80	–80	–460	–425	–425	–1149	–1149	–1149
5^{th}	–34	–28	–34	–98	–74	–98	–173	–141	137
10^{th}	–15	–15	–15	–51	–43	–51	–92	–76	–173
25^{th}	0	–1	0	–9	–11	–9	–19	–22	–92
75^{th}	28	23	28	35	29	35	43	39	–19
90^{th}	66	49	66	84	63	84	109	99	43
95^{th}	117	77	117	137	93	137	188	171	109
Max	670	515	498	687	481	481	1159	1317	1317

Table 4 Cont.

Panel B: Median growth in NPAT by industry and time period (ranked by median adjusted NPAT growth)

Industry	1990–2006					1990–2002					2003–2006				
	Adj ($\hat{g}$)	Unadj (g)	Unadj All (g)	N Adj	N All	Adj ($\hat{g}$)	Unadj (g)	Unadj All (g)	N Adj	N All	Adj ($\hat{g}$)	Unadj (g)	Unadj All (g)	N Adj	N All
IT	–2	–2	–2	155	184	–17	–25	–25	74	83	11	10	11	81	101
Energy	1	5	2	176	214	–7	1	–6	122	145	12	15	21	54	69
Telco. svcs.	2	3	2	26	36	–2	0	–5	12	16	11	6	17	14	20
Materials	7	7	7	598	770	1	1	2	417	551	21	19	20	181	219
Utilities	7	15	15	42	52	7	19	17	29	36	7	8	10	13	16
Cons. stpl.	8	10	11	365	435	11	11	11	272	331	6	10	9	93	104
Industrials	10	11	11	752	880	6	6	7	508	597	17	19	18	244	283
Cons. disc.	11	11	12	657	814	8	9	9	406	500	15	14	15	251	314
Health care	14	16	20	155	199	14	16	20	92	121	13	15	18	63	78
Financials	20	18	21	301	355	10	10	12	173	212	29	31	38	128	143
Full sample	10	10	11	3227	3939	6	7	7	2105	2592	16	16	18	1122	1347

We present descriptive statistics in table 4. For all 3939 observations the median unadjusted growth rates in sales, *EBITDA* and *NPAT* are 10, 10 and 11%, respectively. These median growth rates fall by 1–2% for the sub-sample of 3227 observations for which adjusted growth rates could be computed. After accounting for reinvestment, we report median growth rates of 10% for sales, 9% for *EBITDA* and 10% for *NPAT*.

There is considerable variation in growth rates across time and industry. We disaggregated the sample into 10 industry groups according to the Global Industry Classification System (GICS) of Standard & Poor's and into two time periods. The two time periods represent periods in which the Australian sharemarket exhibited considerable difference in returns. From 31 December 1989 to 31 December 2002 the total annualised return on the S&P/ASX200 was 9%, a figure which rose to 22% for the subsequent four years. The median *NPAT* growth of listed firms mirrored this sharemarket performance. From 1990–2002, the median annual *NPAT* growth for the sample was 7% (or 6% after adjusting for reinvestment). From 2003–2006, median *NPAT* growth increased to 18% for all firms, and to 16% for the sub-sample of firms for which an adjusted growth rate could be computed. Median adjusted *NPAT* growth was also 16%. The greatest improvements were amongst Information Technology and Financial firms, which experienced increases in median adjusted *NPAT* growth of 16 and 10% respectively.

4 Results

4.1 Persistence in Growth

Our metric for persistence is the proportion of firms whose sales or earnings growth consistently exceeded or fell below the industry median compared to the proportion expected by chance. This restricts our observations to those for which the growth rate is interpretable, which requires a positive base-year value for sales, *EBITDA* or *NPAT*. Chan, Karceski and Lakonishok (2003) utilise a method for preserving these observations, whereby if a firm has a negative base-year value, it is given an inferred growth rate for that year. Their substitution procedure is as follows. First, they measure change in operating performance per share relative to share price. Suppose we call this variable *eps change relative to price*. Second, they rank firms in each year according to this alternative measure of growth. Third, in the case where the base-year value for operating performance is negative, they substitute the growth for the firm with the same percentile rank for which the base-year value is positive.

While this method increases sample size and mitigates against survivorship bias, it introduces a set of inferred growth rates which are drawn from a different population. *Eps change relative to price* exhibits considerably more *dispersion* amongst firms whose standard growth rates are uninterpretable, compared to the subsample of firms whose growth rates are interpretable. For our sample, when *NPAT* is the measure of operating performance, the interquartile range for *eps change relative to price* was –2.5 to + 2.4% for firms whose standard growth rate was interpretable. In contrast, the range was –5.6 to 15.0% for sample firms whose standard growth rate was uninterpretable. This occurs because firms with more volatile earnings are more likely to report negative earnings in any given year. The *level* of growth computed on this basis is also lower for firms with positive base-year earnings, with those firms having median *eps change relative to price* of 0.6%, compared to 1.7% for firms with negative base-year earnings. In summary, the use of inferred growth rates incorporates lower and less volatile growth rates into the analysis than we would otherwise expect to observe. Inferred growth rates are a different population.

If a firm had an interpretable growth rate for the seventeen-year sample period, it contributed eight valid observations of ten-year growth. Likewise, that same firm would contribute thirteen observations of five-year growth. These figures are presented in table 5 as *valid observations.* We compute the percentage of observations which were above or below their industry median in every consecutive year and compare this figure to what would be expected by chance. If there is no persistence in growth, the proportion of firms expected to exceed the median is 2×0.5^n where n is the number of years in question. That is, a lack of persistence implies that 50% of firms are expected to have above- or below-median growth for two consecutive years, a figure which decreases to 25% and 12.5% for consecutive growth over three- and four-year periods. If growth is random, just 1-in-512 observations is expected to have above- or below-median growth for ten consecutive years. Note that we compute the median growth rate in each year with respect to the total number of firms for which the growth rate is interpretable.

Our null hypothesis is:

H_0: *the proportion of firms whose growth rate consistently exceeds or falls below the industry median is equal to that which would be expected by chance.*

We tested this hypothesis by computing the following Z-statistic and corresponding p-values:

$$Z \cong \frac{p_s - p}{\sqrt{\frac{p(1-p)}{n}}}$$

where:

- p_s is the proportion of firms whose growth consistently exceeded or fell below the industry median;
- p is the expected proportion if growth was random in each year; and,
- n = total number of valid observations.

As detailed in table 5, sample firms display notably higher persistence in growth than would be expected by chance. For instance, 11% of firms had adjusted *NPAT* growth above or below the industry median for five consecutive years, compared to the naïve expectation of 6%. Persistence in growth is driven by high-growth firms, with there being a disproportionate number of firms which experience persistently high growth and few firms experiencing persistently low growth. Over five years, 9% of firms experienced consistently high adjusted *NPAT* growth in each year, compared to just 1% of firms which experienced consistently low adjusted *NPAT* growth. All proportions of observations consistently above or below the industry median are statistically different from the naïve expectation at the one percent level.

Table 5
Persistence in Growth

We recorded the number of observations in which firms recorded consecutive above- or below-median industry growth and compared this to the total number of valid observations for the corresponding length of time. In every instance the proportion of observations above or below the industry median is greater than the naïve expectation at the one percent level of significance, according to a *z*-test of difference in proportions.

Consecutive years	2	3	4	5	6	7	8	9	10
Expected % above/below median	50.0	25.0	12.5	6.3	3.1	1.6	0.8	0.4	0.2
Panel A: Adjusted growth rates									
Valid observations	2542	1664	1128	760	503	323	212	140	87
Growth in sales									
Consistently above median	839	364	172	82	45	24	16	11	8
Consistently below median	555	162	52	18	8	2	0	0	0
Consistently high or low (%)	55	32	20	13	11	8	8	8	9
Growth in EBITDA									
Consistently above median	877	390	197	113	66	40	28	20	13
Consistently below median	524	138	42	14	4	0	0	0	0
Consistently high or low (%)	55	32	21	17	14	12	13	14	15
Growth in NPAT before abnormals									
Consistently above median	851	363	159	72	29	12	7	4	3
Consistently below median	521	135	39	11	1	0	0	0	0
Consistently high or low (%)	54	30	18	11	6	4	3	3	3
Panel B: Unadjusted growth rates									
Valid observations	3939	3027	2354	1844	1437	1121	875	674	506
Growth in sales									
Consistently above median	1224	590	297	150	69	34	23	15	10
Consistently below median	1089	493	239	116	62	32	18	9	5
Consistently high or low (%)	59	36	23	14	9	6	5	4	3
Growth in EBITDA									
Consistently above median	1203	567	295	164	97	59	37	24	15
Consistently below median	929	313	97	31	11	4	1	0	0
Consistently high or low (%)	54	29	17	11	8	6	4	4	3
Growth in NPAT before abnormals									
Consistently above median	1199	575	287	151	78	40	21	11	4
Consistently below median	873	276	81	22	8	4	2	0	0
Consistently high or low (%)	53	28	16	9	6	4	3	2	1

Importantly, we report higher persistence than Chan, Karceski and Lakonishok (2003, table III), for all measures of operating performance. Chan, Karceski and Lakonishok do not find significant persistence in *NPAT* growth, but report some degree of persistence in sales growth and growth in operating income before depreciation. Over a five-year period, they report that 6.3% of firms achieve consecutive years of above-median adjusted sales growth, while we report a figure of 10.8%.[3] However, for *EBITDA* growth, Chan, Karceski and Lakonishok report that only 3.6% of firms were able to achieve five years of above-median growth, a figure which falls to just 3.0% for *NPAT* growth. In contrast, we report figures of 14.9% for adjusted *EBITDA* growth and 9.5% for adjusted *NPAT* growth.

Chan, Karceski and Lakonishok (2003) have economic explanations for their reported differences in persistence for sales and earnings growth. They contend that sales growth can be maintained by long-lasting shifts in customer demand or expansion into new products or markets, but growth in earnings is more difficult to achieve, because growth in sales is traded off against a decline in margins. We considered this possibility and analysed the relationship between sales growth and profit margins (*EBITDA*/sales and *NPAT*/sales). This analysis showed a significantly positively relationship between sales growth and change in profit margin—sales growth translated into increased profitability for our sample. This is consistent with firms achieving economies of scale. In the presence of fixed costs, revenue growth results in an increase in margins and earnings growth exceeds revenue growth.[4]

In contrast to the economic explanations of Chan, Karceski and Lakonishok (2003), we have a statistical explanation for their reported difference in persistence between sales and earnings growth. Recall that Chan, Karceski and Lakonishok use inferred growth rates in their analysis where base-year earnings are negative. This involves using the growth rate from the distribution of firms with positive base-year earnings at the same percentile when firms are ranked according to *eps change relative to price*. This substitution affects the sample at the earnings level, rather than the sales level for which base-year values are positive. Chan et al's contrasting findings of persistence in growth at the sales level, but random growth at the earnings level, could simply result from using inferred growth rates drawn from a different population. Alternatively, Chan et al's results could come from not fully accounting for the impact of changes in equity capital on growth. In general, we report greater persistence in revenue and earnings growth which takes this adjustment into account, compared to growth rates based on raw accounting figures.

The finding of significant persistence in growth is primarily due to the persistence exhibited by firms in four industries which comprised two-thirds of the sample—Health Care, Industrials, Consumer Discretionary and Consumer Staples. In table 6 we report the proportion of observations in which adjusted *NPAT* growth was consistently above or below the industry median by ten industry classifications. Over five years, 17% of observations within these four industries were consistently above or below the industry median, compared to 7% for the remaining industries.

---

3. There are 82 observations consistently above the industry median relative to 760 valid observations, a ratio of 10.8%.
4. See Hall (2005) for a derivation in which continuously compounded earnings growth is the sum of sales growth and margin growth. An implication of this is that margin growth is positive where sales grow faster than fixed costs.

Compared to the rest of the sample, growth rates in these four industries were relatively high and exhibited lower variation. Overall, the median adjusted *NPAT* growth for the 1929 observations in these four industries was 11%, compared to 8% for the remaining 1298 observations. For the industries which exhibited persistence in growth, the interquartile range of adjusted *NPAT* growth was 53%, compared to 75% for the rest of the sample. This supports our contention that the maturity and reinvestment policy of firms is likely to be associated with their ability to persistently grow revenue and earnings.

Table 6
Persistence in Growth by Industry

This table presents the proportion of valid observations in which adjusted growth in *NPAT* was consistently above or below the industry median for ten industry groups. ***, ** and ** represent significance at the 1, 5 and 10% levels respectively. Significance levels are not reported for sub-samples with less than 10 valid observations.

Consecutive years	2	3	4	5	6	7	8	9	10
Exp % above/bel med	50.0	25.0	12.5	6.3	3.1	1.6	0.8	0.4	0.2
				Valid observations					
Full sample	2542	1664	1128	760	503	323	212	140	87
Energy	136	83	51	35	22	15	10	5	2
Materials	445	275	171	106	58	27	11	4	1
Industrials	606	412	283	198	139	96	64	42	26
Cons. disc.	515	351	253	173	121	82	63	48	35
Cons. staples	281	200	142	99	67	44	28	18	11
Health care	126	87	65	49	34	22	16	11	6
Financials	253	166	115	74	49	31	17	11	6
IT	122	56	29	13	5	1	0	0	0
Telco. svcs.	19	7	1	0	0	0	0	0	0
Utilities	39	27	18	13	8	5	3	1	0
				% of firms which had consistently high or low adjusted NPAT growth relative to their industry peers					
Full sample	54***	30***	18***	11***	6***	4***	3***	3***	3***
Energy	52	24	16	11	5	0	0	0	0
Materials	52	24	11	6	2	0	0	0	0
Industrials	57***	34***	22***	15***	8***	3	2	0	0
Cons. disc.	54*	31***	19***	11**	7**	7***	8***	8***	9***
Cons. staples	57**	31*	18*	10	7**	2	0	0	0
Health care	58*	34**	23***	16***	12***	9***	6**	0	0
Financials	51	27	15	8	0	0	0	0	0
IT	48	23	7	0	0	0	–	–	–
Telco. svcs.	58	29	0	–	–	–	–	–	–
Utilities	46	33	22	8	0	0	0	0	–

4.2 Survivorship Bias

There are two pieces of prima facie evidence that our documented persistence is attributable to survivorship bias. First, there is greater persistence in growth the longer the period over which persistence is measured. Second, there is greater persistence in growth amongst high-growth compared to low-growth firms. If low-growth firms are more likely to leave the sample over time, then it is more likely that we will observe surviving firms with persistent growth above the industry median.

We accounted for survivorship bias in two ways. First, we disaggregated the results from table 5 into sub-samples with different levels of survivorship. Second, we computed the probability of an additional year of above-median growth, conditional upon having observed above-median growth in every prior year.

4.2.1 Persistence Amongst Observations with Different Levels of Survivorship As reported in table 5, there are 2542 observations used to measure the persistence in adjusted growth over two years. Close to one-third of these observations do not survive for analysis of growth over a three-year period, either because the firm itself drops out of the sample, or the firm reported negative earnings in the second year, so a valid growth rate in the third year could not be computed. Only 3% of these initial observations are used to measure the persistence in growth over a ten-year period.

If our results are attributable to survivorship bias, we would observe systematically greater persistence amongst observations which survived for longer periods of time. In table 7 we report the proportion of observations achieving above- or below-median adjusted growth for subsamples with different survival rates. The proportions should be compared by reading down the columns, to directly compare the persistence over a given time period, for subsamples which survived for anywhere between two and ten years. These sub-samples do not overlap so there is no question of a handful of common observations affecting the comparison.

These results show that there is no greater persistence amongst observations which survived for longer periods of time, with the exception of observations which survived for ten years. For instance, 11% of all observations achieved above- or below-median adjusted *NPAT* growth for five consecutive years. This proportion was 10% for the 257 observations which were valid for only five years and 8% for the 180 observations which were valid for six years. For observations which survived for anywhere from five to nine years, the proportion was in the narrow range of 8–11%. A similar pattern emerges for adjusted revenue and *EBITDA* growth. In general, there is no consistent relationship between persistence in growth over a given number of years and the period during which the observation survived, with the exception of the 87 observations which survived for ten years.[5]

The lack of survivorship bias is illustrated in the figure below. The vertical axis measures the probability of achieving consecutive years of above- or below-median adjusted growth in revenue, *EBITDA* or *NPAT*. For each measure of

5. On an unadjusted basis there is only evidence of survivorship bias at the *NPAT* level, with greater persistence amongst observations at the seven to ten year level of survivorship, compared to observations which survived for fewer years. At the revenue and *EBITDA* levels, there is no relationship between persistence in growth and survival rates.

performance we report proportions over 2–5 years, conditional upon the number of years in which the firm survived. The horizontal lines represent the average proportions for each sub-sample. Apart from the increase in persistence amongst observations which survived for ten years, there is no relationship between persistence and survivorship.

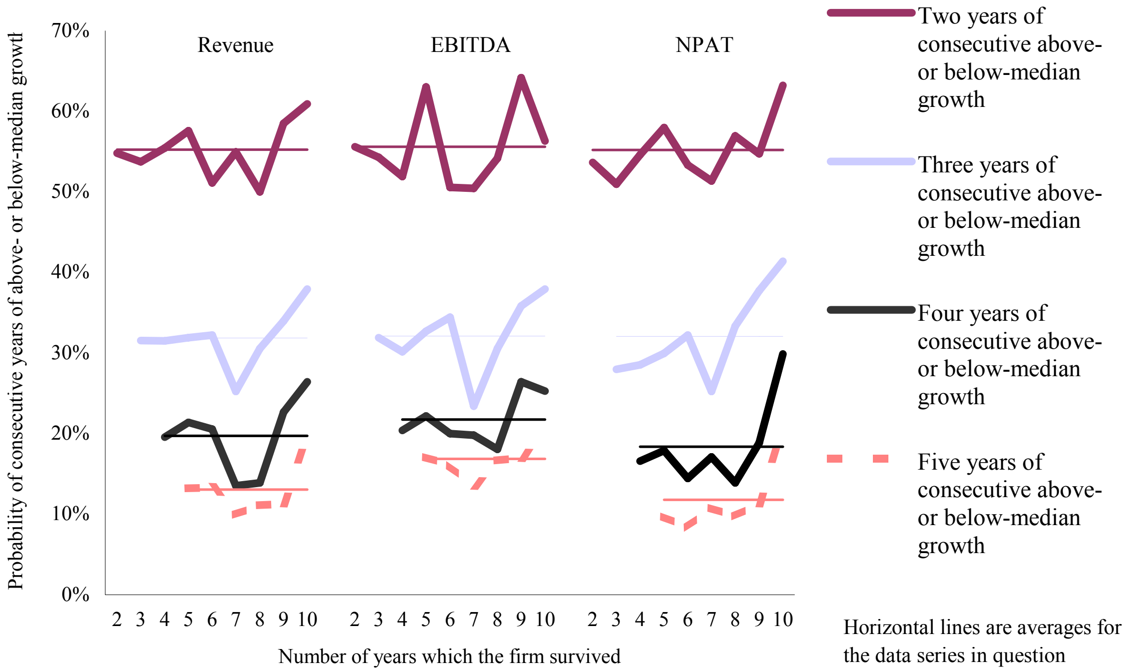
Table 7

Persistence of Adjusted Growth Amongst Subsamples with Different Levels of Survivorship

Consecutive Years	2	3	4	5	6	7	8	9	10
Exp % abv/bel med	50.0	25.0	12.5	6.3	3.1	1.6	0.8	0.4	0.2
Growth in sales									
2 years survival	55***	–	–	–	–	–	–	–	–
3 years survival	54*	32***	–	–	–	–	–	–	–
4 years survival	55**	32***	20***	–	–	–	–	–	–
5 years survival	58**	32**	21***	13***	–	–	–	–	–
6 years survival	51	32**	21***	13***	11***	–	–	–	–
7 years survival	55	25	14	10	8***	5**	–	–	–
8 years survival	50	31	14	11*	8**	6***	3*	–	–
9 years survival	58	34	23**	11	11***	9***	6***	4***	–
10 years survival	61**	38***	26***	20***	15***	14***	13***	10***	9***
All firms	55***	32***	20***	13***	11***	8***	8***	8***	9***
Growth in EBITDA									
2 years survival	56***	–	–	–	–	–	–	–	–
3 years survival	54**	32***	–	–	–	–	–	–	–
4 years survival	52	30**	20***	–	–	–	–	–	–
5 years survival	63***	33***	22***	17***	–	–	–	–	–
6 years survival	51	34***	20***	16***	14***	–	–	–	–
7 years survival	50	23	20**	14***	13***	11***	–	–	–
8 years survival	54	31	18	17***	11***	11***	11***	–	–
9 years survival	64**	36*	26***	17***	17***	13***	13***	13***	–
10 years survival	56	38***	25***	21***	16***	15***	15***	15***	15***
All firms	55***	32***	21***	17***	14***	12***	13***	14***	15***
Growth in NPAT									
2 years survival	54**	–	–	–	–	–	–	–	–
3 years survival	51	28	–	–	–	–	–	–	–
4 years survival	55*	29	17**	–	–	–	–	–	–
5 years survival	58**	30*	18***	10**	–	–	–	–	–
6 years survival	53	32**	14	8	2	–	–	–	–
7 years survival	51	25	17	11**	7**	2	–	–	–
8 years survival	57	33	14	10	6	4*	1	–	–
9 years survival	55	38**	19	11	8*	4	4**	–	–
10 years survival	63**	41***	30***	21***	11***	6***	5***	5***	3***
All firms	54***	30***	18***	11***	6***	4***	3***	3***	3***

Figure 1

Probability of Consecutive Years of Above- or Below-Median Growth Adjusted for Reinvestment According to the Number of Years in which the Observation Survived



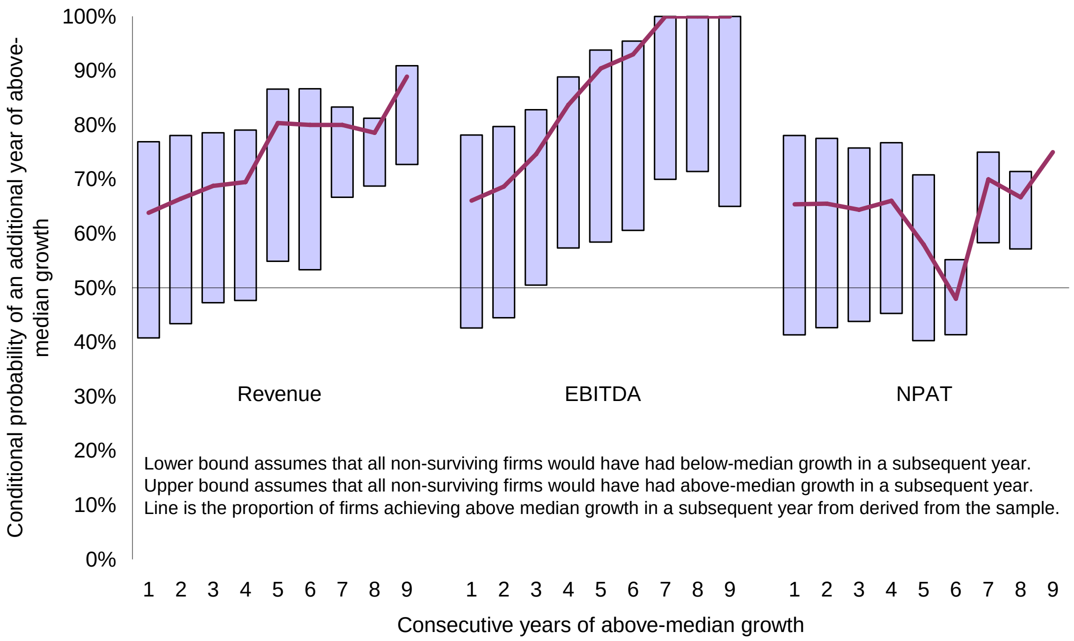
4.2.2 Conditional Probability of an Additional Year of Above-Median Growth An alternative way to measure persistence is to compute the probability of an additional year of above-median growth, conditional upon the observation having achieved above-median growth in prior years. If there is no persistence in growth, the probability of achieving above-median growth in any given year is 50%, independent of growth rates prior to this point. In the figure below the solid lines represent the conditional probabilities of an additional year of above-median growth, contingent upon the observation having achieved above-median growth in every prior year. Based on our sample, there is approximately a two-thirds chance of achieving an additional year of *NPAT* growth (adjusted or unadjusted) above the industry median, having observed consecutive above-median *NPAT* growth for up to nine prior years. However, at the sales and *EBITDA* levels, we observe a notable increase in these conditional probabilities the more prior years of consecutive above-median growth. If the observation survives for at least five years, the conditional probability of an additional consecutive year of above-median growth increases to approximately a four-in-five chance at the sales and *EBITDA* levels.

This does not necessarily imply that survivorship bias affects our results. It could simply be the case that certain firms are able to make operating and investment decisions which result in growth which outstrips their industry peers, and that this skill is most prevalent amongst firms with a long history of performance.

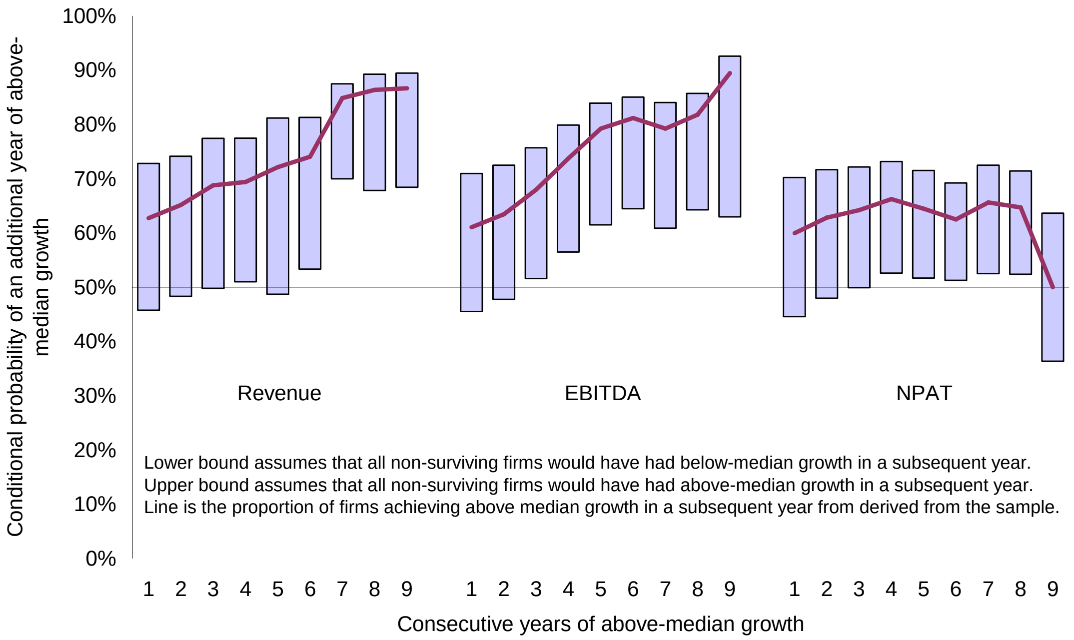
Figure 2

Probability Range of an Additional Year of Above-Median Growth, Conditional Upon Above-Median growth in Previous Years

Panel A: Adjusted Growth



Panel B: Unadjusted Growth



To investigate further we constructed a range of conditional probabilities upon the assumptions of maximum and minimum levels of survivorship bias. The lower bound values presented in the figure result from assuming the maximum possible survivorship bias. That is, we assume that every observation which drops out of the sample as we move to an additional year would have reported growth below the industry median. The upper bound values result from the opposite assumption—that all non-surviving observations would have reported above-median growth.

Referring to adjusted *NPAT* growth over five years, it appears unlikely that our reported persistence is due to survivorship bias. Of the 159 observations which reported above-median growth for four consecutive years, 72 reported an additional year of above-median growth, 37 reported below-median growth and 50 observations did not survive for a fifth consecutive year. This means that a true conditional probability in the range of 45–77% is technically possible, given that we are unable to observe these 50 non-surviving observations.

Importantly, while the conditional probabilities show an upward trend at the sales and *EBITDA* levels, the lower bound of these probabilities is typically close to or exceeds 50%. Hence, even allowing for maximum possible survivorship bias, our primary conclusion that firms exhibit persistence in growth is likely to remain valid.

4.3 Relationship Between Valuation Ratios and Growth

While growth is more persistent than we would expect by chance, it remains difficult to achieve, with just one-in-nine firm-years achieving adjusted *NPAT* growth above or below the industry median for five consecutive years. The issue for active investors is whether market prices incorporate an assumption of persistence which is overly-optimistic. If market prices unbiasedly reflect the present value of expected cash flows, valuation ratios should be better predictors of future growth than past growth.

We computed five-year adjusted growth rates in sales and earnings, in addition to the beginning and ending book-to-market equity, earnings-to-price and sales-to-price ratios. We partitioned the data into three equal-sized groups according to the level of growth and computed the median and mean valuation ratios for the beginning and end of the five-year period. In our discussion we focus on *NPAT* growth because this is the measure of cash flows most relevant for equity market participants.

The evidence presented in table 8 is that valuation ratios are unreliable predictors of future growth. Rather, there is a strong inverse relationship between the book-to-market equity ratio and historical growth, and a relatively weak inverse relationship between the earnings-to-price ratio and future growth. Consider the results displayed in the left-hand side of panel C. Firms ranked in the top third according to past *NPAT* growth had a median book-to-market equity ratio of 0.43, compared to a median ratio of 0.91 for low-growth firms. For the median low-growth firm, one dollar of book value of equity has a market value of \$1.10, compared to a market value of \$2.32 for the median high-growth firm. Hence, the market placed a 110% premium on the book value of equity for a firm with high past *NPAT* growth (2.32/1.10–1 = 1.10). This premium declines to just 6% when we consider beginning valuation ratios.

Table 8

Valuation Ratios Amongst High, Medium and Low-Growth Partitions

At each year-end reporting period we computed the compound annual adjusted growth rates in sales, *EBITDA* and *NPAT* for the subsequent five-year period. This resulted in 760 valid observations of five-year annualised growth. We then sorted the firms according to these growth rates and split the sample into equal-sized groups of low, medium and high growth. The statistics in each panel are the median and mean ratios of book-to-market equity, sales-to-price and earnings-to-price for each group. We perform two tests of statistical significance, Wilcoxon sum-rank tests (results of which are reported next to the median growth rates) and Student *t*-tests (results of which are reported next to the mean growth rates). Differences in ratios are reported for: (1) low vs. medium growth groups; (2) medium vs. high growth groups; and, (3) low vs. high growth groups. Significance levels for these tests are reported next to the summary statistic for that group. This means that, next to the summary statistics for the high-growth group, is the significance level for a test of a ratio difference versus the low-growth group. Significance levels of 1%, 5% and 10% for a two-tailed test are reported as ***, ** and *.

	Median			Mean		
Growth Partition	Low	Medium	High	Low	Medium	High
Panel A: 5-year growth in sales (adjusted for the amount of equity invested in the firm)						
Growth (% cum)	6	123	362	–2	128	534
Growth (% pa)	1	17	36	–9	18	41
Valuation ratios at the beginning of the period over which growth is estimated:						
Book-to-market (%)	81***	67	61***	93***	77	76***
Sales-to-price	1.5	1.5***	1.1***	2.6	2.3	2.0**
Earnings-to-price (%)	8.7	7.8	8.1	11.1***	9.2	9.4**
Valuation ratios at the end of the period over which growth is estimated:						
Book-to-market (%)	88***	59***	51***	107***	72	62***
Sales-to-price	1.2	1.0	1.1	2.0	2.0	2.2
Earnings-to-price (%)	7.0	6.7	6.7	7.4	7.1	7.1
Panel B: 5-year growth in EBITDA (adjusted for the amount of equity invested in the firm)						
Growth (% cum)	–17	120	375	–89	124	610
Growth (% pa)	–4	17	37	–26	17	43
Valuation ratios at the beginning of the period over which growth is estimated:						
Book-to-market (%)	75	69	62**	85	78	82
Sales-to-price	1.4	1.3	1.4	2.2	2.2	2.5
Earnings-to-price (%)	8.9***	7.2	8.2	11.3***	8.8	9.7**
Valuation ratios at the end of the period over which growth is estimated:						
Book-to-market (%)	91***	64***	47***	109***	72***	59***
Sales-to-price	1.1	1.0	1.1	2.7**	1.7	1.7**
Earnings-to-price (%)	6.7	6.7	7.0**	5.1**	7.8	8.7***
Panel C: 5-year growth in NPAT (adjusted for the amount of equity invested in the firm)						
Growth (% cum)	–78	101	456	–184	111	769
Growth (% pa)	–26	15	41	–45	16	47
Valuation ratios at the beginning of the period over which growth is estimated:						
Book-to-market (%)	73**	66	69	85	78	83
Sales-to-price	1.5**	1.2***	1.4	2.1	2.0**	2.8**
Earnings-to-price (%)	9.0***	7.1	8.0***	11.2***	9.1	9.4***
Valuation ratios at the end of the period over which growth is estimated:						
Book-to-market (%)	91***	66***	43***	109***	77***	55***
Sales-to-price	1.4***	0.9	1.0***	2.8**	1.7	1.6**
Earnings-to-price (%)	6.5	6.7	7.1***	4.9**	7.9	8.8***

Adjusted *NPAT* growth can be interpreted as the return on reinvested equity. The fact that firms with high subsequent *NPAT* growth had low book-to-market equity ratios is consistent with the market rationally placing high valuations on firms which make investments which earn returns above the cost of capital. But this relationship is considerably stronger when end-of-period ratios are considered and is more consistent across alternative valuation ratios, alternative measures of operating performance (sales and *EBITDA*) and when mean ratios are considered. It appears that investors pay a substantial premium per dollar of invested equity capital for the prospect of realising high growth in a subsequent period.

In contrast, firms with low ratios of earnings-to-price experience relatively high growth over the subsequent five-year period, a result which is consistent with the market forming unbiased expectations of earnings growth. At the beginning of the five-year period, the median earnings-to-price ratios are 8.0 and 9.0% respectively, for firms which later experience high and low adjusted *NPAT* growth. This means that, prior to the five-year period, the market is willing to pay $12.50 per dollar of current earnings for firms which later experience high growth, compared to $11.10 per dollar for low-growth firms, a premium of 13%. Subsequent to the five-year growth period, the market prices the high growth firms at $14.18 per dollar of current earnings, compared to a price of $15.45 for low-growth firms. This price-earnings discount of 8% is consistent with the market assuming that the high earnings growth is unlikely to continue.

However, compared to the evidence relating to the book-to-market equity ratio, this relationship is not as consistent across growth partitions and for different measures of operating performance. Furthermore, there are a greater number of instances in which we observe the lowest median or mean earnings-to-price ratio for medium growth firms. Compared to the results for the book-to-market equity ratio, this suggests a relatively less systematic relationship between earnings-to-price and future growth.

We also addressed the relationship between growth and valuation ratios using regression analysis, which also incorporates size, market conditions and industry as explanatory variables. If the market forms unbiased expectations of future growth, we would expect to observe negative coefficients on *beginning* valuation ratios. If the market forms expectations of future growth as an extrapolation of past growth, we would expect negative coefficients on *ending* valuation ratios. Results of this regression analysis are presented in table 9.[6]

6. In this analysis, we exclude observations in which the compound adjusted growth over five years is less than -100%. On an unadjusted basis this is not possible, because one year out of five in which the growth rate is less than -100% would result in a negative base-year value for the following year. Thus, the observation would be excluded from the sample. But on an adjusted basis, we can observe adjusted growth rates which are less than minus one for consecutive years. This materially increases the dispersion of compound annual growth rates over five years which causes some loss of explanatory power. However, when we repeated our analysis using the entire sample of 760 observations, the sign and significance of coefficients was largely unchanged.

Table 9

Relationship Between Valuation Ratios and Growth

At each year-end reporting period we computed the compound annual adjusted growth rates in sales, *EBITDA* and *NPAT* for the subsequent five-year period. We excluded observations where the cumulative growth rate over five years was less than –100%, which can result from our adjustment for reinvestment and equity issuance. We estimated the coefficients of a series of ordinary least squares regressions, where growth was the dependent variable. The first independent variable in each case was the valuation ratio—book-to-market equity, sales-to-price or earnings-to-price. The other independent variables were the natural logarithm of the book value of equity (a measure of firm size); an indicator variable for observations occurring from 2003–2006 (a period when Australian sharemarket returns were 22% a year, compared to 9% a year for the period 1989–2002); and indicator variables for eight industry classifications, whose coefficients are not reported. *p*-values for a two-tailed test of significance appear in brackets.

Valuation ratio	Intercept		Coefficient on valuation ratio		Coefficient on ln BV Equity		Coefficient on market		Adj-R^2 (%)
Panel A: 5-year growth in sales (adjusted for the amount of invested equity in the firm; N =737)									
Valuation ratios at the beginning of the period over which growth is estimated:									
B/M	0.32	(<0.01)	-0.035	(<0.01)	–0.006	(0.20)	–0.033	(0.03)	4.0
S/P	0.31	(<0.01)	-0.011	(<0.01)	–0.007	(0.14)	–0.029	(0.05)	5.4
E/P	0.32	(<0.01)	-0.28	(0.01)	–0.007	(0.15)	–0.029	(0.05)	3.7
Valuation ratios at the end of the period over which growth is estimated:									
B/M	0.36	(<0.01)	-0.054	(<0.01)	–0.008	(0.09)	–0.045	(<0.01)	7.0
S/P	0.24	(0.02)	0.000	(0.90)	–0.003	(0.48)	–0.033	(0.03)	2.8
E/P	0.24	(0.02)	-0.01	(0.87)	–0.003	(0.49)	–0.033	(0.03)	2.8
Panel B: 5-year growth in EBITDA (adjusted for the amount of invested equity in the firm; N = 701)									
Valuation ratios at the beginning of the period over which growth is estimated:									
B/M	0.29	(0.02)	-0.020	(0.12)	–0.007	(0.20)	0.005	(0.77)	2.2
S/P	0.25	(0.04)	-0.001	(0.78)	–0.005	(0.31)	0.005	(0.76)	1.8
E/P	0.31	(0.01)	-0.24	(0.05)	–0.008	(0.13)	0.008	(0.64)	2.4
Valuation ratios at the end of the period over which growth is estimated:									
B/M	0.40	(<0.01)	-0.079	(<0.01)	–0.011	(0.04)	–0.009	(0.59)	8.0
S/P	0.32	(0.01)	-0.016	(<0.01)	–0.009	(0.09)	–0.001	(0.94)	3.7
E/P	0.17	(0.14)	0.43	(<0.01)	–0.003	(0.61)	0.004	(0.82)	3.3
Panel C: 5-year growth in NPAT (adjusted for the amount of invested equity in the firm; N =665)									
Valuation ratios at the beginning of the period over which growth is estimated:									
B/M	0.42	(0.01)	0.003	(0.87)	–0.013	(0.08)	0.037	(0.10)	0.9
S/P	0.40	(0.01)	0.003	(0.42)	–0.012	(0.09)	0.036	(0.11)	1.0
E/P	0.65	(<0.01)	-0.73	(<0.01)	–0.023	(<0.01)	0.047	(0.03)	4.4
Valuation ratios at the end of the period over which growth is estimated:									
B/M	0.76	(<0.01)	-0.195	(<0.01)	–0.024	(<0.01)	0.001	(0.95)	12.7
S/P	0.56	(<0.01)	-0.030	(<0.01)	–0.020	(<0.01)	0.023	(0.29)	5.4
E/P	0.34	(0.03)	0.50	(<0.01)	–0.010	(0.17)	0.037	(0.10)	2.1

The regression analysis provides further evidence that valuation ratios have a relatively stronger association with historical growth compared to future growth. Where ending book-to-market equity was the valuation ratio used in the regression, coefficients on this variable were –0.054 for adjusted sales growth, –0.079 for adjusted *EBITDA* growth and –0.195 for adjusted *NPAT* growth; small firms had more growth than large firms and explanatory power ranged from 7–13%. Importantly, the coefficients on book-to-market equity are significantly more negative when ending valuation ratios are used, compared to when beginning valuation ratios are used. Firms with high book-to-market ratios at the beginning of the five-year period had relatively lower adjusted growth in sales and *EBITDA* over the next five years, but this relationship was not present for *NPAT* growth. In general, regressions which used the sales-to-price ratio as the explanatory valuation ratio were consistent with those which used the book-to-market equity ratio, albeit with lower explanatory power.

In contrast, a low earnings-to-price ratio does appear to be indicative of future growth. The coefficient on the beginning earnings to price ratio was –0.28 for adjusted revenue growth, –0.24 for adjusted *EBITDA* growth and –0.73 for adjusted *NPAT* growth. For the regressions which incorporate ending valuation ratios, this relationship reverses with respect to adjusted *EBITDA* and *NPAT* growth—high earnings-to-price ratios are indicative of relatively high past adjusted growth in *EBITDA* and *NPAT*. The results with respect to the earnings-to-price ratio are consistent with the market factoring in a degree of mean-reversion to earnings. For stocks with relatively low base-year earnings, prices incorporate an expectation of a recovery in those earnings. The opposite holds for stocks with relatively high base-year earnings—the market does not appear to price these stocks on the basis that earnings will continue at this level.

The results from this multivariate analysis are consistent with those from the univariate analysis presented in table 8. In aggregate, the book-to-market equity and sales-to-price ratios suggest that the market pays a substantial premium for firms which have experienced high recent growth, but is not particularly adept at identifying firms with strong future growth prospects. Analysis of the earnings-to-price ratio implies the opposite conclusion. The market pays a premium relative to current earnings for firms whose earnings grow strongly over the next five years and discounts firms whose earnings have experienced recent strong earnings. Thus, in its pricing of stocks relative to current earnings, the market appears to factor in a degree of mean-reversion in those earnings

5. Conclusion

We measured whether growth in sales and earnings for Australian-listed firms is persistent and predictable using valuation ratios such as book-to-market equity, sales-to-price and earnings-to-price. If growth is persistent, then investors are rational to extrapolate past growth into the future. But if valuation ratios are not predictive of future growth, but are instead a function of past growth, it is likely that investors overstate the extent of any persistence.

We found persistence in growth above that which would be expected by chance, in contrast to the conclusions reach by Chan, Karceski and Lakonishok (2003) in their study of US-listed firms. But this does not necessarily imply that persistent high growth is easy to achieve or that investors form unbiased expectations of future growth. For a firm which achieved growth above its industry median in the prior year, there is approximately a two-thirds probability of repeating this performance in a subsequent year—better than an even-money bet, but not an indication that the firm dominates the competition. For the most part, this conditional probability of repeated high growth is independent of the number of prior high-growth years, which suggests that analysts are unlikely to identify firms with high-growth prospects by selecting firms with a longer track record of superior growth.

Our results are robust to survivorship bias. We repeated our analysis of persistence for sub-samples of observations which survived for anywhere from two to ten years and found little systematic relationship between persistence and survivorship. Observations which survived for up to nine years had a level of persistence in growth over two years similar to those observations which survived for just two years. We also computed ranges for the conditional probability of an additional year of above-median growth, given a number of years of consecutive growth. The lower bound of this range incorporates maximum possible survivorship bias. These lower bounds were either above or only slightly below 50%, which suggests that non-surviving observations would have had to have been extremely poor performers to invalidate our results.

We found that the book-to-market ratio was not particularly useful in predicting future growth and is more useful in explaining the variation in historical growth. The practitioner classification of low book-to-market stocks as growth stocks somewhat overstates the case—these stocks are likely to have experienced significant growth in sales and earnings, but with a significantly lower probability of repeating this performance. The ability of the sales-to-price ratio to predict future growth is also limited, and this ratio largely explains the variation in past growth, albeit with lower explanatory power than the book-to-market equity ratio.

In contrast, the relationship between the earnings-to-price ratio and growth is consistent with the market forming an unbiased expectation that growth is mean-reverting. The earnings-to-price ratio has an inverse relationship with future growth and a direct relationship with historical growth. This result is consistent with market prices incorporating expectations of long-term earnings, rather than being unduly influenced by high or low earnings in any given year. However, the earnings-to-price ratio is still not a particularly useful indicator of future growth. The premium paid by the market per dollar of current earnings is small relative to the magnitude of growth later experienced by these firms.

In summary, while Australian firms exhibit persistence in growth, the market is not particularly adept at identifying firms with superior growth prospects, paying large premiums relative to book value for firms with high recent growth, and considerably smaller premiums for firms with subsequent high growth. Relative to current earnings, the market applies a small discount in the pricing of firms with high past growth, and a small premium in the pricing of firms which subsequently experience high growth. While directionally consistent with rational expectations, this discount and premium is relatively small in comparison to the magnitude of differential growth amongst listed firms.

(Date of receipt of final transcript: October 18, 2007.
Accepted by David Gallagher & Garry Twite, Area Editors.)

References

Black, F. 1972, 'Capital market equilibrium with restricted borrowing', *Journal of Business*, vol. 45, pp. 444–55.

Chan, L., Hamao, Y. & Lakonishok, J. 1991, 'Fundamentals and stock returns in Japan', *Journal of Finance*, vol. 46, pp. 1739–89.

Chan, L., Karceski, J. & Lakonishok, J. 2003, 'The level and persistence of growth rates', *Journal of Finance*, vol. 58, pp. 643–84.

Chan, L. & Lakonishok, J. 2004, 'Value and growth investing,' *Financial Analysts Journal*, vol. 60, pp. 71–6.

Fama, E. & French, K. 1992, 'The cross-section of expected stock returns', *Journal of Finance*, vol. 47, pp. 427–65.

Fama, E. & French, K. 1993, 'Common risk factors in the returns on stocks on bonds', *Journal of Financial Economics*, vol. 33, pp. 3–56.

Fama, E. & French, K. 1998, 'Value versus growth: The international evidence', *Journal of Finance*, vol. 53, pp. 1975–99.

Gaunt, C. 2004, 'Size and book to market effects and the Fama French three factor asset pricing model: Evidence from the Australian stockmarket', *Accounting and Finance*, vol. 44, pp. 27–44.

Hall, J. 2005, 'The impact of growth, volatility and competitive advantage on the value of equity investments and their embedded options,' PhD Thesis, UQ Business School, The University of Queensland.

Lakonishok, J., Shleifer, A. & Vishny, R. 1994, 'Contrarian investment, extrapolation, and risk', *Journal of Finance*, vol. 49, pp. 1541–78.

Lintner, J. 1965, 'The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets', *Review of Economics and Statistics*, vol. 47, pp. 13–37.

Sharpe, W. 1964, 'Capital asset prices: A theory of market equilibrium under conditions of risk', *Journal of Finance*, vol. 19, pp. 425–42.

Standard and Poors, 2004, Index Tables, www.standardandpoors.com, 5 July 2004.

Taylor, J., Moosa, I. & Cowling, B. 2000, *Microeconomics*, Australian edition, John Wiley & Sons Australia Ltd, Milton, Queensland.

Appendix

Distortions Due to Computing Growth on a Per-Share Basis

The following example illustrates the potential distortion to growth computations performed on a per-share basis. Firm A has a book value of $10.00 per share at the start of period 1 and reports earnings of $1.20 at the end of the period. It distributes $0.60 as dividends and reinvests $0.60, implying that book value increases to $10.60 per share. In period 2, it reports earnings of $1.29. Earnings growth in period 2 is therefore 7.5%, with the reinvested capital of $0.60 contributing $0.09 to earnings, for a return of 15%. Now, assume that all earnings were reinvested in the firm, so book value at the start of period 2 was $11.20. Assuming this investment earned a return of 15%, earnings would grow by 15%. So, under our 100% reinvestment assumption the growth in net profit after tax equals the return on equity for investments made in the previous period. However, the computations for growth in sales and *EBITDA* are not as straightforward. In our example, say that sales originally grows by 5% from $10.00 to $10.50, and *EBITDA* grows by 6%, from $3.00 to $3.18. With 100% reinvestment, sales growth increases to 10%, and *EBITDA* growth increases to 12%.

Table A1

Example of Adjusted Growth Rates

	Unadjusted		Adjusted		Adjusted for DPR only	
	t=1	*t*=2	*t*=1	*t*=2	*t*=1	*t*=2
Firm A: Dividend payout ratio = 50%						
Book value (start)	10.00	10.60	10.00	11.20	10.00	11.20
Sales	10.00	10.50	10.00	11.00	10.00	11.00
EBITDA	3.00	3.18	3.00	3.36	3.00	3.36
NPAT	1.20	1.29	1.20	1.38	1.20	1.38
Dividends	0.60		0.00		0.00	
Book value (end)	10.60		11.20		11.20	
Sales growth		5.0%		10.0%		10.0%
EBITDA growth		6.0%		12.0%		12.0%
NPAT growth		7.5%		15.0%		15.0%
Firm B: Dividend payout ratio = 0%; New equity = 100% of earnings						
Book value (start)	10.00	12.40	10.00	11.20	10.00	12.40
Sales	10.00	12.00	10.00	11.00	10.00	12.00
EBITDA	3.00	3.72	3.00	3.36	3.00	3.72
NPAT	1.20	1.56	1.20	1.38	1.20	1.56
Dividends	0.00		0.00		0.00	
Book value (end)	12.40		12.40		12.40	
Sales growth		20.0%		10.0%		20.0%
EBITDA growth		24.0%		12.0%		24.0%
NPAT growth		30.0%		15.0%		30.0%

Contrast this case with firm B, which has the same book value and operating performance for the first period. But if firm B made no dividend payments, and issued additional equity of $1.20 at the end of period 1 in the project that earns a return of 15%, its earnings growth in period 2 will be 30%. If the growth of these firms is compared after only accounting for their contrasting dividend payout ratios, we would conclude that firm B is growing at double the rate of firm A. Our method of computing the adjusted growth in sales, *EBITDA* and *NPAT* simply takes into account all changes in equity, regardless of whether those changes are due to the reinvestment of earnings or the issue of new equity.