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Firms' financial flexibility

and

the profitability of style investing

By

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Submitted for the

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Abstract

Firms' Financial Flexibility and the Profitability of Style Investing

By: Viet Nga Cao

This thesis examines how firms' financial flexibility affects the profitability of three of the most commonly used style investing strategies. They are the value-growth trading strategy (going long on stocks with high Book-to-Market ratio and short on stocks with low Book-to-Market ratio), the momentum trading strategy (going long on stocks that have performed well and short on stocks that have performed poorly recently), and the accruals based trading strategy (going long on stocks with low accruals and short on stocks with high accruals).

The findings suggest the value premium exists when controlling for risks using the Fama and French three factor model. However, it is explained when the risk factors are conditioned on firms' investment irreversibility and the business cycle. Next, the momentum profit can be explained by (a) adjusting returns for risks using the Fama and French model that is conditioned on firms' financial constraints and the business cycle, and (b) accounting for the interaction between the momentum profit and firms' investments beyond the risk-return relationship. Finally, the accruals based trading strategy is most successful at the two ends of the financial inflexibility spectrum, supporting both an explanation based on the risk-return relationship and an explanation based on the catering theory. When controlling for the cyclicality in stock returns, the strategy ceases to be profitable.

The results suggest that the understanding of corporate investment decisions can help improve the understanding of securities markets and portfolio investment strategies. There are a few lessons that investors can learn from the findings of this thesis. Value-growth investors should focus on value and growth firms with high investment irreversibility gap. Momentum investors should pursue the trading strategy among firms with high financial constraints and during economic upturns. They could also benefit from forming their portfolio from past winners and past losers with high investment gaps. Accruals based investors would benefit from pursuing the strategy among firms with high investment and financing flexibility and during economic upturns.

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List of Abbreviations

AMEX....................American Stock Exchange
APT....................Arbitrage Pricing Theory
BM....................Book-to-Market
CAPEX....................Capital Expenditure
CAPM....................Capital Asset Pricing Model
CCAPM....................Consumption CAPM
DEA....................Data Envelopment Analysis
DMU....................Decision Making Unit
FC....................Financial Constraints
GNP....................Gross National Product
HML....................High-Minus-Low
ICAPM....................Intertemporal CAPM
IIR....................Investment Irreversibility
MP....................Growth Rate of Industrial Production
NASDAQ.............National Association of Securities Dealers Automated Quotation
NYSE....................New York Stock Exchange
OLS....................Ordinary Least Square
P/E....................Price-to-Earnings ratio
SIC....................Standard Industrial Classification
SMB....................Small-Minus-Big
U.K....................United Kingdom
U.S....................United States

Statement of Copyright

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Viet Nga Cao

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Chapter 1 - Introduction

The first philosophical discussion about categorisation starts in "Categories"[1] by Aristotle (B.C. 384 – 322). In the context of the financial markets, categorisation of financial instruments is particularly useful as it helps investors process the huge amount of information available more easily. Investors view assets in groups such as stocks with small capitalisation and large capitalisation, value stocks and growth stocks. The expectation of stock returns depends on which category the stock is classified into.

According to Barberis and Shleifer (2003), classifying assets into groups and allocating funds across the groups is a popular approach in portfolio management. The asset groups can be referred to as styles and the allocation process, style investing. Barberis and Shleifer (2003) concede that a new investment style can emerge due to two drivers, i.e. (a) financial innovations, and (b) the discovery that a particular group of securities can generate superior returns. The focus of this thesis is on the second channel, i.e. the discovery of a style's outperformance.

A style can become out of favour[2] when the market becomes more efficient with regards to that particular style. Along this line, Schwert (2003) suggests that it happens due to more active practitioners pursuing the investment strategies to

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[1] http://www.gutenberg.org/files/2412/2412-h/2412-h.htm, Accessed on 12th September 2010.

[2] According to Barberis and Shleifer (2003), a style disappears when it has poor performance for a long time. The poor performance might be due to the deterioration of the fundamentals, for example the poor performance of the railroad companies which might partially explain why railroad bonds became out of favour in the early 20th century, or the current subprime mortgage crisis might render mortgage backed securities less attractive to investors. When a style disappears in this way, it is more likely to initially arise due to financial innovations.

exploit the anomalies that have been discovered and published. Alternatively, a style might disappear as the studies originally documenting it use biased samples. Schwert (2003) reports several anomalies which have become weaker since the publication of the papers that discovered them. The Barberis and Shleifer (2003) and the Mullainathan (2002) models on how investment styles appear and disappear have several predictions that are consistent with the existing empirical evidence.

Investment styles have been playing important roles to industry practitioners. The fund management industry has developed a preference for "specialty" managers who focus on an asset class to a single balanced manager (Bailey and Arnot, 1986). According to Bogle (2005, p.16), the "middle-of-the-road" funds in diversified blue chips companies that resembled the volatility of the whole stock market once dominated the equity mutual funds in 1945. They have now been taken over by funds specialised in different styles. Finally, Kumar (2006) and Froot and Teo (2008) document that styles drive individual and institutional investors' trades.

The popularity of style investing can be traced back to the importance of the portfolio allocation decision. Brinson et al. (1986) suggest that 93.6% of the actual variation in returns of a typical institutional investor can be attributed to the asset mix. The remaining variation of less than 7% is due to other factors such as the skills of investment managers and market timing. Investment styles are useful as they help simplify the portfolio allocation process. Managers that do not adhere to their designated styles will expose a portfolio to unnecessary risks (Gallo and

Lockwood, 1997)[3]. In addition, being specialised in a particular style helps fund managers save the cost of gathering information about individual securities (Sharpe, 1987). A fund manager can save cost by utilising its financial analysts' comparative advantages and enjoy the economies of scale.

Furthermore, because of the demand for specialised fund managers, investment styles have become a useful tool for fund managers' marketing activities. According to Cronqvist (2006), fund managers' advertising activities affect investors' portfolio choice towards active management and hot sectors. Investment styles also help evaluate the performance of specialised fund managers. To help with identifying the true styles of a fund manager beyond any marketing material, and to determine the appropriate benchmarks, Sharpe (1988, 1992) develops style analysis, a simple technique to identify a fund manager's styles. Based on the styles identified, a benchmark can be constructed using the appropriate style indices and weights. The distance from the fund manager's performance and the benchmark would reflect the manger's skill. Sharpe's technique has gained popularity in the late 1990s due to its efficiency and accuracy in determining the combination of styles that a fund manager pursues (Hardy, 2003).

This thesis investigates whether certain style based trading strategies are profitable. Of several trading strategies designed to follow different investment styles, this thesis examines the profitability of the value-growth, the momentum,

[3] However, investment styles can sometimes cause misallocation of funds. Both models of Barberis and Shleifer (2003) and Mullainathan (2002) predict that investment styles cause too much co-movement within a style and too little co-movement across styles and these co-movements might not necessarily be supported by fundamentals.

and the accruals based trading strategies. The three styles are chosen due to their popularity and profitability robustness. Value and growth are known in the investing public as the most popular styles. Momentum and accruals styles are known in the market efficiency literature as generating the most robust profits (Fama and French, 2008). Furthermore, this thesis investigates how the profitability of these strategies is affected by the extent to which firms can adjust their investments and get access to financing.

Research into the profitability of these style based trading strategies is meaningful to industry practitioners. Dupleich et al. (2010) analyse the exposures of hedge funds between 1995 and 2008 using the value-growth, momentum and accruals styles. The value-growth and the momentum styles turn out to be dominant but not the accruals style. Similarly, Ali et al. (2008) report that very few mutual funds employ the accruals based trading strategy. By contrast, Green et al. (2009) suggest that the accruals style is actively deployed among hedge funds. Trammel (2010) points out that the industry practitioners' interest in the accruals based trading strategy goes further than its profitability. They are interested in whether the success of the trading strategy is due to earnings manipulation or future growth of firms with high accruals. Such an understanding of accruals is important in determining a firm's intrinsic value – a central task of an investment analyst.

1.1. The Trading Strategies and the Research Motivations

Although the profitability of the value-growth, momentum, and accruals based trading strategies is well researched and numerous studies have attempted to explain possible sources of the gains from these trading strategies but their success has been limited. This section provides a snapshot on the existing literature, highlights the gaps, and the potential contributions of the thesis towards examining and testing the success of the aforementioned trading strategies.

1.2.1. The Value-Growth Trading Strategy

Value and growth are known to the investing public as early as the beginning of the 20th century. According to Graham and Dodd (1940, reprinted in 2009, p.61), during the period after the World War I up to the market peak during 1927 – 1929, investors pursued the "new era" investment theory that favours stocks with high growth, or *growth* stocks. Graham and Dodd's classic work "Security Analysis" is often referred to as the first comprehensive support for investment in *value* stocks (Klarman, 2009). Value style has since become one of the most important investment styles.

Subsequent academic studies tend to simplify the definition of value (growth) stocks down to stocks of firms with high (low) ratios of fundamentals to price. They study the profitability of the value-growth trading strategy, i.e. the strategy that goes long in value stocks and short in growth stocks. The information needed to pursue this strategy is historical and public. In the language of the efficient market hypothesis, the success of the value-growth trading strategy violates the semi-strong form market efficiency, hence the value anomaly.

The empirical evidence on the success of the value-growth trading strategy starts in the U.S. markets with Graham and Dodd (1934, reprinted in 1940, 2009). It is subsequently examined in Basu (1977), Litzenberger and Ramaswamy (1979), Rosenberg et al. (1985), Fama and French (1992), and Lakonishok et al. (1994), to name a few. It is also widely documented in several markets with different accounting practices. Chan et al. (1991) document that the value-growth trading strategy is profitable in the Japanese market over the 18 year period from 1971 to 1988. Subsequently, Capaul et al. (1993) report the profitability of the value-growth trading strategy (here after the value premium) in six developed markets including Japan over the 12-year period from 1981 to 1992. Fama and French (1998) extend the investigation to several international markets over an extended period of 20 years from 1975 to 1995. They find that value stocks outperform growth stocks in thirteen markets, including both developed and emerging markets.

Lakonishok et al. (1994) argue that the value premium is the result of the error-in-expectation as investors rely too heavily on past returns when forecasting future returns. The literature also suggests that the value premium could arise due to information asymmetry, divergence of opinions and/or short sale constraints. Given that growth stocks are often followed more closely by analysts, while value stocks are often unpopular stocks (Ibbotson and Riepe, 1997), value investors are compensated for bearing the extra costs and risks due to the higher degree of information asymmetry (Bhardwaj and Brooks, 1992). In addition, Doukas et al. (2004) advocate that divergence of opinions is a risk factor, and value (growth) firms have positive (negative) and significant (insignificant) coefficient on this factor in the augmented Carhart (1997) model. Finally, there is evidence that the value premium is more pronounced in the presence of short sale constraints (Ali et al., 2003, and Nagel, 2005).

The most often cited and risk based explanation for the value premium is the relative distress of value and growth stocks. Fama and French (1995) suggest that the high Book-to-Market ratio of value stocks signals persistent poor earnings whereas the low Book-to-Market ratio of growth stocks signals persistent strong earnings. However, Dichev (1998) finds that the relationship between value firms and the bankruptcy risk is not a monotonic one, casting doubt on the distress risk as an explanation for the value premium.

A turning point in the search for a rational explanation for the value premium comes from the pioneering work of Berk et al. (1999). This study links the expected stock returns with firms' investment activities. This paper lays the foundation for the theoretical models of Zhang (2005), Cooper (2006) and Carlson et al. (2004) in explaining the value premium. In the Zhang (2005) model, firms face higher costs in cutting their production capacity than in expanding it[4]. Value firms are burdened with more unproductive capital stocks. In bad times they will face more difficulty in cutting their capital stocks compared to growth firms. Consequently, value stocks have less flexibility to survive in the adverse environment during the bad state of the business cycle. Together with the

[4] The difference in the costs is due to the extent to which firms' investments can be reversible, i.e. the degree of investment irreversibility.

countercyclical price of risk, this process attributes the difference in the returns of value and growth stocks to the difference in risks.

In the Cooper (2006) model, when a firm has experienced adverse shocks to its productivity, if the capital investment is largely irreversible, the book value of the firm's assets remains fairly constant. As the market value of this firm falls, its Book-to-Market ratio rises. Value firms with high Book-to-Market ratios are more sensitive to the shocks to the aggregate productivity. They can benefit from positive aggregate shocks because with their existing excess capacity, they do not need to undertake any costly new investment to exploit the opportunities during economic upturns. On the other hand, growth firms with low Book-to-Market ratios would need to undertake costly investment to fully benefit from the positive aggregate shocks. Compared to value firms, growth firms would have lower systematic risks because they do not co-move much with the business cycle during economic upturns.

In the Carlson et al. (2004) model, a firm's investments may result in higher operating leverage through long term commitments such as the fixed operating costs of a larger plant, labour contract commitments and commitments to suppliers. Furthermore, when demand for a firm's product decreases, the firm's future operating profits are lower, leading to a lower equity value relative to its capital stocks. If the fixed operating costs are proportional to the capital stocks, it translates into higher operating leverage, or higher systematic risks. If the book value of equity is considered as a proxy for the firm's capital stocks, the Book-to-Market ratio would describe the operating leverage component of a firm's risks.

Thus, value firms with higher Book-to-Market ratios are riskier and earn higher expected returns than growth firms with lower Book-to-Market ratios.

The aforementioned theoretical models share a common feature, i.e. the value premium can be explained by how easily firms can flexibly adjust their physical capital investments in response to aggregate shocks. Empirical tests on the relationship between a firm's physical investments and the value premium are limited so far. Anderson and Garcia Feijo (2006) document that value and growth firms have different capital expenditure levels. Their results, although shedding light on the value and growth firms' investment behaviours, cannot be considered as the direct evidence on the effect of (in)flexibilities in firms' investments as articulated in the three aforementioned theoretical models in explaining the value premium.

Gulen et al. (2008) report that the expected value premium exhibits a counter-cyclical behaviour. Also, there is a systematic difference in firms' investment and financing flexibility between value and growth stocks. Moreover, firms' inflexibility positively affects their cost of equity capital. This thesis takes the work of Gulen et al. (2008) a step further and provides evidence on whether the success of the value-growth trading strategy can be explained by the firm level flexibility. In addition, this thesis uses a more comprehensive and improved set of variables to describe investment flexibility. More specifically this is the first study, to the author's knowledge, that provides empirical evidence on the implications of investment flexibility on the success of the value-growth trading strategy.

Furthermore, this thesis considers the interaction between investment flexibility and the states of the economy, a critical component in all the theoretical models of Zhang (2005), Carlson et al. (2004) and Cooper (2006). Finally, Caggese (2007) suggests that financial constraints, which describe the ability of firms to mobilise funds, can interact with investment irreversibility to influence firms' investments. Hence, this thesis provides evidence on whether financial constraints affects the success of the value-growth trading strategy directly through its influence on the risk profiles of value and growth firms, or indirectly through its influence on the relationship between firms' investment irreversibility and their investment activities.

1.2.2. The Momentum Trading Strategy

The next strategy to be examined is based on the stock price momentum, a popular technical analysis tool. In the academic literature, the first evidence on the profitability of the momentum trading strategy, i.e. the strategy to buy past winners and sell past losers, was documented in Levy (1967). However, Jensen and Benington (1970) report that the strategy is not better than a simple buy-and-hold one. Over 20 years later, Jegadeesh and Titman (1993) revisit the stock price momentum phenomenon. They report that winner (loser) stocks, i.e. those performing well (badly) in the last six to twelve months, will continue to perform well (badly) in the following six to twelve months. The return to the momentum trading strategy (here after the momentum profit) cannot be explained by the CAPM related risk (Jegadeesh and Titman, 1993), or the Fama and French three factor model (Fama and French, 1993, 1996). In the language of the efficient market hypothesis, the success of such a simple trading strategy based purely on past stock returns violates the weak form market efficiency, hence the momentum anomaly.

The momentum trading strategy also proves to be robustly profitable over time and across the markets. According to Rouwenhorst (1998, 1999), the momentum profit also exists in several developed and emerging markets outside the US. Jegadeesh and Titman (2001) update the evidence reported in their 1993 article. The momentum profit in the U.S. market is positive and significant during the nine years following the period originally examined in Jegadeesh and Titman (1993). More importantly, its economic significance during the extended period is comparable to that during the period in the original study. Known as the momentum anomaly in the market efficiency literature, it is the most robust one among several anomalies examined in Fama and French (2008). Grundy and Martin (2001) report that the momentum profit exists in several sub-periods back to 1926.

To explain the momentum profit, Daniel et al. (1998) propose a model in which investors are overconfident about their private signals and subject to the self-attribution bias, i.e. attributing success to their own competence and failure to bad luck. As more public information is released, the self-attribution bias causes investors to continue to be overconfident and over-react to their private information, causing stock price momentum. Barberis et al. (1998) and Hong and Stein (1999) attribute the momentum to investor under-reaction to news. In Barberis et al. (1998), under-reaction is due to investor conservatism, whereas in Hong and Stein (1999) it is due to the gradual diffusion of news. Grinblatt and Han (2005) attribute the momentum profit to the disposition effect, i.e. the tendency that investor “hold on to their losing stocks too long and sell their winners too soon” (p. 312).

Fama and French (1996) concede that their three factor model cannot explain the momentum profit. Chordia and Shivakumar (2002) document that the momentum profit varies across the business cycle, is positive and significant during expansions and turns insignificant during contractions. They suggest that the momentum profit is linked to the common factors in the macro economy. However, Griffin et al. (2003) find that the momentum profit in several international markets is positive and significant in both economic upturns and downturns, challenging the view [5] in Chordia and Shivakumar (2002).

A few studies examine whether the momentum profit can be explained by firms' investments. The Berk et al. (1999) model, when calibrated with realistic project life and depreciation parameters, generates a positive momentum profit for a period of five years, more persistent than the one observed empirically in several studies. Despite this mismatch, the Berk et al. (1999) model embarks a promising direction into the relationship between firms' investment activities and the momentum profit. Similar to the Berk et al. (1999) model, the Johnson (2002) model on firms' growth related risk, when calibrated, generates too persistent momentum profits. Empirically, Liu and Zhang (2008) document that half of the momentum profit can be explained by the growth rate risk proxied by the growth rate of industrial production.

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[5] Lakonishok et al. (1994), Petkova and Zhang (2005), and Lettau and Ludvigson (2001) argue that the necessary condition for the value premium to be driven by risks is that value stocks outperform growth stocks in good states and underperform in bad states of the business cycle. By the same token, Griffin et al. (2003) argue that the necessary condition for the momentum profit to be driven by risks is that it is positive during economic upturns and negative during downturns. Hence, they concede that the momentum profit is not driven by macroeconomic risks, given the evidence of the momentum profit in both states of the business cycle.

In a related line of research, Morck et al. (1990) provide a comprehensive analysis on different channels through which stock prices could affect firms' investments. Recent studies extend the evidence in Morck et al. (1990). In Baker et al. (2003), equity dependent firms, i.e. firms that need to rely on external equities to finance their investments, would under-invest when their stocks are undervalued. Such firms would have to issue equities at a price below the fundamental value to finance for all the profitable investments in the pipeline. In Polk and Sapienza (2009), if stocks are overpriced according to their existing level of investments, managers who hold a short term view might invest further to cater investors' sentiment and maintain the recent stock price trend. Bakke and Whited (2010) support the proposition that stock prices contain private information that managers use when making investment decisions, particularly among less financially constrained firms. On the other hand, Ovtchinnikov and McConnell (2009) concede that increasing stock prices reflect the better quality of growth opportunities.

In short, the literature suggests that firms' investments are related to their risks, which might predict future stock returns. On the other hand, stock prices are likely to influence firms' investments. Hence, it is possible that past stock prices are related to future stock prices through firms' current investments. The research into the relationship between stock price momentum and firms' investments is limited mainly to the theoretical works of Berk et al. (1999) and Johnson (2002), and the empirical work of Liu and Zhang (2008). None of these studies fully explains the momentum profit pattern observed in the existing literature. There is a gap to extend this research direction in light of the recent studies on stock prices and firms' investments. This thesis aims to fill in this gap by extending the understanding on whether the momentum profit can be explained by the investment patterns of past winners and past losers. It contributes to the understanding of the relationship between corporate policy decisions and the stock price momentum. The explanations for the momentum profit suggested in this thesis can help reconcile several findings documented in the literature.

This thesis suggests a new explanation, to the author's knowledge, for the momentum profit based on the concept of the credit multiplier effect of Kiyotaki and Moor (1997) and the conjecture of Ovtchinnikov and McConnell (2009). The latter study concedes that higher stock prices reflect the better quality of growth opportunities. Hence, past winners would invest more than past losers because they have better investment opportunities. According to Hahn and Lee (2009), among financially constrained firms, those with higher debt capacity are more exposed to the credit multiplier effect, and this exposure is priced. Therefore, among financially constrained firms, past winners are more exposed to the credit multiplier effect, are riskier and have higher expected returns than past losers.

This thesis also extends the literature on the mispricing of past winners and past losers by attributing it to investors' interpretation of their investments. Along this line, this thesis argues that the equity issuance channel in Baker et al. (2003) would suggest past winners invest more than past losers. This is because they can issue more overpriced shares to finance their investments that would not otherwise be undertaken. As investors welcome the new efficient investments, past winners might be further mispriced, and the return continuation might be maintained. Alternatively, along the lines of Polk and Sapienza (2009), if past winners and past losers are mispriced due to investors misjudging their investments, past winners might continue to invest to maintain their upward price movement, hence the return continuation.

1.2.3. The Accruals based Trading Strategy

Finally, this thesis examines the success of the accruals based trading strategy, (the strategy of buying stocks that have low accruals and selling stocks that have high accruals) in generating excess returns. First documented in Sloan (1996), this strategy is reported to generate positive and significant returns that cannot be explained by the CAPM related risk. Similar to the value trading strategy, the accruals based trading strategy uses the historical and public information. In the language of the efficient market hypothesis, the success of the accruals based trading strategy violates the semi-strong form market efficiency, hence the accruals anomaly.

The evidence for the profitability of the accruals based trading strategy is mixed in the international market. Pincus et al. (2007) report that among 20 developed countries the return to the accruals based trading strategy (here after the accruals premium) is significant only in the US, the U.K., Canada and Australia. On the other hand, La Fond (2005) reports that the accruals premium is a global phenomenon, given its significance in 15 out of 17 developed countries. Known as the accruals anomaly in the market efficiency literature, it is one of the most robust anomalies examined in Fama and French (2008). Although Green et al. (2009) claim that the accruals premium has disappeared in the last few years, other authors such as Wu et al. (2010), Gerard et al. (2009), Livnat and Petrovits (2009), and Ali and Gurun (2009) show its time varying characteristic and suggest that it is likely to reemerge in the future.

Sloan (1996) first explains the return to the accruals based trading strategy with the functional fixation hypothesis. In his hypothesis investors are irrational and ignore the difference in the persistence of cash based versus accrual based earnings when making their earnings forecasts. As the cash based earnings are more persistent than the accrual based earnings, accruals are mispriced. Firms with high accruals are overpriced whereas those with low accruals are underpriced.

Some studies attribute the accruals premium to investor irrationality in understanding firm growth. Fairfield et al. (2003) argue that accruals contribute to both the overall growth of a firm through net operating assets, and its profitability. As investors fail to recognise that the association between growth and future profitability is weaker than that between current earnings and future profitability, firms with high (low) accruals are overpriced (underpriced).

Other studies attribute the accruals premium to the behaviours of firms' managers. Richardson et al. (2006) suggest that the difference in the persistence of the cash based and accruals based earnings is due to managers' earnings manipulation. Alternatively, Kothari et al. (2006) suggest that the mispricing of accruals might be due to managers of overpriced firms distorting earnings upwards to nurture investors' expectations.

Wei and Xie (2008) suggest that managers genuinely accumulate inventories and other working capital items to anticipate high future growth, and make errors in extrapolating past high growth into the future. This explanation can account for the return predictability of both accruals and fixed capital investments. However, Chan et al. (2006) argue that if the accruals premium is driven by changes in the business conditions, then it should be roughly uniform across accrual components and industries. They report that the predictability of accounts receivable and inventories are different, and the accruals premium varies in different industries.

Some studies seek to explain the accruals premium by the relative distress risk. According to Khan (2008), firms with low accruals possess the characteristics of distress stocks such as negative earnings, high leverage, low sales growth, and high bankruptcy risks. Ng (2005) also reports that distress risks affect the accruals premium and controlling for distress risks lowers the premium. On the other hand, Wu et al. (2010) argue that the discount hypothesis explains the accruals premium. When the discount rate is lower, more investment projects become profitable, hence firms would invest in presumably both fixed capitals and working capitals. Furthermore, lower discount rates mean lower expected returns going forward. Hence, to the extent that accruals reflect working capital investments, higher accruals are followed by lower expected stock returns.

The existing literature on the accruals premium leaves several gaps to be filled. Firstly, given the evidence in Wei and Xie (2008) that the return predictability of accruals is related to but not subsumed by the return predictability of fixed capital investments, there should be a process by which changes in working capital investments are dependent on changes in fixed capital investments but the relationship is not a monotonic one. The implication of such a process on the accruals premium has yet to be discussed in the literature. This thesis extends the work of Wei and Xie (2008) to examine the implication of such a process on the accruals premium.

Secondly, Wu et al. (2010) suggest that the accruals premium should follow the business cycle pattern[6], given that (a) the accruals based trading strategy shares some common characteristics with the value-growth trading strategy (Desai et al., 2004), (b) both are related to firms' investments, and (c) the value premium is cyclical mainly due to firms' investment irreversibility (Zhang, 2005). This thesis extends the work of Wu et al. (2010) to examine how the accruals premium varies across the business cycle due to the factors identified in Zhang (2005) as driving the value premium cyclical.

Thirdly, the explanation for the accruals premium in Kothari et al. (2006) rely on the initial overvaluation of stocks and managements' subsequent investments to maintain the overvaluation. Given that stocks are more likely to be overvalued when the sentiment is high, and managements are more likely to purposely invest to cater for this sentiment (Polk and Sapienza, 2009), this thesis extends the work of Kothari et al. (2006) to examine whether an explanation for the accruals premium based on the catering theory would also predict that the premium varies with the investor sentiment cycle[7].

Finally, the accruals premium is predicted to vary systematically, either with the business cycle pattern (Wu et al., 2010) or with the investor sentiment cycle (conjectured in this thesis). To evaluate the importance of the cyclicality of the accruals premium, this thesis is the first to examine whether the accruals premium exists after removing the cyclical component of returns. Such an

[6] i.e. the systematic variation across the periods of economic upturns and downturns, which correspond to the expansion and contraction of economic activities respectively.

[7] i.e. the systematic variation across the periods of high and low investor sentiment.

understanding would benefit investors who attempt to exploit the accruals based trading strategy.

1.2. The Research Questions, Findings, and Implications

1.2.1. The Research Questions

This thesis aims to fill in the gaps identified from the literature by investigating how the information on firms' investments can help explain the profitability of the value-growth, momentum and accruals based trading strategies. The two related research questions that this thesis addresses are:

(1) can the value-growth, momentum, and accruals based trading strategies generate positive and significant profit to investors? and

(2) how firms' investment and financing flexibility affect the profitability of these trading strategies?

This research extends our understanding on how the decisions of firm management can affect the profitability of investors' trading strategies in the stock market. Furthermore, answers to the second question would help the investors who pursue these trading strategies improve their profitability. The investigation in each of the three trading strategies, i.e. the value-growth, momentum, and accruals based trading strategies, would also contributes to the literature specific to these strategies. The hypotheses about the financial flexibility and the profitability of the value-growth trading strategy are discussed in section 2.3 (p. 52), of the momentum trading strategy, section 3.3 (p. 146), and of the accruals based trading strategy, section 4.3 (p. 228).

1.2.2. The Main Findings

This thesis supports the conjecture that investment irreversibility is relevant to the success of the value-growth trading strategy. While this evidence is closely related to the model in Zhang (2005), it is also broadly consistent with Cooper (2006) and Carlson et al. (2004). Firms' financial constraints affect the profitability of the value-growth trading strategy through their influence on the relationship between investment irreversibility and the value premium. The value premium can be explained by the Fama and French three factor model conditioned on financial constraints, investment irreversibility and the business cycle.

Next, this thesis finds that the success of the momentum trading strategy can be explained by a combination of the explanations based on Ovtchinnikov and McConnell (2009), Baker et al. (2003), and Polk and Sapienza (2009). Past winners invest more than past losers, and the investment gap is higher during economic upturns. The momentum profit is only positive and significant among firms with high financial constraints. It can be explained (a) by adjusting returns for risks using the Fama and French three factor model conditioned on the financial constraints and the business variables, and (b) by accounting for the interaction between the momentum profit and firms' investments as suggested in the explanations based on Baker et al. (2003) and Polk and Sapienza (2009).

Finally, this thesis finds that the accruals based trading strategy is most successful at the two ends of the inflexibility spectrum. The pronounced accruals premium among firms with high investment and financing inflexibility support the explanation advocated in Wu et al. (2010) that the accruals premium is due to the difference in risks between firms with high and low accruals. The evidence at the low end supports the explanation based on Polk and Sapienza (2009) that the accruals premium is due to investors mispricing firms' working capital investments. The accruals premium is also more pronounced during economic upturns among firms at the high end. These patterns are concentrated in the manufacturing industries, to which the investment and financing environments are crucial. When controlling for the cyclicality in stock returns, the accruals premium ceases to exist, suggesting that wrong timing can cost investors dearly.

1.2.3. The Implications of the Findings

This thesis reports that the sources of the profitability of the trading strategies can be traced back to a risk-return relationship based on the fundamental information about the firm and the economy. In the context of the market efficiency literature, the market is efficient with regards to the information about the Book-to-Market ratio, since future stock returns cannot be predicted using this ratio when risks are taken into account. However, future returns can be predicted using information about past stock returns and firms' accruals even when returns are adjusted for risks. This return predictability can be explained by the management's behaviours. Hence the market is not fully efficient with regards to the information about past stock returns and firms' accruals. The findings also suggest that our understanding of corporate investment decisions can help extend our understanding of the securities markets and portfolio investment strategies.

Furthermore, the findings can help investors in improving the profitability of these trading strategies. Investors can be better off when pursuing the value-growth trading strategy on value and growth firms with bigger gap to the extent to which firms' assets are irreversible. Similarly, they would benefit from pursuing the momentum trading strategy among firms with high financial constraints and in economic upturns than among those with low financial constraints and in economic downturns. Implementing the momentum trading strategy among past winners and past losers that are far different in their current investment activities can also improve the profitability of this trading strategy. Finally, investors would benefit from pursuing the accruals based trading strategy among firms that are either highly inflexible or highly flexible in investment and financing (i.e. at the two extremes of financial constraints). They also benefit from pursuing the strategy during economic upturns among firms that are highly inflexible. The profits can be either completely or partially explained when risks are controlled for using the asset pricing model conditioned on these financial inflexibility characteristics. Hence investors should bear in mind that all or part of the improved performance of the trading strategies might just be a compensation for higher risks.

1.3. Thesis Outline

The inquiry into the relationship between financial flexibility and the profitability of the value-growth trading strategy is presented in Chapter 2. Chapter 3 investigates its relationship with the profitability of the momentum trading strategy. The relationship with the profitability of the accruals based trading strategy is examined in Chapter 4. Although the thesis uses the same approach, i.e. investigating the influence of firms' investment and financing flexibility on the profitability of the three trading strategies, three chapters deal with three different trading strategies, addressing different gaps in the literature of each strategy. Therefore, each chapter is presented independently. They start with an introduction of the relevant trading strategy, highlighting the gaps in the literature and how an investigation of firms' investment and financing flexibility can fill in such gaps, and identifying the contributions of the respective investigations into the relevant strategy.

Each empirical chapter then follows the usual sequence of literature review, hypothesis development, methodologies and data, results, and conclusions. It is unavoidable that when similar methodologies are used to investigate different issues about the three trading strategies, the discussions of the methodologies in the three chapters have some overlaps. However attempts have been made to minimise the duplications. Finally, chapter 5 provides the concluding remarks on the findings in each of the three investigations, their implications, and the directions for future research.

Chapter 2 – Firms' Investment, Financing Flexibility and the Value-Growth Trading Strategy

2.1. Introduction

Investing in value and growth stocks has been known to the investing public since the early 20th century. Investors in the early days believed that "good common stocks are those which have shown a rising trend of earnings" (Graham and Dodd, 1940, reprinted in 2009, p.29). However, the principle of "the best companies make the best stocks" is now widely recognised in the market as one of the market myths (Dorfman, 2009). The early work of Graham and Dodd (first edition in 1934, reprinted in 1940, 2009) promoted the idea of investing in value stocks, which they define as those with solid fundamentals, at a price which gives investors sufficient margin of safety.

Academic studies tend to simplify the definition of value stocks down to stocks of firms with a high ratio of fundamentals to price such as the Book-to-Market ratio (book value of equity / market value of equity), the earnings yield or E/P ratio (firms' earnings / market value of equity), the cash flow yield (cash flow / market value of equity), or the dividend yield (dividend / market value of equity). Stocks of firms with a low ratio of fundamentals to price are classified as growth stocks[8].

There is extensive empirical evidence on the higher returns of value stocks relative to growth stocks. Research on the profitability of the value-growth trading strategy, i.e. the strategy that goes long in value stocks and short in growth stocks,

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[8] The selection of these variables, as noted by Chan et al. (1991), is based on intuition and their popularity among practitioners. Firms with a high ratio of fundamentals to stock prices are often perceived as priced relatively cheaper compared with their "intrinsic value" or other comparable firms with a lower corresponding ratio. Therefore the ratios of fundamentals to stock prices are often used as value indicators.

started in the U.S. market[9]. The phenomenon, also known as the value anomaly in the market efficiency literature, appears to be also widely documented in several markets with different accounting practices. Chan et al. (1991) document that despite the differences in the accounting practices between the U.S. and the Japanese markets, e.g. the popularity of accelerated depreciation method among the Japanese firms, there is evidence that the value premium (or the profitability of the value-growth trading strategy) exists in the Japanese market over the 18 year period from 1971 to 1988. Stock returns exhibit a positive relationship with the value indicators such as the Book-to-Market ratio and the cash flow yield but not with the earnings yield. Capaul et al. (1993) report the strong value premium in six developed markets over 12 years period from 1981 to 1992. Fama and French (1998) extend the investigation to several international markets over an extended period of 20 years from 1975 to 1995. They find evidence that using the Book-to-Market ratio, the dividend yield, the cash flow yield and the earnings yield to classify value and growth stocks, value stocks outperform growth stocks in thirteen markets, including both developed and emerging markets.

Research into the relative performance of value stocks vs. growth stocks attributes the superior return of value stocks to several factors. With the emergence of the asset pricing literature, starting with the CAPM of Sharpe (1964) and Litner (1965), studies on the value and growth stocks since the 1970s account for the difference in risks in explaining the difference in the returns. Basu (1977), Litzenberger and Ramaswamy (1979), Rosenberg et al. (1985), Fama and French

[9] Graham and Dodd (1934, reprinted in 1940, 2009), Basu (1977), Litzenberger and Ramaswamy (1979), Rosenberg et al. (1985), Fama and French (1992), Lakonishok et al. (1994), to name a few.

(1992), Lakonishok et al. (1994) find that value stocks generate higher returns than growth stocks after accounting for the difference in returns that are due to the difference in risks. Fama and French (1995) attribute the value premium to the financial distress risk of value firms. On the other hand, Lakonishok et al. (1994) suggest that it is due to investors making errors when forming their expectation based on the extrapolation of past growth into the future.

Recent theoretical development, led by Berk et al. (1999), links the expected stock returns with the investment activities of the underlying firm. These theoretical papers lay the foundation for several theoretical papers aiming to explain the profitability of trading strategies by modeling the relationship between firms' investment activities and their stock prices. To explain the value premium, Zhang (2005) develops an equilibrium model in which firms face higher costs in cutting their production capacity than in expanding it. Firms are assumed to adjust their capital investments to achieve the optimal level across the business cycle. Value firms are burdened with more unproductive capital stocks. They will face more difficulty in cutting their capital stocks in bad times compared to growth firms. On the other hand, in good times, growth firms will face higher adjustment costs than value firms.

In the Zhang (2005) model, due to the asymmetry of the costly reversibility, the expansion is easier than the reduction of capital stocks. Consequently, value firms have less flexibility than growth firms to survive in the adverse environment during the bad state of the business cycle. In addition, the model also assumes that discount rates are time varying, higher in bad states and lower in good states. As a result, more assets will become redundant in bad states, exposing value firms to even more pressure to disinvest, and reinforcing their inflexibility relative to growth firms. With this mechanism, the Zhang (2005) model attributes the difference in the returns of value and growth stocks to the difference in risks.

Closely related to the Zhang (2005) model are the two models of Cooper (2006) and Carlson et al. (2004). The Cooper (2006) model explains the outperformance of value over growth stocks based on firms' excess capacity. When a firm has experienced adverse shocks to its productivity, if the capital investment is largely irreversible, the book value of the firm's assets remains fairly constant. As the market value of this firm falls, its Book-to-Market ratio rises. Those firms with high Book-to-Market ratios, i.e. value firms, are more sensitive to aggregate shocks, i.e. shocks to aggregate productivity. They can benefit from positive aggregate shocks as their existing excess capacity allows them to exploit the opportunities during economic upturns without undertaking any costly new investment. On the other hand, firms with low Book-to-Market ratios, i.e. growth firms, would need to undertake costly investments to fully benefit from the positive aggregate shock. Growth firms would therefore not co-move much with the business cycle during economic upturns, hence lower systematic risks.

In Carlson et al. (2004), a firm's investments may result in higher operating leverage through long term commitments such as the fixed operating costs of a larger plant, labour contract commitments and commitments to suppliers. In this model, when the demand for a firm's product decreases, the firm's future operating profits are lower, leading to a lower equity value relative to its capital stocks. If the fixed operating costs are proportional to the capital stocks, the decline in the product demand could result in higher operating leverage. As the book value of equity can be considered as a proxy for the firm's capital stocks, the Book-to-Market ratio describes the operating leverage component of risks that reflects the state of the product market demand conditions relative to invested capitals. Thus, value firms with higher Book-to-Market ratios are riskier and generate higher returns than growth firms with lower Book-to-Market ratios.

The three models of Zhang (2005), Cooper (2006) and Carlson et al. (2004) share a common feature - the value premium is rooted in the difference in the extent to which firms can flexibly adjust their physical capital investments in response to aggregate shocks. Empirical tests on the relationship between a firm's physical investments and the value premium are limited so far. Anderson and Garcia Feijo (2006) test the effect of firms' investments on stock returns. Their results, although shedding light on the investment and disinvestment activities of value and growth firms, cannot be considered as direct evidence for the explanatory power of investment inflexibility to the value premium. Gulen et al. (2008) report a counter-cyclical pattern of the expected value premium. The authors also find that there is a systematic difference in the firm level investment and financing inflexibility of value and growth stocks, and a positive relationship between firms' costs of equity capital and these measures.

There is a gap in the literature to empirically test whether the inflexibility in firms' physical capital investments can account for the value premium. This chapter aims to fill in this gap by empirically investigating (a) whether the value premium actually exists, and if yes, (b) whether it is affected by the inflexibility of firms' physical capital investments. The Zhang (2005) model suggests that the value premium arises as value and growth firms respond to positive and negative aggregate shocks differently due to their difference in the irreversibility of physical capital investment. Therefore, this chapter hypothesises that firms' investment irreversibility and its interaction with the business cycles affect the value premium.

The closely related model of Cooper (2006) employs excess capacity, a consequence of investment irreversibility when firms face adverse productivity shocks, to explain the value premium. The Cooper (2006) model suggests that due to the difference in excess capacity, value and growth firms co-move differently with the business cycles, resulting in their different systematic risks. Therefore this chapter hypothesises that firms' excess capacity and its interaction with the business cycle affect the value premium.

Long term commitments from firms' physical investments at the same time make the investments difficult to reverse and contribute to firms' operating leverage. The Carlson et al. (2004) model suggests that value and growth firms have different operating leverage, which reflects the relation between the product market demand conditions and the invested capital. As the product market demand tends to vary with the business cycle, this chapter hypothesises that firms' operating leverage and its interaction with business cycles affect the value premium.

In adjusting their physical capital investments across the business cycle, firms need to consider not only the reversibility nature of the physical investments, but also their financing flexibility or financial constraints, i.e. the ease of accessing sufficient financial resources in a timely manner. Hence, this chapter also examines the role of financing flexibility in explaining the value premium. Along the lines of

Hahn and Lee (2009), Livdan et al. (2009), and Gulen et al. (2008), financial constraints could play a direct role in the existence of the value premium, i.e. value firms are subject to higher financial constraints and earn higher returns to compensate for investors' exposure to higher level of risks. In this case, this chapter hypothesises that the gap in the financial constraints of value and growth firms affects the value premium.

On the other hand, financial constraints can indirectly affect the value premium. In the Caggese (2007) model, financial constraints amplify the impact of investment irreversibility on firms' investment activities. If investment irreversibility drives the value premium, financial constraints can play an indirect role to explain the value premium through its influence on the relationship between firms' investment irreversibility and their decision to adjust the physical investment stocks. In this case, this chapter hypothesises that firms' financial constraints and their interaction with investment irreversibility affect the value premium.

The chapter makes the following main contributions. This chapter takes the work of Gulen et al. (2008) a step further and provides evidence on whether the success of the value-growth trading strategy can be explained by the firm level flexibility. In addition, this chapter uses a more comprehensive and improved set of variables to describe investment flexibility. More specifically this is the first study, to the author's knowledge, that provides empirical evidence on the implications of investment flexibility on the success of the value-growth trading strategy.

Furthermore, this chapter considers the interaction between investment flexibility and the macro environment, a critical component in all the theoretical models of Zhang (2005), Carlson et al. (2004) and Cooper (2006). Finally, Caggese

(2007) suggests that financial constraints can interact with investment irreversibility to influence firms' investments. Hence, this chapter provides evidence on whether financial constraints affect the success of the value-growth trading strategy directly through their influence on the risk profiles of value and growth firms, or indirectly through their influence on the relationship between firms' investment irreversibility and their investment activities.

Consistent with the literature, this chapter finds strong evidence of the outperformance of value stocks over growth stocks of firms listed on NYSE, AMEX, and NASDAQ from 1972 to 2006. The outperformance of value stocks holds even when the returns are adjusted for risks using the Fama and French model, which contains a value factor. The empirical evidence supports the predictions of Zhang (2005) that firms' investment irreversibility helps explain the value premium. It is also broadly consistent with the conjecture in Carlson et al. (2004) and Cooper (2006) that firms' investment inflexibility helps explain the value premium. However, when measuring investment inflexibility using operating leverage and excess capacity, i.e. the two variables describing investment flexibility in Carlson et al. (2004) and Cooper (2006) respectively, the findings reject the claim that these measures explain the value premium. The findings suggest that financial constraints affect the value premium indirectly through their interaction with firms' investment irreversibility.

The findings in this chapter have several implications for both academics and practitioners. This chapter reports that the sources of the profitability of the value-growth trading strategy can be traced back to a risk-return relationship based on the fundamental information about the firm and the economy. In the language of the market efficiency literature, future stock returns cannot be predicted based on the Book-to-Market ratio after controlling for risks. Hence the evidence suggests that the market is efficient with regards to the Book-to-Market ratio. Furthermore, the findings suggest that the profitability of the value-growth trading strategy is affected by the inflexibility in the investment and financing environment at the firm level. In other words, our understanding of corporate finance can help extend our understanding of the securities markets.

The results from this chapter can benefit investors who attempt to profit from the value-growth trading strategy. The profit from the value-growth trading strategy can be improved if investors use the value and growth firms with bigger gap to the extent to which firms' assets are irreversible. The value premium can be completely explained when risks are controlled for using the asset pricing model conditioned on these characteristics. Hence the improved performance might just be a compensation for higher risks.

2.2. Literature Review

Investing in value and growth stocks is an old stock market wisdom that motivates extensive academic research. During the booming period from the end of World War I to the market rally of 1927 – 1929, right before the 1930 Great Depression, investing in stocks with high growth was considered among investors as the investment theory of the new era, according to Graham and Dodd (1940, reprinted in 2009). Formal studies into the returns of growth stocks might have started in this period with the book by Edgar Lawrence Smith (1925), who argued that common stocks tended to increase in value over years as companies retained earnings for reinvestment (Graham and Dodd, 1940, reprinted in 2009).

The subsequent Great Depression cast doubt on not only the investment theory of investing in growth, but also on the general investing activity in the stock market. Graham and Dodd (1934, reprinted in 1940, 2009) re-established the confidence in investing in the stock market by providing a discipline to investing. Their classic book Security Analysis (1934, reprinted in 1940, 2009) is often cited as the first comprehensive defense for investing in value stocks, i.e. stocks with prices below the company fundamentals (Graham and Dodd, 1940, reprinted in 2009) to leave investors with a margin of safety.

While Graham and Dodd offered a framework to identify value stocks since the 1930s, there has been no universal agreement among industry practitioners on the definition of value and growth stocks (Ibbotson and Riepe, 1997). Instead, the general consensus is on the broad characteristics of value and growth investing. 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). More generally, it refers to investments in stocks whose assets are undervalued by the market.

The norm in the investment community is to recommend stocks based on the ratios of fundamentals to prices, e.g. the Book-to-Market ratio, or the reciprocal ratio of price to fundamentals, e.g. the P/E ratio (market value of equity / firms' earnings). These ratios are widely used in the academic research on value and growth stocks (Subrahmanyam, 2010). According to Poitras (2005), there is a subtle difference between the original Graham and Dodd's concept of value stocks, i.e. stocks with stock price falling below their intrinsic value, and the modern finance's definition of value stocks, i.e. stocks with high ratios of fundamentals to price. The more mechanical definition of value stocks by academics serves the purpose of classifying a large number of stocks into value and growth stocks, as academics are more concerned with the average returns across stocks rather than the evaluation of individual stocks.

Early academic studies focused on the relationship between the P/E ratio and stock returns observed by practitioners. Although investors buy stocks with high P/E ratios for growth and stocks with low P/E ratios for income, stocks with low P/E ratios tend to provide not only income but also capital appreciation. Nicholson (1960, 1968) suggested that while the P/E ratio reflected investor satisfaction of company growth, if prices were pushed to extreme, they would eventually reverse. On the other hand, stocks with low P/E ratios on average would perform better as their prices have not been pushed to a vulnerable level. Breen (1968) also found the dominant effect of P/E ratios compared to the industry association in predicting future returns.

These early studies are subject to several drawbacks on the samples' characteristics. The samples are often limited to a small number of firms, e.g. 100 stocks in Nicholson (1960), 189 stocks in Nicholson (1968). Alternatively they might be constrained to short periods of time, e.g. five year intervals within a total of twenty years in Nicholson (1960) or thirteen years in Breen (1968). More importantly, given the early stage of the asset pricing literature, not surprisingly these early studies did not adjust returns for risks. Any difference in returns between stocks with high and low P/E ratios might be due to the difference in risks.

Finally, according to Basu (1977), early studies failed to account for (a) selection bias, (b) market frictions and (c) the availability of earnings information after the reporting date, which cast doubt on their conclusions.

2.2.1. The Value Premium and the CAPM

It is possible that any difference in returns of value and growth stocks is the result of the difference in risks. While the early studies suffered from the failure to adjust returns for risks, with the proliferation of the asset pricing literature, pioneered by Sharpe (1964) and Lintner (1965), later studies use different asset pricing models to adjust returns for risks. Studies in the 1970s and 1980s use the CAPM to adjust returns for risks and investigate whether and why the ratios of price to fundamentals can help identify outperforming stocks.

Basu (1977) uses the CAPM to adjust returns for risk and finds that the portfolio with low P/E ratios earns higher risk adjusted returns than the portfolio with high P/E ratios, which is often referred to as the P/E effect. On the other hand, Reinganum (1981) documents that using the CAPM to adjust returns for risks, the portfolios ranked based on the E/P ratio experience abnormal returns but it is subsumed by the size effect[10]. Extending the sample period beyond the earlier studies, avoiding data selection bias and accounting for the January effect, Jaffe et al. (1989) later find that the effect is significant. Litzenberger and Ramaswamy (1979) report that stocks with high dividend yields earn higher before-tax returns than stocks with low dividend yields.

[10] I.e. the evidence that small stocks earn higher returns than big stocks (Banz, 1981).

Beside the earnings related ratios, researchers also document similar evidence with regards to other ratios of prices to other fundamentals. Rosenberg et al. (1985) first test the relationship between stock returns and the Book-to-Market ratio. They report that the value trading strategy based on the Book-to-Market ratio generates positive and significant returns. In short, using the CAPM to adjust for risks, value stocks with high Book-to-Market ratios, high dividend yields, or high earnings yields earns higher risk adjusted returns than growth stocks with low corresponding ratios. Along the lines of the Roll (1977) critique, the evidence suggests either (a) an anomaly that value stocks outperform growth stocks, or (b) the CAPM used to adjust returns for risks is misspecified.

2.2.2. The Value Premium, Financial Distress and the Fama and French Three Factor Model

The literature on the value premium experiences a twist with the study by Fama and French (1992). The authors find that the CAPM is not supported by the data, i.e. the relationship between betas and average returns is too flat to comply with the CAPM. Fama and French (1992) document that stock returns are better explained by a combination of size and the Book-to-Market ratio. First proposed in Chan and Chen (1991) as the explanation for the size effect, the financial distress argument is also employed in Fama and French (1992) for the value premium. The rationale is that stocks in distress or with poor prospects should face higher costs of capital than stocks with strong prospects.

Fama and French (1993) report that the factors relevant to stock returns are the excess market return, the size factor (SMB[11]) and the value factor (HML[12])

[11] i.e. the difference between the returns on small and big stock portfolios.

based on the Book-to-Market ratio. In Fama and French (1996), the three-factor model is interpreted as either the Intertemporal CAPM (ICAPM) or the Arbitrage Pricing Theory (APT). Fama and French (1995) argue that the high Book-to-Market ratio signals persistent poor earnings whereas the low Book-to-Market ratio signals strong earnings. Stock prices forecast the reversion of earning growth after firms are ranked based on size and Book-to-Market ratios. Hence stocks with high Book-to-Market ratios have lower prices and higher subsequent returns than stocks with low Book-to-Market ratios.

Along the lines of Fama and French (1995), the difference in the returns of stocks with high and low Book-to-Market ratios is driven by risks only if the relative distress is a priced risk factor. Fama and French (1996, p. 77) provide the following explanation:

> "…Consider an investor with specialized human capital tied to a growth firm (or industry or technology).…[A] negative shock to a distressed firm more likely implies a negative shock to the value of human capital since employment to the firm is more likely to contract… If variation in distress is correlated across firms, workers in distressed firms have an incentive to avoid the stocks of all distressed firms. The result can be a state-variable risk premium in the expected returns of distressed stocks".

Cochrane (1999) interprets the distress argument as follows: the financial distress of individual firms cannot be the priced risk factor, as it can be diversified away; the underlying reason for stocks in financial distress to earn high returns is

[12] i.e. the difference between the returns on the portfolios of stock with high and low Book-to-Market ratios.

that these stocks perform badly in the bad state of the economy with poor credit and poor liquidity, "… precisely when investors least want to hear that their portfolio is losing money" (p. 41).

Several studies cast doubt on the distress explanation of the value premium. In order for the value premium to be explained by financial distress, value firms should have high financial distress relative to growth firms. However, Dichev (1998) finds that the relationship between value firms and the bankruptcy risk, measured by the classic z-score and O-score, is not a monotonic one. Firms with high bankruptcy risks consist of firms with both high and low Book-to-Market ratios[13].

Furthermore, if distress is the priced risk factor, it should be positively related to stock returns. Dichev (1998), on the other hand, finds that there is a negative relationship between bankruptcy risks and stock returns. Using a different measure of distress risks, Campbell et al. (2008) also report that distressed firms have low average returns. Furthermore, they find that returns on distressed stocks are particularly low during the period of high stock market volatility. This evidence is at odd with distressed stocks having low average returns, given that those stocks which perform poorly during bad times (i.e. risky stocks) tend to have high average returns. Griffin and Lemmon (2002) find that the negative relationship between bankruptcy risks and stock returns documented in Dichev (1998) is driven by the poor stock price performance of firms with low Book-to-Market ratios (or growth

[13] Firms with high bankruptcy risks have high Book-to-Market ratios, but firms with highest bankruptcy risks have lower Book-to-Market ratios.

firms) in the high bankruptcy risk group. Overall, the evidence on the returns of distress stocks cast doubt on the distress explanation for the value premium.

Overall, there appears to be no consensus about whether the value premium is due to the relative financial distress, and whether financial distress is a priced risk factor. Hence, although there is evidence that the Fama and French three factor model can explain the value premium, it is unclear whether the value premium is due to distress risks (Fama and French, 1992, 1993, 1996). There is also a question of whether the Fama and French three factor model is a specification of the ICAPM (Fama and French, 1993, 1996), although there is some evidence that the factors in the Fama and French model are linked to the innovations in state variables that describe the investment opportunities[14]. The risk based explanation for the value premium is also enriched as other theoretically motivated asset pricing models claim to explain it.

2.2.3. The Value Premium and the Models with Consumption and Labour Incomes

Jagannathan and Wang (1996) advocate the inclusion of labour income into the aggregate wealth in addition to the market portfolio. Adopting the conditional CAPM in which beta is allowed to be sensitive to the business cycle, proxied by the default spread, their model can explain the size effect. Santos and

[14] Liew and Vassalou (2000) and Vassalou (2003) find that the SMB and HML factors are related to the future growth in the economy. Petkova (2006) provides further evidence that the SMB and HML factors are also related to the innovations in several variables, including the aggregate dividend yield, the term spread, the default spread, and the one-month Treasury bill yield, that describe investment opportunities. Hahn and Lee (2006) find that changes in the default spread and the term spread capture the explanatory power of the SMB and HML factors.

Veronesi (2006) extend the line of research which accounts for human wealth as part of the aggregate wealth. Their results suggest that the value premium could be explained by the conditional CAPM containing information about consumption and labour income, and the HML factor might reflect the same information that the conditioning variables supplement to the original CAPM.

Lettau and Ludvigson (2001) report that the value premium can be explained when the beta of the CCAPM is conditioned on *cay*, the consumption to wealth ratio, to allow for time varying risk premia. This ratio acts as the state variable which describes how consumption might deviate from its relation with wealth (human and financial). It summarises investor expectations about future returns on the aggregate wealth, and not just on the stock market. The authors find that the pricing errors of the conditional CCAPM are comparable to the Fama and French model in pricing the 25 size x Book-to-Market portfolios. Furthermore, value portfolios have higher consumption betas in bad state than growth portfolios, consistent with value stocks being riskier than growth stocks.

Parker and Julliard (2005) find evidence that the HML and SMB factors in Fama and French model predict consumption growth. Furthermore, their predictability is highest when the consumption is measured over three year horizon. This is also the horizon that makes the CCAPM best prices the cross-section of stock returns. This evidence explains why the CCAPM with long run consumption measurement can capture the value premium, given the empirical success of the Fama and French model. It also suggests that the Fama and French model is linked to the fundamentals in the macro environment, and the value premium can be explained by a theoretically motivated model instead of an empirically driven model.

Jagannathan and Wang (2007) report that when the aggregate consumption is measured as the year-over-year growth at the fourth quarter, the CCAPM performs almost equally well as the Fama and French model in pricing the 25 size x Book-to-Market portfolios. Moreover, when combining the CCAPM and the Fama and French models, the average alpha value remains unchanged, suggesting that the two models may capture the same underlying risks. Similar to Parker and Julliard (2005), this evidence suggests that the factors in the Fama and French model may be linked to consumptions, good news for a risk based explanation for the value premium.

2.2.4. The Value Premium and the Investment based Models

Cochrane (1991) develops a production based asset pricing model which is comparable to the consumption based model. The production based model describes producers and production functions in the place of consumers and utility functions, and models the relationship between stock returns and investment returns. The findings support that the model has some success in pricing aggregate stock returns. However, it cannot explain the forecastability of dividend yields on stock returns. Cochrane (1996) reports that several investment based models are comparable to the CAPM and the Chen et al. (1986) model and outperform the CCAPM in explaining the cross section of the size ranked portfolio returns.

Recent theoretical development, led by Berk et al. (1999), links the expected stock returns with firm characteristics related to their investment activities. In the Berk et al. (1999) model, firms possess assets-in-place and growth-options and prefer low risk investments. When doing so, they increase their current value and lower their risks in subsequent periods, leading to lower subsequent returns. This model uses the Book-to-Market ratio as the state variable to summarise the firm's risk relative to the asset base and explains the lower subsequent returns of growth firms relative to value firms. Gomes et al. (2003) relax the requirement in the Berk et al. (1999) model that investment opportunities are heterogeneous in risks. The Gomes et al. (2003) model is a general equilibrium one in which the conditional CAPM holds. Size and the Book-to-Market ratio correlate with the true conditional market beta and therefore predict stock returns. These two papers are the foundation for the three models by Zhang (2005), Cooper (2006) and Carlson et al. (2004) that explain the value premium.

Zhang (2005) relaxes the assumption in Gomes et al. (2003) that firms have equal growth options. The model explains the value premium using the cost reversibility and the time varying discount rates. Firms are assumed to adjust their capital investments to the optimal level across the business cycle and face higher costs in cutting than in expanding. Due to the asymmetry of the cost reversibility, the expansion is easier than the reduction of capital stocks. Consequently, value firms with more established capital stocks have less flexibility than growth firms in surviving the adverse environment during the bad states of the business cycle.

Furthermore, the Zhang (2005) model assumes that prices of risks are countercyclical, i.e. discount rates are assumed to be time varying, low during economic upturns and high during downturns. In bad states, as the discount rates are higher, more assets will become redundant. Value firms will therefore face more pressure to disinvest in bad states, reinforcing their higher investment irreversibility relative to growth firms. With this mechanism, Zhang (2005) attributes the difference in the returns of value and growth stocks to the difference in their risks.

The Cooper (2006) model explains the outperformance of value over growth stocks based on excess capacity. When a firm has experienced adverse shocks to its productivity, if the capital investment is largely irreversible, the book value of the firm’s assets remains fairly constant. As the market value of this firm falls, its Book-to-Market ratio rises. Those firms with high Book-to-Market ratios, i.e. value firms, are more sensitive to aggregate shocks, i.e. shocks to aggregate productivity. They can benefit from positive aggregate shocks as their existing excess capacity means that they do not need to undertake any costly new investments to exploit the economic upturns. On the other hand, firms with low Book-to-Market ratios, i.e. growth firms, would need to undertake costly investments to fully benefit from the positive aggregate shock. Cooper (2006) models that growth firms have lower systematic risks because they do not co-move much with the business cycle during economic upturns, which is due to the costs these firms would incur when investing to exploit the increasing demand during these periods.

Carlson et al. (2004) offer an explanation for the value premium with a model based on operating leverage. A firm’s investments may result in higher operating leverage through long term commitments such as the fixed operating costs of a larger plant, labour contract commitments and commitments to suppliers. Furthermore, when the demand for a firm’s product decreases, the firm’s future operating profits are lower, leading to a lower equity value relative to its capital stocks. If the fixed operating costs are proportional to the capital stocks, the decline in product demand could result in a higher operating leverage, or higher systematic risks. In the Carlson et al. (2004) model, a firm's beta consists of a component derived from operating leverage, i.e. the present value of future commitments associated with existing capital stocks scaled by the firm's value. If the book value of equity is considered as a proxy for the firm's capital stocks, the Book-to-Market ratio would describe the operating leverage component of risks and reflect the state of product market demand conditions relative to invested capitals. Thus, value firms with higher Book-to-Market ratios are riskier and generate higher returns than growth firms with lower Book-to-Market ratios.

The three models of Zhang (2005), Cooper (2006) and Carlson et al. (2004) share a common feature - the value premium is rooted in the difference in the extent to which firms can flexibly adjust their physical capital investments in response to aggregate shocks. Empirical tests on the relationship between a firm's physical investments and the value premium are limited so far. Anderson and Garcia Feijo (2006) provide evidence on the difference in the capital expenditure levels of value and growth firms and the relationship between firms' investments and stock returns. Their results, although shedding light on the value and growth firms' investments, cannot be considered as direct evidence for any of the three models that attribute the success of the value-growth trading strategy to the extent to which firms' investments are inflexible.

Gulen et al. (2008) report a counter-cyclical pattern of the expected value premium. This finding suggests the need to consider the time varying nature of risks in explaining the value premium. The authors also find that there is a systematic difference in the firm level investment and financing inflexibility of value and growth stocks, and a positive relationship between firms' costs of equity capital and these measures. However, Gulen et al. (2008) do not provide evidence that the value premium can be explained when these inflexibility measures are taken into account.

2.2.5. The Value Premium and the Asset Pricing Models with Time Varying Components

There is a tendency to recognize the time varying nature of the risk-return relationship in explaining the value premium. Some of these studies also fall into the categories of the asset pricing models already reviewed, e.g. Jagannathan and Wang (1996) and Lettau and Ludvigson (2001) in section 2.2.3 (p. 41). Petkova and Zhang (2005) use four state variables[15], being dividend yield, default spread, term spread and Treasury bill rate, to condition the beta and excess market returns in the CAPM model. Their findings show that the betas of the portfolio that goes long in value and short in growth stocks co-varies positively with the expected market risk premium. This result suggests that value stocks have higher downside risks than growth stocks; however the covariance is too small to explain the value premium. Together with Lettau and Ludvigson (2001), this paper contributes important, although not decisive, evidence against the argument of Lakonishok et al. (1994) that value stocks are not riskier than growth stocks[16].

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[15] Literature suggests a variety of leading macroeconomic indicators in explaining stock returns, with these four indicators being most frequently used.

[16] Lakonishok et al. (1994) search for undesirable state of the world in which the value portfolio underperforms the growth portfolio to support for the argument of the value portfolio being fundamentally riskier. In periods of low GNP growth or low market returns, however, the value portfolio still outperform its growth counterpart consistently. Fama and

Avramov and Chordia (2006) first condition betas of several asset pricing models[17] on both state variables and firm-level characteristics[18] that describe the risks of growth options and assets in place, motivated in Berk et al. (1999) and Gomes et al. (2003). They find that conditioning betas helps improve the predictability of most asset pricing models. Of these models, the Fama and French three factor model performs the best, capable of capturing the size, the value but not the momentum effects. The model specification in Avramov and Chordia (2006) could be improved in light of the recent theoretical development using firms' investment characteristics to explain the value premium.

2.2.6. Other Explanations for the Value Premium

Error-in-Expectation

Lakonishok et al. (1994) argue that investors rely too heavily on past returns when forecasting future returns. They become overly optimistic in forecasting future returns of growth stocks while overly pessimistic in forecasting future returns of out-of-favour value stocks. The growth stock prices will then be bid up to the level commensurate with the expected growth rates, but too high to their fundamentals. The opposite happens to value stocks. Over time, as stock

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French (1996) argue that industry conditions should have greater influence to the prospects of individual firms than the overall GNP of the economy.

[17] Including the original CAPM, Fama and French 3 factor model and its extended models augmented with the Pastor-Stambaugh (2003) liquidity factor and with the momentum factor, the original CCAPM of Rubinstein (1976), Lucas (1978) and Breenden (1979), Jagannathan and Wang (1996) model, and Lettau and Ludvigson (2001) model (cited in Avramov and Chordia, 2006).

[18] Previous studies either link beta with state variables (e.g. Petkova and Zhang, 2005) or with firm characteristics (Ferson and Harvey, 1991, 1998, 1999, cited in Avramov and Chordia, 2006, p. 1003).

prices converge to the fundamental values, value stocks outperform growth stocks. According to Barberis and Shleifer (2003), the extrapolation of past returns into the future expected returns is based on the cognitive bias of representative heuristic described in Tversky and Kahneman (1984, cited in Barberis and Shleifer, 2003).

Several studies find supportive evidence for the error-in-expectation hypothesis. La Porta (1996) and Chan et al. (2000) find that stocks with higher growth expectations underperform those with low growth expectations. According to La Porta et al. (1997), the returns around the earnings announcement events of value stocks are higher than those of growth stocks. This tendency persists for five years following the portfolio formation, consistent with the argument in Lakonishok et al. (1994) that the market updates slowly the earnings prospects of value stocks. On the other hand, Dechow and Sloan (1997) find no evidence for the extrapolation of past trends into the future. Skinner and Sloan (2002) report that growth stocks have as many positive earnings surprises as negative ones but respond asymmetrically to the negative ones.

Information Asymmetry

According to Bhardwaj and Brooks (1992), the degree of information asymmetry between management and insiders versus outside investors is greater for neglected firms. Hence neglected stocks are expected to generate higher returns for investors to compensate for bearing these extra costs and risks[19]. Growth stocks

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[19] Several studies document the association of positive stock returns and the information asymmetry to explain the cross section of stock returns in different corporate decision contexts. Examples include Krishnaswami et al. (1999) with regards to the placement structure of corporate debt, and Krishnaswami and Subramaniam (1999) with regards to corporate spin-off decision.

are often followed more closely by press and analysts given their perceived high growth prospects. By contrast, value stocks are often unpopular stocks or stocks that face turn-around opportunities (Ibbotson and Riepe, 1997). Information asymmetry may therefore explain the higher returns of value stocks compared to growth stocks.

Divergence of Opinions

Using the dispersion of analysts' earnings forecast as a proxy for the divergence of opinions, Diether et al. (2002) report that investors have more diverge opinions on value stocks than growth stocks. Furthermore, stocks with higher dispersions earn lower future returns than the otherwise similar stocks. The authors attribute their results to the Miller (1977) dispersion premium hypothesis. On the contrary, Doukas et al. (2004) advocate the divergence discount hypothesis. They find that the value (growth) portfolio has positive (negative) and significant coefficient on the dispersion factor in the augmented Carhart (1997) model. The authors suggest that the dispersion is a proxy for risks. Accordingly, value stocks have high dispersions, are priced at a discount and hence generate higher subsequent returns than growth stocks.

Doukas et al. (2006) and Boehme et al. (2006) argue that the Miller (1977) model requires the presence of both the divergence of opinions and short sale constraints. When controlling for short sale constraints, Doukas et al. (2006) find that their evidence is consistent with the dispersion discount hypothesis advocated in Doukas et al. (2004). On the contrary, Boehme et al. (2006) find evidence to support the divergence premium hypothesis when controlling for a combined measure of short sale constraints. Hence it is still disputable whether the evidence in Doukas et al. (2004) suggests that value and growth stocks are mispriced or are subject to different levels of the priced dispersion factor.

Short Sale Constraints and Other Limits to Arbitrage

Ali et al. (2003) report that the value anomaly is more pronounced for stocks that are subject to idiosyncratic return volatility, high transaction costs and low institutional ownerships. Of these, idiosyncratic return volatility is the most influential. Shleifer and Vishny (1997) argue that the value premium exists due to the excessive volatility in the returns of the hedge portfolio. Nagel (2005) finds that it is more pronounced among firms in the low institutional ownership class. Moreover, the documented asymmetry in the variation of value and growth stock returns to institutional ownership is consistent with institutional investors being able to eliminate the mispricing of overvalued stocks more easily than undervalued stocks. The evidence points towards (a) the mispricing explanation for the value premium, and (b) its persistence due to the lack of arbitrage activities.

2.2.7. The Gaps in the Literature

From the review of the literature, there appears to be a lack of rigorous empirical evidence to support the emerging theories that use the inflexibility characteristics of the firm level investments to explain the cross section of the returns of value and growth stocks. Specifically, Zhang (2005), Cooper (2006) and Carlson et al. (2004) identify three aspects, i.e. investment irreversibility, excess capacity, and operating leverage respectively, that drive the value premium. These studies are complementary rather than substitute as the three aspects are closely related. This is because firms with investments that are highly irreversible would have excess capacity when facing adverse productivity shocks. In addition, long term commitments from firms' physical investments make the investments difficult to reverse and contribute to firms' operating leverage. There is no existing study that tests whether investment flexibility can explain the value premium. This chapter aims to fill in this gap. Section 2.3 (p. 52) forms the research questions and develops the hypotheses to empirically test the links between the inflexibility characteristics of the firm level investments and the profitability of value-growth trading.

2.3. The Research Questions and Hypotheses

Section 2.2.7 (p. 51) identifies a gap, i.e. empirical testing of the relationship between the inflexibility characteristics of the firm level investments and the value premium. This chapter aims to fill in this gap by providing the empirically evidence for the relationship between the three characteristics identified in Zhang (2005), Cooper (2006) and Carlson et al. (2004) and the value premium. These models share a common feature - the value premium is rooted in the difference in the extent to which firms can flexibly adjust their physical capital investments in response to aggregate shocks. The research questions that this chapter aims to address are therefore as follows:

(1) Whether the value premium exists in the sample; and

(2) If it does, whether it is affected by the inflexibility of firms' physical capital investments.

To address the first research question, this chapter expects to find the evidence of the value premium in the sample examined, given the extensive evidence on its existence in the literature reviewed in section 2.2 (p. 34). The first hypothesis is as follows:

$H_{2.1}$: The strategy of buying value stocks and selling growth stocks generates positive returns.

This chapter addresses the second research question by testing the hypotheses on the relationship between firms' investment inflexibility and the value premium. Gulen et al. (2008) find that their proxies for investment irreversibility of Zhang (2005) are not significant in the cross section of stock returns; whereas operating leverage of Carlson et al. (2004) and the financial leverage are. The composite flexibility, measured as the average of these variables, is highly statistically significant. This result might be driven by the contribution of the financial and operating leverage rather than the investment irreversibility proxies, given the statistical insignificance of the latter. This evidence therefore lends no direct support to the relevance of investment irreversibility as modeled in Zhang (2005). Furthermore, the evidence in Gulen et al. (2008) is on the impact of these inflexibility measures on firms' costs of capital rather on whether real flexibility accounts for the value premium. Finally, in testing the relationship between the real flexibility measures and the cross section of stock returns, Gulen et al. (2008) do not consider the interaction of the macroeconomic environment and the real flexibility factors as modeled in both Zhang (2005) and Carlson et al. (2004).

Firms' investment irreversibility and the value premium:

In Zhang (2005), value firms' investment irreversibility makes them riskier as they are burdened with investments that are costly to reverse. They become less flexible in confronting macroeconomic shocks and adjusting to the optimal investment level. This chapter therefore hypothesises that the bigger the investment irreversibility gap between value and growth firms, the higher the value premium.

Furthermore, according to Zhang (2005), in bad states of the business cycle, value firms are burdened with more unproductive capital stocks and will face more difficulty in cutting their capital stocks compared to growth firms. On the other hand, in good states of the business cycle, growth firms have less capital stocks and need to expand. Hence, value firms have less flexibility than growth firms in surviving the bad states of the business cycle. Hence, the business cycle variation plays an essential role in translating the difference in investment irreversibility (if any) into the difference in the systematic risks of value and growth stocks. This chapter hypothesizes that the cross sectional difference in the returns of value and growth stocks should be reduced or eliminated when taking into account firms' investment irreversibility and its interaction with the business cycle.

The following hypotheses are complementary rather than substitute:

$H_{2.2a}$: *The bigger the investment irreversibility gap between value and growth firms, the higher the value premium; and*

$H_{2.2b}$: *Firms' investment irreversibility and business cycles together affect the value premium.*

<u>Firms' operating leverage and the value premium</u>:

According to Carlson et al. (2004), operating leverage is the key to explain the value premium. Value stocks are those which suffer a decrease in the demand for their products, having the relatively low equity value as compared to the book value or the capital stocks. If the fixed operating costs are proportional to the capital stocks, value firms would have higher operating leverage and are therefore exposed to higher systematic risks compared to growth firms. This chapter therefore hypothesises that the bigger the operating leverage gap between value and growth firms, the higher the value premium.

According to the Carlson et al. (2004) model, if the macroeconomic environment continues to be unfavourable, i.e. the product demand declines further, value firms (those which have been suffering from deteriorating demands), will have higher operating leverage, or even higher systematic risks. Therefore, this chapter also hypothesises that the cross sectional difference in the returns of value and growth stocks should be reduced or eliminated when taking into account the difference in firms' operating leverage and its interaction with the business cycle.

The following hypotheses are complementary rather than substitute:

$H_{2.3a}$: *The bigger the operating leverage gap between value and growth firms, the higher the value premium; and*

$H_{2.3b}$: *Firms' operating leverage and business cycles together affect the value premium.*

Firms' excess capacity and the value premium:

Cooper (2006) suggests the role of excess capacity to the existence of the value premium. Value firms are those that have experienced adverse shocks and excess capacity and therefore benefit more from positive shocks and suffer more from negative shocks. Hence they are exposed to higher systematic risks compared to growth firms. The relevance of excess capacity or efficiency to the value premium has not been tested empirically. This chapter hypothesises that the bigger the excess capacity gap between value and growth firms, the higher the value premium.

In the Cooper (2006) model, during the economic upturn, value firms' excess capacity allows them to enjoy the expanding product market demand whereas growth firms would need to invest to take advantage of it. Hence, this chapter also hypothesises that the difference in value and growth stock returns is influenced by both firms' excess capacity and the state of the business cycle. The cross sectional difference in the returns of value and growth stocks should be reduced or eliminated when taking into account the difference in firms' excess capacity and its interaction with the business cycle.

The following hypotheses are complementary rather than substitute:

$H_{2.4a}$: The bigger the excess capacity gap between value and growth firms, the higher the value premium; and

$H_{2.4b}$: Firms' excess capacity and business cycles together affect the value premium.

Firms' financial constraints and the value premium:

Firms' investments can be influenced by their financial constraint status. Livdan et al. (2009) find that firms with financial constraints are riskier as they are prevented from making investments and smoothing the dividend streams in confronting aggregate shocks. Gulen et al. (2008) include financial leverage as a proxy for financial constraints and reports that value firms with higher Book-to-Market ratios have higher financial leverage.

Along the lines of Livdan et al. (2009) and Gulen et al. (2008), financial constraints could play a direct role in the existence of the value premium, i.e. value firms are subject to higher financial constraints and earn higher returns to compensate for investors' exposure to a higher level of risks. This chapter hypothesises that if this argument holds, the bigger the financial constraint gap between value and growth firms, the higher the value premium.

Furthermore, the business cycle would accentuate the impact of financial constraints on stock returns as the constraints tend to be more severe during the bad states of the business cycle. Hence this chapter also hypothesizes that the cross sectional difference in the returns of value and growth stocks should be reduced or eliminated when taking into account firms' financial constraints and the business cycle.

The following hypotheses are complementary rather than substitute:

$H_{2.5a}$: *The bigger the financial constraint gap between value and growth firms, the higher the value premium; and*

$H_{2.5b}$: *Firms' financial constraints and business cycles affect the value premium.*

Alternatively financial constraints can indirectly affect firms' investment. In the Caggese (2007) model, financial constraints amplify the impact of investment irreversibility on firms' investment in fixed capital and working capital stocks. Investment irreversibility induces firms to maintain their working capital investments too low during downturns and fixed capital investments too low during economic upturns. Financial constraints reinforce the impact of investment irreversibility on the investment of working capital and fixed capital stocks[20].

Moreover, given the theoretical studies on how firms' investment irreversibility could explain the value premium (Zhang, 2005), we can expect that financial constraints can help explain the value premium through their influence on the relationship between firms' investment irreversibility and their investments. Specifically, the higher the financial constraints are, the stronger the impact of investment irreversibility on the value premium. Therefore the alternative hypothesis is that the more financially constrained firms are, the higher the value premium.

In addition, according to Caggese (2007), financial constraints and investment irreversibility may together affect firms' ability to invest at the optimal level differently during different states of the business cycle. Hence, this chapter hypothesises that the cross sectional difference in the returns of value and growth stocks should be reduced or eliminated when taking into account both firms' financial constraints and investment irreversibility, and the business cycle.

The following hypotheses are complementing each other and are alternative to the hypotheses $H_{2.5a}$: and $H_{2.5b}$:

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[20] At the beginning of a downturn, firms might want to downside their fixed assets but are prevented from doing so due to the irreversibility constraint. As the downturn continues revenues worsen. Some firms may also have binding financing constraints and are forced to reduce their investment in working capital. When the downturn ends, firms are more cautious about increasing their fixed capital. Consequently, during downturns, firms that face investment irreversibility and / or financial constraints would have fixed investment at an inefficiently high level and working capital at an inefficiently low level. During economic upturns, fixed investment might be inefficiently low.

$H_{2.6a}$: The more financially constrained both the value and growth firms are, the higher the value premium; and

$H_{2.6b}$: Firms' financial constraints, their investment irreversibility and business cycles together affect the value premium.

The hypotheses developed and examined in this chapter are summarised in Table 2.1.

[Insert Table 2.1 about here]

2.4 The Methodology and Sample

2.4.1. Measurement of Key Firm Level Variables

Investment irreversibility:

To measure the extent to which firms' assets are irreversible, this chapter follows the industrial economics literature. Kessides (1990) recommends 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) modify 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 fixed asset sale / total fixed assets.

To avoid the effect of fully depreciated assets being included in a firm's balance sheet, this chapter replaces the denominator of total fixed assets in Farinas and Ruano (2005) with the beginning of the year net fixed assets. To increase the precision in measuring the cross sectional difference in the fixed asset rental activities among firms, this chapter uses the rental expense scaled by the modified denominator instead of the dummy variables in Farinas and Ruano (2005). Finally, using one year's proceeds from fixed asset sales significantly reduces the sample size whereas the underlying economic force that it measures, i.e. the intensity of the second hand market for the assets employed by a firm, would not dramatically change from one year to the next. Hence this chapter modifies the numerator of this measure in Farinas and Ruano (2005) to be the sum of the proceeds from fixed asset sales in the last three years.

The fixed asset ratio used in Gulen et al. (2008) does not directly describe the extent to which a firm's assets are irreversible. Firms may have very high percentage of fixed assets in their balance sheets but this mere fact does not make the assets highly irreversible if their fixed assets, for example, are quickly depreciated. It might explain why the fixed asset ratio is statistically weakest and insignificant among the proxies for real flexibility employed in Gulen et al. (2008).

The other measurement of irreversibility in Gulen et al. (2008) is the dummy that takes the value of 1 if the firm disinvests for at least one year during the last three years. Gulen et al. (2008) attribute this measure to the frequency of disinvestments and argues that the more frequently the firm needs to disinvest, the more prone it is to irreversibility. In this chapter, the measurement of the asset sale proceeds ratio captures not only the frequency of disinvestments but also the magnitude of the sale proceeds. More importantly, along the lines of Kessides (1990) and Farinas and Ruano (2005), the more frequent a firm sells its assets, the more active the second hand market for its assets is, and therefore the *lower* the irreversibility of its assets. Also, if firms can recover non-trivial funds from asset sales, they are subject to lower investment irreversibility as the funds can be reinvested into new assets. On the other hand, often firms with bulky assets which tend to be more difficult to disinvest are likely to achieve non-trivial asset sale proceeds. The relationship between firms' disinvestments and their asset irreversibility can therefore be either negative or positive; which of these signs prevails is an empirical question.

The final measurements of the three aspects of investment irreversibility are the depreciation charge and the rental expense during the year, and the sum of the proceeds from fixed asset sales in the last three years, all scaled by the beginning of the year net fixed assets. The higher the depreciation charge ratio, the more quickly the assets are depreciated, the more easily the firm can replace them with new assets. The more assets are rented, the more easily the firm can replace them with new assets at the end of the rental contract, normally no longer than their useful life. Therefore, these variables are positively correlated with firms' flexibility and negatively correlated with investment irreversibility. The final measure, i.e. fixed asset sale proceeds ratio, hereinafter referred to as the disinvestment ratio, can be either negatively or positively related to firms' investment irreversibility.

Operating leverage:

To measure the operating leverage, this chapter uses the standard text-book measure of the percentage change in operating profits before tax to the percentage change in sales. Firms with high fixed costs relative to variable costs benefit more from higher sales volume as they do not need to spend as much on additional units produced. The downside of having high fixed costs relative to variable costs is that if the sales volume is low, firms do not save as much on additional units not produced. Hence, firms with high operating leverage, or high fixed costs relative to variable costs, have operating profits more sensitive to changes in sales. The ratio of changes in operating profits to changes in sales is therefore positively related to the degree of operating leverage. To avoid the negative value of operating leverage in case operating profits and sales move in opposite directions in a year, negative ratios are replaced with missing values.

Capacity utilisation:

To proxy for the capacity utilisation, this chapter measures the efficiency of firms relative to their peers in the same industry using the Data Envelopment Analysis (DEA) technique. DEA is a non-parametric technique used to measure the efficiency of decision making units (DMUs) first initiated in Charnes et al. (1978). DEA evaluates each DMU, optimises its performance by either minimising inputs given the output level or maximising outputs given the input level, and determines an efficient frontier on which the efficient DMUs lie. According to Banker and Maindiratta (1986, cited in Murthi et al., 1997), DEA offers three advantages over its parametric counterparts. Firstly, it does not require any assumption about the functional form of the relationship between inputs and outputs. Secondly, the efficient frontier can practically be achieved, whereas the parametric methods estimate efficiency relative to the average performance. Thirdly, DEA calculates an efficiency index for individual DMUs whereas the parametric methods calculate statistical averages.

In Cooper (2006), value firms suffer negative shocks and have excess capacity. The efficiency of value firms is viewed from the input perspective, i.e. value firms have more capacity than what is needed to meet the current low demands. Therefore this chapter chooses the input minimisation model, i.e. given the current level of output, determining the minimum input needed to compare with firms' actual inputs[21]. To determine its capacity utilisation, each firm is evaluated against the other firms in the same industry. Industries are defined as one of the

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[21] The settings of the DEA input minimisation option are as follows (Emrouznejad, 2005). Given n DMUs denoted as $\{DMU_j; j = 1...n\}$, m inputs denoted as $\{x_{ij}; i = 1,...m\}$ x_{ij} and s outputs denoted as $\{y_{rj}; r = 1...s\}$, the input oriented DEA model seeks to minimise ϕ subject to:

$$\sum_j \lambda_j x_{ij} + S_i^+ = \phi x_{ij_0} \quad \forall i$$

$$\sum_j \lambda_j y_{rj} - S_r^- = yr_{j_0} \quad \forall r$$

$$S_i^+ \;\; S_r^- \geq 0 \;\; \forall i \;\; \forall r$$

$$\lambda_j \geq 0$$

where j_0 is the DMU to be assessed. S_i and S_r are slack variables. S_i^+ represents an additional inefficiency use of input *i* whereas S_r^- represents an additional inefficiency in the production of output *r*. ϕ^* is the optimal value of ϕ. DMU_{j_0} is Pareto efficient if ϕ^* =1 and the optimal value of S_i^+ and S_r^- =0. Conversely, DMU_{j_0} is inefficient if $\phi < 1$ and / or the slacks are positive. The positive values of λ_j construct a composite unit with output $\sum \lambda_j y_{rj}$ with r = 1…. and input $\sum \lambda_i x_{ij}$ with I = 1…, that outperforms unit DMU_{j_0} and provides targets for DMU_{j_0} .

Fama and French (1997) 49[22] industries. The output variable is the inflation adjusted sales. Two input variables are the annual cost of fixed capital, i.e. depreciation expense, and the annual cost of human capital, i.e. inflation adjusted salary related expense. The depreciation expense is not inflation adjusted as it reflects the historical costs at the time the fixed capital is acquired. DEA seeks to find the optimum level of inputs given the level of output of a firm within an industry. To implement DEA, this chapter uses the SAS programme by Emrouznejad (2005). The result is an efficiency level from 0 to 1 for each firm each year, with 0 corresponding to inefficiency and 1 to efficiency. When the DEA analysis fails to give any efficiency level for a firm, i.e. when the optimisation fails, this chapter assumes that the corresponding efficiency is zero.

Financial constraints:

Almeida and Campello (2007) use the payout ratio together with the credit ratings of bonds and commercial papers and total assets to proxy for financial constraints. According to Hahn and Lee (2009), these criteria reflect financial constraints in terms of external funds available for borrowing rather than the higher cost of borrowing, with the former being more relevant than the latter according to Jaffee and Russell (1976), Stiglitz and Weiss (1981), and Greenwald et al. (1984) (cited in Hahn and Lee, 2009). Compared with the other alternative measures in Almeida and Campello (2007), the payout ratio is a more direct and straight forward measure of the ability of a firm to mobilise funds. The net payout ratio is

[22] Fama and French (1997) originally provide the categorisation of 48 industries. The recent update on Kenneth French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_49_ind_port.html) increases the number of industries to 49.

better than the payout ratio at measuring the constraints in terms of fund availability as it takes into account not only firms' distribution in the form of dividends but also repurchases[23], and their mobilisation through share issuance. Hence, this chapter uses the net payout ratio as the proxy for firms' financial constraints.

Gulen et al. (2008) use financial leverage as a measure for financial inflexibility of firms. There is a subtle difference between the debt overhang and the financial constraints. A firm might have high debt overhang but if it can get access to bank loans or capital markets, it is not financially constrained. The hypotheses to be tested are on firms' financial constraints. Therefore it is more appropriate to use the net payout ratio in testing hypotheses $H_{2.5}$ and $H_{2.6}$.

The construction of the key firm level variables described in this section is summarised in Panel A of Table 2.2.

[Insert Table 2.2 about here]

2.4.2. Methodology

To address the research questions and the hypotheses set out in section 2.3 (p. 52), this chapter employs two methods of analysis. In the portfolio sorting approach, stocks are sorted by the value of Book-to-Market ratios as of 31st December (year t-1) in ascending order. Ten portfolios with equal number of stocks are composed and positions (long and short) are taken at the beginning of July of the following year (year t) and held until the end of June the next year (year

[23] Share repurchases are relevant given that they have become an increasingly important form of distribution relative to the traditional dividend payment.

t+1). The gap of six months between the account year end and the beginning of the portfolio holding period ensures that the information that is necessary to compose portfolios (i.e. the Book-to-Market ratio) is available to investors. The raw returns of ten equally weighted deciles and of the long-short portfolio that goes long in value stocks (i.e. the portfolio with the highest ranking in the Book-to-Market ratio) and short in growth stocks (i.e. the portfolio with the lowest ranking in the Book-to-Market ratio) are reported.

Following Fama and French (1992), this chapter measures the book value of equity and the Book-to-Market ratio as follows[24]:

- Book value of equity equals book value of common equity plus balance sheet deferred tax[25];
- Market capitalisation equals stock price multiplied with outstanding number of shares; and
- The Book-to-Market ratio equals book value of equity divided by market capitalisation measured as of 31st December[26] of each year.

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[24] Fama and French (1993, 1995, and 1996) adjust the book value of equity for additional variables including investment tax credit and book value. Given that data on these additional variables are not available for several stocks, this chapter uses the original measure of book value of equity in Fama and French (1992) so that it is more consistently measured across stocks.

[25] Balance sheet deferred tax refers to the liabilities on taxable amounts resulting from the temporary differences between the carrying values for the accounting and the tax purposes (http://www.iasplus.com/standard/ias12.htm, accessed on 16/08/2010). Balance sheet deferred tax is added to the book value of common equity in determining the Book-to-Market ratio due to the remote nature (documented in, for example, Colley et al., 2010) of the liabilities. This practice is also employed in Fama and French (1992, 1993, and 1996).

The second methodology uses (a) an asset pricing model to adjust stock returns for risks and investigates whether the positive relationship between risk adjusted stock returns and the Book-to-Market ratio is present after controlling for risks, and (b) how this relationship is affected by firms' investment environment. This chapter adapts the asset pricing framework of Avramov and Chordia (2006) to examine the relationship between the risk adjusted returns and the Book-to-Market ratio. Avramov and Chordia (2006) use 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. The framework involves a 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.

The asset pricing framework of Avramov and Chordia (2006) offers an important advantage as it can flexibly incorporate additional information into the main asset pricing model to adjust stock returns for risks. This chapter extends the model of Avramov and Chordia (2006) to test the contribution of the inflexibility of the firm level investments to the value premium. In Avramov and Chordia (2006), size and the Book-to-Market ratio are chosen as the conditioning variables as they proxy for asset-in-place and growth options, motivated by the Berk et al. (2003) model. In this chapter, the firm level conditioning variables in the original Avramov and Chordia (2006) model are replaced with the relevant proxies for investment and financing flexibility that are hypothesised to be relevant to the

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[26] The majority of U.S. listed firms have their fiscal year ended in December (Kamp, 2002), hence the Book-to-Market ratio is measured in December each year. This practice is also employed in Fama and French (1992, 1993, and 1996).

value premium. These proxies are introduced one by one to highlight their supplementary roles. The investment irreversibility, operating leverage and excess capacity measures are not simultaneously present in a model as they all measure different aspects of investment inflexibility in different models of Zhang (2005), Carlson et al. (2004) and Cooper (2006) respectively.

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

$$R_{jt} - R_{Ft} = \alpha_0 + \sum_{f=1}^{3} \left[\beta_{j,1,f} \quad \beta_{j,2,f} \quad \beta_{j,3,f} \quad \beta_{j,4,f} \right] \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ MWF_{t-1} \\ Firm_{j,t-1} \times MWF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \tag{2.1}$$

in which R_{jt} is the return on stock j and R_{Ft} is the risk free rate at time t. F_{ft} represents the priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model (1993, 1996). Firm characteristic $Firm_{jt-1}$ is the one month lagged firm level measurements of (a) investment irreversibility, (b) operating leverage, (c) excess capacity, and (d) financial constraints. The construction of these variables at December each year is presented in section 2.4.1 (p. 59). The variables, measured at December year t-1, are matched with stock returns from July year t to June year t+1, and lagged one month to be $Firm_{jt-1}$ in equation 2.1. MWF_{t-1} is the one month lagged market wide variable describing the factors in the business cycle that induce firms to adjust their investments to the optimal level. The market wide variable is included in addition to the firm level measurements to test hypotheses $H_{2.2b}$, $H_{2.3b}$, $H_{2.4b}$, $H_{2.5b}$ and $H_{2.6b}$

regarding the interaction of the firm level investment inflexibility and the business cycle.

Avramov and Chorida (2006) argue that the inclusion of the business cycle variables is motivated by the literature on the time series predictability of business cycle variables, such as Fama and French (1989) and Chen (1991). Following Jagannathan and Wang (1996), Avramov and Chorida (2006) eventually use the default spread as the business cycle indicator. Similar to Jagannathan and Wang (1996), their choice of a single indicator is also motivated by the desire to have a small number of variables to ensure some precision in the estimation procedure. The default spread is chosen as (a) according to Jagannathan and Wang (1996), interest rate variables are likely to be more helpful in predicting future business conditions; and (b) Bernanke (1990) reports that of several interest rate variables, the default spread is the best single variable to forecast the business cycle. This chapter measures the default spread as the spread between the U.S. corporate bonds with Moody's rating of AAA and BAA.

In stage two, i.e. the cross sectional regressions, the part of returns that are unexplained by the asset pricing model in stage one is regressed against the Book-to-Market ratio. This regression helps assess the return predictability of the Book-to-Market ratio after controlling for risks.

$$R_{jt}^{*} = c_{0t} + c_{BM,t} BM_{j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{j,t-1} \\ PR_{j,t-1} \\ Turnover_{j,t-1} \end{bmatrix} + u_{jt} \qquad (2.2)$$

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 (2.1). $BM_{j,t-1}$ is the firm level

Book-to-Market ratio. The vector of size, cumulative returns and stock turnover in equation (2.2) represent the control factors, being the size, momentum, and liquidity that might also predict the cross section of stock returns.

The statistical null hypothesis is that the coefficient $c_{BM,t}$ attached to the Book-to-Market ratio is not significantly different from zero. This means the Book-to-Market ratio no longer predicts stock returns. It suggests that the value premium is explained when returns are adjusted for risks in stage one.

$H_{2.0}$: $c_{BM,t} = 0$

The coefficients and t-statistics are reported. As the independent variables in stage two are not estimated, stage two regression is not subject to the error-in-variable issue discussed in Shanken (1992) (Bauer et al., 2010 and Subrahmanyam, 2010). The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) procedure.

This chapter follows Avramov and Chordia (2006) to measure the variables in stage two. Size measures the market capitalisation of a stock at the end of each month. The Book-to-Market ratio in equation (2.2) is measured in a similar way with the Book-to-Market ratio in the portfolio approach and is winsorised at 0.5% and 99.5%. Three variables that measure past returns are cumulative returns for month 2 to 3, 4 to 6 and 7 to 12 prior to the current month. The turnover of NYSE – AMEX stocks equals 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[27]. The construction of the key firm level variables described in this section is summarised in Panel B of Table 2.2.

Avramov and Chordia (2006) and Brennan et al. (1998) transform the variables in equation (2.2) as follows: (1) lagging two months (size and turnover variables), (2) taking natural logarithm (size, turnover variables and the Book-to-Market ratio), and (3) taking deviation from the respective cross sectional mean (size, turnover variables, the Book-to-Market ratio and cumulative returns). The transformation is formalised below:

$$Size\_transformed_{j,t} = \ln\left[lag_2\left(Size_{j,t}\right)\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[lag_2\left(Size_{i,t}\right)\right] \tag{2.3}$$

$$BM\_transformed_{j,t} = \ln\left[BM_{j,t}\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[BM_{i,t}\right] \tag{2.4}$$

$$Turnover\_transformed_{j,t} = \ln\left[lag_2\left(Turnover_{j,t}\right)\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[lag_2\left(Turnover_{i,t}\right)\right] \tag{2.5}$$

in which $Size_{j,t}$, $BM_{j,t}$, and $Turnover_{j,t}$ are the measurements of size, Book-to-Market, and turnover in NYSE / AMEX or NASDAQ for firm j at time t as described above. $lag_2(x_t)$ refers to the two - month lag of variable x_t. $\ln[y]$ refers to the natural log of variable y. *n* refers to the number of stocks in the sample at time *t*. $Size\_transformed_{j,t}$, $BM\_transformed_{j,t}$ and

[27] The turnovers of the NYSE/AMEX and of the NASDAQ listed stocks are separated as the NASDAQ market is a dealer market and the trading volume for the NASDAQ traded stocks could therefore be double counted (Atkins and Dyl, 1997, cited in Avramov and Chordia, 2006). Furthermore, a dummy variable for the NASDAQ listed stocks is included to control for the tendency that returns on the NASDAQ listed stocks are lower than the NYSE/AMEX counterparts (Loughran, 1993, cited in Avramov and Chordia, 2006).

$Turnover\_transformed_{j,t}$ are the corresponding variables after the transformation and replace $Size_{j,t}$, $BM_{j,t}$, and $Turnover_{j,t}$. These variables are lagged one month to become $Size_{j,t-1}$, $BM_{j,t-1}$, and $Turnover_{j,t-1}$ in equation (2.2).

The variables are lagged to avoid any biases caused by bid-ask effects and thin trading. Due to the considerable skewness, they are transformed using natural logarithm. Finally, taking deviation from the cross sectional mean implies that the average stock will have the values of each of the firm level characteristic equal to zero, and the expected return is determined solely by the risk factors.

2.4.3. Sample Description

The sample includes stocks which are not in the financial and utility sectors and are listed in the three stock markets – NYSE, AMEX and NASDAQ. Financial stocks are excluded as they have different asset structures compared to the non-financial stocks. Utilities stocks are excluded as utilities firms and potentially their investments are more strictly regulated than firms in other industries. Stocks should have a minimum of 36 months of non-negative book value of equity to be included in the sample. The sample covers 414 months from July 1972 to December 2006, with 988,050 firm-month observations. The coverage period starts in 1972 due to the availability of the data to measure net payout ratio. Panel A of Table 2.3 shows some statistics for the key variables. All variables except for the efficiency measure show a high degree of skewness given their high standard deviations and the considerable difference between means and medians. The three variables that describe the extent to which firms' assets are irreversible, i.e. the depreciation charge ratio, the rental ratio and the disinvestment ratio, have their means within a close range but the medians significantly apart.

The correlation matrix of the key variables shows that the three investment irreversibility variables are significantly positively correlated. The correlation coefficients (a) between the depreciation charge ratio and the disinvestment ratio, and (b) between the rental expense ratio and the disinvestment ratio, are close to zero; while that between the rental expense ratio and the depreciation charge ratio is higher (at 0.33) but still well below 1.00. The remaining correlation coefficients between any other two variables are either statistically or economically insignificant, suggesting that they describe different economic forces.

[Insert Table 2.3 about here]

Panel B of Table 2.3 describes the statistics for the variables in the regressions of the Avramov and Chordia's asset pricing framework. An average stock in the sample has the excess return of 0.94% per month with the average market capitalisation of $1.30 billion and the average Book-to-Market ratio of 0.98. The average cumulative returns of the past 2nd to 3rd month, 4th to 6th month, and 7th to 12th month are 2.75%, 4.09% and 8.67% per month respectively. All the variables in this panel show a significant level of skewness, with the mean values well above the median, which suggests that it is appropriate to transform them in accordance with Avramov and Chordia (2006) and Brennan et al. (1998) as described in section 2.4.2 (p. 65).

2.5. The Results

2.5.1. Results of the univariate analysis

2.5.1.1. The Profitability of the Value-Growth Trading Strategy

Table 2.4 reports the returns to the ten equally weighted portfolios sorted by the Book-to-Market ratio and the long-short portfolios. For the full sample, the returns to the portfolios follow a monotonic pattern, increasing from the growth portfolio to the value portfolio. The return to the long-short portfolio is 1.55% per month and is statistically significant.

[Insert Table 2.4 about here]

Furthermore, in the subsamples with the available data to calculate the key firm level variables, including the depreciation charge ratio, the rental expense ratio, the disinvestment ratio, the operating leverage, the efficiency ratio, and the net payout ratio, similar patterns are observed. With the exception of the subsample with the availability of the efficiency ratio, the returns to the portfolios in the other subsamples also follow a monotonic pattern, increasing from the growth portfolios to the value portfolios. The returns to the long-short portfolios in these subsamples are positive and statistically significant, varying between 1.23% per month (the subsample with the available operating leverage) and 1.62% per month (the subsample with the available disinvestment ratio).

In the subsample with the efficiency ratio, the returns to the portfolios do not strictly follow a monotonic pattern from the growth to the value portfolio – the return declines from decile 2 to 4 before it increases from decile 4 through to decile 10 (i.e. the value portfolio). The return of 0.94% per month to the long-short portfolio in this subsample is also significant, but well below the returns to the long-short portfolios in the other subsamples. Overall, the evidence obtained using the portfolio sorting methodology suggests that value stocks outperform growth stocks, consistent with the existing literature on the value premium.

To conclude, there is evidence that the returns to the portfolios based on the Book-to-Market ratio increase monotonically from low to high Book-to-Market deciles. The returns to the long-short portfolios are positive and significant. The evidence suggests that hypothesis $H_{2.1}$, i.e. whether the value-growth trading strategy is profitable, cannot be rejected in the univariate analysis.

2.5.1.2. Investment Irreversibility and the Value Premium

This chapter first investigates how investment irreversibility differs between value and growth stocks to test the relationship between firms' investment irreversibility and the value premium (hypothesis $H_{2.2a}$). Columns 1 to 3 in Table 2.5 present the average measures of investment irreversibility, i.e. the ratio of depreciation expenses, rental expenses and the proceeds from fixed asset sale, to beginning of the year net fixed assets of the Book-to-Market deciles. The time series average of (a) the mean investment irreversibility measures of ten equally weighted decile portfolios, and (b) the difference in these means measures of the value and growth portfolios, are reported. Table 2.6 presents the evidence on the relationship between investment irreversibility and the value premium.

Investment irreversibility measured by the depreciation charge ratio

In column 1 in Table 2.5, the depreciation charge ratio decreases monotonically across the ten Book-to-Market deciles from the growth portfolio to the value portfolio. The growth portfolio has the average depreciation charge ratio of 23.57% whereas that of the value portfolio is 14.26%. The assets of value firms appear to be on average longer lived than the assets of growth firms, suggesting that it is easier for growth firms to make new investments than value firms. As expected, the depreciation charge ratio, being negatively related to firms' investment irreversibility, is higher among growth firms and lower among value firms.

[Insert Table 2.5 about here]

Table 2.6 investigates hypothesis $H_{2.2a}$ that the higher the gap in investment irreversibility between value and growth stocks, the higher the value premium. Panel A provides the evidence when investment irreversibility is measured using the depreciation charge ratio. Hence, only those firms with the available data to construct the depreciation charge ratio are included. The sample is then divided into three subsamples. Firms having the depreciation charge ratio in the top 30% are included in the subsample with low investment irreversibility. Firms having the depreciation charge ratio in the bottom 30% are included in the subsample with high investment irreversibility. The remaining firms are included in the subsample with medium investment irreversibility.

[Insert Table 2.6 about here]

In the overall sample, the return to the long-short portfolio is 1.54% per month and is statistically significant (column 2 in Table 2.4). Similarly, the first three columns of Panel A in Table 2.6 show that in all the three subsamples by the depreciation charge ratio, the average returns to the ten deciles generally increase from the growth portfolios to the value portfolios. In the subsample with low investment irreversibility (high depreciation charge ratios), the return to the long-short portfolio is 2.00% per month and is statistically significant. In the subsamples with medium and high investment irreversibility, the returns are lower (1.19% per month and 1.38% per month respectively).

The last three columns of Panel A in Table 2.6 present the average depreciation charge ratio of the deciles and the corresponding gaps in this ratio between the value and growth portfolios in the three subsamples. The depreciation charge ratio exhibits a decreasing pattern across the deciles from the growth to the value portfolios in the subsample with low investment irreversibility (high depreciation charge ratio). The pattern is not monotonic in the subsamples with medium and high investment irreversibility. All the gaps in the depreciation charge ratios of the value and growth portfolios are negative in the three subsamples, similar to the gap in the overall sample (column 1 in Table 2.5).

The gap in absolute value is the highest (3.58%) in the subsample with low investment irreversibility. It is lower in the subsamples with medium and high investment irreversibility (1.31% and 0.70% respectively). The results show that the subsample with the highest investment irreversibility gap (3.58%) generates the highest value premium (2.00% per month). The magnitude of the gap and of the value premium in this subsample is well above that in the other two subsamples. However, the positive relationship between the depreciation gap and the value premium does not hold between these two subsamples[28]. The evidence weakly

[28] The subsample with a lower gap (0.56%) generates a higher value premium (1.38% per month), whereas in the subsample with a higher gap (1.31%), the premium is lower (1.19% per month).

supports the hypothesis that the higher the investment irreversibility gap, the higher the value premium ($H_{2.2a}$).

Investment irreversibility measured by the rental expense ratio

In column 2 in Table 2.5, the rental expense ratio follows a declining pattern across the ten Book-to-Market deciles from the growth to the value portfolio. The growth portfolio has the average rental expense ratio of 17.13% whereas that of the value portfolio is 8.04%. Growth firms appears to use more rented assets than value firms, suggesting that it is easier for growth firms to shift between fixed assets than value firms. As expected, the rental expense ratio, being negatively related to the investment irreversibility of firms' assets, is higher among growth firms and lower among value firms.

Panel B in Table 2.6 provides the evidence to test hypothesis $H_{2.2a}$ (i.e. the higher the gap in investment irreversibility between value and growth stocks, the higher the value premium) when investment irreversibility is measured using the rental expense ratio. Hence, only those firms with the available data to construct the rental expense ratio are included. The sample is then divided into three subsamples. Firms having the rental expense ratio in the top 30% are included in the subsample with low investment irreversibility. Firms having the rental expense ratio in the bottom 30% are included in the subsample with high investment irreversibility. The remaining firms are included in the subsample with medium investment irreversibility.

Column 3 in Table 2.4 reports that the return to the long-short portfolio is 1.53% per month and is statistically significant in the overall sample with the available rental expense ratio. Similarly, the first three columns of Panel B in Table

2.6 show that in all the three subsamples by the rental expense ratio, the average returns to the ten deciles generally increase from the growth portfolios to the value portfolios. The return to the long-short portfolio in the subsample with low investment irreversibility (high rental expense ratios) is 1.68% per month and is statistically significant. In the subsamples with medium and high investment irreversibility, the returns are lower (1.19% per month and 1.38% per month respectively).

The last three columns of Panel B in Table 2.6 present the average rental expense ratio of the deciles and the corresponding gaps in this ratio between the value and growth portfolios in the three subsamples. The rental expense ratio exhibits a decreasing pattern across the deciles from the growth to the value portfolios in all the three subsamples. All the gaps in the rental expense ratio of the value and growth portfolios are negative in the three subsamples, similar to the gap in the overall sample (column 2 in Table 2.5).

The gap in absolute value is the highest (5.71%) in the subsample with low investment irreversibility. It is lower in the subsamples with medium and high investment irreversibility (1.65% and 0.35% respectively). The results show that the subsample with the highest investment irreversibility gap (5.71%) generates the highest value premium (1.68% per month). The magnitude of the gap and of the value premium in this subsample is higher than that in the other two subsamples. However, the positive relationship between the rental gap and the value premium does not hold in these two subsamples[29]. Similar to the evidence on the relationship between the depreciation gap and the value premium discussed in the previous section, the results in this section only weakly support the hypothesis that the higher the investment irreversibility gap, the higher the value premium ($H_{2.2a}$).

Investment irreversibility measured by the disinvestment ratio

In column 3 in Table 2.5, the disinvestment ratio follows an increasing pattern across the ten Book-to-Market deciles from the growth to the value portfolio. The average disinvestment ratio of the growth portfolio is 1.57% whereas that of the value portfolio is 3.23%. The disinvestment ratio appears to be positively related to the Book-to-Market ratio. The evidence is consistent with the disinvestment ratio being positively related to firms' investment irreversibility. While being scaled by the same deflator, i.e. the beginning of the year net fixed assets, the magnitude of the disinvestment ratio is much lower than that of the depreciation charge ratio and the rental expense ratio, relative to the net fixed assets. The evidence suggests that reversing investments through the disinvestment of existing assets is less important a channel compared to the option to rent or to depreciate the existing assets, and invest in new ones.

Panel C in Table 2.6 provides the evidence to test hypothesis $H_{2.2a}$ (i.e. the higher the gap in investment irreversibility between value and growth stocks, the higher the value premium) when investment irreversibility is measured using the disinvestment ratio. Hence, only those firms with the available data to construct the

[29] The subsample with a lower gap (0.35%) generates a higher value premium (1.49% per month), whereas in the subsample with a higher gap (1.65%), the premium is lower (1.30% per month).

disinvestment ratio are included. The sample is then divided into three subsamples. Firms having the disinvestment ratio in the top 30% are included in the subsample with high investment irreversibility. Firms having the disinvestment ratio in the bottom 30% are included in the subsample with low investment irreversibility. The remaining firms are included in the subsample with medium investment irreversibility.

Column 4 in Table 2.4 reports that the return to the long-short portfolio in the overall sample with the available disinvestment ratio is 1.62% per month and is statistically significant. Similarly, the first three columns of Panel C in Table 2.6 show that in all the three subsamples by the disinvestment ratio, the average returns to the ten deciles generally increase from the growth portfolios to the value portfolios. The returns to the long-short portfolios in the subsamples with low, medium and high investment irreversibility (low, medium and high disinvestment ratios respectively) are 1.56% per month, 1.42% per month, and 1.66% per month respectively and are all statistically significant.

The last three columns of Panel C in Table 2.6 present the average disinvestment ratio of the deciles and the corresponding gaps in this ratio between the value and growth portfolios in the three subsamples. The disinvestment ratio does not follow any specific pattern across the deciles from the growth to the value portfolios in all the three subsamples. Furthermore, there appears to be no relationship between the disinvestment gap and the value premium in the three subsamples.

Conclusions

Of the three measures for investment irreversibility, the disinvestment ratio appears to contribute the least economic magnitude. Furthermore, the results reject the hypothesis that the higher the investment irreversibility gap, the higher the value premium ($H_{2.2a}$) when investment irreversibility is measured by the disinvestment ratio.

2.5.1.3. Operating Leverage and the Value Premium

This chapter first investigates how operating leverage differs between value and growth stocks to test the relationship between firms' operating leverage and the value premium (hypothesis $H_{2.3a}$). Column 4 in Table 2.5 reports the time series average of (a) the mean operating leverage of ten equally weighted deciles, and (b) the difference in these means of the value and growth portfolios. Operating leverage increases monotonically across the ten Book-to-Market deciles from the growth to the value portfolio. The growth portfolio has the average operating leverage of 1.28 times whereas that of the value portfolio is 3.30 times. The profitability of value firms appears to be more sensitive to changes in their sales, suggesting that value firms rely more heavily on fixed costs in their cost structure as compared to growth firms. As expected, operating leverage is on average higher among value firms than among growth firms.

Table 2.7 investigates hypothesis $H_{2.3a}$ that the higher the gap in operating leverage between value and growth stocks, the higher the value premium. Only those firms with the available data to construct operating leverage are included. The sample is then divided into three subsamples. Firms having operating leverage in the top 30% are included in the subsample with high operating leverage. Firms having operating leverage in the bottom 30% are included in the subsample with low operating leverage. The remaining firms are included in the subsample with medium operating leverage.

[Insert Table 2.7 about here]

As reported in column 5 in Table 2.4, the return to the long-short portfolio in the overall sample is 1.23% per month and is statistically significant. Similarly, the first three columns in Table 2.7 show that in all the three subsamples by operating leverage, the average returns to the ten deciles generally increase from the growth portfolios to the value portfolios. The returns to the long-short portfolios in the subsamples with high, medium and low operating leverage are 1.05% per month, 1.15% per month and 1.12% per month respectively and are all statistically significant.

The last three columns in Table 2.7 present the average operating leverage of the deciles and the corresponding gaps in this measure between the value and growth portfolios in the three subsamples. Operating leverage follows an increasing pattern from the growth to the value portfolio in the subsample with medium operating leverage. However, in the other subsamples, it does not appear to follow any pattern across the Book-to-Market deciles. Furthermore, there appears to be no relationship between the operating leverage gap and the value premium in the three subsamples. Hence, the results reject the hypothesis that the higher the operating leverage gap, the higher the value premium ($H_{2.3a}$).

2.5.1.4. Excess capacity and the Value Premium

This chapter first investigates how excess capacity differs between value and growth stocks to test the relationship between firms' excess capacity and the value premium (hypothesis $H_{2.4a}$). Column (5) of Table 2.5 reports the time series average of (a) the mean excess capacity of ten equally weighted deciles, and (b) the difference in this measure between the value and growth portfolios. The efficiency ratio follows a declining pattern, although not strictly monotonic, from the growth to the value portfolio. The growth portfolio has the average efficiency ratio of 76.24% whereas that of the value portfolio is 57.94%. Growth firms appear to be more efficient than value firms, consistent with the expectation that generally value firms have more excess capacity than growth firms.

Table 2.8 investigates hypothesis $H_{2.4a}$ that the higher the gap in excess capacity between value and growth stocks, the higher the value premium. Only firms with the available data to construct the efficiency ratio are included. The sample is then divided into three subsamples. Firms having the efficiency ratio in the top 30% are included in the subsample with low excess capacity. Firms having the efficiency ratio in the bottom 30% are included in the subsample with high excess capacity. The remaining firms are included in the subsample with medium excess capacity.

[Insert Table 2.8 about here]

Column 6 in Table 2.4 shows that in the overall sample, the return to the long-short portfolio is 0.94% per month. While statistically significant, it is 40% lower than the corresponding figure in the original sample. In the first three columns in Table 2.8, the returns to the long-short portfolios are positive and significant in two out of the three subsamples (0.89% per month and 0.91% per month). However, the returns to the Book-to-Market deciles from the growth to the value portfolios in these subsamples do not follow any monotonic pattern.

The last three columns in Table 2.8 present the average efficiency ratio of the deciles and the corresponding gaps in this ratio between the value and growth portfolios in the three subsamples. The efficiency ratio does not follow any pattern from the growth to the value portfolio in any subsample. Furthermore, there appears to be no relationship between the efficiency gap and the value premium in the three subsamples. Hence, the findings reject the hypothesis that the higher the efficiency gap, the higher the value premium ($H_{2.4a}$).

2.5.1.5. Financial Constraints and the Value Premium

To test the relationship between firms' financial constraints and the value premium (hypotheses $H_{2.5}$ and $H_{2.6}$), this chapter first investigates how financial constraints differ between value and growth stocks. Column 6 in Table 2.5 reports the time series average of (a) the mean net payout ratios of ten equally weighted deciles, and (b) the difference in this ratio between the value and growth portfolios. The net payout ratio does not follow any monotonic pattern across the Book-to-Market deciles from the growth to the value portfolios. The net payout ratio of the deciles varies within the range of 10% to 15%.

Table 2.9 presents the evidence on the relationship between financial constraints and the value premium. If financial constraints play the primary role to the value premium, i.e. it is driven by the difference between the financial constraints of value and growth firms, the higher the gap in financial constraints between value and growth firms, the higher the value premium ($H_{2.5a}$).

Alternatively, financial constraints could play a secondary role to the value premium through reinforcing the impact of firms' investment irreversibility on firms' investments in working capitals and fixed capitals. Furthermore, section 2.5.1.2 (p. 75) supports the contribution of firms' investment irreversibility to the value premium. Therefore, alternatively the more financially constrained firms are, the higher the value premium among these firms ($H_{2.6a}$).

[Insert Table 2.9 about here]

The sample in Table 2.9 includes firms with the available data to construct the net payout ratio. The sample is then divided into three subsamples. Firms having the net payout ratio in the top 30% are included in the subsample with low financial constraints. Firms having the net payout ratio in the bottom 30% are included in the subsample with high financial constraints. The remaining firms are included in the subsample with medium financial constraints.

Column 7 in Table 2.4 reports that the return to the long-short portfolio in the overall sample with the available net payout ratios is 1.61% per month and is statistically significant. The first three columns in Table 2.9 show that in all the three subsamples by net payout ratios, the average returns to the ten deciles generally increase from the growth portfolios to the value portfolios. The returns to the long-short portfolios in the subsamples with low, medium and high financial constraints (i.e. high, medium and low net payout ratios) are 1.50% per month, 1.48% per month and 1.44% per month respectively. The differences approximate each other and do not support the hypothesis that the value premium is higher among firms with higher financial constraints (hypothesis $H_{2.6a}$).

The last three columns in Table 2.9 present the average net payout ratio of the deciles and the corresponding gaps in this ratio of the value and growth portfolios in the three subsamples. Similar to the overall sample, in the three subsamples, the net payout ratio does not appear to follow any pattern across the deciles from the growth to the value portfolios. Furthermore, there appears to be no relationship between the financial constraint gap and the value premium in the three subsamples. Hence, the findings reject the hypothesis that the higher the financial constraint gap, the higher the value premium ($H_{2.5a}$).

Overall, the evidence does not support either hypothesis H_{5a} (the higher the financial constraint gap, the higher the value premium), or hypothesis $H_{2.6a}$ (the value premium is higher among firms with higher financial constraints) in the univariate analysis. It is possible that the relationship between financial constraints and the value premium exists but not in the linear direction hypothesised in $H_{2.5a}$ and $H_{2.6a}$.

2.5.2. Results of the multivariate analysis

2.5.2.1. The Profitability of the Value-Growth Trading Strategy

Scenarios 1 and 2 in Table 2.10 provide the evidence for the value premium using the Avramov and Chordia (2006) regression approach. In scenario 1, returns are not adjusted for risks in the stage one regression. The raw returns are regressed against the firm level variables as described in equation 2.2 (p. 69) in the stage two regression. The Book-to-Market coefficient is positive and significant. It suggests that there is a positive and significant relationship between the cross section of stock returns and the Book-to-Market ratio. This result confirms the evidence so far that the value premium exists in the sample. The coefficients of the control variables also show the expected signs. The size coefficient is negative and significant (i.e. the return predictability of size), while the cumulative return coefficients are positive and significant (i.e. the return predictability of cumulative returns).

[Insert Table 2.10 about here]

In scenario 2, the unconditional Fama and French three factor model is used to adjust returns for risks in stage one. The time series regression in stage one is described in equation 2.1 (p. 68) with the following constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. The risk adjusted returns are regressed against the firm level variables as described in equation 2.2. The adjusted R^2 drops from 4.43% in scenario 1 to 2.18% in scenario 2, suggesting that the Fama and French model in stage one helps better explain the return predictability of the variables in equation 2.2. However, the Book-to-Market coefficient is positive and significant. The evidence suggests that the Book-to-Market ratio predicts stock returns, or the value premium exists, even when stock returns are adjusted for risks using the unconditional Fama and French model.

To conclude, the Book-to-Market ratio is positively related to the returns, including both raw returns and the risk adjusted returns using the Fama and French three factor model, at the firm level. Consistent with the evidence in the univariate analysis in section 2.5.1.1 (p. 74), the evidence in this section suggests that hypothesis $H_{2.1}$, i.e. whether the value-growth trading strategy is profitable, cannot be rejected. The answer to the first research question, i.e. whether the value premium exists in the sample, is therefore affirmative.

2.5.2.2. Investment Irreversibility and the Value Premium

The univariate evidence in section 2.5.1.2 (p. 75) suggests that the investment irreversibility gap between value and growth firms is related to the magnitude of the value premium (hypothesis $H_{2.2a}$) when investment irreversibility is proxied by the depreciation charge ratio and the rental expense ratio. The evidence does not support this conjecture when investment irreversibility is proxied by the disinvestment ratio. This section investigates hypothesis $H_{2.2b}$, i.e. firms' investment irreversibility and the business cycle together affect the value premium. To provide evidence for this hypothesis, this chapter uses the asset pricing framework of Avramov and Chordia (2006) as detailed in section 2.4.2 (p. 65). The three proxies for investment irreversibility reflect the three independent aspects of investment irreversibility. Therefore this chapter uses all the three measures to investigate whether investment irreversibility and the business cycle can explain the value premium. Only firms with available information to calculate the three measures of investment irreversibility are included in Panel B in Table 2.10.

Scenario 3 in Panel B in Table 2.10 replicates scenario 2[30] and uses the unconditional Fama and French model to adjust returns for risks in stage one. Similar to the result in scenario 2, scenario 3 shows that the value premium is present in this subsample, with the Book-to-Market coefficient $c_{BM,t}$ (0.21) in the cross sectional regression (equation 2.2, p. 80) being statistically significant. In scenario 4, the unconditional Fama and French model in stage one is replaced by the conditional version in which the betas are conditioned on the three measures of

[30] Scenario 2 investigates the original sample with no requirement that any investment irreversibility, operating leverage, efficiency, or financial constraints measure is available.

investment irreversibility. The time series regression in stage one is described in equation 2.1 (p. 68) with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. As the Book-to-Market coefficient $c_{BM,t}$ (0.13) in the cross sectional regression (equation 2.2) remains statistically significant, introducing information about investment irreversibility does not help the Fama and French model to explain the value premium. The coefficient $c_{BM,t}$ is smaller in scenario 4 than in scenario 3, suggesting that introducing the information on firms' investment irreversibility into the asset pricing model helps reduce the economic significance of the value premium in the sample.

Central to the mechanism that gives rise to the value premium in Zhang (2005) is the difference in the value and growth firms' response to the business cycle due to the difference in their investment irreversibility. Furthermore, Petkova and Zhang (2005) and Lettau and Ludvigson (2001) find that value stocks outperform growth stocks in good states and under-perform in bad states of the economy. The evidence presented so far suggests that introducing solely investment irreversibility is insufficient for the Fama and French model to explain the value premium. This chapter next supplements the conditional Fama and French model with the information about the business cycle.

In scenario 5 (panel B in Table 2.10), stock returns are adjusted for risks using the Fama and French model which is conditioned on the business cycle variable. Equation 2.1 (p. 68) describes the time series regression in stage one with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. The Book-to-Market coefficient $c_{BM,t}$ is 0.18

and is statistically significant, meaning that introducing the business cycle variable only does not help the Fama and French model to explain the value premium.

Finally, in scenario 6 (panel B in Table 2.10), stock returns are adjusted for risks using the Fama and French model which is conditioned on both investment irreversibility and the default spread as described in the full version of equation 2.1. The Book-to-Market coefficient $c_{BM,t}$ of 0.08 is statistically insignificant. However, the p-value is actually 10.15%, only marginally above the threshold of 10% for the purpose of determining the conventional statistical significance. Compared with the Book-to-Market coefficients reported in scenarios 3 to 5, the Book-to-Market coefficient in scenario 6 is also least economically significant with the smallest coefficient.

The results support hypothesis $H_{2.2b}$ that the value premium can be explained when taking into account firms' investment irreversibility. While the Fama and French model includes a value factor, it is incapable of explaining the value premium. The sole information about firms' investment irreversibility is insufficient to improve the power of the Fama and French model in explaining the value premium. The Fama and French model can explain the value premium only when both firms' investment irreversibility and the business cycle are used as the conditioning variables.

2.5.2.3. Operating Leverage and the Value Premium

This section investigates hypothesis $H_{2.3b}$, i.e. firms' operating leverage and the business cycle together affect the value premium using the asset pricing framework of Avramov and Chordia (2006). Only firms with the available information to calculate operating leverage are included in Panel C of Table 2.10.

Scenario 7 in Panel C of Table 2.10 replicates scenario 2 and uses the unconditional Fama and French model to adjust returns for risks in stage one. Similar to the result in scenario 2, scenario 7 shows that the value premium is present in this subsample, with the Book-to-Market coefficient $c_{BM,t}$ in the cross sectional regression (equation 2.2, p. 80) being positive and statistically significant.

In scenarios 8 to 10, the unconditional Fama and French model in stage one is replaced by the conditional versions in which the betas are conditioned on (a) firms' operating leverage[31], (b) the business cycle variable[32], and (c) both firms' operating leverage and the business cycle variables[33]. In the cross sectional regression (equation 2.2), the Book-to-Market coefficient $c_{BM,t}$ remains positive (from 0.13 to 0.16) and significant (t-statistic varying from 2.57 to 2.86). The result rejects hypothesis $H_{2.3b}$ that firms' operating leverage and the business cycle together help explain the value premium. Furthermore, the univariate results in section 2.5.1.3 (p. 82) reject hypothesis $H_{2.3a}$ that the higher the operating leverage gap, the higher the value premium. Taken together, the findings do not support the relevance of firms' operating leverage to the value premium.

2.5.2.4. Excess Capacity and the Value Premium

This section investigates hypothesis $H_{2.4b}$, i.e. firms' excess capacity and the business cycle together affect the value premium using the asset pricing framework of Avramov and Chordia (2006). Only firms with the available

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[31] The constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$ is imposed on equation 2.1.

[32] The constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$ is imposed on equation 2.1.

[33] No constraint is imposed on equation 2.1.

information to calculate the efficiency ratio are included in Panel D of Table 2.10. Scenario 11 in Panel D of Table 2.10 replicates scenario 2 and uses the unconditional Fama and French model to adjust returns for risks in stage one. Similar to the result in scenario 2, scenario 11 shows that the value premium is present in this subsample, with the Book-to-Market coefficient $c_{BM,t}$ in the cross sectional regression (equation 2.2, p. 80) being positive and statistically significant.

In the scenarios 12 to 14, the unconditional Fama and French model in stage one is replaced by the conditional versions in which the betas are conditioned on (a) firms' efficiency ratio[34], (b) the business cycle variable[35], and (c) both firms' efficiency ratios and the business cycle variable[36]. In the cross sectional regression (equation 2.2), the Book-to-Market coefficient $c_{BM,t}$ remains positive (from 0.14 to 0.18) and significant (t-statistic varying from 2.62 to 3.13). The results reject hypothesis $H_{2.4b}$ that firms' efficiency or excess capacity and the business cycle together help explain the value premium. Furthermore, the univariate results in section 2.5.1.4 (p. 84) reject hypothesis $H_{2.4a}$ that the higher the efficiency gap, the higher the value premium. Taken together, the findings do not support the relevance of firms' excess capacity to the value premium.

2.5.2.5. Financial Constraints and the Value Premium

This section investigates hypotheses $H_{2.5b}$ and $H_{2.6b}$ using the asset pricing framework of Avramov and Chordia (2006). If financial constraints play the

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[34] The constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$ is imposed on equation 2.1.

[35] The constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$ is imposed on equation 2.1.

[36] No constraint is imposed on equation 2.1.

primary role, financial constraints and the business cycle together are expected to affect the value premium ($H_{2.5b}$). Alternatively, if financial constraints play the secondary role, then financial constraints, investment irreversibility and the business cycle together are expected to affect the value premium ($H_{2.6b}$).

Financial constraints and the value premium:

Only firms with the available information to calculate net payout ratios are included in Panel E in Table 2.10. Scenario 15 in Panel E in Table 2.10 replicates scenario 2 and uses the unconditional Fama and French model to adjust returns for risks in stage one. Similar to the result in scenario 2, scenario 15 shows that the value premium is present in this subsample, with the Book-to-Market coefficient $c_{BM,t}$ in the cross sectional regression (equation 2.2, p. 80) being positive and statistically significant.

In the scenarios 16 to 18, the unconditional Fama and French model in stage one is replaced by the conditional versions in which the betas are conditioned on (a) firms' financial constraints[37], (b) the business cycle variable[38], and (c) both firms' financial constraints and the business cycle variable[39]. The Book-to-Market coefficient $c_{BM,t}$ in the cross sectional regression (equation 2.2) remains positive (varying from 0.10 to 0.17) and significant (t-statistic varying from 1.97 to 3.11). The results reject hypothesis $H_{2.5b}$ that firms' financial constraints and the business cycle affect the value premium.

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[37] The constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$ is imposed on equation 2.1.

[38] The constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$ is imposed on equation 2.1.

[39] No constraint is imposed on equation 2.1.

Financial constraints, investment irreversibility and the value premium:

Only firms with the available information to calculate both net payout ratios and the three measures of investment irreversibility are included in Panel F in Table 2.10. Scenario 19 (Panel F in Table 2.10) replicates scenario 2 and uses the unconditional Fama and French model to adjust returns for risks in stage one. Similar to the result in scenario 2, scenario 15 shows that the value premium is present in this subsample, with the Book-to-Market coefficient $c_{BM,t}$ in the cross sectional regression (equation 2.2) being positive and statistically significant.

In scenario 20, the unconditional Fama and French model in stage one is replaced by the conditional version in which the betas are conditioned on both financial constraints and investment irreversibility. The time series regression in stage one is described in equation 2.1 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. As the Book-to-Market coefficient $c_{BM,t}$ in the cross sectional regression (equation 2.2) remains positive and significant, introducing financial constraints and investment irreversibility does not help the Fama and French model to explain the value premium.

As section 2.5.2.2 (p. 89) supports hypothesis $H_{2.2b}$ that investment irreversibility and the business cycle together affect the value premium, it is possible that the indirect role of financial constraints to the value premium through investment irreversibility, if exists, would be also dependent on the business cycle state. Scenarios 21 and 22 (Panel F in Table 2.10) account for this possibility. In scenario 21, stock returns are adjusted for risks using the Fama and French model which is conditioned on the business cycle variable. Equation 2.1 describes the time series regression in stage one with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. The Book-to-Market coefficient $c_{BM,t}$ is positive and significant.

Finally, in scenario 22 (panel F in Table 2.10), stock returns are adjusted for risks using the conditional Fama and French model with betas being conditioned on both firms' financial constraints and investment irreversibility, and the business cycle variable. Stock returns are adjusted for risks using the Fama and French model which is conditioned on both investment irreversibility and the default spread as described in the full version of equation 2.1. The Book-to-Market coefficient $c_{BM,t}$ of 0.07 is statistically insignificant with the t-statistic of 1.60. Compared with the coefficient $c_{BM,t}$ reported in scenarios 19 to 21, the corresponding coefficient in scenario 22 is also least economically significant with the smallest coefficient. Both the coefficient and the t-statistic (0.07 and 1.60 respectively) of the Book-to-Market variable in scenario 22 are lower than in those in scenario 6 (0.08 and 1.64 respectively) in which financial constraints are not present.

The results in this section support hypothesis $H_{2.6b}$ that financial constraints, investment irreversibility and the business cycle together affect the value premium. The value premium is better explained than when only (a) firms' investment irreversibility and (b) the default spread are considered. Section 2.5.2.2 (p. 89) supports hypothesis $H_{2.2b}$ that investment irreversibility and the business cycle together affect the value premium. The findings in this section supplement that adding financial constraints to this relationship better explains the value premium.

2.6. Conclusions

This chapter investigates the effects of firms' physical investment inflexibility on the value premium. Consistent with the literature, this chapter finds strong evidence of the value premium in the sample examined. This chapter reports the raw value premium of 1.55% per month. The value premium is also evident given the positive and significant relationship between stock returns and the Book-to-Market ratio. When stock returns are adjusted for risks using the unconditional Fama and French three factor model, the relationship remains positive and significant. The evidence suggests that the value premium exists even when returns are adjusted for risks using the Fama and French three factor model.

This chapter finds that consistent with Zhang (2005), firms' investment irreversibility is relevant to the value premium. There is a monotonic upward trend in investment irreversibility across the Book-to-Market portfolios from the growth to the value portfolio. Furthermore, when using two out of the three dimensions of investment irreversibility, this chapter finds that the higher the gap in investment irreversibility between value and growth firms, the higher the value premium. When the Fama and French three factor model is conditioned on both investment irreversibility and the business cycle, the relationship between stock returns and the Book-to-Market ratio becomes marginally insignificant.

The above finding suggests that the value-growth trading strategy is no longer profitable once risks are controlled for using the conditional Fama and French model with the model specification described above. The evidence supports the theory in Zhang (2005) and highlights the important role of both the business cycle and the firm level investment irreversibility in explaining the value premium.

It is also broadly consistent with the conjecture in Cooper (2006) and Carlson et al. (2004) that investment inflexibility helps explain the value premium. When measuring investment inflexibility using operating leverage and excess capacity as in Carlson et al. (2004) and Cooper (2006) respectively, the findings reject the claim that these measures explain the value premium.

Livdan et al. (2009) and Caggese (2007) suggest that firms' financial constraints may affect firms' overall risk profiles and the relationship between investment irreversibility and firms' investment activities respectively. Therefore financial constraints may directly contribute to the value premium or indirectly, through its influence on investment irreversibility and firms' investment activities. This chapter finds no evidence that financial constraints play the primary role that drives the value premium. The net payout ratio, which proxies for firms' financial constraints, does not follow any pattern across the ten Book-to-Market deciles from the growth to the value portfolio. Also, there is no clear relationship between the gap in net payout ratios between value and growth firms and the value premium.

Moreover, when returns are adjusted for risks using the Fama and French model conditioned on financial constraints, the relationship between risk adjusted returns and the Book-to-Market ratio remains positive and significant. This evidence suggests that the value-growth trading strategy is profitable even when returns are adjusted for risks using the Fama and French model conditioned on firms' financial constraints.

This chapter finds some evidence for the indirect role of financial constraints to the value premium. The univariate evidence rejects the hypothesis that the value premium is higher among firms with higher financial constraints.

However, when the Fama and French model is conditioned on (a) financial constraints and investment irreversibility, and (b) the business cycle variable, the relationship between stock returns and the Book-to-Market ratio becomes statistically insignificant, rendering the value-growth strategy to be no longer profitable.

Implications

The findings in this chapter have several implications. This chapter reports that a risk-return relationship can explain the value premium. Hence, future stock returns cannot be predicted based on the Book-to-Market ratio after controlling for risks. In the language of the market efficiency literature, the market is efficient with regards to the Book-to-Market ratio. Furthermore, the risk-return relationship can only explain the value premium when accounting for the inflexibility in the investment and financing environment at the firm level. Hence, the findings suggest that the understanding of corporate finance can help extend the understanding of the securities markets.

Finally, the findings have practical implications to investors who attempt to profit from the value-growth trading strategy. The profit from the value-growth trading strategy can be improved if investors use the value and growth firms with bigger investment irreversibility gaps. The value premium can be completely explained when returns are adjusted for risks using the asset pricing model conditioned on these characteristics. Therefore investors should bear in mind that the improved performance might just be a compensation for higher risks. Investors could benefit from future work on how to utilise the information about financial constraints to further improve the profitability of the value-growth trading strategy among value and growth firms with big investment irreversibility gaps.

Table 2.1: Summary of Hypotheses

The hypotheses examined in chapter 2 are summarised below:

	IIR	**OPL**	**EC**	**FC**	**IIR x FC**
$H_{2.1}$	Accept	Accept	Accept	Accept	Accept
$H_{2.2}$	Accept				
$H_{2.3}$		Accept			
$H_{2.4}$			Accept		
$H_{2.5}$				Accept	
$H_{2.6}$					Accept

IIR represents the explanation that the value premium is driven by the difference in investment irreversibility between value and growth firms, motivated by Zhang (2005). OPL represents the explanation that the value premium is driven by the difference in the operating leverage between value and growth firms, motivated by Carlson et al. (2004). EC represents the explanation that the value premium is driven by the difference in the excess capacity between value and growth firms, motivated by Cooper (2006). FC represents the explanation that the value premium is driven by the difference in risks due to the financial constraints between value and growth firms, motivated by Livdan et al. (2009) and Gulen et al. (2008). Finally, IIRxFC represents the explanation that financial constraints indirectly affect the value premium. Along the lines of Caggese (2007) financial constraints may influence the impact of investment irreversibility on the value premium.

Table 2.2: Construction of Key Variables

The key variables used in chapter 2 are constructed as follows:

A. Key variables in portfolio sorting

Key variables	**Construction**
Depreciation charge ratio	The depreciation expense for the year, scaled by the beginning of the year net fixed assets.
Rental expense ratio	The rental expense for the year, scaled by the beginning of the year net fixed assets.
Disinvestment ratio	The sum of the proceeds from fixed asset sales in the last three years, scaled by the beginning of the year net fixed assets.
Operating leverage	The percentage change in operating profits before tax to the percentage change in sales. To avoid the negative value of operating leverage in case operating profits and sales move in opposite directions in a year, negative ratios are replaced with missing values.
Efficiency	The efficiency of firms relative to their peers in the same industry is measured using Data Envelopment Analysis (DEA) technique. The input minimisation model, i.e. given the current level of output, determining the minimum input needed to compare with firms' actual inputs, is chosen. Each firm is evaluated against the other firms in the same industry, defined as one of 49 industries classified by Fama and French (1997) and updated on French's website. The output variable is the inflation adjusted sales. Two input variables are the annual cost of fixed capital, i.e. the depreciation expense, and the annual cost of human capital, i.e. the inflation adjusted salary related expense. The former is not adjusted for inflation as it reflects the historical costs at the time the fixed capital is acquired. The SAS programme for DEA by Emrouznejad (2005) generates an efficiency level from 0 to 1 for each firm-year, with 0 corresponding to inefficiency and 1 to efficiency. When the analysis fails to give any efficiency level, this chapter assumes that the corresponding efficiency is zero.

Key variables (cont.)	Construction (cont.)
Net payout ratio	Dividends plus repurchases minus share issuance, scaled by the net incomes.

B. Key variables in the regression of the Avramov and Chordia (2006) framework

Key variables	Construction
Size (Market capitalization)	The product of the outstanding number of shares and the share price at the end of each month, in billion $.
Book-to-Market ratio	The sum of the book value of common equity and balance sheet deferred tax, scaled by the market capitalisation, measured in December each year, and is winsorised at 0.5% and 99.5%.
Cumulative returns, month 2-3, 4-6, 7-12	The buy-and-hold cumulative returns for month 2 to 3, 4 to 6 and 7 to 12 prior to the current month.
Turnover, NYSE/ AMEX	The trading volume of the NYSE/AMEX listed stocks divided by the outstanding number of shares. This variable has the value of zero for the NASDAQ listed stocks.
Turnover, NASDAQ	The trading volume of the NASDAQ listed stocks divided by the outstanding number of shares. This variable has the value of zero for the NYSE/AMEX listed stocks.

Table 2.3: Sample Description

Table 2.3 presents some descriptive statistics of the sample of non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market. 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 1972 to 2006.

A. Key variables in portfolio sorting

A - Key variables in portfolio sorting	Mean	Median	Standard deviation
Depreciation charge ratio (1)	0.35	0.18	2.86
Rental expense ratio (2)	0.30	0.11	1.76
Disinvestment ratio (3)	0.26	0.02	6.13
Operating leverage (4)	20.84	1.73	362.39
Efficiency (5)	0.06	0.00	0.20
Net payout ratio (6)	-0.28	0.07	23.86
Non-zero efficiency (7)	0.65	0.65	0.28

Correlation	(1)	(2)	(3)	(4)	(5)	(6)
(1)	**1.00**	**0.33**	**0.11**	**0.00**	**-0.01**	**0.00**
		0.00	0.00	0.94	0.00	0.96
	106,893	92,504	96,950	74,476	105,483	98,219
(2)	**0.33**	**1.00**	**0.02**	**0.00**	**-0.01**	**0.00**
	0.00		0.00	0.93	0.00	0.86
	92,504	92,591	84,003	64,078	91,304	84,649
(3)	**0.11**	**0.02**	**1.00**	**0.00**	**0.00**	**0.00**
	0.00	0.00		0.92	0.92	0.86
	96,950	84,003	97,871	67,078	96,565	89,215
(4)	**0.00**	**0.00**	**0.00**	**1.00**	**0.00**	**0.00**
	0.94	0.93	0.92		0.57	0.93
	74,476	64,078	67,078	74,621	73,721	68,994
(5)	**-0.01**	**-0.01**	**0.00**	**0.00**	**1.00**	**0.01**
	0.00	0.00	0.92	0.57		0.06
	105,483	91,304	96,565	73,721	116,221	105,745
(6)	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**1.00**
	0.96	0.86	0.86	0.93	0.06	
	98,219	84,649	89,215	68,994	105,745	107,589
(7)	**-0.04**	**-0.05**	**0.02**	**-0.01**	**1.00**	**0.00**
	0.00	0.00	0.08	0.41		1.00
	8,588	6,899	7,490	6,610	8,591	8,136

Panel A reports the statistics for the key variables used in the portfolio sorting methodology. The construction of these variables is described in Table 2.2. The correlation matrix reports the correlations among the above mentioned variables. The lines in bold report the correlation coefficients between any two variables. The lines underneath report the two tailed p-values to test whether these coefficients are different from zero, The second lines underneath report the number of firm-year observations with available data to construct a variable.

B. Key variables in the regression of the Avramov and Chordia (2006) framework

B - Key variables in regressions	Mean	Median	Standard deviation
Excess returns (%)	0.94	-0.22	14.98
Market capitalisation ($ billion)	1.30	0.09	6.50
Book-to-Market	0.98	0.78	0.90
Cumulative returns, months 2 to 3 (%)	2.75	0.90	20.80
Cumulative returns, months 4 to 6 (%)	4.09	1.50	25.71
Cumulative returns, month 7 to 12 (%)	8.67	3.57	39.04
Turnover, NYSE and AMEX (%)	6.25	4.54	6.78
Turnover, NASDAQ (%)	11.80	6.61	20.86

Panel B describes the statistics for the variables used in the regression of the Avramov and Chordia (2006) asset pricing framework. The construction of the key variables is described in Table 2.2.

Table 2.4: Returns to the Value-Growth Trading Strategy

Table 2.4 presents the returns to the equally weighted portfolios of stocks sorted by the value of the Book-to-Market ratio as of 31st December of year t-1 in ascending order. Ten portfolios with equal number of stocks are composed and positions (long and short) are taken at the beginning of July year t and held until June year t+1. V-G represents the return to the portfolio that goes long in value stocks (i.e. the portfolio with the highest ranking in the Book-to-Market ratio) and short in growth stocks (i.e. the portfolio with the lowest ranking in the Book-to-Market ratio). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) from 1972 to 2006. Stocks are required to have a minimum of 36 months of non-negative book value of equity. The table also presents the respective returns in the subsamples with data to calculate the depreciation charge ratio, the rental expense ratio, the disinvestment ratio, operating leverage, the efficiency ratio and the net payout ratio (refer to Table 2.2 for details). The lines in bold are the portfolio returns, and the lines that are not in bold are the two tailed t-statistics to test whether a portfolio's return is different from zero. *, ** and *** denote the significance levels of 10%, 5% and 1% respectively.

BM decile	Overall sample (1)	Sample with Depreciation charge ratio (2)	Sample with Rental expense ratio (3)	Sample with Dis-investment ratio (4)	Sample with Operating Leverage (5)	Sample with Efficiency ratio (6)	Sample with Net payout ratio (7)
Growth	**0.65**	**0.65**	**0.71**	**0.73**	**0.75**	**0.85**	**0.71**
	1.81	1.81	1.89	1.95	2.28	2.88	2.00
2	**1.08**	**1.08**	**1.10**	**1.20**	**0.99**	**1.17**	**1.18**
	3.22	3.24	3.21	3.49	3.17	4.25	3.56
3	**1.09**	**1.09**	**1.12**	**1.21**	**1.02**	**1.08**	**1.26**
	3.59	3.59	3.53	3.79	3.58	4.09	4.14
4	**1.25**	**1.25**	**1.27**	**1.38**	**1.25**	**1.01**	**1.36**
	4.18	4.15	4.15	4.48	4.28	3.79	4.57
5	**1.41**	**1.41**	**1.45**	**1.59**	**1.36**	**1.24**	**1.55**
	4.85	4.86	4.82	5.34	4.79	4.52	5.30
6	**1.48**	**1.47**	**1.45**	**1.58**	**1.43**	**1.48**	**1.62**
	5.13	5.09	4.86	5.35	5.09	5.50	5.60
7	**1.54**	**1.55**	**1.60**	**1.69**	**1.43**	**1.44**	**1.62**
	5.36	5.39	5.48	5.70	5.13	5.28	5.62
8	**1.66**	**1.67**	**1.70**	**1.84**	**1.55**	**1.57**	**1.81**
	5.62	5.64	5.57	6.09	5.41	5.74	6.10
9	**1.79**	**1.79**	**1.85**	**1.91**	**1.76**	**1.66**	**1.89**
	5.79	5.80	5.84	6.02	5.98	5.61	6.06
Value	**2.20**	**2.19**	**2.24**	**2.34**	**1.98**	**1.79**	**2.32**
	6.46	6.45	6.51	6.79	5.96	5.10	6.72
V-G	**1.55**	**1.54**	**1.53**	**1.62**	**1.23**	**0.94**	**1.61**
	6.13	6.11	5.96	6.21	4.70	2.82	6.46
	***	***	***	***	***	***	***

Table 2.5: The Investment and Financing Flexibility of the Book-to-Market deciles

Table 2.5 presents the average measures of the key firm level variables, including the depreciation charge ratio, the rental expense ratio, and the disinvestment ratio, operating leverage, the efficiency ratio, and the net payout ratio, of the equally weighted portfolios of stocks sorted by the value of the Book-to-Market ratio as of 31st December of year t-1 in ascending order. Ten portfolios with equal number of stocks are composed and positions (long and short) are taken at the beginning of July year t and held until June year t+1. V-G represents the difference in the mean measures of the value stocks (i.e. the portfolio with the highest ranking in the Book-to-Market ratio) and growth stocks (i.e. the portfolio with the lowest ranking in the Book-to-Market ratio). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) from 1972 to 2006. Stocks are required to have a minimum of 36 months of non-negative book value of equity. For the construction of these variables, refer to Table 2.2.

BM decile	Depreciation charge ratio (%)	Rental expense ratio (%)	Disinvestment ratio (%)	Operating leverage	Efficiency ratio (%)	Net payout ratio (%)
	(1)	(2)	(3)	(4)	(5)	(6)
Growth	23.57	17.13	1.57	1.28	76.24	14.03
2	20.30	13.11	1.69	1.30	74.10	10.54
3	18.25	10.55	2.03	1.33	71.11	13.36
4	17.27	9.14	2.38	1.43	74.08	14.01
5	16.52	8.77	2.40	1.54	66.88	15.34
6	15.98	8.68	2.77	1.65	70.81	15.32
7	15.80	8.64	2.71	1.76	68.98	15.13
8	15.61	8.73	2.85	1.90	67.77	13.25
9	15.13	8.75	3.13	2.29	62.59	10.22
Value	14.26	8.04	3.23	3.30	57.94	3.40
V-G	-9.31	-9.08	1.66	2.02	-18.29	-10.63

Table 2.6: Investment Irreversibility and the Value-Growth Trading Strategy

Table 2.6 presents the return to the value-growth trading strategy in the subsamples by investment irreversibility. The portfolio formation is described in Table 2.4. The three proxies for investment irreversibility, i.e. the depreciation charge ratio, the rental expense ratio, and the disinvestment ratio, are described in Table 2.2. The averages of these measures of investment irreversibility for the Book-to-Market portfolios and the difference in these measures of the value and growth portfolios are also presented. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) from 1972 to 2006. Stocks are required to have a minimum of 36 months of non-negative book value of equity.

A. Investment irreversibility measured by depreciation charge ratio

Panel A	Returns (%)			Depreciation charge ratio (%)		
BM decile	High	Medium	Low	High	Medium	Low
Growth	**0.58**	**0.88**	**0.75**	**38.88**	**18.20**	**9.69**
	1.29	2.59	2.73			
2	**0.97**	**1.01**	**0.95**	**37.24**	**17.66**	**10.12**
	2.35	3.25	3.38			
3	**1.17**	**1.25**	**1.07**	**37.22**	**17.30**	**10.16**
	2.87	4.20	4.09			
4	**1.28**	**1.24**	**1.27**	**37.32**	**17.18**	**10.01**
	3.34	4.25	4.81			
5	**1.51**	**1.31**	**1.29**	**36.51**	**16.89**	**9.98**
	3.97	4.66	4.97			
6	**1.63**	**1.38**	**1.45**	**36.51**	**16.86**	**9.83**
	4.11	4.95	5.41			
7	**1.72**	**1.55**	**1.42**	**36.01**	**16.89**	**9.82**
	4.55	5.36	5.45			
8	**1.75**	**1.72**	**1.51**	**35.22**	**16.90**	**9.75**
	4.65	5.82	5.21			
9	**1.96**	**1.90**	**1.69**	**35.73**	**17.02**	**9.56**
	5.14	6.09	5.82			
Value	**2.57**	**2.08**	**2.13**	**35.30**	**16.90**	**9.12**
	6.48	5.95	6.07			
V-G	**2.00**	**1.19**	**1.38**	**-3.58**	**-1.31**	**-0.56**
	6.82	4.17	5.42			
	***	***	***			

In Panel A, the stocks are required to have available data to calculate the depreciation charge ratio. The first three columns present the returns to the Book-to-Market deciles and to the long-short portfolio, while the last three columns present the corresponding average depreciation charge ratios, for each subsample of high (top 30%), medium (middle 40%)

and low (bottom 30%) depreciation charge ratios. Panels B and C repeat Panel A with the depreciation charge ratio being replaced with the rental expense ratio and the disinvestment ratio respectively. The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether a portfolio's return is different from zero. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

B. Investment irreversibility measured by rental expense ratio

	Returns (%)			Rental expense ratio (%)		
BM decile	High	Medium	Low	High	Medium	Low
Growth	**0.75**	**0.76**	**0.77**	**45.33**	**11.11**	**2.72**
	1.68	2.05	2.59			
2	**0.96**	**1.17**	**1.09**	**41.03**	**10.48**	**2.80**
	2.39	3.27	3.78			
3	**1.06**	**1.28**	**1.17**	**41.52**	**9.70**	**2.79**
	2.68	3.89	4.28			
4	**1.26**	**1.30**	**1.30**	**40.14**	**9.74**	**2.73**
	3.41	4.05	4.83			
5	**1.55**	**1.59**	**1.22**	**40.96**	**9.87**	**2.62**
	4.02	5.16	4.59			
6	**1.51**	**1.56**	**1.33**	**40.01**	**9.86**	**2.52**
	4.05	4.89	5.10			
7	**1.66**	**1.55**	**1.60**	**40.96**	**9.80**	**2.48**
	4.72	5.15	5.89			
8	**1.73**	**1.67**	**1.65**	**40.01**	**9.91**	**2.47**
	4.73	5.21	5.98			
9	**1.98**	**1.79**	**1.89**	**40.61**	**9.62**	**2.45**
	5.30	5.52	6.32			
Value	**2.44**	**2.06**	**2.26**	**39.62**	**9.46**	**2.37**
	6.11	5.83	6.62			
V-G	**1.68**	**1.30**	**1.49**	**-5.71**	**-1.65**	**-0.35**
	5.24	4.50	5.53			
	***	***	***			

C. Investment irreversibility measured by proceeds from fixed asset sale

BM decile	Returns (%) High	Returns (%) Medium	Returns (%) Low	Disinvestment ratio (%) High	Disinvestment ratio (%) Medium	Disinvestment ratio (%) Low
Growth	**0.98**	**0.71**	**0.66**	**16.83**	**1.92**	**0.00**
	2.63	1.90	1.59			
2	**1.21**	**1.11**	**1.28**	**16.00**	**2.07**	**0.00**
	3.61	3.30	3.27			
3	**1.32**	**1.32**	**1.30**	**15.80**	**2.17**	**0.00**
	4.15	4.09	3.71			
4	**1.52**	**1.37**	**1.43**	**14.94**	**2.18**	**0.00**
	4.83	4.38	4.33			
5	**1.54**	**1.44**	**1.71**	**15.50**	**2.18**	**0.00**
	5.03	4.78	5.32			
6	**1.56**	**1.60**	**1.65**	**15.36**	**2.30**	**0.00**
	4.86	5.30	5.06			
7	**1.71**	**1.76**	**1.70**	**16.07**	**2.25**	**0.00**
	5.28	5.88	5.62			
8	**1.72**	**1.86**	**1.70**	**15.89**	**2.18**	**0.02**
	5.14	6.33	5.22			
9	**2.09**	**1.96**	**2.10**	**15.64**	**2.22**	**0.02**
	6.08	6.43	6.09			
Value	**2.53**	**2.13**	**2.32**	**17.26**	**2.11**	**0.02**
	6.73	6.31	5.93			
V-G	**1.56**	**1.42**	**1.66**	**0.43**	**0.19**	**0.02**
	5.34	5.14	5.34			
	***	***	***			

Table 2.7: Operating Leverage and the Value-Growth Trading Strategy

Table 2.7 presents the return to the value-growth trading strategy in the subsamples by operating leverage. The portfolio formation is described in Table 2.4. The measurement of operating leverage is described in Table 2.2. The average operating leverage for the Book-to-Market portfolios and the difference in this measure of the value and growth portfolios are also presented. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) from 1972 to 2006. Stocks are required to have a minimum of 36 months of non-negative book value of equity.

	Returns (%)			Operating leverage		
BM decile	High	Medium	Low	High	Medium	Low
Growth	**0.99**	**0.69**	**0.74**	**7.04**	**1.50**	**0.79**
	2.50	2.13	2.11			
2	**1.25**	**0.94**	**0.94**	**6.15**	**1.55**	**0.79**
	3.37	3.07	2.88			
3	**1.49**	**1.06**	**0.83**	**6.97**	**1.59**	**0.79**
	4.32	3.62	2.85			
4	**1.45**	**1.24**	**1.09**	**6.40**	**1.61**	**0.71**
	4.57	4.25	3.92			
5	**1.49**	**1.27**	**1.19**	**6.84**	**1.68**	**0.71**
	4.53	4.38	4.18			
6	**1.44**	**1.36**	**1.31**	**7.32**	**1.76**	**0.70**
	4.28	4.50	4.55			
7	**1.65**	**1.52**	**1.24**	**7.08**	**1.75**	**0.66**
	5.15	5.30	4.32			
8	**1.92**	**1.45**	**1.46**	**7.69**	**1.75**	**0.65**
	5.69	5.28	5.21			
9	**2.15**	**1.55**	**1.44**	**8.48**	**1.81**	**0.61**
	6.26	5.45	5.15			
Value	**2.04**	**1.83**	**1.86**	**9.76**	**1.89**	**0.62**
	5.32	5.75	5.70			
V-G	**1.05**	**1.15**	**1.12**	**2.71**	**0.38**	**-0.17**
	3.48	4.48	3.77			
	***	***	***			

The stocks are required to have available data to calculate operating leverage. The first three columns present the returns to the Book-to-Market deciles and to the long-short portfolio, while the last three columns present the corresponding average operating leverage ratios, for each subsample of high (top 30%), medium (middle 40%) and low (bottom 30%) operating leverage. The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether a portfolio's return is different from zero. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 2.8: Excess Capacity and the Value-Growth Trading Strategy

Table 2.8 presents the return to the value-growth trading strategy in the subsamples by excess capacity. The portfolio formation is described in Table 2.4. The measurement of excess capacity is described in Table 2.2. The average efficiency ratio for the Book-to-Market portfolios and the difference in this measure of the value and growth portfolios are also presented. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) from 1972 to 2006. Stocks are required to have a minimum of 36 months of non-negative book value of equity.

The stocks are required to have available data to calculate the efficiency ratio. The first three columns present the returns to the Book-to-Market deciles and to the long-short portfolio, while the last three columns present the corresponding average efficiency ratio, for each subsample of high (top 30%), medium (middle 40%), and low (bottom 30%) efficiency ratios. The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether a portfolio's return is different from zero. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	Returns (%)			Efficiency ratio (%)		
BM decile	High	Medium	Low	High	Medium	Low
Growth	**0.95**	**0.85**	**1.36**	**98.35**	**65.64**	**34.07**
	2.54	2.68	1.87			
2	**1.06**	**1.25**	**0.86**	**98.61**	**64.45**	**34.05**
	3.37	3.75	1.80			
3	**1.03**	**1.32**	**1.24**	**99.56**	**67.52**	**33.45**
	3.55	4.45	2.63			
4	**0.69**	**0.76**	**1.57**	**99.76**	**67.32**	**34.60**
	2.28	2.48	4.70			
5	**1.27**	**1.10**	**1.49**	**98.60**	**65.91**	**32.19**
	4.41	3.48	4.34			
6	**1.47**	**1.38**	**1.52**	**98.61**	**66.83**	**31.93**
	4.70	4.34	3.30			
7	**1.54**	**1.25**	**1.39**	**98.50**	**67.28**	**31.58**
	4.46	3.98	3.77			
8	**1.60**	**1.40**	**1.99**	**98.73**	**68.71**	**29.43**
	5.20	4.59	4.47			
9	**1.64**	**1.70**	**1.68**	**99.18**	**66.89**	**31.06**
	4.57	4.80	3.49			
Value	**1.84**	**1.77**	**1.77**	**99.07**	**65.58**	**30.06**
	4.92	4.08	3.26			
V-G	**0.89**	**0.91**	**0.41**	**0.71**	**-0.06**	**-4.01**
	2.08	1.97	0.48			
	**	**				

Table 2.9: Financial Constraints and the Value-Growth Trading Strategy

Table 2.9 presents the return to the value-growth trading strategy in the subsamples by financial constraints. The portfolio formation is described in Table 2.4. The measurement of the net payout ratio, which is proxied for financial constraints, is described in Table 2.2. The average net payout ratio for the Book-to-Market portfolios and the difference in this measure of the value and growth portfolios are also presented. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) from 1972 to 2006. Stocks are required to have a minimum of 36 months of non-negative book value of equity.

The stocks are required to have available data to calculate the net payout ratio. The first three columns present the returns to the Book-to-Market deciles and to the long-short portfolio, while the last three columns present the corresponding average net payout ratio, for each subsample of high (top 30%), medium (middle 40%), and low (bottom 30%) net payout ratios. The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether a portfolio's return is different from zero. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	Returns (%)			Net payout ratio (%)		
BM decile	High	Medium	Low	High	Medium	Low
Growth	**0.54**	**0.91**	**0.84**	**77.93**	**10.78**	**-23.61**
	1.64	2.43	2.10			
2	**1.29**	**1.21**	**1.09**	**67.37**	**12.15**	**-28.63**
	4.24	3.71	2.86			
3	**1.29**	**1.31**	**1.19**	**65.31**	**12.81**	**-23.54**
	4.66	4.23	3.23			
4	**1.32**	**1.59**	**1.43**	**65.79**	**12.59**	**-25.23**
	5.08	5.21	3.97			
5	**1.47**	**1.73**	**1.42**	**66.25**	**12.57**	**-28.15**
	5.50	5.74	3.96			
6	**1.52**	**1.77**	**1.57**	**64.64**	**11.51**	**-23.57**
	5.92	5.94	4.38			
7	**1.56**	**1.65**	**1.58**	**67.28**	**10.26**	**-22.16**
	5.98	5.53	4.36			
8	**1.57**	**1.99**	**1.66**	**67.08**	**9.59**	**-19.76**
	5.80	6.40	4.76			
9	**1.66**	**2.13**	**1.96**	**77.33**	**8.05**	**-21.67**
	5.97	6.82	5.36			
Value	**2.04**	**2.39**	**2.27**	**80.56**	**6.36**	**-19.03**
	6.64	6.72	5.79			
V-G	**1.50**	**1.48**	**1.44**	**2.63**	**-4.42**	**4.57**
	6.12	5.82	4.43			
	***	***	***			

Table 2.10: The Value Premium and Firms' Investment Characteristics

Table 2.10 presents the results of the regressions of risk adjusted returns on the Book-to-Market ratio and other firm level variables using the framework of Avramov and Chordia (2006). The sample covers non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market during the period from 1972 to 2006. Stocks are required to have a minimum of 36 months of non-negative book value of equity.

This table uses the Fama and French model as the base model in the general model specification described in equation 2.1 (p. 68). The part of returns unexplained by the asset pricing model in equation 2.1 is regressed against the Book-to-Market ratio in a cross sectional regression to assess the explanatory power of the model with regards to the value premium, i.e. the positive relationship between current stock returns and the Book-to-Market ratio. Size, cumulative returns, and stock turnovers are included in the cross sectional regression to control for the predictability of stock returns with regards to these variables. The regression is described in equation 2.2 (p. 69). The construction of the key variables in stage two is described in Table 2.2. Their transformation is described in section 2.4.2 (p. 65).

The coefficients and the autocorrelation and heteroskedasticity corrected two tailed t-statistics following the Newey and West (1987) method to test whether a coefficient is different from zero. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively. The coefficients are multiplied by 100.

The settings of the regressions in different scenarios are as follows:

A. Overall sample

- Scenario 1: Returns are not adjusted for risks; hence no stage one regression is run. In stage two, the regression is described in equation 2.2.
- Scenario 2: Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.

	Panel A - Overall sample				Panel B – Sample with investment irreversibility measures							
	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6	
Book-to-Market	0.31	***	0.19	***	0.21	***	0.13	**	0.18	***	0.08	
	4.04		3.19		3.37		2.44		2.99		1.64	
Control variables												
Size	-0.15	***	-0.09	***	-0.10	***	-0.07	**	-0.09	**	-0.05	
	-2.73		-2.68		-2.66		-2.15		-2.40		-1.46	
Return 2_3	0.78	***	0.93	***	1.02	***	0.91	***	1.00	***	0.88	***
	3.05		4.08		4.31		3.72		4.41		3.42	
Return 4_6	0.71	***	0.62	***	0.69	***	0.58	***	0.64	***	0.63	***
	3.07		3.19		3.49		2.96		3.23		3.26	
Return 7_12	0.51	***	0.47	***	0.47	***	0.48	***	0.50	***	0.57	***
	3.07		3.26		3.34		3.49		3.53		4.63	
Turnover_NASDAQ	-0.08		-0.09		-0.08		-0.08		-0.10	*	-0.10	**
	-0.97		-1.60		-1.23		-1.37		-1.81		-2.06	
Turnover_NYSE AMEX	-0.08		-0.13	***	-0.13	***	-0.12	***	-0.12	**	-0.11	***
	-1.16		-2.68		-2.58		-2.60		-2.36		-2.66	
NASDAQ	0.10		0.19		0.23	*	0.23	**	0.18		0.18	*
	0.75		1.47		1.89		1.98		1.47		1.90	
Intercept	0.89	***	0.04		0.07		0.13	*	0.04		0.10	
	2.80		0.50		0.83		1.82		0.53		1.50	
Adjusted R^2	4.43%		2.18%		2.19%		2.19%		2.15%		2.34%	
Average monthly observations	2,360		2,360		1,845		1,845		1,845		1,845	

B. The sample with available data to calculate the investment irreversibility measures

The investment irreversibility measures include the depreciation charge ratio, the rental expense ratio, and the disinvestment ratio, of investment irreversibility. For the construction of these variables, refer to Table 2.1.

- Scenario 3: Repeating Scenario 2 for the subsample with available data to construct investment irreversibility measures. Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 4: Returns are adjusted for risks using the conditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. The variable $Firm_{j,t-1}$ refers to the investment irreversibility measures. In stage two, the regression is described in equation 2.2.

- Scenario 5: Returns are adjusted for risks using the conditional Fama and French model on the business cycle variable. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 6: Returns are adjusted for risks using the conditional Fama and French model as described in equation 2.1. The variable $Firm_{j,t-1}$ refers to the investment irreversibility measures. In stage two, the regression is described in equation 2.2.

Panel C – Sample with operating leverage measure								
	Scenario 7		Scenario 8		Scenario 9		Scenario 10	
Book-to-Market	0.19	***	0.15	***	0.16	***	0.13	***
	3.11		2.73		2.86		2.57	
Control variables								
Size	-0.06	**	-0.06	**	-0.04		-0.02	
	-2.15		-1.97		-1.57		-0.80	
Return 2_3	1.23	***	1.25	***	1.24	***	1.27	***
	5.03		5.13		5.17		5.15	
Return 4_6	0.61	***	0.64	***	0.62	***	0.72	***
	3.00		3.28		3.18		3.82	
Return 7_12	0.51	***	0.53	***	0.53	***	0.57	***
	3.20		3.42		3.49		3.82	
Turnover_NASDAQ	-0.08		-0.07		-0.11	**	-0.11	***
	-1.53		-1.37		-2.20		-2.58	
Turnover_NYSE AMEX	-0.15	***	-0.15	***	-0.14	***	-0.14	***
	-3.11		-3.22		-3.11		-3.15	
NASDAQ	0.30	*	0.27		0.26		0.27	*
	1.64		1.60		1.54		1.78	
Intercept	0.04		0.06		0.00		-0.01	
	0.49		0.81		0.03		-0.11	
Adjusted R^2	2.34%		2.34%		2.29%		2.36%	
Average monthly observations	1,672		1,672		1,672		1,672	

C. The sample with available data to calculate operating leverage

For the construction of this variable, refer to Table 2.1.

- Scenario 7: Repeating Scenario 2 for the subsample with available data to construct operating leverage. Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.

- Scenario 8: Returns are adjusted for risks using the conditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. The variable $Firm_{j,t-1}$ refers to operating leverage. In stage two, the regression is described in equation 2.2.
- Scenario 9: Returns are adjusted for risks using the conditional Fama and French model on the business cycle variable. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 10: Returns are adjusted for risks using the conditional Fama and French model as described in equation 2.1. The variable $Firm_{j,t-1}$ refers to operating leverage. In stage two, the regression is described in equation 2.2.

Panel D – Sample with efficiency measure								
	Scenario 11		Scenario 12		Scenario 13		Scenario 14	
Book-to-Market	0.19	***	0.18	***	0.15	***	0.14	***
	3.16		3.13		2.69		2.62	
Control variables								
Size	-0.09	***	-0.09	***	-0.08	**	-0.08	**
	-2.70		-2.60		-2.42		-2.33	
Return 2_3	0.95	***	0.96	***	0.90	***	0.89	***
	4.17		4.19		4.13		4.12	
Return 4_6	0.62	***	0.61	***	0.58	***	0.56	***
	3.20		3.15		3.12		3.00	
Return 7_12	0.46	***	0.47	***	0.48	***	0.47	***
	3.23		3.25		3.46		3.46	
Turnover_NASDAQ	-0.09	*	-0.10	*	-0.12	***	-0.12	***
	-1.64		-1.64		-2.46		-2.44	
Turnover_NYSE AMEX	-0.13	***	-0.14	***	-0.13	***	-0.13	***
	-2.68		-2.73		-2.57		-2.62	
NASDAQ	0.18		0.19		0.14		0.15	
	1.46		1.51		1.17		1.21	
Intercept	0.04		0.05		0.02		0.02	
	0.52		0.55		0.23		0.29	
Adjusted R^2	2.18%		2.16%		2.14%		2.12%	
Average monthly observations	2,348		2,348		2,348		2,348	

D. The sample with available data to calculate the efficiency ratio

For the construction of this variable, refer to Table 2.1.

- Scenario 11: Repeating Scenario 2 for the subsample with available data to construct the efficiency ratio. Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.

- Scenario 12: Returns are adjusted for risks using the conditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. The variable $Firm_{j,t-1}$ refers to the efficiency ratio. In stage two, the regression is described in equation 2.2.
- Scenario 13: Returns are adjusted for risks using the conditional Fama and French model on the business cycle variable. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 14: Returns are adjusted for risks using the conditional Fama and French model as described in equation 2.1. The variable $Firm_{j,t-1}$ refers to the efficiency ratio. In stage two, the regression is described in equation 2.2.

Panel E – Sample with financial constraint measure								
	Scenario 15		Scenario 16		Scenario 17		Scenario 18	
Book-to-Market	0.19	***	0.17	***	0.15	***	0.10	**
	3.21		3.11		2.69		1.97	
Control variables								
Size	-0.09	***	-0.08	***	-0.07	**	-0.07	**
	-2.54		-2.52		-2.19		-2.16	
Return 2_3	0.88	***	0.82	***	0.82	***	0.78	***
	3.92		3.62		3.79		3.53	
Return 4_6	0.64	***	0.67	***	0.64	***	0.68	***
	3.22		3.45		3.33		3.64	
Return 7_12	0.51	***	0.53	***	0.55	***	0.61	***
	3.56		3.72		3.97		4.55	
Turnover_NASDAQ	-0.09		-0.10	**	-0.13	***	-0.11	***
	-1.59		-2.02		-2.64		-2.63	
Turnover_NYSE AMEX	-0.14	***	-0.13	***	-0.13	***	-0.12	***
	-2.70		-2.63		-2.65		-2.67	
NASDAQ	0.18		0.17		0.15		0.20	*
	1.44		1.39		1.21		1.77	
Intercept	0.04		0.07		0.01		0.05	
	0.45		0.84		0.14		0.62	
Adjusted R^2	2.15%		2.09%		2.13%		2.09%	
Average monthly observations	2,173		2,173		2,172		2,172	

E. The sample with available data to calculate the financial constraint measure.

The net payout ratio is used to proxy for firms' financial constraints. For the construction of this variable, refer to Table 2.1.

- Scenario 15: Repeating Scenario 2 for the subsample with available data to construct the net payout ratio. Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 16: Returns are adjusted for risks using the conditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. The variable $Firm_{j,t-1}$ refers to the net payout ratio. In stage two, the regression is described in equation 2.2.
- Scenario 17: Returns are adjusted for risks using the conditional Fama and French model on the business cycle variable. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 18: Returns are adjusted for risks using the conditional Fama and French model as described in equation 2.1. The variable $Firm_{j,t-1}$ refers to the net payout ratio. In stage two, the regression is described in equation 2.2.

F. The sample with available data to calculate the financial constraint and investment irreversibility measures

For the construction of these variables, refer to Table 2.1.

- Scenario 19: Repeating Scenario 2 for the subsample with available data to construct the net payout ratio and the three investment irreversibility measures. Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 20: Returns are adjusted for risks using the conditional Fama and French model. The regression is described in equation 2.1 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. The variable $Firm_{j,t-1}$ refers to the net

payout ratio and the three investment irreversibility measures. In stage two, the regression is described in equation 2.2.

- Scenario 21: Returns are adjusted for risks using the conditional Fama and French model on the business cycle variable. The regression is described in equation 2.1 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 2.2.
- Scenario 22: Returns are adjusted for risks using the conditional Fama and French model as described in equation 2.1. The variable $Firm_{j,t-1}$ refers to the net payout ratio and the three investment irreversibility measures. In stage two, the regression is described in equation 2.2.

Panel F – Sample with investment irreversibility and financial constraint measures								
	Scenario 19		Scenario 20		Scenario 21		Scenario 22	
Book-to-Market	0.21	***	0.19	***	0.19	***	0.07	
	3.29		3.30		3.15		1.60	
Control variables								
Size	-0.10	***	-0.09	***	-0.08	**	-0.02	
	-2.61		-2.53		-2.13		-0.80	
Return 2_3	1.00	***	0.91	***	0.98	***	0.84	***
	4.26		3.90		4.35		3.09	
Return 4_6	0.71	***	0.71	***	0.71	***	0.80	***
	3.52		3.63		3.54		3.97	
Return 7_12	0.51	***	0.55	***	0.55	***	0.61	***
	3.67		3.91		3.93		5.13	
Turnover_NASDAQ	-0.09		-0.09		-0.11	*	-0.09	**
	-1.33		-1.54		-1.93		-2.09	
Turnover_NYSE AMEX	-0.14	***	-0.14	***	-0.13	***	-0.12	***
	-2.77		-2.64		-2.56		-2.97	
NASDAQ	0.22	*	0.20	*	0.18		0.19	**
	1.86		1.74		1.51		2.16	
Intercept	0.05		0.08		0.02		0.08	
	0.65		0.98		0.26		1.30	
Adjusted R^2	2.15%		2.11%		2.11%		2.57%	
Average monthly observations	1,689		1,689		1,689		1,689	

Chapter 3 – Firms' Investment, Financing, and the Momentum Trading Strategy

3.1. Introduction

A technique widely used in technical analysis is price channel based on the idea that successive price changes are dependent (Brock et al., 1992). The profitability of a trading strategy that buys past winners and sells past losers over a horizon of six months was documented in the academic literature as early as in Levy (1967). Later on, Jensen and Bennington (1970) conceded that this trading rule was not better than a simple buy-and-hold strategy. Jegadeesh and Titman (1993) revisit this phenomenon and report that the trading strategy does generate statistically and economically significant returns. The success of this strategy (which is referred to as the momentum trading strategy) implies that the information about past stock returns can be used to generate excess returns, a violation of the weak form market efficiency, hence also known as "momentum anomaly".

There is abundant evidence confirming the profitability of the momentum trading strategy (or the momentum profit) in the literature. Rouwenhorst (1998, 1999) reports that the momentum profit can be found in several international markets. In the U.S. market, Grundy and Martin (2001, p.1) report the momentum profit to be "remarkably stable across subperiods of the entire post-1926 era" after controlling for the time-varying and cross-sectional time variation in risks. In explaining the momentum profit, Jegadeesh and Titman (1993), argue that the momentum trading strategy does not appear to involve a high level of risks. The momentum profit exists even when returns are adjusted for risks using the CAPM. Fama and French (1996) concede that momentum is the only anomaly that cannot be explained by their otherwise successful three factor model.

Several authors, including Daniel et al. (1998), Barberis et al. (1998), and Hong and Stein (1999), attempt to explain the momentum profit using psychological biases. Daniel et al. (1998) attribute the momentum profit to investor over-reaction to prior private signals whereas Barberis et al. (1998) and Hong and Stein (1999) attribute it to investor under-reaction to news. So far the evidence in support of these models is limited and mixed. Hong et al. (2000) find the supportive evidence for Hong and Stein (1999) model. Kausar and Taffler (2005) support the Daniel et al. (1998) model but not the Barberis et al. (1998) and the Hong and Stein (1999) models. Chan et al. (2004) partially support the Barberis et al. (1998) model.

Chordia and Shivakumar (2002) report that the momentum profit is positive in the U.S. market only during the expansionary period, a necessary but not the sufficient condition for a risk based explanation for the momentum profit. Cooper et al. (2004) report that the momentum profit in the U.S. market is positive and significant only during the periods of stock market upturns. They argue that this result is consistent with the prediction of several behavioural models as the stock market upturns and downturns measure the investor sentiment cycle. However, it is arguable that the stock market upturns and downturns can be a measure of different macroeconomic states as in Griffin et al. (2003)[40]. On the other hand, Griffin et al. (2003) find that the momentum profit is positive and significant in several international markets in both economic upturns and downturns.

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[40] Cochrane (1991) finds some evidence that some variables used to describe the business cycle can forecast the aggregate stock market return, and the aggregate stock market return can forecast future economic activities.

Some studies examine whether the momentum profit can be explained by firms' investments. In the Berk et al. (1999) model, firms possess assets-in-place and growth options. They also prefer low risk projects than high risk projects. In the Johnson (2002) model, the momentum profit arises due to the risk attached to expected growth. When calibrated, these models generate the momentum profits that persist longer than the profit documented in the existing empirical studies. Empirically, Liu and Zhang (2008) document that half of the momentum profit can be explained by the growth rate risk proxied by the growth rate of industrial production.

There is also a growing literature on the relationship between stock prices and subsequent investments. Morck et al. (1990) provide a comprehensive analysis on different channels through which stock prices could affect firms' investments. Recent studies extend the evidence in Morck et al. (1990). In Baker et al. (2003), equity dependent firms, i.e. firms that need to rely on external equities to finance their investments, would under-invest when their stocks are undervalued. Such firms would have to issue equities at a price below the fundamental value to finance for all the profitable investments in the pipeline. In Polk and Sapienza (2009), if stocks are overpriced according to their existing level of investments, managers who hold a short term view might invest further to cater investors' sentiment and maintain the recent stock price trend. Bakke and Whited (2010) support the proposition that stock prices contain private information that managers use when making investment decisions, particularly among less financially constrained firms. Finally, Ovtchinnikov and McConnell (2009) concede that increasing stock prices reflects the better quality of growth opportunities.

In short, the literature suggests that firms' investments are related to their risks, which might predict future stock returns. On the other hand, stock prices are likely to influence firms' investments. Hence, it is possible that past stock prices are related to future stock prices through firms' current investments. There is a gap to extend the research on firms' investments and the momentum profit in light of the recent studies on stock prices and firms' investments. This chapter aims to fill in this gap by examining whether the momentum profit can be explained by the investment patterns of past winners and past losers.

This chapter argues that there are three processes that can contribute to the profitability of the momentum trading strategy based on the deviation in the investment patterns of past winners and past losers. First, according to Ovtchinnikov and McConnell (2009), stock prices reflect investment opportunities; and the positive association between stock prices and investments is a by-product of their positive relationship with investment opportunities[41]. Accordingly, past winners would invest more than past losers because they have better investment opportunities. According to Hahn and Lee (2009), among financially constrained firms, those with higher debt capacity are more exposed to the credit multiplier effect of Kiyotaki and Moor (1997), and this exposure is priced. Therefore, among financially constrained firms, as past winners invest more, they are more exposed to the credit multiplier effect, hence are riskier and generate higher returns.

On the other hand, along the lines of the equity issuance channel in Baker et al. (2003), past winners would invest more than past losers as they can issue

[41] This is consistent with the pricing of growth opportunities and why the firms with higher (lower) growth opportunities trade at higher (lower) price.

more overpriced shares to finance their investments that would not otherwise be undertaken. As investors welcome the new efficient investments, past winners might be further mispriced, and the return continuation might be maintained. Alternatively, along the lines of Polk and Sapienza (2009), if past winners and past losers are mispriced due to investors misjudging their investments, past winners might continue to invest to maintain their upward price movement, hence the return continuation.

This chapter contributes in enhancing the understanding of the relationship between corporate policy decisions and the stock price momentum and supports the investing community in making investment decisions. This is the first study, to the author’s knowledge, to suggest an explanation for the momentum profit using the concept of the credit multiplier effect of Kiyotaki and Moor (1997). It also extends the literature on the mispricing of past winners and losers by attributing it to investors’ interpretation of their investments. Along this line, the chapter suggests two explanations using the share issuance channel based on Baker et al. (2003) and the catering theory based on Polk and Sapienza (2009).

The propositions in this chapter can be reconciled with several findings documented in the literature. For example, the reported momentum profit among firms that do not pay dividends (Asem, 2009), have low credit ratings (Avramov et al., 2007), are exposed to a high financial distress risk (Agarwal and Taffler, 2008) could be reconciled with the evidence of the momentum profit in the financially constrained firms. This pattern is consistent with an explanation using the credit multiplier effect based on Ovtchinnikov and McConnell (2009) / Hahn and Lee

(2009). It is also consistent with an explanation using the share issuance channel based on Baker et al. (2003).

Furthermore, often during economic upturns, the discount rate is lower (see, e.g. Zhang, 2005), making more investment projects worthwhile. One can expect a more pronounced deviation in the investment patterns of past winners and past losers during economic upturns than during downturns. External funds also tend to be available more readily during economic upturns. Hence both the above mentioned processes suggest a more pronounced momentum profit during economic upturns and among financially constrained firms, resolving the so called "puzzle" in Avramov et al. (2007).

Consistent with the literature, this chapter finds evidence of the momentum profit in non-financial, non-utilities firms listed on NYSE, AMEX, and NASDAQ from 1972 to 2006. It also finds that past winners invest more than past losers and the investment gap is higher during economic upturns than during downturns. The investment gap is also higher, with a positive speed of change among firms with high financial constraints[42]. It is lower with a close to zero speed of change among firms with low financial constraints. The momentum profit is positive and significant among firms with high financial constraints and insignificant among firms with low financial constraints. These observations are consistent with an explanation using the credit multiplier effect based on Ovtchinnikov and

[42] Firms at the bottom 30% of the overall sample in terms of the net payout ratio are classified as those with high financial constraints. Firms at the top 30% are classified as those with low financial constraints. The remaining firms are classified as those with medium financial constraints.

McConnell (2009) and Hahn and Lee (2009), and an explanation based on the share issuance channel in Baker et al. (2003).

The subsample with medium financial constraints generates a positive and significant momentum profit and has the investment gap with a positive speed of change. This evidence is consistent with an explanation based on the catering theory in Polk and Sapienza (2009). Different from the other two explanations, the catering theory does not require financial constraints as the sufficient condition, provided that firms are not too financially constrained to invest.

Finally, this chapter finds that cumulative returns can predict future returns even when controlling for risks using the unconditional Fama and French three factor model, evident for the momentum profit. The return predictability is weak when the betas are conditioned on firms’ financial constraints and the business cycle variable. Cumulative returns remain their predictability when the Fama and French model conditioned on firms’ investments is used to adjust returns for risks. It suggests that at least part of the information on firms’ investments is not relevant to the momentum profit through a risk-return channel. The momentum profit is explained when (a) controlling for risks using the Fama and French model conditioned on firms’ financial constraints and the business cycle variables, and (b) accounting for the interaction between the momentum profit and firms’ investments as suggested in the mispricing explanations based on Polk and Sapienza (2009) and Baker et al. (2003).

3.2. Literature Review

3.2.1. Literature Review on the Profitability of the Momentum Trading Strategy

In the literature, the success of the momentum trading strategy was first documented by Levy (1967). It was later questioned in Jensen and Bennington (1970). Motivated by the popularity of this trading strategy in the modern investment practice, and in light of the academic research on the strategies that employ the opposite courses of action at a longer time horizon[43], Jegadeesh and Titman (1993) revisit this strategy. They document the profitability of a hedging strategy that goes long in NYSE and AMEX stocks that have performed well in the last three to twelve months (i.e. past winners) and short in stocks that have performed badly (past losers). During the period from 1965 to 1989, this strategy delivers significant positive returns in the following three to twelve months. Since Jegadeesh and Titman (1993) revisit the profitability of the momentum trading strategy, they have inspired a significant amount of subsequent research.

The success of the momentum trading strategy has been considered as a challenge in the literature given that it does not appear to be riskier and is robust in numerous international markets outside the US. Jegadeesh and Titman (1993) do not find evidence that the momentum profit is due to a positive market beta of the hedge portfolio or a positive serial correlation of the factor mimicking portfolio. Fama and French (1996) report that their three factor model cannot explain the momentum profit.

[43] I.e. the contrarian investment strategy, documented in De Bondt and Thaler (1985).

Rouwenhorst (1998, 1999) finds that the price momentum exists in several markets outside the US. This is important evidence against the possibility that the result in Jegadeesh and Titman (1993) is due to U.S.-specific reasons. Rouwenhorst (1998) reports the momentum profit in twelve European markets during the period from 1978 to 1995. The momentum profit exists even when returns are adjusted for risks using (a) the international market factor, and (b) the international version of the SMB factor in the Fama and French three factor model (1993, 1996). Rouwenhorst (1999) also reports evidence of the momentum profit in emerging markets in different continents.

Aside from its documented robustness across markets, the momentum profit is evidently persistent over time. Jegadeesh and Titman (2001) update the evidence they first reported in their 1993 article on the U.S. market. The momentum profit is positive and significant during the nine years following the period originally examined in Jegadeesh and Titman (1993). More importantly, the economic significance of the momentum profit during the extended period is comparable to that during the period in the original study. According to Fama and French (2008), the momentum anomaly is the most robust anomaly among several anomalies examined. Grundy and Martin (2001) report that the momentum profit exists in several sub-periods back to 1926. These studies suggest that the success of the momentum trading strategy is not likely to be a product of data mining, given its robustness across the markets and over time.

The persistence of the momentum profit motivates several studies to investigate how investors can exploit it. The evidence on whether transaction costs can fully account for the persistence of the momentum profit is mixed. Lesmond et al. (2004) find that transaction costs can completely eliminate the momentum profit in the U.S. market as the strategy requires extensive trading, particularly among stocks that are prone to high transaction costs. Lesmond et al. (2004) suggest that the transaction cost estimates in Jegadeesh and Titman (1993) does not include the important components such as bid-ask spread, short sale costs, and taxes.

In another study, Korajczyk and Sadka (2004) report that although the transaction costs reduce the magnitude of the momentum profit, it is positive and significant even after accounting for these costs. Furthermore, their estimates show that from nearly 3% to over 30% of different types of hedge funds can make transaction cost adjusted profits from the momentum trading strategy. The transaction costs estimated in Korajczyk and Sadka (2004) are lower than in Lesmond et al. (2004), which explains for their higher momentum profits net of transaction costs.

Although the momentum profit is documented across different markets, studies on the impact of transaction costs on the momentum profit are concentrated on the U.S. market only. Given the size and the depth of the U.S. equity market compared to the international markets, the trading costs in other international markets should be higher than or equal to those in the U.S. market. Therefore, it is likely that transaction costs would considerably reduce the momentum profit, possibly to non-existence as Lesmond et al. (2004) suggest.

While it is important to acknowledge the role of transaction costs in explaining the robustness of the momentum profit, it is crucial to address the question of the sources of the momentum profit in the first place. According to Rouwenhorst (1998), the international evidence of the momentum profit suggests either (a) even a more serious problem of model misspecification, or (b) a systematic mispricing due to investors' irrationality. These two possibilities point towards different directions. The momentum profit could either be explained when returns are adjusted for risks appropriately, or when accounting for investors' psychological biases. The following sections provide a review on each of these sides.

Explanations for the Momentum Profit based on the Risk-Return Relationship

Fama and French (1996) concede that their three factor model cannot explain the momentum profit. Schwert (2003) reports that the momentum profit is even higher when returns are adjusted for risks using the Fama and French three factor model than using the CAPM. Ang et al. (2001) develop a downside risk factor that reflects the correlation of stock returns with the market return during downturns. They find that the momentum profit loads positively on this factor in a two factor model consisting of a market factor and a downside risk factor. However, the alpha estimated in their two factor model is still statistically significant, suggesting that their model cannot fully explain the momentum profit.

While Ang et al. (2001) focus on the impact of market downturns, several other studies examine the impact of the overall business cycle on the momentum profit. Chordia and Shivakumar (2002) document that the momentum profit varies across the business cycle, remains positive and significant during expansions and turns insignificant during contractions. Furthermore, they find that the momentum profit is driven by the strategy which ranks stocks on the basis of the returns predicted from the lagged macroeconomic variables. The authors conclude that the momentum profit is linked to common factors in the macro economy.

Griffin et al. (2003) extend the work of Chordia and Shivakumar (2002) to 16 international markets. Contrary to the evidence in Chordia and Shivakumar (2002), they find that the predicted returns from the lagged macroeconomic variables do not exhibit the momentum pattern, although the raw returns exhibit a strong momentum pattern. Furthermore, while using the unconditional macroeconomic model of Chen et al. (1986) to fit the momentum profit, Griffin et al. (2003) find that the fitted momentum profit is significantly different from the actual momentum profit. Also, the model fitness is well below that of the Fama and French three factor model reported in Fama and French (1996).

Finally, different from the evidence in Chordia and Shivakumar (2002) on the U.S. market's, Griffin et al. (2003) find that the momentum profit in the international markets is positive and significant in both economic upturns and downturns, a challenge to a risk based explanation for the momentum profit. Lakonishok et al. (1994), Petkova and Zhang (2005), and Lettau and Ludvigson (2001) argue that the necessary condition for the value premium to be driven by risks is that value stocks outperform growth stocks in good states, and under-perform in bad states of the business cycle. By the same token, Griffin et al. (2003) argue that the necessary condition for the momentum profit to be driven by risks is that it is positive during economic upturns and negative during economic downturns. Hence, they concede that the momentum profit is not driven by macroeconomic risks, given the evidence of the momentum profit in both states of the business cycle.

Some studies incorporate the macroeconomic information into the factor models to account for the riskiness of the momentum profit. Wu (2002) uses a conditional version of the Fama and French model in which the betas are conditioned on the macroeconomic variables. When adjusting the momentum profit for risks using this model, the alpha remains positive and significant, suggesting that the tested conditional Fama and French model cannot explain the momentum anomaly. However, Wu (2002) argues that using the asset pricing tests of Dumas and Solnik (1995) leads to a different conclusion, i.e. the Fama and French model conditioned on the macroeconomic variables can explain the momentum profit.

Similar to Wu (2002), Avramov and Chordia (2006) also examine the explanatory power of conditional asset pricing models. They also find that the unconditional Fama and French model cannot explain the momentum profit. Furthermore, several other factor models and their conditional versions cannot explain the momentum profit. It is explained only when returns are adjusted for risks using the Fama and French model with alpha conditioned on the macroeconomic variable and betas on size, Book-to-Market, and the macroeconomic variable. Hence, both Wu (2002) and Avramov and Chordia (2006) confirm the result in Chordia and Shivakumar (2002) that the momentum profit is related to the business cycle. Also, to explain the momentum profit, it is important to adjust returns for risks using asset pricing models that contain conditional information on the macro economy.

Motivated by the existing empirical evidence on its relationship with the business cycle, Avramov et al. (2007) investigate whether the momentum profit is related to credit risks, on the basis that credit risks vary across the business cycle.

They find that the momentum profit is positive and significant only among firms with low credit ratings, and does not exist among firms with high credit ratings. The momentum profit in the high credit risk firms survives the adjustment for risks using the CAPM and the Fama and French three factor model. Their findings suggest that there might be a process by which credit risks are linked to the momentum profit. Avramov et al. (2007) leave an interesting puzzle, i.e. the momentum profit exists only among firms with high credit risks but is significant only during economic expansions when the default rate is lower.

In searching for a risk based explanation for the momentum profit, several studies examine its relationship with firms' investments. As discussed in section 2.2.4 (p. 43), the Berk et al. (1999) theoretical model explains stock returns based on changes in firms' portfolios of investment projects. When calibrating the model with realistic project life and depreciation parameters, the model generates positive momentum profits for a period of five years. The magnitude of the calibrated momentum profit is comparable to that of the momentum profit observed in the U.S. market documented in existing empirical studies. However, the calibrated momentum profit is more persistent. For example Jegadeesh and Titman (2001) report that the momentum profit disappears beyond about two years following the portfolio formation date. Although the calibrated momentum profit does not match with the observed profit, Berk et al. (1999) embark a promising direction into the relationship between firms' investment activities and the momentum profit.

In the Johnson (2002) model, past winners (losers) are likely to have experienced positive (negative) growth shocks. The author assumes that firms with positive (negative) growth rate shocks are more likely to have high (low) growth rate levels. Firms with high growth rate are exposed to higher growth risks, and if this risk is priced, one would expect past winners to outperform past losers in the holding period. The model offers a straight-forward connection between firms' cash flows and the momentum profit. However, similar to the Berk et al. (1999) model, the Johnson (2002) model when calibrated generates the momentum profit that is persistent beyond the time horizon observed in the existing empirical studies.

Sagi and Seasholes (2007) study the interaction of the various firm level attributes with the momentum profit. They report that the momentum profit can be improved by up to 14% if the trading strategy is restricted to firms with more growth options, higher revenue volatility, and lower costs. Sagi and Seasholes (2007) concede that their work links the momentum profit with firms' microeconomics and does not necessarily support the rational or behavioural line of research. However, the relationship between firms' growth options and the momentum profit established in Sagi and Seasholes (2007) is closely related to the feature in Johnson's model (2002) that past winners are riskier than past losers because the former are exposed to the risk derived from higher growth.

Motivated by the Johnson (2002) model, the Sagi and Seasholes (2007) empirical evidence, and several studies that document the relationship between the momentum profit and the business cycle, Liu and Zhang (2008) investigate whether the momentum profit is due to past winners and past losers having different exposures to the growth related risk. This risk is proxied by the growth rate of industrial production (MP) from the Chen et al. (1986) macroeconomic model. Griffin et al. (2003) find that the Chen et al. (1986) model does not explain the momentum profit. Different from Griffin et al. (2003), Liu and Zhang (2008) arrive at a different conclusion using different test portfolios and regression windows to estimate risk premiums.

Liu and Zhang (2008) report that past winners have higher loadings on the MP factor than past losers. Also, the loadings and risk premiums of the MP factor can account for more than half of the momentum profit. Furthermore, the higher loading of past winners on the MP factor lasts for about six months following the portfolio formation period, corresponding to the persistence of the momentum profit observed in several existing empirical studies. Although the momentum profit is not completely explained, the work of Liu and Zhang (2008) contributes to the literature on the risk based explanations for the momentum profit.

Similar to the Liu and Zhang (2008) model, several other asset pricing models can only partially explain the momentum profit. The Pastor and Stambaugh (2003) liquidity factor can explain half of the momentum profit over the period from 1966 to 1999. The cash flow beta estimated from aggregate consumptions and firms' dividends in Bansal et al. (2005) is higher for past winners and lower for past losers. Finally, Chen et al. (2010) report that their investment based factor model is better than the CAPM and the Fama and French three factor model in explaining the momentum profit. Although none of these models can explain it completely, their partial success to date is promising to the search for a risk based explanation for the momentum profit.

Several studies, including Jegadeesh and Titman (2001) and Griffin et al. (2003), find that the momentum profit reverses beyond the holding period. According to Liu and Zhang (2008), this evidence is hard to reconcile with a risk based explanation. If past winners outperform past losers in the post formation period because the former is riskier than the latter, there is no built-in mechanism to explain why such a pattern only last for about one year following the formation period, as observed in the data. Jegadeesh and Titman (2001) also argue that the subsequent return reversal is against the explanation in Conrad and Kaul (1998) that the momentum profit is due to the cross sectional variation in mean returns. Liu and Zhang (2008) concede that the reversal can be explained by the persistence of the difference in the loadings on the industrial growth factor of past winners and past losers. The difference in the factor loadings lasts for about one year beyond the formation period, coinciding with the period of time between the portfolio formation and the return reversal.

The lack of a satisfactory risk based explanation for the momentum profit that can accommodate the subsequent return reversal motivates researchers to turn to the explanations based on investors' psychological biases. The following section reviews the proliferation of the research on the momentum profit in this direction.

Explanations for the Momentum Profit based on Investors' Biases

Jegadeesh and Titman (1993) attribute the momentum profit to investors' under-reaction to firm specific information rather than the under-reaction to common factors. The theoretical building blocks of the research in the momentum profit using investors' psychological biases consist of Daniel et al (1998), Barberis et al (1998) and Hong and Stein (1999).

Daniel et al. (1998) develop a model in which investors are overconfident and are subject to the self-attribution bias, i.e. attributing success to their own competence and failure to bad luck. Due to overconfidence, investors would be overconfident about their own skills to extract information. Hence they would overreact to private information and under-react to public information. As more public information is released, the self-attribution bias causes investors to continue to be overconfident. Hence investors continue overreacting to prior private signals, leading to the stock price momentum. When stock prices eventually return to the fundamental values as more public information is released, stock returns reverse in the long term.

The Barberis et al. (1998) model uses different psychological biases, i.e. representativeness and conservatism, to explain the momentum profit Due to conservatism, investors update their information slowly, and classify firms' earnings to follow either a trend or a mean-reverting process. News can have different strengths and statistical weights. When they place more weights on the mean-reverting model and less weights on the trend model, investors under-react to earnings announcements. On the other hand, when they place more weights on the trend model following a string of shocks in the same direction, they over-react to earnings announcements. The model generates both under-reaction / return momentum in the short term and over-reaction / return reversal in the long term.

In the Hong and Stein (1999) model, there are two classes of investors, i.e. the "news watcher" and the "momentum trader". The news watcher trades based on his or her private information while the momentum trader simply chases the trend. If the information diffuses slowly, initially stock prices will under-react to news. As momentum traders chase the trend, eventually stock prices will over-react at longer horizon. Similar to the Daniel et al. (1998) and the Barberis et al. (1998)

models, the Hong and Stein (1999) model unifies both under-reaction and over-reaction to explain both stock return momentum and reversal.

Based on these models, several studies develop and test the predictions on how the momentum trading strategy behaves among different groups of stocks or during a period of time. Cooper et al. (2004) argue that the Daniel et al. (1998) model can be extended to predict the momentum profit following stock market gains or losses. On the basis that investors in general should be more overconfident following market gains, the Daniel et al. (1998) model would predict a higher momentum profit during this time. Cooper et al. (2004) also argue that (a) to the extent that the delayed over-reaction is greater when the risk aversion is lower in the Hong and Stein (1999) model, and (b) wealth increases leads to lower risk aversion according to e.g. Campbell and Cochrane (1999), the Hong and Stein (1999) model also suggests a higher momentum profit following stock market gains. Cooper et al. (2004) find supportive evidence for this prediction extended from Daniel et al. (1998) and Hong and Stein (1999).

Huang (2006) provides the confirming evidence for the finding in Cooper et al. (2004). The momentum profit is higher during market upturns in 17 international markets. Market upturns and downturns are determined based on the past 12 and 24 months' cumulative returns. When the lagged world industrial production growth is used to determine up markets and down markets, the momentum profit behaves as expected. This evidence casts doubt on whether the cumulative past market returns proxy for the period of high investor confidence as interpreted in Cooper et al. (2004).

On the basis that the momentum profit might be due to investors' under-reaction to fundamental news (Barberis et al., 1998 and Hong and Stein, 1999), Agarwal and Taffler (2008) concede that investors under-react to the distress risk. They argue that this view is consistent with their evidence that the momentum profit is pronounced among firms with high exposure to the financial distress risk. The under-reaction argument in Agarwal and Taffler (2008) is motivated by the negative risk premium for the distress risk (e.g. Dichev, 1998). However, a recent study by George and Hwang (2010) argues that the so-called negative distress risk premium might be due to firms optimising their distress costs in a rational manner. This study therefore casts doubt on the argument in Agarwal and Taffler (2008) that the momentum profit is driven by investors' under-reaction to the distress risk.

In Asem (2009), the momentum profit is lower among firms that pay out dividends. The author attributes this result to investors' under-reaction to the dividend announcements and reductions. Given that firms in distress (Agarwal and Taffler, 2008) or having low credit ratings (Avramov et al., 2007) are more likely to omit dividends, the evidence in Asem (2009) in a way is consistent with the evidence in Agarwal and Taffler (2008) and Avramov et al. (2007). Liu et al. (2008) find that investors do not under-react to dividends omission or reduction. Hence, it is possible that the relationship between the momentum profit and firms' dividend paying status identified in Asem (2009) is not driven by investors' under-reaction to the dividend related events.

3.2.2. Literature on Stock Prices and Firms' Investments

This section reviews the literature on how firms' investments are influenced by firms' stock price movements. This line of research started as early as in Bosworth (1975, cited in Morck et al., 1990). Morck et al. (1990) provide a comprehensive analysis on different channels through which stock prices might affect firms' investments. First, stock prices only passively reflect future activities and therefore do not affect firms' investments. Second, managers rely on the stock prices as a source of information in making investment decisions. Third, managers time the equity financing so that new shares are issued at the time they are overvalued, making the cost of capital low and allowing investments that would not otherwise be undertaken. Finally, managers cater investors' mispricing to protect themselves. Morck et al. (1990) find little evidence that managers learn new information from stock prices (the second channel). They also report that after controlling for the company fundamentals, stock prices do not influence investments, inconsistent with the last two channels. Blanchard et al. (1993) also find evidence supporting this view.

More recent studies extend the evidence in Morck et al. (1990) in all four channels. Among the most prominent studies in stock mispricing and corporate investments are Baker et al. (2003) and Polk and Sapienza (2009). Baker et al. (2003) find that equity dependent firms, i.e. firms that need to rely on external equities to finance their investments, would under-invest when their stocks are undervalued. This is because these firms would have to issue equities at a price below the fundamental value to finance such investments. By the same token, these firms would issue equities to invest when their stocks are overpriced. Hence, firms subject to financial constraints in the sense that they need to rely on external equities to finance investments would invest more efficiently when their stocks are overpriced. Baker et al. (2003) support the third channel in Morck et al. (1990).

Polk and Sapienza (2009), on the other hand, complement the stock mispricing – investments channel by the catering theory. This channel is independent of the equity issuance channel of Baker et al. (2003), as mispricing can affect firms' investments even when firms do not rely on seasoned equity offerings for financing. If stocks are overpriced according to their level of investments, managers who hold a short term view may want to maintain the recent upward trend of the stock price by investing further to cater investors' sentiment. Firms with abundant financial resources (e.g. cash and debt capacity) would also invest more when their stocks are overpriced. Different from Baker et al. (2003), firms may invest in negative NPV projects to cater for investor sentiment. Polk and Sapienza (2009) support the fourth channel in Morck et al. (1990).

The debate on whether stock prices are related to firms' investments continues with the works of Ovtchinnikov and McConnell (2009) and Bakke and Whited (2010). Ovtchinnikov and McConnell (2009) report that there is no systematic difference in the relationship between stock prices and firms' investments among undervalued firms as compared to that among overvalued firms. Bakke and Whited (2010) only find some limited evidence that such a difference exists. The literature is therefore inconclusive on the relationship between stock mispricing and firms' investments.

In line with the second channel in Morck et al. (1990), several studies examine whether the information contained in stock prices affect firms' investments. Chen et al. (2007) suggests that stock prices contain private information[44] not known to managers and relevant to the investment decision making. Furthermore, managers use the private information in stock prices in their investment decisions. Bakke and Whited (2010) strongly support this proposition, particularly among less financially constrained firms. The evidence is consistent with the second channel but is inconsistent with the finding in Morck et al. (1990).

On the other hand, Ovtchinnikov and McConnell (2009) argue that the relevant information in stock prices is the growth opportunities, and increasing stock prices reflects the better quality of growth opportunities. They find the supportive evidence when the growth opportunities are both stock price based (i.e. Tobin's Q) and non-stock price based (e.g. asset growth and sales growth) measures. Furthermore, this relationship is more pronounced among firms with more debt overhang and information asymmetries, and facing higher distress costs, or generally more financially constrained firms. In light of Morck et al. (1990), the evidence in Ovtchinnikov and McConnell (2009) supports the first channel and is also consistent with the finding in Morck et al. (1990).

In summary, there is existing empirical evidence on the influence of current stock prices on firms' investments in the presence of financial constraints. However, the explanations for this influence remain disputable. Recent literature also suggests that firms' investments and their financial constraints are related to their risks, and hence to their stock returns. Kiyotaki and Moor (1997) describe the credit multiplier effect, i.e. how the dual role of fixed assets as a factor of production and as collaterals for debts can help amplify a small technological

[44] For example, information about the product market demand or the relevant strategic issues.

shock to affect the stock market returns. Firms facing credit limits and having more fixed assets can use these assets as collaterals to obtain more funds and invest more in fixed assets, which in turn can be used as collaterals for further borrowings. Based on the concept of the credit multiplier effect, Almeida and Campello (2007) test a model in which asset tangibility affects the sensitivity of corporate investments to cash-flow in firms with financial constraints.

Hahn and Lee (2009) test the asset pricing implication of the credit multiplier effect. Because stock prices reflect the net present value of investments, the stock returns of firms facing financial constraints and having high debt capacity are more sensitive to the availability of funds. If the exposure to the availability of funds is priced by the market, firms with high debt capacity would earn higher returns than firms with low debt capacity. Hahn and Lee (2009) find that among financially constrained firms, debt capacity significantly affects the cross section of stock returns. This relationship exists only among financially constrained firms.

3.2.3. The Gaps in the Literature

Given the overwhelming evidence on the existence of the momentum profit across the markets and over time, the most prominent question is what explains the phenomenon. The literature suggests that firms' investments are related to their risks, which might predict future stock returns. On the other hand, stock prices are likely to influence firms' investments. Hence, it is possible that past stock prices are related to future stock prices through firms' current investments. The research into the relationship between stock price momentum and firms' investments is limited mainly to the theoretical works of Berk et al. (1999) and Johnson (2002), and the empirical work of Liu and Zhang (2008). None of these studies fully explains the momentum profit pattern observed in the existing literature.

There is a gap to extend the abovementioned research direction in light of the recent studies on stock prices and firms' investments. This chapter aims to fill in this gap by extending the understanding on whether the momentum profit can be explained by the investment patterns of past winners and past losers. The literature on the momentum trading strategy is also characterised with several scattered findings on the pattern of the momentum profit. Hence it is useful if a new explanation for the momentum profit can accommodate some of these findings. The following section forms the research questions and develops the hypotheses to empirically test the relationship between firms' investments and the profitability of the momentum trading strategy.

3.3. The Research Questions and Hypotheses

This chapter aims to investigate whether the profitability of the momentum trading strategy observed in the stock market can be explained by the firm level investment activities. The questions that this chapter aims to address are as follows:

(1) Whether the momentum trading strategy is profitable in the sample; and

(2) If it is, whether firms' investment patterns can explain it.

Given the extensive evidence on the existence of the momentum profit reviewed in section 3.2 (p. 129), this chapter expects to find evidence of the momentum profit in the U.S. markets. The first hypothesis is as follows:

$H_{3.1}$: The strategy of buying past winners and selling past losers generates positive returns.

To answer the second research question, this chapter examines whether the momentum profit is related to the investment gap between past winners and past losers. The literature in the relationship between stock prices and firms' investments reviewed in section 3.2.2 (p. 141) suggests that increasing stock prices can be associated with firms' investments, which could be due to one or more of the followings:

- Model 1 - higher growth opportunities are reflected in the price (Ovtchinnikov and McConnell, 2009),
- Model 2 - more private information is embedded in the price (Bakke and Whited, 2010),
- Model 3 - firms issue overpriced stocks to finance investments that could not have been undertaken otherwise (Baker et al., 2003), and
- Model 4 - managers invest to cater for investor sentiment that make stocks mispriced (Polk and Sapienza, 2009).

The second hypothesis is therefore as follows:

$H_{3.2}$: Past winner firms invest more than past loser firms.

Firms' accessibility to sufficient funds also directly affects their investment activities. Hence the next hypothesis examines how the investment gap between past winners and past losers differs across different groups of firms with different financial constraints. According to Bakke and Whited (2010), managers react more strongly to the private information embedded in the stock price when firms are less financially constrained. This is because with more financial resources, it is easier for managers to respond to the private information. Polk and Sapienza (2009) also argue that the catering process works better among firms with abundant financial resources as they give firms the freedom to undertake investments to cater for investor sentiment.

On the other hand, Ovtchinnikov and McConnell (2009) suggest that the investments of more financially constrained firms are more responsive to changes in their investment opportunity set than those of less financially constrained firms. By definition, equity dependent firms are financially constrained; hence the equity issuance channel of Baker et al. (2003) should work better among financially constrained firms than among those with abundant financial resources. Taking the prediction based on the arguments in Ovtchinnikov and McConnell (2009) and Baker et al. (2003) as the basis, the next hypothesis is formed as follows:

> $H_{3.3}$*: The investment gap between past winner firms and past loser firms is higher among firms with higher financial constraints than among firms with lower financial constraints.*

If firms' investments respond to the private information in the stock price as suggested by Bakke and Whited (2010), hypothesis $H_{3.3}$ would be rejected. However, it is difficult to establish how this relationship evolves into further price appreciation of past winners versus past losers to explain the momentum profit.

If the sensitivity of firms' investments to stock price is due to the stock prices reflecting the quality of growth opportunities (Ovtchinnikov and McConnell, 2009), hypothesis $H_{3.3}$ would be supported. Furthermore, financially constrained firms might have a richer portfolio of projects in the pipeline than financially unconstrained firms. This is because without financing frictions, firms would have exercised the best growth options already. Hence, financially constrained firms would invest more and benefit from the rectification of the financing frictions.

Kiyotaki and Moor (1997) describe the credit multiplier effect by which financing frictions can be rectified as firms invest. Among firms with financial constraints, when past winners invest more than past losers, the new investments can be used as collaterals. Hence, past winners would increase their debt capacity at a faster rate than past losers do. Along the lines of Almeida and Campello (2007), past winners are more exposed to the credit multiplier effect than past losers. Furthermore, Hahn and Lee (2009) concede that the exposure to the credit multiplier effect is priced only among firms with financial constraints. Hence, past winners would generate higher returns than past losers when their stocks are not mispriced and reflect fundamental information about the investment opportunity set (Ovtchinnikov and McConnell, 2009).

If firms' investments respond to stock prices through the equity issuance channel of Baker et al. (2003), financially constrained firms can have the sufficient resources to invest more efficiently. More efficient investments in turn might help maintain the upward movement of the overpriced stocks until the mispricing is eventually corrected. This process could give rise to a more pronounced momentum profit among financially constrained firms, and no profit among financially unconstrained firms.

Finally, in the case of the explanation based on the catering theory (Polk and Sapienza, 2009), hypothesis $H_{3.2}$ would be accepted and hypothesis $H_{3.3}$ would be rejected. Furthermore, if the catering achieves its objective, one would expect the price trend to continue as investor sentiment is maintained, until the mispricing is corrected. Polk and Sapienza (2009) argue that this catering behaviour is more likely to happen when firms have access to abundant resources. Therefore the momentum profit would be stronger among financially unconstrained firms.

Similar to the formation of hypothesis $H_{3.3}$, the following hypothesis on the momentum profit is formed on the basis of the prediction based on the arguments in Ovtchinnikov and McConnell (2009) and Baker et al. (2003):

> $H_{3.4}$: *The momentum profit is pronounced among firms with higher financial constraints and non-existent among firms with lower financial constraints.*

Firms' investment activities tend to vary across different business cycle stages. Hence, if the momentum profit is driven by investments, it should also be influenced by the business cycle. The existing evidence on the performance of the momentum trading strategy during the economic expansion versus contraction is contradicting. In Chordia and Shivakumar (2002), the momentum profit is positive only during the expansionary period. On the other hand, Griffin et al. (2003) report that the momentum profit in several international markets is positive and significant in both good and bad business cycle stages.

Cooper et al. (2004) study the momentum profit in the stock market upturns and downturns, and find that the profit is positive and significant only during the market upturns. One may argue that the result in Cooper et al. (2004) is consistent with that in Chordia and Shivakumar (2002), as the aggregate stock market returns are related to the business cycle. For example, Cochrane (1991) finds some evidence that some variables used to describe the business cycle can forecast the aggregate stock market return, and vice versa, the aggregate stock market return can forecast future economic activities.

If the momentum profit is driven by the investment activities of past winners and past losers, there is an alternative possibility. The stages of business cycle might affect firms' investment activities, through which it would influence the momentum profit. If managers attempt to invest efficiently, and stock prices reflect the growth opportunities (Ovtchinnikov and McConnell, 2009), one would expect the investment gap between past winners and past losers to be higher during economic upturns than during downturns. This is because often during economic upturns, the discount rate is lower, making the value of growth opportunities higher and more projects worth investing. For the same reason, in the case of the share issuance channel (Baker et al., 2003), if the new investments are efficient, the investment gap between past winners and past losers would also be higher during economic upturns than during downturns.

Alternatively, managers may attempt to invest to cater for investor sentiment (Polk and Sapienza, 2009). The catering activity is likely to be stronger during the period of high investor sentiment. Several studies[45] suggest that the investor sentiment cycle and the business cycle are closely related. This chapter therefore hypothesises that during economic upturns, which could coincide with sentiment upturns, the investment gap between past winners and past losers is higher.

If the momentum profit is driven by the investment gap between past winners and past losers as conjectured in the previous hypotheses, one could expect

[45] E.g. Baker and Wurgler, 2006 and Lemmon and Portniaguina, 2006.

the momentum profit to be stronger during economic upturns than during downturns. The final hypothesis can therefore be formed as follows:

$H_{3.5a}$: The investment gap of past winners and past losers is bigger during economic upturns than during downturns.

$H_{3.5b}$: The momentum profit is more pronounced during economic upturns than during downturns.

Of the explanations examined in this chapter, those based on the arguments in Polk and Sapienza (2009) and Baker et al. (2003) attribute the momentum profit to the mispricing of past winners and past losers. As a result, the return predictability of cumulative returns would remain even when controlling for risks. Alternatively, the explanation based on the arguments in Ovtchinnikov and McConnell (2009), Kiyotaki and Moor (1997) and Hahn and Lee (2009) attributes the profit to the difference in the risks of winners and losers. In this case, the return predictability of cumulative returns would disappear when controlling for risks. The null hypothesis using the risk-based explanation is as follows:

$H_{3.6}$: The momentum profit can be explained by an asset pricing model that incorporates relevant fundamental factors.

Any explanation to the momentum profit should be able to accommodate the long term return reversal. The explanations based on the catering theory of Polk and Sapienza (2009) and the share issuance channel of Baker et al. (2003) can accommodate the return reversal as the mispricing would eventually be corrected. The explanation based on the growth opportunities model of Ovtchinnikov and McConnell (2009) could accommodate the return reversal in the longer term due to the diminishing marginal return on investments. Since the better investment opportunities would be prioritised, as firms invest, the quality of the growth opportunities will deteriorate. Hence, the return continuation of past losers and past winners would not persist forever.

The hypotheses developed and examined in this chapter are summarised in Table 3.1.

[Insert Table 3.1 about here]

The following section discusses the methodologies employed to test the hypotheses set out in the current section, and describes the data to be tested.

3.4. The Methodology and Sample

3.4.1. Measurement of Key Firm Level Variables

Firms' investment activities are measured by the CAPEX ratio, i.e. the ratio of capital expenditures incurred during the year divided by net fixed assets at the beginning of the year. The firm month observations with missing data on current year's capital expenditures or previous year's net fixed assets are excluded. Since this chapter examines the investment activities of past winners and past losers as the stock price evolves, it reports monthly contemporaneous CAPEX. For example, if the current month is March 2005, the CAPEX ratio for each stock is measured for the financial year ended in December 2005.

The portfolio CAPEX is determined as follows: (1) calculate the mean contemporaneous CAPEX of the portfolio in each calendar month; and (2) calculate the average of this mean contemporaneous CAPEX across the calendar month for each portfolio. To calculate the CAPEX gap between the past winners and past losers, this chapter (a) first takes the difference in the mean contemporaneous CAPEX ratio of the winner and the loser portfolios in each calendar month; and (b) calculates the average of this CAPEX gap across the calendar months.

To test the impact of financial constraints on the momentum profit, this chapter uses the net payout ratio, similar to the choice in chapter 2 (section 2.4, p. 70). For each firm in each financial year, the net payout ratio is calculated as dividends plus repurchases minus share issuance, scaled by the net incomes. Since this chapter investigates the momentum trading strategy in the financially constrained versus unconstrained subsamples, and the financial constraint status in general does not tend to fluctuate frequently from month to month, the net payout ratio is measured at a lag with stock returns. It is measured in December year t-1 and is used to classify firms into the groups with high, medium and low financial constraints from July year t to June year t+1. Firms in the bottom 30% of the overall sample are included in the subsample with high financial constraints. Firms in the top 30% are included in the subsample with low financial constraints. The remaining firms are included in the subsample with medium financial constraints. The construction of the key firm level variables described in this section is summarised in Panel A of Table 3.2.

[Insert Table 3.2 about here]

This chapter uses the cumulative market returns to classify the period under examination into upturns and downturns. These states would coincide with both the economic and the sentiment upturns and downturns. Following Cooper et al. (2004), when the three year cumulative market return is positive, the dummy variable UP is assigned the value of 1, and zero otherwise. On the other hand, when the cumulative market return is negative, the dummy variable DOWN is assigned the value of 1, and zero otherwise.

3.4.2. Methodology

To address the research questions and the hypotheses set out in section 3.3 (p. 146), this chapter employs two methods of analysis. The first methodology is the portfolio sorting approach based on past stock return performance to form the momentum trading strategy. A 6 x 6 momentum strategy that skips one month between the formation and the holding periods is formed as follows. In each month, stocks are sorted in ascending order into deciles by the cumulative returns from month t-6 to month t-1 (i.e. the formation period) using the sample decile breakpoints. The resulting ten portfolios are held for six months from month t+1 to month t+6 (i.e. the holding period). The portfolio construction procedure results in the overlapping portfolios with stocks entering and exiting the portfolios each month. The raw returns of the ten equally weighted deciles and of the long-short portfolio that goes long in past winners (i.e. the portfolio with top ranking in the formation period's cumulative return) and short in past losers (i.e. the portfolio with bottom ranking in the formation period's cumulative return) are reported.

To address the first research question of whether the momentum profit exists in the sample, this chapter first employs a variety of the momentum trading strategies with the formation period of either 3, 6, 9, or 12 months, the holding period of either 3, 6, 9, or 12 months, with and without one month in between the formation and the holding period. With four choices for the formation period and four choices for the holding period, without skipping a month in between, there are 16 momentum strategies. Similarly, when the momentum strategies skip a month between the formation and the holding period, there are another 16 strategies. In total, there are 32 strategies. The original Jegadeesh and Titman (1993) paper does not skip a month between the formation and holding period. Several subsequent studies, such as Cooper et al. (2004), skip a month between these periods when constructing the portfolio to avoid the bid-ask bounce effects.

To examine the second research question on the sources of the momentum profit, among the above 32 strategies, this chapter identifies a strategy that satisfies the following conditions:

- Skip a month between the formation and holding period to avoid the bid-ask bounce and the very short term reversal (Jegadeesh, 1990); and
- Does not require regular rebalancing to avoid the possibility that the results could be eliminated by transaction costs[46].

This chapter measures the momentum profit during economic upturns and downturns using the UP and DOWN dummy variables described in section 3.4.1 (p. 153). When the profit is regressed against the UP and DOWN dummy variables, the coefficient attached to the UP (DOWN) variable gives the average momentum profit during economic upturns (downturns). When the profit is regressed against the UP dummy variable and a constant, the coefficient attached to the UP dummy variable measures the difference between the momentum profit during economic upturns versus downturns. All the t statistics are corrected for autocorrelation and heteroskedasticity with the Newey and West (1987) method. Cooper et al. (2004) suggest that this approach preserves the time series of returns and reliably corrects any serial correlation.

[46] For a review on the momentum profit and transaction costs, refer to Swinkels (2004).

To test whether the momentum profit can be explained by risks, similar to chapter 2, this chapter uses the asset pricing framework of Avramov and Chordia (2006) to control individual stock returns for risks. This approach has an advantage that it uses all the information at the firm level rather than the aggregate information at portfolio level. For a detailed discussion on the framework of Avramov and Chordia (2006), refer to section 2.4 (p. 59).

The hypotheses formed in section 3.3 (p. 146) relate firms' investments and financing to the momentum profit. Hence the firm level investments and financial constraints variables are used as the conditioning variables in the Avramov and Chordia (2006) framework. These variables are measured using the CAPEX ratio and the net payout ratio as described in section 3.4.1 (p. 153). A business cycle variable is also used as the conditioning variable, as hypothesis $H_{3.5}$ conjectures that the investment gap and the momentum profit potentially vary across the economic upturns and downturns. Similar to chapter 2, this chapter uses the default spread to describe the business cycle, on the basis that as a single indicator, it performs better than other popular alternatives.

The Fama and French model is used as the base model in the following general model specification:

$$R_{jt} - R_{Ft} = \alpha_{j,0}$$

$$+ \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1,f} & \beta_{j,2,f} & \beta_{j,3,f} & \beta_{j,4,f} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ MWF_{t-1} \\ Firm_{j,t-1} \times MWF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \qquad (3.1)$$

in which R_{jt} is the return on stock j and R_{Ft} is the risk free rate at time t. F_{ft} represents the priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model (1993, 1996). Firm characteristic $Firm_{jt-1}$ is the one month lagged firm level measurement of investments and / or financial constraints. MWF_{t-1} is the one month lagged market wide factor describing the business cycle variable, proxied by the default spread, i.e. the spread between the U.S. corporate bonds with Moody's ratings of AAA and BAA.

The part of returns unexplained by the asset pricing model in equation (3.1) is regressed against the cumulative returns in a cross sectional regression. The following regression helps assess the return predictability of cumulative returns after controlling for risks:

$$R_{jt}^{*} = c_{0t} + \sum_{m=1}^{3} c_{mt} PR_{m,j,t-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{jt-1} \\ BM_{jt-1} \\ Turnover_{jt-1} \end{bmatrix} + u_{jt} \tag{3.2}$$

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 (3.1). $PR_{m,j,t-1}$ are the firm level cumulative returns for the periods of 1-3 month, 4-6 month, and 7-12 month prior to the current month. The vector of size, the Book-to-Market ratio, and stock turnovers in equation (3.2) represents the control factors, being the size, value and liquidity that might also predict the cross section of stock returns.

Size measures the market capitalisation at the end of each month. The Book-to-Market ratio is measured as the sum of the book value of common equity and balance sheet deferred tax, scaled by the market capitalisation. The ratio is measured in December of the previous year for the firm-month observations from July of the current year to June of the following year. There is a six month gap between (a) the time at which this ratio is measured and (b) the time at which stock returns are measured. This gap ensures that the required accounting data to calculate the ratio is available to investors when they consider their investment decisions. The turnover of the stocks listed on NYSE /AMEX stock exchanges is calculated as the trading volume divided by the outstanding number of shares. The turnover of the stocks listed on NASDAQ stock exchange is constructed in a similar manner. The construction of the key firm level variables described in this section is summarised in Panel B of Table 3.2.

Similar to chapter 2, following Avramov and Chordia (2006) and Brennan et al. (1998), this chapter transforms the firm level variables in equation (3.2) by (1) lagging two months (size and turnovers), (2) taking natural logarithm (size, turnovers and the Book-to-Market ratio), and (3) taking deviation from the cross sectional mean (size, turnovers, the Book-to-Market ratio, the accrual ratio and past cumulative returns). The transformation is described below:

$$Size\_transformed_{j,t} = \ln\left[lag_2\left(Size_{j,t}\right)\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[lag_2\left(Size_{i,t}\right)\right] \quad (3.3)$$

$$BM\_transformed_{j,t} = \ln\left[BM_{j,t}\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[BM_{i,t}\right] \quad (3.4)$$

$$Turnover\_transformed_{j,t} = \ln\left[lag_2\left(Turnover_{j,t}\right)\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[lag_2\left(Turnover_{i,t}\right)\right] \quad (3.5)$$

in which $Size_{j,t}$, $BM_{j,t}$, and $Turnover_{j,t}$ are the measurements of size, Book-to-Market, and turnover in NYSE / AMEX or NASDAQ for firm j at time t as described above. $lag_2\left(x_t\right)$ refers to the two month lag of variable x_t. $\ln[y]$ refers to the natural log of variable y. *n* refers to the number of stocks in the sample at time t. $Size\_transformed_{j,t}$, $BM\_transformed_{j,t}$ and $Turnover\_transformed_{j,t}$ are the corresponding variables after the transformation and replace the role of $Size_{j,t}$, $BM_{j,t}$, and $Turnover_{j,t}$. These variables are lagged by one month to become $Size_{j,t-1}$, $BM_{j,t-1}$, and $Turnover_{j,t-1}$ in equation (3.2).

The variables are lagged to avoid any biases by bid-ask effects and thin trading and are taken as natural logarithms to avoid skewness. Taking the deviation from the cross sectional mean implies that the average stock will have the firm level characteristics at the average level (i.e. the deviation from the cross sectional mean is zero), and its expected return is driven solely by risks.

The statistical null hypothesis is that the coefficients c_{mt} attached to the cumulative returns are not significantly different from zero. This means the cumulative returns no longer predict subsequent stock returns. It suggests that the momentum profit is explained when returns are adjusted for risks in stage one.

$H_{3.0}$: $c_{mt} = 0$

The coefficients and t-statistics are reported. As argued in chapter 2, the procedure employed in this chapter does not involve regressions with estimated independent variables. Therefore it is not subject to the error-in-variable problem (Bauer et al., 2010 and Subrahmanyam, 2010). The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method.

3.4.3. Sample Description

The sample includes all non-financial and non-utilities stocks listed in the NYSE, AMEX and NASDAQ stock exchanges. The sample period is between 1972 and 2006. Similar to chapter 2, financial stocks are excluded as they have different asset structures compared to the non-financial stocks. Utilities stocks are excluded as utilities firms and potentially their investments are more strictly regulated than firms in other industries. The coverage period starts in 1972 due to the availability of the data to measure the net payout ratio.

Only stocks with available information to calculate the CAPEX ratio for the year and the proxy for financial constraints in December of the previous year are considered. Following Jegadeesh and Titman (2001), this chapter excludes the firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile. According to Jegadeesh and Titman (2001), the purpose is to avoid the results to be driven by small and illiquid stocks or bid-ask bounce. The sample has 557,730 firm-month observations, stretching across 414 months from July 1972 to December 2006. The descriptive statistics of the sample are reported in Table 3.3.

[Insert Table 3.3 about here]

Panel A of Table 3.3 reports the statistics of the key variables used in the portfolio sorting methodology. All the variables, including the monthly returns, the holding period cumulative returns, the CAPEX ratio, and the net payout ratio are highly skewed. The correlation coefficient of the two firm level variables, i.e. the CAPEX ratio and the net payout ratio, is close to zero and is statistically insignificant. The low correlation suggests that these variables describe different economic forces.

Panel B of Table 3.3 describes the statistics of the variables in the regressions of the Avramov and Chordia's asset pricing framework. The sample is further constrained in that there should be data on stock returns, market capitalisation, and the Book-to-Market ratio in the current year and in the 36 months prior to the current month. According to Avramov and Chordia (2006), this condition ensures that the estimation at the firm level is not noisy. An average stock has the average market capitalisation of $2.33 billion and the average Book-to-Market ratio of 0.76. The average cumulative returns of the past 2^{nd} to 3^{rd} month, 4^{th} to 6^{th} month, and 7^{th} to 12^{th} month are 3.36%, 5.13% and 10.87% respectively. All the variables in this panel show a significant level of skewness, with the mean values well above the median. The skewness suggests that it is appropriate to transform the variables in accordance with Avramov and Chordia (2006) and Brennan et al. (1998) as described in section 3.4.2 (p. 155).

3.5. The Results

3.5.1. The Profitability of the Momentum Trading Strategy

Following Jegadeesh and Titman (1993), Table 3.4 presents the momentum trading strategy with the formation and holding periods varying between 3 months to 12 months. The variety of the formation and holding periods helps ensure that the evidence on the momentum profit is robust. Taking the 6 x 6 strategy as an example, in each month, stocks are sorted in ascending order by the cumulative returns from month t-6 to month t-1. Ten portfolios with equal number of stocks are composed and positions (long and short) are taken from month t to month t+5. W-L represents the momentum profit, or the return to the portfolio that goes long in past winners (i.e. the portfolio with the highest ranking in the cumulative returns) and short in past losers (i.e. the portfolio with the lowest ranking in the cumulative returns). The portfolio construction procedure results in overlapping portfolios with stocks entering and exiting at different points in time.

[Insert Table 3.4 about here]

Panel A reports the returns to the portfolios and to the long-short portfolios when the momentum trading strategies do not skip between the formation and the holding periods. Panel B reports the returns when the momentum trading strategies skip one month between the formation and the holding periods. Consistent with the literature, this chapter finds strong evidence for the momentum profit in the sample. The returns to the portfolios follow an increasing pattern from past losers to past winners. All the momentum trading strategies in both Panel A and Panel B generate positive and statistically significant momentum profits. Their magnitudes vary from 0.51% to 1.29% per month. Skipping a month between the formation and the holding periods tends to improve the profitability of the trading strategy. Also, the strategies that rely on longer formation or holding periods tend to generate lower returns.

Scenarios 1 and 2 in Table 3.9 provide evidence for the momentum profit using the Avramov and Chordia (2006) regression approach. In scenario 1, returns are not adjusted for risks in the stage one regression. The raw returns are regressed against the firm level variables in the stage two regression as described in equation 3.2 (p. 158). The three cumulative return coefficients are positive and significant. They suggest that there is a positive and significant relationship between the cross section of stock returns and the cumulative returns. This result confirms the evidence so far that the momentum profit exists in the sample. The coefficients of the control variables also show the expected signs. The size coefficient is negative and significant (i.e. the return predictability of size), while the Book-to-Market coefficient is positive and significant (i.e. the return predictability of the Book-to-Market ratio).

In scenario 2, returns are adjusted for risks using the unconditional Fama and French three factor model in stage one. The time series regression in stage one is described in equation 3.1 (p. 157) with the following constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. The risk adjusted returns are regressed against the firm level variables as described in equation 3.2. The adjusted R^2 drops from 6.20% in scenario 1 to 2.74% in scenario 2, suggesting that the Fama and French model in stage one helps better explain the return predictability of the firm level variables in equation 3.2. Although the cumulative return coefficient at the longest lag becomes statistically insignificant, the other two cumulative return coefficients are still positive and significant. The evidence suggests that cumulative returns exhibit predictability, (thus suggesting that the momentum profit exists), even when accounting for risks using the unconditional Fama and French model.

To summarise, there is evidence that the returns to the portfolios based on cumulative returns increase from past losers to past winners. The returns to the long-short portfolios are positive and significant. The cumulative returns are positively related to the current returns, even when they are adjusted for risks using the Fama and French three factor model at the firm level. The evidence suggests that hypothesis $H_{3.1}$, i.e. whether the momentum trading strategy is profitable in the sample, is accepted. The answer to the first research question, whether the momentum profit exists in the sample, is therefore affirmative. The following sections report evidence in testing hypotheses $H_{3.2}$ to $H_{3.6}$ in order to address the second research question of whether the momentum profit is affected by firms' investment patterns.

3.5.2. The Investment Patterns of Past Winners' and Past Losers

To address the second research question of whether the momentum profit is related to firms' investments, this chapter uses a momentum trading strategy that satisfies the conditions set out in section 3.4 (p. 153). The strategy would skip a month between the formation and holding periods and requires few regular rebalancing. In Panel B of Table 3.4 which reports the performance of the momentum strategies that skip a month, the highest momentum profits concentrate in the strategies with 6 to 9 month formation periods and 3 to 6 month holding periods. The 6 month holding period is preferred to the 3 month holding period as it reduces the need to balance the portfolios by a half.

The 6x6 strategy turns out to be the one with the highest momentum profit (1.21% per month) given the selection criteria. It is also known to be the most successful one in the literature. Skipping a month helps avoid the bid-ask bounce and the short term reversal described in Jegadeesh (1990). Hence this chapter employs the 6x1x6 strategy, i.e. 6 month formation period, skipping 1 month, and 6 month holding period, to test hypotheses $H_{3.2}$ to $H_{3.5}$.

Table 3.5 reports the investment activities, measured by the contemporaneous CAPEX ratio, of past winners and past losers during the holding period. Column (1) of Table 3.5 shows that in the overall sample, past winners invest more than past losers by about 15% of a firm's net fixed assets per year. This difference translates into 40% of the average investments past losers undertake each year. The investment gap is also statistically significant. However, there is no monotonic pattern in the average investments from past losers to past winners during the holding period. The average investments of the portfolios in between the winner and the loser portfolios approximate each other, and are lower than those of the winner and the loser portfolios.

[Insert Table 3.5 about here]

Columns (2), (3) and (4) of Table 3.5 show the relationship between capital market accessibility described by financial constraints and the investments of past winners and past losers during the holding period. The overall sample is divided into three subsamples. Firms having the net payout ratio in the bottom 30% are included in the subsample with high financial constraints. Firms having the net payout ratio in the top 30% are included in the subsample with low financial constraints. The remaining firms are included in the subsample with medium financial constraints.

In the subsample with high financial constraints, the investment gap between past winners and past losers is about 21%, statistically significant and economically highest among the winner-loser investment gaps in the three subsamples. The investment gap in the subsample with low financial constraints is about ¾ that in the subsample with high financial constraints and is also statistically significant. The gap in the subsample with medium financial constraints, at nearly 9%, is lower than those in the other two subgroups.

Columns (2) and (3) show that the investment gap is smaller among less financially constrained firms. The evidence suggests that when firms have reasonable access to the capital market, the past stock return performance plays a less important role to managements' investment decisions. However, this tendency is not present in columns (3) and (4). In fact, the gap in the subsample with medium financial constraints is smaller than that in the subsample with low financial constraints. Furthermore, the CAPEX ratio patterns across the deciles from past losers to past winners in all the three subsamples by firms' financial constraints do not follow any monotonic pattern. The investments follow a U-shape, higher in past losers, lower in the middle deciles, and well higher in past winners. The patterns are closer to a monotonic increase from past losers to past winners in the subsamples with high and medium financial constraints.

To shed further light into the investment activities of past winners and past losers, the chapter next studies the investment activities of past winners and past losers during both the formation and the holding periods. An event window consisting of the formation period (month -6 to month -1), the skipping month (month 0), and the holding period (month 1 to month 6) is considered. For each of the thirteen event months within this window, the average contemporaneous CAPEX ratios of the ten deciles and the CAPEX gaps are calculated. The average contemporaneous CAPEX ratios of each portfolio in each calendar month are first calculated. Then the gap in these mean CAPEX ratios between past winners and past losers in each calendar month is calculated. Finally, the average of these CAPEX gaps is taken across the calendar months for each event month.

Figure 3.1 shows that the investment gaps between past winners and past losers exhibit very different patterns among the subsamples with different financial constraints. In terms of the magnitude, during the holding period, the investment gap in the subsample with high financial constraints dominates, followed by the investment gaps in the subsample with low and medium constraints respectively. The magnitudes of the investment gap lines can explain the observation documented earlier in Table 3.5.

[Insert Figure 3.1 about here]

In terms of the speed of change over time, in the overall sample, the investment gap increases with a relatively constant slope across the formation and holding period. The investment gaps in the subsamples with high and medium financial constraints exhibit an upward pattern. On the contrary, the investment gap in the subsample with low financial constraints changes from an upward movement towards a horizontal one during the holding period. Panel B focuses on the behaviour of the investment gaps during the holding period. A trend line is added to each of the investment gap lines in the overall sample and in each subsample. In the subsample with high financial constraints, the investment gap line has a slope of 0.74. The slopes are 0.87 and -0.05 respectively in the subsamples with medium and low financial constraints.

The evidence suggests that in general, past winners invest more than past losers during the holding period, and the gap is increasing over time. Hypothesis $H_{3.2}$ is therefore supported. Furthermore, during the holding period, the investment gap in the subsample with high financial constraints has a higher magnitude and a higher speed of change over time than in the subsample with low financial constraints, supporting hypothesis $H_{3.3}$.

The higher magnitude of the investment gap in the subsample with high financial constraints is consistent with the argument in Ovtchinnikov and McConnell (2009). The authors argue that (a) the investment of more financially constrained firms is more responsive to changes in their investment opportunity set than that of less financially constrained firms, and (b) stock prices reflect the investment opportunities. It is also consistent with the share issuance argument in Baker et al. (2003) in which overpriced firms issue shares to finance investments and underpriced firms forgo positive NPV investments when they are financially constrained.

The evidence is inconsistent with the catering theory of Polk and Sapienza (2009) in which (a) firms invest to cater for investor sentiment, and (b) they would be more likely to do so when having abundant financial resources. The evidence is also against an argument that managers invest more in firms with rising stock prices in response to more positive private information embedded in the price (Bakke and Whited, 2010). According to this argument, managers would react more strongly to the private information embedded in the stock price if firms are less financially constrained, making the investment gap more pronounced among firms with low financial constraints.

Furthermore, the positive speed of change of the investment gap in the subsample with high financial constraints and the zero speed of change in the subsample with low financial constraints can be explained by the corresponding theories that explain their magnitudes. If stock prices reflect the investment opportunities as argued by Ovtchinnikov and McConnell (2009), and the higher investment gap in the subsample with high constraints compared to that in the subsample with low constraints is driven by the higher sensitivity of investments to changes in the investment opportunity set, the positive speed of change of the investment gap in the subsample with high financial constraints should be driven by fundamental forces. This chapter argues that the credit multiplier effect of Kiyotaki and Moor (1997) might represent these forces.

According to the credit multiplier effect, starting with a small investment gap between past winners and past losers, firms that invest more have additional collateral for further borrowings. By contrast, firms that cut back investments have less collateral for further borrowings. Hence the credit multiplier effect can widen the investment gap and make its slope positive over time. In fact, Almeida and Campello (2007) report that only among firms with financial constraints does asset tangibility affect the extent to which firms' investments respond to cash flows. Consistent with Kiyotaki and Moor (1997) and Almeida and Campello (2007), in this chapter, the slope of the investment gap is positive in the subsample with high financial constraints but not in the subsample with low financial constraints.

From the perspective of the share issuance channel (Baker et al., 2003), among the financially constrained firms, the more stocks are mispriced, the more likely it is that new shares are issued at a higher price. This translates into the more fund is available at a lower cost of capital, and hence the more the firm would be able to invest. Conditional on more efficient investments helping to maintain the upward movement of overpriced stocks, financially constrained firms would continue issuing shares and investing sensibly. This tendency might also lead to the positive speed of change of the investment gap in the subsample with high financial constraints.

The relationships between the investment gap in the subsample with medium financial constraints and the gaps in the other two subsamples do not show any clean support towards any hypothesis. The investment gap in the subsample with medium constraints is smaller than the gap in the subsample with high constraints, consistent with hypothesis $H_{3.3}$. However, it is smaller than the gap in the subsample with low constraints, inconsistent with hypothesis $H_{3.3}$. Furthermore, firms having sufficient financial resources is not the sufficient condition of the catering theory of Polk and Sapienza (2009). As long as firms are not highly constrained, the catering theory would predict that the investment gap is higher among firms with more financial resources. Given that the subsample with medium financial constraints is in the grey area of the two opposite forces, its investment pattern might be the results of the influences by both sides.

3.5.3. Firms' Investments and the Momentum Profit

Hypothesis $H_{3.4}$ extends hypotheses $H_{3.2}$ and $H_{3.3}$ to examine the subsequent stock price behaviour. The explanation based on Ovtchinnikov and McConnell (2009) suggests that past winners are being more exposed to the credit multiplier effect among firms with high financial constraints. According to Hahn and Lee (2009), this exposure is priced. Hence this explanation would suggest higher returns to past winners than past losers ($H_{3.4}$). The explanation based on the share issuance channel of Baker et al. (2003) would also suggests the return continuation among financially constrained firms ($H_{3.4}$) if the consequent investments can make investors even more optimistic about the prospect of the overpriced firm. The explanation based on the catering theory in Polk and Sapienza (2009) would also suggest return continuation, as mispricing would lead to investments with the purpose of reinforcing further mispricing. However, the return continuation is expected to be stronger among the subsample with low financial constraints, rejecting hypothesis $H_{3.4}$.

Table 3.7 presents the returns to the ten equally sorted portfolios sorted by cumulative returns, and the long-short portfolios in the overall sample and in the subsamples by firms' financial constraints. In the overall sample and in each subsample, the returns to the deciles monotonically increase from past losers to past winners. The momentum profit in the overall sample is statistically significant at 1.21% per month, similar to the result reported in Table 3.4 for J=K=6 in Panel B. Among the three subsamples, the subsample with high financial constraints generates the highest momentum profit (0.65% per month). By contrast, the subsample with low financial constraints generates the lowest profit (0.20% per month). While the momentum profits in the subsamples with high and medium financial constraints are statistically significant, that in the subsample with low financial constraints is not.

[Insert Table 3.7 about here]

The evidence in the three subsamples supports hypothesis $H_{3.4}$, consistent with the explanation based on Ovtchinnikov and McConnell (2009). It is also consistent with the mispricing explanation based on Baker et al. (2003). On the other hand, the catering theory of Polk and Sapienza (2009), which would predict a rejection of hypothesis $H_{3.4}$, is not supported. Finally, it is unclear that the positive and significant momentum profit in the subsample with medium financial constraints is consistent with which of these three explanations.

To conclude, the evidence in sections 3.5.2 (p. 165) and 3.5.3 (p. 171) supports hypothesis $H_{3.2}$ that past winners invest more than past losers. The investment gap is higher in the subsample with high financial constraints than in the subsample with low financial constraints ($H_{3.3}$). The speed of change of the investment gap in the subsample with high financial constraints is positive. It is close to zero in the subsample with low financial constraints. Furthermore, there is supportive evidence on the positive and significant momentum profit in the subsample with high financial constraints, while small and insignificant in the subsample with low financial constraints ($H_{3.4}$).

These patterns are consistent with an explanation in which stock prices reflect investment opportunities, and the sensitivity of investments to growth opportunities is higher for firms with high financial constraints (Ovtchinnikov and McConnell, 2009). Also, the financially constrained firms which invest more are more exposed to the credit multiplier effect (Kiyotaki and Moor, 1997, Almeida and Campello, 2007), and generate higher returns as the exposure is priced (Hahn and Lee, 2009). They are also consistent with an explanation in which financially constrained firms issue shares and invest efficiently when overpriced, and forgo valuable investment projects when underpriced (Baker et al., 2003).

The evidence does not support the prediction based on the Polk and Sapienza (2009) catering theory on the investment patterns of past winners and past losers in the subsamples with high versus low financial constraints. It is also inconsistent with the prediction based on the Bakke and Whited (2010) conjecture that stock prices reflect private information. Furthermore, it is difficult to extend the Bakke and Whited (2010) conjecture to predict the return continuation. The prediction by the catering theory of Polk and Sapienza (2009) (i.e. rejecting $H_{3.4}$) is not supported in the subsamples with high and low financial constraints. Finally, the pattern of the investment gap and the significant momentum profit in the subsample with medium financial constraints do not lend clear support to any explanation.

3.5.4. Firms' Investments and the Momentum Profit across the Business Cycle

This section provides evidence for hypothesis $H_{3.5a}$, i.e. whether the investment gap is higher during economic upturns, and hypothesis $H_{3.5b}$, i.e. whether the momentum profit is more pronounced during economic upturns, than during downturns. If the investment gap between past winners and past losers is driven by the difference in the growth opportunities, along the lines of Ovtchinnikov and McConnell (2009), the investment gap would be higher during economic upturns than during economic downturns. This is because there would be more growth opportunities during economic upturns. More growth opportunities would also encourage managers of financially constrained firms to issue shares to invest when the share is overpriced. Hence, the share issuance channel of Baker et al. (2003) would also suggest a higher investment gap during economic upturns.

Alternatively, if the investment gap is driven by managers catering for investor sentiment, along the lines of Polk and Sapienza (2009), the investment gap would be higher during sentiment upturns and lower during sentiment downturns. This is because the catering activity is more likely to achieve its objective when the general investor sentiment in the market is high. Furthermore, investors tend to be optimistic during economic upturns. Hence economic upturns (downturns) and sentiment upturns (downturns) are likely to coincide. This chapter uses the positive cumulative market returns to capture both the economic and sentiment upturns.

Table 3.6 presents the investments of firms in the ten equally weighted portfolios sorted by cumulative returns during economic upturns and downturns. The corresponding investment gaps between past losers and past winners are also presented. In the overall sample, the investment gap between past winners and past losers is statistically significant during both economic upturns and downturns. However, the gap of 14.75% during economic upturns is more than twice that during downturns (6.55%). The difference in the investment gaps during economic upturns versus downturns is statistically significant.

[Insert Table 3.6 about here]

Figure 3.2 shows that across the formation and the holding period, the investment gap during economic upturns is higher than that during downturns. Furthermore, in Table 3.8, consistent with Cooper et al. (2004), the momentum profit in the overall sample is positive and significant during economic upturns, while it is insignificant during downturns. The evidence supports hypothesis $H_{3.5}$ that the investment gap is bigger and the momentum profit is more pronounced during economic upturns. Together with the evidence supporting hypotheses $H_{3.2}$, $H_{3.3}$ and $H_{3.4}$, this evidence suggests that the momentum profit and the investment gap are related.

[Insert Figure 3.2 about here]

It is interesting to see how the investment gap and the momentum profit vary across the economic upturns and downturns in each subsample by firms' financial constraints. In columns (3) and (4) of Table 3.6, the investment gaps among firms with high financial constraints are approximately 23% and 7% during economic upturns and downturns respectively. The difference in the investment gaps is statistically significant. In the subsamples of firms with medium and low financial constraints, it is not statistically significant. Panel A of Figure 3.2 shows that while the investment gaps across the formation and the holding periods of the three subsamples during downturns approximate each other, the investment gaps during economic upturns mirror those across economic upturns and downturns (see Figure 3.1). Panel B of Figure 3.2 reinforces this observation. The investment gaps in the subsamples with high and low financial constraints during downturns approximate each other, whereas those during economic upturns mirror the pattern in Panel B of Figure 3.1.

The cyclical patterns of the investment gaps in the three subsamples further support that the difference in the investment patterns of past winners and past losers could be explained by the argument in Ovtchinnikov and McConnell (2009). This explanation maintains that stock prices reflect the quality of growth opportunities, and the investments of financially constrained firms are more sensitive to changes in the investment opportunity set. The evidence is also consistent with the share issuance channel in Baker et al. (2003) where overpriced stocks of financially constrained firms are issued to finance the investments that would otherwise be forgone.

However, the evidence contradicts the catering theory of Polk and Sapienza (2009), i.e. the investment gap between past winners and past losers is due to managers of past winners investing more to cater for investor sentiment. If catering for investor sentiment drives the difference in the investment patterns of past winners and past losers, the investment gap should be (a) bigger, and (b) more cyclical among firms with low financial constraints. This is because (a) it is easier to cater for investor sentiment if firms have financial resources, and (b) the sentiment is higher during economic upturns, making it easier for the catering activity. The evidence reinforces the evidence for hypothesis $H_{3.3}$ in section 3.5.2 (p. 165) that the investment gap patterns among firms with high and low financial constraints support an explanation based on Ovtchinnikov and McConnell (2009) or based on Baker et al. (2003) but not on Polk and Sapienza (2009).

Table 3.8 presents the cyclicality of the momentum profits in the three subsamples by firms' financial constraints. Given that the subsample of firms with high financial constraints is the only group with a statistically cyclical investment gap, one would expect the momentum profit it generates to be the most cyclical. It is evident in columns (3) and (4). In the subsample of firms with medium financial constraints, the momentum profit is significant during economic upturns and insignificant during downturns. The difference in the momentum profit during economic upturns versus downturns is weakly significant. In the subsample of firms with low financial constraints, the difference in the momentum profits during economic upturns and downturns is significant. However, the individual momentum profit is either economically insignificant (during economic upturns) or statistically insignificant (during downturns).

[Insert Table 3.8 about here]

Furthermore, the momentum profit being positive and significant during economic upturns and negative and significant during downturns among firms with high financial constraints is the necessary but not the sufficient condition for past winners having higher risks than past losers. This argument is based on Lakonishok et al. (1994), Lettau and Ludvigson (2001), and Petkova and Zhang (2005). These studies argue that, in the context of the value premium, if the value premium is due to the difference in risks between value and growth stocks, value stocks should outperform growth stocks in economic upturns and underperform in downturns. Similarly, Griffin et al. (2003) also argue that if the momentum profit is due to the risks relating to the aggregate stock market movement, the momentum profit should be positive during the periods of positive market returns and negative during the periods of negative market returns.

The evidence so far is in line with the existing literature on the momentum profit. Firms tend to pay dividends when they are not financially constrained. They also tend to have low credit ratings and be more exposed to higher distress risk when they are financially constrained. Hence, the evidence reported in Asem (2009), Avramov et al. (2007) and Agarwal and Taffler (2008) respectively is consistent with hypothesis $H_{3.4}$ in this chapter that the momentum profit is higher in the subsample with high financial constraints.

Avramov et al. (2007) find it puzzling that the momentum profit exists only among firms with low credit ratings but stronger during economic expansions when the default risk is lower. This puzzle is in fact consistent with the hypotheses $H_{3.3}$, $H_{3.4}$ and $H_{3.5}$ that are supported in this chapter. Hence, this chapter can reconcile two puzzling pieces of evidence in Avramov et al. (2007) by either (a) an explanation based on Ovtchinnikov and McConnell (2009); or (b) an explanation based on Baker et al. (2003).

3.5.5. The Momentum Profit – Investment based Risk vs. Mispricing Explanations

So far this chapter has established that there is a relationship between the momentum profit and the investment pattern of past winners and losers. This relationship can be explained by either a risk based explanation based on Ovtchinnikov and McConnell (2009), a mispricing explanation based on Baker et al. (2003), or a mispricing explanation based on Polk and Sapienza (2009). When taking into account firms' financial constraints, the evidence can also be explained by either the risk based explanation based on Ovtchinnikov and McConnell (2009) or the mispricing explanation based on Baker et al. (2003).

This section examines whether the cross section of the returns to past winners and past losers can be explained by the risk based explanation or the mispricing explanations. If the risk based explanation based on Ovtchinnikov and McConnell (2009) alone can explain the momentum profit, it would be explained by an asset pricing model that incorporates the relevant factors, including firms' investments, their financial constraints, and the business cycle state (hypothesis $H_{3.6}$).

In Table 3.9, scenario 3 adjusts returns for risks using the conditional Fama and French model in which the betas are conditioned on the financial constraints variable (the net payout ratio). In scenario 4, the betas are conditioned on the investments variable (the CAPEX ratio). Finally, in scenario 5, the betas are conditioned on both the financial constraints and investments variables. The time series regressions in stage one are described in equation 3.1 (p. 157) with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. The risk adjusted returns are regressed against the firm level variables as described in equation 3.2 (p. 158).

[Insert Table 3.9 about here]

In all the three scenarios, the 2-3 month and 4-6 month cumulative return coefficients (from 0.80 to 0.97) are higher than the 7-12 month cumulative return coefficients (from 0.32 to 0.37). All the coefficients are statistically significant particularly the coefficients at the shorter lags. The evidence suggests that cumulative returns exhibit predictability (thus suggesting that the momentum profit exists) even when accounting for risks using the Fama and French model supplemented with the information about firms' financial constraints and / or investments.

Given the evidence documented in the literature and the evidence in section 3.5.4 (p. 174) on the momentum profit and the business cycle, scenarios 6 to 9 adjust the returns for risks using the Fama and French model supplemented with the business cycle variable. In scenario 6, the betas are solely conditioned on the business cycle variable. The time series regression in stage one is described in equation 3.1 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In scenario 7, the conditioning variables include both the business cycle variable and the financial constraints variable. In scenario 8, they include the business cycle variable and the investments variable. Finally, in scenario 9, they include all of the business cycle variable, the financial constraints variable, and the investments variable. Scenarios 7 to 9 employ the full versions of both equation 3.1 and equation 3.2.

In scenario 6, all the cumulative return coefficients, varying between 0.44 and 0.81, are significant. Hence, cumulative returns continue to exhibit predictability (thus suggesting that the momentum profit continues to exist) when accounting for risks using the Fama and French model supplemented with the business cycle information. In scenario 7, the cumulative return coefficients at the two longer lags become economically small (0.43 and 0.18) and statistically insignificant. Compared to the result in scenario 6, the result in scenario 7 suggests that the return predictability of cumulative returns reduces considerably. The evidence suggests that firms' financial constraints and the business cycle play an important role in rationally explaining the momentum profit. However, a cumulative return coefficient is still positive and significant. It is therefore possible that either (a) the asset pricing model to adjust returns for risks in stage one is still misspecified, or (b) the risk based explanation does not solely account for the momentum profit (i.e. the joint hypothesis problem).

In scenario 8, all the cumulative return coefficients remain positive (0.57 to 0.84) and significant. The results are similar in scenario 9. Given that the return predictability of cumulative returns is weak in scenario 7 when returns are adjusted for risks using the Fama and French model conditioned on the financial constraints and the business cycle variables, scenarios 8 and 9 suggest that at least part of firms' investments influences the momentum profit through a mispricing channel.

Scenarios 10 to 12 incorporate the possibility of a mispricing explanation for the momentum profit. In this case, the momentum profit should exist even after returns are adjusted for risks using an asset pricing model in stage one. Only when returns are adjusted for risks and the mispricing is accounted for would the return predictability of cumulative returns be eliminated. The two investment based mispricing explanations identified in this chapter are the explanation based on the share issuance channel of Baker et al. (2003) and the one based on the catering theory of Polk and Sapienza (2009). The explanation based on Baker et al. (2003) suggests that the momentum profit should only exist among firms with high financial constraints. The mispricing explanation based on Polk and Sapienza (2009) suggests that the more financial capacity a firm has, the more easily the manager can invest to cater for investor sentiment.

To account for the mispricing possibility, in the cross sectional regression in stage two, the three interaction terms between the cumulative returns and the firm level variables are supplemented to equation 3.2 as follows:

$$R_{jt}^{*} = c_{0t} + \sum_{m=1}^{3} c_{mt} PR_{m,j,t-1} + \sum_{m=1}^{3} c_{4mt} \times PR_{m,j,t-1} \times Firm_{j,t-1} +$$

$$+ \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} \end{bmatrix} \times \begin{bmatrix} Size_{jt-1} \\ BM_{jt-1} \\ Turnover_{jt-1} \end{bmatrix} + u_{jt} \tag{3.6}$$

where R_{jt}^{*}, $PR_{m,j,t-1}$, $Size_{jt-1}$, BM_{jt-1}, and $Turnover_{jt-1}$ are defined as in equation 3.2, and $Firm_{jt-1}$ is the firm level financial constraints and investments variables defined as in equation 3.1. A positive and significant coefficient attached to the interaction term between a cumulative return and the firm level financial constraints variable in equation 3.6 would suggest that the higher the firms' financial constraints, the stronger the return predictability of the cumulative return after controlling for risks. This would be evident for the momentum profit that is due to mispricing. Similarly, a positive and significant coefficient attached to the interaction term between a cumulative return and the firm level investments variable in equation 3.6 would suggest that the higher the firms' investments, the stronger the return predictability of the cumulative return after controlling for risks.

In scenario 10, returns are adjusted for risks in stage one using the unconditional Fama and French model (i.e. the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$ is imposed on equation 3.1). The stage-two regression is described in equation 3.6 where $Firm_{jt-1}$ is the investments variable defined as in equation 3.1. The coefficients attached to the three interaction terms are positive, and two of them (1.10 and 0.91) are statistically significant. Therefore, an investment based mispricing explanation could be partially responsible for the return predictability of cumulative returns when firms' investments are high. Yet, the cumulative return coefficients at the two shorter lags are both positive (0.52 and 0.80 respectively) and significant. Hence, cumulative returns continue to predict future returns even when (a) controlling for risks using the unconditional Fama and French model and (b) accounting for the mispricing among firms with high investments. The evidence suggests that the momentum profit is not explained.

In scenario 11, returns are adjusted for risks using the unconditional Fama and French model. The stage-two regression is described in equation 3.6 where $Firm_{jt-1}$ is the financial constraints variable defined as in equation 3.1. Similar to scenario 10, the cumulative return coefficients at the two shorter lags are both positive (0.89 and 0.79 respectively) and significant. Hence, cumulative returns continue to predict future returns, and the momentum profit is not explained. Furthermore, none of the coefficients attached to the interaction terms (between -0.02 and 0.09) is statistically significant. This evidence suggests that information about firms' financial constraints is not relevant to the return predictability of cumulative returns in a mispricing context.

In scenario 12, returns are also adjusted for risks using the unconditional Fama and French model. The stage-two regression is described in equation 3.6 where $Firm_{jt-1}$ refers to both the financial constraints and investments variables defined in equation 3.1. The cumulative return coefficient at lag 4-6 month is positive (0.79) and significant. Hence, the cumulative return at this lag continues to predict future returns (thus suggesting that the momentum profit continues to exist). Similar to scenario 11, all of the three interaction terms between cumulative returns and the financial constraints variable have insignificant coefficients. Closely similar to scenario 10, two out of the three interaction terms between cumulative returns and the investments variable have positive and significant coefficients. The evidence reinforces the observation from scenarios 10 and 11 that the investments variable rather than the financial constraints variable is likely to be relevant to the return predictability of cumulative returns through a mispricing channel.

Finally, given some success of scenarios 7 and 10, it is possible that the predictability of cumulative returns (or the momentum profit) is due to a combination of both a risk based explanation (scenario 7) and a mispricing explanation (scenario 10). In scenario 13, returns are adjusted for risks using the Fama and French model conditioned on the financial constraints variable and the business cycle variable similar to scenario 7. The stage-two regression is described in equation 3.6 where $Firm_{jt-1}$ refers to the investments variable as defined in equation 3.1. For the first time, none of the cumulative return coefficients is statistically significant. Furthermore, of the three coefficients attached to the interaction terms, only one remains significant.

The evidence suggests that the return predictability of cumulative returns, or the momentum profit, can be explained by a combination of two explanations. The first component is a risk based explanation based on firms' financial constraints and the business cycle. The second component is a mispricing explanation based on firms' investments. The evidence partially supports Hypothesis $H_{3.6}$ that the momentum profit can be explained by an asset pricing model containing relevant fundamental information. It is consistent with the other evidence in this chapter that the investment patterns of past winners and past losers and the momentum profit are consistent with a risk based explanation based on Ovtchinnikov and McConnell (2009), and a mispricing explanation based on Baker et al. (2003) and Polk and Sapienza (2009).

3.6. Conclusions

This chapter examines the relationship between firms' investment activities and the profitability of the momentum trading strategy. Consistent with the literature, this chapter finds that the momentum profit exists in the sample examined. All the momentum strategies with the formation and the holding periods of three to twelve months, with and without skipping a month between the two periods, generate positive and significant momentum profits. The widely successful 6 x 6 strategy that skips one month between the formation and the holding period generates a statistically significant momentum profit of 1.21% per month.

The findings show that the momentum profit could be explained by the difference in the investment patterns of past winners and past losers based on three different explanations – the explanation using the credit multiplier effect based on Ovtchinnikov and McConnell (2009) / Hahn and Lee (2009), the explanation using the share issuance channel of Baker et al. (2003), and the explanation using the catering theory of Polk and Sapienza (2009). All of these explanations link past stock prices with firms' investments and future stock prices.

The evidence in this chapter lends support to a combination of the above explanations. Past winners invest more than past losers, and the investment gap is higher during economic upturns than during downturns, consistent with all the three explanations. The investment gap is higher among the firms with high financial constraints than among the firms with low financial constraints. Moreover, the speed of change over time of the investment gap among the firms with high financial constraints is positive. By contrast, it is zero among the firms with low financial constraints. The momentum profit is positive and significant among firms with high financial constraints albeit insignificant among firms with low financial constraints. These observations are consistent with the explanation based on Ovtchinnikov and McConnell (2009) and the explanation based on Baker et al. (2003), while they are inconsistent with the explanation based on Polk and Sapienza (2009).

However, the subsample of firms with medium financial constraints generates a positive and significant momentum profit. Also, its investment gap has a positive speed of change over time. Of the three explanations, this evidence can only be reconciled with the one based on the catering theory of Polk and Sapienza

(2009). The theory does not require firms to be financially constrained. Management can cater for investor sentiment as long as firms are not too financially constrained. The patterns of the investment gap and the momentum profit during economic upturns generally amplify those averaging across upturns and downturns, hence lending support to the corresponding explanations tested in this chapter.

Finally, this chapter reports that cumulative returns can predict future returns even when controlling for risks using the unconditional Fama and French three factor model. This is evident for the existence of the momentum profit. The return predictability is weak when the betas are conditioned on firms' financial constraints and the business cycle variable. Cumulative returns retain their predictability when returns are adjusted for risks using the Fama and French model conditioned on firms' investments. This evidence suggests that at least part of the information on firms' investments is not relevant to the momentum profit through a risk-return channel. The return predictability of cumulative returns is explained when (a) controlling for risks using the Fama and French model conditioned on firms' financial constraints and the business cycle variables, and (b) accounting for the interaction between the momentum profit and firms' investments as suggested in the mispricing explanations based on Polk and Sapienza (2009) and Baker et al. (2003).

The evidence suggests that the momentum profit can be explained by a combination of a risk based explanation based on firms' financial constraints and the business cycle along the lines of Ovtchinnikov and McConnell (2009) and the mispricing explanations based on the share issuance channel of Baker et al. (2003)

and the catering theory of Polk and Sapienza (2009). The findings of this chapter can also be reconciled with several results documented in the literature, such as the stronger momentum profit among firms that do not pay dividends (Asem, 2009), have low credit ratings (Avramov et al., 2007), and have high distress risk (Agarwal and Taffler, 2008). This chapter offers an explanation to a puzzle from Avramov et al. (2007) that the momentum profit exists only among firms with low credit rating but appears stronger during economic expansions when the default risk is lower.

Implications

The findings in this chapter have several implications. This chapter reports that a risk-return relationship cannot fully explain the momentum profit. Hence, future stock returns can be predicted using past stock returns even when accounting for risks. This return predictability can be explained by the management's behaviours - timing the share issuance at the time of over-valuation to finance the investments that are otherwise forgone (Baker et al., 2003), and catering the investor sentiment by means of investing (Polk and Sapienza, 2009). In the language of the market efficiency literature, the market is not fully efficient with regards to the information about past stock returns. Furthermore, the profitability of the momentum trading strategy is affected by firms' investment and their financial constraints. It generally suggests that the understanding of corporate finance can help extend the understanding of the securities markets.

Finally, investors would benefit more from pursuing the strategy among firms with high financial constraints and in economic upturns than among those with low financial constraints and in downturns. Implementing the trading strategy among past winners and past losers that are far different in their current investment activities can also improve the performance of the strategy. The momentum profit can be partially explained when risks are controlled for using the asset pricing model conditioned on these financial inflexibility characteristics. Hence investors should bear in mind that part of the improved performance of the momentum trading strategy might just be a compensation for higher risks, i.e. higher exposure to the credit multiplier effect.

Table 3.1: Summary of Hypotheses

The hypotheses examined in chapter 3 are summarised below:

	O&M/KM, HL	**B&W**	**BSW**	**P&S**
$H_{3.1}$	Accept		Accept	Accept
$H_{3.2}$	Accept	Accept	Accept	Accept
$H_{3.3}$	Accept	Reject	Accept	Reject
$H_{3.4}$	Accept		Accept	Reject
$H_{3.5}$	Accept		Accept	Accept
$H_{3.6}$	Accept		Reject	Reject

O&M / KM, HL represent the explanation based on firms' growth opportunities (Ovtchinnikov and McConnell, 2009) and the credit multiplier effect described in Kiyotaki and Moor (1997) and tested in Hahn and Lee (2009). B&W represents the explanation based on private information embedded in the stock price of Bakke and Whited (2010). BSW represents the explanation based on the share issuance channel of Baker et al. (2003). Finally, P&S represents the explanation based on the catering theory of Polk and Sapienza (2009).

Table 3.2: Construction of Key Variables

The key variables used in chapter 3 are constructed as follows:

A. Key variables in portfolio sorting

Key variables	**Construction**
Holding period cumulative returns	The cumulative six month returns during the momentum portfolio holding period in a 6x6 strategy which skips one month between the formation and the holding periods. The strategy is formed as follows. In each month, stocks are sorted in ascending order into deciles by the cumulative returns from month t-6 to month t-1 (i.e. the formation period) using the sample decile breakpoints. The resulting ten portfolios are held for six months from month t+1 to month t+6 (i.e. the holding period).
CAPEX ratio	The ratio of capital expenditures incurred during a year divided by the beginning of the year net fixed assets. The reported monthly CAPEX is the contemporaneous CAPEX. For example, if the current month is March 2005, the CAPEX ratio for each stock is measured for the financial year ended in December 2005.
Net payout ratio	Dividends plus repurchases minus share issuance, scaled by the net incomes, measured in December of the previous year.

B. Key variables in the regression of the Avramov and Chordia (2006) framework

The construction of these variables is described in Panel B of Table 2.2 (p. 103).

Table 3.3: Sample Description

Table 3.3 presents some descriptive statistics of the sample of non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

	Mean	Median	Standard deviation
A – Key variables in portfolio sorting			
Returns (%)	1.15	0.76	10.61
Holding period cumulative returns (%)	9.48	12.20	30.14
CAPEX ratio (%)	33.38	23.88	58.07
Net payout ratio (%)	2.93	19.84	1,320.33
Correlation, CAPEX and net payout	-0.00		
p-value	0.47		
B – Key variables in regressions			
Market capitalisation ($ billion)	2.33	0.35	8.35
Book-to-Market ratio	0.76	0.64	0.55
Cumulative returns, months 2 to 3 (%)	3.36	2.26	15.26
Cumulative returns, months 4 to 6 (%)	5.13	3.43	19.19
Cumulative returns, months 7 to 12 (%)	10.87	6.92	30.24
Turnover, NYSE and AMEX (%)	16.41	11.53	17.29
Turnover, NASDAQ (%)	7.12	5.44	6.45

A. Key variables in portfolio sorting

Panel A reports the statistics for the variables used in the portfolio sorting methodology. Returns measure the monthly stock returns. The construction of the other variables is described in Panel A of Table 3.2. Panel A also reports the correlation coefficient between these variables, and the two tailed p-value to test whether the correlation coefficient is different from zero.

B. Key variables in the regression of the Avramov and Chordia (2006) framework

Panel B describes the statistics for the variables used in the regression of the Avramov and Chordia (2006) asset pricing framework. The sample is further constrained in that there should be data on stock returns, market capitalisation, and the Book-to-Market ratio in the current year and in the 36 months prior to the current month. The construction of the variables is described in Panel B of Table 2.2.

Table 3.4: Returns to the Alternative Momentum Trading Strategies

Table 3.4 presents the returns to the momentum trading strategies with different formation and holding periods. The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

		Panel A				Panel B			
J		K= 3	6	9	12	3	6	9	12
3	**Losers**	**0.85**	**0.68**	**0.68**	**0.66**	**0.60**	**0.58**	**0.58**	**0.65**
		2.17	1.77	1.78	1.78	1.55	1.51	1.54	1.77
3	**Winners**	**1.36**	**1.41**	**1.45**	**1.41**	**1.46**	**1.49**	**1.49**	**1.40**
		3.89	4.06	4.21	4.10	4.12	4.26	4.30	4.05
3	**W-L**	**0.51**	**0.73**	**0.77**	**0.75**	**0.86**	**0.91**	**0.91**	**0.75**
		1.95	3.32	3.81	4.38	3.47	4.22	4.78	4.51
6	**Losers**	**0.72**	**0.60**	**0.57**	**0.66**	**0.57**	**0.52**	**0.57**	**0.71**
		1.80	1.50	1.46	1.73	1.43	1.32	1.48	1.88
6	**Winners**	**1.60**	**1.66**	**1.64**	**1.53**	**1.70**	**1.73**	**1.64**	**1.50**
		4.47	4.67	4.65	4.37	4.73	4.84	4.64	4.26
6	**W-L**	**0.88**	**1.06**	**1.08**	**0.87**	**1.13**	**1.21**	**1.07**	**0.79**
		2.99	3.98	4.52	4.00	3.99	4.73	4.73	3.70
9	**Losers**	**0.73**	**0.64**	**0.72**	**0.82**	**0.57**	**0.63**	**0.75**	**0.88**
		1.81	1.63	1.88	2.17	1.45	1.65	1.98	2.36
9	**Winners**	**1.79**	**1.76**	**1.67**	**1.54**	**1.86**	**1.76**	**1.64**	**1.51**
		4.94	4.90	4.71	4.37	5.11	4.91	4.61	4.25
9	**W-L**	**1.06**	**1.12**	**0.95**	**0.72**	**1.29**	**1.13**	**0.89**	**0.62**
		3.49	4.14	3.75	3.03	4.51	4.33	3.60	2.68
12	**Losers**	**0.75**	**0.80**	**0.90**	**0.98**	**0.62**	**0.76**	**0.87**	**0.95**
		1.92	2.07	2.37	2.61	1.62	2.00	2.32	2.57
12	**Winners**	**1.71**	**1.66**	**1.58**	**1.50**	**1.71**	**1.63**	**1.53**	**1.44**
		4.72	4.63	4.45	4.22	4.73	4.52	4.28	4.05
12	**W-L**	**0.96**	**0.86**	**0.68**	**0.52**	**1.10**	**0.87**	**0.66**	**0.49**
		3.21	3.09	2.59	2.07	3.90	3.25	2.62	2.06

A. The momentum strategies without skipping one month between the formation and the holding periods

Panel A reports the returns to the equally weighted portfolios of stocks sorted in ascending order by the cumulative returns in the last J months (the formation period) using the sample decile breakpoints. Ten portfolios with equal number of stocks are composed and positions (long and short) are taken and held for the following K months. The raw returns of the ten equally weighted deciles and of the long-short portfolio that goes long in past winners (i.e. the portfolio with top ranking in the formation period's cumulative return) and short in past losers (i.e. the portfolio with bottom ranking in the formation period's cumulative return) are reported.

B. The momentum strategies that skip one month between the formation and the holding periods

Panel B reports the returns of the deciles and of the long-short portfolios when the momentum strategies skip one month between the formation and the holding periods.

In both Panels A and B, the lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether a portfolio's return is different from zero.

Table 3.5: The Financial Constraints and Investments of the Momentum Deciles

Table 3.5 presents the average CAPEX ratios of past winners and past losers during the holding period in the overall sample and the three subsamples by firms' financial constraints. The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded. The momentum strategy is a 6 x 6 one which skips one month between the formation and the holding period. The design of the strategy is described in Table 3.4. The construction of the CAPEX ratio and the net payout ratio is described in Table 3.2.

The portfolio CAPEX is determined as follows: (1) calculate the mean contemporaneous CAPEX of the portfolio in each calendar month; and (2) calculate the average of this mean contemporaneous CAPEX across the calendar month for each portfolio. To calculate the investment gap between the past winners and past losers (W-L), this chapter (a) first takes the difference in the mean contemporaneous CAPEX ratio of the winner and the loser portfolios in each calendar month; and (b) calculates the average of this CAPEX gap across the calendar months.

The overall sample is divided into three subsamples. Firms having the net payout ratio in the bottom 30% are included in the subsample with high financial constraints. Firms having the net payout ratio in the top 30% are included in the subsample with low financial constraints. The remaining firms are included in the subsample with medium financial constraints. The two tailed t-statistics to test whether the investment gaps are different from zero are presented. *, ** and *** denote the significance levels of 10%, 5% and 1% respectively.

	Overall sample (1)	High financial constraints (2)	Medium financial constraints (3)	Low financial constraints (4)
Losers	35.39	43.96	29.31	31.67
2	31.75	41.73	28.07	25.13
3	29.71	40.97	27.92	23.31
4	29.31	41.73	27.51	23.07
5	29.49	42.47	27.63	22.87
6	29.56	44.29	28.52	23.21
7	30.78	46.43	29.24	23.88
8	32.49	48.41	30.63	24.31
9	36.36	52.29	32.68	26.19
Winners	48.92	64.81	38.18	46.00
W-L	13.53	20.84	8.87	14.33
t-stat	14.86 ***	21.95 ***	14.54 ***	4.46 ***

Table 3.6: The Financial Constraints and Investments of the Momentum Deciles across the Business Cycle

Table 3.6 presents the average CAPEX ratios of past winners and past losers during the holding period in the overall sample and the three subsamples by firms' financial constraints. The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

The momentum strategy is a 6 x 6 one which skips a month between the formation and the holding period. The design of the strategy is described in Table 3.4. The construction of the CAPEX ratio and the net payout ratio is described in Table 3.2. The measurement of the portfolio CAPEX is described in Table 3.5. The construction of the subsample of firms with high, medium and low financial constraints is also described in Table 3.5.

Economic upturns and downturns are classified using the lagged three year cumulative market returns. If the cumulative market return is positive (negative), the following month is classified as the upturn (downturn). The cumulative CAPEX ratio of the holding period is calculated as the sum of the mean CAPEX ratio of the portfolio for the six month holding period. For each momentum decile, the cumulative CAPEX ratio series is regressed against an UP and a DOWN dummy variables. The coefficients attached to these UP and DOWN dummies measure the average CAPEX ratio of the corresponding decile portfolio during economic upturns and downturns respectively.

Defining the cumulative investment gap as the sum of the gap for the six month holding period, the coefficients in the regression of the cumulative investment gap against an UP dummy and a DOWN dummy measure the average cumulative investment gaps during economic upturns and downturns respectively. The cumulative investment gap is then regressed against the UP dummy variable and a constant. The coefficient attached to the UP dummy variable measures the difference between the investment gap following economic upturns versus downturns. All the coefficients from the regressions are divided by six to report the monthly figures in this table. The two tailed t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method to test whether the investment gaps during upturns and downturns are different from zero, and different from each other. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	Overall sample		High financial constraints		Medium financial constraints		Low financial constraints	
	Up	Down	Up	Down	Up	Down	Up	Down
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Losers	36.22	29.65	44.78	36.44	29.72	24.80	32.51	24.79
2	32.48	26.59	43.16	32.06	28.46	24.17	25.52	21.51
3	30.32	25.50	42.07	34.12	28.50	23.76	23.39	21.53
4	29.93	25.05	43.27	31.96	27.99	23.69	23.28	20.65
5	30.24	24.54	44.29	31.46	28.01	24.47	23.23	19.45
6	30.13	25.59	46.45	30.46	28.82	26.21	23.43	20.74
7	31.56	25.71	48.63	33.18	29.84	25.47	24.28	20.91
8	33.31	27.12	50.77	35.39	31.25	26.30	24.72	21.05
9	37.46	29.51	54.71	37.11	33.19	29.48	26.51	22.96
Winners	50.96	36.20	67.63	43.64	38.79	34.14	47.95	31.40
W-L	14.75	6.55	22.85	7.20	9.07	9.34	15.44	6.61
t-stat	6.77	2.30	10.42	2.04	6.60	3.66	2.02	1.40
	***	**	***	**	***	***	**	

	Overall sample (1) – (2)	High financial constraints (3) – (4)	Medium financial constraints (5) – (6)	Low financial constraints (7) – (8)
t-stat	2.30	3.78	-0.10	0.99
p-value	2%	0%	92%	32%
	**	***		

Table 3.7: Financial Constraints and the Momentum Trading Strategy

Table 3.7 presents the returns to the momentum trading strategy in the overall sample and the three subsamples by firms' financial constraints. The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded. The momentum strategy is a 6 x 6 one which skips a month between the formation and the holding period. The design of the strategy is described in Table 3.4. The construction of the net payout ratio is described in Table 3.2. The construction of the subsamples with high, medium and low financial constraints is described in Table 3.5.

	Overall sample (1)	High financial constraints (2)	Medium financial constraints (3)	Low financial constraints (4)
Losers	**0.52**	**1.23**	**1.25**	**1.35**
	1.32	2.72	3.68	3.76
2	**0.86**	**1.14**	**1.23**	**1.22**
	2.78	2.97	4.38	4.66
3	**0.96**	**0.99**	**1.29**	**1.19**
	3.38	2.71	4.80	5.03
4	**1.09**	**1.05**	**1.29**	**1.25**
	4.07	2.99	4.97	5.47
5	**1.14**	**1.10**	**1.31**	**1.28**
	4.38	3.19	5.20	5.85
6	**1.23**	**1.21**	**1.43**	**1.30**
	4.81	3.52	5.68	5.91
7	**1.22**	**1.29**	**1.40**	**1.34**
	4.75	3.76	5.52	6.07
8	**1.35**	**1.49**	**1.41**	**1.35**
	5.10	4.28	5.46	6.07
9	**1.44**	**1.68**	**1.49**	**1.44**
	4.99	4.58	5.33	6.12
Winners	**1.73**	**1.88**	**1.74**	**1.55**
	4.84	4.51	5.14	5.17
W-L	**1.21**	**0.65**	**0.50**	**0.20**
	4.73	2.14	2.06	0.75
	***	**	**	

The raw returns of the ten equally weighted deciles and of the long-short portfolios that go long in past winners (i.e. the portfolio with top ranking in the formation period's cumulative return) and short in past losers (i.e. the portfolio with bottom ranking in the formation period's cumulative return) are reported. The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether a portfolio's return is different from zero. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 3.8: Financial Constraints and the Momentum Trading Strategy across the Business Cycle

Table 3.8 presents the returns to the momentum trading strategy in the overall sample and the three subsamples by firms' financial constraints. The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded. The momentum strategy is a 6 x 6 one which skips a month between the formation and the holding period. The design of the strategy is described in Table 3.4. The construction of the net payout ratio is described in Table 3.2. The construction of the subsamples of firms with high, medium and low financial constraints is described in Table 3.5.

This chapter uses the methodology used in Cooper et al. (2004) to determine portfolio returns following economic upturns and downturns. Economic upturns and downturns and the associated dummy variables UP and DOWN are defined in Table 3.4. For each momentum decile portfolio, the cumulative return of the holding period is calculated as the sum of the return of the portfolio for the six month holding period. The cumulative return series is regressed against an UP dummy and a DOWN dummy variable. The coefficients attached to these UP and DOWN dummies measure the average cumulative return of the corresponding decile portfolio during economic upturns and downturns respectively.

W-L measures the momentum profit, i.e. the return of the long-short portfolios that go long in past winners (i.e. the portfolio with top ranking in the formation period's cumulative return) and short in past losers (i.e. the portfolio with bottom ranking in the formatio period's cumulative return). The coefficients in the regression of the cumulative momentum profit against an UP dummy and a DOWN dummy measure the average cumulative momentum profit during economic upturns and downturns respectively. The cumulative momentum profit is then regressed against the UP dummy variable and a constant. The coefficient attached to the UP dummy variable measures the difference between the momentum profit following economic upturns versus downturns. All the coefficients from the regressions are divided by six to report the monthly figures in this table. In the main table, the lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether a portfolio's return is different from zero. In the supplementary table, the two tailed t-statistics test whether the returns to a long-short portfolio during upturns and downturns are different from each other. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	Overall sample		High financial constraint		Medium financial constraint		Low financial constraint	
	Up (1)	Down (2)	Up (3)	Down (4)	Up (5)	Down (6)	Up (7)	Down (8)
Losers	**0.35**	**2.03**	**1.10**	**2.80**	**1.12**	**2.37**	**1.16**	**2.96**
	1.51	1.88	3.95	2.39	5.16	2.34	5.23	4.00
2	**0.76**	**1.83**	**1.02**	**2.29**	**1.12**	**2.26**	**1.12**	**2.11**
	3.69	2.03	4.15	2.41	5.48	2.84	6.28	2.82
3	**0.90**	**1.67**	**0.88**	**2.09**	**1.20**	**2.14**	**1.15**	**1.69**
	4.54	1.98	3.46	2.11	6.15	2.70	6.89	2.24
4	**1.03**	**1.74**	**0.98**	**1.86**	**1.19**	**2.18**	**1.20**	**1.76**
	5.43	2.18	4.13	2.07	6.18	2.98	7.50	2.48
5	**1.09**	**1.66**	**1.09**	**1.56**	**1.24**	**1.99**	**1.23**	**1.77**
	5.91	2.29	4.57	1.49	6.91	2.83	7.98	2.85
6	**1.21**	**1.58**	**1.21**	**1.67**	**1.38**	**2.01**	**1.26**	**1.77**
	6.82	2.13	4.81	2.04	7.36	2.77	8.21	2.77
7	**1.19**	**1.67**	**1.32**	**1.43**	**1.35**	**1.97**	**1.30**	**1.72**
	6.44	2.30	5.33	1.62	7.30	2.85	8.40	2.82
8	**1.33**	**1.69**	**1.53**	**1.57**	**1.38**	**1.87**	**1.30**	**1.82**
	7.11	2.40	5.94	2.00	7.32	2.59	8.02	3.00
9	**1.45**	**1.52**	**1.74**	**1.60**	**1.47**	**1.79**	**1.43**	**1.76**
	6.97	2.20	6.16	2.07	7.10	2.73	8.26	2.53
Winners	**1.78**	**1.59**	**2.00**	**1.42**	**1.75**	**1.93**	**1.50**	**2.05**
	6.43	2.03	6.14	1.68	6.61	2.67	6.87	2.86
W-L	**1.42**	**-0.44**	**0.89**	**-1.37**	**0.63**	**-0.44**	**0.34**	**-0.91**
	8.28	-0.83	3.82	-1.98	3.51	-0.74	1.86	-1.59
	***		***	**	***		*	

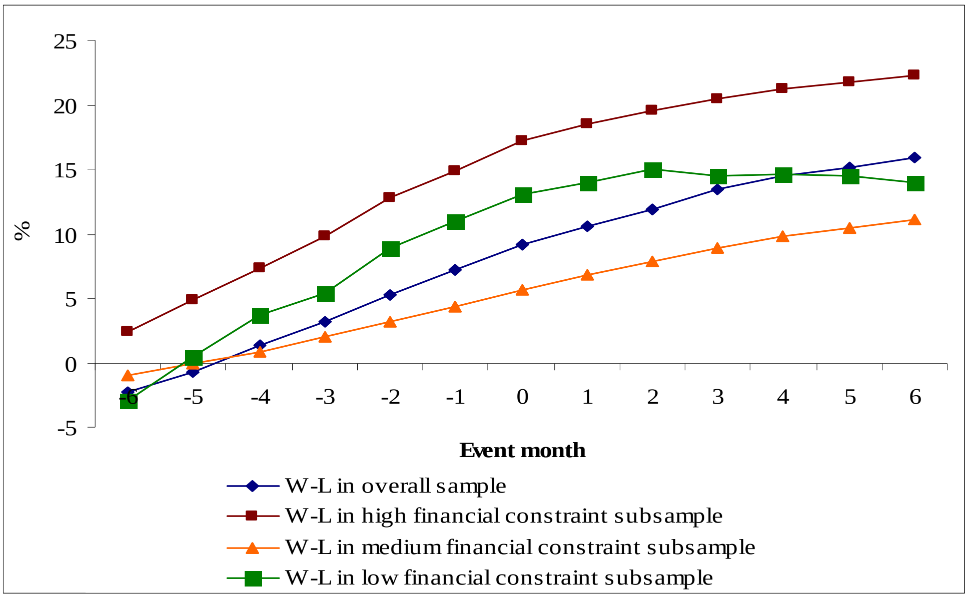
	Overall sample (1) – (2)	High financial constraint (3) – (4)	Medium financial constraint (5) – (6)	Low financial constraint (7) – (8)
t-stat	3.33	3.11	1.73	2.09
p-value	0%	0%	9%	4%
	***	***	*	**

Figure 3.1: The Investments of the Momentum Deciles

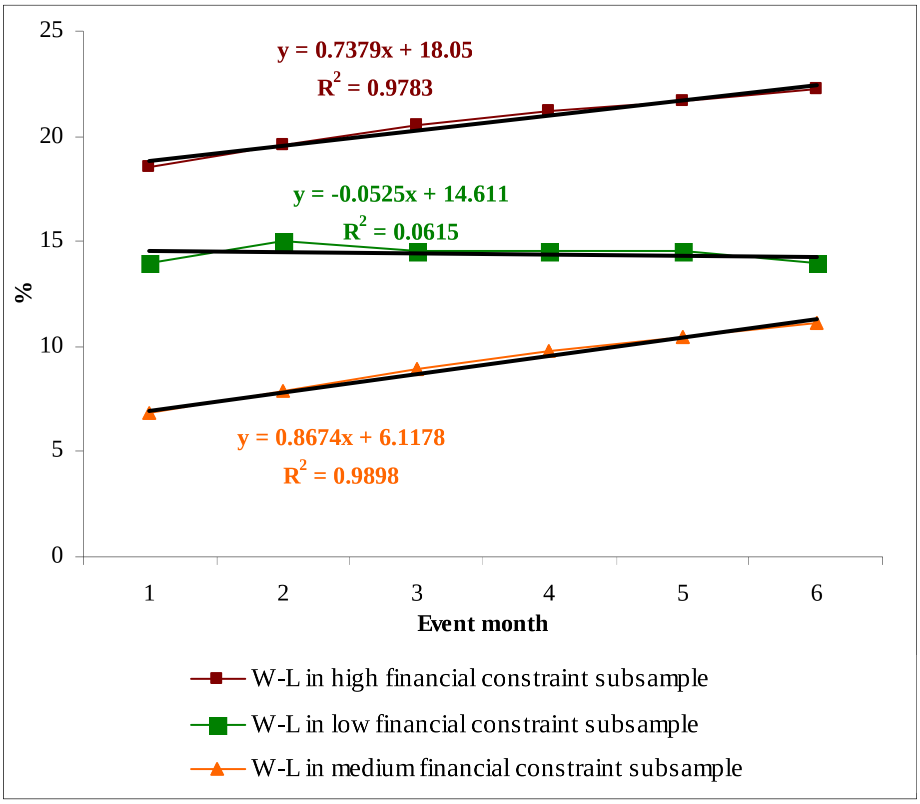
Figure 3.1 presents the average CAPEX ratios of past winners and past losers during the holding period in the overall sample and the three subsamples by firms' financial constraints. The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December of the previous year are considered. The firm-month observations with a stock price below \$5 or the market value falling within the smallest NYSE size decile are excluded. The momentum strategy is a 6 x 6 one which skips a month between the formation and the holding period. The design of the strategy is described in Table 3.4. The construction of the CAPEX ratio and the net payout ratio is described in Table 3.2. The construction of the subsample of firms with high, medium and low financial constraints is described in Table 3.5.

An event window consisting of the formation period (month -6 to month -1) and the holding period (month 1 to month 6) is considered. For each of the twelve event months within this window, the average contemporaneous CAPEX ratios of the ten deciles are calculated. This is done by first taking the average contemporaneous CAPEX ratios of each portfolio in each calendar month for each event month. Then the gap in the mean CAPEX ratios between past winners and past losers in each calendar month is calculated. Finally, the average of this CAPEX gap is taken across the calendar months.

A. Investment gaps between past winners and past losers across the formation and holding periods



B. Investment gaps between past winners and past losers across the holding period



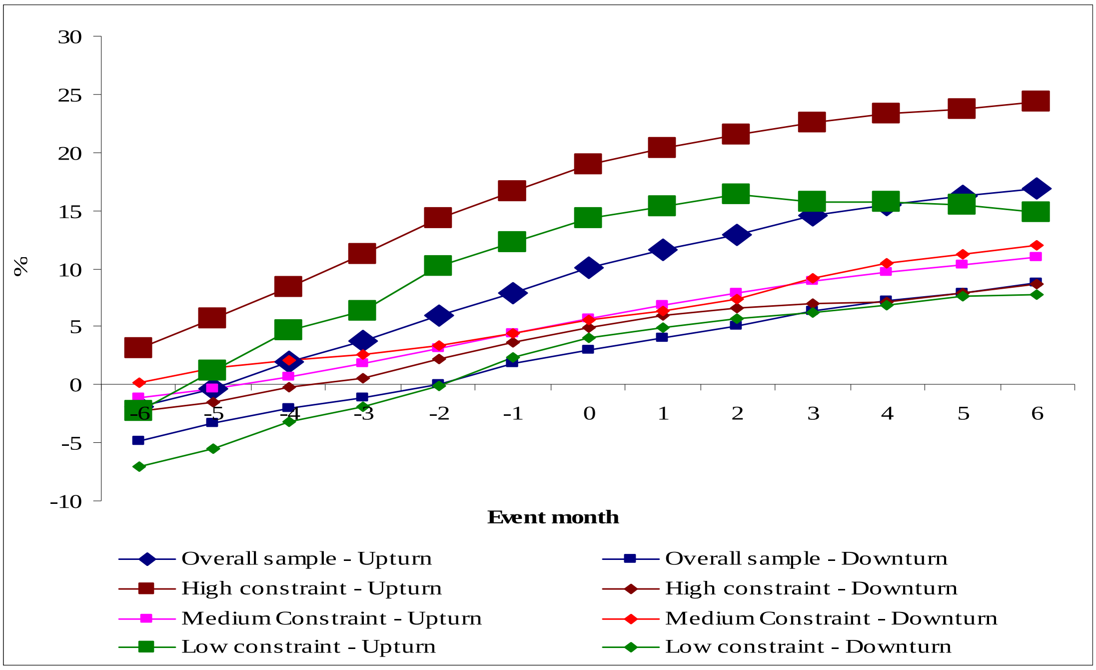
C. Data supporting Figures 3.1 A & B

Event month	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Overall sample	-2.25	-0.70	1.40	3.16	5.21	7.15	9.15	10.63	11.95	13.45	14.43	15.12	15.85
High financial constraint subsample	2.45	4.83	7.33	9.87	12.75	14.93	17.16	18.53	19.57	20.51	21.21	21.69	22.28
Medium financial constraint subsample	-0.96	-0.12	0.89	1.96	3.13	4.41	5.66	6.80	7.84	8.93	9.75	10.44	11.15
Low financial constraint subsample	-2.91	0.39	3.68	5.33	8.91	10.94	13.02	14.01	15.01	14.52	14.58	14.51	13.94

Figure 3.2: The Investments of the Momentum Deciles across the Business Cycle

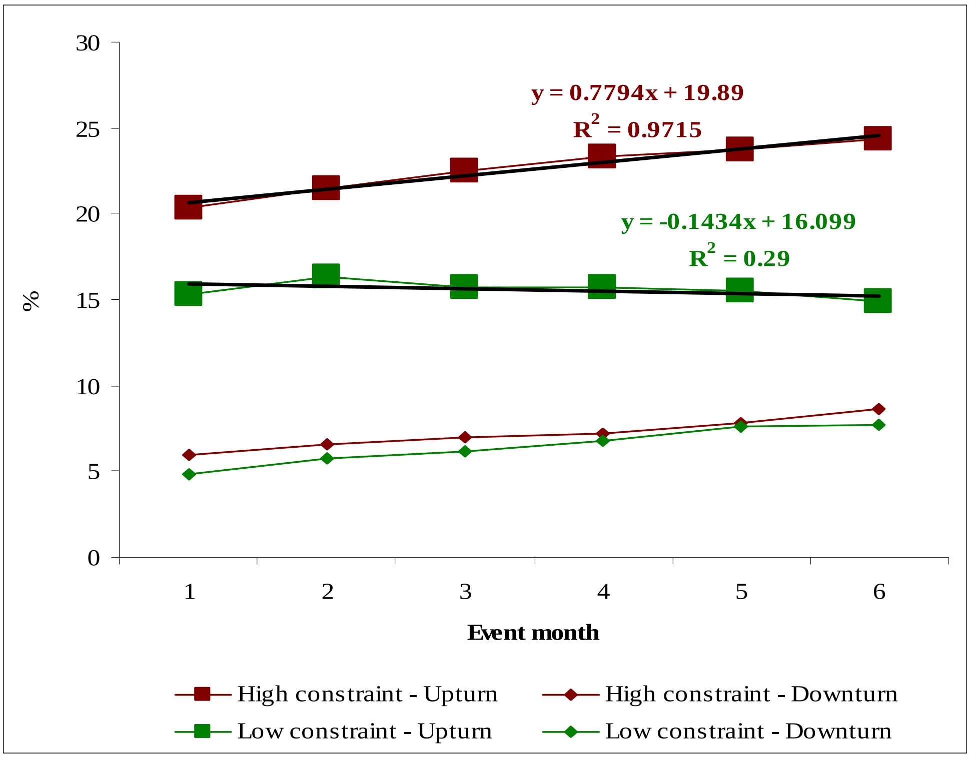
Figure 3.2 presents the average CAPEX ratios of past winners and past losers during the holding period in the overall sample and the three subsamples by firms' financial constraints in different states of the business cycle. The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded. The momentum strategy is a 6 x 6 one which skips a month between the formation and the holding period. The design of the strategy is described in Table 3.4. The construction of the CAPEX ratio and the net payout ratio is described in Table 3.2. The construction of the subsample of firms with high, medium and low financial constraints is described in Table 3.5.

A. Investment gaps between past winners and past losers across the formation and holding periods in economic upturns vs. downturns



An event window consisting of the formation period (month -6 to month -1) and the holding period (month 1 to month 6) is considered. The calendar months are classified into economic upturns and downturns as defined in Table 3.6. During upturn months, for each of the twelve event months within this window, the average contemporaneous CAPEX ratios of the ten deciles are calculated. This is done in a similar way as the average contemporaneous CAPEX ratios are calculated for all months in Figure 3.1. The same procedure is repeated to determine the average CAPEX ratios of the past winners and past losers, and the average investment gap between them during downturns.

B. Investment gaps between past winners and past losers during the holding period in economic upturns vs. downturns



C. Data supporting Figures 3.2 A & B

Event month	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Overall sample – Upturn	-1.86	-0.32	1.90	3.79	5.97	7.94	10.05	11.60	12.95	14.50	15.49	16.19	16.90
Overall sample – Downturn	-4.90	-3.28	-2.00	-1.15	0.06	1.82	3.05	4.03	5.10	6.32	7.21	7.86	8.78
High constraint – Upturn	3.14	5.75	8.45	11.23	14.29	16.58	18.96	20.37	21.48	22.51	23.29	23.75	24.31
High constraint – Downturn	-2.26	-1.47	-0.27	0.59	2.24	3.61	4.94	5.98	6.54	6.94	7.17	7.83	8.62
Medium Constraint – Upturn	-1.12	-0.34	0.71	1.87	3.08	4.41	5.68	6.86	7.92	8.91	9.64	10.32	11.03
Medium Constraint – Downturn	0.17	1.39	2.10	2.56	3.40	4.43	5.55	6.38	7.30	9.11	10.50	11.23	12.00
Low constraint – Upturn	-2.31	1.25	4.69	6.39	10.23	12.19	14.34	15.35	16.37	15.75	15.73	15.52	14.86
Low constraint – Downturn	-7.02	-5.44	-3.19	-1.91	-0.12	2.41	4.01	4.87	5.71	6.20	6.82	7.64	7.69

Table 3.9: The Momentum Profit - Investment based Risk versus Mispricing Explanations

Table 3.9 presents the results of the regressions of risk adjusted returns on the momentum variables and other firm level variables using the framework of Avramov and Chordia (2006). The sample includes non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market from 1972 to 2006. Only stocks with available information to calculate the CAPEX ratio for the current year and the net payout ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded. The sample is further constrained in that there should be data on stock returns, market capitalisation, and the Book-to-Market ratio in the current year and in the 36 months prior to the current month.

This chapter uses the Fama and French model as the base model in the time series regression described in equation 3.1 (p. 157). The part of returns unexplained by the asset pricing model in equation 3.1 is regressed against the cumulative past returns in a cross sectional regression to assess the explanatory power of the model with regards to the momentum anomaly, i.e. the positive relationship between current stock returns and cumulative past stock returns. Size, the Book-to-Market ratio, and stock turnovers are included in the cross sectional regression to control for the predictability of stock returns with regards to these variables. The cross sectional regression is described in equation 3.2 (p. 158). The construction of the key variables in stage two is described in Table 3.2. Their transformation is described in section 3.4.2 (p. 155).

The specifications of the regressions for the scenarios tested are as follows:

- Scenario 1: Returns are not adjusted for risks, hence no stage one regression is run. In stage two, the regression is described in equation 3.2.
- Scenario 2: Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 3.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 3.2.
- Scenarios 3, 4 and 5: Returns are adjusted for risks using the conditional Fama and French model. The regression is described in equation 3.1 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. In scenario 3, the variable $Firm_{j,t-1}$ refers to the financial constraints variable; in scenario 4 it refers to the investments variable; and in scenario 5, both the financial constraints and the investments variables. In stage two, the regression is described in equation 3.2.

- Scenario 6: Returns are adjusted for risks using the conditional Fama and French model on the business cycle variable. The regression is described in equation 3.1 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 3.2.
- Scenarios 7, 8, 9: Returns are adjusted for risks using the conditional Fama and French model as described in equation 3.1. In scenario 7, the variable $Firm_{j,t-1}$ refers to the financial constraints variable; in scenario 8 it refers to the investments variable; and in scenario 9, both the financial constraints and the investments variables. In stage two, the regression is described in equation 3.2.
- Scenarios 10, 11, 12: Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 3.1 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 3.6 (p. 182). In Scenario 10, $Firm_{j,t-1}$ refers to the financial constraints variable; in scenario 11 it refers to the investments variable; and in scenario 12, both the financial constraints and the investments variables.
- Scenario 13: Returns are adjusted for risks using the conditional Fama and French model as described in equation 3.1 where the variable $Firm_{j,t-1}$ refers to the financial constraints variable. In stage two, the regression is described in equation 3.6 with $Firm_{j,t-1}$ referring to the investments variable.

The coefficients and t-statistics are reported. The coefficients are multiplied by 100. The two tailed t-statistics to test whether a coefficient is different from zero are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) procedure. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5	
Momentum variables										
lagRET23	0.76	**	0.87	***	0.85	***	1.01	***	0.97	***
	2.54		3.12		3.05		3.71		3.57	
lagRET46	0.80	***	0.81	***	0.86	***	0.81	***	0.87	***
	3.22		3.61		3.97		3.77		4.23	
lagRET712	0.48	**	0.26		0.32	*	0.32	*	0.37	**
	2.47		1.35		1.68		1.76		2.02	
Control variables										
lagBM	0.00	***	0.09	*	0.07		0.05		0.04	
	3.37		1.67		1.32		1.03		0.83	
lagSize	0.00	***	-0.27	***	-0.26	***	-0.27	***	-0.26	***
	-7.66		-12.79		-12.89		-13.06		-13.05	
lagTONQ	0.00		-0.03		0.00		-0.02		0.01	
	-0.25		-0.52		-0.01		-0.34		0.15	
lagTONX	0.00		-0.06		-0.05		-0.05		-0.05	
	-0.38		-1.00		-0.81		-0.78		-0.84	
NASDAQ	0.00	*	0.27	***	0.27	***	0.26	***	0.26	***
	1.81		3.50		3.70		3.57		3.70	
Intercept	-0.48	***	0.32	***	0.35	***	0.35	***	0.37	***
	-16.52		4.22		4.99		5.19		5.79	
Adjusted R^2	6.20%		2.74%		2.62%		2.55%		2.51%	

	Scenario 6		Scenario 7		Scenario 8		Scenario 9	
Momentum variables								
lagRET23	0.81	***	0.82	**	0.81	***	0.85	***
	3.14		1.98		2.57		3.26	
lagRET46	0.79	***	0.43		0.84	***	0.66	***
	3.46		1.07		3.75		3.18	
lagRET712	0.44	***	0.18		0.57	***	0.47	***
	2.79		0.65		3.19		3.35	
Control variables								
lagBM	0.06		0.17	*	-0.03		0.05	
	1.07		1.88		-0.52		0.99	
lagSize	-0.27	***	-0.26	***	-0.27	***	-0.24	***
	-11.94		-9.26		-9.81		-10.60	
lagTONQ	-0.02		-0.08		-0.08		0.07	
	-0.41		-1.49		-1.62		1.13	
lagTONX	-0.05		-0.02		-0.10	**	-0.06	
	-1.02		-0.41		-1.94		-1.14	
NASDAQ	0.28	***	0.20	***	0.19	***	0.26	***
	4.24		3.00		3.14		4.06	
Intercept	0.32	***	0.38	***	0.38	***	0.36	***
	4.46		5.68		5.68		6.21	
Adjusted R^2	2.56%		2.34%		2.44%		2.16%	

	Scenario 10		Scenario 11		Scenario 12		Scenario 13	
Momentum variables								
lagRET23	0.52	*	0.89	***	0.50		0.34	
	1.70		3.13		1.59		0.53	
lagRET46	0.80	***	0.79	***	0.79	***	0.13	
	3.10		3.46		3.06		0.17	
lagRET712	-0.07		0.25		-0.09		-0.49	
	-0.28		1.35		-0.37		-1.03	
Interaction variables								
lagRET23 x lagFC			0.01		0.04			
			0.08		0.39			
lagRET46 x lagFC			0.09		0.08			
			0.84		0.72			
lagRET712 x lagFC			-0.02		0.01			
			-0.28		0.10			
lagRET23 x lagCAPEX	1.10	**			1.21	**	1.21	
	2.04				2.20		0.86	
lagRET46 x lagCAPEX	0.02				-0.04		0.81	
	0.02				-0.07		0.54	
lagRET712 x lagCAPEX	0.91	**			0.98	***	2.08	**
	2.47				2.70		2.14	
Control variables								
lagBM	0.10	*	0.09	*	0.10	*	0.19	*
	1.73		1.64		1.68		1.90	
lagSize	-0.27	***	-0.27	***	-0.26	***	-0.26	***
	-12.65		-12.72		-12.62		-9.44	
lagTONQ	-0.03		-0.02		-0.03		-0.09	*
	-0.63		-0.45		-0.56		-1.66	
lagTONX	-0.06		-0.06		-0.06		-0.03	
	-1.02		-0.99		-1.00		-0.62	
NASDAQ	0.27	***	0.27	***	0.27	***	0.20	***
	3.48		3.51		3.48		3.09	
Intercept	0.31	***	0.32	***	0.31	***	0.36	***
	4.13		4.17		4.10		5.48	
Adjusted R^2	3.08%		2.94%		3.28%		2.85%	

Chapter 4 – Firms' Investment and Financing Flexibility and the Accruals based Trading Strategy

4.1. Introduction

Sloan (1996) documents that the strategy to buy stocks of firms with low accounting accruals and sell stocks of firms with high accounting accruals generates positive and significant profits. Sloan's finding suggests that high accruals predict low subsequent returns. The author first explains this profit (or the accruals premium) with the functional fixation hypothesis. In his hypothesis investors are irrational and ignore the difference in the persistence of cash based versus accrual based earnings when making their earnings forecasts. As the cash based earnings are more persistent than the accrual based earnings, accruals are mispriced. Firms with high accruals are overpriced whereas those with low accruals are underpriced.

Subsequent to Sloan's paper, several studies have been trying to explain the accruals premium. Of these studies, a growing line of research view accruals as a reflection of firm growth. Zhang (2007) and Fairfield et al. (2003) argue that the accruals premium arises due to investors' failure to recognise the true contribution of growth to firm value. In addition, Wu et al. (2010) show that a risk based explanation based on firms' investments can partially explain the accruals premium.

Accruals reflect firm growth as they represent firms' investment in working capital. The return predictability of accruals is likely related to the return predictability of firm growth. Cooper et al. (2008) document that high total asset growth predicts low subsequent stock returns. Furthermore, as firm growth often involves investment in both fixed capital and working capital, the return predictability of accruals and of fixed investments are related. Titman et al. (2004)

document that a strategy that buys stocks with low fixed investments and sells those with high fixed investments also generates positive and significant profits (here after the fixed investment premium).

Wei and Xie (2008) argue that both the accruals premium and the fixed investment premium are due to management over-optimism about firms' future product market demands. Alternatively, Polk and Sapienza (2009) and Kothari et al. (2006) argue that the fixed investment premium and the accruals premium are due to the management of overvalued firms catering for investor sentiment. However, Wei and Xie (2008) document that the negative relationship between fixed capital investments and stock returns is related to the negative relationship between accruals and stock returns, but they are not subsumed by each other.

While the debate on what explains the accruals premium remains in dispute, there arises another debate on whether it is disappearing. According to Green et al. (2009), the accruals premium has disappeared in the last few years. However, some studies show that the accruals premium varies over time, hence it is likely to reemerge in the future. Wu et al. (2010) argue that the accruals premium should vary with the business cycle, given that (a) the accruals premium shares some common characteristics with the value premium (Desai et al., 2004), (b) both are related to firms' investments, and (c) the value premium is cyclical due to firms' investment irreversibility (Zhang, 2005). From the mispricing perspective, Gerard et al. (2009), Livnat and Petrovits (2009), and Ali and Gurun (2009) suggest that the accruals premium varies with the investor sentiment cycle.

The literature on the accruals premium as a reflection of firm growth is scattered and leaves several gaps to be filled. The return predictability of accruals is related to but not subsumed by the return predictability of fixed capital investments (Wei and Xie, 2008). Hence, there should be a process by which changes in working capital investments are dependent on but asynchronous with changes in fixed capital investments. The implication of such a process on the accruals premium has yet to be examined. Furthermore, the work of Wu et al. (2010) could be extended to examine how the accruals premium varies across the business cycle due to, for example, firms' investment irreversibility. This time varying pattern should be differentiated from any time varying pattern across the investor sentiment cycle identified in the literature.

This chapter aims to fill in these gaps by investigating (a) whether the accruals premium exists, and (b) how it is affected by firms' investments. The literature[47] suggests that financial constraints and investment irreversibility could create inflexibility in investing and disinvesting in response to aggregate shocks. Hence if the accruals premium is driven by firms' investments, it should be more pronounced among firms with high financial constraints and / or investment irreversibility. On the other hand, low financial constraints and investment irreversibility would give management more freedom. Hence, if the accruals premium is driven by the management of overvalued firms investing to prolong the stock overvaluation, it would be less pronounced among firms with low financial constraints and / or investment irreversibility.

Furthermore, a risk based explanation for the accruals premium would predict a higher premium during economic upturns than in downturns, alongside

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[47] For example, part of the literature reviewed in section 2.2.4 (p. 54) and the review on financial constraints in section 2.3 (p. 63).

the arguments in Lakonishok et al. (1994), Petkova and Zhang (2005), and Lettau and Ludvigson (2001) on the value premium. Caggese (2007) describes a process by which such a pattern of the accruals premium could arise in the presence of investment irreversibility and / or financial constraints. The pattern should be differentiated from the variability across the investor sentiment cycle of the accruals premium due to mispricing.

Finally, central to this chapter is the relationship between firms' investment irreversibility, financial constraints and the accrual premium. As the manufacturing industry is the brick-and-mortar industry with investment in fixed and working capitals playing a crucial role as compared to other industries, the predictions so far are expected to hold more strongly among the manufacturing firms.

This chapter makes the following main contributions. It takes the work of Wu et al. (2010) a step further by examining how the accruals premium varies across the business cycle in the presence of firms' financial inflexibility. It is the first, to the author's knowledge, to differentiate the pattern of the accruals premium due to fundamental forces versus management's attempt to cater investor sentiment. This is also the first study to examine whether the accrual premium exists after removing the cyclical component of returns.

This chapter finds that the accruals premium exists in a sample of non-financial, non-utilities firms listed on NYSE, AMEX and NASDAQ from 1972 – 2006. The accruals premium is more pronounced among firms with high financial constraints. Wu et al. (2010) suggest that when the discount rate is high, firms invest less in both working capitals and fixed capitals. This chapter argues that if the firm is also subject to financial constraints, it would be subject to an even higher effective discount rate, leading to even lower investment levels and higher subsequent returns.

Furthermore, the accruals premium is more prominent in firms with low investment irreversibility. Polk and Sapienza (2009) suggest that the management of overvalued firms invests to cater for investor sentiment. This chapter argues that the management would also invest in working capitals for the same purpose. Low investment irreversibility might induce management to be more comfortable in pursuing their aim of catering investor sentiment. Hence it explains the more pronounced accruals premium in the firms with low investment irreversibility. This chapter also finds that the accruals premium is most pronounced at the two extremes of the inflexibility spectrum. The evidence at the high end of the spectrum supports an explanation based on Wu et al. (2010) whereas the evidence at the low end supports an explanation based on Polk and Sapienza (2009).

The relationship between the inflexibility measures and the accruals premium is concentrated in the manufacturing industries where physical investments are of high importance. The evidence reinforces that the accruals premium is related to firms' investments. The return predictability of accruals remains when risks are controlled for using the Fama and French three factor model, unconditional and conditional on the business cycle and the inflexibility measures. Finally, when isolating the cyclicality in stock returns using the term spread, the default spread, the aggregate dividend yield, and the Treasury bill rate, accruals cease to predict future returns, hence the accruals premium disappears.

Any explanation for the profitability of the accruals based trading strategy should therefore be able to explain its cyclical nature.

4.2. Literature Review

Sloan (1996) documents an interesting finding that the strategy of buying stocks of firms with low accounting accruals and selling stocks of firms with high accounting accruals generates positive and significant profits in one to three years from the portfolio formation date for stocks listed in the U.S. market. The accruals premium is also documented in international markets (LaFond, 2005, and Pincus et al., 2007). Some authors question whether the accruals premium actually exists. For example, Desai et al. (2004) argue that the accruals premium is a manifestation of the value premium. However, this result only holds if the value premium is defined as the return predictability of the ratio of operating cash flows to price. On the other hand, the value premium is well documented when the value-growth characteristic is defined using a variety of other ratios[48] such as the Book-to-Market, the dividend yield and so on. Other studies question whether the research design is inappropriate (Kraft et al., 2006, and Leippold and Lohre, 2010).

The majority of the research investigates the reasons why the accruals premium exists. There are two main explanations, i.e. the accruals premium arises due to either the mispricing of, or the difference in the risks between, the stocks of firms with high and low accruals. Other studies also attempt to explain the time series pattern of the accruals premium. The following sections review the literature in these directions.

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[48] For details, refer to the literature review in section 2.2 (p. 45) of chapter 2.

4.2.1. The Mispricing of Accruals and the Accrual Premium

Sloan (1996) first argues that the accruals premium can be explained by the functional fixation hypothesis. In this hypothesis investors are irrational and ignore the difference in the persistence of cash based versus accrual based earnings when making their earnings forecasts. Accruals tend to reverse in the subsequent periods. Hence the cash based earnings are more persistent than the accrual based earnings. If investors ignore this difference, they would over-weigh the accruals component and under-weigh the cash component in earnings forecasts. Investor irrationality therefore causes the overpricing of firms with high accruals and underpricing of firms with low accruals. As the mispricing is corrected, a strategy that goes long in stocks with low accruals and short in high accruals can earn positive and significant returns.

Sloan's (1996) hypothesis received mixed support. Richardson et al. (2005) argue that because less reliable accruals lead to low earnings persistence, they induce stronger mispricing. The authors report that the zero cost trading strategy based on less reliable accruals generates higher returns. On the other hand, Zach (2006) provides evidence against the functional fixation hypothesis. For example, firms in the extreme accrual portfolios do not migrate to a different portfolio in the subsequent year. This evidence suggests that accruals do not reverse, and investors underreact rather than overreact to the information about accruals.

Recently some studies have attributed the mispricing of accruals to investor irrationality towards the understanding of growth. Fairfield et al. (2003) argue that accruals contribute to both the growth in net operating assets as part of the overall growth of a firm, and its profitability. The growth component in accruals can lead to lower future profitability in the same manner as the long term investment growth does. According to Fairfield et al. (2003), this pattern is due to both the diminishing marginal returns to investment and the conservative accounting principle. Fairfield et al. (2003) attribute the mispricing of accruals to investors' failure to recognise that the association between growth and future profitability is weaker than that between current aggregate earnings and future profitability. Zhang (2007) finds that the mispricing of accruals increases with the embedded growth information. This finding corroborates with the view of Fairfield et al. (2003) view. It is also consistent with the finding in Thomas and Zhang (2002) that inventories contribute the majority of the predictive power of accruals, given that inventories are closely tied with firm growth.

It is also possible that the management's suboptimal behaviours induce investor irrationality. Sloan (1996) attributes the mispricing to investors' failure to recognise the different persistence of cash based and accrual based earnings, Richardson et al. (2006) suggest that the different persistence is due to managers' manipulation of earnings. This view is consistent with the evidence in Xie (2001) that the mispricing of the abnormal accruals[49] drives the mispricing of the total accruals documented in Sloan (1996).

Chan et al. (2006) support the earnings management hypothesis. They report that firms that have high stock returns and high earnings growth subsequently increase accruals suddenly. These firms then experience tumbling earnings and stock prices. The authors attribute this evidence to management trying

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[49] I.e. the accruals made at the discretion of managers or discretionary accruals.

to delay reporting the slow growth by manipulating earnings through accruals. Chan et al. (2006) do not find evidence in favour of the hypothesis that managers genuinely accumulate inventories and other working capital items to anticipate high future growth, and make errors in extrapolating past high growth into the future[50]. This argument is put forward in Wei and Xie (2008) to explain the return predictability of both accruals and fixed capital investments. Chan et al. (2006) argue that if the accruals premium is driven by changes in the business conditions, then it should be roughly uniform across accrual components and industries. They report that the return predictability of accounts receivable and inventories are different, and the accruals premium varies across different industries.

Kothari et al. (2006) suggest that the accruals premium is due to stock mispricing caused by managers' misbehaviour. The literature suggests that when stocks are overpriced, managers might invest more to cater for investor sentiment in order to maintain the overvaluation (Polk and Sapienza, 2009). According to Kothari et al. (2006), managers of overpriced firms might distort earnings upwards to nurture investors' expectations, whereas managers of underpriced firms have no motivation to distort earnings downwards. They find that there is an asymmetry in the response of firms with high and low accruals to past returns. Firms with high accruals have high previous returns, whereas those with low accruals do not necessarily have low previous returns. The authors also report the expected behaviours of managers of overpriced firms with high accruals. Some examples

[50] This argument is similar to the error-in-expectation hypothesis to explain the value anomaly proposed in Lakonishok et al. (1994) whereby investors make the estimation errors based on past performance.

include high equity issuance, high capital expenditure, active mergers and acquisitions as suggested by Baker et al. (2003) and Polk and Sapienza (2009)[51].

Firms with high accruals might simply correspond to the higher level of fixed investments undertaken. Fairfield et al. (2003) suggest that the mispricing of accruals can be considered as part of the family of research on the mispricing of fixed capital investments (Titman et al., 2004), or the mispricing of total asset growth (Cooper et al., 2008). Wei and Xie (2008) test the predictability of fixed capital investment and of accruals to future stock returns. They find that the return predictability of fixed capital investments is related to the return predictability of accruals.

However, Wei and Xie (2008) find that the two return predictability relationships are not subsumed by each other. Accruals continue to predict subsequent returns even after controlling for the return predictability of fixed investments. Wei and Xie (2008) attribute the return predictability of accruals, or the accruals premium, to the management's over-optimism about firms' future product demands and the consequent overinvestments. However, Chen et al. (2006) do not find evidence to support this view. Hence, although there appears to be some connection between the mispricing of fixed capital investments and accruals, this connection is far from direct.

4.2.2. The Risk based Explanations for the Accruals Premium

There has been only limited attempt to explain the accruals premium on a risk basis. A common feature of the existing risk based explanations for the

[51] For a review of stock prices and firms' investment, refer to section 3.2.2 (p. 152).

accruals premium is that none can completely explain it. Khan (2008) finds that the stocks of firms with low accruals possess the characteristics of distress stocks such as negative earnings, high leverage, low sales growth, and high bankruptcy risks. Ng (2005) also suggests that the return to the accruals based trading strategy is subject to distress risks, and controlling for distress risks lowers it. Khan (2008) concedes that a considerable portion of the accruals premium can be explained by a four factor model. The four factors consist of two factors describing news about futures expected dividends and future expected returns on the market portfolio, and two Fama and French factors (SMB and HML).

To explain the accruals premium, Wu et al. (2010) suggest the discount hypothesis. In their hypothesis, the management rationally adjusts firms' investment in working capitals as the discount rate changes. When the discount rate is lower, more investment projects become profitable, hence firms would invest in presumably both fixed capitals and working capitals. Furthermore, lower discount rate means lower expected returns going forward. Hence, to the extent that accruals reflect firms' investments in working capitals, higher accruals would be followed by lower expected stock returns. The opposite happens when the discount rate is higher. Wu et al (2010) document that the accruals premium is significantly reduced when returns are adjusted for risks using the CAPM or Fama and French model supplemented with an investment factor.

4.2.3. The Time Series Pattern of the Accruals Premium

Since the discovery of the accruals premium in the U.S. market in Sloan (1996), its existence has been confirmed in numerous subsequent studies. If the accruals premium is due to mispricing, its strength would be diminished over time as it is more widely exploited. To explain the persistence of the accruals premium, Mashruwala et al. (2006) point to idiosyncratic risk and transaction costs. Alternatively Hirshleifer et al. (2009) suggest that the accruals premium persists thanks to short sale constraints.

Lev and Nissim (2006) concede that the accruals premium is not weakening. They explain its persistence by the lack of interest from institutional investors due to the unfavourable characteristics of the firms with extreme accruals. According to Ali et al. (2008), very few mutual funds exploit the accrual anomaly. However, Green et al. (2009) concede that the accruals premium has been driven down to negative recently. They attribute this pattern to hedge funds' active deployment of the accruals based trading strategy in addition to the weakening of the mispricing signal.

Wu et al. (2010) suggest that the weakening accruals premium in the recent year documented in Green et al. (2009) is only temporary due to its cyclicality. Wu et al. (2010) argue that this pattern is due to the common characteristics shared between the accruals premium and the value premium as identified by Desai et al. (2004). In addition, the value premium and the accruals premium can be explained by the risk-return relationships based on firms' investments in Zhang (2005) and Wu et al. (2010) respectively. As the value premium is expected to be cyclical[52], the accruals premium is likely to be cyclical. It can be predicted using the variance risk premium of Bollerslev et al. (2009, cited in Wu et al., 2010). However, according to Wu et al. (2010), the more widely used variables, i.e. the term spread,

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[52] For a review of the literature on the cyclicality of the value premium, refer to section 2.2.5 (p. 58).

the default spread and the relative Treasury bill rate, are individually less successful in predicting the accruals premium.

Some studies argue that the accruals based trading strategy works better in different phases of the investor sentiment cycle. Ali and Gurun (2009) and Gerard et al. (2009) concede that the strategy works better during high investor sentiment periods. Ali and Gurun (2009) attribute this tendency to investors paying less attention to the difference in accruals based and cash based earnings. Gerard et al. (2009) attribute it to investor optimism in investing in high distress stocks. Livnat and Petrovits (2009) find that stocks with low accruals generate higher returns following low sentiment periods. The authors attribute this pattern to investor under-reaction to the accrual information that disconfirms their belief about the current market state. To the extent that investors tend to be optimistic during economic upturns and pessimistic during economic downturns, the evidence to support the economic cyclicality of the accruals premium could be similar to the evidence to support its sentiment cyclicality.

4.2.4. The Gaps in the Literature

The literature leaves several gaps to be filled. Firstly, the return predictability of accruals is related to but not subsumed by the return predictability of fixed capital investments (Wei and Xie, 2008). Hence there should be a process by which changes in working capital investments are dependent on changes in fixed capital investments, but the relationship is not a contemporaneous one. An example is described in Caggese (2007). Due to investment irreversibility, fixed capital investments may not be cut back but working capitals could be, hence they may not move together. Furthermore, as changes in working capitals are part of accruals, the accruals should also be related to the relative movement of fixed capitals and working capitals. The implication of such a process on the accruals premium has yet to be discussed in the literature.

Secondly, Wu et al. (2010) suggest that the return to the accruals based trading strategy should follow the business cycle pattern. This is because (a) the accrual premiums share some common characteristics with the value premium (Desai et al., 2004), (b) both are related to firms' investments, and (c) the value premium is cyclical due to firms' investment irreversibility (Zhang, 2005). Therefore, it is important to extend the work of Wu et al. (2010) to examine how the accruals premium varies across the business cycle in the presence of, for example, firms' investment irreversibility.

Finally, the three studies that explain the accruals premium by the mispricing of accruals suggest that the premium varies with investor sentiment. Gerard et al. (2009) rely on investors' optimism when investing in distress stocks. Livnat and Petrovits (2009) attribute the pattern to investors' under-reaction in updating new information. Ali and Gurun (2009) argue in favour of investors' lack of attention to the difference in cash based and accrual based earnings during the high sentiment period. Kothari et al. (2006), while also seek to explain the accruals premium by the mispricing of accruals, rely on the initial overvaluation of stocks. Given that stocks are more likely to be overvalued when the sentiment is high and management purposely invest to cater for this sentiment (Polk and Sapienza, 2009), it is possible that an investment based mispricing explanation would also predict a time varying accrual premium.

This chapter aims to address the gaps identified in this section. The following section develops the research questions and the hypotheses to fill in these gaps on the relationship between firms' investments and the accruals premium.

4.3. The Research Questions and Hypotheses

This chapter aims to investigate how firms' investments affect the return to the accruals based trading strategy. The questions that this chapter aims to address are as follows:

(1) Whether the accruals premium exists; and

(2) If it does, how firms' investments affect it.

Wu et al. (2010) suggest that the accruals premium arises due to firms' varying level of working capital investments in response to the varying discount rate. On the other hand, motivated by the catering theory in Polk and Sapienza (2009), Kothari et al. (2006) argue that it is due to management's manipulation of earnings and accruals upwards to extend the overvaluation of high accrual stocks. However, even without earnings manipulation, overvalued firms can also have high accruals, given that new working capitals are often needed to deploy new capital investment to cater for investor sentiment as stipulated in Polk and Sapienza (2009).

This chapter argues that the accruals premium can be explained by two explanations from the perspective that accruals reflect firms' working capital investments. The first one is based on the risk-return relationship, i.e. stocks with low accruals are riskier than stocks with high accruals[53]. Furthermore, the cross section of returns of stocks with low versus high accruals can be explained when returns are adjusted for risks using an asset pricing model with an additional investment factor (Wu et al., 2010). Alternatively, along the lines of Polk and Sapienza (2009), stocks of firms with high accruals could be overpriced as their managers invest in working capitals to cater for investor sentiment and prolong the overvaluation.

To address the first research question, this chapter expects to find evidence of the accruals premium in the sample examined, given the extensive existing evidence on its existence in the literature reviewed in section 4.2 (p. 219). The first hypothesis is as follows:

> *$H_{4.1}$: The strategy of buying stocks with low accruals and selling stocks with high accruals generates positive returns.*

As the explanations for the accruals premium examined in this chapter are both related to firms' investments, the factors affecting firms' investments are likely to affect the accruals premium. Consistent with the approach in chapters 2 and 3, this chapter focuses on the role of investment irreversibility and financial constraints, both of which reflect the firm level inflexibility. According to Livdan et al. (2009), firms with high financial constraints are unable to invest in all of the desired investment projects and smoothen dividend streams in facing the external aggregate shocks. Zhang (2005) also suggests that investment irreversibility makes it more difficult for value firms to disinvest compared to growth firms.

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[53] See Khan (2008), Ng (2003) and Wu et al. (2010). Refer to section 4.2.2 (p. 234) for more details.

Taken together, financial constraints and investment irreversibility create inflexibility in investing and disinvesting in response to aggregate shocks. If the accruals premium is due to an investment based risk factor (Wu et al., 2010), it should be more pronounced among firms with high financial constraints and / or high investment irreversibility. On the other hand, if the accruals premium is driven by the management of overvalued firms investing to prolong the overvaluation along the lines of Polk and Sapienza (2009), financial constraints and investment irreversibility make it harder for management to act. In this case, the accruals premium would be less pronounced.

The opposite forces that financial constraints and / or investment irreversibility exert on the accruals premium might cancel each other out. If the impact of the risk based force based on Wu et al. (2010) outweighs the impact of the mispricing force based on Polk and Sapienza (2009), the accruals premium would be higher among firms with higher financial constraints and / or investment irreversibility. By contrast, if the impact of the mispricing force outweighs the impact of the risk based force, it would be lower. Taking the risk based explanation as the basis, the following hypothesis is formed:

> $H_{4.2}$: *The accruals premium among firms with higher financial constraints and / or investment irreversibility is higher than that among firms with lower financial constraints and / or investment irreversibility.*

From the perspective that accruals reflect firms' working capitals necessary to support the deployment of fixed capitals, one would expect that both accruals and fixed capital investments predict stock returns in the same way. However, Wei and Xie (2008) document that the return predictability of accruals and fixed capital investments are not subsumed by each other. Caggese (2007) suggests that working capital and fixed capital investments do not move together due to the firm level frictions of investment irreversibility and financial constraints. At the beginning of an economic downturn, firms might want to downsize their fixed capitals but are prevented from doing so as fixed capitals tend to be difficult to reverse, i.e. having high degree of irreversibility. As the downturn continues, revenues become worsen. If firms also face financial constraints, they may be forced to cut working capital investments. When the downturn ends, firms would be more cautious about increasing their fixed capitals. As a result, during downturns, firms with high investment irreversibility and / or financial constraints would have fixed investments at a level higher than the optimal level given the fundamentals. On the other hand, their working capital investments would be at a level lower than the optimal level given the fundamentals. During economic upturns, fixed capital investments might be inefficiently lower than the optimal level.

According to Caggese (2007), the relationship between working capital investments and fixed capital investments varies across the business cycle. As they do not always move together, their return predictabilities might not be subsumed by each other, as evidenced by Wei and Xie (2008). The Caggese (2007) model can be extended to hypothesise the accruals premium across the business cycle in the presence of the firm level frictions. First, during downturns, firms' working capitals are lower than the optimal level. Therefore firms with high working capitals or high accruals should be rewarded. This movement might neutralise the tendency that firms with low accruals are exposed to higher risks and are rewarded with higher returns than firms with high accruals. By contrast, the Caggese (2007) model does not predict the working capital level during economic upturns. Across the business cycle, one could expect the accruals premium to be stronger during economic upturns among firms with higher financial constraints and / or investment irreversibility.

The accruals premium can also be time varying if it is driven by the management of overvalued firms investing to cater for investor sentiment, along the lines of Polk and Sapienza (2009). In this case, the accruals premium would vary across the investor sentiment cycle, higher during the high sentiment phase and lower during the low sentiment phase. As argued in section 3.3 (p. 146) of chapter 3, the economic cycle and the sentiment cycle are closely related. Therefore, an observation that the accruals premium is stronger during (economic and sentiment) upturns than during downturns does not necessarily lend support to the risk based explanation based on Wu et al. (2010) or the mispricing explanation based on Polk and Sapienza (2009).

In combination with hypothesis $H_{4.2}$, the time varying pattern of the accruals premium can provide evidence to support either of the explanations examined in this chapter. If the cyclicality is observed among firms with high financial constraints and / or high investment irreversibility, such evidence would support the explanation based on Wu et al. (2010). By contrast, if the cyclicality is observed among firms with low financial constraints and / or low investment irreversibility, the evidence would support the explanation based on Polk and Sapienza (2009). This chapter hypothesises that during economic upturns, which can coincide with sentiment upturns, the accrual premium is more pronounced. Hypothesis $H_{4.3}$ is formed as follows:

$H_{4.3}$: The accruals premium is stronger during economic upturns than during downturns.

Central to the hypotheses developed in this chapter is the dynamic relationship between fixed capital and working capital investments in the presence of investment and financing inflexibility. The manufacturing industry is the brick-and-mortar industry with investments playing a crucial role as compared to other industries. Hence the hypotheses developed in this section are expected to hold more strongly among the manufacturing firms. This expectation is consistent with Zhang (2007) who reports that (a) the manufacturing firms belong to the group with the highest covariance between accruals and growth, and (b) firms in this group generate higher returns to the accruals based trading strategy. Hypothesis $H_{4.4}$ is formed as follows:

$H_{4.4}$: The manufacturing industry exhibits the strongest pattern in that the accruals premium is more pronounced among firms with high financial constraints / high investment irreversibility and during economic upturns.

Of the explanations examined in this chapter, the one based on the argument in Polk and Sapienza (2009) attributes the accruals premium to the mispricing of the stocks of firms with high and low accruals. As a result, the return predictability of the accruals ratio would remain even when controlling for risks. Alternatively, the explanation based on Wu et al. (2010) attributes the accruals premium to the difference in the risks of firms with high and low accruals. In this case, the return predictability of the accruals ratio would disappear when controlling for risks. The null hypothesis using the risk-based explanation is as follows:

$H_{4.5}$: The accruals premium can be explained by an asset pricing model that incorporates relevant fundamental factors.

The hypotheses developed and examined in this chapter are summarised in Table 4.1.

[Insert Table 4.1 about here]

4.4 The Methodology and Sample

4.4.1. Measurement of Key Firm Level Variables

This chapter follows the measure of total accruals originally proposed in the seminal paper by Sloan (1996). The indirect balance sheet method to measure the accruals ratio is as follows:

$$ACC = (\Delta CA - \Delta CL - Dep)/TA \quad (4.1)$$

in which ΔCA is changes in non-cash current assets, ΔCL is changes in current liabilities excluding short term debts and tax payable, Dep is the depreciation charge during the year, and TA is the average total assets. In addition to the objective of replicating the original measure of accruals in Sloan (1996), the choice of the measure used in Sloan (1996) is also due to the availability of data, since this chapter covers the data from 1972 to 2006, expanding well before 1988 when SFAS 95, which requires firms to report cash flow statements, took effect.

Of the three aspects of investment irreversibility described in section 2.4.1 (p. 59), chapter 2, the data to calculate the depreciation charge ratio is most available. It also describes the most widely used source of funding to replace existing assets. Hence this chapter uses the depreciation charge ratio to measure investment irreversibility. It is calculated as the ratio of depreciation expense during the year to the beginning of the year net fixed assets. The ratio is measured in December of year t-1 and is used to sort firms into the high and low investment irreversibility groups. Firms having the depreciation charge ratio in the top 30% are included in the subsample with low investment irreversibility. Firms having the depreciation charge ratio in the bottom 30% are included in the subsample with high investment irreversibility.

Financial constraints are measured in a similar way as in chapters 2 and 3, using the net payout ratio. Sections 2.4 (p. 59) and 3.4 (p. 153) argue that this measure is appropriate as it reflects financial constraints in terms of the availability of funds, more relevant than in terms of the cost of borrowing. The net payout ratio is measured in December of year t-1 as dividends plus repurchases minus share issuance, all scaled by the net incomes. The ratio is used to sort firms into financially constrained and unconstrained groups from July of year t to June of year t+1. Firms having the net payout ratio in the top 30% are included in the subsample with low financial constraints. Firms having the net payout ratio in the bottom 30% are included in the subsample with high financial constraints.

The construction of the key firm level variables described in this section is summarised in Panel A of Table 4.2.

[Insert Table 4.2 about here]

To examine the time varying pattern of the accruals premium, this chapter uses the Chicago Fed National Activity Index, a weighted average of 85 existing monthly national economic indicators with the mean of zero and the standard deviation of one. A positive index indicates that growth is above the trend, and a negative index indicates that growth is below the trend. Therefore this chapter assigns a positive index to economic upturns and a negative index to downturns. This approach is close to the definitions in Caggese (2007) of upturns and downturns based on whether sales are above or below the trend. The dummy variable UP is assigned the value of 1 if the index is positive, and zero otherwise. The dummy variable DOWN is assigned the value of 1 if the index is negative, and zero otherwise.

4.4.2. Methodology

This chapter uses two methods of analysis to address the research questions and the hypotheses set out in section 4.3 (p. 228). In the portfolio sorting approach, stocks are sorted by the accruals ratio as of 31st December (year t-1) in ascending order. Ten portfolios with equal number of stocks are composed and positions (long and short) are taken at the beginning of July of the following year (year t) and held until the end of June of the next year (year t+1). The gap of six months between the account year end and the beginning of the portfolio holding period ensures that the information that is necessary to compose portfolios (i.e. the accruals ratio) is available to investors. The raw returns of ten equally weighted deciles and of the long-short portfolio that goes long in stocks with low accruals ratios and short in stocks with high accruals ratios are reported.

Similar to chapter 3, this chapter measures the accruals premium during economic upturns and downturns using the UP and DOWN dummy variables described in section 4.4.1 (p. 234). When the accruals premium is regressed against the UP and DOWN dummy variables, the coefficient attached to the UP (DOWN) variable gives the average accruals premium during economic upturns (downturns).

When the premium is regressed against the UP dummy variable and a constant, the coefficient attached to the UP dummy variable measures the difference between the accruals premium during economic upturns versus downturns. All the t statistics are corrected for autocorrelation and heteroskedasticity with the Newey and West (1987) method. According to Cooper et al. (2004), this approach allows the time series of returns to be preserved, while any serial correlation is reliably corrected.

To test whether the accruals premium can be explained by risks, this chapter follows chapters 2 and 3 and uses the asset pricing framework of Avramov and Chordia (2006) to control for individual stock returns for risks. This approach has an advantage in that it uses all the information at the firm level rather than the aggregate information at portfolio level. For detailed discussion on the framework of Avramov and Chordia (2006), refer to section 2.4 (p. 59).

The hypotheses established in section 4.3 (p. 228) relate firms' investment irreversibility and financial constraints to the accruals premium. Hence the firm level investment irreversibility and financial constraints variables are used as the conditioning variables in the Avramov and Chordia (2006) framework. These variables are measured using the depreciation charge ratio and the net payout ratio as described in section 4.4.1 (p. 234). A business cycle variable is also used as the conditioning variable, as hypotheses $H_{4.3}$ and $H_{4.4}$ establish that the accruals premium potentially varies across the economic upturns and downturns. Similar to chapters 2 and 3, this chapter uses the default spread to describe the business cycle, on the basis that as a single indicator, it performs better than other popular alternatives.

The Fama and French model is used as the base model in the following general model specification:

$$R_{jt} - R_{Ft} = \alpha_{j,0} + \sum_{f=1}^{3} \begin{bmatrix} \beta_{j,1,f} & \beta_{j,2,f} & \beta_{j,3,f} & \beta_{j,4,f} \end{bmatrix} \times \begin{bmatrix} 1 \\ Firm_{j,t-1} \\ MWF_{t-1} \\ Firm_{j,t-1} \times MWF_{t-1} \end{bmatrix} \times F_{ft} + e_{jt} \quad (4.2)$$

in which R_{jt} is the return on stock j and R_{Ft} is the risk free rate at time t. F_{ft} represents the priced risk factors, which include the market factor, the HML and SMB factors of the Fama and French model (1993, 1996). Firm characteristic $Firm_{jt-1}$ is the one month lagged firm level measurement of the investment irreversibility and / or financial constraints. MWF_{t-1} is the one month lagged market wide factor describing the business cycle variable, proxied by the default spread – the spread between U.S. corporate bonds with Moody's ratings of AAA and BAA.

The part of returns unexplained by the asset pricing model in equation (4.2) is regressed against the accruals ratio in a cross sectional regression. The following regression helps assess the return predictability of the accruals ratio after controlling for risks:

$$R^{*}_{jt} = c_{0t} + c_{ACC,t} \times ACC_{jt-1} + \begin{bmatrix} c_{1t} & c_{2t} & c_{3t} & c_{4t} \end{bmatrix} \times \begin{bmatrix} Size_{jt-1} \\ BM_{jt-1} \\ PR_{jt-1} \\ Turnover_{jt-1} \end{bmatrix} + u_{jt} \quad (4.3)$$

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 (4.2). $ACC_{j,t-1}$ represents the accruals ratio of the individual firm. The vector of size, the Book-to-Market ratio, cumulative returns $PR_{m,j,t-1}$ for the periods of 1-3 month, 4-6 month, and 7-12 month prior to the current month, and stock turnovers in equation (4.3) represents the control factors, being the size, value, momentum and liquidity that might also predict the cross section of stock returns.

Size measures the market capitalisation at the end of each month. The Book-to-Market ratio is measured as the sum of the book value of common equity and balance sheet deferred tax, scaled by the market capitalisation. The accruals ratio is measured as in equation (4.1). The Book-to-Market ratio and the accruals ratio are measured in December of the previous year for the firm-month observations from July of the current year to June of the following year. There is a six month gap between (a) the time at which these ratios are measured and (b) the time at which stock returns are measured. This gap is to ensure the required accounting data needed to calculate the ratio is available to investors to consider their investment decisions. The turnover of the stocks listed on NYSE /AMEX stock exchanges is calculated as the trading volume divided by the outstanding number of shares. The turnover of the stocks listed on NASDAQ stock exchange is constructed in a similar manner. The construction of the key firm level variables described in this section is summarised in Panel B of Table 4.2.

Similar to chapters 2 and 3, following Avramov and Chordia (2006) and Brennan et al. (1998), this chapter transforms the firm level variables in equation (4.3) by (1) lagging two months (size and turnovers), (2) taking natural logarithms (size, turnovers and the Book-to-Market ratio), and (3) taking the deviation from the cross sectional mean (size, turnovers, the Book-to-Market ratio, the accrual ratio and past cumulative returns). The transformation is described below:

$$Size\_transformed_{j,t} = \ln\left[lag_2\left(Size_{j,t}\right)\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[lag_2\left(Size_{i,t}\right)\right] \qquad (4.4)$$

$$BM\_transformed_{j,t} = \ln\left[BM_{j,t}\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[BM_{i,t}\right] \qquad (4.5)$$

$$Turnover\_transformed_{j,t} = \ln\left[lag_2\left(Turnover_{j,t}\right)\right] - \frac{1}{n}\sum_{n}^{i=1}\ln\left[lag_2\left(Turnover_{i,t}\right)\right] \qquad (4.6)$$

in which $Size_{j,t}$, $BM_{j,t}$, and $Turnover_{j,t}$ are the measurements of size, Book-to-Market, and turnover in NYSE / AMEX or NASDAQ for firm j at time t as described above. $lag_2(x_t)$ refers to the two - month lag of variable x_t. $\ln[y]$ refers to the natural log of variable y. *n* refers to the number of stocks in the sample at time *t*. $Size\_transformed_{j,t}$, $BM\_transformed_{j,t}$ and $Turnover\_transformed_{j,t}$ are the corresponding variables after the transformation and replace the role of $Size_{j,t}$, $BM_{j,t}$, and $Turnover_{j,t}$. These variables are lagged one month to become $Size_{j,t-1}$, $BM_{j,t-1}$, and $Turnover_{j,t-1}$ in equation (4.3).

The variables are lagged to avoid any biases by bid-ask effects and thin trading and are taken as natural logarithms to avoid skewness. Taking the deviation from the cross sectional mean implies that the average stock will have the firm level characteristics at the average level (i.e. the deviation from the cross sectional mean is zero), and its expected return is driven solely by risks.

The accruals ratio is not included in the original framework of Avramov and Chordia (2006). This chapter uses this variable to capture its return predictability, which is evident for the accruals premium. This approach uses the same logic that Avramov and Chordia (2006) capture, for example, the value premium. The accruals ratio in equation 4.3 is also transformed in the same manner as the Book-to-Market ratio:

$$ACC\_transformed_{j,t} = ACC_{j,t} - \frac{1}{n}\sum_{n}^{i=1} ACC_{i,t} \qquad (4.7)$$

in which $ACC_{j,t}$ is the accrual ratio assigned to firm *j* at time *t* as described above. The other symbols are defined as in equations (4.4) to (4.6). $ACC\_transformed_{j,t}$ is the corresponding variable after the transformation and replaces the role of $ACC_{j,t}$ in equation (4.3). This variable is lagged one month to become $ACC_{j,t-1}$ in equation (4.3).

The statistical null hypothesis is whether the coefficient $c_{ACC,t}$ attached to the accruals ratio is not significantly different from zero. This means the accruals ratio no longer predicts stock returns. It suggests that the accruals premium is explained when returns are adjusted for risks in stage one.

$H_{4.0}$: $c_{ACC,t} = 0$

The coefficients and t-statistics are reported. As argued in chapters 2 and 3, the procedure employed in this chapter does not involve regressions with estimated independent variables. Therefore it is not subject to the error-in-variable problem

(Bauer et al., 2010 and Subrahmanyam, 2010). The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method.

4.4.3. Sample Description

The sample includes all non-financial and non-utilities stocks listed in the NYSE, AMEX and NASDAQ stock exchanges. The sample period is between 1972 and 2006. Similar to chapters 2 and 3, financial stocks are excluded as they have different asset structures compared to the non-financial stocks. Utilities stocks are excluded as utilities firms and potentially their investments are more strictly regulated than firms in other industries. The coverage period starts in 1972 due to the availability of the data to measure the net payout ratio.

Only stocks with sufficient data to construct the variables used in this chapter are included. Following Jegadeesh and Titman (2001), this chapter excludes the firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile. According to Jegadeesh and Titman (2001), the purpose is to avoid our results to be driven by small and illiquid stocks or the bid-ask bounce. The sample has 490,025 firm-month observations and 5,274 firms. The descriptive statistics of the sample are reported in Table 4.3.

[Insert Table 4.3 about here]

Panel A of Table 4.3 reports the statistics for the key variables used in the portfolio sorting methodology. All the variables, including the monthly returns, the accrual ratio, the depreciation charge ratio, and the net payout ratio are highly skewed. The correlations between the accrual ratio and (a) the depreciation charge ratio, and (b) the net payout ratio are statistically significant, but the coefficient correlation is economically close to zero. The correlation between the depreciation charge ratio and the net payout ratio is both statistically and economically insignificant. The low correlation coefficients suggest that these variables reflect different economic forces.

Panel B of Table 4.3 describes the statistics for the variables in the regressions of the Avramov and Chordia's asset pricing framework. The sample is further constrained in that there should be data on stock returns, market capitalisation, and the Book-to-Market ratio in the current year and in the 36 months prior to the current month. According to Avramov and Chordia (2006), this condition ensures that the estimation at the firm level is not noisy.

An average stock has an average market capitalisation of $3.00 billion and an average Book-to-Market ratio of 0.76. The average cumulative returns of the past 2^{nd} to 3^{rd} month, 4^{th} to 6^{th} month, and 7^{th} to 12^{th} month are 2.67%, 3.95% and 8.18% respectively. All the variables in this panel show a significant level of skewness, with the mean values well above the median, which suggests that it is appropriate to transform them in accordance with Avramov and Chordia (2006) and Brennan et al. (1998) as described in section 4.4.2 (p. 236).

4.5. The Results

4.5.1. The Profitability of the Accruals based Trading Strategy

Table 4.4 reports the returns to the ten equally weighted portfolios sorted by the accruals ratio and the long-short portfolios. All the accrual deciles earn positive and significant returns. The returns to the accrual deciles exhibit a decreasing pattern from the portfolio with low to high accruals ratios. Furthermore, the return to the long-short portfolio is 0.54% per month and is statistically significant. The evidence suggests that stocks with low accruals outperform stocks with high accruals.

[Insert Table 4.4 about here]

Scenarios 1 and 2 in Table 4.14 provide evidence for the accruals premium using the Avramov and Chordia (2006) regression approach. In scenario 1, returns are not adjusted for risks in the stage one regression. The raw returns are regressed against the firm level variables similar to equation 4.3 (p. 238) in the stage two regression. The accruals coefficient is negative and significant, suggesting that there is a negative and significant relationship between the cross section of stock returns and the accruals ratio. This result confirms the evidence so far that the accruals premium exists in the sample. The coefficients of the control variables also show the expected signs. The size coefficient is negative and significant (i.e. the return predictability of size), the Book-to-Market coefficient is positive and significant (i.e. the return predictability of the Book-to-Market ratio), while the cumulative return coefficients are positive and significant (i.e. the return predictability of cumulative returns).

In scenario 2, the unconditional Fama and French three factor model is used to adjust returns for risks in stage one. The time series regression in stage one is described in equation 4.2 (p. 238) with the following constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. The risk adjusted returns are regressed against the firm level variables as described in equation 4.3. The adjusted R^2 drops from 6.76% in scenario 1 to 3.45% in scenario 2, suggesting that the Fama and

French model in stage one helps better explain the return predictability of the variables in equation 4.3. However, the accruals coefficient is positive and significant. The evidence suggests that the accruals ratio predicts stock returns, or the accruals premium exists, even when returns are adjusted for risks using the unconditional Fama and French model.

To conclude, there is evidence that the returns to the portfolios based on the accruals ratio increase from the portfolio with high accruals ratio to the portfolio with low accruals ratio. The return to the long-short portfolio is positive and significant. The accruals ratio is negatively related to the returns, including both raw returns and the risk adjusted returns using the unconditional Fama and French three factor model, at the firm level. The evidence supports hypothesis $H_{4.1}$. The answer to the first research question, i.e. whether the accruals premium exists in the sample, is therefore affirmative.

4.5.2. The Accruals Premium and the Investment Related Factors

An interesting result from Scenario 2, Table 4.14, is that when controlling for risks using the unconditional Fama and French model, the Book-to-Market coefficient becomes statistically insignificant, while the accruals coefficient remains significant. This result differs from the result from Scenario 2, Table 2.10 (p. 114) in chapter 2. In chapter 2, the Book-to-Market coefficient remains statistically significant when the firm level returns are adjusted for risks using the unconditional Fama and French model. The key difference between Scenario 2, Table 2.10, chapter 2 and Scenario 2, Table 4.14, chapter 4 is that the former includes an accruals variable in the stage two cross sectional regression. The result is consistent with Beaver (2002) and Desai et al. (2004) who advocate that the accruals anomaly and the value anomaly are related. Beaver (2002, p.468) quotes the conclusion from McNichols (2000) that "aggregate accruals models that do not incorporate long-term earnings growth are potentially misspecified and can result in misleading inferences regarding earnings management" and concludes that "the mispricing of accruals may in fact be the "glamour stock" phenomenon … in disguise". Desai et al. (2004) finds that the two anomalies are essentially one when and only when the value anomaly is defined using the operating cash flow to price ratio.

Furthermore, the evidence in Scenario 2, Table 4.14 suggests that the value premium might be subsumed by the accruals premium, as the Book-to-Market coefficient becomes insignificant while the accruals coefficient remains significant. Several theoretical studies explain the value premium using firms' investment characteristics[54]. Also, Beaver (2002) and several other studies[55] observe that firm growth is reflected in accruals. Hence, the accruals premium is likely to be related to firms' investments, which is a crucial factor of firm growth. Hypotheses $H_{4.2}$ to $H_{4.4}$ identify two factors, i.e. investment irreversibility and financial constraints, which affect firms' investments. These factors therefore might influence the accruals premium. The relevant hypotheses are tested in the following sections.

4.5.2.1. Investment Irreversibility, Financial Constraints and the Accruals Premium

Hypothesis $H_{4.2}$ hypothesises that the accruals premium is potentially explained by an explanation based on Wu et al. (2010). Along the lines of Wu et al.

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[54] Examples include Zhang (2005), Cooper (2006), and Carlson et al. (2004). For a review on this topic, refer to section 2.2.4 (p. 54)

[55] For example, Zhang (2007). For a review on this topic, refer to section 4.2.1 (p. 231).

(2010), firms with high investment irreversibility / high financial constraints have less flexibility in investing in response to aggregate shocks. Hence the accruals premium is expected to be higher among firms with high investment irreversibility / financial constraints. Alternatively, if the accruals premium is driven by an explanation based on Polk and Sapienza (2009), the management of overvalued firms would hesitate investing to cater for investor sentiment when the financial resources are limited or the investment is difficult to be reversed. Hence the accruals premium is expected to be higher among firms with low investment irreversibility / financial constraints.

Independent effects of investment irreversibility and financial constraints:

This section reports the impact of investment irreversibility and financial constraints independently on the accruals premium. Table 4.5 presents the returns to the ten equally weighted portfolios sorted by the accruals ratio and the long-short portfolios among firms with high vs. low investment irreversibility. Firms having the depreciation charge ratio in the bottom 30% are included in the subsample with high investment irreversibility. Firms having the depreciation charge ratio in the top 30% are included in the subsample with low investment irreversibility. In both subsamples, although the returns to the accruals ranked deciles do not strictly follow a monotonic pattern, they generally decline from the portfolios with low accruals to the portfolio with high accruals.

[Insert Table 4.5 about here]

The returns to the long-short portfolios are statistically significant in both subsamples. They are 0.30% per month and 0.65% per month in the subsamples with high and low investment irreversibility respectively. The higher return to the accruals based trading strategy in the low investment irreversibility group lends support to the mispricing explanation based on Polk and Sapienza (2009). This is because the management of overvalued firms might find it easier to invest to prolong the investor sentiment, and they are more likely to do so, when investments can be more easily reversed. Hypothesis $H_{4.2}$ is rejected in the case of investment irreversibility.

Similar to investment irreversibility, financial constraints also impose inflexibility to firms' investments. Firms having the net payout ratio in the bottom 30% are included in the subsample with high financial constraints. Firms having the net payout ratio in the top 30% are included in the subsample with low financial constraints. In Table 4.6, the return to the long-short portfolio is 0.57% per month and significant in the subsample with high financial constraints. It is only 0.24% per month and insignificant in the subsample with low financial constraints. The higher return to the accruals based trading strategy in the subsample with high financial constraints lends support to the explanation based on Wu et al. (2010). Hypothesis $H_{4.2}$ is accepted in the case of financial constraints.

[Insert Table 4.6 about here]

<u>Collective effects of investment irreversibility and financial constraints</u>:

This section presents the performance of the accruals based trading strategy when both the inflexibility measures are binding or non-binding. In Table 4.7, firms are first sorted by the depreciation charge ratio into the groups with high (bottom 30%) and low (top 30%) investment irreversibility. Within each group, firms are further sorted by the net payout ratio into the subsamples with high (bottom 30%) and low (top 30%) financial constraints. In each subsample by investment irreversibility and financial constraints, returns to the ten equally weighted portfolios sorted by the accruals ratio and the long-short portfolios are reported.

[Insert Table 4.7 about here]

The returns to the long-short portfolios are positive and significant in two out of four scenarios when both the inflexibility measures are binding and when they are non-binding. At 0.73% per month and 0.80% per month, the returns to the long-short portfolios in the two subsamples with extreme inflexibility approximate each other. They are also more economically significant than those in the remaining two subsamples.

As a robustness check, Table 4.8 presents evidence when the sample is dependently sorted by the net payout ratio and the depreciation charge ratio as the primary and the secondary sorting criteria respectively. Similar patterns to the results in Table 4.7 are observed. The returns to the long-short portfolios are statistically and economically significant only when firms are in the subsample with extreme inflexibility. When both criteria are binding, the return to the long-short portfolio is 0.75% per month. When none of them is binding, it is 0.60% per month. The magnitude of the returns in these two extreme subsamples is close to the magnitude of the corresponding returns in the two extreme subsamples in Table 4.7. The evidence suggests that hypothesis $H_{4.2}$ is accepted in the case both investment irreversibility and financial constraints are high, and rejected when both of them are low.

[Insert Table 4.8 about here]

Discussion:

Overall, the evidence in this section supports both a risk based explanation based on Wu et al. (2010) and a mispricing explanation based on Polk and Sapienza (2009). The explanation based on Wu et al. (2010) would predict the accruals premium to be more pronounced among firms with high inflexibility, i.e. high investment irreversibility and high financial constraints. This is because the high inflexibility would prevent firms from investing / disinvesting to respond to the aggregate shocks. Consequently, the difference in risks and returns between the stocks with high and low accruals is reinforced.

A mispricing explanation based on Polk and Sapienza (2009) would predict the accruals premium to be more pronounced among firms with low inflexibility, i.e. low investment irreversibility and low financial constraints. This is because the low inflexibility would make managers of overvalued firms less hesitant in investing to cater for investor sentiment and prolong the overvaluation of stocks with high accruals.

Independently, financial constraints appear to be related to a risk-based explanation based on Wu et al. (2010) and investment irreversibility, a mispricing one based on Polk and Sapienza (2009). Collectively, the former explanation is supported in the subsample when both the inflexibility criteria are binding, whereas the latter explanation is supported when none of the criteria is binding. Hence, the mispricing and risk based explanations appear to coexist. The evidence is consistent with the existing studies, including Khan (2008), Ng (2003) or Wu et al. (2010), where a risk based explanation cannot completely explain the accruals premium.

One caveat to the results in this section is that the returns to the deciles sorted by the accruals ratio in the subsamples do not follow a strict monotonic pattern. A possible reason is that both the investment based explanations might be more relevant to a brick-and-mortar industry where accruals reflect more information on firms' investments. The industry level analysis is presented in section 4.5.2.3 (p. 257) below. Furthermore, given that firms' investments vary over time, the following section examines the time varying pattern of the accruals premium and its relationship with the inflexibility measures.

4.5.2.2. The Time Varying Pattern of the Accruals Premium

Hypothesis $H_{4.3}$ predicts that the accruals premium would systematically vary over time. In Table 4.4, the return to the long-short portfolio in the overall sample is regressed against the UP and DOWN dummy variables. The UP and DOWN coefficients from the regression show that the average return to the long-short portfolio is 0.67% per month during economic upturns, and 0.36% per month during downturns. Hence there is some evidence that the accruals premium is more pronounced during economic upturns than during downturns. However, when regressing the return to the long-short portfolio against the UP dummy variable and a constant, the constant coefficient is not statistically significant. This evidence suggests that the difference between the return to the long-short portfolio during economic upturns versus downturns is not reliable.

<u>Independent effects of investment irreversibility and financial constraints</u>:

This section reports the impact of investment irreversibility and financial constraints independently on the cyclical pattern of the accruals premium. This chapter hypothesises that if the accruals premium can be explained by an explanation based on Wu et al. (2010), the cyclical pattern would be more pronounced among firms with high investment irreversibility ($H_{4.3}$). Alternatively, if it can be explained by an explanation based on Polk and Sapienza (2009), it would be more pronounced among firms with low investment irreversibility.

Section 4.5.2.1 (p. 246) suggests that the accruals premium shows the mispricing characteristic in the relationship with investment irreversibility. Hence one could expect that the cyclical pattern is more pronounced in the subsample with low investment irreversibility. On the other hand, the accruals premium shows the risk based characteristic in the relationship with financial constraints. Hence the cyclical pattern is expected to be more pronounced in the subsample with high financial constraints.

Table 4.5 presents the time varying pattern of the returns to the long-short portfolios in the subsamples with different levels of investment irreversibility. Among the stocks with high investment irreversibility, during economic upturns, the return to the long-short portfolio is 0.44% per month and is statistically significant. During downturns, it is only 0.12% per month and is statistically insignificant. The gap in the return to the long-short portfolio during economic upturns versus downturns is 0.32% per month; however, this difference is statistically insignificant.

A similar pattern is also observed among the stocks with low investment irreversibility. During economic upturns, the return to the long-short portfolio is 0.84% per month and is statistically significant. During downturns it is only 0.39% per month and is statistically insignificant. The gap of 0.45% per month during economic upturns versus during downturns is higher than the corresponding gap in the subsample with high investment irreversibility. However it is also statistically insignificant. Furthermore, of the statistically significant returns to the long-short portfolios during economic upturns in the two subsamples, the one in the low investment irreversibility subsample is nearly twice that in the high investment irreversibility subsample. Overall, there is some evidence that the accruals premium is cyclical, stronger during economic upturns and weaker during downturns, in both the subsample with high and low investment irreversibility. The cyclical pattern appears to be more pronounced in the low investment irreversibility subsample. However the evidence is not statistically significant. Hypothesis $H_{4.3}$ is accepted among firms with low investment irreversibility.

The cyclical pattern of the returns to the long-short portfolios in high and low financial constraints is presented in Table 4.6. In the subsample with high financial constraints, the return to the long-short portfolio during economic upturns is 0.84% per month, and is statistically significant. During downturns, it is only 0.23% per month and is insignificant. The gap in the return between economic upturns and downturns is 0.61% per month and statistically insignificant. In the subsample with low financial constraints, although the return to the long-short portfolio is higher during economic upturns than during downturns, it is statistically and economically insignificant in both states. The gap in the return between economic upturns and downturns is also statistically and economically insignificant. Overall, there is some tendency that the accruals premium is cyclical in the subsample with high financial constraints. However, similar to the evidence in the subsamples by investment irreversibility, the evidence in here is also statistically insignificant. Hypothesis $H_{4.3}$ is accepted among firms with high financial constraints.

Collective effect of investment irreversibility and financial constraints:

Section 4.5.2.1 (p. 246) shows that the returns to the long-short portfolios are economically and statistically significant when both investment irreversibility and financial constraints are (a) binding or (b) non-binding. The former is consistent with an explanation based on Wu et al. (2010) whereas the latter is consistent with an explanation based on Polk and Sapienza (2009). Hence, one would expect the cyclicality of the accruals premium in these extreme subsamples.

Table 4.7 presents the time varying pattern of the returns to the long-short portfolios in the subsamples of firms dependently sorted by investment irreversibility as the primary criterion and financial constraints as the secondary criterion. In the subsample of firms with high investment irreversibility – high financial constraints, the return to the long-short portfolio during economic upturns is 1.24% per month and statistically significant. It is only 0.09% per month and insignificant during downturns.

The return to the long-short portfolio in the subsample of firms with low investment irreversibility – low financial constraints exhibits a similar pattern. The return is 1.06% per month and statistically significant during economic upturns, but only 0.46% per month and insignificant during downturns. The gap in the return during economic upturns versus downturns in this subsample is statistically insignificant. In the remaining two subsamples where only one inflexibility criterion is binding, the returns to the long-short portfolio are mostly statistically and economically insignificant.

Table 4.8 provides the robustness test for the results in Table 4.7. Stocks are dependently sorted into subsamples by financial constraints as the primary criterion and investment irreversibility as the secondary criterion. The results mirror those from Table 4.7. The return to the long-short portfolio during economic upturns in the subsample with high financial constraints – high investment irreversibility is 1.29% per month and statistically significant. It is only 0.06% per month and insignificant during downturns. The gap in the return to the long-short portfolio between economic upturns versus downturns is also statistically significant.

The return pattern in the subsample of firms with low financial constraints – low investment irreversibility is less cyclical than in the corresponding subsample in Table 4.7. The return to the long-short portfolio during economic upturns is weakly significant. None of the returns to the long-short portfolios in the remaining subsamples with one binding inflexibility condition is statistically significant. The evidence suggests that hypothesis $H_{4.3}$ is accepted in the subsample of firms with both binding and non-binding investment irreversibility and financial constraints.

Discussion:

When both investment irreversibility and financial constraints are binding, the return to the long-short portfolio is statistically and economically significant during economic upturns, whereas it is insignificant during downturns. The gap in the return during economic upturns versus downturns is also statistically significant. At the other end of the inflexibility spectrum when none of the inflexibility measures is binding, there is some weak evidence of a cyclical pattern of the return to the long-short portfolio. The return during economic upturns is positive and significant, while smaller and insignificant during downturns.

However, the gap in the return between economic upturns and downturns is statistically insignificant.

Overall, the evidence in this section lends strong support to hypothesis $H_{4.3}$ when both investment irreversibility and financial constraints are binding. The combination of both investment irreversibility and financial constraints means that during downturns, firms tend to cut working capital investments to below the optimal level when responding to the changing discount rate, as fixed capital investment is difficult to reverse (Caggese, 2007). Stocks with low accruals are therefore less rewarded, hence the weakening return to the long-short portfolio during downturns. The evidence support an investment based explanation for the accruals premium based on Wu et al. (2010). Hypothesis $H_{4.3}$ only receives weak support when none of the inflexibility conditions is binding. Therefore, there is only weak evidence that the accruals premium is due to managers of overvalued firms investing to prolong the overvaluation along the lines of Polk and Sapienza (2009). When only one inflexibility measure is imposed the results also weakly support hypothesis $H_{4.3}$. The supporting evidence among firms with low investment irreversibility lends support to the explanation based on Polk and Sapienza (2009). In addition, the supporting evidence among firms with high financial constraints lends support to an explanation based on Wu et al. (2010).

The time varying characteristic analysed in this section is consistent with the evidence in Wu et al. (2010) that the accruals premium can be predicted using the variance risk premium, and to a lesser extent, using the widely used variables (i.e. the term spread, default spread and a derivation of the Treasury bill rate). Ali and Gurun (2009), Gerard et al. (2009), and Livnat and Petrovits (2009) find that the accruals premium varies with investor sentiment. The analysis in this section brings together the time varying characteristic of the accruals premium from both a risk based and a mispricing perspective. The results have some implications to practitioners who attempt to deploy the accruals based trading strategy. Imposing both the inflexibility conditions on the sample and timing the strategy can considerably improve the performance. Wrong timing, on the other hand, can cost investors dearly as the accruals based trading strategy generates a return close to zero during downturns.

4.5.2.3. The Accruals Premium in Different Industries

The hypotheses in this chapter are built around the relationship between the impacts of firms' investment and financing constraints on the returns to the accruals based trading strategy. The relationship might vary across the industries as firms in different industries tend to face constraints in their investment and financing environment to different extents. This section provides evidence for hypothesis $H_{4.4}$ that the patterns of the accruals premium observed so far are more pronounced in the manufacturing industry in which firms' investments in fixed and working capital plays a more crucial role than in other industries.

Table 4.9 reports the return to the portfolios sorted by the accruals ratio and to the long-short portfolios in different industries. Firms are classified into industries using the one-digit SIC industries (for detailed information on the industries, refer to Appendix 4.1, p. 272). The returns to the long-short portfolios are positive and statistically significant only in the two manufacturing industries

(SIC codes no. 2 and 3). In the other industries it is non-existent[56]. The evidence is consistent with the perspective that investments in fixed capital and working capital are related to the accruals premium, given that they are likely to affect the manufacturing industries more than the other industries.

[Insert Table 4.9 about here]

Furthermore, the result supplements the findings in Zhang (2007) that the accruals premium increases monotonically with the covariance between the accruals and the employment growth at two-digit SIC industry level. In the sample examined in this chapter, the accruals premium is ***only*** statistically and economically significant among firms in the manufacturing industries, which according to Zhang (2007) belong to the highest covariance group. Along the lines of Zhang (2007), accruals in the manufacturing firms reflect investments in working capital and are more likely to reflect information about firms' investments than accruals in the other industries. Hence it is likely that the accruals premium is affected by the factors that affect firms' investments, including investment irreversibility and financial constraints.

The accruals premium in different industries in the subsamples of firms by investment irreversibility is reported in Table 4.10. In both panels, the returns to the long-short portfolios are statistically significant only in the manufacturing industries, consistent with the evidence in Table 4.9. Furthermore, the returns to the long-short portfolios in these two manufacturing industries are higher among firms

[56] One exception is industry group 7, i.e. personal services, in which the return to the accruals based trading strategy is weakly significant at 0.43% per month. However, the returns of the accrual quintiles are not close to a monotonic pattern but considerably fluctuate.

with low investment irreversibility in panel B than among firms with high investment irreversibility in panel A (0.66% per month and 0.93% per month, compared with 0.34% per month and 0.39% per month). The pattern observed in the overall sample reported in Table 4.5 and analysed in section 4.5.2.1 (p. 246) therefore also concentrates in the manufacturing industries.

[Insert Table 4.10 about here]

Table 4.11 shows that the pattern of the returns to the long-short portfolios in the subsamples of firms by financial constraints reported in Table 4.6 and analysed in section 4.5.2.1 (p. 246) concentrates in the heavy manufacturing industry (SIC code no.3). In the subsample with high financial constraints (panel A), the only statistically significant return to the long-short portfolio is 0.92% per month in the heavy industry. In the subsample with low financial constraints (panel B), the returns are mostly statistically insignificant[57]. The pattern observed in Table 4.6 that the return to the long-short portfolio is higher among firms with high financial constraints than that among firms with low financial constraints also appears to concentrate on the heavy manufacturing industry. While it is 0.92% per month and significant in the subsample with high financial constraints (panel A), it is 0.18% per month and insignificant in the subsample with low financial constraints (panel B).

[Insert Table 4.11 about here]

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[57] The only exception is the light manufacturing industry (SIC code no. 2), with the weakly significant return of 0.28% per month.

The patterns of the returns to the long-short portfolios in the subsamples where both the investment and the financing inflexibility are binding / non-binding, observed in Tables 4.7 and 4.8 and analysed in section 4.5.2.1 (p. 246) also concentrate on the heavy manufacturing industry. In both Tables 4.12 and 4.13, the returns to the long-short portfolios in this industry are the only statistically significant ones among those in all of the industries.

[Insert Table 4.12 about here]

[Insert Table 4.13 about here]

Finally, the time varying patterns of the returns to the long-short portfolios in the sample and subsamples by different inflexibility measures are mirrored in the manufacturing industries. In Table 4.9, the gap in the return during economic upturns versus downturns in the overall sample is positive and significant only in the light manufacturing industry. Only the returns during economic upturns of the two manufacturing industries are positive and significant.

In Table 4.10, the cyclicality appears to be more pronounced in the low investment irreversibility subsample for the two manufacturing industries[58]. However, none of the gaps is statistically significant. The returns during economic upturns in the two manufacturing industries are also the only positive and significant ones. In Table 4.11, the cyclicality is more pronounced in the subsample

[58] The return is 1.10% per month during economic upturns versus 0.11% per month during downturns for the light industry and 1.05% per month during economic upturns versus 0.78% per month during downturns for the heavy industry in the low investment irreversibility subsample.

with high financial constraints for the heavy industry[59] (1.31% per month during economic upturns versus 0.44% per month during downturns, and the gap is statistically significant). The return during economic upturns in the heavy industry is also the most economically significant and statistically significant[60] in the subsample with high financial constraints.

Lastly, in Tables 4.12 and 4.13, the return to the long-short portfolio of the heavy industry appears to be cyclical in the extreme inflexibility subsamples. However, none of the gaps in the return during economic upturns versus downturns is statistically significant. The heavy industry[61] is also the only industry that has the significant returns to the long-short portfolios, both economically and statistically, during economic upturns.

Overall, the evidence supports hypothesis $H_{4.4}$ and suggests that the evidence to support both (a) an explanation based on Wu et al. (2010), and (b) an explanation based on Polk and Sapienza (2009) presented in sections 4.5.2.1 (p. 246) and 4.5.2.2 (p. 251) concentrate on the manufacturing industries. According to Zhang (2007), the accruals of the manufacturing industries reflect more information on firms' investments than those of the other industries. Therefore the

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[59] For the light industry, although the gap in the returns during economic upturns and downturns is significant in the subsample with low financial constraints, its magnitude approximates that in the subsample with high financial constraints.

[60] The return during economic upturns of the light industry in the subsample with high financial constraints is also weakly statistically significant; however the returns to the portfolios sorted by the accruals ratio do not follow a monotonic pattern.

[61] The returns of the light industry also show the cyclical pattern, although none of them is statistically significant.

evidence reinforces the investment based explanations, whether risk based or mispricing, in explaining the accruals premium.

4.5.3. The Accruals Premium – Risk based vs. Mispricing explanations

The evidence so far lends support to both the risk based explanation based on Wu et al. (2010) and the mispricing explanation based on Polk and Sapienza (2009), both of which relate the accruals premium to firms' investments. This section examines whether the cross section of the returns to stocks of firms with low and high accruals can be explained by the risk based explanation or the mispricing explanation. If the risk based explanation based on Wu et al. (2010) alone can explain the accruals premium, it would be explained by an asset pricing model that incorporates the relevant fundamental factors, including firms' investment irreversibility and their financial constraints, and the business cycle state (hypothesis $H_{4.5}$).

Scenario 3 in Table 4.14 adjusts returns for risks using the conditional Fama and French model in which the betas are conditioned on the financial constraints variable (the net payout ratio). In scenario 4, the betas are conditioned on the investments irreversibility variable (the depreciation charge ratio). The time series regressions in stage one are described in equation 4.2 (p. 238) with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. The risk adjusted returns are regressed against the firm level variables as described in equation 4.3 (p. 238). The accruals coefficients in both scenarios of -0.81 and -0.99 are significant, thus suggesting that the accruals ratio negatively predicts stock returns. The evidence suggests that the accruals premium exists even when accounting for risks using the Fama and French model supplemented with the information about firms' financial constraints or investment irreversibility.

[Insert Table 4.14 about here]

In scenario 5, returns are adjusted for risks using the conditional Fama and French model in which the betas are conditioned on the business cycle variable. The time series regressions in stage one are described in equation 4.2 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. The risk adjusted returns are regressed against the firm level variables as described in equation 4.3. The accruals coefficient of -1.14 remains significant, suggesting that the accruals ratio continues to negatively predict stock returns. The accruals premium continues to exist when returns are adjusted for risks using the Fama and French model supplemented with the business cycle information.

In scenarios 6, 7 and 8, the Fama and French model is conditioned on both the business cycle and the firm level variables – financial constraints, investment irreversibility, and both, respectively. The stage one regression is described by equation 4.2 in its full version. The accruals coefficients of -0.97, -1.18, and -1.02 respectively, are significant. The evidence suggests that the accruals ratio continues to negatively predict stock returns, and hence the accruals premium continues to exist. The Fama and French model used to adjust returns for risks includes all the information identified as relevant. The persistence of the accruals premium suggests that a risk based mechanism might not be solely responsible for it.

Both the risk based and mispricing explanations for the accruals premium in this chapter predict that the premium should be more pronounced during economic upturns than during downturns. Scenario 9 tests if the accruals premium exists after removing the cyclical component of stock returns. Returns are adjusted for the cyclical pattern using the four widely used variables, being the term spread, the default spread, the aggregate dividend yield, and the short term Treasury bill rate[62]. The raw individual stock returns are adjusted for the cyclicality in the following OLS time series regression:

$$R_{jt} = \alpha_j + \begin{bmatrix} \gamma_{j,1} & \gamma_{j,2} & \gamma_{j,3} & \gamma_{j,4} \end{bmatrix} \times \begin{bmatrix} R_t^{30} \\ Def_t \\ Term_t \\ Dy_t \end{bmatrix} + e_{jt} \quad (4.8)$$

in which R_t^{30} is the 30 day T bill rate in % at time t, Def_t is the default spread in % between the returns of U.S. corporate bonds rated BAA and AAA, at time t. $Term_t$ is the term spread in % between the returns of 10 year Treasury bonds and 1 year Treasury bonds. Dy_t is the dividend yield of the stocks listed in NYSE, AMEX, and NASDAQ, calculated as $100 \times e^{ldy}$ where ldy is the natural log of the imputed dividend yield taken from Jacob Boudoukh's data for the paper Boudoukh et al. (2007). In Boudoukh's data, *ldy* is the natural log of the imputed dividend yield calculated from value weighted returns, including and excluding distributions, for NYSE, AMEX, and NASDAQ, taken from CRSP.

The part of returns unexplained by the four business cycle variables from equation 4.8 is measured as the sum of the constant and the residual terms. It is used as the dependent variable in the cross sectional OLS regression 4.3. The

[62] Examples of studies using these variables to examine the cyclical behaviour of asset pricing anomalies are Petkova and Zhang (2005) and Chordia and Shivakuma (2002) on the value anomaly and the momentum anomaly respectively.

regression tests whether the accruals ratio continues to predict returns, or the accruals anomaly exists, after the returns are adjusted for cyclicality. The accruals coefficient becomes statistically insignificant with the t-statistic of 0.20. Its magnitude is only about 25% of that in other scenarios. Hence, there is no longer a trace of the return predictability of the accruals ratio. The evidence confirms the cyclicality of the accruals premium documented so far in this chapter.

To summarise, the accruals ratio continues to predict returns, or the accruals premium continues to exist, when returns are adjusted for risks using the Fama and French model, unconditional or conditional on the firm level variables and the business cycle variable. This evidence suggests that a risk based explanation might not be the responsible sole factor for the accruals premium. Hypothesis $H_{4.5}$ is therefore rejected. This finding is also consistent with the existing literature that several asset pricing models can only partially explain the accruals premium. This chapter argues that the cyclicality of the accruals premium results from both the risk based explanation based on Wu et al. (2010) and the mispricing explanation based on Polk and Sapienza (2009). Therefore, that the accruals ratio ceases to predict stock returns when removing their cyclicality might be evident for both of these explanations.

4.6. Conclusions

This chapter examines the impact of firms' investments on the profitability of the accruals based trading strategy. Consistent with the literature, this chapter finds that the accruals based trading strategy is profitable in the sample examined. The chapter reports a raw accruals premium of 0.54% per month.

The literature documents the connection between the accruals premium and firms' investments. This chapter extends the literature by examining the impact of the firm level forces that prohibit firms from investing at the optimal level on the accruals premium. The analysis is taken from the perspective that firms' accruals reflect their investments in working capital, as suggested by Fairfield et al. (2003), Zhang (2007), and Wu et al. (2010).

This chapter finds that the accruals premium is more pronounced among firms with high financial constraints or low investment irreversibility. The former is consistent with an explanation based on Wu et al. (2010) in which, due to the limited financial resources, firms have less flexibility in investing at the optimal level. The latter is consistent with an explanation based on Polk and Sapienza (2009) in which the management of overvalued firms invests to cater for investor sentiment and prolong the overvaluation.

Furthermore, both investment irreversibility and financial constraints reflect financial inflexibility and may reinforce the impact of each other. This chapter finds that the accruals premium is most pronounced at the two extremes of the inflexibility spectrum. The evidence at the high end of the spectrum supports the explanation based on Wu et al. (2010), whereas the evidence at the low end supports the explanation based on Polk and Sapienza (2009).

This chapter finds some weak evidence that the accruals premium is more pronounced during economic upturns among firms with low investment irreversibility or high financial constraints. When taking into account both inflexibility measures, the evidence is strong for firms at the high end of the inflexibility spectrum, supporting the explanation based on Wu et al. (2010). The evidence at the low end, which would support the explanation based on Polk and Sapienza (2009), is weak.

This chapter also finds that the patterns in the relationship between the inflexibility measures and the accruals premium so far are concentrated in the manufacturing industries, especially the heavy industry. According to Zhang (2007), the accruals of the manufacturing industries reflect more information on firms' investments than those of the other industries. This evidence reinforces the perspective that the accruals premium is related to firms' investments.

Finally, when returns are adjusted for risks using the Fama and French model, both unconditional and conditional on the business cycle and the inflexibility measures, the accruals ratio continues to predict stock returns. This relationship is evident for the profitability of the accruals based trading strategy. Hence, the risk-return relationship might not be solely responsible for the accruals premium. When isolating the cyclicality in stock returns, the accruals ratio ceases to predict stock returns, or the accruals premium completely disappears. Any explanation for the accruals premium should therefore be able to explain its cyclical nature.

Implications

The findings in this chapter have several implications. This chapter reports that a risk-return relationship cannot fully explain the pattern of the accruals premium. Hence, future stock returns can be predicted using the accruals ratio even when accounting for risks. Several patterns of the accruals premium can be explained by the management's behaviour, i.e. catering for investor sentiment by means of investing (Polk and Sapienza, 2009). In the language of the market efficiency literature, the market is not fully efficient with regards to the information about the accruals ratio. Furthermore, the profitability of the accruals based trading strategy is affected by firms' investment irreversibility and their financial constraints. It generally suggests that the understanding of corporate finance can help extend the understanding of the securities markets.

Finally, investors would benefit from the findings in this chapter. Imposing both investment and financing inflexibility conditions on the sample and correctly timing the strategy can considerably improve the performance of the accruals based trading strategy. Investors seeking to deploy this strategy would benefit from pursuing it among firms that are either highly inflexible or highly flexible in investment and financing. They also benefit from pursuing the strategy during economic upturns among firms that are highly inflexible. Wrong timing, on the other hand, can cost investors dearly as the accruals based trading strategy can generate a return close to zero.

Appendix 4.1: One Digit SIC Industry Classification

SIC code	Industry name	Example
0	Agriculture, forestry, fisheries	Crops, livestock, fishing, hunting, trapping
1	Mining & construction	Coal mining, building construction
2	Light manufacturing industry	Textile, food, paper manufacturing
3	Heavy manufacturing industry	Leather, metal, industrial machineries
4	Transportation, communication & utilities	Railroad, passenger transportation, warehousing, communication, electric, gas
5	Wholesale and retail trades	Wholesale of durables / non-durables, food stores, automotive dealers
6	Financial services	Banks, security brokers / dealers
7	Personal services	Hotels, amusement and recreation services
8	Business services	Legal, engineering, accounting services
9	Public administration	Legislative government, police, justice

Table 4.1: Summary of Hypotheses

The hypotheses examined in chapter 4 are summarised below:

	WZZ	**P&S**
$H_{4.1}$	Accept	Accept
$H_{4.2}$	Accept	Reject
$H_{4.3}$	Accept	Accept
$H_{4.4}$	Accept	Reject
$H_{4.5}$	Accept	Reject

WZZ represents the explanation that the accruals premium is due to an investment based factor along the lines of Wu et al. (2010). P&S represents the explanation that the accruals premium is due to managers investing to cater investor sentiment, or the catering theory, along the lines of Polk and Sapienza (2009).

Table 4.2: Construction of Key Variables

The key variables used in chapter 4 are constructed as follows:

A. Key variables in portfolio sorting

Key variables	**Construction**
Accruals ratio	The total accruals used in Sloan (1996), measured as changes in non-cash current assets minus changes in current liabilities (excluding short term debts and tax payable) and depreciation, scaled by average total assets (described in equation 4.1, p. 238).
Depreciation charge ratio	The ratio of depreciation expense during the year to the beginning of the year net fixed assets.
Net payout ratio	Dividends plus repurchases minus share issuance, scaled by the net incomes.

B. Key variables in the regression of the Avramov and Chordia (2006) framework

The construction of these variables is described in Panel B of Table 2.2 (p. 103).

Table 4.3: Sample Description

Table 4.3 presents some descriptive statistics of the sample of non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

	Mean	Median	Standard deviation
A – Key variables in portfolio sorting			
Returns (%)	1.37	0.82	10.56
Accruals ratio	-2.28	-2.96	8.35
Depreciation charge ratio	35.09	15.75	571.53
Net payout ratio	4.40	18.25	1,133.21
Correlation			
Accruals & Dep. Charge	0.008		
p-value	0%		
Accruals & Net payout	-0.027		
p-value	0%		
Dep. Charge & Net payout	-0.001		
p-value	72%		
B – Key variables in regressions			
Market capitalisation ($ billion)	3.00	0.54	9.45
Book-to-Market ratio	0.76	0.66	0.51
Cumulative returns, months 2 to 3 (%)	2.67	1.94	13.23
Cumulative returns, months 4 to 6 (%)	3.95	2.85	16.29
Cumulative returns, months 7 to 12 (%)	8.18	5.74	24.26
Turnover, NYSE and AMEX (%)	16.04	11.30	16.06
Turnover, NASDAQ (%)	6.86	5.30	6.00

A. Key variables in portfolio sorting

Panel A reports the statistics for the key variables used in the portfolio sorting methodology. Returns measure the average monthly stock returns. The construction of the other variables is described in Panel A of Table 4.2. Panel A also reports the correlation coefficients among these variables, and the two tailed p-value to test whether the correlation coefficients are different from zero.

B. Key variables in the regression of the Avramov and Chordia (2006) framework

Panel B describes the statistics for the variables used in the regression of the Avramov and Chordia (2006) asset pricing framework. The sample is further constrained in that there should be data on stock returns, market capitalisation, and the Book-to-Market ratio in the current year and in the 36 months prior to the current month. The construction of the variables is described in Panel B of Table 2.2.

Table 4.4: Returns to the Accruals based Trading Strategy

Table 4.4 presents the returns to the equally weighted portfolios of stocks sorted by the value of the accruals ratio as of 31st December of year t-1 in ascending order. Ten portfolios with equal numbers of stocks are composed and positions (long and short) are taken at the beginning of July of year t and held until June of year t+1. L-H represents the return to the portfolio that goes long in the stocks with low accruals (i.e. the portfolio with the lowest ranking in the accruals ratio) and short in the stocks with high accruals (i.e. the portfolio with the highest ranking in the accruals ratio).

The table presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

	All	Upturn	Downturn
Low	**1.56**	**1.20**	**2.03**
	5.08	3.19	3.94
2	**1.50**	**1.21**	**1.88**
	5.60	3.71	4.31
3	**1.47**	**1.12**	**1.91**
	5.63	3.62	4.33
4	**1.45**	**1.15**	**1.83**
	5.65	3.74	4.28
5	**1.38**	**1.01**	**1.84**
	5.28	3.24	4.17
6	**1.46**	**1.12**	**1.89**
	5.49	3.51	4.08
7	**1.33**	**1.01**	**1.76**
	5.03	3.03	4.01
8	**1.28**	**0.94**	**1.71**
	4.62	2.72	3.61
9	**1.27**	**0.84**	**1.81**
	4.16	2.41	3.66
High	**1.03**	**0.53**	**1.67**
	2.89	1.20	2.78
L - H	**0.54**	**0.67**	**0.36**
	4.29	3.99	1.92
	***	***	**
		Up-Down	
	t	1.27	
	p	0.20	

The construction of the accruals ratio is described in Table 4.2. To classify the time horizon into economic upturns and downturns, this chapter uses the Chicago Fed National Activity Index, a weighted average of 85 existing monthly national economic indicators with the mean of zero and the standard deviation of one. A positive index indicates that growth is above the trend, and a negative index indicates that growth is below the trend. Therefore we assign positive index to economic upturns and negative index to downturns. The dummy variable UP is assigned the value of 1 if the index is positive, and zero otherwise. The dummy variable DOWN is assigned the value of 1 if the index is negative, and zero otherwise.

This chapter measures the return to the long-short portfolio during economic upturns and downturns by regressing it against the UP and DOWN dummy variables. The coefficient attached to the UP (DOWN) variable gives the average returns to the accruals based trading strategy during economic upturns (downturns). The return is then regressed against the UP dummy variable and a constant. The coefficient attached to the UP dummy variable measures the difference between the return to the long-short portfolio during economic upturns versus downturns.

The lines in bold are the portfolio returns, and the lines not in bold are the associated two tailed t-statistics to test whether they are different from zero. The table also reports the two tailed t-statistic and p-value to test whether the return to the long-short portfolio is different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.5: Investment Irreversibility and the Accruals based Trading Strategy

Table 4.5 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in the subsamples with high versus low investment irreversibility (IIR). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

	High IIR			**Low IIR**		
	All	Up	Down	All	Up	Down
Low	**1.45**	**1.13**	**1.85**	**1.69**	**1.29**	**2.22**
	5.25	3.38	3.90	4.56	2.83	3.51
2	**1.41**	**1.07**	**1.86**	**1.59**	**1.22**	**2.07**
	5.73	3.50	4.35	4.55	2.96	3.64
3	**1.44**	**1.06**	**1.92**	**1.62**	**1.29**	**2.04**
	5.59	3.45	4.21	4.85	3.25	3.63
4	**1.35**	**1.03**	**1.75**	**1.45**	**1.19**	**1.80**
	5.36	3.38	4.25	4.39	3.06	3.31
5	**1.30**	**0.95**	**1.75**	**1.51**	**1.11**	**2.04**
	5.26	3.15	4.32	4.45	2.67	3.73
6	**1.44**	**1.11**	**1.87**	**1.49**	**1.13**	**1.94**
	5.59	3.63	4.13	4.31	2.68	3.29
7	**1.40**	**1.06**	**1.83**	**1.35**	**1.03**	**1.77**
	5.36	3.40	4.04	3.86	2.31	3.15
8	**1.17**	**0.82**	**1.61**	**1.17**	**0.69**	**1.78**
	4.63	2.66	3.69	3.25	1.62	3.14
9	**1.30**	**0.90**	**1.81**	**1.12**	**0.68**	**1.69**
	4.98	2.67	4.12	3.05	1.59	2.78
High	**1.15**	**0.69**	**1.74**	**1.05**	**0.44**	**1.83**
	3.76	1.79	3.33	2.48	0.83	2.65
L-H	**0.30**	**0.44**	**0.12**	**0.65**	**0.84**	**0.39**
	1.96	2.32	0.46	3.28	2.95	1.29
	**	**		***	***	
		Up-Down			Up-Down	
	t	1.07		t	1.06	
	p	0.29		p	0.29	

The construction of the depreciation charge ratio, the proxy for investment irreversibility (IIR) is described in Table 4.2. Firms having the depreciation charge ratio in the bottom 30% are included in the subsample with high investment irreversibility. Firms having the depreciation charge ratio in the top 30% are included in the subsample with low investment irreversibility. Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. The table also reports the two tailed t-statistic and p-value to test whether the returns to the long-short portfolios in the subsamples by investment irreversibility are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.6: Financial Constraints and the Accruals based Trading Strategy

Table 4.6 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in the subsamples with high versus low financial constraints (FC). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

	High FC			**Low FC**		
	All	Up	Down	All	Up	Down
Low	**1.38**	**0.96**	**1.89**	**1.50**	**1.14**	**1.94**
	4.14	2.22	3.57	5.20	3.38	3.94
2	**1.50**	**1.10**	**2.00**	**1.33**	**1.03**	**1.70**
	4.49	2.71	3.60	5.10	3.33	4.20
3	**1.37**	**1.01**	**1.82**	**1.54**	**1.26**	**1.90**
	4.23	2.47	3.26	6.25	4.32	4.44
4	**1.40**	**1.13**	**1.74**	**1.35**	**0.95**	**1.86**
	4.26	2.83	3.22	5.62	3.28	4.79
5	**1.44**	**1.15**	**1.81**	**1.34**	**0.94**	**1.85**
	4.40	2.78	3.27	5.50	3.11	4.44
6	**1.32**	**1.11**	**1.58**	**1.47**	**1.07**	**1.96**
	3.92	2.74	2.94	5.76	3.74	4.46
7	**1.40**	**1.03**	**1.85**	**1.35**	**0.97**	**1.81**
	4.01	2.31	3.45	5.62	3.44	4.28
8	**1.11**	**0.56**	**1.81**	**1.23**	**0.87**	**1.69**
	3.05	1.27	3.07	5.04	2.93	4.02
9	**1.15**	**0.66**	**1.76**	**1.27**	**0.84**	**1.81**
	3.00	1.49	2.78	4.83	2.67	3.99
High	**0.81**	**0.12**	**1.66**	**1.26**	**0.86**	**1.76**
	1.88	0.23	2.31	4.26	2.39	3.64
L-H	**0.57**	**0.84**	**0.23**	**0.24**	**0.28**	**0.17**
	2.70	3.29	0.66	1.62	1.57	0.78
	***	***				
		Up-Down			Up-Down	
	t	1.43		t	0.38	
	p	0.15		p	0.71	

The construction of the net payout ratio, the proxy for financial constraints (FC), is described in Table 4.2. Firms having the net payout ratio in the bottom 30% are included in the subsample with high financial constraints. Firms having the net payout ratio in the top 30% are included in the subsample with low financial constraints. Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. The table also reports the two tailed t-statistic and p-value to test whether the returns to the long-short portfolios in the subsamples by financial constraints are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.7: Investment Irreversibility and Financial Constraints and the Accruals based Trading Strategy

	High IIR – High FC			High IIR – Low FC			Low IIR – High FC			Low IIR – Low FC		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low	**1.56**	**1.41**	**1.75**	**1.26**	**0.90**	**1.71**	**1.42**	**0.87**	**2.10**	**2.05**	**1.70**	**2.50**
	4.42	3.39	2.78	4.47	2.83	3.56	3.35	1.58	3.26	5.59	3.79	3.85
2	**1.55**	**1.29**	**1.88**	**1.48**	**1.10**	**1.98**	**1.62**	**1.38**	**1.92**	**1.24**	**0.85**	**1.73**
	4.93	2.95	3.83	6.16	3.95	5.21	3.94	2.85	2.79	3.31	2.06	2.83
3	**1.29**	**0.95**	**1.71**	**1.41**	**1.03**	**1.90**	**1.66**	**1.37**	**2.01**	**1.56**	**1.28**	**1.92**
	4.13	2.53	3.24	5.45	3.62	4.26	4.01	2.74	3.15	4.21	3.00	3.18
4	**1.56**	**1.32**	**1.86**	**1.34**	**0.77**	**2.08**	**1.28**	**0.80**	**1.88**	**1.52**	**1.18**	**1.95**
	4.81	3.23	3.14	5.31	2.50	4.83	2.98	1.49	2.69	4.84	3.13	3.85
5	**1.31**	**0.95**	**1.77**	**1.24**	**0.89**	**1.69**	**1.45**	**1.05**	**1.96**	**1.72**	**0.99**	**2.64**
	4.13	2.28	3.46	4.84	3.10	3.88	3.45	2.01	2.83	5.22	2.73	4.71
6	**1.70**	**1.33**	**2.16**	**1.26**	**0.78**	**1.87**	**1.40**	**1.16**	**1.69**	**1.60**	**1.33**	**1.95**
	5.27	3.53	4.15	4.98	2.98	4.07	3.13	2.08	2.41	5.00	3.38	3.57
7	**1.63**	**1.25**	**2.10**	**1.29**	**1.10**	**1.54**	**1.06**	**0.52**	**1.73**	**1.49**	**1.17**	**1.90**
	5.14	3.03	4.14	5.00	3.57	3.70	2.46	1.00	2.70	4.41	2.99	3.25
8	**1.22**	**0.91**	**1.61**	**1.28**	**0.81**	**1.88**	**1.29**	**0.79**	**1.92**	**1.15**	**0.71**	**1.71**
	3.70	2.20	2.99	5.02	2.85	3.96	2.98	1.68	2.67	3.20	1.62	2.74
9	**1.49**	**1.08**	**2.00**	**1.16**	**0.89**	**1.52**	**0.91**	**0.53**	**1.38**	**1.45**	**1.02**	**2.00**
	4.53	2.70	4.17	4.69	2.70	3.77	2.00	0.93	1.99	3.84	2.55	3.76
High	**0.83**	**0.17**	**1.65**	**1.39**	**0.96**	**1.94**	**1.15**	**0.24**	**2.28**	**1.25**	**0.64**	**2.03**
	2.21	0.35	2.69	4.89	2.70	3.95	2.28	0.39	2.96	3.34	1.44	3.26
L-H	**0.73**	**1.24**	**0.09**	**-0.13**	**-0.06**	**- 0.23**	**0.27**	**0.63**	**- 0.19**	**0.80**	**1.06**	**0.46**
	2.82	4.32	0.22	-0.60	-0.22	- 0.61	0.86	1.71	- 0.34	2.59	2.48	1.04
	***	***						*		***	**	

	High IIR- High FC Up-Down	High IIR- Low FC Up-Down	Low IIR- High FC Up-Down	Low IIR-Low FC Up-Down
t-statistic	2.22	0.36	1.21	0.89
p-value	3% **	72%	23%	37%

Table 4.7 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in the subsamples by investment irreversibility (as the primary criterion) and financial constraints (as the secondary criterion). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

The construction of the net payout ratio (the proxy for financial constraints or FC) and the depreciation charge ratio (the proxy for investment irreversibility or IIR) is described in Table 4.2. Firms are first sorted by the depreciation charge ratio into the groups with high (bottom 30%) and low (top 30%) investment irreversibility. Within each group, they are further sorted by the net payout ratio into the subsamples with high (bottom 30%) and low (top 30%) financial constraints. Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

In the main table, the lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. The supplementary table reports the two tailed t-statistics and p-values to test whether the returns to the long-short portfolios in the subsamples by investment irreversibility and financial constraints are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.8: Financial Constraints and Investment Irreversibility and the Accruals based Trading Strategy

	High FC – High IIR			High FC – Low IIR			Low FC – High IIR			Low FC – Low IIR		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low	**1.61**	**1.34**	**1.96**	**1.36**	**1.01**	**1.80**	**1.28**	**0.96**	**1.68**	**1.85**	**1.46**	**2.34**
	4.38	3.09	2.77	3.32	1.84	3.02	4.50	3.00	3.46	5.06	3.49	3.59
2	**1.45**	**0.90**	**2.14**	**1.50**	**1.10**	**2.00**	**1.33**	**0.92**	**1.85**	**1.39**	**0.99**	**1.88**
	4.09	1.88	3.59	3.51	2.30	2.88	5.52	3.22	4.70	3.81	2.25	3.42
3	**1.28**	**0.95**	**1.69**	**1.66**	**1.31**	**2.09**	**1.47**	**1.09**	**1.95**	**1.35**	**1.20**	**1.53**
	3.84	2.24	3.30	4.01	2.60	3.20	5.84	3.77	4.38	4.06	3.33	2.84
4	**1.63**	**1.38**	**1.95**	**1.44**	**1.08**	**1.88**	**1.41**	**0.96**	**1.99**	**1.61**	**1.25**	**2.05**
	4.69	3.27	3.06	3.30	2.04	2.77	5.36	2.90	4.73	5.26	3.48	3.99
5	**1.28**	**0.84**	**1.83**	**1.20**	**0.86**	**1.62**	**1.17**	**0.80**	**1.63**	**1.59**	**1.18**	**2.10**
	3.74	1.94	3.10	2.80	1.70	2.29	4.60	2.68	3.74	4.99	2.97	3.78
6	**1.38**	**1.09**	**1.74**	**1.44**	**0.92**	**2.09**	**1.34**	**0.91**	**1.87**	**1.12**	**0.61**	**1.76**
	4.19	2.71	3.16	3.22	1.70	2.86	5.39	3.43	4.31	3.39	1.70	3.02
7	**1.40**	**1.15**	**1.72**	**1.26**	**0.61**	**2.08**	**1.42**	**1.19**	**1.70**	**1.56**	**1.13**	**2.10**
	4.40	2.92	3.40	2.77	1.04	2.99	5.66	3.71	4.08	4.67	2.76	3.80
8	**1.40**	**1.00**	**1.90**	**1.25**	**0.71**	**1.92**	**1.24**	**0.69**	**1.93**	**1.11**	**0.69**	**1.63**
	4.05	2.12	3.34	2.95	1.50	2.88	4.73	2.19	4.37	3.19	1.65	3.02
9	**1.22**	**0.83**	**1.70**	**0.81**	**0.18**	**1.60**	**1.14**	**0.92**	**1.41**	**1.29**	**0.81**	**1.88**
	3.58	1.94	3.24	1.68	0.29	2.08	4.71	3.01	3.37	3.58	1.98	3.47
High	**0.87**	**0.05**	**1.90**	**1.15**	**0.46**	**2.01**	**1.41**	**1.00**	**1.92**	**1.25**	**0.72**	**1.92**
	2.15	0.10	2.57	2.29	0.73	2.55	5.02	2.81	3.83	3.52	1.70	3.22
L-H	**0.75**	**1.29**	**0.06**	**0.21**	**0.56**	**-0.21**	**-0.12**	**-0.03**	**-0.24**	**0.60**	**0.74**	**0.41**
	2.55	4.59	0.12	0.59	1.33	-0.36	-0.58	-0.13	-0.66	2.12	1.95	1.02
	**	***								**	*	

	High FC- High IIR Up-Down	High FC- Low IIR Up-Down	Low FC- High IIR Up-Down	Low FC-Low IIR Up-Down
t-statistic	2.18	1.05	0.47	0.55
p-value	3% **	29%	64%	58%

Table 4.8 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in the subsamples by financial constraints (as the primary criterion) and investment irreversibility (as the secondary criterion). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

The construction of the net payout ratio (the proxy for financial constraints or FC) and the depreciation charge ratio (the proxy for investment irreversibility or IIR) is described in Table 4.2. Firms are first sorted by the net payout ratio into the groups with high (bottom 30%) and low (top 30%) financial constraints. Within each group, they are further sorted by the depreciation charge ratio into the subsamples with high (bottom 30%) and low (top 30%) investment irreversibility. Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

In the main table, the lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. The supplementary table reports the two tailed t-statistics and p-values to test whether the returns to the long-short portfolios in the subsamples by financial constraints and investment irreversibility are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.9: Returns to the Accruals based Trading Strategy in Different Industries

	I=0			I=1			I=2		
	All	Up	Down	All	Up	Down	All	Up	Down
Low	278			420			420		
	0.98	**0.81**	**1.18**	**1.49**	**1.17**	**1.91**	**1.55**	**1.30**	**1.87**
	1.52	0.90	1.33	3.69	2.10	2.92	5.92	4.40	4.22
2	378			420			420		
	1.37	**1.37**	**1.36**	**1.47**	**1.05**	**2.01**	**1.40**	**1.08**	**1.80**
	2.64	2.01	1.91	3.85	2.07	3.17	6.12	4.05	4.69
3	356			420			420		
	0.42	**0.27**	**0.62**	**1.60**	**1.21**	**2.10**	**1.40**	**0.99**	**1.93**
	0.95	0.50	0.90	4.21	2.57	3.33	6.00	3.72	4.87
4	378			420			420		
	1.31	**1.51**	**1.06**	**1.55**	**1.16**	**2.04**	**1.20**	**0.83**	**1.68**
	2.75	2.79	1.33	4.29	2.58	3.30	4.86	2.95	3.92
High	414			420			420		
	1.13	**0.57**	**1.84**	**1.33**	**0.63**	**2.23**	**1.23**	**0.70**	**1.91**
	2.80	1.03	3.67	3.53	1.23	3.52	4.51	2.14	4.03
L-H	278			420			420		
	-0.28	**-0.04**	**-1.03**	**0.16**	**0.54**	**-0.32**	**0.32**	**0.59**	**-0.04**
	-0.38	-0.05	-1.35	0.61	1.33	-0.84	2.74	4.28	-0.20
							***	***	
		Up-down			Up-down			Up-down	
t		0.89			1.64			2.87	
p		37%			10%			0%	
								***	

	I=3			I=4			I=5		
	All	Up	Down	All	Up	Down	All	Up	Down
Low	420			420			420		
	1.63	**1.37**	**1.96**	**1.25**	**0.93**	**1.67**	**1.47**	**0.96**	**2.13**
	5.13	3.48	3.83	3.68	2.16	2.79	4.96	2.61	3.86
2	420			420			420		
	1.36	**1.14**	**1.66**	**1.32**	**0.89**	**1.87**	**1.38**	**0.80**	**2.13**
	4.62	3.17	3.36	4.43	2.33	3.79	4.92	2.16	4.11
3	420			420			420		
	1.41	**1.15**	**1.74**	**1.37**	**1.15**	**1.66**	**1.45**	**0.93**	**2.11**
	4.81	3.25	3.52	4.95	3.65	3.39	5.20	2.57	4.05
4	420			420			420		
	1.22	**0.95**	**1.55**	**1.41**	**1.21**	**1.67**	**1.27**	**0.66**	**2.05**
	4.02	2.57	3.07	5.10	3.61	3.79	4.34	1.80	4.06
High	420			420			420		
	1.11	**0.70**	**1.64**	**1.43**	**1.17**	**1.75**	**1.28**	**0.77**	**1.94**
	3.03	1.60	2.66	4.73	3.41	3.64	3.76	1.77	3.28
L-H	420			420			420		
	0.52	**0.67**	**0.33**	**-0.17**	**-0.24**	**-0.08**	**0.19**	**0.19**	**0.19**
	4.26	3.84	1.85	-0.81	-0.94	-0.27	1.08	0.85	0.71
	***	***	*						
		Up-down			Up-down			Up-down	
t		1.40			- 0.37			-0.00	
p		16%			71%			100%	

	I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down
Low	420			420					
	1.84	**0.93**	**3.01**	**1.72**	**1.04**	**2.58**			
	4.56	1.89	4.56	4.36	2.31	4.36			
2	420			420			28		
	1.57	**1.17**	**2.09**	**1.65**	**1.13**	**2.32**	**-1.01**	**-6.58**	**-0.35**
	4.07	2.55	3.25	4.40	2.53	3.50	-0.58	-1.74	-0.21
3	420			415			42		
	1.44	**1.18**	**1.79**	**1.62**	**0.95**	**2.51**	**2.77**	**2.75**	**2.78**
	4.06	2.47	3.21	3.92	1.51	3.38	2.39	1.72	3.26
4	420			420			36		
	1.65	**1.23**	**2.18**	**1.17**	**0.67**	**1.81**	**1.95**	**-1.88**	**2.30**
	4.15	2.28	3.55	3.14	1.41	2.89	1.43	-0.58	2.10
High	420			419			145		
	1.40	**0.76**	**2.22**	**1.44**	**0.65**	**2.45**	**1.54**	**0.67**	**2.46**
	3.33	1.42	3.49	2.96	1.27	2.55	1.16	0.46	1.29
L-H	420			419					
	0.44	**0.17**	**0.79**	**0.34**	**0.39**	**0.15**			
	1.90	0.58	2.60	0.78	0.98	0.20			
			***						
		Up-down			Up-down				
t		-1.44			0.28				
p		15%			78%				

Table 4.9 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in different industries. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

Stocks are classified into different industry groups using the first digit of the SIC code (data324 in COMPUSTAT). Appendix 4.1 describes the nature of each industry group. Table 4.4 describes the portfolio formation and the construction of the UP and DOWN dummy variables and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. The table also reports the two tailed t-statistics and p-values to test whether the returns to the long-short portfolios in each industry are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.10: Investment Irreversibility and the Accruals based Trading Strategy in Different Industries

A	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	down	All	Up	Down	All	Up	Down	All	Up	down	All	Up	Down	All	Up	Down
Low	132			420			420			420			420			420			408			378					
	1.37	**1.80**	**0.75**	**1.71**	**1.54**	**1.93**	**1.56**	**1.21**	**2.01**	**1.44**	**1.28**	**1.64**	**1.22**	**0.83**	**1.72**	**1.30**	**0.86**	**1.87**	**1.58**	**1.10**	**2.24**	**1.56**	**1.20**	**2.01**			
	1.20	1.36	0.42	4.06	2.84	2.88	6.20	3.93	4.70	4.56	3.37	3.03	3.95	1.97	3.61	4.33	2.06	3.57	3.43	1.87	3.33	3.29	2.02	2.77			
2	338			420			420			420			420			420			420			414			4		
	1.05	**0.60**	**1.56**	**1.74**	**1.01**	**2.68**	**1.44**	**1.16**	**1.80**	**1.25**	**0.94**	**1.64**	**1.26**	**0.99**	**1.61**	**1.13**	**0.66**	**1.74**	**1.54**	**1.02**	**2.21**	**1.95**	**1.52**	**2.50**	**-10.39**		
	1.97	0.89	2.09	4.00	1.83	3.80	5.93	4.18	4.56	4.10	2.55	3.12	4.47	3.30	3.31	3.88	1.82	3.17	3.77	1.88	2.78	3.99	2.40	3.06	-1.97		
3	282			420			420			420			420			420			420			394			30		
	1.08	**1.38**	**0.79**	**1.31**	**0.83**	**1.94**	**1.33**	**0.93**	**1.84**	**1.26**	**1.08**	**1.50**	**1.32**	**1.19**	**1.49**	**1.58**	**1.07**	**2.22**	**1.25**	**1.14**	**1.38**	**1.67**	**1.28**	**2.16**	**0.44**	**-2.80**	**0.80**
	1.99	1.83	1.02	3.33	1.67	2.96	5.51	3.46	4.68	4.14	2.94	2.89	4.46	3.62	2.90	5.57	3.00	3.97	3.05	2.23	1.86	3.39	2.17	2.93	0.32	-4.19	0.79
4	335			420			420			420			420			420			413			409			12		
	1.56	**1.45**	**1.68**	**1.46**	**1.28**	**1.70**	**1.27**	**0.95**	**1.69**	**1.09**	**0.76**	**1.51**	**1.34**	**1.13**	**1.61**	**1.18**	**0.63**	**1.90**	**1.85**	**1.62**	**2.15**	**2.21**	**1.42**	**3.23**	**3.88**	**4.04**	**3.86**
	2.96	1.99	2.17	3.57	2.65	2.56	5.33	3.58	4.07	3.72	2.11	3.22	4.77	3.16	3.51	3.98	1.64	3.60	4.05	2.38	2.85	4.14	1.75	3.65	2.15	0.00	0.00
High	414			420			420			420			420			420			420			418			102		
	1.14	**0.41**	**2.05**	**1.52**	**0.80**	**2.45**	**1.23**	**0.87**	**1.68**	**1.04**	**0.76**	**1.41**	**1.36**	**0.96**	**1.88**	**1.26**	**0.59**	**2.11**	**1.39**	**1.16**	**1.68**	**0.57**	**0.25**	**0.98**	**1.91**	**1.81**	**2.00**
	2.73	0.74	3.61	3.60	1.43	3.40	4.85	2.78	3.75	3.18	1.81	2.48	4.19	2.50	3.91	3.72	1.23	3.76	3.23	1.98	2.35	1.19	0.37	1.43	1.22	1.00	1.16
L-H	132			420			420			420			420			420			408			378					
	-0.01	**0.20**	**-1.83**	**0.19**	**0.75**	**-0.51**	**0.34**	**0.33**	**0.34**	**0.39**	**0.52**	**0.23**	**-0.14**	**-0.13**	**-0.16**	**0.04**	**0.26**	**-0.25**	**0.31**	**-0.06**	**0.42**	**0.66**	**0.85**	**0.83**			
	-0.01	0.30	-2.30	0.55	1.44	-1.01	2.06	1.43	1.18	2.01	2.03	0.71	-0.51	-0.32	-0.43	0.16	0.84	-0.83	0.69	-0.10	0.65	1.36	1.34	1.02			
			**				***			***	**																
		Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t		1.83			1.79			- 0.01			0.70			0.06			1.16			- 0.55			0.01				
p		7%			7%			100%			49%			95%			25%			58%			99%				
		*			*																						

B	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low				368			420			420			419			420			415			378					
				1.64	**1.58**	**1.72**	**1.83**	**1.56**	**2.17**	**1.84**	**1.47**	**2.31**	**1.21**	**0.72**	**1.83**	**1.70**	**1.06**	**2.51**	**1.91**	**1.15**	**2.92**	**1.10**	**1.00**	**1.23**			
				2.36	1.68	1.53	4.28	3.29	2.59	4.76	3.17	3.66	2.10	0.92	1.85	4.12	2.34	3.87	4.49	2.22	4.50	2.21	1.77	1.50			
2	7			408			420			420			420			420			420			420					
	6.30	**10.18**	**-3.41**	**1.38**	**1.28**	**1.50**	**1.50**	**1.11**	**2.00**	**1.54**	**1.32**	**1.82**	**1.36**	**0.71**	**2.20**	**1.60**	**1.27**	**2.01**	**1.56**	**0.92**	**2.37**	**1.45**	**0.72**	**2.39**			
	1.25	2.01	-1.54	2.52	1.74	1.60	4.26	2.70	3.49	4.02	2.92	2.97	2.86	1.34	2.60	4.28	2.51	3.24	3.56	1.75	3.84	3.41	1.42	3.78			
3	15			410			420			420			420			420			420			396					
	0.37	**1.44**	**-2.58**	**1.17**	**0.66**	**1.82**	**1.63**	**1.13**	**2.27**	**1.48**	**1.28**	**1.74**	**1.48**	**0.71**	**2.47**	**1.35**	**0.92**	**1.91**	**1.59**	**1.34**	**1.90**	**1.09**	**0.36**	**2.05**			
	0.10	0.52	-0.34	2.01	0.83	1.96	4.36	2.51	3.91	3.62	2.64	2.62	3.47	1.41	3.38	3.56	1.80	3.14	3.87	2.50	3.14	2.35	0.59	2.64			
4	12			412			420			420			420			420			420			409					
	-3.33	**-0.29**	**-18.51**	**2.23**	**1.97**	**2.55**	**1.11**	**0.66**	**1.70**	**1.27**	**0.89**	**1.77**	**1.52**	**1.22**	**1.92**	**1.26**	**0.75**	**1.90**	**1.46**	**0.73**	**2.40**	**1.60**	**0.65**	**2.77**			
	-0.68	-0.06	-13.57	4.00	2.84	2.99	2.83	1.40	2.66	3.23	2.01	2.75	4.08	2.45	3.43	3.26	1.57	3.20	3.19	1.16	3.67	2.96	1.08	2.74			
High	133			409			420			420			418			420			420			408					
	0.77	**2.26**	**-1.42**	**0.61**	**-0.30**	**1.72**	**1.16**	**0.46**	**2.06**	**0.91**	**0.43**	**1.53**	**1.28**	**1.11**	**1.49**	**1.52**	**0.84**	**2.39**	**1.54**	**0.97**	**2.28**	**1.05**	**0.60**	**1.68**	**1.60**	**-0.51**	**5.15**
	0.89	2.11	-1.39	1.19	-0.49	2.17	3.18	1.01	3.38	2.08	0.81	2.13	2.95	2.36	2.16	3.60	1.55	3.15	3.26	1.63	3.18	2.22	1.04	2.28	0.61	-0.21	1.03
L-H				357			420			420			417			420			415			378					
				1.03	**1.74**	**-0.30**	**0.66**	**1.10**	**0.11**	**0.93**	**1.05**	**0.78**	**-0.05**	**-0.40**	**0.35**	**0.18**	**0.23**	**0.12**	**0.50**	**0.18**	**0.57**	**-0.04**	**0.31**	**-0.49**			
				1.46	2.06	-0.31	2.15	2.80	0.20	4.78	4.07	2.77	-0.09	-0.57	0.40	0.45	0.52	0.21	1.61	0.48	1.08	-0.08	0.53	-0.52			
					**		***	***		***	***	***															
					Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t					1.53			1.55			0.74			-0.67			0.16			-0.62			0.72				
p					13%			12%			46%			50%			88%			54%			47%				

Table 4.10 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in different industries within the subsamples with high versus low investment irreversibility. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

The construction of the depreciation charge ratio, the proxy for investment irreversibility (IIR) is described in Table 4.2.

- Firms in ***Panel A*** have the depreciation charge ratio in the bottom 30% and hence are included in the subsample with high investment irreversibility.
- Firms in ***Panel B*** have the depreciation charge ratio in the top 30% and hence are included in the subsample with low investment irreversibility.
- Within each subsample, stocks are classified into different industry groups using the first digit of the SIC code (data324 in COMPUSTAT). Appendix 4.1 describes the nature of each industry group.

Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. Each panel also reports the two tailed t-statistics and p-values to test whether the returns to the long-short portfolios in each industry are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.11: Financial Constraints and the Accruals based Trading Strategy in Different Industries

A	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low	12			414			414			414			414			414			414			414					
	-1.38	**1.42**	**-6.97**	**1.14**	**0.98**	**1.35**	**1.28**	**0.81**	**1.87**	**1.75**	**1.45**	**2.12**	**1.33**	**1.20**	**1.49**	**1.49**	**0.81**	**2.35**	**1.52**	**0.79**	**2.43**	**1.69**	**0.91**	**2.67**			
	-0.34	0.42	-3.35	2.37	1.36	1.79	3.83	2.03	3.31	4.70	3.16	3.49	3.14	2.12	2.05	3.81	1.60	3.29	3.36	1.41	3.61	3.47	1.53	3.67			
2	18			414			414			414			414			414			414			414					
	-1.45	**-2.42**	**1.07**	**1.40**	**0.57**	**2.43**	**1.43**	**1.18**	**1.74**	**1.31**	**1.19**	**1.46**	**1.18**	**0.54**	**1.97**	**0.94**	**0.48**	**1.52**	**1.52**	**0.90**	**2.30**	**1.52**	**0.85**	**2.36**			
	-0.56	-0.77	0.29	3.01	0.92	3.19	4.62	3.22	3.06	3.55	2.65	2.32	2.67	0.88	2.64	2.63	1.13	2.44	3.47	1.71	3.31	3.04	1.21	2.83			
3	140			414			414			414			414			414			414			409					
	0.77	**0.54**	**1.08**	**1.14**	**0.69**	**1.70**	**1.44**	**1.09**	**1.88**	**1.22**	**1.04**	**1.44**	**1.27**	**1.03**	**1.56**	**1.16**	**0.51**	**1.98**	**1.45**	**1.35**	**1.58**	**1.99**	**1.20**	**3.02**			
	0.83	0.52	0.74	2.27	1.11	1.99	4.47	2.88	3.80	3.21	2.29	2.29	3.09	2.17	2.15	3.33	1.21	3.29	3.15	2.25	2.19	3.62	1.56	3.51			
4	36			414			414			414			414			414			414			403					
	-0.39	**-2.10**	**3.01**	**1.53**	**0.97**	**2.23**	**1.36**	**1.13**	**1.65**	**1.33**	**0.99**	**1.76**	**1.76**	**1.48**	**2.12**	**1.33**	**0.74**	**2.07**	**1.36**	**0.98**	**1.83**	**1.59**	**0.16**	**3.30**			
	-0.19	-0.96	2.09	3.33	1.70	2.85	4.13	2.60	3.52	3.28	2.10	2.54	4.77	3.29	3.61	3.45	1.68	3.24	2.83	1.53	2.52	2.79	0.25	3.11			
High	270			414			414			414			414			414			414			399			11	9	0
	0.56	**0.57**	**0.54**	**1.34**	**0.62**	**2.25**	**1.07**	**0.25**	**2.10**	**0.83**	**0.15**	**1.68**	**1.41**	**1.27**	**1.58**	**1.11**	**0.58**	**1.78**	**1.26**	**0.64**	**2.05**	**1.09**	**0.41**	**2.01**	**-0.70**	**-6.31**	**6.03**
	0.83	0.69	0.61	2.77	0.99	2.96	3.00	0.56	3.53	1.84	0.27	2.30	3.44	2.71	2.51	2.65	1.13	2.32	2.40	0.95	2.81	2.19	0.68	2.48	-0.11	-0.96	0.54
L-H	12			414			414			414			414			414			414			399			0	0	0
	-3.47	**-0.49**	**-0.79**	**-0.20**	**0.36**	**-0.90**	**0.21**	**0.56**	**-0.22**	**0.92**	**1.31**	**0.44**	**-0.08**	**-0.07**	**-0.09**	**0.38**	**0.23**	**0.57**	**0.25**	**0.15**	**0.38**	**0.42**	**0.51**	**0.80**			
	-0.60	-0.59	-0.86	-0.44	0.55	-1.42	0.72	1.68	-0.50	4.89	4.80	1.59	-0.21	-0.15	-0.16	1.27	0.63	1.21	0.63	0.32	0.67	0.85	0.86	1.05			
								*		***	***																
		Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t		0.24			1.39			1.39			2.14			0.02			-0.55			-0.31			-0.30				
p		81%			17%			16%			3%			98%			58%			76%			76%				
											**																

B	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low	35			410			414			414			414			414			364			315					
	2.65	**3.00**	**1.63**	**1.63**	**1.16**	**2.23**	**1.44**	**1.20**	**1.73**	**1.48**	**1.18**	**1.85**	**1.05**	**0.68**	**1.50**	**1.34**	**0.97**	**1.80**	**1.56**	**1.05**	**2.18**	**1.25**	**0.71**	**1.83**			
	1.13	1.26	0.56	3.43	1.79	2.58	5.76	3.99	4.20	5.00	3.13	3.92	2.73	1.40	2.14	4.22	2.80	3.08	3.37	2.09	2.60	1.80	0.88	1.80			
2	114			411			414			414			414			414			386			363					
	1.54	**0.14**	**3.54**	**1.45**	**0.73**	**2.37**	**1.42**	**1.12**	**1.79**	**1.37**	**1.07**	**1.74**	**1.29**	**0.97**	**1.69**	**1.39**	**1.00**	**1.89**	**1.86**	**1.29**	**2.62**	**1.43**	**0.43**	**2.60**			
	1.55	0.13	2.16	3.05	1.59	3.18	6.45	4.44	5.13	5.00	3.23	3.74	3.92	2.60	3.16	4.79	2.63	3.66	3.74	2.35	3.40	3.11	0.85	4.42			
3	153			414			414			414			414			414			378			377			12		
	1.55	**1.16**	**2.12**	**1.56**	**1.21**	**1.98**	**1.45**	**0.91**	**2.13**	**1.34**	**0.94**	**1.85**	**1.22**	**0.79**	**1.77**	**1.63**	**1.12**	**2.26**	**2.58**	**2.33**	**2.86**	**1.06**	**0.93**	**1.21**	**-0.05**		
	1.79	1.00	1.74	3.65	2.43	3.00	6.06	3.76	5.56	4.65	2.63	3.72	4.01	2.03	3.42	5.39	3.02	3.75	5.98	4.33	3.88	2.25	1.57	1.72	-0.02		
4	114			414			414			414			414			414			390			366					
	1.30	**1.79**	**0.61**	**1.73**	**1.28**	**2.30**	**1.35**	**0.88**	**1.93**	**1.13**	**0.87**	**1.45**	**1.33**	**1.01**	**1.73**	**1.67**	**1.20**	**2.26**	**1.50**	**1.12**	**1.98**	**1.25**	**1.28**	**1.22**			
	1.30	2.06	0.31	3.95	2.04	3.66	5.82	3.38	4.72	4.18	2.75	3.22	4.77	2.94	3.68	5.45	3.04	4.34	3.47	1.99	3.32	2.91	2.24	1.98			
High	324			414			414			414			414			414			414			411			36		
	0.76	**0.91**	**0.60**	**1.14**	**0.77**	**1.61**	**1.15**	**0.65**	**1.79**	**1.29**	**0.93**	**1.75**	**1.12**	**0.93**	**1.35**	**1.24**	**0.63**	**2.01**	**1.33**	**0.91**	**1.85**	**1.21**	**1.00**	**1.48**	**1.89**	**2.72**	**1.52**
	1.63	1.62	0.96	2.81	1.56	2.33	4.52	2.15	4.03	4.25	2.48	3.51	3.38	2.36	2.40	3.62	1.49	3.80	2.98	1.61	2.78	2.36	1.33	2.47	0.47	0.39	0.47
L-H	35			410			414			414			414			414			364			312					
	-0.60	**-0.45**	**-0.50**	**0.57**	**0.39**	**0.58**	**0.28**	**0.55**	**-0.06**	**0.18**	**0.25**	**0.10**	**-0.07**	**-0.25**	**0.15**	**0.09**	**0.34**	**-0.21**	**-0.03**	**0.00**	**0.09**	**-0.26**	**-0.49**	**0.04**			
	-0.24	-0.71	-0.76	1.19	0.64	0.83	1.81	2.64	-0.24	1.15	1.37	0.36	-0.19	-0.53	0.25	0.32	0.89	-0.51	-0.07	0.00	0.11	-0.33	-0.56	0.05			
							*	***																			
		Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t		0.06			-0.20			1.99			0.46			-0.51			0.98			-0.09			-0.43				
p		95%			84%			5%			64%			61%			33%			93%			67%				
								**																			

Table 4.11 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in different industries within the subsamples with high versus low financial constraints. The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

The construction of the net payout ratio, the proxy for financial constraints (FC) is described in Table 4.2.

- Firms in ***Panel A*** have the net payout ratio in the bottom 30% and hence are included in the subsample with high financial constraints.
- Firms in ***Panel B*** have the net payout ratio in the top 30% and hence are included in the subsample with low financial constraints.
- Within each subsample, stocks are classified into different industry groups using the first digit of the SIC code (data324 in COMPUSTAT). Appendix 4.1 describes the nature of each industry group.

Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. Each panel also reports the two tailed t-statistics and p-values to test whether the returns to the long-short portfolios in each industry are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.12: Investment Irreversibility and Financial Constraints and the Accruals based Trading Strategy in Different Industries

A	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low	12			414			414			414			408			414			363			302					
	-1.38	**1.42**	**-6.97**	**2.20**	**1.70**	**2.83**	**1.55**	**1.09**	**2.13**	**1.90**	**1.71**	**2.14**	**1.27**	**0.81**	**1.83**	**1.51**	**1.44**	**1.59**	**1.54**	**0.97**	**2.21**	**1.38**	**1.27**	**1.52**			
	-0.34	0.42	-3.35	4.19	2.71	3.39	4.16	2.55	3.09	4.45	3.27	3.12	2.46	1.11	2.50	3.73	2.80	2.28	2.55	1.25	2.48	2.25	1.32	1.89			
2	48			414			414			414			414			414			378			366					
	2.95	**5.54**	**-0.67**	**1.53**	**0.63**	**2.65**	**1.64**	**1.44**	**1.89**	**1.60**	**1.56**	**1.65**	**1.11**	**0.43**	**1.97**	**0.46**	**-0.28**	**1.39**	**1.64**	**0.96**	**2.49**	**1.54**	**1.17**	**2.02**			
	0.84	1.06	-0.45	2.90	0.96	3.14	5.08	3.52	3.40	3.89	3.05	2.39	2.80	0.94	3.03	1.19	-0.61	1.88	3.41	1.53	3.96	2.89	1.78	2.56			
3	101			414			414			414			414			414			401			342					
	1.54	**0.92**	**2.18**	**1.39**	**1.11**	**1.74**	**1.59**	**1.39**	**1.83**	**1.04**	**0.65**	**1.54**	**1.57**	**1.62**	**1.51**	**1.77**	**1.45**	**2.17**	**1.10**	**0.46**	**1.85**	**2.63**	**1.18**	**4.13**			
	1.31	0.54	1.34	2.80	1.84	2.09	4.68	3.37	3.44	2.60	1.14	2.39	4.24	3.83	2.48	4.79	3.15	3.37	2.02	0.70	2.21	4.11	1.33	4.14			
4	48			414			414			414			414			414			370			370					
	1.03	**-0.12**	**2.63**	**1.55**	**0.76**	**2.55**	**1.71**	**1.50**	**1.97**	**1.15**	**0.97**	**1.37**	**1.50**	**1.59**	**1.38**	**0.96**	**0.17**	**1.95**	**1.24**	**0.96**	**1.57**	**1.77**	**1.66**	**1.90**			
	0.58	-0.06	1.67	3.20	1.36	3.35	5.05	4.23	3.53	2.94	2.02	2.44	3.73	3.40	2.29	2.37	0.37	3.11	2.35	1.42	1.95	3.24	2.42	2.12			
High	286			414			414			414			414			414			414			407			46	44	0
	1.19	**0.92**	**1.53**	**1.90**	**1.32**	**2.63**	**1.11**	**0.59**	**1.77**	**0.92**	**0.27**	**1.73**	**1.35**	**0.84**	**1.99**	**1.42**	**0.75**	**2.26**	**1.08**	**1.30**	**0.81**	**1.47**	**0.79**	**2.34**	**0.74**	**0.94**	**0.34**
	1.90	1.22	1.68	3.52	1.82	2.83	3.31	1.31	3.16	2.07	0.53	2.16	2.95	1.49	2.83	3.51	1.37	3.35	1.81	1.37	0.80	2.59	1.09	2.46	0.66	0.76	0.18
L-H	12			414			414			414			408			414			363			302					
	-5.02	**-0.85**	**-1.74**	**0.30**	**0.38**	**0.20**	**0.44**	**0.50**	**0.37**	**0.98**	**1.44**	**0.41**	**-0.06**	**-0.05**	**-0.16**	**0.09**	**0.69**	**-0.67**	**0.94**	**-0.47**	**1.20**	**0.15**	**0.10**	**-1.13**			
	-1.22	-1.11	-1.81	0.63	0.64	0.27	1.26	1.12	0.54	2.70	3.29	0.64	-0.12	-0.08	-0.21	0.25	1.71	-1.40	1.50	-0.48	1.22	0.22	0.12	-1.09			
			*							***	***						*										
		Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t		0.76			0.20			0.16			1.28			0.10			2.18			-1.14			0.94				
p		45%			84%			88%			20%			92%			3%			25%			35%				
																	**										

B	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low				90			420			420			240			359			312			240					
				1.57	**-1.49**	**4.24**	**1.63**	**1.34**	**2.00**	**1.95**	**1.81**	**2.13**	**2.56**	**2.97**	**2.06**	**1.20**	**0.88**	**1.59**	**2.20**	**1.77**	**2.72**	**0.89**	**1.10**	**0.63**			
				1.20	-0.89	2.29	3.98	2.69	2.68	4.90	3.53	3.49	2.48	1.78	1.70	1.92	1.15	1.57	4.42	3.10	3.32	1.25	1.29	0.74			
2				169			420			420			351			382			372			284					
				0.14	**-1.31**	**1.90**	**1.55**	**1.54**	**1.56**	**1.18**	**0.74**	**1.74**	**1.55**	**1.52**	**1.60**	**1.52**	**0.96**	**2.30**	**1.46**	**0.84**	**2.23**	**1.19**	**0.25**	**2.58**			
				0.17	-1.28	1.51	4.13	3.33	2.61	3.29	1.67	2.92	2.22	1.87	1.11	2.57	1.29	2.34	2.92	1.64	2.98	1.88	0.35	2.57			
3				160			420			420			314			382			360			298					
				3.04	**2.59**	**3.60**	**1.32**	**0.70**	**2.13**	**1.46**	**1.23**	**1.75**	**1.57**	**0.70**	**2.80**	**2.31**	**2.44**	**2.15**	**2.07**	**1.98**	**2.17**	**1.24**	**0.92**	**1.60**			
				2.38	1.34	2.22	3.04	1.56	2.90	3.33	2.72	2.66	1.75	0.81	1.84	4.67	3.30	3.00	4.67	3.36	3.67	1.98	1.36	1.66			
4				174			420			420			345			398			372			312					
				0.46	**0.51**	**0.40**	**1.56**	**0.87**	**2.46**	**1.42**	**0.97**	**2.00**	**1.75**	**1.41**	**2.20**	**1.37**	**0.28**	**2.79**	**1.94**	**1.62**	**2.35**	**1.93**	**1.29**	**2.75**			
				0.53	0.51	0.28	3.66	1.83	3.29	3.41	2.31	3.05	3.54	2.12	2.89	2.54	0.40	3.46	4.22	2.88	3.49	3.57	2.11	4.20			
High	70	68	0	317			420			420			392			418			399			374					
	1.52	**3.95**	**-2.13**	**1.74**	**1.26**	**2.44**	**1.30**	**0.62**	**2.18**	**1.06**	**0.46**	**1.84**	**1.64**	**1.25**	**2.19**	**2.08**	**0.99**	**3.47**	**1.44**	**1.13**	**1.83**	**0.88**	**0.55**	**1.32**			
	1.37	2.55	-1.23	2.49	1.72	1.87	2.97	1.29	2.98	2.70	1.02	2.69	2.98	2.08	2.24	4.25	1.61	4.64	3.06	1.98	2.75	1.82	0.92	2.15			
L-H				90			420			420			240			359			312			230					
				0.01	**-1.59**	**-0.86**	**0.33**	**0.72**	**-0.17**	**0.89**	**1.36**	**0.29**	**1.31**	**0.47**	**-0.82**	**-0.66**	**-0.25**	**-2.06**	**0.76**	**0.21**	**0.38**	**0.50**	**0.13**	**-0.86**			
				0.01	-2.18	-0.58	0.77	1.34	-0.28	2.73	3.17	0.59	1.11	0.45	-0.74	-0.88	-0.32	-1.98	1.54	0.37	0.51	0.54	0.17	-1.14			
					**					***	***							**									
					Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t					-0.42			1.03			1.55			0.91			1.41			-0.18			0.90				
p					68%			30%			12%			36%			16%			86%			37%				

Table 4.12 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in different industries within the subsamples with high versus low investment irreversibility (primary) and financial constraints (secondary). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded. The construction of the net payout ratio (the proxy for financial constraints or FC) and the depreciation charge ratio (the proxy for investment irreversibility or IIR) is described in Table 4.2. Firms are first sorted by the depreciation charge ratio into the groups with high (bottom 30%) and low (top 30%) investment irreversibility. Within each group, they are further sorted by the net payout ratio into the subsamples with high (bottom 30%) and low (top 30%) financial constraints.

- Firms in ***Panel A*** have the depreciation charge ratio in the bottom 30% and the net payout ratio in the bottom 30%, and hence are included in the subsample with high investment irreversibility – high financial constraints.
- Firms in ***Panel B*** have the depreciation charge ratio in the top 30% and the net payout ratio in the top 30%, and hence are included in the subsample with low investment irreversibility – low financial constraints.
- In each subsample, stocks are classified into different industry groups using the first digit of the SIC code (data324 in COMPUSTAT). Appendix 4.1 describes the nature of each industry group.

Within each industry group, the accruals based trading strategy is formed. Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. Each panel also reports the two tailed t-statistics and p-values to test whether the returns to the long-short portfolios in each industry are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.13: Financial Constraints and Investment Irreversibility and the Accruals based Trading Strategy in Different Industries

A	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low				400			413			414			395			414			299			262					
				1.48	**1.12**	**1.92**	**1.43**	**0.87**	**2.12**	**2.18**	**1.77**	**2.70**	**1.43**	**1.55**	**1.27**	**1.48**	**0.93**	**2.16**	**2.91**	**2.09**	**3.86**	**1.09**	**0.86**	**1.40**			
				2.57	1.50	2.17	3.23	1.72	2.59	4.97	3.34	3.54	2.18	1.72	1.26	3.38	1.63	2.50	3.83	2.36	3.31	1.72	0.93	1.57			
2	24			414			414			414			410			414			364			340					
	-2.23	**-0.61**	**-4.94**	**1.46**	**0.37**	**2.82**	**1.56**	**1.09**	**2.16**	**1.59**	**1.31**	**1.95**	**0.78**	**0.04**	**1.70**	**1.02**	**0.43**	**1.77**	**0.67**	**0.34**	**1.05**	**1.61**	**1.35**	**1.88**			
	-0.98	-0.30	-1.58	2.69	0.61	3.06	4.33	2.47	3.42	3.48	2.27	2.46	1.82	0.06	2.67	2.58	0.86	2.57	1.18	0.44	1.45	2.66	1.74	2.06			
3	51			412			414			414			404			413			381			350					
	1.14	**-0.39**	**2.21**	**1.56**	**0.73**	**2.62**	**1.43**	**1.30**	**1.59**	**1.30**	**1.11**	**1.55**	**0.87**	**0.58**	**1.25**	**1.25**	**0.91**	**1.69**	**1.24**	**1.09**	**1.40**	**2.51**	**0.16**	**5.15**			
	0.61	-0.18	0.99	2.71	1.03	2.65	3.68	2.70	2.63	3.33	2.25	2.65	1.67	1.13	1.28	3.30	1.96	2.61	2.13	1.59	1.60	4.05	0.19	5.26			
4	24			414			414			414			414			414			364			344					
	-1.01	**-3.68**	**3.43**	**1.52**	**0.77**	**2.45**	**1.59**	**1.23**	**2.04**	**1.09**	**1.16**	**1.00**	**1.63**	**1.53**	**1.75**	**0.97**	**0.15**	**2.01**	**1.21**	**0.87**	**1.62**	**2.07**	**2.89**	**1.16**			
	-0.41	-1.28	1.81	2.66	1.18	2.59	4.47	3.12	3.47	2.72	2.31	1.68	3.47	2.67	2.25	2.14	0.27	2.78	2.02	1.17	1.69	3.54	4.23	1.14			
High	182			413			414			414			413			414			410			403			4		
	0.99	**0.93**	**1.07**	**1.64**	**1.26**	**2.11**	**1.12**	**0.30**	**2.13**	**0.52**	**-0.39**	**1.66**	**1.51**	**1.29**	**1.78**	**1.35**	**0.88**	**1.95**	**0.62**	**1.00**	**0.14**	**1.46**	**0.61**	**2.58**	**-10.39**		
	1.22	0.92	1.07	3.08	1.85	2.44	2.91	0.61	3.40	1.19	-0.76	1.98	2.99	2.01	2.00	3.12	1.68	2.58	0.99	0.98	0.14	2.39	0.78	2.51	-1.97		
L-H				399			413			414			394			414			295			262					
				-0.18	**-0.17**	**-0.26**	**0.28**	**0.56**	**-0.02**	**1.66**	**2.16**	**1.05**	**-0.20**	**0.18**	**-0.55**	**0.12**	**0.06**	**0.20**	**2.02**	**0.45**	**2.78**	**-0.25**	**-0.05**	**-1.68**			
				-0.32	-0.26	-0.33	0.64	0.95	-0.02	4.07	4.59	1.35	-0.30	0.23	-0.50	0.31	0.11	0.33	2.32	0.42	2.39	-0.32	-0.06	-1.52			
										***	***								**		**						
					Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t					0.08			0.58			1.20			0.55			-0.18			-1.45			1.13				
p					94%			56%			23%			59%			86%			15%			26%				

B	I=0			I=1			I=2			I=3			I=4			I=5			I=7			I=8			I=9		
	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down	All	Up	Down
Low				96			414			414			237			342			293			238					
				1.13	**-2.82**	**4.48**	**1.43**	**1.22**	**1.69**	**1.82**	**1.58**	**2.12**	**2.13**	**2.28**	**1.94**	**0.76**	**-0.03**	**1.76**	**2.30**	**2.06**	**2.61**	**0.18**	**0.12**	**0.25**			
				0.88	-1.65	2.29	3.60	2.56	2.33	5.01	3.28	3.85	2.10	1.40	1.49	1.19	-0.04	1.53	4.37	3.56	3.19	0.23	0.15	0.30			
2				141			414			414			317			360			340			307					
				1.78	**-0.16**	**3.80**	**1.45**	**1.29**	**1.65**	**1.30**	**1.12**	**1.52**	**1.79**	**0.92**	**2.87**	**1.90**	**1.77**	**2.08**	**0.92**	**0.48**	**1.44**	**1.51**	**0.16**	**3.08**			
				1.69	-0.15	1.71	4.05	2.90	2.92	3.84	2.73	2.70	2.97	1.31	2.91	3.42	2.45	2.26	1.63	0.81	1.63	2.34	0.22	2.83			
3	9			167			414			414			306			401			342			281					
	3.41	**4.66**	**-6.60**	**1.26**	**-0.12**	**2.87**	**0.93**	**0.37**	**1.62**	**1.52**	**1.04**	**2.12**	**1.97**	**0.63**	**3.64**	**2.18**	**1.62**	**2.85**	**2.33**	**1.73**	**3.12**	**1.44**	**1.57**	**1.30**			
	0.57	0.00	0.00	1.26	-0.09	1.95	2.39	0.93	2.28	4.07	2.53	3.59	2.37	0.73	2.57	4.49	2.77	3.90	5.14	2.99	4.42	2.23	2.45	1.35			
4				140			414			414			336			362			342			316					
				1.24	**0.96**	**1.55**	**1.27**	**0.52**	**2.21**	**1.13**	**0.68**	**1.68**	**1.76**	**1.06**	**2.55**	**1.56**	**1.11**	**2.16**	**1.58**	**1.25**	**1.98**	**0.78**	**0.59**	**0.99**			
				1.40	1.09	1.17	3.13	1.21	3.17	2.86	1.63	2.65	2.21	1.07	1.91	2.93	1.82	2.59	2.93	1.74	2.72	1.51	0.89	1.47			
High	81			365			414			414			389			400			390			360					
	1.49	**3.65**	**-1.67**	**1.98**	**2.67**	**1.08**	**1.13**	**0.50**	**1.91**	**1.22**	**0.63**	**1.97**	**1.21**	**0.81**	**1.75**	**2.36**	**2.03**	**2.74**	**1.04**	**0.59**	**1.60**	**1.03**	**0.36**	**1.77**			
	1.36	2.65	-1.02	2.93	3.23	1.08	2.92	1.19	2.73	3.39	1.42	3.30	2.62	1.57	2.05	4.90	3.24	4.56	2.05	0.91	2.24	1.83	0.53	2.55			
L-H				96			414			414			237			342			293			232					
				0.38	**-3.27**	**0.38**	**0.30**	**0.72**	**-0.22**	**0.60**	**0.96**	**0.16**	**0.76**	**0.56**	**-0.55**	**-1.19**	**-2.06**	**-1.29**	**0.98**	**0.98**	**0.34**	**-0.71**	**-0.28**	**-1.57**			
				0.27	-3.95	0.33	0.77	1.51	-0.36	2.03	2.42	0.35	0.69	0.54	-0.56	-1.60	-2.44	-1.25	1.74	1.57	0.46	-0.69	-0.36	-1.93			
					***					**	**						**		*					*			
					Up-down			Up-down			Up-down			Up-down			Up-down			Up-down			Up-down				
t					-2.57			1.20			1.25			0.80			-0.57			0.65			1.09				
p					1%			23%			21%			42%			57%			52%			28%				
					**																						

Table 4.13 presents the returns to the accruals based trading strategy across the time horizon and during economic upturns and downturns in different industries within the subsamples with high versus low financial constraints (primary) and investment irreversibility (secondary). The sample includes non-financial, non-utilities firms listed in the three main U.S. exchanges (NYSE, AMEX, and NASDAQ) during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded.

The construction of the net payout ratio (the proxy for financial constraints or FC) and the depreciation charge ratio (the proxy for investment irreversibility or IIR) is described in Table 4.2. Firms are first sorted by the net payout ratio into the groups with high (bottom 30%) and low (top 30%) financial constraints. Within each group, they are further sorted by the depreciation charge ratio into the subsamples with high (bottom 30%) and low (top 30%) investment irreversibility.

- Firms in ***Panel A*** have the net payout ratio in the bottom 30% and the depreciation charge ratio in the bottom 30%, and hence are included in the subsample with high financial constraints - investment irreversibility.
- Firms in ***Panel B*** have the net payout ratio in the top 30% and the depreciation charge ratio in the top 30%, and hence are included in the subsample with low financial constraints – low financial constraints.
- In each subsample, stocks are classified into different industry groups using the first digit of the SIC code (data324 in COMPUSTAT). Appendix 4.1 describes the nature of each industry group.

Within each industry group, the accruals based trading strategy is formed. Table 4.4 describes the portfolio formation, the construction of the UP and DOWN dummy variables, and the procedure to estimate the average return to the long-short portfolio during economic upturns and downturns.

The lines in bold are the portfolio returns, whereas the lines that are not in bold are the associated two tailed t-statistics to test whether they are different from zero. Each panel also reports the two tailed t-statistics and p-values to test whether the returns to the long-short portfolios in each industry are different during upturns vs. downturns. The t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Table 4.14: The Return Predictability of the Accruals Ratio

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
Accrual	-1.36 ***	-1.03 ***	-0.81 **	-0.99 ***	-1.14 ***	-0.97 ***	-1.18 ***	-1.02 ***	0.26
	-3.79	-2.95	-2.16	-2.80	-3.32	-2.72	-3.51	-3.02	0.20
Control variables									
Book-to-Market	0.18 **	0.02	0.00	-0.02	-0.02	-0.03	-0.05	-0.05	0.10
	2.33	0.26	0.02	-0.29	-0.30	-0.60	-1.02	-1.04	0.48
Size	-0.15 ***	-0.08 ***	-0.07 ***	-0.08 ***	-0.08 ***	-0.08 ***	-0.08 ***	-0.07 ***	-0.88 ***
	-3.74	-4.19	-3.79	-3.89	-4.23	-3.98	-4.11	-3.87	-7.42
Return 2_3	0.36	0.53 *	0.56 *	0.51 *	0.45	0.47	0.46	0.49 *	-1.53 *
	1.01	1.66	1.81	1.66	1.43	1.54	1.51	1.63	-1.84
Return 4_6	0.76 **	0.73 ***	0.71 ***	0.67 ***	0.66 ***	0.67 ***	0.61 ***	0.65 ***	-1.03
	2.41	2.68	2.80	2.62	2.53	2.70	2.45	2.68	-1.21
Return 7_12	0.83 ***	0.86 ***	0.89 ***	0.83 ***	0.81 ***	0.87 ***	0.82 ***	0.88 ***	-0.56
	3.33	3.92	4.25	3.99	3.82	4.34	4.04	4.45	-0.79
TO_ NASDAQ	0.05	0.07	0.06	0.04	0.08	0.08	0.06	0.06	1.40 ***
	0.65	1.30	1.30	0.85	1.59	1.61	1.37	1.24	5.05
TO_NYSE/AMEX	-0.02	-0.07	-0.06	-0.07	-0.07	-0.06	-0.07	-0.06	0.33 ***
	-0.35	-1.47	-1.36	-1.42	-1.39	-1.33	-1.53	-1.32	3.26
NASDAQ	0.15	0.24 ***	0.23 ***	0.23 ***	0.26 ***	0.24 ***	0.24 ***	0.23 ***	2.58 ***
	1.56	3.66	3.81	3.84	4.22	4.22	4.19	4.21	6.24
Intercept	1.30	0.05	0.08	0.09	0.04	0.07	0.09	0.11 *	2.58
	5.10	0.64	1.16	1.44	0.58	1.17	1.45	1.91	9.24
Adjusted R^2	6.76%	3.45%	3.26%	3.16%	3.30%	3.13%	3.09%	3.03%	6.07%

Table 4.14 presents the results of the regressions of risk adjusted returns on the accrual ratio and other firm level variables using the framework of Avramov and Chordia (2006). The sample covers non-financial, non-utilities firms listed in the three main exchanges (NYSE, AMEX, and NASDAQ) in the U.S. market during the period from 1972 to 2006. Only stocks with available information to calculate the accrual ratio, the net payout ratio and the depreciation charge ratio in December of the previous year are considered. The firm-month observations with a stock price below $5 or the market value falling within the smallest NYSE size decile are excluded. The sample is further constrained in that there should be data on stock returns, market capitalisation, and the Book-to-Market ratio in the current year and in the 36 months prior to the current month.

This chapter uses the Fama and French (1993, 1996) model as the base model in the general model specification described in equation 4.2 (p. 238). The part of returns unexplained by the asset pricing model in equation 4.2 is regressed against the accrual ratio in a cross sectional regression to assess the explanatory power of the model with regards to the accrual anomaly, i.e. the negative relationship between current stock returns and cumulative past stock returns. Size, the Book-to-Market ratio, the cumulative returns, and stock turnovers are included in the cross sectional regression to control for the predictability of stock returns with regards to these variables. The regression is described in equation 4.3 (p. 238). The construction of the key variables in stage two is described in Table 4.2. Their transformation is described in section 4.4.2 (p. 236).

The settings of the regressions in two stages for the scenarios are as follows:

- Scenario 1: Returns are not adjusted for risks, hence no stage one regression is run. In stage two, the regression is described in equation 4.3.
- Scenario 2: Returns are adjusted for risks using the unconditional Fama and French model. The regression is described in equation 4.2 with the constraint $\beta_{j,2,f} = \beta_{j,3,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 4.3.
- Scenarios 3 and 4: Returns are adjusted for risks using the conditional Fama and French model. The regression is described in equation 4.2 with the constraint $\beta_{j,3,f} = \beta_{j,4,f} = 0$. In scenario 3, the variable $Firm_{j,t-1}$ refers to the financial constraint variable; in scenario 4 it refers to the investment irreversibility variable. In stage two, the regression is described in equation 4.3.
- Scenario 5: Returns are adjusted for risks using the conditional Fama and French model on the business cycle variable. The regression is described in

equation 4.2 with the constraint $\beta_{j,2,f} = \beta_{j,4,f} = 0$. In stage two, the regression is described in equation 4.3.

- Scenarios 6, 7, 8: Returns are adjusted for risks using the conditional Fama and French model as described in equation 4.2. In scenario 6, the variable $Firm_{j,t-1}$ refers to the financial constraint variable; in scenario 7 it refers to the investment irreversibility variable; and in scenario 8, to both the financial constraint and the investment irreversibility variables. In stage two, the regression is described in equation 4.3.
- Scenarios 9: The cyclical component of returns is isolated using four macro-economic variables including the term spread, the default spread, the aggregate dividend yield, and the short term Treasury rate. The regression is described in equation 4.8 (p. 264). In stage two, the regression is described in equation 4.3.

The coefficients and t-statistics are reported. The coefficients are multiplied by 100. The two tailed t-statistics are corrected for autocorrelation and heteroskedasticity following the Newey and West (1987) method to test whether a coefficient is different from zero. *, ** and *** denote the statistical significance levels of 10%, 5% and 1% respectively.

Chapter 5 – Conclusions

This thesis has examined whether the value-growth, momentum and accruals based trading strategies generate positive and significant profits, and how these profits are influenced by the financial inflexibility in firms' investment and financing environment. The thesis builds on the recent literature on how the frictions at the firm level investment and financing environment affect their investments (for example Kiyotaki and Moor (1997), Almeida and Campello (2007) and Caggese (2007)) to shed light on the relationship between firms' investments and stock returns. The thesis also builds on the literature on how stock market prices affect firms' investments, started in Morck et al. (1990), and extended in Baker et al. (2003), Polk and Sapienza (2009), and Ovtchinnikov and McConnell (2009).

The findings suggest that all three trading strategies examined generate positive and significant excess returns to investors[63]. The results also support a relationship between the performance of these strategies and the lack of investment and financing flexibility at the firm level. There is also some evidence that different aspects of inflexibility actually interact with each other in influencing the profitability of the trading strategies. As these frictions impact upon firms' investments, this thesis also sheds light on how firms' investments and stock returns are related. The findings specific to the investigation into each of the three strategies are presented below.

[63] Ideally, while estimating the profitability of a trading strategy the returns should be adjusted for transactions costs. However, readily available data do not allow for precise estimation of such costs and hence the estimates reported in this thesis refer to gross returns. Therefore, the reported gains may or may not be realisable for frequent traders (e.g. speculators) but are meaningful for liquidity traders who incur transaction costs anyway.

5.1. Firms' Investment, Financing Flexibility, and the Value-Growth Trading Strategy

This thesis first, in chapter 2, investigated whether the value-growth trading strategy is profitable, and how this profitability (if any) is affected by firms' investment and financing flexibility. The strategy generates a positive and significant gross value premium of 1.55% per month. The strategy is also evidently profitable given the positive and significant relationship between individual stock returns and the Book-to-Market ratio. When stock returns are adjusted for risks using the unconditional Fama and French three factor model, the relationship remains positive and significant, suggesting that the Fama and French factor model cannot explain the profitability of the value-growth trading strategy.

Consistent with Zhang (2005), firms' investment irreversibility is relevant to the profitability of the value based trading strategy. It is more difficult for value firms to reverse their investments than for growth firms. Furthermore, out of the three dimensions of investment irreversibility (the depreciation charge ratio, the rental expense ratio, and the disinvestment ratio), the first two denote that the higher the gap in investment irreversibility between value and growth firms, the higher the value premium.

When returns are adjusted for risks using the Fama and French three factor model conditioned on both investment irreversibility and the business cycle variables, the relationship between the risk adjusted stock returns and the Book-to-Market ratio becomes marginally insignificant. This evidence supports the theory in Zhang (2005) that the success of the value-growth trading strategy is due to the difference in value and growth firms' investment irreversibility. It is also broadly consistent with the conjecture in Cooper (2006) and Carlson et al. (2004) that firms' investment inflexibility explains the value premium. When measuring investment inflexibility using operating leverage and excess capacity, i.e. the two variables describing investment flexibility in Carlson et al. (2004) and Cooper (2006) respectively, the findings reject the claim that these measures help explain the profitability of the value-growth trading strategy.

The findings also reject the conjecture that financial constraints play a primary role to the profitability of the value-growth trading strategy. The net payout ratio, which proxies for firms' financial constraints, does not follow any pattern across the portfolios sorted based on the Book-to-Market ratio from the growth portfolio to the value portfolio. Also, there is no clear relationship between the payout gap of the value and growth firms and the value premium. Moreover, when returns are adjusted for risks using the Fama and French model conditioned on the financial constraints variable, the relationship between risk adjusted returns at the firm level and the Book-to-Market ratio remains positive and significant. This relationship is evident for the profitability of the value-growth trading strategy. Hence, the risk-return relationship that takes into account firms' financial constraints is insufficient to explain the value premium.

On the other hand, there is some evidence for the supplementary role of financial constraints to the relationship between investment irreversibility and the value premium. The univariate evidence rejects the hypothesis that the value premium is higher among firms with higher financial constraints. However, when returns are adjusted for risks using the Fama and French model conditioned on (a) financial constraints and investment irreversibility, and (b) the business cycle variable, the relationship between the firm level risk adjusted returns and the Book-to-Market ratio becomes statistically insignificant, rendering the value-growth strategy no longer reliably profitable.

5.2. Firms' Investment, Financing, and the Momentum Trading Strategy

The next issue examined in this thesis (chapter 3) is whether the momentum trading strategy is profitable and whether this profitability (if any) can be explained by firms' investment patterns. The findings provide evidence of momentum profit. All the momentum strategies with the formation and the holding periods of three to twelve months, with and without a month between the two periods, generate positive and significant momentum profits. The widely successful 6 x 6 strategy which skips a month between the formation and the holding period generates a statistically significant momentum profit of 1.21% per month.

The findings show that the momentum profit could be explained by the difference in the investment activities of past winners and past losers based on three different explanations – the explanation using the credit multiplier effect based on Ovtchinnikov and McConnell (2009) / Hahn and Lee (2009), the explanation using the share issuance channel based on Baker et al. (2003), and the explanation using the catering theory based on Polk and Sapienza (2009). All of these explanations link past stock prices with firms' investments and future stock prices.

The findings lend support to a combination of the above explanations. Past winners invest more than past losers, and the investment gap is higher during economic upturns than during economic downturns, consistent with all the three explanations. Compared to the investment gap between past winners and past losers among the firms with low financial constraints, the gap is higher among the firms with high financial constraints. Moreover, the speed of change of the investment gap among the firms with high financial constraints is positive, whereas that among the firms with low financial constraints approximates zero. The momentum profit is positive and significant among firms with high financial constraints but insignificant among firms with low financial constraints. The above observations are consistent with the explanation based on Ovtchinnikov and McConnell (2009) and the explanation based on Baker et al. (2003), while inconsistent with the explanation based on Polk and Sapienza (2009).

However, the subsample of firms with medium financial constraints generates a positive and significant momentum profit, and its investment gap has a positive speed of change. Of the three explanations, this evidence can only be reconciled with the one based on Polk and Sapienza (2009). The catering theory in Polk and Sapienza (2009) does not require firms to be financially constrained. Management can cater for investor sentiment as long as firms are not too financially constrained. The patterns of the investment gap and the momentum profit during economic upturns generally amplify those averaging across economic upturns and downturns. This evidence lends support to all the three explanations tested in this thesis.

Finally, there is evidence that cumulative returns can predict future returns even when risks are controlled for using the unconditional Fama and French three factor model. This finding is evident for the profitability of the momentum trading strategy. The return predictability is weak when the betas are conditioned on firms' financial constraints and the business cycle variable. When returns are adjusted for risks using the Fama and French model conditioned on firms' investments, cumulative returns retain their predictability. This evidence suggests that at least part of the information on firms' investments is not relevant to the momentum profit through a risk-return channel. The momentum profit is explained when (a) controlling for risks using the Fama and French model conditioned on firms' financial constraints and the business cycle variables, and (b) accounting for the interaction between the momentum profit and firms' investments as suggested in the explanations based on Polk and Sapienza (2009) and Baker et al. (2003).

5.3. Firms' Investment and Financing Flexibility, and the Accruals based Trading Strategy

The final issue investigated in this thesis (chapter 4) is whether the accruals based trading strategy is profitable and how the profitability (if any) is affected by firms' investments. Given the existing evidence on the relationship between the profitability of the accruals based trading strategy and firms' investments, this thesis examines the relationship between the success of the strategy and the firm level forces that prohibit firms from investing at the optimal level. The findings in this thesis support the arguments in Fairfield et al. (2003), Zhang (2007), and Wu et al. (2010) that firms' accruals reflect working capital investments.

The accruals based trading strategy is found to be profitable, generating an average return of 0.54% per month. The accruals premium is more pronounced among firms with high financial constraints or low investment irreversibility. Firms with high financial constraints have less flexibility in investing at the optimal level. Wu et al. (2010) suggest that the stocks of firms with high accruals are subject to a higher level of an investment risk factor than those of firms with low accruals.

Hence the more pronounced accruals premium among firms with high financial constraints is consistent with an explanation based on Wu et al. (2010).

By contrast, the pronounced accruals premium among firms with low investment irreversibility is consistent with an explanation along the lines of Polk and Sapienza (2009). These authors concede that the management of overvalued firms invests in both fixed capitals and working capitals to prolong the overvaluation. Low investment irreversibility would make it easier for management to cater for investor sentiment. Hence, firms with high accruals are more likely to be overpriced, particularly when their investment irreversibility is low.

Furthermore, along the lines of Caggese (2007), both investment irreversibility and financial constraints reflect the inflexibility and may reinforce the impact of each other on firms' investments. This thesis finds that the accruals premium is most pronounced at the two extremes of the inflexibility spectrum. The evidence at the high end of the spectrum supports the explanation based on Wu et al. (2010) whereas the evidence at the low end supports the explanation based on Polk and Sapienza (2009).

There is some weak evidence that the accruals premium is more pronounced during economic upturns among firms with low investment irreversibility or high financial constraints. When taking into account both inflexibility measures, the evidence is strong for firms at the high end of the inflexibility spectrum, supporting the explanation based on Wu et al. (2010). The evidence at the low end, which would support the explanation based on Polk and Sapienza (2009), is weak.

The patterns in the relationship between the inflexibility measures and the accruals premium documented so far is concentrated in the manufacturing industries, especially the heavy industry. According to Zhang (2007), the accruals of the manufacturing industries reflect more information on firms' investments than those of the other industries. This evidence reinforces the perspective that the accruals premium is related to firms' investments.

Finally, when returns are adjusted for risks using the Fama and French model, both unconditional and conditional on the business cycle and the inflexibility measures, the accruals ratio continues to predict stock returns. This constitutes evidence in favour of the profitability of the accruals based trading strategy. Hence, the risk-return relationship might not be solely responsible for the accruals premium. When isolating the cyclicality in stock returns using the term spread, the default spread, the aggregate dividend yield, and the Treasury bill rate, the accruals premium completely disappears. Any explanation for the profitability of the accruals based trading strategy should therefore be able to explain its cyclical nature.

5.4. Implications of the Findings

The results of this thesis have several implications for the understanding of the sources of the profitability of the value-growth, momentum, and accruals based trading strategies. Given that these strategies are widely deployed among the investing public, investors might also benefit from the results of this thesis in designing these strategies.

The profitability of the value-growth, momentum, and accruals based trading strategies are sometimes known as evidence against the efficient market hypothesis and are often referred to as anomalies. This thesis reports that the sources of the profitability of the trading strategies sometimes can be traced back to a risk-return relationship based on the fundamental information about the firm and the economy, and the behaviours of firms' managements.

In the context of the market efficiency literature, the market is efficient with regards to the information about the Book-to-Market ratio, since future stock returns cannot be predicted using this ratio when risks are taken into account. However, future returns can be predicted using information about past stock returns and firms' accruals even when returns are adjusted for risks. This return predictability can be explained by the management's behaviours. Hence the market is not fully efficient with regards to the information about past stock returns and firms' accruals. Furthermore, the findings in this thesis suggest that the profitability of the three trading strategies is affected by the inflexibility in the investment and financing environment at the firm level. In other words, the understanding of corporate finance can help extend the understanding of the securities markets.

The results from this thesis can benefit investors who attempt to profit from the value-growth, momentum, and accruals based trading strategies. The profit from the value-growth trading strategy can be improved if investors pursue the strategy using value and growth firms with bigger gap to the extent to which firms' assets are irreversible. The profit can be completely explained when risks are controlled for using the asset pricing model conditioned on these characteristics. Hence, investors should bear in mind that the improved performance might just be a compensation for higher risks.

Investors would benefit more from pursuing the momentum trading strategy among firms with high financial constraints and in economic upturns than among those with low financial constraints and in downturns. Implementing the trading strategy among past winners and past losers that are far different in their current investment activities can also improve the performance of the strategy. The momentum profit can be partially explained when risks are controlled for using the asset pricing model conditioned on these financial inflexibility characteristics. Hence investors should bear in mind that part of the improved performance of the momentum trading strategy might just be a compensation for higher risks, i.e. higher exposure to the credit multiplier effect.

Finally, imposing both investment and financing inflexibility conditions on the sample and correctly timing the strategy can considerably improve the performance of the accruals based trading strategy. Investors seeking to deploy this strategy would benefit from pursuing it among firms that are either highly inflexible or highly flexible in investment and financing. They also benefit from pursuing the strategy during economic upturns among firms that are highly inflexible. Wrong timing, on the other hand, can cost investors dearly as the accruals based trading strategy can generate a return close to zero.

5.5. Areas for Future Research

The results of this thesis strengthen the conjecture that the profitability of style investing may be rooted from the "real" activities at the firm level, such as firms' investment and financing activities. An interesting research direction into the future would be to extend the scope of the "real" activities to examine their impacts on the profitability of trading strategies. These “real” aspects might include factors in the labour market and firms’ product markets.

There are several similar characteristics between the commitment or inflexibility caused by fixed capital investments and labour contracts. Labour contract commitments are related to the investment inflexibility examined in this thesis. Furthermore, this thesis reported that investment irreversibility together with financial constraints affect the success of the value-growth strategy. It also reported that they affect the success of the accruals based trading strategy. It is therefore possible that the value-growth trading strategy and the accruals based trading strategy could be affected by labour market commitments.

Furthermore, the characteristics of the product market could affect several aspects of firms’ performance. Peress (2010) argues that the stock prices of firms with higher market power are more informative. This thesis provided the empirical evidence to test the rational explanation for the momentum profit based on the argument in Ovtchinnikov and McConnell (2009) that stock prices reflect firms’ investment opportunities. The momentum profit among firms with high financial constraints can be explained by the exposure to the credit multiplier effect of Kiyotaki and Moor (1997). If firms with high market power have more informative stock prices, it is likely that both financial constraints and market power can affect the momentum profit.

Another direction could be to investigate how company fundamentals interact with the macroeconomic factors. This is because the activities at the firm level, from hiring, financing, investing to competing in the product market, vary across the business cycle. In turn, the business cycle is driven by the macroeconomic factors. Furthermore, as discussed above, the performance of the investment strategies is potentially affected by the factors in the labour and product markets. Therefore, an understanding of how these company fundamentals interact with the macroeconomic factors would also help better design and time these investment strategies to improve their performance.

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