Value versus Growth

The sources of return differences

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Abstract

The paper thoroughly investigates the role of fundamental and behavioural factors which were identified in the literature as being able to explain the difference in returns between value and growth stocks. Using two-stage model specifications, the paper shows that fundamental factors, including the risk factors, the business cycle factor and the firm-level investment decision factors, are the important drivers of the value anomaly. Zhang (2005)'s mechanism in which the value premium arises due to firms' investment irreversibility interacting with business cycle receives strong supporting evidence. Consumer sentiment plays an important role. The evidence that information asymmetry, divergence of opinions and short sale constraints help to explain the value effect is mixed and might subject to measurement problems.

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Acknowledgements

Introduction

Managers are classified into value and growth groups as early as in the 1920s by Edgar Lawrence Smith (1925, cited in Ibbotson and Riepe, 1997), who advocate growth investing. The first comprehensive argument in defense of value investing is from Graham and Dodd in 1934 (later edition in 1951), who discourage investors from paying too high for the growth expectation and encourage a “margin of safety” for an investment to be realized as a profit. According to Ibbotson and Riepe (1997), there is an implied agreement on broad characteristics of value and growth stocks. Growth style refers to investments in companies experiencing rapid growth in earnings, sales or return on equity. Value style often refers to investments in unpopular stocks (such as stocks in mature industries), turn-around opportunities (such as stocks of companies experiencing problems, but that are expected to recover, including bankruptcy restructuring), or more generally, stocks whose assets are undervalued by the market. Growth stocks tend to have high ratios of market price to fundamentals whereas value stocks tend to have low corresponding ratios, e.g. low P/E, low P/B or low P/CF ratios or high dividend yields.

Early academic attempts to explain for the return difference between value and growth stocks in the 1960s all fail to adjust returns for risks. Studies by Breen (1968), Breen and Savage (1968), McWilliams (1966), and Miller and Widmann (1966) find evidence that returns on low P/E stocks are higher than on high P/E stocks (cited in Basu, 1977). According to Basu (1977), these studies also fail to account for (a) selection bias, (b) market frictions and (c) the availability of earnings information after the reporting date. With the proliferation of the asset pricing model and behavioural finance literature, since then, subsequent papers study the value premium using different asset pricing models and behavioural factors.

This paper aims at investigating (a) whether the value premium actually exists, and if yes, (b) the reasons, economic or psychological, that underlie the difference in the performance of value and growth stocks documented in the literature. It also targets to shed some light to the relationship between the real and the financial markets, with the appreciation of the role of human psychology in the decision – making process. We empirically investigate several behavioural factors including investor sentiment, divergence of opinion, short sale constraint and information asymmetry by introducing them in the risk based conditional asset pricing model of Avramov and Chordia (2006). We also use this conditional model to empirically test the roles of investment irreversibility and operating leverage, as theoretically modelled in Zhang (2005) and Carlson et al. (2004) respectively.

The paper makes two main contributions. Firstly, it includes the behavioural factors that are found to be influential to the value effect in a two stage asset pricing model. The results help to shed light on how risks and behavioural factors together contribute towards the value effect. Secondly, the paper investigates the connection between firms' real activities and the value effect. Motivated by the development in theories, the paper empirically compares the roles of firms' investment irreversibility and their operating leverage using the two stage conditional asset pricing model above.

Our empirical evidence suggests that the value effect can be explained by the combination of firms' investment irreversibility and the business cycle, supporting the theoretical model of Zhang (2005). Firms' investment irreversibility alone is not sufficient to give rise to the value effect. In testing the role of the operating leverage as suggested in Carlson et al. (2004), we find supportive evidence that this characteristic can also help capture the value effect. However, the evidence is limited due to the reduction in the sample size when constructing the measurement of the degree of operating leverage. Furthermore, investor sentiment is empirically important in providing supplementary information that helps capture the value effect. The result for other behavioural factors, including error-in-expectation, divergence of opinions and short sale constraints, and information asymmetry, is mixed. There might be measurement problems, as the sample size is halved when these behavioural factors are used.

Literature review

Value premium in a risk based context

Basu (1977, 1983) uses the CAPM to adjust for risks and finds that the low P/E stock portfolios have higher risk adjusted returns than the high P/E ones. Litzenberger and Ramaswamy (1979) report a positive relationship between dividend yield and before tax expected stock returns. Rosenberg, Reid and Lanstein (1985) report that strategies that are short in stocks with low book-to-market ratio and long in stocks with high book-to-market ratio generate positive returns that are statistically significant. Ball (1978) argues that in line with the Roll's critique of the CAPM, the market portfolio used in the empirical tests is not mean – variance efficient, hence the model to adjust returns for risks is misspecified. In addition, the model misspecification may be due to variable omission. If earnings-related multiples correlate with the omitted variable(s), the multiples will tend to explain the differences in stock returns not captured by the market beta. According to the interpretation of Fama and French (1992) of Ball's argument, regardless of the priced risk factor(s) omitted, the higher the risk, the lower the price relative to earnings and dividends. Hence P/E and dividend yields are likely to explain for stock return differences regardless of what the underlying sources of risk are.

According to Fama and French (1992, 1993, 1996), the three-factor model can explain for the value premium. The authors propose that financial distress is the economic explanation to the anomaly and is captured in the HML factor of the model. This argument is consistent with a study by Heaton and Lucas (1997, cited in Dimson and Mussavian, 2000), which find that the average stockholders are owners of small and private businesses. Their income from these small private businesses is similarly vulnerable to the shocks that cause financial distress to value firms. Value stocks should therefore earn higher returns to attract these average investors to hold. This is in line with the interpretation by Cochrane (1999) of the distress argument. Lakonishok et al. (1994) argue that the value premium is too large to be explained by risk. Fama and French (1996) point out that the market premium, the size premium and the B/M premium are of similar magnitudes, and so are their standard deviations. It is also possible that beta and standard deviation do not fully capture the risks embedded in the two portfolios (Chan and Lakonishok, 2004). Fama and French (1998) find that the three-factor model can explain for the value effect in thirteen countries and emerging markets while the CAPM failed to do so.

Jagannathan and Wang (1996) develop a conditional version of the traditional CAPM where beta is conditioned on a state variable represented by the default spread. The authors recognise the role of the labour income growth in the return of the aggregate wealth. This model specification is claimed to eliminate the size effect but does not go further to explain the value premium. Petkova and Zhang (2005) use four state variables to condition the beta in the traditional CAPM model. The excess market return is also conditioned on these state variables. Petkova and Zhang (2005) report that value betas co-vary positively and growth betas co-vary negatively with the expected market risk premium, or the betas of the portfolios that go long in value and short in growth stocks co-vary positively with the expected market risk premium. This means that value stocks have higher downside risk than growth stocks; however the covariance is too small to explain the value premium. This is an important, although not decisive, evidence against the argument in Lakonishok et al. (1994) that value stocks are not riskier than growth stocks. Lettau and Ludvigson (2001) study the conditional version of the consumption CAPM in which cay, the log consumption-to-wealth ratio is used to condition the consumption beta. Their empirical results show that value portfolios are riskier than growth portfolios as the consumption beta of the former is higher than that of the latter in bad state, and vice versa in good state.

Avramov and Chordia (2006) offer a conditional framework for different asset pricing models. Stock returns at the stock-level with an aim to avoid losing information when stocks are classified into portfolios as in the portfolio approach. This study is also the first to condition betas on both the state variable (default spread, motivated by the literature on the return predictability of macroeconomic variables) and firm-level characteristics (size and

Book-to-market ratio, motivated by the theoretical model of Gomes, Kogan and Zhang (2003)). The paper finds that the conditioning beta helps to improve the predictability of most asset pricing models. The conditional Fama and French model can capture the value effect. While the settings of the conditional framework prove to be effective in studying the cross-section of stock returns, the model specification could be improved in light of the recent theoretical development.

Value premium and firms' real activities

A recent theoretical development is to link the expected stock returns with the real activities of the underlying firm. A pioneering study is by Berk, Green and Naik (1999), which proposes a mechanism to link growth option, assets-in-place and expected returns. The model requires that investment opportunities are heterogeneous in risk. Gomes, Kogan and Zhang (2003) relax this restriction by a general equilibrium context. These two papers are the foundation for the development of the three models by Zhang (2005), Cooper (2006) and Carlson et al. (2004).

Zhang (2005) relaxes the assumption in Gomes et al. (2003) that firms have equal growth options, and establish a relationship between firms' current productivity and investment decision. The value premium is explained by the cost reversibility and the countercyclical price of risk. Firstly, firms face higher cost in cutting than in expanding, leading to asymmetric convex adjustment cost. Value firms are burdened with more unproductive capital stock. As a result of the cost reversibility assumption, in bad state of the business cycle, they will face more difficulty in cutting their capital stock compared to growth firms. On the other hand, in good state, growth stocks will face higher adjustment costs than value stocks. Due to asymmetry of the cost reversibility, expansion is easier than reduction of capital sock. Consequently, value stocks are riskier than growth stocks as the former have less flexibility than the latter in confronting external shocks. Secondly in bad state, the discount rates are higher. As a result, more assets will become redundant, and value firms will face more pressure to disinvest.

Cooper (2006) established a model using excess capacity as a proxy for investment irreversibility. When a firm has experienced adverse shocks, it has idle capital or excess capacity whereas the market value declines, leading to high Book-to-Market ratio. These firms benefit more from positive shocks and suffer more from negative shocks, or having higher systematic risk. In Zhang (2005) the ease of new investment enjoyed by growth firms in good time brings about the higher flexibility of growth firms in confronting external shocks, hence lower systematic risk. In Cooper (2006), new investments are more costly and hence will partially dampen the positive effect of an economic boom to growth stocks than to value stocks. As a result, growth stocks do not co-vary much with economic booms, or are exposed to lower systematic risk. The common feature in Zhang (2005) and Cooper (2006) is that value firms have more capacity than growth firms, benefit more from positive shocks and suffer more from negative shocks.

On the other hand, Carlson et al. (2004) use operating leverage and the changes in demand for firms' products to explain the value premium. When demand for a firm's product decreases, the equity value relative to its capital stock will also decrease. Given that the book value of equity is a proxy for its capital stock, the firm's Book-to-Market ratio increases. Assuming that the fixed operating costs are proportional to the capital stock, the firm's operating leverage also increase, exposing the firm to higher systematic risk.

Given development of this branch of investment-related theoretical models, there is a need for empirical studies to match the growth of theoretical studies. It would be interesting to empirically test the explanatory power of firm-level investment decisions through different channels as proposed in Zhang (2005), Cooper (2006) and Carlson et al. (2004) in explaining the value premium. Anderson and Garcia Feijoo (2006) make an attempt in testing the effect of firms' investment decisions (as proxied by different relative measures of capital stock) on stock returns. They find that (1) value firms significantly accelerate capital investment before being classified according to Fama and French's portfolio sorting rules; and (2) the average return of firms that recently accelerate investment is significantly lower. These results, although shed some light on the role of firms' investment decision on stock returns, are too general to be attributable to the empirical evidence of any of the theoretical models that inspired the study.

Value premium and behavioural factors

Several behavioural factors are hypothesised to give rise to the momentum effect. *Error-in-expectation* is a mechanism deemed to lead to the mispricing of value and growth stocks proposed and empirically tested in Lakonishok et al. (1994). Investors are argued to rely too heavily on past returns when forecasting future returns. In forecasting futures returns of growth stocks, i.e. those stocks with prosperous past returns, investors become overly optimistic; on the other hand, they become overly pessimistic in forecasting future returns of out-of-favour value stocks. Prices of growth stocks will then be bid up to the level commensurate with the expected growth rates, and become too high to their fundamentals. The opposite happens to value stocks. Over time, as stock prices converge to fundamental values, value stocks outperform growth stocks.

A seminal study by Miller (1977) proposed a model that employs *divergence of opinions of investors* and *short-sale constraints* to explain for the enduring overvaluation of stocks. Stock prices are determined in a simple demand-supply model for stocks in which short-sale constraints limit the supply of a stock to a fixed amount (vertical supply curve). As the number of stocks is fixed and if there are more potential investors than the number of stocks, only those investors that are most optimistic about the stock are willing to pay high enough to possess the stock. An increase in the divergence of opinion or short sale constraints, all else equal, will lead to further overvaluation of the stock and future underperformance of the stock return. In light of Miller (1977), several studies focus on the single role of either divergence of opinions or short-sale constraints. Examples include (1) divergence of opinions - Diether et al. (2002) and Doukas et al. (2004); and (2) short-sale constraints - Ali et al. (2003), Nagel (2005) and Phalippou (2007). However, Miller's framework requires the existence of both factors. Two papers by Doukas et al. (2006) and Boehme et al. (2006) investigate the combined effect of divergence of opinions and short sale constraints but do not directly address the value effect.

According to Bhardwaj and Brooks (1992), for neglected firms, the *degree of information asymmetry* is greater between their management and insiders versus outside investors. Outside investors face higher monitoring costs and the risk of management transferring wealth to themselves – a typical agency problem. Hence neglected stocks should generate higher returns for investors to compensate for bearing these extra costs and risks. Several studies document the association of positive stock returns and the information asymmetry to explain for the cross section of stock returns in different corporate decision contexts[1]. In the context of value versus growth stocks, growth stocks, which are often referred to as glamour stocks, are often followed more closely by publication and analysts given their perceived high growth prospects. On the other hand, value stocks are often unpopular stocks or stocks that face turn-around opportunities (Ibbotson and Riepe, 1997). Information asymmetry may therefore contribute to the differences in returns of value and growth stocks.

A growing branch of literature looks at the relationship between *investor sentiment* and stock returns. Baker and Wurgler (2006) report that extreme stocks, i.e. highly distressed or highly growth stocks, are most sensitive to their market based composite sentiment index at the beginning of the period. Lemmon and Portniaguina (2006) use consumer confidence from survey data and find that subsequent returns are low for value stocks given low beginning-of-period sentiment measure, and vice versa. Growth stocks are found to have no response to this sentiment measure. Using buy-sell imbalance as their market based retail investor sentiment, Kumar and Lee (2005) also find that value portfolios are sensitive to investor sentiment whereas growth portfolios are not. The studies above suggest that the evidence of the linkage between the investor sentiment and the value effect is not clear and conclusive. It appears,

[1] Examples include Krishnaswami et al. (1999) with regard to the placement structure of corporate debt, Krishnaswami and Subramaniam (1999) with regard to corporate spin-off decision.

however, that value and growth firms react differently to investor sentiment. When investors become pessimistic, they are over-pessimistic about the prospect of value stocks, which turns out to be better than their expectation later on and results in higher returns for value stocks. On the other hand, investors are not over-optimistic about growth firms. This mechanism might give rise to the cross sectional differences in returns of value and growth stocks.

Conclusion

The diverse literature on the value effect leaves an important gap, that is to synthesise various potential sources of the value premium to better understand their relative importance. This paper attempts to fill in this gap by investigating the role of information contained in firms' real activities and of investors' irrational behaviour in the context of a risk based asset pricing model.

Methodology and data

To assess the relative importance of various sources of the value premium, the paper uses the conditional asset pricing framework in Avramov and Chordia (2006). The framework involves Fama and MacBeth two stage procedure. In stage one, stock returns of individual firms are adjusted for risks using an asset pricing model. In stage two, the risk adjusted returns are regressed against the variables that proxy for the widely documented asset pricing anomalies. An asset pricing anomaly is captured when the coefficient attached to it is not significantly different from zero. Lower adjusted R-square is the signal for the improving explanatory power of the model overall. The framework in Avramov and Chordia (2006) uses firm-level data rather than the traditional portfolio approach in order to avoid (a) losing information when stocks are grouped into portfolios and (b) data snooping biases. Avramov and Chordia (2006) is the first study to use both firm level variables, i.e. book-to-market and size, and the business cycle factor to condition betas. Antoniou et al. (2007) use Avramov and Chordia (2006) framework but include analyst forecast variables in the second stage to test the impact of these variables on the momentum effect and find that these behavioral variables are not relevant to the momentum effect.

In this study we propose several changes to the framework settings. Size and book-to-market are chosen as the conditioning variables in Avramov and Chordia (2006) as they proxy for asset-in-place and growth options in Gomes et al. (2003). However, several studies have developed from Gomes et al. (2003) to offer more general theoretical models to explain the value effect. We base our selection of the conditioning variables on Zhang (2005), Cooper (2006) and Carlson et al. (2004). In Zhang (2005), firms' investment irreversibility of value stocks makes them riskier as they are burdened with investments that are costly to reverse and become less flexible in confronting macroeconomic shocks. Being burdened with investment during economic recession also means that value stocks have enough capacity to meet the rising demand for their products and win the advantage over growth firms during economic expansion. According to Cooper (2006), this mechanism gives rise to value stocks having higher risks than growth stocks. Therefore, we do not differentiate the investment irreversibility mechanism of Zhang (2005) and the excess capacity mechanism of Cooper (2006) and use the measurement of the extent to which firms' assets are irreversible as the conditioning variable in the conditional asset pricing model of Avramov and Chordia (2006), replacing their choice of size and book-to-market. Alternatively, we test the mechanism suggested in Carlson et al. (2004) by using the degree of operating leverage as the firm level conditioning variable. We keep the business cycle factor in the model as the interaction between the business cycle and the relevant firm characteristics in these theoretical models gives rise to the value effect. Starting with risk based explanations for the value premium, we additionally incorporate several behavioural factors, including error-in-expectation, divergence of opinion, short sale constraints, and information asymmetry, that are documented as capable of explaining the value effect. We also consider an alternative source of behavioural influence, i.e. investor sentiment. Prior studies in investor sentiment suggest that value stocks are more sensitive to it while growth stocks are not.

The general model specification is described below. In stage one, the following time series regression is run for individual firms:

$$R_{jt} - R_{Ft} = [\alpha_{j,0} \quad \alpha_{j,1} \quad \alpha_{j,2}] \times \begin{bmatrix} 1 \\ BC_{t-1} \\ BF_{j,t-1} \end{bmatrix} +$$

$$+\sum_{f=1}^{3} [\beta_{j,1} \quad \beta_{j,2} \quad \beta_{j,3} \quad \beta_{j,4} \quad \beta_{j,5} \quad \beta_{j,6}] \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BC_{t-1} \\ BF_{j,t-1} \\ Firm_{j,t-1} \times BC_{t-1} \\ Firm_{j,t-1} \times BF_{j,t-1} \end{bmatrix} \times F_{ft} + e_{jt} \qquad (1)$$

in which R_{jt} is the return on stock j at time t; BC_{t-1} is one month lagged business cycle variable, chosen as the spread between US corporate bonds with Moody's rating of AAA and BAA. F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model. Firm characteristic $Firm_{jt-1}$ is the firm level measurement of the extent to which firms' assets are irreversible or the degree of firms' operating leverage. $BF_{j,t-1}$ is (are) the behavioural factor(s) selected as the conditioning variable(s).

In stage two, i.e. the cross sectional regressions, the risk adjusted returns obtained from stage one are then regressed on lagged returns to assess the explanatory power of the model to the momentum effect. Size, book-to-market and stock turnover are included in these cross sectional regressions to control for the existence of other well documented asset pricing anomalies in the sample.

$$R_{jt}^{*} = c_{0t} + c_{BM,t} BM_{j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{j,t-1} \\ PR_{j,t-1} \\ Turnover_{j,t-1} \end{bmatrix} + u_{jt} \tag{2}$$

in which R_{jt}^{*} is the risk adjusted return of stock j at time t, measured as the sum of the constant and the residual terms from equation (1). $PR_{m,j,t-1}$ are the three sets of past cumulative returns that proxy for the momentum effect from month 2 to month 3, month 4 to month 6 and month 7 to month 12 prior to the current month. The vector of size, past returns and stock turnover in equation (2) represent the control factors, representing other well documented asset pricing anomalies (size, momentum, and liquidity). The null hypothesis is that the coefficient $c_{BM,t}$ attached to the book-to-market is not significantly different from zero, meaning that the value effect is captured when returns are adjusted for risks in stage one. Fama and MacBeth coefficients and t-statistics are reported. The t-statistics are corrected using the Newey and West (1987) procedure.

We first measure the key variables as follows. Size measures the market capitalisation of a stock at the end of each month. To calculate book-to-market ratio, book value equals common equity plus deferred tax (if available), market value equals market capitalisation as of December of the previous year. This ratio is matched with the series of monthly stock returns from July current year to June following year. Three variables that measure past returns are cumulative returns for month 2 to 3, 4 to 6 and 7 to 12 prior to current month. The turnover of NYSE – AMEX stocks equal trading volume divided by outstanding number of shares if the stock is listed in NYSE or AMEX. The turnover of NASDAQ stocks is constructed in a similar manner.

Similar to Avramov and Chorida (2006), we perform transformation of the key variables measured above to avoid skewness. We first lag size for two months, then taking the deviation from the cross-sectional mean of its natural log. Book-to-market is transformed by taking the deviation from the cross-sectional mean of its natural log. Lagged returns are transformed by taking the deviation from the cross-sectional mean. Stock turnovers are transformed by firstly lagging for two months, then taking the deviation from the cross-sectional mean of their natural logs. We assign zero NYSE-AMEX stock turnover for stocks listed in NASDAQ and zero NASDAQ stock turnover for stocks listed in NYSE or AMEX. In equation (1) and (2), these transformed variables are lagged for a further one month with respect to stock returns.

To measure the extent to which firms' assets are irreversible, i.e. variable $Firm_{jt-1}$, in equation (1), we look at the industrial economic literature. Kessides (1990) recommended a proxy for industry level sunk costs, consisting of three components – the portion of capital which can be rented (negatively correlated with the level of irreversibility), the extent to which fixed assets have depreciated (negatively correlated), and the intensity of the second-hand market for the capital employed (negatively correlated). Farinas and Ruano (2005) modified the industry-level measure in Kessides (1990) to three separate firm-level measures: a dummy of 1 for firms renting at least part of their capital and 0 otherwise, the ratio of depreciation charged during the year / total fixed assets, and the ratio of proceeds of sales of fixed assets / total fixed assets. We modify the measurement in Farinas and Ruano (2005) to use rental expense / gross fixed assets, proceeds sales of fixed assets / gross fixed assets and depreciation charge / gross fixed assets. All three variables are negatively correlated with the level of irreversibility of firms' assets and are measured in December of the previous year. They are matched with stock returns from June the current year to July the following year. These variables are lagged one month to become $Firm_{jt-1}$ in equation (1).

Alternative to investment irreversibility, we use firms' degree of operating leverage, measured as the sensitivity of operating profits to revenues according to Mandelker and Rhee (1984). Hence we take operating leverage as the slope coefficient l_1 in the following regression:

$$\log(e_t) = l_0 + l_1 \log(s_t) + u_t \tag{3}$$

in which $\log(e_t)$ is the natural log of a firm's operating profit (EBIT), and $\log(s_t)$ is the natural log of the firm's revenue for the quarter. The regression is run at each December for individual stocks using prior 20 quarterly accounting data. To increase the precision of the estimates, before running the rolling regressions, we standardise the log of operating profits and revenues through the life of a stock to have zero mean and standard deviation measured in cents. Similar to other accounting data, we match the resulting degree of operating leverage l_1 determined at each December with stock returns from June the next year to July the following year. The variable is then lagged one month to become $Firm_{jt-1}$ in equation (1).

We use two alternative groups of behavioural factors $BF_{j,t-1}$. Firstly, we use variables derived from analysts forecasts to measure error-in-expectation, divergence of opinions and short sale constraints, and information asymmetry. The proxies are norms commonly used in prior studies on these factors. Error-in-expectation is proxied by mean forecast error, measured as the average forecasted earnings per share (EPS) minus actual EPS, then divided by the stock price at the beginning of the month. Divergence of opinions is proxied by the dispersion of analysts' earnings per share (EPS) forecast, measured as the standard deviation of forecasted EPS for the current fiscal year divided by stock price at the beginning of the month. The extent to which stocks are short sale constrained is proxied by the size controlled analyst coverage, measured as error term in the following regression for each firm:

$$\log(numest_t) = \alpha + \beta \log(size_t) + \varepsilon_t \tag{4}$$

in which $\log(numest_t)$ is the natural log of the number of estimate when there are analysts following the stocks at time t, $\log(size_t)$ is the natural log of the market capitalisation of the firm at time t. If there is no analyst, by definition the analyst coverage is set to zero. The extent to which a firm is subject to information asymmetry is also measured by these three variables, following Bhardwaj and Brooks (1992) and Krishnaswami and Subramaniam (1999). Hence practically we do not differentiate the two groups of behavioural factors being (a) error-in-expectation, divergence of opinions and short sale constraints, and (b) information asymmetry. All variables are lagged one month to become $BC_{j,t-1}$ in equation (1). Alternative to the above group of behavioural factors, we use investor sentiment, the one month lag consumer confidence index published by the Conference Board and used in Lemmon and Portniaguina (2006).

To assess the supplementary contribution of each group of variables, we introduce each group of variables subsequently into equation (1) through the following system of restrictions. First, the model is fully restricted, i.e. the original or unconditional Fama and French model in equation (1), or $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,2} = \beta_{j,3} = ... = \beta_{j,6} = 0$. Then, only firm characteristics are used as the conditioning variable, or $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,3} = ... = \beta_{j,6} = 0$. We include both firm characteristics and the business cycle factor by limiting our restrictions to $\alpha_{j,2} = 0$ and $\beta_{j,4} = \beta_{j,6} = 0$. When we include both firm characteristics and behavioural factors, the following restrictions are imposed: $\alpha_{j,1} = 0$ and $\beta_{j,3} = \beta_{j,5} = 0$.

The sample size includes stocks which are not in the financial and utility sectors and are listed in the three stock markets – NYSE, AMEX and NASDAQ. Stocks should have a minimum of 36 months of non-negative book value of equity to be included in the sample.

The coverage period is from July 1964 to December 2006. The resulting sample is as follows: 1,484,375 firm-months over the period of July 1964 to December 2006, or 510 months. Total number of firms across the sample is 9,821. Data used in this paper is from CRSP – Compustat – IBES databases.

The results

The existence of the value effect

To determine whether the value premium exist in the sample, we first cross-sectionally regress the excess returns of individual stocks on their contemporaneous transformed book-to-market ratio. Other firm characteristics, i.e. size, lagged returns and stock turnovers are included in the regression to control for the size, momentum and liquidity anomalies. Results in part A of Table 1 show that the coefficient attached to the contemporaneous book-to-market ratio is positive and significant. The value effect exists in the sample when stock returns are not adjusted for risks.

[Table 1 about here]

We then use the two-stage cross sectional model of Avramov and Chordia (2006) to examine the value effect and the contribution of various potential sources to this phenomenon. In panel B of Table 1, we investigate whether the value effect exists in our sample when returns are adjusted for risks using the (unconditional) Fama and French model in the following time-series regression:

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \beta_{j,1} F_{ft} + e_{jt} \tag{5}$$

where F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of Fama and French. Equation (5) is the restricted version of equation (1) when we impose $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,2} = \beta_{j,3} = ... = \beta_{j,6} = 0$ to equation (1). The null hypothesis is that $c_{BM,t}$ in the cross-sectional regression expressed in equation (2) is insignificant.

Panel B of Table 1 shows that after adjusting for risks in the time series regressions using the Fama and French model, the remaining return components still exhibit significant coefficient attached to the book-to-market variable in the cross sectional regressions. The value effect cannot be explained when stock returns are adjusted for risks using unconditional Fama and French model.

The role of firms' investment characteristics

To assess which firms' investment characteristics contribute to the value effect, we adjust risks for individual stock returns using the conditional Fama and French model in which firms' investment characteristics are used as the conditioning variables. In stage one, the following time-series regression is run:

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \left[\beta_{j,1} \quad \beta_{j,2}\right] \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{6}$$

in which R_{jt} is the return on stock j at time t; F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model. Firm characteristic $Firm_{jt-1}$ is the firm level measurement of the extent to which firms' assets are irreversible in panel A and the degree of operating leverage in panel B. Equation (6) is the restricted version of equation (1) when $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,3} = \ldots = \beta_{j,6} = 0$.

[Table 2 about here]

Panel A of Table 2 shows that the coefficient of the book-to-market variable in the cross sectional equation (2) is 0.10 with the significant level of 3%. However, compared with the results in panel B of Table 1 when no information on firms' investment irreversibility is included in stage one, both the magnitude and the significance of the value factor are much lower. The evidence suggests that although firms' investment irreversibility has certain contribution, including this factor alone into stage one to adjust stock returns for risks is insufficient to completely capture the value effect. On the other hand, when the degree of operating leverage is introduced into stage one, the coefficient of the value factor declines to only 0.04 and is insignificant. However, the sample size in panel B is only roughly 40% of the sample size in panel A and the original sample. The reduction in the sample size when the degree of operating leverage is introduced into the empirical framework limits our generalisation of the contribution that operating leverage makes to explain the value effect. An alternative measurement of the operating leverage that does not significantly reduce the sample size may give rise to a more reliable conclusion.

Due to the measurement limitation of the operating leverage, in the following sections we analyse the supplementary contribution of the business cycle and the behavioural factors using the base model that includes investment irreversibility as the firm level characteristic conditional variable.

The role of the business cycle factor

Zhang (2005) suggests the interaction of firms' investment irreversibility and the business cycle, and Cooper (2006) proposes the interaction of firms' excess capacity with the positive and negative macro level shocks. The above empirical result shows that the two stage model with investment irreversibility alone helps but cannot completely capture the value effect. Hence we assess the supplementary contribution of the business cycle to our empirical framework that already contains information about firms' investment irreversibility.

[Table 3 about here]

Table 3 reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ. In panel A, the following time-series regression is run in stage one:

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,3} & \beta_{j,5} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BC_{t-1} \\ Firm_{j,t-1} \times BC_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{7}$$

The risk-adjusted returns of individual stocks is measured as the sum of alpha and the error term. Equation (7) is the restricted version of equation (1) when $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,4} = \beta_{j,6} = 0$). In panel B, alpha is conditioned on the business cycle factor in the time-series regression in stage one:

$$R_{jt} - R_{Ft} = \begin{bmatrix} \alpha_{j,0} & \alpha_{j,1} \end{bmatrix} \times \begin{bmatrix} 1 \\ BC_{t-1} \end{bmatrix} +$$

$$+ \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,3} & \beta_{j,5} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BC_{t-1} \\ Firm_{j,t-1} \times BC_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{8}$$

The risk-adjusted returns of individual stocks is measured as the sum of the constant component of alpha and error term. Equation (8) is the restricted version of equation (1) when $\alpha_{j,2} = 0$ and $\beta_{j,4} = \beta_{j,6} = 0$.

Including the business cycle factor in betas only or betas and alpha in the time-series regression in stage one helps to improve the explanatory power of the empirical framework with regard to the value effect. The coefficient attached to the value factor changes from significant in panel A of Table 2 (i.e. when only firms' investment irreversibility is used as the conditioning variable) to insignificant in both panels of Table 3. The evidence suggests that the value effect can be explained by a mechanism that links firms' investment irreversibility with the business cycle, consistent with the theoretical model in Zhang (2005).

The role of investor sentiment

While there is no conclusive evidence that investor sentiment gives rise to the value effect, prior studies on investment sentiment suggest that there is evidence that value and growth firms react differently to investor sentiment. When investors become pessimistic, they are over-pessimistic about the prospect of value stocks, which turns out to be better than their expectation later on and results in higher returns for value stocks. On the other hand, investors are not over-optimistic about growth firms. This mechanism might give rise to the value effect. We assess the supplementary contribution of investor sentiment to our empirical framework that already contains information about firms' investment irreversibility.

[Table 4 about here]

Table 3 reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ. In panel A, the following time-series regression is run in stage one:

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \left[\beta_{j,1} \quad \beta_{j,2} \quad \beta_{j,4} \quad \beta_{j,6} \right] \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BF_{t-1} \\ Firm_{j,t-1} \times BF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{9}$$

The risk-adjusted returns of individual stocks is measured as the sum of alpha and the error term. Equation (9) is the restricted version of equation (1) when $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,3} = \beta_{j,5} = 0$). BF_{t-1} is the one month lagged consumer confidence index published by the Conference Board and used in Lemmon and Portniaguina (2006). In panel B, alpha is conditioned on the business cycle factor in the time-series regression in stage one:

$$R_{jt} - R_{Ft} = \left[\alpha_{j,0} \quad \alpha_{j,2} \right] \times \begin{bmatrix} 1 \\ BF_{t-1} \end{bmatrix} +$$

$$+ \sum_{f=1}^{3} \left[\beta_{j,1} \quad \beta_{j,2} \quad \beta_{j,4} \quad \beta_{j,6} \right] \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BF_{t-1} \\ Firm_{j,t-1} \times BF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{10}$$

The risk-adjusted returns of individual stocks is measured as the sum of the constant component of alpha and error term. Equation (10) is the restricted version of equation (1) when $\alpha_{j,1} = 0$ and $\beta_{j,3} = \beta_{j,5} = 0$.

Including the investor sentiment factor in betas only or betas and alpha in the time-series regression in stage one helps to improve the explanatory power of the empirical framework with regard to the value effect. The coefficient attached to the value factor changes from significant in panel A of Table 2 (i.e. when only firms' investment irreversibility is used as the conditioning variable) to insignificant in both panels of Table 4. The evidence suggests that the investor sentiment plays an important supplementary role to explain the value effect. This result extends the literature on the empirical evidence of investor sentiment affecting the cross-section of stock returns.

The role of error-in-expectation, divergence of opinions, short sale constraints and information asymmetry

Due to the difficulty in practically separating the measurements of the behavioural factors error-in-expectation, divergence of opinions, short sale constraints, and information asymmetry, we are unable to differentiate the supplementary contribution of each of the factor in this group. For convenience, we refer factors in this group as the analyst forecast variables as all proxies are derived from analyst forecasts of firms' earnings per share.

Table 5 reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ with the behavioural factor BF_{t-1} being the one month lagged mean forecast error, analyst coverage and dispersion of analysts forecast. In panel A, equation (9) is run in stage one whereas in panel B, equation (10) is run in stage one.

[Table 5 about here]

Introducing the behavioural factors based on analyst forecasts does not consistently improve the explanatory power of the empirical framework. The value effect can only be captured in panel A but not in panel B of Table 5. In fact, the coefficient attached to the value factor is negative and significant in panel B. This result suggests that after using the conditional asset pricing models (10) with BF_{t-1} representing the one month lagged mean forecast error, analyst coverage and dispersion of analysts forecast to adjust for risks, the value premium is significant and reverse in sign, i.e. value stocks are expected to earn lower returns than growth stocks. This result might be due to measurement problems with the proxies for the behavioural factors considered in this section using variables derived from analyst forecasts. The sample size declines to half of the original sample size when introducing these variables into the framework. Therefore, we find only limited evidence on the contribution of the behavioural factors proxied by analyst forecasts to the explanation of the value effect.

Conclusion

The paper investigate the role of various sources, rationally and behaviorally, that contribute to the value effect in the US market. The empirical evidence in this paper shows that the value effect can be explained by the combination of firms' investment irreversibility and the business cycle, supporting the theoretical model of Zhang (2005). Firms' investment irreversibility alone is not sufficient to give rise to the value effect. In testing the role of the operating leverage as suggested in Carlson et al. (2004), we find supportive evidence that this characteristic can also help capture the value effect. However, the evidence is limited due to the reduction in the sample size when constructing the measurement of the degree of operating leverage. Furthermore, investor sentiment is empirically important in providing supplementary information that help capture the value effect. The result for other behavioural factors, including error-in-expectation, divergence of opinions and short sale constraints, and information asymmetry, is mixed. There might be measurement problems, as the sample size is halved when these behavioural factors are used.

Table 1: The existence of the value effect

This table reports the evidence of the value effect in the sample. First, raw excess returns of individual stocks are cross-sectionally regressed against their contemporaneous transformed book-to-market ratio. Other anomalies are controlled by including the contemporaneous transformed variables that proxy for them, including size, lagged returns, stock turnovers. Similar to Avramov and Chordia (2006), we include NASDAQ dummy to reflect the difference in the way trading volume is recorded for NYSE-AMEX versus NASDAQ stocks. Panel A reports the time-series averages of these cross-sectional regressions. A significant coefficient attached to the book-to-market ratio is evident for the existence of the value effect in the sample using the raw stock returns.

Panel B reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ.

$$R_{jt}^{*} = c_{0t} + c_{BM,t} BM_{j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{j,t-1} \\ PR_{j,t-1} \\ Turnover_{j,t-1} \end{bmatrix} + u_{jt} \tag{2}$$

in which R_{jt}^{*} is the risk-adjusted returns of individual stocks using the Fama and French model. The risk adjusted returns are measured as the sum of alpha and error term in the following time-series regressions for individual stocks (the unconditional version of equation (1)):

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \beta_{j,1} F_{ft} + e_{jt} \tag{5}$$

R_{jt} is the return on stock j at time t; F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model. $PR_{m,j,t-1}$ are the three sets of past cumulative returns that proxy for the momentum effect from month 2 to month 3, month 4 to month 6 and month 7 to month 12 prior to the current month. The vector of size, lagged returns and stock turnover in equation (2) represent the control factors, representing other well documented asset pricing anomalies (size, momentum, and liquidity). The null hypothesis is that the coefficient $c_{BM,t}$ attached to the book-to-market ratio is not significantly different from zero, meaning that the value effect does not exist once returns are adjusted for risks in stage one. The t-statistics are corrected for autocorrelation and heteroskedasticity using the Newey and West (1987) procedure. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

A – The value effect using raw returns	BM	RET23	RET46	RET712	Size	TONQ	TONX	NASDAQ	Intercept	adjr2	Average no. of firms per month
Coefficient	0.28	0.01	0.01	0.01	-0.17	-0.04	-0.08	0.21	0.91	4.96%	2,574
t value	4.09	2.16	3.21	4.81	-3.23	-0.68	-1.33	1.33	3.09		
p value	0.00	0.03	0.00	0.00	0.00	0.49	0.19	0.18	0.00		
	***	**	***	***	***				***		
B – The value effect using risk adjusted returns in unconditional model	lagBM	lagRET23	lagRET46	lagRET712	lagSize	lagTONQ	lagTONX	NASDAQ	Intercept	adjr2	Average no. of firms per month
Coefficient	0.16	0.01	0.01	0.01	-0.09	-0.09	-0.16	-0.09	0.05	2.25%	2,559
t value	3.16	4.91	3.92	3.88	-2.74	-1.86	-3.54	-0.43	0.72		
p value	0.00	0.00	0.00	0.00	0.01	0.06	0.00	0.67	0.47		
	***	***	***	***	***	*	***				

Table 2: The value effect and firms' investment characteristics

This table reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ.

$$R_{jt}^{*} = c_{0t} + c_{BM,t} BM_{j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{j,t-1} \\ PR_{j,t-1} \\ Turnover_{j,t-1} \end{bmatrix} + u_{jt} \qquad (2)$$

in which R_{jt}^{*} is the risk-adjusted returns of individual stocks, measured as the sum of alpha and error term in the following time-series regressions for individual stocks (the restricted version of equation (1) when $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,3} = \ldots = \beta_{j,6} = 0$):

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \end{bmatrix} \times F_{ft} + e_{jt} \qquad (6)$$

R_{jt} is the return on stock j at time t; F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model. Firm characteristic $Firm_{j,t-1}$ is the firm level measurement of the extent to which firms' assets are irreversible in panel A. We modify the measurement in Farinas and Ruano (2005) to use rental expense / gross fixed assets, proceeds sales of fixed assets / gross fixed assets and depreciation charge / gross fixed assets. All three variables are negatively correlated with the level of irreversibility of firms' assets and are measured in December of the previous year. They are matched with stock returns from June the current year to July the following year. In panel B, firm characteristic $Firm_{j,t-1}$ is the firm level measurement of degree of operating leverage. We take operating leverage as the slope coefficient l_1 in the following regression: $\log(e_t) = l_0 + l_1 \log(s_t) + u_t$ (3)

in which $\log(e_t)$ is the natural log of a firm's operating profit (EBIT), and $\log(s_t)$ is the natural log of the firm's revenue for the quarter. The regression is run at each December for individual stocks using prior 20 quarterly accounting data. To increase the precision of the estimates, before running the rolling regressions, we standardise the log of operating profits and revenues through the life of a stock to have zero mean and standard deviation measured in cents. Similar to other accounting data, we match the resulting degree of operating leverage determined at each December with stock returns from June the next year to July the following year. These variables are lagged one month to become $Firm_{j,t-1}$ in equation (1). $PR_{m,j,t-1}$ are the three sets of past cumulative returns that proxy for the momentum effect from month 2 to month 3, month 4 to month 6 and month 7 to month 12 prior to the current month. The vector of size, lagged returns and stock turnover in equation (2) represent the control factors, representing other well documented asset pricing anomalies (size, momentum, and liquidity). The null hypothesis is that the coefficient $c_{BM,t}$ attached to the book-to-market ratio are not significantly different from zero, meaning that the value effect is captured when returns are adjusted for risks in stage one. The t-statistics are corrected for autocorrelation and heteroskedasticity using the Newey and West (1987) procedure. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	lagBM	lagRET23	lagRET46	lagRET712	lagSize	lagTONQ	lagTONX	NASDAQ	Intercept	adjr2	Average no. of firms per month
A – Firm characteristic is investment irreversibility											
Coefficient	0.10	0.01	0.01	0.01	-0.07	-0.07	-0.14	-0.25	0.10	2.14%	2435
t value	2.16	4.33	3.52	4.30	-2.38	-1.79	-3.31	-1.40	1.75		
p value	0.03	0.00	0.00	0.00	0.02	0.07	0.00	0.16	0.08		
	**	***	***	***	**	*	***		*		
B - Firm characteristic is degree of operating leverage											
Coefficient	0.04	0.02	0.01	0.01	-0.06	-0.07	-0.17	0.15	0.15	2.68%	967
t value	0.81	4.84	3.72	2.60	-2.65	-1.81	-3.72	2.78	2.41		
p value	0.42	0.00	0.00	0.01	0.01	0.07	0.00	0.01	0.02		
		***	***	***	***	*	***	***	**		

Table 3: The value effect and the supplementary role of the business cycle

This table reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ.

$$R_{jt}^{*} = c_{0t} + c_{BM,t} BM_{j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{j,t-1} \\ PR_{j,t-1} \\ Turnover_{j,t-1} \end{bmatrix} + u_{jt} \qquad (2)$$

In panel A, R_{jt}^{*} is the risk-adjusted returns of individual stocks, measured as the sum of alpha and error term in the following time-series regressions for individual stocks (the restricted version of equation (1) when $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,4} = \beta_{j,6} = 0$):

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,3} & \beta_{j,5} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BC_{t-1} \\ Firm_{j,t-1} \times BC_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \qquad (7)$$

In panel B, R_{jt}^{*} is the risk-adjusted returns of individual stocks, measured as the sum of the constant component of alpha and error term in the time-series regressions where alpha is also conditioned on the business cycle (the restricted version of equation (1) when $\alpha_{j,2} = 0$ and $\beta_{j,4} = \beta_{j,6} = 0$):

$$R_{jt} - R_{Ft} = \begin{bmatrix} \alpha_{j,0} & \alpha_{j,1} \end{bmatrix} \times \begin{bmatrix} 1 \\ BC_{t-1} \end{bmatrix} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,3} & \beta_{j,5} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BC_{t-1} \\ Firm_{j,t-1} \times BC_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \qquad (8)$$

R_{jt} is the return on stock j at time t; BC_{t-1} is the one month lagged business cycle variable, chosen as the spread between US corporate bonds with Moody's rating of AAA and BAA. F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model. Firm characteristic $Firm_{j,t-1}$ is the firm level measurement of the extent to which firms' assets are irreversible. We modify the measurement in Farinas and Ruano (2005) to use rental expense / gross fixed assets, proceeds sales of fixed assets / gross fixed assets and depreciation charge / gross fixed assets. All three variables are negatively correlated with the level of irreversibility of firms' assets and are measured in December of the previous year. They are matched with stock returns from June the current year to July the following year. These variables are lagged one month to become $Firm_{j,t-1}$ in equation (4). $PR_{m,j,t-1}$ are the three sets of past cumulative returns that proxy for the momentum effect from month 2 to month 3, month 4 to month 6 and month 7 to month 12 prior to the current month. The vector of size, lagged returns and stock turnover in equation (2) represent the control factors, representing other well documented asset pricing anomalies (size, momentum, and liquidity). The null hypothesis is that the coefficient $c_{BM,t}$ attached to the book-to-market ratio are not significantly different from zero, meaning that the value effect is captured when returns are adjusted for risks in stage one. The t-statistics are corrected for autocorrelation and heteroskedasticity using the Newey and West (1987) procedure. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	lagBM	lagRET23	lagRET46	lagRET712	lagSize	lagTONQ	lagTONX	NASDAQ	Intercept	adjr2	Average no. of firms per month
A – Alpha is constant											
Coefficient	0.04	0.01	0.01	0.01	-0.06	-0.09	-0.13	-0.21	0.08	2.26%	2435
t value	0.90	3.89	4.28	5.66	-2.03	-2.47	-3.30	-1.38	1.49		
p value	0.37	0.00	0.00	0.00	0.04	0.01	0.00	0.17	0.14		
		***	***	***	**	***	***				
B – Alpha is conditioned on the business cycle factor											
Coefficient	0.10	0.00	0.00	0.00	-0.12	-0.07	0.06	0.13	-0.10	2.22%	2435
t value	0.91	0.96	0.54	1.53	-2.87	-0.97	1.15	0.75	-1.25		
p value	0.36	0.34	0.59	0.13	0.00	0.33	0.25	0.45	0.21		
					***						

Table 4: The value effect and the supplementary role of investor sentiment

This table reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ.

$$R_{jt}^{*} = c_{0t} + c_{BM,t} BM_{j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{j,t-1} \\ PR_{j,t-1} \\ Turnover_{j,t-1} \end{bmatrix} + u_{jt} \tag{2}$$

In panel A, R_{jt}^{*} is the risk-adjusted returns of individual stocks, measured as the sum of alpha and error term in the following time-series regressions for individual stocks (the restricted version of equation (1) when $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,3} = \beta_{j,5} = 0$):

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,4} & \beta_{j,6} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BF_{t-1} \\ Firm_{j,t-1} \times BF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{9}$$

In panel B, R_{jt}^{*} is the risk-adjusted returns of individual stocks, measured as the sum of the constant component of alpha and error term in the time-series regressions where alpha is also conditioned on the business cycle (the restricted version of equation (1) when $\alpha_{j,1} = 0$ and $\beta_{j,3} = \beta_{j,5} = 0$):

$$R_{jt} - R_{Ft} = \begin{bmatrix} \alpha_{j,0} & \alpha_{j,2} \end{bmatrix} \times \begin{bmatrix} 1 \\ BF_{t-1} \end{bmatrix} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,4} & \beta_{j,6} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BF_{t-1} \\ Firm_{j,t-1} \times BF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{10}$$

R_{jt} is the return on stock j at time t; BF_{t-1} is the one month lagged consumer confidence index published by the Conference Board and used in Lemmon and Portniaguina (2006). F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model. Firm characteristic $Firm_{j,t-1}$ is the firm level measurement of the extent to which firms' assets are irreversible. We modify the measurement in Farinas and Ruano (2005) to use rental expense / gross fixed assets, proceeds sales of fixed assets / gross fixed assets and depreciation charge / gross fixed assets. All three variables are negatively correlated with the level of irreversibility of firms' assets and are measured in December of the previous year. They are matched with stock returns from June the current year to July the following year. These variables are lagged one month to become $Firm_{j,t-1}$ in equation (4). $PR_{m,j,t-1}$ are the three sets of past cumulative returns that proxy for the momentum effect from month 2 to month 3, month 4 to month 6 and month 7 to month 12 prior to the current month. The vector of size, lagged returns and stock turnover in equation (2) represent the control factors, representing other well documented asset pricing anomalies (size, momentum, and liquidity). The null hypothesis is that the coefficient $c_{BM,t}$ attached to the book-to-market ratio are not significantly different from zero, meaning that the value effect is captured when returns are adjusted for risks in stage one. The t-statistics are corrected for autocorrelation and heteroskedasticity using the Newey and West (1987) procedure. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	lagBM	lagRET23	lagRET46	lagRET712	lagSize	lagTONQ	lagTONX	NASDAQ	Intercept	adjr2	Average no. of firms per month
A – Alpha is constant											
Coefficient	0.06	0.01	0.01	0.01	-0.03	-0.12	-0.13	-0.25	0.10	2.24%	2612
t value	1.47	4.60	3.68	4.58	-1.18	-3.31	-3.31	-1.43	1.60		
p value	0.14	0.00	0.00	0.00	0.24	0.00	0.00	0.15	0.11		
		***	***	***		***	***				
B – Alpha is conditioned on the business cycle factor											
Coefficient	0.13	0.02	0.01	0.01	0.04	-0.66	-0.20	-1.10	0.23	2.09%	2612
t value	0.75	2.54	2.23	2.25	0.50	-5.42	-2.21	-4.56	2.09		
p value	0.46	0.01	0.03	0.03	0.62	0.00	0.03	0.00	0.04		
		***	**	**		***	**	***	**		

Table 5: The value effect and the supplementary role of analyst forecast based behavioural factors

This table reports the time-series averages of individual stocks' cross-sectional OLS regression coefficients (equation (2)) for all stocks listed in NYSE – AMEX – NASDAQ.

$$R^*_{jt} = c_{0t} + c_{BM,t} BM_{j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{j,t-1} \\ PR_{j,t-1} \\ Turnover_{j,t-1} \end{bmatrix} + u_{jt} \tag{2}$$

In panel A, R^*_{jt} is the risk-adjusted returns of individual stocks, measured as the sum of alpha and error term in the following time-series regressions for individual stocks (the restricted version of equation (1) when $\alpha_{j,1} = \alpha_{j,2} = 0$ and $\beta_{j,3} = \beta_{j,5} = 0$):

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,4} & \beta_{j,6} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BF_{t-1} \\ Firm_{j,t-1} \times BF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{9}$$

In panel B, R^*_{jt} is the risk-adjusted returns of individual stocks, measured as the sum of the constant component of alpha and error term in the time-series regressions where alpha is also conditioned on the business cycle (the restricted version of equation (1) when $\alpha_{j,1} = 0$ and $\beta_{j,3} = \beta_{j,5} = 0$):

$$R_{jt} - R_{Ft} = \begin{bmatrix} \alpha_{j,0} & \alpha_{j,2} \end{bmatrix} \times \begin{bmatrix} 1 \\ BF_{t-1} \end{bmatrix} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1} & \beta_{j,2} & \beta_{j,4} & \beta_{j,6} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ BF_{t-1} \\ Firm_{j,t-1} \times BF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{10}$$

R_{jt} is the return on stock j at time t; BF_{t-1} is the one month lagged mean forecast error, analyst coverage and dispersion of analysts forecast. Mean forecast error is measured as the average forecasted earnings per share (EPS) minus actual EPS, then divided by the stock price at the beginning of the month. The dispersion of analysts' earnings per share forecast is measured as the standard deviation of forecasted EPS for the current fiscal year divided by stock price at the beginning of the month. The size controlled analyst coverage, measured as error term in the following regression for each firm: $\log(numest_t) = \alpha + \beta \log(size_t) + \varepsilon_t$ (4)

in which $\log(numest_t)$ is the natural log of the number of estimate when there are analysts following the stocks at time t, $\log(size_t)$ is the natural log of the market capitalisation of the firm at time t. If there is no analyst, by definition the analyst coverage is set to zero. F_{ft} represents priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model. Firm characteristic $Firm_{j,t-1}$ is the firm level measurement of the extent to which firms' assets are irreversible. We modify the measurement in Farinas and Ruano (2005) to use rental expense / gross fixed assets, proceeds sales of fixed assets / gross fixed assets and depreciation charge / gross fixed assets. All three variables are negatively correlated with the level of irreversibility of firms' assets and are measured in December of the previous year. They are matched with stock returns from June the current year to July the following year. These variables are lagged one month to become $Firm_{j,t-1}$ in equation (4). $PR_{m,j,t-1}$ are the three sets of past cumulative returns that proxy for the momentum effect from month 2 to month 3, month 4 to month 6 and month 7 to month 12 prior to the current month. The vector of size, lagged returns and stock turnover in equation (2) represent the control factors, representing other well documented asset pricing anomalies (size, momentum, and liquidity). The null hypothesis is that the coefficient $c_{BM,t}$ attached to the book-to-market ratio are not significantly different from zero, meaning that the value effect is captured when returns are adjusted for risks in stage one. The t-statistics are corrected for autocorrelation and heteroskedasticity using the Newey and West (1987) procedure. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	lagBM	lagRET23	lagRET46	lagRET712	lagSize	lagTONQ	lagTONX	NASDAQ	Intercept	adjr2	Average no. of firms per month
A - Alpha is constant, betas are conditioned on investment irreversibility and AC, MFE, dispersion											
Coefficient	-0.24	0.01	0.00	-0.00	0.17	-0.67	0.22	1.43	-0.87	1.32%	1315
t value	-1.54	1.32	0.17	-0.24	3.31	-3.56	3.00	7.88	-5.28		
p value	0.13	0.19	0.87	0.81	0.00	0.00	0.00	0.00	0.00		
					***	***	***	***	***		
B - Alpha is conditioned on AC, MFE, dispersion, betas are conditioned on investment irreversibility and AC, MFE, dispersion											
Coefficient	-0.51	0.00	0.00	0.00	0.09	0.07	-0.36	0.69	-0.55	0.75%	1289
t value	-3.07	0.68	0.61	0.77	0.80	0.24	-3.77	2.57	-2.10		
p value	0.00	0.50	0.54	0.44	0.43	0.81	0.00	0.01	0.04		
	***						***	***	**		

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