Australian evidence on the implementation of the size and value premia

Paul Docherty[a]

Howard Chan[b]

Steve Easton[a]

[a]Newcastle Business School, The University of Newcastle, NSW 2308, Australia

[b]Department of Finance, The University of Melbourne, VIC 3010, Australia

Corresponding Author

Paul Docherty, Newcastle Business School, The University of Newcastle, NSW 2308, Australia. Tel +61 2 4921 5046. Email Paul.Docherty@newcastle.edu.au.

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Abstract

This paper investigates whether passive investment managers can exploit the size and value premia without incurring prohibitive transaction costs or being exposed to substantial tracking error risk. Returns on the value premium are shown to be pervasive across size groups, while the size premium is non-linear and driven by micro-caps. The value premium cannot be explained by the CAPM, however returns on value portfolios do covary across monetary regimes. The substantial turnover required to achieve annual rebalancing and the relative illiquidity of Australian small-cap firms means that investing in a portfolio of large-cap value firms appears to be the best way for passive fund managers to exploit the Fama and French (1993) premia.

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1. Introduction

Fama and French (1993) developed the three-factor asset pricing model in response to numerous studies identifying anomalies that are not priced by the capital asset pricing model (CAPM). This model has been shown to be applicable in international markets, with several studies identifying that the Fama and French (1993) model has superior power in explaining Australian equity returns compared with the CAPM.

Halliwell, Heaney and Sawicki (1999) replicated the Fama and French (1993) study in the Australian market using data from 1981 to 1991. They found a significant negative relationship between firm size and returns. In contrast, there was little evidence that the book-to-market (HML) factor had explanatory power. However, they noted that their results may be biased by missing market and accounting data. For example, on average only 350 firms were studied per year, resulting in a sample that was highly skewed towards firms with a large market capitalisation. Nevertheless, to the extent that the results may be relied on, as the prevalence of transaction costs and illiquidity make it difficult to implement strategies with small firms, the evidence provided by Halliwell et al. (1999) suggests that the value premium cannot be exploited as it was shown to not appear in large firms.

Faff (2001) used Australian equity 'style' indexes produced by the Frank Russell company as proxies for the size and book-to-market mimicking portfolios. As the sample period examined from 1991 to 1999 does not overlap with Halliwell et al. (1999), the study serves to test the external validity of the earlier findings. Faff (2001) showed that an investment strategy taking a long position on value indices and a short position on growth indices provided significant positive returns. This result suggests that the value premium may be exploitable. Faff (2001) also found evidence of large firm indices outperforming small firm indices, which he noted appears to be consistent with other recent evidence of a reversal of the size effect.[1]

Gaunt (2004) extended upon the earlier work by Halliwell et al. (1999) by testing the Fama-French model in Australian using data from 1991 to 2000. Once again, the sample was biased towards larger firms as, on average, only 50% of all listed firms were considered. Gaunt (2004) provided evidence of a statistically significant small firm effect, with this result being driven by the smallest quintile of observations. It was shown that returns on portfolios formed on book-to-market have some explanatory power, however the role of HML in explaining returns was only shown to be small compared with beta and SMB.

Durack, Durand and Maller (2004) examined a sample consisting of approximately 50% of all listed firms over the period from 1981 to 2000. They found evidence that supports the existence of the size premium and showed its importance in explaining the cross-section of Australian returns. However, their analysis regarding the significance of the value premium was inconclusive. Using the same dataset, Durand, Limkriangkrai and Smith (2006) showed that the Australian equities market is largely segmented. They found that returns on large firms were able to be explained by the US Fama-French three

[1] For example, see Dimson and Marsh (1999).

factors, but returns on small firms could not. This result may further suggest that the size and value premia are exploitable.

O'Brien, Brailsford and Gaunt (2008) replicated Fama and French (1993) using the longest time series and deepest sample of data investigated to date. After examining monthly returns from 1981 to 2005, they found evidence of a positive relationship between returns and the book-to-market ratio of a firm. Contrary to previous evidence, this relationship was significant for large firms but not smaller firms. While the returns on the mimicking portfolio formed on size were not statistically significant, O'Brien et al. (2008) contended that the Fama and French (1993) model is superior to the CAPM in Australia and that this result is due to both size and value premia.

In the Australian market, only a small number of previous studies have sought to explain the size and value premia[2] or have undertaken an investigation into the economic significance of forming small-cap and value portfolios.[3] However, this market provides an ideal environment for such tests. While it shares most of the characteristics of the US market, some characteristics are unique. In particular, the Australian market consists of a smaller number of listed firms with trading concentrated in those firms with a large market capitalisation.[4] Trading in smaller firms is thin and in thinly traded markets asset pricing anomalies are difficult to exploit. Additional transaction costs are incurred when investors needing to execute trades immediately must cross the bid-ask spread. Therefore, an examination of the ability to implement passive trading strategies based on the size and

[2] The main exceptions are Gharghori, Chan and Faff (2007), Nguyen, Faff and Gharghori (2009) and Chan, Kofman and Faff (2011).

[3] The main exception is Bettman, Ng and Sault (2011)

[4] This feature is noted by Brailsford and Faff (1993)

value premia in Australia is important for risk management and to provide more information to enable managed funds to make prudent investment decisions.

International research has examined various factors that may have an impact on the economic significance of the size and value premia. Loughran (1997) asserts that the value premium is largely driven by the January seasonal and the poor performance of newly-listed growth firms. He also reports that the value premium has no explanatory power with respect to returns for large firms over the period 1963 to 1995. This result has substantial implications for the funds management industry, given the greater transaction costs associated with trading small firms. This finding is refuted by Fama and French (2006) who show that the value premium over a long time series is not significantly different between small and big firms.

The abnormal returns generated by value and size portfolios will only increase investor utility if investment strategies based on these premia are not substantially riskier than alternative strategies based on investing in growth firms and large firms. Fama and French (1993) examined the relationship between systematic risk and portfolios formed on firm size and book-to-market ratio. Across their sample period from 1963 to 1990, they found that the value premium was not explained by the CAPM. In contrast, Ang and Chen (2005) showed that the CAPM did explain the value premium across the period 1926 to 1963. They also found that there was no evidence of a statistically significant alpha in the post 1963 period where a conditional CAPM with time-varying betas is estimated.

Fama and French (1996) argue that the size and value premia proxy for fundamental risk factors. Jensen, Johnson and Mercer (1997) provided an empirical test of this assertion by examining the returns on size and value portfolios across monetary policy regimes. They suggest that as monetary policy and business conditions change, investors' perceptions of risk are modified, and so are the required return levels. Central banks impose stabilisation monetary policy, where a restrictive (expansionary) policy is undertaken when the economy is strong (weak). They showed that the size and value premia are statistically significant in periods of expansionary monetary policy and either insignificant or negative in periods of restrictive policy. They argue that this result demonstrates that the Fama and French (1993) factors may be explained by fundamental risk and monetary policy decisions and that this risk should be factored into investment decisions made by size and value investors.

While the statistical significance of size and value portfolios is now well established, very few studies have examined whether profits can be achieved from the implementation of trading strategies based on the Fama and French (1993) factors.

The evidence regarding the ability to implement a strategy based on the size premium is mixed. Stoll and Whaley (1983) undertake an economic feasibility study and find that transaction costs preclude the ability to profit from trading in small firms. Similarly, Horowitz, Loughran and Savin (2000) argue that the size effect has disappeared and is therefore not implementable in out-of-sample tests.

In contrast, several papers have found that the size premium is economically significant. Banz (1981) established a trading strategy based on market capitalisation and was able to generate returns of 20% per annum. Schultz (1983) showed that after taking transaction costs into account the size premium persists, even where a portfolio is turned over frequently.

The most comprehensive study of the economic significance of the size premium in Australia was carried out by Bettman, Ng and Sault (2011). They use volume and bid-ask spreads to account for liquidity and transaction costs. After accounting for these costs, the profits that can be achieved from investing in the smallest decile of firms become statistically insignificant, indicating the size premium is not economically significant.

A limited number of studies have also examined whether trading on the value premium creates economically significant benefits. Houge and Loughran (2006) examined actively managed mutual funds and style indexes and failed to find any evidence that value funds or indexes outperform growth strategies. They suggest that this is due to high transaction costs from the price impact of institutional trading.

Dimson, Nagel and Quigley (2003) investigate the economic significance of the value premium in the United Kingdom. They show that annual rebalancing results in high turnover in small-cap value portfolios, which are highly illiquid due to thin trading in small firms on the UK market. This result is extended by Agarwal and Wang (2007), who implement the limited dependent variable estimate of transaction costs, which measures both implicit and explicit costs. They demonstrate that the value premium is not profitable after controlling for transaction costs. Agarwal and Wang (2007) argue that transaction costs are a limit to arbitrage that may explain the persistence of the value premium.

This paper addresses three key questions. The first is an out-of-sample examination of whether size and value premia are pervasive across size groupings, and therefore whether they are able to be implemented within an Australian market that is characterised by a concentration of trading in large-cap firms. The concentration of large firms in the Australian market is evident given the mean (median) market capitalisation for December 2005 was $750.10 million ($28.35 million). Consistent with Fama and French (2006), the value premium is shown to be pervasive across size groupings; however the size premium is shown to be largely driven by microcap firms. Second, this paper investigates whether returns on small-cap and value portfolios may be explained by an increased exposure to risk factors, such as systematic risk in the context of the CAPM, or fundamental risk as measured by changes in the monetary environment. Third, this paper explores the turnover required for annual rebalancing of value and small-cap portfolios and the relative liquidity of portfolios formed based on these anomalies.[5] The illiquidity of small firms in the Australian market reduces the economic significance of small-value portfolios. The implication of this illiquidity is that the most implementable passive application of the Fama and French (1993) result in Australian is an investment in larger-cap value firms.

The paper proceeds as follows. Section 2 discusses the data. Tests for the pervasiveness of the size and value premia and provided in Section 3. Section 4 provides an examination of whether the size and value premia may be explained by risk factors. Section 5 reports the turnover required to eliminate benchmark tracking risk and provides tests of the liquidity of firms in size and book-to-market portfolios. Section 6 provides a summary.

2. Data

This paper assesses the economic significance of the size and value premia over the 32 year period from 1975 to 2006. Prior to the application of filter rules, the sample contains, on average, 90% of all listed firms across the sample period.

[5] The liquidity of portfolios is measured as the daily trading probability. This methodology was used by Dimson et al. (2003).

Monthly price relatives, market capitalisation data and 13-week Treasury note yields were collected for each firm from the Australian Graduate School of Management (AGSM) database. The book-value of assets was collected from Aspect Financial for the period 1992 to 2006. Prior to this date, accounting data was collected from Australian Stock Research Service Summarised Balance Sheet and Profit and Loss Statements.

Fama and French (1993) argue that only firms with ordinary common equity should be included in the study of their three-factor model. Therefore, financial firms and property trusts were excluded from the sample. Firms with a negative book value and extremely high book-to-market ratio were also excluded.[6]

Table 1 reports summary statistics for the firms that remain in the sample after filter rules were applied. The concentration of market capitalisation in a small number of firms is evident in the large differences between the mean and median market capitalisation across the sample. The time-series average of the value-weighted book-to-market ratios across the sample is 0.781, which is similar to the mean book-to-market ratio of 0.703 reported by Dempsey (2010) across the sample period 1990-2006. The maximum value-weighted book-to-market ratio is 1.416 in 1975, while the minimum value is 0.334 in 2000. These years are characterised as periods of expansionary and restrictive periods of monetary policy respectively, providing formative evidence of a negative relationship between aggregate book-to-market ratios and economic conditions.

[TABLE ONE ABOUT HERE]

[6] Firms with a book-to-market ratio greater than 10 are excluded, as extreme book-to-market values are likely to be associated with highly distressed firms (as argued by Fama and French, 1993). The results in this paper are robust to this assumption, as the significance of all mimicking portfolios was unchanged when this filter rule was not applied.

3. Pervasiveness of the size and value premia

3.1 Returns on portfolios formed on firm size and book-to-market ratio

The time series portfolios used to estimate size and value premia are constructed in a manner consistent with Fama and French (1993). Each December from 1974 to 2005, all firms in the sample are ranked on book-to-market ratio and size. The book-to-market ratio is calculated as the book-value of ordinary equity divided by the market capitalisation of the firm and size is measured as market capitalisation. To avoid look-ahead bias, only book-values with a balance date at least six months prior to portfolio formation are included in the sample. All firms in the sample are split into three groups based on their book-to-market ratio; namely growth (bottom 30%), neutral (middle 40%) and value (top 30%). Independently, the sample is also split into two groups based on firm size; namely small (bottom 50%) and big (top 50%).

Six portfolios are formed at the intersections of these sorts, namely small growth (SG), small neutral (SN), small value (SV), big growth (BG), big neutral (BN) and big value (BV). Value-weighted returns are calculated for each of these portfolios. SMB is calculated as the returns on the zero investment portfolio formed by taking a long position on small firms and a short position on large firms. This is achieved by taking the simple average of returns on the three small-firm portfolios (SG, SN and SV) less the simple average of returns on the three big-firm portfolios (BG, BN and BV). Similarly, HML is constructed by taking a long position in the two value portfolios (SV and BV) and a short position in the two growth portfolios (SG and BG).

To test Loughran's (1997) assertion that the value premium is only significant for small firms and therefore not implementable, the HML portfolio is decomposed into small firms and large firms. Using the same methodology as Fama and French (2006), the small-firm value premium (HML-S) is calculated as the difference between the SV and SG portfolios. The big-firm value premium (HML-B) is calculated as BV less BG.

Finer sorts are also carried out as a test of the linearity of the size and book-to-market effects and their pervasiveness across size groupings. Each December all of the firms in the sample are sorted into size quintiles. Independently, the sample is sorted by the book-to-market ratio and similarly divided into quintiles. Consistent with Fama and French (1993), 25 portfolios are constructed at the intersection of the size and book-to-market breakpoints and the value-weighted returns are calculated for the following year. SMB 5x5 is calculated as the average returns on the five portfolios consisting of firms in the smallest size quintile less the average returns on the five largest firm quintiles. HML 5x5 is calculated as the average returns on the five portfolios in the highest book-to-market quintile less average returns on the five portfolios in the lowest book-to-market quintile.

The returns on portfolios formed on firm size and book-to-market ratio are reported in Table 2. Panel A shows the mean excess returns on the six portfolios formed at the intersection of firm size and book-to-market ratio breakpoints. The small-value portfolio provided the highest mean excess returns, confirming previous evidence by O'Brien et al. (2008). These returns were significantly different from zero at the 1% confidence level. Conversely, the big-growth portfolio generated the lowest mean excess returns and is the only portfolio with returns not significantly different from zero.

The mean returns on portfolios constructed to capture the size and value premia are reported in Panel B of Table 2. There is evidence of both a size and value premium across this period, as returns on both SMB and HML are statistically significant at the 5% confidence level.

The mean returns on the SMB 5x5 and HML 5x5 portfolios reported in Panel B provide an insight into the linearity of the size and value premia. The size premium is substantially larger when it is constructed as the difference between returns in the two extreme quintiles, achieving a return of 2.2% per month for the quintile portfolio compared with 0.5% per month using the traditional Fama and French (1993) methodology. Further, the premium is significant at the 1% level for the quintile portfolio and only at the 5% level using the Fama and French methodology. This result is consistent with prior evidence that has shown that the size effect is non-linear and largely driven by the smallest microcap firms.[7] The magnitude and significance of the value premium appears to be robust to this methodological change.

Panel B also reports the returns on the value premium specific to small (HML-S) and big (HML-B) firms. This allows for an out-of-sample test of Loughran's (1997) finding that the value premium is not pervasive across size groupings. The value-weighted returns on HML-B are positive and significant at the 1% confidence level, while the returns on the HML-S portfolio are insignificant. This result differs from Fama and French (2006) who find that the value premium is larger for small firms, although they show that the difference between the returns on the value premium for small and big firms is not statistically significant. It is also acknowledged that the insignificance of the small firm value premium may be specific to the sample period studied in this paper.

The difference in the means between HML-S and HML-B in Australian data is only equal to 0.786 standard errors. Therefore, there is no evidence that the value premium differs across size portfolios. The out-of-sample tests conducted in this paper are able to reject

[7] For example, see Fama and French (1992) and O'Brien et al. (2008).

Loughran's (1997) conclusion that the value premium only exists for small firms and therefore is not able to be implemented.

[TABLE 2 ABOUT HERE]

The accumulated values of each of the six portfolios are shown in Figure 1. This figure further illustrates the existence and persistence of the size and value premia across the long time-series examined in this paper. An investment in the SV portfolio in 1975 would have earned an accumulated return of 553% by the end of 2006. In comparison, an equivalent investment in the BG portfolio would have only earned an accumulated return of 149% by 2006.

[FIGURE 1 ABOUT HERE]

3.2 Cross-sectional regressions

Cross-sectional regressions are also estimated to calculate the marginal relationship between size, book-to-market ratio and returns across various size groupings. Fama and French (2008) found that results from cross-sectional regressions estimated for the entire market can be driven by micro-cap firms. They therefore advocate partitioning into big, small and micro-cap portfolios for separate estimation. In order to approximately replicate Fama and French (2008), big firms represent the largest 90% of market capitalisation, small firms comprise the next 7% and micro-caps are the remaining 3%.[8]

[8] This method was also adopted by Gray and Johnson (2011) in the Australian market. In Fama and French (2008) the big, small and micro-cap categories represent 90.48%, 6.45% and 3.07% of market capitalisation respectively.

The regressions use natural logs of the size and book-to-market variables, as Fama and French (1992) show that the natural logarithm is the most appropriate functional form to capture the relationship between these factors and returns.

The equation that is estimated to test for the relationship between size, book-to-market ratio and returns across various size groupings is estimated as follows:

$$R_{i,m} = \alpha_0 + \beta_1 \ln(SIZE_{i,n}) + \beta_2 \ln(B/M_{i,n}) + \varepsilon_{i,m} \qquad (1)$$

Where $R_{i,m}$ is the one-month return on firm *i* in month *m*, $SIZE_{i,n}$ is the market capitalisation for firm *i* in December of year *n* and $B/M_{i,n}$ is the book-to-market ratio of firm *i* using book-value of equity and market capitalisation from the balance date of year *n*.

The results from the cross-sectional regressions estimated for big, small and micro-cap firms are reported in Table 3. The relationship between the book-to-market ratio and returns is positive and significant across all three size groupings. The difference between the coefficients on the book-to-market variable estimated in the micro-cap regression and the big firm regression is not statistically different from zero. This provides further evidence that the value premium is pervasive across size groupings and is broadly consistent with Fama and French (2008).[9]

The size coefficient is negative and significant at the 1% confidence level for micro-cap firms, but insignificant in the other samples. Furthermore, the difference between the size coefficient in the micro-cap and big firm samples is -0.007, which is statistically

[9] Fama and French (2008) report a significant value premium for small and micro-cap firms, however the relationship between book-to-market ratio and returns is only marginally significant at the 10% confidence level for big firms.

significant at the 1% level. The size premium does not appear to be pervasive across size groupings and is largely driven by micro-cap firms.

The alpha term is statistically significant at the 1% confidence level for the micro-cap regression but insignificant for the small and big firm samples. This indicates that there may be omitted variables that may further explain the returns generated by Australian micro-cap firms.

The evidence reported in Table 3 shows that the value premium is pervasive across size groupings. This evidence contradicts Loughran (1997) and concurs with Fama and French (2006). The size premium appears to be non-linear and largely driven by micro-cap firms. In a market such as Australia, where micro-cap firms are thinly traded, it is unlikely tht investors would be able to exploit any anomalies that only exist in micro-cap firms.

4. Are size and value portfolios riskier?

4.1 Can the size and value premia be explained by the CAPM?

The realised abnormal returns generated by small-cap value portfolios will only increase investor utility so long as investing in these portfolios does not disproportionately increase investors' exposure to risk. The returns on the size and value premia are examined to determine whether they are associated with either systematic or fundamental risk. To determine whether the size and value premia are captured by systematic risk in the context of the CAPM, time-series regressions are estimated.

The Sharpe (1964) and Lintner (1965) CAPM may be expressed as follows:

$$E(R_p) - R_f = \beta_1[E(R_m)-R_f] \qquad (2)$$

Where R_p is the return on portfolio p, R_f is the risk-free rate of interest and R_m is the return on the value-weighted portfolio.

The empirical counterparty of this model takes the form:

$$R_p - R_f = \alpha_0 + \beta_1[R_m - R_f] \quad (3)$$

Equation 3 is estimated for the returns on all six size and book-to-market portfolios, as well as SMB and HML. To perform an out-of-sample test of Ang and Chen's (2005) finding that the conditional CAPM with time-varying betas may explain the value premium, Equation 3 is also estimated with both fixed betas and time-varying betas. To calculate time-varying betas, beta is calculated using 60 monthly observations.[10] The beta for each portfolio is recalculated monthly.[11]

The results from CAPM regressions are reported in Table 4. The alpha term is positive and statistically significant for both fixed and time-varying betas where SV is the dependent variable and negative and significant for both BG and BN. Therefore, the CAPM is not able to adequately explain the returns on these portfolios. The significance of the alpha term on the BG portfolio provides evidence that the significant of the HML-B zero investment portfolio may be largely due to the underperformance of large growth firms.

When the CAPM is estimated with HML as the dependent variable, the alpha is positive and statistically significant for both fixed and time-varying betas. The beta is also negative and statistically significant in both regressions. Ang and Chen (2005) report that

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[10] At least 24 observations are used to calculate beta.

[11] The CAPM was also estimated using one period leading and lagged market returns, as Dimson (1979) showed that this methodology helps to overcome problems introduced by infrequent trading. The results reported in this section are robust to the change in the methodology used to estimate beta.

the CAPM is able to explain the value premium in the United States during the period from 1926 to 1963. This result does not hold up in an out-of-sample test in the Australian market across the later sample period examined in this paper.

Where SMB is the dependent variable, the alpha term is positive and statistically significant at the 5% level when beta is fixed, but insignificant when time-varying betas are used. Beta is not significantly different from zero in either regression. Therefore, there is not sufficient evidence to reject the hypothesis that a conditional CAPM with time-varying betas may explain the size premium.

[TABLE 4 ABOUT HERE]

The values of the time-varying betas for both the SMB and HML portfolios are plotted in Figure 2. It can be inferred from this figure that the beta for the HML portfolio is negative for the majority of the sample, while the sign of the beta for the SMB portfolio changes frequently across time. Between 1979 to 1981 and 2004 to 2006 the market beta for the SMB portfolio is large and positive and the beta for the HML portfolio is substantially negative. Conversely, between 1990 to 1992 the beta on the HML portfolio is substantially positive and the beta on the SMB portfolio is negative, these changes in time-varying betas appear broadly consistent with shifts in monetary policy. The periods 1979 to 1981 and 2004 to 2006 are both characterised by mostly restrictive monetary policy while the period 1990 to 1992 is characterised by expansionary monetary policy. This relationship is examined more formally in the next section.

[FIGURE 2 ABOUT HERE]

4.2 Do size and value premia capture fundamental risk?

Fundamental risk is measured as a function of innovations in the monetary policy environment. The returns on a portfolio are exposed to fundamental risk if those returns covary with changes in the economic environment. Jensen et al. (1997)categorise their sample into two regimes, defined as expansionary and restrictive monetary policy regimes. A regime shift occurs following a change in the monetary environment. Therefore, monthly observations were classified as being in the restrictive (expansionary) policy environment where the contemporaneous or immediately preceding change in the Federal Reserve discount rate was an increase (decrease).

In this paper, the sample is similarly classified into two regimes; restrictive and expansionary. As the Reserve Bank of Australia only began providing a cash-rate target in 1990, inter-month changes before this time are quite noisy and may not reflect underlying changes in the monetary environment. To overcome this problem, interbank cash rates are compared with their moving average to determine whether they are trending upwards or downwards. Periods of restrictive (expansionary) monetary policy are defined as being the months following a period where the interbank cash rate was above (below) its twelve-month moving average value.

The monetary policy cycles are reported in Table 5. It is noted that prior to 1990, some of the monetary regimes were for shorter period than those usually considered as constituting a regime. To ensure that this measurement issue has no effect on the results, all of the analysis was also carried out including only the period post-1990 when the Reserve Bank of Australia began to issue a target cash rate. The significance of the results reported below was the same across this period as for the entire sample.

[TABLE 5 ABOUT HERE]

Mean returns were calculated for the six size and book-to-market portfolios as well as SMB and HML during the restrictive and expansionary regimes.[12] These mean returns are reported in Table 6. Due to the reduced sample size when the premium is calculated across two regimes, the size premium is insignificant in both the expansionary and restrictive periods. The difference between the mean returns in these two regimes is not statistically significant. This result is robust to the inclusion (Panel A) and exclusion (Panel B) of the month of the regime switch. In summary, there is no evidence to suggest that investing in the size premium will increase investors' exposure to fundamental risk.

There is evidence in Table 6 that HML covaries counter-cyclically, as the returns on this portfolio are positive and statistically significant at the 5% confidence level in expansionary regimes but insignificant during restrictive regimes. This result can be largely attributed to the BV portfolio. The returns generated on this portfolio are positive and statistically significant at the 5% level during expansionary regimes (whether the months of regime shifts are included or excluded) and insignificant during restrictive regimes. In Panel B, the mean return of the HML portfolio in the expansionary regime is 2.07 standard errors different from the return in the restrictive regime. This result provides evidence consistent with that of Jensen et al. (1997), who report that in the United States, the value premium is similarly counter-cyclical, as the returns during expansionary regimes are statistically significantly greater than returns in restrictive regimes.

[TABLE 6 ABOUT HERE]

[12] The six portfolios are SG, SN, SV, BG, BN and BV.

5. Turnover and liquidity of value and growth portfolios

Fama and French (2007) demonstrate that the size premium is almost entirely generated by small-cap firms that earn large positive returns and migrate into the large firm portfolio. Similarly, the value premium is largely driven by high (low) returns on value (growth) firms that then move into the neutral or growth (value) portfolios.[13] The implication of this result is that a large amount of rebalancing-induced turnover would be required to exploit the size and value premia in an otherwise passive portfolio.

Dimson et al. (2003) calculate the required turnover of a passive small-value portfolio by calculating the proceeds, purchases and re-weightings needed to rebalance the portfolio annually. This paper extends upon Dimson et al. (2003) by calculating the proceeds, purchases and re-weightings required for six constructed benchmark portfolios formed at the intersection of size and book-to-market breakpoints in the Australian market. All portfolios are formed in December of year *t-1* and rebalanced annually. Annual rebalancing is realistic as the largest Australian style indexes rebalance portfolios once a year.[14] Moreover, the results reported in this paper will tend to understate portfolio turnover compared with indexes that rebalance more frequently than once a year. Dimson and Marsh (2001) showed that there is a positive relationship between the frequency of rebalancing and portfolio turnover.

[13] In Australia, Gharghori, Hamzah and Veeraraghavan (2010) find that the size and value premium are largely driven by small-cap value firms that do not migrate out of their portfolio. The implication of this result is that an investor seeking to exploit the size and value premia in a passive portfolio should not incur large rebalancing-induced transaction costs.

[14] Carino and Pritamani (2007) report that the Russell Style indices are reconstituted annually each May.

Portfolio proceeds are defined as a combination of firms that were sold because they migrated out of the relevant portfolio, delisted firms and the reinvestment needs that arise due to dividend payments. Portfolio purchases comprise both newly listed firms and firms that migrated into a portfolio. Annual re-weightings are calculated as the difference between portfolio proceeds and purchases. The mean annual values for each of the components of proceeds and purchases are calculated for the entire sample.

Panel A of Table 7 reports the average annual proceeds from delisting, migration out of a portfolio and dividends. For all six portfolios, migration is the primary source of proceeds. This is particularly evident for the SG and SN portfolios, where migration out of the portfolio accounts for a turnover of more than half of the portfolio value. This can be reconciled with Fama and French (2007), who identify that the value premium is largely derived from underperforming small growth firms that migrate out of the portfolio.

The average purchases from new listings and migration into a portfolio are reported in Panel B. Migration into the portfolio is again the largest contributor to portfolio turnover. The annual re-weighting requirements are relatively small compared with the net proceeds and purchases.

The turnover of large firm portfolios is slightly less than that of small firm portfolios, although there is no identifiable difference between the turnover requirements of value and growth portfolios. The turnover on the SV portfolio, which allows for the exploitation of both the size and value premium, is 50.3% per annum.[15] This high rebalancing-induced turnover would be incurred by an otherwise passive portfolio with only annual

[15] This number counts the buy and sell trades combined as one transaction. The one-way transactions exceed 100% of portfolio value.

rebalancing. The total turnover is slightly greater than the result reported by Dimson et al. (2003) in the United Kingdom; however the reasons for proceeds and purchases appear to be similar across the two markets. The high turnover requirements would substantially reduce the economic significance of returns earned on each of the portfolios, particularly if transaction costs are increased due to the existence of thin trading.

[TABLE 7 ABOUT HERE]

Time-series changes in rebalancing requirements for the SV portfolio are shown in Figure 3. In aggregate, Panel A shows that the turnover proceeds from annual rebalancing has been stable across the sample period, although there is some evidence of volatility in both the total and proportionate turnover proceeds between the years 1980-1990. Panel B shows that the aggregate amount of turnover purchases and proportionate contributions of new listings and migration into the portfolio are both relatively constant across the sample period.

[FIGURE 3 ABOUT HERE]

To further investigate the economic significance of returns on portfolios formed at size and the book-to-market ratio breakpoints, the relative liquidity of various portfolios is considered. Where substantial portfolio turnover is required to achieve annual rebalancing, the costs of illiquidity could be high when funds demand immediate execution of trades to reduce benchmark tracking risk. Consistent with Dimson et al. (2003), the constructed benchmark portfolios outlined above are used to measure the turnover required to eliminate tracking error.

Intra-day data is not available for the long time-series examined in this paper, therefore traditional measures of liquidity that relate to the bid-ask spread cannot be calculated.

Dimson et al. (2003) encounter the same problem in their United Kingdom data set and use trading frequencies to calculate the probabilities of firms not trading as a measure of its illiquidity. Lesmond, Ogden and Trzcinka (1999) argue that where bid and ask price data is not available, alternative measures such as trading frequencies are an appropriate proxy. They show that estimates derived from using the incidence of zero return days as a measure of liquidity is highly correlated to traditional measures of this variable.

The number of days since the last trade is calculated for each firm in the sample. The average of these monthly trading frequencies is then calculated over a year to eliminate noise. As outlined by Campbell, Lo and MacKinlay (1997), the value-weighted number of days since the last trade is then calculated for each portfolio. Using ex-post measures of trading frequency as a proxy for the expected value, the probability that a firm will not trade on a given day is calculated as follows:

$$\pi = \frac{\bar{k}}{1 + \bar{k}} \tag{4}$$

Where π is the probability of a firm not trading on a given day and $\bar{k}$ is the average duration since the last trade for each firm.

The time series averages of the non-trading probabilities is calculated for each of the six size and book-to-market portfolios across the entire sample. The non-trading probabilities of each portfolio are also calculated across two hold-out periods (1975 to 1990 and 1991 to 2006) to provide an insight into innovations in liquidity in the various portfolios across time.

Table 8 reports the daily non-trading probabilities of the six size and value portfolios. The non-trading probabilities are higher than those reported by Dimson et al. (2003) for the United Kingdom, particularly for small-cap portfolios. This indicates that the size premium may be even more difficult to exploit in Australia compared with the United Kingdom and the United States. Small firms are substantially more illiquid compared with large firms, however there is no discernable difference between the liquidity of value and growth portfolios. The average non-trading probability is still 41% for the most liquid portfolio in Panel A. This may be attributed to a concentration of trading in a small number of the largest firms listed on the Australian market. As the large firm portfolio consists of all firms with a market capitalisation greater than the median value, it consists of a number of smaller, less liquid firms. In Panels B and C, it is shown that the non-trading probabilities for the small portfolios are very similar across both the first and second half of the sample. Two of the three big firm portfolios shown substantial reductions in non-trading probabilities from 1990 onwards.

[TABLE 7 ABOUT HERE]

Figure 4 shows annual innovations in the non-trading probabilities. It is evident that the liquidity of all firms has increased across time; however small-cap Australian firms still trade infrequently.

[FIGURE 4 ABOUT HERE]

Liquidity is a significant issue for investors attempting the capture the size and value premia in Australia, particularly in light of the large turnover required for annual rebalancing of portfolios. Passive investors will need to trade off the benefits between liquidity and accurately tracking the benchmark return. Given the pervasiveness of the value premium across size groupings and the substantial role illiquid micro-cap firms play in the size premium, the big-value portfolio may be the most economically significant portfolio after adjusting for trading costs. However, it must be noted that even some of the small firms characterised in the "big" portfolio may be illiquid due to the concentration of trading in the largest firms on the Australian market.

6. Summary

Across a long time series in Australia, evidence is provided to support the statistical significance of the size and value premia. A number of tests are carried out to determine whether these premia can be exploited in the Australian market, which is characterised by a concentration of trading in the largest firms.

The value premium is shown to be pervasive across size groupings, while the size premium is largely driven by micro-cap firms. This result is inconsistent with Loughran (1997), who reports that there is no value premium among the largest firms in the United States post 1963. Therefore, the value premium may be able to be captured even in a market such as Australia that is characterised by a high concentration of trading in the largest firms.

The value premium is not explained by the CAPM, irrespective of whether fixed or time-varying betas are employed. This is consistent with the result reported by Fama and French (2006) across a similar time period in the United States. In Australia, growth firms appear to be more sensitive to systematic risk in the context of the CAPM. A statistically significant positive alpha is generated when returns on the HML portfolio are regressed against the excess market return. The results in this paper are not able to reject the possibility that the size premium may be captured by a conditional CAPM with time-varying betas.

Evidence is presented that shows the value premium covaries counter-cyclically with innovations in the monetary environment. Therefore, portfolios seeking to take advantage of the value premium may be exposed to fundamental risk. The size premium does not significantly differ across monetary regimes and therefore does not appear to capture fundamental risk.

In situations where portfolios are rebalanced annually, the required portfolio turnover induced by this rebalancing is substantial for all size and value portfolios. This turnover would be even greater if the portfolio is rebalanced more frequently. This turnover is particularly costly for portfolios consisting of small firms, which are shown to have an average daily non-trading probability in excess of 80%.

The high portfolio turnover and illiquidity of small-cap firms affects the economic significance of returns earned from investing in small firms. Managers of passive portfolios consisting of small and value firms may need to consider increasing exposure to benchmark tracking risk by not immediately executing trades as required to achieve annual rebalancing. The concentration of trading in the largest Australian firms results in significant illiquidity among small firms and substantial transaction costs. As the value premium is pervasive across size groupings and large firms are not as affected by illiquidity, a passive portfolio manager attempting to exploit the size or value premia is advised to seek to reduce transaction costs by investing in a portfolio of large value firms. This portfolio allows for the exploitation of the value premium without exorbitant transaction costs.

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Table 1: Annual Sample Size and Firm Characteristics

This table reports the average number of firms in the sample each year and the characteristics of those firms. The mean market capitalisation, median market capitalisation and value-weighted average book-to-market ratios as at December of year t-1 are also reported.

Year (t)	Final Sample	Mean Market Capitalisation ($ millions)	Median Market Capitalisation ($ millions)	Value-weighted Book-to-Market Ratio
1975	747	14.38	2.53	1.416
1976	785	19.48	2.73	1.300
1977	802	20.35	2.67	1.222
1978	811	22.49	3.50	1.272
1979	790	27.33	4.59	1.149
1980	771	41.20	6.01	0.907
1981	772	62.89	10.13	0.691
1982	770	54.47	8.11	1.007
1983	743	51.32	6.43	1.279
1984	721	75.98	9.11	0.953
1985	748	70.21	9.40	1.033
1986	802	94.29	12.74	0.850
1987	931	139.04	17.50	0.705
1988	1119	127.89	12.25	0.796
1989	1103	143.83	9.93	0.884
1990	981	197.72	7.22	0.751
1991	852	183.99	5.08	0.749
1992	780	275.65	7.41	0.666
1993	855	288.58	8.82	0.689
1994	871	482.91	19.18	0.563
1995	1011	377.88	16.19	0.597
1996	1051	433.38	17.10	0.655
1997	1055	486.43	22.54	0.617
1998	1096	844.51	18.54	0.355
1999	1098	869.99	15.79	0.356
2000	1148	966.02	24.20	0.334
2001	1284	508.81	21.59	0.719
2002	1286	931.58	18.03	0.529
2003	1250	902.02	16.89	0.610
2004	1265	962.72	26.68	0.593
2005	1388	1020.92	27.68	0.513
2006	1518	750.10	28.35	0.653

Table 2: Returns on firm size and book-to-market ratio portfolios

This table reports the returns on portfolios formed on firm size and book-to-market ratio. Each December, firms are sorted by market capitalisation and divided at the median to form small and big portfolios. Independently, firms are sorted on their book-to-market ratio and allocated into one of three categories; growth (bottom 30%), neutral (middle 40%) and value (top 30%). Panel A reports the mean excess returns on the six portfolios formed at the intersection of the size and book-to-market breakpoints. The portfolios are small growth (SG), small neutral (SN), small value (SV), big growth (BG), big neutral (BN) and big value (BV). Panel B reports the mean returns on the zero investment portfolios formed to exploit the size and value premia. SMB and HML are constructed using the same methodology as Fama and French (1993). SMB 5x5 (HML 5x5) are the zero investment portfolio formed by taking a long position in the quintile of the smallest (value) firms and short in the quintile of biggest (growth) firms. HML-S and HML-B are the value premia for small firms and large firms respectively. The associated standard deviation (SD) and t-statistics are reported under the value-weighted mean portfolio returns.

Panel A: Returns on six portfolios formed on firm size and book-to-market ratio

	SG	SN	SV	BG	BN	BV
Mean	0.010	0.013	0.014	0.004	0.008	0.011
SD	0.090	0.063	0.056	0.052	0.045	0.059
T-statistic	(2.200*)	(4.178**)	(5.042**)	(1.460)	(3.423**)	(3.541**)

Panel B: Returns on zero investment portfolios that measure size and value premia

	SMB	SMB 5x5	HML	HML-S	HML-B	HML 5x5
Mean	0.005	0.022	0.006	0.004	0.007	0.006
SD	0.048	0.078	0.043	0.059	0.046	0.051
T-statistic	(2.078*)	(5.51**)	(2.552*)	(1.436)	(2.882**)	(2.431*)

* Denotes statistical significance at the 5% confidence level.
** Denotes statistical significance at the 1% confidence level.

Table 3: Cross-sectional regressions

This table reports the coefficients on the cross-sectional regressions estimated to examine the marginal relationship between both size and book-to-market ratio and firm returns across size groupings. In each month from January 1975 to December 2006, the following regressions were estimated within the cross-sectional framework:

$R_{i,m} = \alpha_0 + \beta_1 \ln(SIZE_{i,n}) + \beta_2 \ln(B/M_{i,n}) + \varepsilon_{i,m}$

Where $R_{i,m}$ is the one-month return on firm *i* in month m, $SIZE_{i,n}$ is the market capitalisation for firm i in December of year *n* and $B/M_{i,n}$ is the book-to-market ratio of firm i using book-value of equity and market capitalisation from the balance date of year n.

The values reported in the table are the time-series average of the coefficients. Associated t-statistics are reported in parentheses under the relevant coefficients. In the final row, the difference between the coefficients on the micro-cap sample and the big-firm sample are reported.

	Alpha	**Ln(Size)**	**Ln(B/M)**	**Adj. R^2**
Full Sample	0.055	-0.003	0.004	0.016
	(4.333**)	(-3.976**)	(4.622**)	
Micro	0.132	-0.008	0.004	0.014
	(6.838**)	(-6.84**)	(3.513**)	
Small	0.013	-0.000	0.004	0.016
	(0.556)	(-0.053)	(3.744**)	
Big	0.019	-0.001	0.003	0.022
	(1.551)	(-0.497)	(3.097**)	
Micro - Big	0.113	-0.007	0.001	
	(4.942**)	(-3.008**)	(0.669)	

* Denotes statistical significance at the 5% confidence level.
** Denotes statistical significance at the 1% confidence level.

Table 4: CAPM Regressions

This table reports results from the estimation of the capital asset pricing model (CAPM). The CAPM is expressed as follows:

$R_p – R_f = \alpha_0 + \beta_1[R_m-R_f]$

Where R_p is the return on portfolio p, R_f is the risk-free rate of interest and R_m is the return on the value weighted portfolio.

The CAPM is estimated for the returns on all six size and book-to-market portfolios, as well as SMB and HML. Panel A reports the results of the regressions with fixed betas across the sample period and Panel B reports the results for the CAPM equation estimated with time-varying betas. T-statistics are reported in parentheses under their associated coefficients.

Panel A: CAPM regressions with fixed betas

	SG	SN	SV	BG	BN	BV	SMB	HML
A	-0.006	0.003	0.006	-0.009	-0.003	-0.001	0.005	0.01
t(α)	(-1.752)	(1.273)	(2.388*)	(-10.490**)	(-3.228**)	(-0.452)	(2.122*)	(4.865**)
B	1.371	0.84	0.728	1.104	0.925	0.984	-0.025	-0.382
t(β)	(18.063**)	(14.571**)	(13.842**)	(57.994**)	(44.388**)	(21.453**)	(-0.451)	(-8.484**)
Adj. R^2	0.459	0.356	0.332	0.898	0.837	0.545	-0.002	0.156

Panel B: CAPM regressions with one-year time-varying betas

	SG	SN	SV	BG	BN	BV	SMB	HML
A	-0.01	0.002	0.005	-0.009	-0.004	-0.001	0.004	0.011
t(α)	(-3.045**)	(0.75)	(1.995*)	(-10.413**)	(-5.049**)	(-0.556)	(1.557)	(6.069**)
B	1.719	1.262	1.079	1.237	1.166	1.342	0.105	-0.268
t(β)	(11.596**)	(10.003**)	(9.662**)	(26.632**)	(19.237**)	(12.905**)	(1.207)	(-3.325**)
Adj. R^2	0.397	0.387	0.363	0.896	0.842	0.598	0.057	0.185

* Denotes statistical significance at the 5% confidence level.
** Denotes statistical significance at the 1% confidence level.

Table 5: Frequency of restrictive and expansionary monetary policy cycles

This table reports the start and end month of each restrictive and expansionary monetary policy period and the duration of each monetary cycle.

Expansionary monetary policy			**Restrictive monetary policy**		
Start Month	End Month	Number of Months	Start Month	End Month	Number of Months
January 1975	February 1976	14	March 1976	December 1976	10
January 1977	February 1977	2	March 1977	January 1978	11
February 1978	April 1978	3	May 1978	June 1978	2
July 1978	July 1978	1	August 1978	October 1978	3
November 1978	March 1979	5	April 1979	January 1980	10
February 1980	February 1980	1	March 1980	September 1980	7
October 1980	February 1981	5	March 1981	August 1982	18
September 1982	February 1983	6	March 1983	March 1983	1
April 1983	February 1984	11	March 1984	December 1984	10
January 1985	February 1985	2	March 1985	March 1986	13
April 1986	July 1986	4	August 1986	September 1986	2
October 1986	April 1988	19	May 1988	January 1990	21
February 1990	July 1994	54	August 1994	March 1996	20
April 1996	April 1996	1	May 1996	July 1996	3
August 1996	October 1999	39	November 1999	January 2001	15
February 2001	May 2002	16	June 2002	December 2006	55
	Total Months	183		Total Months	201

Table 6: Monthly returns across regimes conditioned by monetary policy

This table reports the average excess returns across monetary policy regimes. The sample is classified into two regimes; restrictive and expansionary. Periods of restrictive (expansionary) monetary policy are defined as being the months following a period where the interbank cash rate was above (below) its twelve month moving average value. Mean excess returns in the restrictive and expansionary regimes are calculated for the six size and book-to-market portfolios and the two zero investment portfolios (SMB and HML). The standard deviation (SD) and t-statistic associated with each mean return are also reported. Panel A reports the results for the entire sample. Panel B reports the results from a replication using the methodology of Jensen et al. (1997), where the month of the regime shift is removed from the sample.

Panel A: Entire sample

		SG	SN	SV	BG	BN	BV	SMB	HML
Restrictive	Mean	0.008	0.011	0.012	0.004	0.007	0.006	0.005	0.003
Regime	SD	0.093	0.06	0.052	0.051	0.04	0.05	0.048	0.046
	T-Stat	(1.215)	(2.535*)	(3.132**)	(1.007)	(2.257*)	(1.763)	(1.369)	(0.962)
Expansionary	Mean	0.011	0.016	0.017	0.003	0.008	0.014	0.006	0.008
Regime	SD	0.094	0.069	0.063	0.055	0.05	0.069	0.051	0.042
	T-Stat	(1.552)	(2.971**)	(3.434**)	(0.67)	(2.123*)	(2.654**)	(1.574)	(2.595**)

Panel B: Month of regime change excluded

		SG	SN	SV	BG	BN	BV	SMB	HML
Restrictive	Mean	0.008	0.01	0.01	0.003	0.006	0.006	0.005	0.002
Regime	SD	0.09	0.06	0.051	0.05	0.04	0.049	0.048	0.044
	T-Stat	(1.165)	(2.298*)	(2.571*)	(0.758)	(1.935)	(1.602)	(1.256)	(0.752)
Expansionary	Mean	0.007	0.014	0.016	0.000	0.006	0.014	0.006	0.011
Regime	SD	0.094	0.07	0.062	0.054	0.049	0.069	0.052	0.041
	T-Stat	(0.926)	(2.526*)	(3.261**)	(0.007)	(1.525)	(2.468*)	(1.408)	(3.452**)

* Denotes statistical significance at the 5% confidence level.
** Denotes statistical significance at the 1% confidence level.

Table 7: Portfolio Turnover

This table reports the time series average of the value-weighted portfolio turnover for six portfolios formed at the intersection of size and book-to-market breakpoints. Panel A reports proceeds, which comprise delistings, migration out of the portfolio and dividends available for reinvestment. Panel B reports purchases, which comprise delistings and migration into the portfolio. Re-weightings are calculated as net proceeds less net purchases.

Panel A: Turnover Proceeds

	SG	SN	SV	BG	BN	BV
Delistings	0.083	0.075	0.111	0.088	0.056	0.067
Migrate Out	0.526	0.517	0.365	0.227	0.269	0.315
Dividends	0.012	0.028	0.027	0.032	0.049	0.043
Net	0.622	0.620	0.503	0.347	0.375	0.425

Panel B: Turnover Purchases

	SG	SN	SV	BG	BN	BV
New Listings	0.139	0.123	0.13	0.073	0.048	0.093
Migrate In	0.420	0.473	0.395	0.204	0.288	0.328
Net	0.559	0.596	0.525	0.277	0.335	0.420
Re-weighting	0.063	0.024	-0.022	0.070	0.040	0.005

Table 8: Daily non-trading probabilities

This table reports the value-weighted average daily non-trading probabilities for firms in each of the six size and book-to-market portfolios. Daily non-trading probabilities are used as a proxy for the liquidity of a portfolio. Using the average number of days since a firm last traded as a measure of trading frequency, the probability that a firm will not trade on a given day is calculated as follows:

$$\pi = \frac{\bar{k}}{1+\bar{k}}$$

Where π is the probability of a firm not trading on a given day and $\bar{k}$ is the average duration since the last trade for each firm.
Results for the entire sample are reported in Panel A. Panel B and Panel C report results for the hold out periods 1975-1990 and 1991-2006 respectively.

Panel A: Mean daily non-trading probabilities 1975-2006

	SG	SN	SV	BG	BN	BV
$\bar{k}$	11.454	9.51	9.096	1.525	1.387	1.245
SD	12.068	8.738	7.165	2.266	2.086	1.519
π	0.849	0.843	0.862	0.427	0.414	0.410

Panel B: Mean daily non-trading probabilities 1975-1990

	SG	SN	SV	BG	BN	BV
$\bar{k}$	12.276	10.986	10.231	1.294	0.941	1.804
SD	12.322	9.180	9.123	0.850	1.073	1.801
π	0.861	0.876	0.862	0.509	0.381	0.513

Panel C: Mean daily non-trading probabilities 1991-2006

	SG	SN	SV	BG	BN	BV
$\bar{k}$	10.633	8.035	7.962	1.755	1.833	0.685
SD	12.155	8.299	4.485	3.127	2.723	0.926
π	0.838	0.810	0.861	0.344	0.447	0.306

Figure 1: Accumulated returns on six size and value portfolios

This figure shows the accumulated returns on six portfolios formed using firm size and book-to-market ratio. Each December, firms are sorted by market capitalisation and divided at the median to form small and big portfolios. Independently, firms are sorted on their book-to-market ratio and allocated into one of three categories; growth (bottom 30%), neutral (middle 40%) and value (top 30%). The six portfolios are small growth (SG), small neutral (SN), small value (SV), big growth (BG), big neutral (BN) and big value (BV). Time is plotted on the horizontal axis and accumulated monthly excess returns are plotted on the vertical axis.

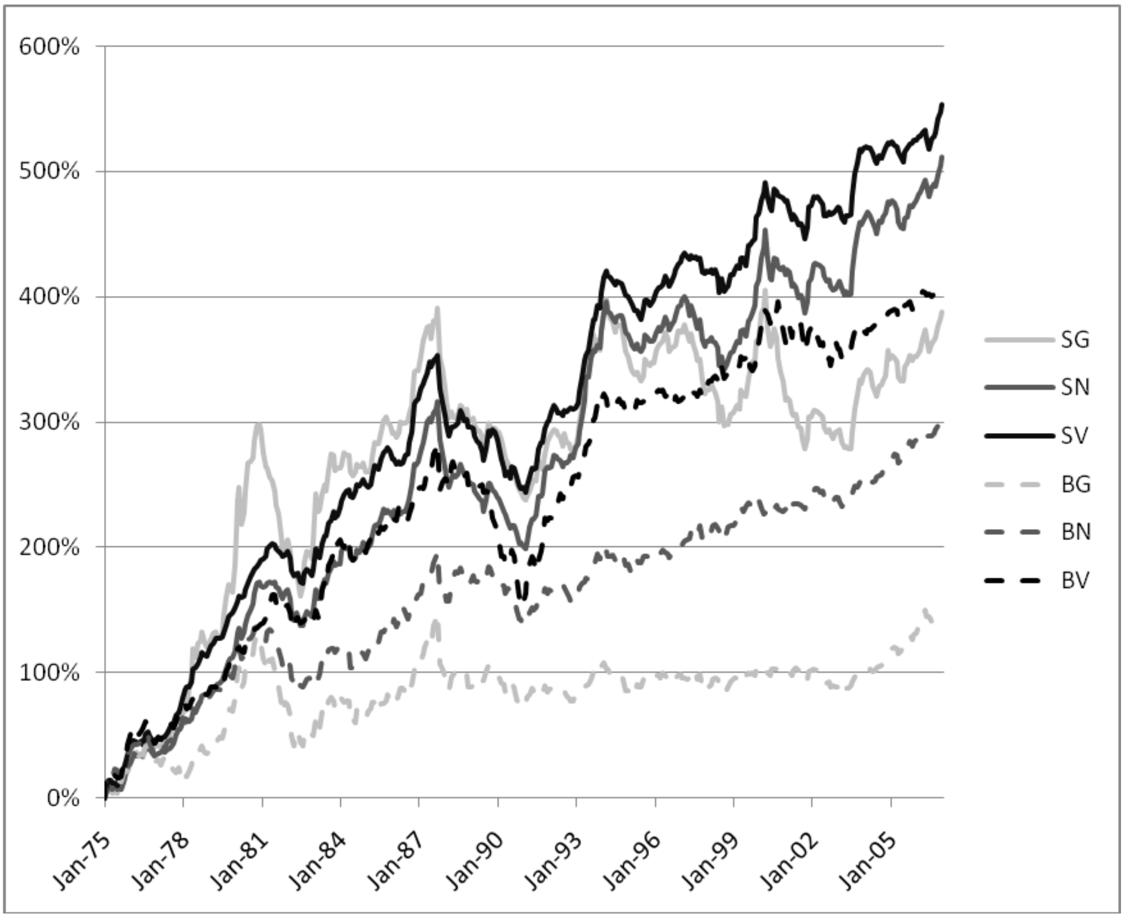


Figure 2: Time-varying betas for HML and SMB portfolios

This figure plots the annual time-varying betas for the HML and SMB portfolios. Time varying betas are estimated using returns from the previous 60 months. At least 24 months returns are required to calculate the beta values at the start of the sample. Time is plotted on the horizontal axis and beta is plotted on the vertical axis.

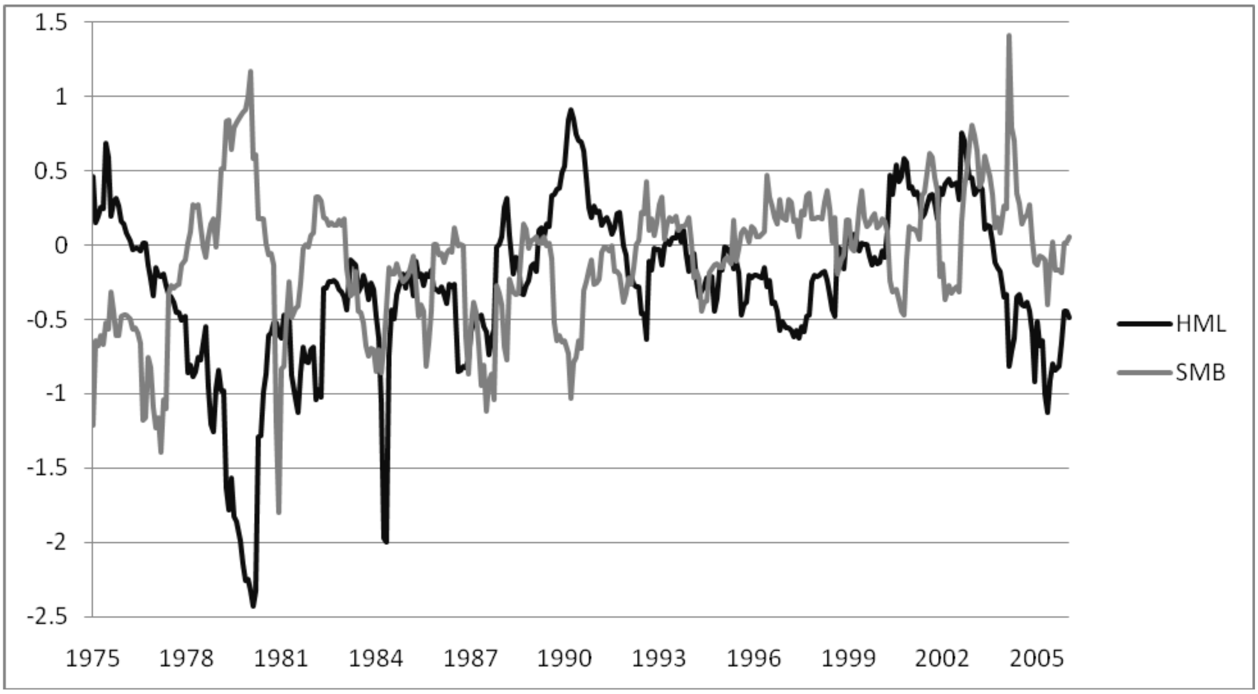
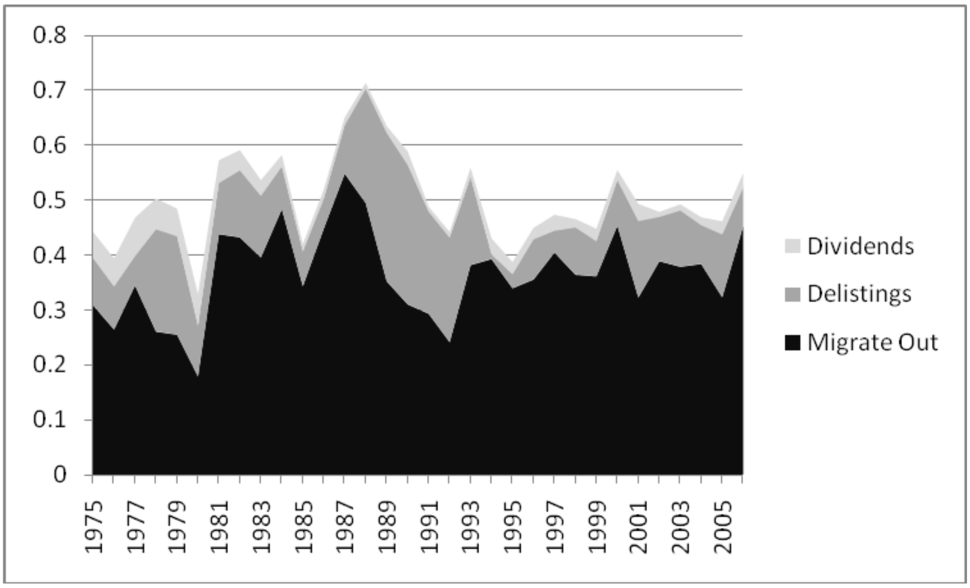


Figure 3: Proceeds and purchases for SV portfolio

This figure plots the time-series of the annual turnover requirements for the small value (SV) portfolio. Panel A reports the turnover proceeds, comprising dividends, delistings and migration out of the portfolio. Panel B reports turnover purchases, comprising new listings and firms that migrate into the portfolio.

Panel A: Turnover Proceeds



Panel B: Turnover Purchases

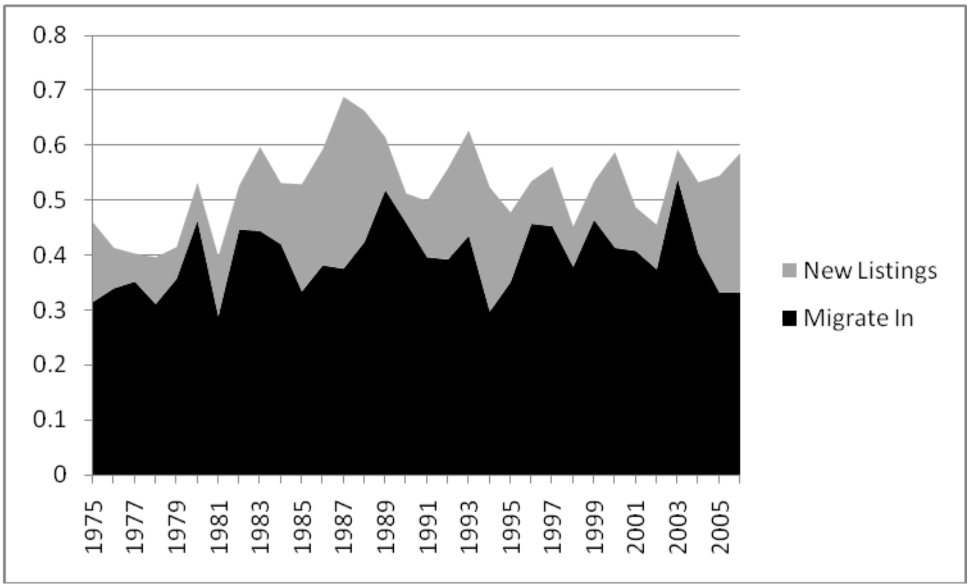


Figure 4: Non-trading probabilities

This figure plots the average daily non-trading probabilities on an annual basis for four portfolios. The four portfolios are small-value (SV), small-growth (SG), big-value (BV) and big-growth (BG).