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MOMENTUM RETURN: IS IT A COMPENSATION FOR RISK?

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the Degree of Doctoral Philosophy

By

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ABSTRACT

This thesis examines if momentum returns are compensation for risk. Using a sample period from 1926 through 2006 for all stocks listed in the NYSE, AMEX and NASDAQ we provide a comprehensive analysis of momentum returns both at the portfolio and at the individual stock level, by using firm level and macro level risk factors and by employing contemporaneous and lagged values of risk factors. The study employs an alternative momentum strategy, measures the relative contribution of risks factor that generates momentum returns and establishes a link between momentum returns, uncertainty and credit ratings.

We report raw momentum returns of 0.8 percent per month (9.6 percent per annum) when returns are measured using the conventional methodology at the portfolio level. Momentum returns are predominantly high and earn more than 1 percent per month during the post-1950s compared to its counterpart in the pre-1950s. The study reports that when measured at the portfolio level momentum returns cannot be explained by risk factors. We document momentum returns of up to 0.01 percent per month (0.12 percent per annum) after Fama-French three factors, Carhart four factors and macroeconomic risk factors are priced for. The results are robust when the lagged values of these risk factors are employed. We further document momentum returns of 0.16 percent per month (1.92 percent per annum) when transaction cost is taken into account.

When measured at the individual stock level momentum returns cannot be explained by Fama-French three factors and contemporaneous values of macroeconomic risk factors. Unexplained returns are observed up to 0.45 percent per month (5.4 percent per annum) when Fama-French three factors are used. Unexplained returns up to 0.15 percent per month (1.8 percent per annum) are observed when contemporaneous values of macroeconomic risk factors are used. However, when the lagged values of macroeconomic risk factors are used, momentum returns disappear.

We decompose momentum returns to measure the relative contribution of the risk factors and the unexplained portion of momentum returns. At the portfolio level, decomposition shows that less than 10 percent of the contribution is from Fama-French three factors and less than 20 percent of the contribution is from macroeconomic risk factors. Unexplained portion contributes the remaining 90 percent and 80 percent, respectively. At the individual stock level, decomposition shows that contribution of both Fama-French three factors and macroeconomic risk factors increases up to 47 percent and 59 percent, respectively; unexplained portion contributes the remaining 63 percent and 41 percent, respectively. When lagged values are used the contribution of risk factors increases up to 68 percent.

Finally, we consider uncertainty at the firm level and the macro-economic risk level by measuring momentum returns of credit rated stocks. We observe momentum returns of 1.22 percent per month (14.64 percent per annum) in credit rated stocks. Among the credit rated stocks momentum returns are mainly earned by speculative grade stocks and during contractions. Momentum returns of about 2 percent per month (23 percent per annum) are observed in speculative grade stock and they are more

pronounced of up to 4.99 percent per month (59.88 percent per annum) during contractions. However, momentum returns of speculative grade stocks disappear when controlled for macroeconomic risk factors.

We show that momentum is quite persistent when measured at the portfolio level by using the conventional approach and at the individual stock level when using an alternative approach. Momentum returns cannot be explained by Fama-French three factors and contemporaneous values of macroeconomic risk factors. However, only at the individual stock level, lagged values of macroeconomic risk can explain momentum returns. When we decompose momentum returns into explained and unexplained components, we provide support to the above findings that the contribution of macroeconomic risk factors is the highest when measured at the individual stock level. Momentum are reactions of the investors' to high uncertainty, when uncertainty is measured at the firm level or at the macro level by measuring returns of credit rated stocks. Momentum returns are investors' reaction due to increased business risk of stocks or due to increased macroeconomic risk during downturns.

It can be concluded that at the portfolio level momentum returns remain when risk factors are price for and at the individual stock level momentum returns diminishes though they do not disappear entirely when risk factors are controlled for. When momentum returns are decomposed at the portfolio level unexplained risk factors contributes the most and at the individual stock level contribution of risk factors increases among which the contribution of macroeconomic risk factors increases the most. Momentum returns could be a compensation for uncertainty at the firm level as it concentrates mostly on Speculative Grade rated stocks with more pronounced effect during contraction. Momentum returns disappear when macroeconomic risk factors are priced.

1 CHAPTER ONE: INTRODUCTION

1.1 Introduction

According to the Oxford dictionary, momentum is an impetus that is gained by movement. In Finance, according to the trading style, momentum is the strength behind the movement of a share price in the same direction, either upward or downward. Momentum strategy is the portfolio trading strategy that the best (worst) stocks returns over the past 3 to 12 months continue to perform well (poorly) over the subsequent 3 to 12 months. The pioneer work of Jegadeesh and Titman (1993) documents that momentum returns resulting from this trading strategy of buying recent past winners and selling recent past losers earns statistically and economically significant profit of 1 percent per month (12 percent per annum). Ever since this phenomenon has been documented by Jegadeesh and Titman (1993) the magnitude and the persistence of momentum returns remain one of the most intriguing challenges to investment professionals and to finance researchers.

The importance of momentum strategy is particularly alluring to investment professionals because of its significance in policy implications. Practitioners are concerned with implementing risk-effective and profitable momentum strategies that are more convenient but at the same time allow generating excess returns for themselves and for their clients. Literature provides evidences that mutual fund managers make asset allocation decision by employing momentum strategies (Grinblatt, Titman and Wermers, 1995 and Chen Jegadeesh and Wermers, 2000). The practice of engaging momentum strategy in portfolio investment is significantly observed in equity markets (Benson, Gallagher and Teodorowski, 2007).

The study of momentum is appealing to finance academia firstly, due to its contradiction with market efficiency. The findings of Jegadeesh and Titman (1993, 2001) that buying past winners and selling past losers earns statistically significant returns over the following three to twelve months suggest that the cross-section of future stock returns can be predicted by past performance. Therefore momentum challenges one of the most central paradigms in finance: the market efficiency hypothesis. The market efficiency hypothesis characterized by Fama (1970) states that prices fully reflect all available information and based on different information sets there are three forms of the market efficiency hypothesis. Among these the weak form holds if future prices cannot be forecasted by historical prices. Momentum challenges the weak form of market efficiency hypothesis, since it implies that future prices can be predicted by historical returns. Secondly, momentum phenomenon remains unexplained when standard asset pricing models, such as Capital Asset Pricing Model (CAPM) or Fama-French three-factor models are applied (Fama and French, 1996). Even dynamic asset pricing models are not good enough to explain momentum returns (Pang, 2005). Thirdly, literature has well-established the fact that momentum phenomenon is not a product of 'data mining' (Jegadeesh and Titman, 1993, 2002). Finally, the profitability of momentum returns is documented to persists and is statistically and economically significant in different dimensions e.g. over time, across markets and in different asset classes (see also Jegadeesh and Titman, 1993, 2002; Rouwenhorst, 1998; Chan, Hameed and Tong , 2000; Chui, Titman and Wei, 2000; Bacmann, Dubois and Isakov, 2001; Griffin, Ji and Martin, 2003; Moskowitz and Grinblatt, 1999; Pang, 2005; Okunev and White, 2003; Miffre and Rallis, 2007). There is weak evidence of the disappearance of momentum returns across markets and over time.

There is considerable controversy in the literature as to whether momentum returns are fair compensation for exposure to systematic risk or can be priced by idiosyncratic risk factors[1]. While some studies show that momentum returns can be explained once controlled for risk factors (Chordia and Shivakumar, 2002; Yao, 2006), other studies reject the notion that momentum profits are compensation for risk and argue that significant momentum profits remain once risks are priced for (Grundy and Martin, 2001 and Kang and Li, 2007). However, the dispute remains in the literature and as noted by Avramov and Chordia (2005) that the literature is yet to settle if the expected returns can be explained by risk factors or if they are more a non-risk firm characteristics. One reason why the puzzle still remains is due to the fact that earlier studies differ in terms of the methodological adjustment employed to derive the empirical results particularly (1) At the level of analysis e.g. portfolio level or individual stock level, (2) The risk factors used e.g. firm level risk factors and macroeconomic level risk factors and (3) The lag structure of the risk factors e.g. the contemporaneous or the lagged values. For example, studies examine momentum returns at the portfolio level with firm level factors by using contemporaneous variable; at the portfolio level with macroeconomic risk factors by using the contemporaneous variables and at the individual stock level by using lagged values of the macroeconomic risk factors (see among others Wang, 2003, Griffin Ji and Martin, 2003, Chordia and Shivakumar, 2002, Cooper Gutierres and Hammeed, 2004). Differences in the methodologies resulted in diverse conclusion of empirical outcomes on momentum returns. This is important

[1] Systematic risk is also interchangeably used for explained risk factors and Idiosyncratic risk is used as unexplained risk factors in the literature

because as pointed out by Lo and MacKinlay (1990), the process of examining data and models effects the likelihood of finding anomalies and may give rise to misleading inference.

Therefore what is crucial for the literature is to perform an independent and comprehensive analysis of momentum returns that relax all the presumptions of the earlier literature as to whether or not momentum returns are compensation for risk. This thesis performs the task. In this thesis we conduct an inclusive examination of whether or not momentum returns are compensation for risk by using a multi-factor regression model designed to capture the explanatory power of the risk factors (1) At the portfolio level and at the individual stock level (2) By using both the contemporaneous and the lagged variables and (3) By using both firm level factors and the macroeconomic factors. The investigation contributes to the literature by performing an independent and comprehensive analysis of whether or not momentum returns are compensation for risks both at the firm level and macro level risk factors, whether or not momentum return remains once accounted for the transaction costs and by introducing uncertainty measured at the firm level credit ratings of companies and at the macro economy by initiating economic cycle and market states.

1.2 Gap in the Literature

Earlier studies though put forth several explanations as to whether momentum returns are compensation to risk, the results remain inconclusive to date. Literature shows that the puzzle of momentum returns cannot be solved by conventional asset pricing models like the CAPM or the Fama-French three-factor model. But the failure of these models does not necessarily imply that the market is inefficient. Fama and French (1996) point out that there may be a more sophisticated model, including additional risk factors, which will eventually be able to encompass momentum returns. However, as long as alternatives models are not developed, research has to seek for other risk factors to examine if momentum profits are simply a compensation for particular risks in the portfolio that have not been taken into consideration. Along this line of reasoning, literature flows in two directions e.g. rational risk based explanations and behavioral models.

Studies that examine momentum phenomenon through risk-based explanations argue that momentum is a mere compensation for exposure to portfolio risks. Therefore the excess returns are expected to disappear once priced for common risk factors. Researchers put forth several explained risk factors that capture momentum effect. An incomplete list includes conditional Fama-French three factor models, cross-sectional dispersion of unconditional expected stock returns macroeconomic factors, industry factors, market states, illiquidity and transaction cost (see Wang, 2003; Conrad and Kaul, 1997; Chordia and Shivakumar, 2002; Moskowitz and Grinblatt, 1999; Cooper, Gutierres and Hammeed, 2004; Sadka , 2006 and Lesmond, Schill and Zhou, 2004).

Nevertheless, literature remains inconclusive as to whether or not momentum returns are compensation to risk, as many studies show that momentum profits are not explained by standard risk factors. For example, studies show that Fama-French three factors cannot explain momentum returns (see among others Fama and French, 1996; Grundy and Martin 2001; Chordia and Shivakumar, 2002 Hwang and Rubesam 2007). On the contrary, Wang (2003) shows that the Fama-French three factors can explain most of the momentum returns when used on a conditional basis. Chordia and Shivakumar (2002) document that momentum returns are explained once the predicted component as measured by the lagged macroeconomic variables is accounted for. Moskowitz and Grinblatt (1999) suggest evidence that the individual momentum return, in the study of Chordia and Shivakumar (2002), mainly comes from industry momentum profits. Cooper, Gutierres and Hammeed (2004) reject the hypothesis put forth by Chordia and Shivakumar (2002) and argue that momentum returns are explained by market states variables. Grundy and Martin (2001) and Kang and Li (2007) documents that momentum returns are mostly comprised of idiosyncratic components that cannot be risk.

1.2.1 Portfolio and Individual Level Analysis

Perhaps one important reason why the empirical literature has so far failed to document direct evidence of whether momentum returns are compensation for risk is due to the assumptions and dimensions of methodology that they employed in those studies. The different empirical results of the earlier studies on momentum returns are due to the different approaches employed in explaining momentum returns e.g. (1) Portfolio or individual level of analysis, (2) Firm level or macro level variables as risk factors and (3) Contemporaneous or lagged values of those variables as explanatory variables. It is to be noted here that ‘Portfolio level analysis’ is defined as the analysis where momentum returns are first measured conventional method as explained by Jegadeesh and Titman (1993) and then risk factors are priced against the momentum return. Evidence from earlier studies that differ in terms of methodology includes Jegadeesh and Titman (2001) who used contemporaneous Fama-French three factors to show that these three factors cannot explain momentum returns. Wang (2003) used Fama-French three factors at the portfolio level and derive empirical results by employing a non-parametric test that Fama-French factors can explain momentum returns. Griffin Ji and Martin (2003) use contemporaneous macroeconomic variables of Chen Roll and Ross (1986) at the portfolio level to generate the results. Grundy and Martin (2001) employ contemporaneous Fama-French three factors at the individual stock level to suggest evidence that Fama-French factors cannot explain momentum returns. It is worth mentioning here that ‘Individual level analysis’ is defined as the analysis where risk factors are first priced at the stock level and then momentum returns are measured from this risk-adjusted stock return by applying the convention method. Moskowitz and Grinblatt (1999) report that most of the momentum effect can be captured industry factors when measured at the individual stock level. Chordia and Shivakumar (2002) use lagged macroeconomic variables at the individual stock level to predict returns and show that predicted returns can explain momentum returns. Kang and Li (2005) show that at the individual stock level when lagged Fama-French three factors and lagged macroeconomic variables of Chordia and Shivakumar (2001) are used in a ‘missing factors’ momentum returns remain unexplained by risk factors.

1.2.2 Decomposing Momentum Returns: What Factors Contribute to Momentum Returns?

With the difficulty that risk-based factor models have in explaining momentum phenomena researchers looked for alternative explanations. Earlier studies focus on the sources of momentum by examining the profitability of each component of momentum returns. Studies in this area mostly use Lo and MacKinlay’s (1990) return decomposition framework (e.g., Conrad and Kaul, 1998; and Lewellen, 2002). Using a decomposition approach Grundy and Martin (2001) suggest evidence that when momentum returns are decomposed into contemporaneous Fama-French three factors (or systematic risk[2] factors in their study) and stock-specific[3] risk factors at the individual stock level, the stock-specific sources of momentum returns generate higher returns compared to the total momentum returns.

Kang and Li (2007) use a 'missing factor' model at the individual stock level and use firm level factors and macroeconomic risk factors to study the sources of momentum profits. These authors decompose stock memberships of the winner/loser portfolios of the momentum strategies based on total returns or factor-adjusted returns according to the stocks' starkly different cross-sectional pricing power. They report that more than half of the momentum returns derives from stock-specific sources. In a more recent study, Chichernea and Slezak (2008) uses an EGARCH-M econometric model and show that when momentum portfolios are formed based on the ranking of raw returns stock-specific returns are a statistically and economically significant source of momentum profits.

The above evidences though firmly establish that there are some evidences of the sources of momentum returns the literature do not tell as to what contributes to momentum returns. In other words, there is no study that quantifies the relative contribution of the explained risk factors and unexplained factors that derives momentum returns. As pointed out by Avramov and Chordia (2005) there is still an ongoing debate as to whether expected returns are explained by risk factors or by non-

[2] Systematic risk factors are components of returns associated with exposure to common risk factors.
[3] Literature defines 'Stock-specific' also known as 'idiosyncratic' risk factors as the component of returns not related to the realization of common risk factors.

risk firm characteristics. Furthermore, though researchers have tried to understand the sources of momentum returns by developing sophisticated models, investment professionals find that difficult to implement in real-life environment. As noted by Rev and Schmid (2007) while there is little controversy on the profitability of momentum strategies, their implementation is afflicted with many difficulties. This warrants an alternative approach of the decomposition of momentum returns and warrants the development of a model that determines the relative contribution of the risk factors in generating momentum returns, and at the same time is more straightforward and convenient to implement in real life environment by investment managers.

What is also apparent from the above evidences is that the empirical results are derived from methodological adjustments designed by employing the level of analysis and the variables employed e.g. portfolio and individual stock level and firm level and macro level variables. In fact, (Li, Miffre and Brooks, 2007; Arena and Yan, 2005 and Dittmar, Kaul, and Lei, 2007) show that if the momentum profits of individual assets are related to factors common across assets, then it is more likely that momentum profits derives from systematic risk. If, however, some portion of the momentum profits of individual assets are idiosyncratic then that portion of profits cannot be compensation for risk (which, by its very nature, must come from systematic variation). This suggest that there is a gap in the literature that requires the investigation of momentum returns by using an alternative and independent decomposition approach at different level of analysis e.g. at the portfolio level and at the individual stock level using both firm level and macro level variables to examine the relative contribution of each component that generates momentum returns.

1.2.3 Behavioural Models and Uncertainty

Behavioral models explicitly assume momentum phenomenon as a consequence to investors' irrationality and/or underreaction and overreaction to stock returns. Several factors that has been argued to have captured momentum effect are investors' conservatism, representative heuristic, biased self-attribution, overconfidence and bounded rationality (see among others Barberis, Shliefer and Vishny (1998), Daniel, Hirshleifer, and Subrahmanyam (1998), Hong and Stein (1999). Barberis, Shliefer and Vishny (1998) claim investors' conservatism to cause momentum effect, whilst representative heuristic leads to overvaluation followed by price correction. Daniel, Hirshleifer, and Subrahmanyam (1998) link momentum return with biased self-attribution and overconfidence. Hong and Stein (1999) develop models and conclude that the phenomenon is partly due to bounded rationality.

More recent work establishes a link between momentum returns and informational uncertainty (see also Jiang, Lee and Zhang, 2006 and Zhang, 2006). For example, low credit rated firms earn higher momentum returns than their high credit rated counterparts which are robust to firm-specific risk factors such as size, age, leverage (Avramov, Chordia, Jostova and Philipov, 2007). Avramov et al (2007) show that momentum returns in low credit rated stocks remain once controlled for other firm-level factors such as firm size, firm age, value, turnover, leverage, return volatility analysts forecasts dispersion, and cashflow volatility. Information uncertainty also fails to capture momentum effect. Zhang (2006) argues that momentum profits is restricted to high information uncertain stocks and remains when return volatility, cashflow volatility, market capitalization and analysts earnings forecast dispersion are used as control variables. Avramov and Hore (2007) suggest evidence that momentum premium still remains when information uncertainty and dividend growth of the firm are controlled for.

The above evidences support that momentum returns of credit rated stocks or stock with high informational uncertainty are not compensation for firm specific factors. However, literature does not provide any analysis on momentum returns of different types of credit rated stocks versus not-rated stocks and also whether or not momentum returns of different types of credit rated stocks are compensation for macroeconomic risk. This is motivating because literature establishes that momentum returns are closely related to macroeconomic activity or the mispricing of certain macroeconomic variables Avramov and Chordia, (2005). In fact, Avramov and Chordia, (2005) show that momentum returns varies with business cycles. This reveals that there is a gap in the literature and it warrants investigation on the uncertainty associated with momentum returns, in particular among credit rated stocks. Furthermore, the analysis is worth investigating to perform both at the firm level and at the macro level.

1.3 Motivation and Objective of the Study

The main purpose of this thesis is to examine if momentum return is a compensation for risk be it firm level or macro economic level risks and the uncertainty that is associated with firm or economy prospects. The motivation of the thesis stems from the fact that if momentum is a compensation for risks (firm level and/or macro level) then the continuous persistence of momentum returns in the US market for over eighty years from 1926 through 2005 is at odd with the market efficiency hypothesis. If, on the other hand, momentum return is a result of investors' psychological bias or derives from stock specific sources then behavioral models should capture such phenomenon. However, earlier literature could not provide a conclusive decision on this issue. And one important reason behind this failure of the earlier studies is the presumptions and methodological adjustment that has been used. Therefore this thesis is motivated to resolve the inconclusive results of previous literature by further investigating on the methodological adjustments in measuring momentum returns.

The thesis performs a comprehensive analysis of momentum returns both at the portfolio and at the individual stock level, by using firm level and macro level risk factors and by employing both contemporaneous and lagged values of risk factors. By using a period from 1926 through 2006 for all stocks listed in the NYSE, AMEX and NASDAQ, the thesis employs an alternative momentum strategy, measures the relative contribution of risk factors at the firm level and generates momentum returns accordingly. Finally, the thesis considers credit ratings of stocks and business cycles and market states in measuring momentum returns.

In the first empirical chapter (Chapter Three of this thesis) the thesis examines if momentum returns are compensation for risk at the portfolio level. Earlier studies remain indecisive as to whether or not momentum returns are compensation for risks and which arises largely due to the assumptions employed in those earlier studies. This thesis performs a test by using a multi-factor regression model (1) By using both the contemporaneous and the lagged variables and (2) By using both firm level factors and the macroeconomic factors. (3) Bu taking into account transaction cost. Although including one or more of the above assumptions in the model is common in examining momentum returns, to the best of our knowledge no prior studies offer a balanced assessment of the momentum returns by relaxing all of those. Furthermore, considering momentum as a risk factor in not common in momentum literature which has been addressed in this thesis.

The second empirical chapter (Chapter Four of this thesis) examines at the individual stock level if momentum returns are compensation for risks. For this purpose we introduce a novel method of measuring momentum returns. Unlike the conventional method where momentum returns are measured by ranking stocks based on past returns, the risk-adjusted method of measuring momentum returns decomposes returns at the individual stock level into (1) Explained[4] and (2) Unexplained portions and then momentum returns are measured by ranking stocks based on (1) Explained and (2) Unexplained risk-adjusted returns. The risk-adjusted measure provides a more penetrating measure of momentum returns and is convenient for the investment professionals to implement in real environment.

[4] We define explained risks as those associated with exposure to common risk factors used for the purpose of this thesis and unexplained risks as those risk factors not related to the realization of common risk factors.

The third empirical chapter (Chapter Five of this thesis) decomposes momentum returns and examines the proportionate contribution of returns (1) Explained by risk factors and (2) Unexplained by risk factors in generating momentum returns. This empirical chapter contributes by providing evidence of the relative weights of each risk components.

In the fourth empirical chapter (Chapter Six of the thesis) uncertainty is introduced into the analysis. Firm-level uncertainty is measured by using the credit ratings and by differentiating between 'Investment Grade' rated stocks and 'Speculative Grade' rated stocks. Macro-level uncertainty is measured by examining momentum returns of different types of credit rated stocks across the business cycle as defined by the National Bureau of Economic Research (NBER) and across up and down states of the market.

1.4 Robustness Test

For robustness a number of tests have been performed for all the empirical chapters of this thesis.

(i) The analysis is conducted in the whole sample period from January 1926 through December 2006 and in different sub-sample periods. The sub-sample periods are ten-year sample period or three-year sample period depending on the availability of data and the nature of analysis performed.

(ii) The empirical estimations have been conducted for

1. Portfolio level of analysis and Individual Stock level analysis.
2. Firm level risk factors and macroeconomic risk factors
3. Contemporaneous variable and lagged variables

(ii) Different formation (J) and holding period (K) are used to calculate momentum returns e.g. JxK= 3, 6, 9 and 12 months.

(iii) Empirical analysis is conducted with and without penny stocks.

1.5 Major Findings and Contributions

1.5.1 Portfolio Level Analysis

The contribution of this thesis at the portfolio level is that we investigate if momentum returns are compensation for both firm level and macro level risks and also transaction cost. For the purpose we use a multi-factor regression model to take into account (1) Both firm level factors and the macroeconomic factors, (2) Both the contemporaneous and the lagged variables and (3) Transaction cost. We have used several risk factors, e.g. (1) Fama-French three factors (2) Carhart (1997) four-factor or momentum factor and (3) Macroeconomic risk factors. Though investigating momentum returns are common in literature, incorporating momentum as a risk factor to investigate if the empirical momentum returns are compensation for Carhart (1997) momentum factor is quite unusual in earlier studies.

The empirical results of the thesis contributes to the literature by documenting that strong momentum returns are observed in stocks traded in the NYSE, NASDAQ and AMEX over the period from 1926 through 2005. This observed momentum returns persists even when transaction costs are taken into account and penny stocks are excluded. We provide evidence of predominantly high momentum returns of 0.8 percent per month (9.6 percent per annum) and are more than 1 percent per month during the post-1950s. We also document that momentum returns are significant and close to 1 percent per month when penny stocks are excluded. The thesis adds to the literature by providing evidence that significant momentum returns of 0.16 percent per month (1.92 percent per annum) remain when accounted for transaction cost. Nevertheless, it has been observed that momentum returns reduces but does not eliminate entirely when transaction cost and penny stocks are considered.

The empirical findings report that momentum returns are not compensation for firm level factors e.g. Fama-French three factors and Carhart (1997) four factors. Statistically significant alpha of 0.01 percent per month (0.12 percent per annum) and 0.02 percent per month (0.24 percent per annum) remains when controlled for Fama-French three factors and macroeconomic risk factors, respectively. Statistically significant alpha of 0.01 percent per month (0.12 percent per annum) is reported when Carhart (1997) momentum factors are accounted for. However, it is documented that the factor momentum has significance influence in explaining the empirical momentum returns. The empirical findings also document that momentum returns are not compensation for macroeconomic risk factors at the portfolio level.

1.5.2 Individual Level Analysis

The empirical results of this thesis contribute to the literature by firmly establishing that among the standard risk factors only macroeconomic variables can explain momentum returns at the individual stock level. The findings at the individual stock level analysis show that momentum returns cannot be explained by Fama-French three factors. It is observed that statistically significant momentum returns of up to 0.45 percent per month (5.4 percent per annum) remains unexplained when controlled for Fama-French three factors. The result holds both for contemporaneous and lagged values of these factors. When macroeconomic risk factors are used momentum returns remains unexplained up to 0.15 percent per month (1.8 percent per annum). However when lagged macroeconomic risk factors are used momentum returns disappear. This suggests that macroeconomic variables have important implication when explaining momentum returns.

1.5.3 Decomposing Momentum Returns: What Factors Contribute to Momentum Returns?

This thesis initiates a quantitative analysis on the relative importance of the risks factors that contributes to momentum returns. The empirical results document that it is the proportionate contribution of both explained risk factors and unexplained risk factors that make up the total momentum returns. However, the contribution of macroeconomic risk factors is far more important than that of the firm level risk factors in contributing to momentum generation.

The empirical findings provide evidence that at the portfolio level, firstly, when contemporaneous Fama-French three factors are considered the contribution of explained risk factors is only 10 percent while the contribution of unexplained risk factors are more than 90 percent. The results are robust when lagged Fama-French three factors are considered e.g. the contribution of explained risk factors is 6 percent while the contribution of unexplained risk components is still more than 93 percent. However, it is noticeable that contemporaneous macroeconomic variables contribute 10 percent while unexplained risk factors contribute 90 percent in generating momentum returns. When lagged macroeconomic risk factors are considered macroeconomic variables contributes 13 percent while unexplained risk factors contribute 87 percent. Finally, when both the contemporaneous Fama-French three factors and macroeconomic factors are considered simultaneously the contribution of unexplained risk factors is 80.44 percent while the contribution of explained risk factors is 20 percent.

At the individual stock level, however, the contribution of explained and unexplained risk factors is somewhat different. Firstly, when contemporaneous Fama-French three factors are considered the contribution of risk factors is more than 40 percent whilst the contribution of unexplained risk factors is more than 50 percent. The results are robust when lagged Fama-French three factors are used. Secondly, when contemporaneous macroeconomic risk factors are used these explained risk factors contribute 31 percent while the contribution of unexplained risk factors is 69 percent. However, when lagged macroeconomic risks are considered the contribution of explained risk factors increase to 59 percent than that of the unexplained risk factors of 41 percent. Thirdly, when both the Fama-French three factors and the macroeconomic risk factors are taken into account simultaneously, the explained risk factors contribute up to 68 percent when the lagged values of these risk factors are considered.

The evidences suggest that at the portfolio level the contribution of unexplained risk factors is dominantly high compared to the explained risk factors in generating momentum returns. However, at the individual stock level, the contribution of risk factors increases and is more pronounced when lagged macroeconomic risk factors are used. Therefore it can be concluded that momentum returns are contributions of both explained and unexplained risk factors, but the contribution of macroeconomic risk factors is particularly important in generating momentum returns.

1.5.4 Momentum Returns, Uncertainty and Credit Ratings

The thesis introduces uncertainty at the firm level and macro level and document that momentum is a reaction of the investors to high uncertainty either due to increased business risk of stocks or due to increased macroeconomic risk. This thesis also contributes by introducing credit rating and observes how momentum returns of credit rated stocks behave across business cycle and when firm level and macro level risk factors are accounted for. The empirical findings report that when uncertainty is measured at the firm level momentum return is significant in credit rated stocks than in not-rated stocks. Among the credit rated stocks momentum returns concentrates on 'Speculative Grade' rated stocks. Furthermore momentum returns of up to 2 percent per month (24 percent per annum) remains once accounted for Fama-French three factors. When momentum returns are controlled for uncertainty at the macroeconomic level momentum returns of Speculative Grade rated stocks are observed to be more pronounced during the contraction periods of NBER business cycles when up to 5 percent per month (60 percent per annum) momentum returns are earned. When controlled for market states factors for 'Speculative Grade' stocks momentum return remains high at 1.6 percent per month (20 percent per annum) once controlled for market states risk factors. However, when controlled for macroeconomic risk factors the empirical results report that momentum returns of all types of credit rated stocks disappears. The empirical findings imply that momentum returns could be compensation to the increased uncertainty during economic downturns.

1.6 Structure of the Thesis

The objective of the thesis, set out in this chapter, is addressed through separate but interrelated analyses in the following chapters. The next chapter (chapter two) brings together the relevant literature on momentum returns along with theories and empirical findings on momentum returns and behavioral models and rational theories. This chapter also addresses the contribution of components in generating momentum returns and momentum returns and risk based common components in other sub-sample of stocks with particular focus on credit rated stocks. The literature review in this chapter serves as the foundation of discussions and analysis of the subsequent chapters.

Chapter three provides the data and methodology and the empirical results of whether or not momentum returns are compensation for risk at the portfolio level. The chapter also delivers the output of measuring momentum returns using the conventional method of Jegadeesh and Titman (2001). Furthermore it describes a comparative analysis of the results of this study with the results of earlier researchers who also employed the conventional method. Chapter Four provides the data, methodology and empirical results of whether or not momentum returns are compensation for risk at the individual stock level. For this purpose the chapter introduces a novel risk-adjusted methodology. This novice methodology measures momentum returns are measured by first adjusting for (1) Explained and (2) Unexplained risks. The chapter shows if momentum returns are compensation for risk at the individual stock level. Chapter Five details the data, methodology and empirical output of the relative contribution of (1) Explained risk factors and (2) Unexplained portions in generating momentum returns. Chapter Six produces the data, methodology and empirical results of momentum returns when controlled for uncertainty both at the firm level and at the macro level. The chapter also provides momentum returns observed in different types of credit rated stocks, how they vary across business cycle and when controlled for risk factors.

Finally, Chapter Eight presents the major findings on whether or not momentum returns are compensation for risks. The chapter also includes implications of the major research findings both for the academia and for the investment professionals and identifies areas for further research.

1.7 Conclusion

This chapter establishes the context of the thesis sets out the gap in the literature and presents the aims and scope of the thesis to fill the gap. Furthermore the motivation and unique contribution of the thesis is laid down. The basic structure of the dissertation is also described here. The study concerns momentum returns and whether or not the huge premiums observed can be attributed to a compensation for risk in the US market. The focus of the study revolves around different measurements for momentum returns, risk factors that contribute to explaining momentum returns and uncertainty measured at the firm level and at the macro level. The next chapter provides a detailed literature review regarding momentum returns and rational theories and behavioral models.

2 CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section presents a comprehensive review of the literatures on momentum returns. It provides evidences from earlier studies related to rational theories that argue momentum returns to be compensation for risk and evidences from behavioral model which conclude that momentum returns are due to investors' psychological bias and uncertainty. The section is divided into three parts; in the first part the section describes the momentum trading strategy, evidence of momentum returns across markets, among asset classes and how investment mangers use momentum trading strategy is real-life investment decision. In the second section the rational theories related to momentum strategies that argue that momentum is compensation for risk is described in details both at the firm-level explained risk factors and the macroeconomic explained risk factors. In the third section evidences from earlier studies have been given that relate momentum returns with psychological biases e.g. underrecation, overreaction and other psychological biases. Literature maintains that unexplained source of momentum profits is more consistent with behavioral explanations. Therefore, earlier empirical evidences related to unexplained risk factors have also been described in this section.

2.1.1 Momentum Trading Strategies

According to the Oxford dictionary 'Momentum' is the quantity of motion of a moving body, measured as a product of its mass and velocity. In other words, it is the impetus and driving force gained by the development of a process or course of events.

In finance, momentum is defined as the rate of acceleration of a security's price or volume. The term momentum has two meanings: (1) A trading style by which traders go with the direction of the current trend; and (2) A technical indicator which measures the rate of change of an asset over a given time frame. According to the trading style, momentum is defined as the tendency of an asset price to keep moving in the same direction, either upwards or downwards. It is the strength behind an upward or downward movement in price. In technical analysis, momentum is the relative change in price over a specific time interval and is often equated with speed or velocity and considered in terms of relative strength. Momentum investors like to buy stocks with high relative strength because they believe a stock that has a strong relative strength rating will continue to move higher.

‘Momentum Strategy’ refers to the trading strategy of buying past winners and selling past losers in momentum literature. The pioneer work of Jegadeesh and Titman (1993) describe momentum phenomenon as the observation that portfolios of stocks with relatively high returns over the past year tend to have high future returns. The strategy is also widely known as the ‘Relative Strength Strategy’. In momentum trading strategy investor uses the percentage growth of momentum in earnings to buy or sell securities. Jegadeesh and Titman (1993) show that in US market by buying recent winners and selling recent losers an abnormal return of approximately 1 percent per month (12 percent per annum) can be achieved.

The history of investment based trading strategy dates back to Levy (1967) who document that buying stocks with current price substantially above their previous twenty-seven weeks average results yield significant abnormal returns. Jegadeesh

(1990) and Lehmann (1990) is the first to study the strategy over a very short period of time, from a week to a month, and report that return actually reverse in the short term. In subsequent studies researchers observe momentum effect over a very short period of time of several weeks or a month and in intermediate period of time of three to twelve months (Jegadeesh, 1990; Lehmann, 1990 and Gutierrez and Kelly, 2006). Jegadeesh and Titman (1993) examine the trading strategy over intermediate horizon, from three months to twelve months, and document that the strategy of buying winners and selling losers over the previous three to twelve months also achieve an abnormal profit of 12 percent per annum in the US market. These authors report that the best performing stocks over the previous week, or month, are more likely to be one of the poor performers over the following week, or month. They conclude that in the short-term returns tend to continue and lead to a “momentum” in stock price. This evidence thereafter invited abundant investigations on momentum premium resulting in the momentum literature of todays.

Following the revolutionary work of Jegadeesh and Titman (1993) several empirical researches document the profitability of momentum strategy. The approach employed by Jegadeesh and Titman (1993) is as follows: At any time period *t*, stocks are selected based on the past four quarters of the returns i.e. 3, 6, 9 and 12 months past return. Then the stocks are ranked based on the formation period (*J*). The stock are then sorted in ascending order and ten equally weighted deciles portfolios are formed. The two extreme deciles portfolios i.e. the top deciles portfolio (Decile1) contains the stocks with the lowest average *J* period returns, is the loser portfolio whilst the bottom deciles portfolio (Decile10) contains the stocks with the highest average *J* period returns, is the winner portfolio[5]. Then a long position is taken in the winner portfolio and a short position in the loser portfolio. This results in a zero-cost arbitrage portfolio. The positions are held over the following 3, 6, 9 or 12 months (known as the holding period and defined as *K*). Momentum return is the difference between the return on winner portfolio and loser portfolio which is realized at the end of the holding period.

By using the daily returns of NYSE and AMEX stocks over the period 1965 to 1989, Jegadeesh and Titman (1993) form 16 momentum portfolios based on different formation and holding period lengths. To avoid bid-ask spread, price pressure and lagged reaction effects that underlie the short-term return reversals as documented by Jegadeesh (1990) and Lehmann (1990), these authors form a second set of portfolios with a one week gap between formation and holding periods. [6] Jegadeesh and Titman (1993) find that each momentum trading strategy provides a positive return except for the 3x3 [(*JxK*) the portfolio formation period (months) x holding period (months)] strategy. The most successful zero-cost strategy holds the portfolio over three-month, based on the returns of the previous twelve-month (12x3), yielding a return of 1.31 percent per month with no lag between portfolio formation and holding periods, and 1.49 percent per month with a one-week lag.[7] These results are representative of the general effect of including a one-week lag, producing slightly higher returns.

In event time, to assess the performance of such strategy based in the prior six-month returns Jegadeesh and Titman (1993) find positive monthly returns of the first year with the highest cumulative return of 9.51 percent after twelve-month except that

[5] In literature these two extreme portfolios are termed as P1 and P10, respectively. Some literatures also define those as the return on winner and return on loser or largely "winner" and "loser".
[6] This is to account for the market micro structure effects and is widely employed by most researchers in recent literature
[7] The profit is not strictly a return, as the momentum portfolio is a zero net investment arbitrage portfolio. However, following the convention of the literature it is referred as a return.

of the first month. However, in the longer period of twenty-four month time reversal takes place and cumulative momentum return drops to 5.56 percent. Again with the strategy of a 6x6 (*JxK*) without a one week lag and report a profit of 0.95 percent per month. This conventional method of measuring momentum returns laid down the foundation of many studies in momentum literature with added specifications in estimating momentum return. This thesis also follows the conventional method of measuring momentum returns.

2.1.2 Momentum Returns across Markets

The distinct and well-recognized approach of momentum strategy of Jegadeesh and Titman (1993, 2001) and its profitability in the US market motivated many researchers to explore the trend in other markets. To date, momentum trading strategy has been tested in almost all developed and emerging markets. In Europe the two most notable studies are by Rouwenhorst (1998) and Chan, Hameed and Tong (2000). Rouwenhorst (1998) study the European Stock (in twelve European countries) and confirm the results with that of Jegadeesh and Titman (1993). Chan, Hameed and Tong (2000) emphasize on stock market indexes and in a sample of twenty-two countries these authors document the presence of momentum profits although slightly less significant when applied to country indices. Griffin, JI and Martin (2003) incorporate both Europe and Asia markets in their study and conclude that compare to Asia, in Europe loser portfolios tend to underperform the market as a whole and are statistically significant. Testing over longer holding periods, Richards (1997) finds a country momentum strategy yielding returns insignificantly different from zero.

The breadth of evidence on the international presence of stock momentum has been expanded by Chui, Titman and Wei (2000) who document, with the exceptions of Korea and Japan, the strongest presence of momentum profits is in Asian market. Again Rouwenhorst (1998, 1999) and Chui et al (2000), find that momentum is economically significant in many European countries, small but positive in many emerging countries, and furthermore present in Asian countries[8]. Griffin, JI and Martin (2003) show that momentum returns are largely profitable around the world. Similar to Rouwenhorst (1999), Griffin, JI and Martin (2003) report weaker momentum returns in Asian countries and in other emerging markets. Bhojraj and Swaminathan (2003) and Fong, Wong and Lean (2005) establish the presence of momentum in international equity indices.

Measuring the portability of momentum returns in other markets gained popularity in recent studies. Evidence from other markets includes Bacmann, Dubois and Isakov (2001) for G-7 countries, Schiereck and Weber (1995) for the German market, Bacmann and Dubois (2000) for the Swiss Market, Forner and Marhuenda (2003) and Muga and Santamaria (2006) for the Spanish market, Mai (1995) for the French market, Hameed and Yuanto (2000) for six Asian market, Chui, Titman and Wei (2000) for Asian basin, Chen (2000) for Taiwan market. In most recent work study Ameer (2007) observe momentum returns in the private sector stocks in Pakistan, Veeraraghavan, Nguyen and Truong (2007) report significant momentum returns in Vietnam stock market, Stork (2008) report statistically significant momentum in twenty Australian and fifteen New Zealand shares, Shegal and Balakrishnan (2008) document momentum patterns in Indian stock returns and Alsubaie and Najand (2008) observe

[8] At least in five counties

momentum returns in the Saudi stock market, one of the largest stock market in middle-east. The above evidences enrich momentum literature and establish the profitability of momentum strategy both economically and statistically significant all around the world.

2.1.3 Momentum Returns among Asset Classes

Studies on momentum phenomenon have also been performed in different dimensions including, over time, across assets and in equity styles. Jegadeesh and Titman (1993, 2001) test momentum effect over different time scale and report that momentum returns continue during the last decade of the millennium and conclude that the phenomenon continues to generate excess return in US market. Their study challenges the argument of many critics who conclude that the results of momentum return in the early study was a product of data mining. Literature also shows that momentum investing constitutes a unique and well-recognized style in the equity market. Chen and DeBondt (2004) report a style momentum in equity return distinct from the price and industry momentum. Defining the style in three different characteristics, including size, B/M and dividend yield, these authors report that in one year time period strategies that long stocks currently in-favor and shorts stocks that are out-of-favor, perform well.

Okunev and White (2003) add a new era to the momentum investigation by incorporating a different asset class in their study other than equity. These authors provide evidence of significant momentum return in foreign currency market during the last half decade of the millennium. Their result attributes that the strong/weak currencies relative to base currency at a particular time are also strong/weak currencies relative to most other base currency. Miffre and Rallis (2007) add to this line of study by investigating the presence of momentum in the commodity futures market. These authors perform a study on thirty-one commodities and by forming thirteen portfolios they conclude that the strategy of buying backwarded contracts and selling contangoed contracts with large volatility will generate an average return of 9.38 percent per annum.

Obrecht (2006) show that momentum returns are observed more among large-caps stocks. The author report that stocks with large capitalization generates statistically significant momentum profit and is robust when transaction costs are taken into account. In a very recent study momentum has been found to be linked to firm credit rating. Avramov, Chordia, Jostova, Philipov (2007) show that momentum profitability is statistically significant and economically large among low-grade firms while does not exist in high-grade firms. Blitz and Vliet (2008) examine global tactical asset allocation (GTAA) strategies across a broad range of asset classes and show that momentum and value strategies applied to GTAA across twelve asset classes deliver statistically and economically significant abnormal returns. Naughton, Malick and Ramiah (2007) provide evidence of momentum returns both the physical equity market and the derivative markets, specifically looking at warrants and options listed at six Asian markets including Hong Kong, Japan, Korea, Malaysia, Singapore and Taiwan and report that momentum is more profitable on derivative markets than the underlying equity markets.

Recent studies demonstrate that momentum return is significant among certain sub-sample of stocks. For example, Jiang, Lee and Zhang (2006) and Zhang (2006) report that momentum returns is strong in firms with high information uncertainty. Again, Avramov, et al (2007) document that low-credit-risk firms realize economically and statistically significant momentum return than high-credit-risk firms. Avramov et al

(2007) document a link between momentum returns and credit risk. These authors report that significant momentum payoff yields from companies with high credit risk. They show that extreme winner and loser portfolios comprise of low-grade companies that generate high momentum payoff, an amount of 2.35% per month. They further add that credit rating effect on momentum is independent of information uncertainty and momentum profitability cannot be explained by firm level factors e.g. firm size, firm age, leverage, etc.

2.1.4 Momentum Returns in Practice

There is considerable evidence that investment managers and practitioners employ momentum strategy in trading stocks or in investment decisions. In practice momentum effect is largely accounted for especially in the money management industry. Grinblatt, Titman and Wermers (1995) and Chen Jegadeesh and Wermers (2000) report that in mutual fund industry there is a tendency of picking stocks that outperforms in the past in forming portfolios. They conclude that mutual fund tends to long past winners and short past losers. Again, Womack (1996) reports that analysts recommend high momentum stock to low momentum stock in practice. Chan, Jegadeesh and Lakonishok (1996) report that momentum trading strategies are largely implemented by many professionals.

Momentum trading strategies are widely used in the foreign exchange market by currency fund managers and commodity trading advisors. Taylor and Allen (1992) report that for short horizons, foreign exchange dealers are more likely to use technical indicators, such as those that exploit momentum, than to base their forecasts on economic fundamentals. In recent studies, Benson, Gallagher and Teodorowski (2007) find evidence supporting the existence of momentum investing in active asset allocation strategies. This evidence exists in the Australian Equities, Australian Fixed Interest and Listed Property asset classes. These authors also report that fund managers with no market timing skill are momentum investors.

2.2 Momentum Returns and Rational Theories

Momentum literature, broadly, are divided into two major wings. On the one hand studies are based on rational theories and on the other hand literature flows by means of behavioral models. Studies that focus on rational theories largely argue that momentum returns are compensations for bearing market wide common risk associated with stock returns. Till date researchers put forth several risk components that have been documented to have explained momentum effect. Among these factors the two most common groups are firm-level factors and macroeconomic factor.

2.2.1 Firm-Level Risk Factors

Among the firm-level factors the most prominent and widely screened factor in momentum return are the Fama-French three factors, industry factor and the transaction cost factors. Though literature document evidences that these firm-level factors can capture much of the momentum returns in different markets and among different assets classes, there is controversy as to the extent to which these factors are compensations for momentum returns.

2.2.1.1 Fama-French three Factors

Momentum literature widely screened the three factor model of Fama and French (1993) in explaining momentum returns. The three factors as explained by Fama and French (1993) are; (i) Excess return over the market portfolio (Rm-Rf), (ii) the difference between the portfolio that buy the small size stocks and sell the big size stocks (SMB) and (iii) the difference between the portfolio that takes long positions in high book-to-market stocks and short positions in low book-to-market stocks (HML) that explains the cross section of expected returns. In their subsequent study, Fama and French (1996) investigate the effect of these contemporaneous three factors on momentum return at the individual stock level and document that though these factors can largely capture the anomaly of CAPM, however cannot explain momentum returns. Consistent to the findings of Fama and French (1996) Chan, Jegadeesh and Lakonishok (1996) document that as these three factors are more concerned with the winner portfolios. However the losers have similar exposures for the market as winner portfolio loads negatively on the book-to-market factor and concentrate on glamour stocks whilst loser loads positively to the book-to-market and focus on the value stocks. Similar to the findings of earlier researchers Grundy and Martin (2001) report that momentum return remains profitable after accounting for the contemporaneous Fama-French three factors at the individual stock level. On the contrary, literature also shows that when Fama-French three-factor is used in a conditional framework it explains momentum better than that of the unconditioning factors but the profitability cannot be eliminated absolutely (see, among others, Wang, 2003 and Wu, 2004). Based on a nonparametric test where lagged macroeconomic variables are considered as time-varying conditional information for Fama-French three factor model, Wang (2003) shows that the Fama-French three factors can explain most of the momentum return.

2.2.1.2 Industry Factors

Literature also identifies other common components that capture momentum effect. One component is the industry factors. There is much empirical evidence on the existence of an industry momentum effect, indicating that industries with relatively high past returns will continue to outperform, and industries with relatively low past returns will continue to underperform. Moskowitz and Grinblatt (1999) observe that at the individual stock level momentum strategy is profitable when picking stocks systematically from industries or countries with extreme past performance. These authors report that in six-month time high momentum-return industry outperforms the low momentum-return industry and that most of the momentum effect measured on the individual stock level can be captured by following an industry momentum strategy. O'Neal (2000) investigates the profitability of industry momentum by using industry mutual funds as tradable assets. He finds a significant excess return of 7.5% per annum for past winner industry mutual funds over past loser industry mutual funds even after accounting for the initial loads and redemption fees. Nijman, Swinkels and Verbeek (2002) perform a combined investigation on industries and countries by formulating a portfolio based regression method of distinguishing between individual stocks, industry and country effects in diversified momentum portfolios. These authors find that individual firm momentum is more significant to explain the momentum return than the industry effects. This result has also been confirmed by Chordia and Shivakumar (2002) who report that individual stock momentum and the macro economy is independent of the relationship between the industry momentum and the macro economy. Lewellen (2002) confirms with the early studies and concludes that industry momentum is driven primarily by the lead-lag effect.

In a subsequent study, by classifying economic states by changes in industrial production (IP), Griffin, JI and Martin (2003) examine that momentum returns are higher and significant in the US, Europe and Asia respectively, as compared to negative less significant for periods of positive IP growth in these same countries. These authors emphasize on the contribution of the industry momentum to momentum profits and conclude that individual stock and industry based momentum return are distinctive and separate phenomenon. However, these studies focus on industries that cannot be traded directly, which makes it difficult to exploit the industry momentum effect. In a recent study Swinkels and Tjoe (2008) analyze the profitability of industry momentum strategies based on two sets of exchange traded funds (ETF). Swinkels and Tjong-A-Tjoe (2008) report that the paper profits as documented in earlier studies of about 5% per annum are present. However, when estimating the transactions costs on these industry momentum strategies, accounting for (a) the bid-ask spread, (b) the broker commission and (c) short selling costs, these authors report that the paper profits from industry momentum strategies disappear in real-life.

2.2.1.3 Transaction Cost

Literature also looks into the effect of transaction cost on momentum returns and examine if the returns are compensation for these costs. There are mixed evidences on whether or not momentum returns can be exploited after taking into account the transaction costs. Literature shows that when considering a round-trip cost of up to 2% momentum profits are large enough to be exploited (see, among others, Jegadeesh and Titman, 1993; Rouwenhorst, 1998; Moskowitz and Grinblatt, 1999; Liu, Strong and Xu, 1999). However, subsequent studies provide evidences that the profitability of momentum strategies substantially depends on the size and the constituents of transaction costs. For example, Grundy and Martin (2001), show that a round-trip cost in excess of 1.5% does wipe out the profitability of momentum strategies. Lesmond, Schill and Zhou (2004) explain that the losers, and to a lesser extent the winners, are heavily tilted towards off-NYSE stocks with small capitalization and low price, suggesting that the long-short portfolios comprise stocks with low liquidity and high trading costs. Once these costs are taken into account, the alleged momentum profits disappear. On the other hand Chan and Lankonishok (1995) show that if on average trading cost of three percent is considered (usually for small firm) momentum return substantially reduces but does not eliminate entirely. In another study Korajczyk and Sadka (2004) conclude that equally-weighted and value-weighted momentum strategies are profitable when net of transaction costs for relatively small investment mandates only. In a study in UK market, Ellis and Thomas (2004) incorporate transaction cost in assessing the zero-cost momentum strategy and considering all possible sources of trading cost including bid-ask spread, commissions, stamp duty, short selling and price impact cost in their study, these authors conclude that even after taking into account a large transaction cost (five percent round trip is appropriate for UK market) momentum profit still prevails for holding period greater than three months. These authors report that when considering a momentum strategy of $JxK = 6x9$ monthly momentum return of 1.04 percent is possible to generate.

In recent study Ali and Trombley (2006) relate momentum profits to short sales constraints and show that the later are important in explaining why momentum profits are not arbitraged away. In another study Agyei-Ampomah (2007) establishes an association among on stock concentration, turnover and trading cost in UK market. The author report that, after factoring out transaction costs the profitability of the momentum strategy disappears for shorter horizons but remains for longer horizons. He conclude that for ranking and holding periods up to 6-months, profitable momentum returns would not be available to most average investors as the cost of implementation outweighs the possible return. Li, Brooks and Miffre (2008) observe that in UK market the asymmetry in the costs of trading winners and losers crucially relates to the high cost of selling loser stocks with small size and low trading volume. They develop a low-cost relative-strength strategy by short-listing from all winner and loser and show that when transaction costs are taken into account momentum returns disappear.

Altogether, the above evidences provide evidence that though firm level factors can capture momentum effect to some extent; these factors cannot eliminate momentum returns entirely. This therefore suggests that momentum returns are not mere compensation of firm level factors, warranting further investigation on macro economic risk factors in explaining momentum returns.

2.2.2 Macro Level Risk Factors

Failure of the firm-level factors in explaining momentum returns has refined and extended the risk-based explanation in the macro-level context in subsequent studies. Momentum returns generating due to macroeconomic risks has been widely screened in literature and gained continuous popularity. Studies in this area argue that if momentum returns bear significant macroeconomic risk premia, then macroeconomic factors should capture momentum phenomenon. In other words, momentum returns are compensation to macroeconomic risk exposures. Research in this area provides evidence of several macroeconomic factors that capture momentum effect. Among those the most popular is the Chen, Roll and Ross (1986) and the Chordia and Shivakumar (2002) macroeconomic risk factors and the seasonality effect.

2.2.2.1 Chen, Roll and Ross (1986) macroeconomic risk factors

Among the macro variables the most widely used are the four factors of Chen, Roll and Ross (1986). [9] The four factors of Chen Roll and Ross (1986) includes; (i) Unanticipated Inflation (UI) which is defined as the difference between the series of expected returns and the realized first difference in the logarithm of the Consumer price Index; (ii) Changes in expected inflation (DEI); (iii) Term Spread (UTS) that capture the influence of the shape of the term structure and is used to capture the effect of changes in risk aversion and (iv) Industrial production changes (MP) which measures the changes in industrial production lagged by at least a partial month. Griffin, Ji and Martin (2003) show that the macroeconomic variables of Chen, Roll and Ross (1986) when used as contemporaneous variables cannot explain momentum phenomenon. Literature also studies the lagged macroeconomic variables to capture the momentum effect. The lag variables are used by researchers to predict market returns. The rational behind the use of lag variables is that momentum return to some extent is predicted

[9] Momentum literature widely utilized the macro economic variables of Chen, Roll and Ross (1986). The variables that these authors develop are industrial production (MP), unexpected inflation (UI), Changes in expected inflation (DEI), Risk Premium (URP) and the term structure (UTS).

return and the test is to investigate if the macro variables could contribute to forecast momentum return. Ferson and Harvey (1999) first employ the four lagged macro economic variables in their study to test the impact of time-varying betas on the portfolios grouped on momentum. They report strong evidence of the betas on the Fama- French factors vary with the lagged macroeconomic variables and that in case of portfolio grouping the loadings on the same variables are robust and provide explanatory power to portfolio return.

2.2.2.2 Chordia and Shivakumar (2002) macroeconomic risk factors

Chordia and Shivakumar (2002) add to this area of study. They develop four macroeconomic variables include dividend yield (DIV) which is the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the market index, the short rate (YLD) is the yield on the three-month Treasury bill, the term premium (TERM) is the yield spread of a ten-year Treasury bond over a three-month Treasury bill, the default premium (DEF) is the yield spread between Moody’s Baa and Aaa rated bonds. Chordia and Shivakumar (2002) develop a forecasting model based on the lagged macro variables and claim that the momentum return disappears when returns are adjusted for their predictability on the lagged macro economic variables. These authors use the lagged macroeconomic variables at the individual stock level to predict one-month-ahead returns and report that the predicted portion of the return is the primary cause of the observed momentum phenomenon. To examine whether the momentum return is explained by the predicted components of returns they find that it is not the recent stock return rather the predictive ability of past returns restricted to the portion of returns is predictable by macro-variables.

In many subsequent studies the macroeconomic variables of Chordia and Shivakumar (2002) have been investigated in different dimensions and contradictory evidences have been laid down by the researchers. Moskowitz and Grinblatt (1999) report that the individual momentum returns, in the study of Chordia and Shivakumar (2002), mainly comes from industry momentum profits. In a subsequent study Cooper, Gutierres and Hammeed (2004) reject the hypothesis put forth by Chordia and Shivakumar (2002) and show that the predicted returns of the macroeconomic variables do not explain momentum returns. Kang and Li (2004) report that when these lagged macroeconomic variables are used at the individual stock level much of the momentum returns remain unexplained suggesting that the momentum returns are not compensation for macroeconomic risk factors.

2.2.2.3 Market States Factors and Seasonality Effect on Momentum Returns

Cooper, Gutierres and Hammeed (2004) assert that the conditioning of the market is one common source of momentum return. These authors define the two states of the market as UP (DOWN) when the lagged three-year market return is nonnegative (negative) these authors report short-run momentum profits exclusively follow UP periods. This is done by summing the lagged thirty-six month market index. They report significant momentum return in the six-month momentum strategy and their result is robust when testing for a one-year and two-year lagged market states and risk-adjustments. These authors also document that when the market state variable is continuous momentum return increases. In a recent study, Hwang and Rubesam (2007) investigate the predictability of momentum profits following the market state variables of Cooper, Gutierrez and Hameed (2004), and find that the predictive power of these variables seems to have disappeared after the year 2000s, suggesting that momentum returns are compensation of market states risk factors.

Literature also document that momentum return exhibits strong seasonality effect. Jegadeesh and Titman (1993) is the first to reveal such pattern and report that momentum is negative in January and positive in every other calendar month. Grinblatt and Moskowitz (2000) also find similar result and show that momentum return tends to increase by the year end, in December, and reverse strongly in January resulting is significant reversal. In line with this investigation Grundy and Martin (2001) conclude that though the mean monthly returns on average are statistically insignificant, when January returns are excluded a statistically significant average momentum return of 1.01 percent per month is possible. In a recent study, Sias (2007) show that the seasonality effect of momentum returns are observed among stocks with high levels of institutional trading and was particularly strong in December. Momentum returns with Januaries excluded results in a momentum return of 0.59 percent for non-quarter-ending months but 3.10 percent for quarter-ending months. The author conclude that one reason for this pattern is the window dressing by institutional investors and tax-loss selling contribute to stock return momentum.

2.3 Momentum Returns and Behavioural Models

A body of empirical work has developed theories where momentum returns are explained by investors' behavior that departs from strict rationality. Behavioral finance explicitly assume that one important component of momentum return is investors' irrationality and psychological biases when trading in the market. Literature develops a number of psychological biases that capture momentum effect and market inefficiencies. With respect to price momentum there are two contradictory biases: the market underreaction bias and the market overreaction bias.

2.3.1 Underreaction Biases

Barberis, Shleifer and Vishny (1998) define market underreaction as the tendency of the investors to underweight new public information. As a consequence, this information is not incorporated immediately in the market prices, rather integrated gradually over a certain time period, suggesting that current news has predictability of future returns. Experiments in psychology undertaken by Edwards (1968) reveal that individuals suffer from a so-called conservatism bias. In this context, conservatism means that in the face of new evidence an individual is slow in updating its beliefs. Due to the conservatism bias individuals tends to underweight new information, which is available after the announcement, relative to the information they have before this event. They adjust their believes gradually rather than instantaneous and so it takes a certain time for the stock price to move to its new fair value. A reason for such a behavior could be that individuals are overconfident about their prior information.

Barberis, Shliefer and Vishny (1998) develop a model of investor sentiment which draws upon psychological evidence of belief formation to explain the underreaction and overreaction of stock prices to new information. According to these authors investors exhibit two cognitive biases including conservatism and the representativeness heuristic.[10] These authors show that because of the representativeness heuristic bias investors assume that firms that earn extraordinary growth will continue these abnormal earnings in the future. They argue that this tendency of the invertors will cause price to overshoot the fundamental value and the conservatism bias will lead to underreaction to new information.

Hong and Stein (1999) focus on the initial underreaction to information and subsequent overreaction, eventually leading to stock price reversal in the long run. The model employs two types of investors, "newswatchers" who rely exclusively on their private information; and "momentum traders” rely solely on the information in past price changes. These authors also assume that private information diffuses only gradually through marketplace leading to an initial underreaction to news. The information obtained by the news watchers are transmitted with a delay and hence price only reflects or incorporates partial information when it first hits the market. This leads to underreaction and result in momentum return. The momentum traders are attracted by this underreaction and subsequent positive serial correlation in returns and thus their trading activity results in an eventual overreaction to news. However, in the long run mispricing is corrected and prices revert back to their fundamental values.

In subsequent studies Lee and Swaminathan (2000) and Jegadeesh and Titman (2001) also confirm the hypotheses of investor underreaction to momentum return. However, these author present behavioral models claiming that momentum return is due to delayed overreaction in the short run as good news in the pre-formation period pushes post-formation prices above (below) the fundamental value. Alternatively, if underreaction is driving momentum, then the good (bad) performance of winner (losers)

[10] Edwards (1968) establish the conservatism bias and Tversky and Kahneman (1974) study behavioral heuristic.

continue in the post-formation period until prices incorporate all the pre-formation news.

2.3.2 Overreaction Biases

The market overreaction bias suggests theories exactly opposite to that of the market underreaction bias. De Bondt and Thaler (1985) conclude that long-term return reversal in stock markets can be explained by prior overreaction of market participants to news. The following reversal is simply a correction for this overreaction. Two other noticeable contributions in the literature on overreaction biases are by Daniel, Hirshleifer, and Subrahmanyam (1998) and Hong and Stein (1999). Daniel, Hirshleifer, and Subrahmanyam (1998) present a behavioral model based on two well know psychological biases, overconfidence and self-attribution to explain the overreaction of stock prices. These authors assume that investors are overconfident regarding private information and tend to overreact based on these information. Again, investors with self-attribution bias react asymmetrically to confirm versus disconfirm of news when subsequent public information hits the market. In other words, both the investors attribute to successes and that of to failures to their own skill and to external noise, respectively, are more than they ought to be. Consequently, when confirm news arrive in the market investors overconfidence increases. This increase in overconfidence deepens the initial overreaction and generates return momentum.

Following Daniel et al (1998) Gervais and Odean (2001), show that aggregate overconfidence increases with market gains. These authors claim that investors in aggregate hold long positions in the equity market and the increase in market prices tends to attribute unduly to investor skill. This overconfidence, following market gains, subsequently will result in stronger overreactions and will generate greater momentum return. In recent years, Cooper, Gutierrez and Hameed (2004) confirm the results of Lee and Swaminathan (2000) and Jegadeesh and Titman (2001) and show that momentum profit reverse in the long run confirming the overreaction theory.

However, literatures also combined several theories to test the effect of momentum returns. Applying the models of Barberis, Shleifer, and Vishny (1998), Daniel et al. (1998) or Hong and Stein (1999), Jegadeesh and Titman (2001) document that the long-term reversal in momentum returns can be linked to the delayed over-reaction of investors. Cooper Gutierrez and Hameed (2004) use the model of Daniel et al. (1998) to test for investors' bias across market states. They claim that investors with overconfidence and self-attribution bias are more likely to yield higher return when the market is rising or up and the other way round when the market is falling. However, according to the model of Daniel et al. (1988) the momentum effect is due to delayed overreaction of the investors and hence return will reverse in the long run

2.3.3 Other Behavioural Biases

Muga and Santamaria (2006) argue that investor type is an important consideration in explaining the momentum effect. Muga and Santamaria (2006) employ the models of Shefrin and Statman (1985) and Odean (1998) to account for the disposition effect of the investors and coupled with the model of Cooper Gutierrez and Hameed (2004) to investigate the effect across market states. These authors report that momentum return is better explained when disposition prone agents and the types of investors are taken into account in different conditions of the market. On the other hand, Hong and Stein (2007) argue that momentum arises from the interaction between heterogeneous agents. Because of investor segmentation and bounded rationality, investor groups (initially) base their decisions on various independent subsets of (value relevant) information. As each subset becomes observable to a broader audience, prices gradually adjust, resulting in momentum. Chui, Titman and Wei (2008) provide evidence that individualism is strongly related to the magnitude of momentum profits. They also report that consistent with the predictions of behavioral models, momentum profits reverse one year after portfolio formation, especially in countries with high degrees of individualism.

2.3.4 Momentum Returns and Uncertainty

Recent work uncovers the interaction between momentum returns and uncertainty. Uncertainty in stocks returns results mainly from three sources; the volatility of a firm's underlying fundamentals, poor information and poor financial performance during market downturn. Literatures document that momentum returns concentrate particularly on high information uncertain stock and stocks with poor financial performance and high credit risk (Zhang, 2006; Avramov, Chordia, Jostova, and Philipov, 2007 and Avarmov and Hore, 2008). Empirical work explains this phenomenon broadly in two directions; rational theories and behavioral models.

Rational theories document that momentum returns concentrate in stocks with high informational uncertainty and in stocks with high volatile firm level fundamentals. Zhang (2006) observes momentum in high information uncertainty stocks; in particular in stocks with high return volatility, high cash flow volatility, or high analysts' earnings forecast dispersion. Furthermore, Zhang (2006) provide evidence that greater information uncertainty produces relatively lower future returns following bad news and relatively higher future returns following good news which results in high momentum returns in stocks with high informational uncertainty.

Empirical work also document that price and earnings momentum are induced due to the uncertainty and the corresponding learning process surrounding the accuracy of multiple information sources responsible for forecasting cashflows (Han, Hong and Warachka, 2007). According to Han et al (2007), momentum arises as investors gradually learn about the relative accuracy of information sources and updates their influences on the aggregate estimate of the optimal combination of multiple forecasts of uncertain accuracy. The aggregate cashflow forecasts with minimal mean-squared forecast error results in the investor's conditional expectation of a firm's future cashflow growth. Momentum is generated solely from updating of the weights (which is optimal weights assigned to information sources that underlie the aggregate estimate) assigned to multiple information sources as the investor learns about their relative forecast accuracy. Han et al (2007) report that when there is no uncertainty surrounding the forecast accuracy of information sources, stock returns are unpredictable.

Studies show that momentum return is observed in stocks with poor financial performance, notably, in stocks with low credit rating. Avramov, Chordia, Jostova, and Philipov (2007) document that momentum payoffs concentrate in low credit rated firms and is not observed otherwise. They report that momentum returns are significant in stocks with high credit risk and remains unexplained when controlled for firm size, firm age, value, turnover, leverage, return volatility analysts forecasts dispersion, and cashflow volatility. Information uncertainty also fails to capture momentum effect. Avramov and Hore, (2008) document that momentum interacts with firm-level informational uncertainty measures and credit conditions. Avarmov and Hore (2008) report that equilibrium momentum concentrates in the interaction between risky cash flows and high credit risk firms. Momentum return deteriorates and eventually disappears as leverage or cash flow risk diminishes. They hypothesized that when highly persistent growth rate coupled with the high information uncertainty are present, the notion of long run risk, or cumulative risk over the investment horizon, emerges. The combination of long run risk and leverage generates the empirically documented concentration of momentum in stocks with high leverage and high information uncertainty[11]. They observe that the autocorrelation between past return and future expected return is positive and increases with leverage and uncertainty in growth rates.

Avramov, Chordia, Jostova and Philipov (2007) demonstrate that credit cycles are crucial in explaining the momentum return of credit rated stocks. Avramov et al (2007) show that there is a negative relation between credit risk and momentum returns which critically depends on credit cycles. The negative relation between credit risk and returns is driven by the poor price performance of low-rated stocks around downgrades. In particular, the relationship is observed solely during credit rating downgrade periods which are attributable to low credit rated firms that experience substantial price drops six months before and after credit rating downgrades. The financial performance of low credit rated firms deteriorate dramatically just before and after the downgrade. Furthermore there is no evidence of credit risk effect during periods of stable or improving credit conditions. The stock price drop around rating downgrades is

[11] According to Bansal and Yaron (2004) long run risk invokes high premium that is required for equity holding.

considerable among low-quality stocks, whereas high-quality firms realize positive returns around downgrades. Avramov et al (2007) conclude that it my be the differential response of low credit rated and high credit rated stocks to rating downgrades that gives rise to the negative relation between credit risk and stock returns. Other empirical work also uncovers momentum interactions. In particular, Hong, Lim, and Stein (2000) show that momentum profitability is especially prominent among small cap stocks.

Behavioral models explain momentum returns, uncertainty and behavioral biases. Hirshleifer (2001) and Daniel, Hirshleifer, and Subrahmanyam (1998, 2001) posit that psychological biases are high when there is more uncertainty. Daniel, Hirshleifer, and Subrahmanyam (1998) develop a model where investors overweight their private information and underreact to public signals (e.g., analyst forecast revisions) as they are overconfident about their private information. This suggests that, future returns are predictable. Daniel, Hirshleifer, and Subrahmanyam (1998, 2001) further argue that the return predictability should be stronger in firms with greater uncertainty as investors tend to be more overconfident when firms' businesses are difficult to value (e.g. high informational uncertainty). Hirshleifer (2001) argue investors' psychological biases are greater in stocks with higher informational uncertainty e.g. lack of accurate feedback about their fundamentals. Therefore, the misvaluation effects of almost any mistaken-beliefs model should be strongest among firms about which there is high uncertainty and poor information.

Chan, Jegadeesh, and Lakonishok (1996) attribute price continuation to a gradual market response to information. Combining the hypothesis of Chan et al (1996) and Hirshleifer (2001) and Daniel, et al (1998, 2001), Zhang (2006) investigate if slow market response to information is due to psychological biases such as overconfidence, these psychological biases will be larger and, hence, the price response will be slower when there is more ambiguity about the implications of the information for a firm's value. Zhang (2006) report that the initial market reaction to new public information is not complete and that the incompleteness of the market reaction increases monotonically with the level of informational uncertainty implying that investors tend to underreact more to new information when there is more ambiguity with respect to its implications for firm value.

Han, Hong and Warachka (2007) documents that their model momentum returns and learning and uncertainty explain behavioral biases. They report that investors optimally combines multiple forecasts to minimize mean-squared forecast error, but are overconfident and biased self-attributed when they assign higher (lower) weights to accurate (inaccurate) private cashflow forecasts relative to their public counterparts. Furthermore, since the investor learns about the accuracy of information sources using their past forecast errors, the information weights are path-dependent. Thus, trends in realized cashflow influence the investor's aggregate cashflow estimate, and induce the appearance of both representativeness and conservatism. They observe that momentum is stronger among stocks with high volatility of a firm's underlying fundamentals e.g. greater analyst forecast dispersion.

2.3.5 Momentum Returns and Unexplained Risk Factors

Recent studies reject the notion that momentum profits are compensation for risk by showing that momentum profits are mostly comprised of unexplained components that cannot be risk (which, according to standard theory, must entail non-diversifiable systematic variation). The literature therefore suggests that a large portion of momentum return generates from unexplained factors which can be attributed to stock-specific factors. Existing literature maintains that an unexplained source of momentum profits is more consistent with behavioral explanations for momentum.

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The two most noticeable work in this area includes Grundy and Martin (2001) and Kang and Li (2004). Both the study used lagged common components in their studies and show that common risk factors alone are not sufficient to explain momentum return. Grundy and Martin (2001) argue that the returns of momentum are attributable to stock-specific than to common components and they also show that the stock-specific return momentum strategy dominates the common component strategy in the total return-based momentum strategy and that the returns of momentum are attributable to the components of returns unexplained by the Fama-French three factor models.

Since a single common components is not strong enough to explain momentum effect, literature study whether the combined power of two or more factors and multi dimensional models can capture momentum phenomenon. Kang and Li (2004) develop a nested model of Chordia and Shivakumar (2002) and Grundy and Martin (2001) and document that the predictive intercept and the predicted returns contain both common factors and stock-specific component that explain momentum return. Kang and Li (2004) employ macro economic factors as well as the industry factors and show that even when controlling for the macro factors of Chordia and Shivakumar (2002) and the industry momentum of Grundy and Martin (2001), stock-specific component generates a significant portion of the momentum profit in the stock return. These authors develop models free from missing-factor problem and show that the stock-specific components explain momentum significantly than the common-factors.

Pang (2005) employ a dynamic asset pricing model of Ferson and Harvey (1999), Chordia and Shivakumar (2002) Griffin, Ji and Martin (2003) and Cooper, Gutierres and Hammeed (2004) and concludes that momentum phenomenon itself produces better performance and that the momentum factor cannot absorb the cross-sectional explanatory power of macro-factors or market related variables. In a recent study, Chichernea and Slezak (2008) find that by using an EGARCH-M, at the individual stock level, unexplained risk premia generates up to 90 percent of momentum returns. These authors also report that when momentum portfolios are formed by sorting on past unexplained risk premia it generates significantly positive profits.

2.4 Conclusion

This chapter provides in details the theories and empirical evidences related to momentum returns. The chapter describes the definition of momentum, momentum trading strategy and the profitability of momentum returns in different dimensions e.g. over time, across markets and among asset classes. The chapter provides empirical evidences on the rational theories that argue in favor and against the fact as to whether or not momentum returns are compensation for risk. The chapter also put forth earlier evidences which document that momentum returns are more a reaction to investors' psychological biases and are due to investors' under or overreaction to stock returns. Furthermore, the chapter lays down contradictory evidences along with a glaring lack of explanations in the literature in terms of (i) Whether or not momentum returns are compensation for both firm level and macro level risks and transaction cost, (ii) What contributes to momentum returns and (iii) Association between momentum returns and uncertainty. The gap in the literature that warrants an investigation on the above controversy in addressed in this thesis.

3 CHAPTER THREE: PORTFOLIO LEVEL ANALYSIS

3.1 Introduction

The focus of this study revolves around three research questions. First, is momentum return a compensation for risk? Second, what contributes to momentum returns and in which proportion? Third, are momentum returns of credit rated stocks compensation for macroeconomic risk? The empirical results of each of these questions along with the data and methodology used to derive the results are presented in the following four chapters. This chapter (the third chapter of this thesis) details data, methodology and empirical results on momentum returns are at the portfolio level. The analysis is named as 'Portfolio Level Analysis' due to the fact that momentum returns are calculated when priced at the portfolio level, e.g. the pricing of explained risk factors are considered at the time when momentum portfolios are formed.

3.2 Data and Methodology

In order to address the first questions of whether or not momentum return are compensation for risks at the portfolio level, it is necessary to decide a suitable research approach, to collect an appropriate set of data and to follow proper analytical procedures.

3.2.1 Data

The choice of an adequate dataset is of prime importance for a study on momentum strategy, in particular when the objective of the study is to investigate whether or not momentum returns are compensation for common explained risk factors. Therefore, for the purpose of the study data have been collected from the Centre for Research in Security Prices (CRSP) of all stocks listed in the three exchanges including, NYSE, AMEX and NASDAQ on a monthly basis. CRSP is one of the most renowned databases for stock prices and returns in the US market. It is the most authentic source of data with the highest level of accuracy and is unique from any other databases in terms of its depth for the daily and monthly stock history which dates back to 1925. Therefore the CRSP dataset remain one of the ideal sources to collect data for this study.

The sample period is from January 1926 through December 2006. All empirical analysis have been conducted on the entire sample period and then further investigation have been made on sub-sample periods (ten-year sub-period). The choice of the sub-periods is based on the consideration of sufficient observations and the availability of the data for the variables used in this study so that meaningful parameter estimates can be obtained. Furthermore, studies on historical stock performance can suffer from survivorship bias. Therefore the study of the sub-periods will help mitigate survivorship bias and also help examine if momentum returns and its interaction with risk factors varies in different sub-periods. For the purpose of the study the following selection criteria have been used for all four empirical chapters; following Jegadeesh and Titman (2001) all stocks that are priced above $1 have been selected, stocks that have non-missing observations at the beginning of the holding period and stocks that have at least six consecutive monthly return observations at the beginning of the holding period.

In the first empirical chapters, for the purpose of analyzing if momentum returns are compensation for risk at the portfolio level, price and return data of all stock traded in the NYSE, AMEX and NASDAQ have been collected from the CRSP dataset. The sample period studied for these three chapters is from January 1926 through December 2005 and the frequency of the data is collected on a monthly basis. The total number of months within this sample period is 960 months and the total number of stocks traded in all the three stock exchanges is 22277 stocks. This results in a total number of 21385920 observations.

3.2.2 Variables Employed

This section describes in details the variables that have been used for the purpose of this study. The study investigates both empirical and theoretical variables as well as business cycle variables.

3.2.2.1 Fama-French Three Factors

Fama and French (1993) developed three empirical factors which have been widely screened by researchers in the momentum literature. Fama-French three factors include return on CRSP value-weighted market index in excess of the one-month Treasury bill rate (MKT_RF), the small-minus-big size factor (SMB) and the high-minus-low book-to-market-ratio factor (HML). The justification of using these variables in the study is that there is controversy in the literature as to whether or not Fama-French three factors are compensation for momentum returns. For example, Fama-French (1996) and Grundy and Martin (2001) report that momentum returns remains once accounted for Fama-French three factors. On the other hand Wang (2003) show that momentum returns eliminates when macroeconomic variables are considered as time-varying conditional information for Fama-French three factors. These variables have been collected from Kenneth French's data library[12] for the period from July 1926 through December 2005. This results in a total number of 955 months.

3.2.2.2 Carhart Four Factors

Carhart (1997) develop a four-factor model by using Fama-French's (1993) three factors and an additional factor to capture the Jegadeesh and Titman's (1993) one year momentum anomaly. This four-factor model is in consistent with market equilibrium model and takes into account four risk factors. The coefficient of this factor-mimicking portfolio model indicates the fraction of mean return attributable to high versus low beta stocks, large versus small market capitalization stocks, value versus growth stocks and one year return momentum versus contrarian stocks. Though investigating momentum phenomenon and pricing momentum returns for several risk factors is common in literature, the use of momentum factor as a risk factor to price momentum return is quite unusual in earlier studies. We use this variable in our thesis to investigate if the momentum risk factor can explain momentum returns. Data for momentum of Carhart four-factor model has been collected from Kenneth French's data

[12] The data are available at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

library for the period from July 1926 through December 2005, which resulted in 955 months.

3.2.2.3 Macroeconomic Variables

For the purpose of the study, the macroeconomic variables as hypothesized by Chordia and Shivakumar (2002) have been employed. These include; dividend yield (DIV) which is the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the market index, the short rate (YLD) is the yield on the three-month Treasury bill, the term premium (TERM) is the yield spread of a ten-year Treasury bond over a three-month Treasury bill, the default premium (DEF) is the yield spread between Moody's Baa and Aaa rated bonds. Data on macroeconomic variables for the sample period have been provided by Jeff Pontiff. These four macroeconomic variables are the theoretical variables that have been widely studied in recent studies on momentum returns. Literature put forth contradictory evidences as to whether or not momentum returns are compensation for macroeconomic risk factors. For example, Chordia and Shivakumar (2002) show that momentum returns can be explained once the predictable components as measured by lagged macroeconomic variables are accounted for. On the other hand Cooper et al (2004) show that there is no evidence that macroeconomic variables can explain momentum returns.

3.2.2.4 Transaction Cost

Researchers study if momentum returns can be exploited when transaction costs are taken into account. Transactions costs that are largely considered in momentum literature can be categorized into two types (i) Proportional trading cost which includes the quoted and effective spreads and are independent of the size of the portfolio traded and (ii) Non-proportional trading cost which includes commissions, stamp duties and short-selling costs which are largely dependent on the size of the portfolio being traded, e.g. that the price impact of trading increases with the size of the portfolio.

The most widely screened transaction cost in momentum literature is the bid-ask spread or the quoted estimate cost (see among others Ball, Kothari, and Shanken (1995), Sadka, 2004 and Li, Brooks and Miffre, 2008). The advantage of using the bid-ask spread is that it is simple to estimate and can be measured with the least error. In this thesis we use only the proportional cost (bid and ask spread) as the analysis of non-proportional cost is beyond the scope of this thesis. We collect data of bid-ask spread from CRSP for the period from 1926 through 2005 on a monthly frequency. At the end of each month we collect the bid-ask spread for each stock which result in a total number of 21385920 observations for 22277stocks for over 960 months.

3.2.3 Statistical Properties of the Data

Table 1 reports the summary statistics for Fama-French three factors and macroeconomic factors, the two main risk factors that have been used in all empirical chapters of this thesis. In panel A of Table I column one reports the four moments of each of the seven variables use in this study, whilst column two through column six represents the descriptive statistics of Fama-French three factors and the last four columns describe that of the four macro economic variables. The table clearly displays that the distribution for neither of the variable is normal. For example the four moments of the variable Mkt_Rf is 0.64, 5.46, 0.22 and 10.81 respectively which implies that the distribution of Mkt_Rf is positively skewed and leptokurtic. This result is consistent with the findings of Kang and Li (2004) who report that for a sample period from 1926 through 2002 in their study, the four moments of Mkt_Rf are 0.62, 5.52, 0.22 and 10.54, respectively. Similar to Kang and Li (2004) we report that among the three Fama-French factors SMB has the heaviest right tail with skewness of 2.22 and a high peak with kurtosis of 25.20. The distribution of HML is rightly skewed (skewness=1.86) and leptokurtic (kurtosis=18.49).

Carhart’s (1997) fourth factor, momentum, the four moments show that mean is 0.008 and standard deviation is 0.047, representing quite a low riskiness of the data. The higher moments e.g. skewness and kurtosis are -3.00 and 31.33 respectively indicating that the heavy left tail and has the highest peak.

Consistent with the Fama-French three factors as explained above none of the macroeconomic variables is normally distributed. DIV with a positive skewness of 1.63

and kurtosis of 7.98 is a fat right tailed and sharply peaked variable. The distribution of YLD also deviates from normal distribution with the four moments of 3.74, 3.14, 0.87 and 3.49, respectively. These findings are also similar to that reported by Kang and Li (2004) who report that the skewness and kurtosis of YLD are 0.95 and 4.00, respectively. TERM is with a fat left tail (skewness of -0.03) and very close to mesokurtic distribution (kurtosis=3.26). The third and fourth moments of DEF is 1.12 and 4.13, respectively implying that the variable has a heavy right tail and slightly peaked distribution.

[Insert Table 1 Here]

Panel B of Table 1 represents the correlation among the Fama-French three factors, Carhart four factors and macroeconomic variables. As apparent from the table, Mkt_Rf is positively related with SMB, HML and DEF but is negatively related to all other variables. SMB and HML are mostly positively correlated with other variables. The variable momentum seems to have a negative relation with other variable though not very strong. On the other hand, the correlation among DIV and YLD and TERM and those with other variables are mixed. Nevertheless, among the four macroeconomic variables only DEF has a positive correlation with all other variables.

3.2.4 Methodology

At first the thesis examines if momentum returns are compensation for risk at the portfolio level. This has been done first by measuring momentum returns using the conventional method following Jegadeesh and Titman (2001). Then an independent multi-factor regression model has been employed (1) At the portfolio level (2) By using both the contemporaneous and the lagged variables and (3) By using both firm level factors and that of the macroeconomic factors.

In order to measure if momentum return is compensation for risk at the portfolio level, at first, momentum returns are measured by using the conventional method of Jegadeesh and Titman (2001). Thereafter the momentum returns are regressed against the common risk factors used in this study in a multi-factor regression model.

3.2.4.1 Measuring Momentum Returns at the Portfolio Level

According to the momentum strategy of Jegadeesh and Titman (2001) at any time period t in the sample period, stocks are selected based on the past four quarters of the returns i.e. 3, 6, 9 and 12 months past return. Then the stocks are ranked based on these quarters, also known as the formation period and symbolized as J periods. These stock returns are then sorted in ascending order and ten equally weighted deciles portfolios are formed. The two extreme deciles portfolios i.e. the top deciles portfolio (Decile1) contains the stocks with the lowest average J period returns, termed the loser portfolio whilst the bottom deciles portfolio (Decile10) contains the stocks with the highest average *J* period returns, termed the winner portfolio[13]. According to the momentum strategy, we than take a long position in the winner portfolio and a short position in the equal size of the loser portfolio and hold the position over the following *K* month period where *K* is defined as the holding period. At the end of the holding period (t^*) momentum return (Momentum return is the difference between the return on winner portfolio and loser portfolio) is realized. Again following Cooper Gutierres and Hammeed (2004) a month time period is skipped between the formation and holding period[14]. An illustration of momentum return using conventional method is given in Appendix E.

In this study for each month *t*, all NYSE/AMEX stocks on the monthly CRSP database with returns for months $t \bullet 5$ through $t \bullet 1$ (formation period) have been ranked into decile portfolios according to their compounded returns during the formation period. The Winner and Loser portfolios are equally-weighted portfolios of the ten percent stocks with the lowest and highest returns over the pervious formation period, respectively. The momentum strategy longs the winner portfolio and shorts the loser portfolio and holds the position for the following holding period (*t+1 through t + 6)*. Since the CRSP dataset include missing values (no trading) we consider all stocks that have non-missing values at the beginning of the holding period (see also Hon and Tonks (2001)). Therefore at t^* momentum return is calculated as the difference between the return from the winner portfolio and the loser portfolio. The equation is as follows

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[13] In literature these two extreme portfolios are termed as P1 and P10, respectively. Some literatures also define those as the return on winner and return on loser or largely “winner” and “loser”.

[14] This convention of skipping a month is widely utilized in recent literatures so as to avoid bid-ask spread, price pressure, and lagged reaction effect. The time period may sometimes vary i.e. Jegadeesh and Titman (1993) skip a week.

$$MR_{t^*} = R_{t^*}^{WP} - R_{t^*}^{LP} \tag{1}$$

To measure momentum returns excluding penny stocks we follow the same procedure as above except that we screened out all stocks that were traded for a dollar or less. Following Cooper, Gutierres and Hammeed (2004) stocks priced below $ 1 (also known as penny stocks) are excluded at the beginning of the holding period.[15]

To measure momentum returns excluding transaction cost we use the above methodology. We collected the bid-ask spread from the CRSP dataset which measures the quoted bid-ask spread as the difference between the quoted ask and bid prices. In order to mitigate the effect extremely high or low spreads we screened out all stocks having negative or more than 100% spread. We also exclude all stocks that are priced at one dollar or less and exclude all stocks that have missing value at the beginning of the holding period.

3.2.4.2 Regressing Momentum Returns at the Portfolio Level

To test the hypothesis if momentum returns are compensation for common explained risks the following multi-factor regression model have been used

$$MR_{t^*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t^*} + \varepsilon_{t^*} \tag{2}$$

[15] Jegadeesh and Titman (2001) exclude $5 using a sample period of 1965-1990 where stocks with a price of dollar five can be can largely considered as a small or illiquid stock. Whereas, in this study, the sample period is from 1926- 2005, where stocks with a price of $5 during the earlier period i.e. from 1926 to 1965 may not be treated as small or illiquid stocks. So we restrict the specification to $1 to keep a reasonable balance throughout the sample period.

$$MR_{t^*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t^*-1} + \varepsilon_{t^*}, \qquad (3)$$

where, $MR_{t^*,6x6}$ [16] is the momentum return generated by using the conventional method of Jegadeesh and Titman (2001) with a *JxK=6x6* strategy, f_{t^*} and f_{t^*-1} are the vectors respectively for the common components as contemporaneous and as lagged values of risk factors, respectively, where the risks factors are (1) Fama-French three factors and the risk-free rate is adjusted already (2) Macroeconomic risk factors and (3) Carhart (1997) four factor, β_j (*j*=1,….,n) is the vector for risk factors and α and ε_{t^*} are the constant and the residuals, respectively. $E(\varepsilon_{t^*}) = 0$, $Cov(\varepsilon_{t^*}, f_{t^*}) = 0$ and ε_{t^*} ~ *iid (0,•²)*. The hypothesis is tested as follows:

Test 1: The test is if Fama-French three factors can explain momentum return at the portfolio level. Hence the hypothesis is as follows:

H0: • = 0; There is no momentum return after adjusting for the Fama-French three factors and therefore momentum returns are compensation for risk.

H1: • • 0

If the common component can explain momentum return then it is expected to find the intercept of the regression model equal to zero.

Test 2: The test is if Carhart's four factor variables can explain momentum return. Therefore the hypothesis is as follows:

[16] We define *t** as the time period when momentum return is realized following Jegadeesh and Titman (1993, 2001) with a strategy of *JxK= 6x6*

H0: • = 0; There is no momentum return after adjusting for the Carhart's four factors and therefore momentum returns are compensation for risk.

H1: • • 0

Test 3: The test is if the macroeconomic variables can explain momentum return. Therefore the hypothesis is as follows:

H0: • = 0; There is no momentum return after adjusting for the macroeconomic factors and therefore momentum returns are compensation for risk.

H1: • • 0

At the portfolio level, by examining the alpha in the regression model it is evaluated whether or not momentum return are compensation for risks, suggesting that an expectation of zero alpha in the regression.

3.3 Empirical Results on Portfolio Level Analysis

3.3.1 Measuring Momentum Returns at the Portfolio Level

This section describes the momentum returns at the portfolio level. It is generated by all stocks in the NYSE, AMEX and NASDAQ during the sample period from January 1926 through December 2006 using the conventional momentum strategy as documented by Jegadeesh and Titman (2001). The empirical results are drawn from Equation 1 as described in section 3.6.2.1. The analysis is robust to variables employed e.g. (1) Firm level factors (2) Macroeconomic risk factors; the phases of variables e.g.

(3) Contemporaneous variables and (4) Lagged variables and to the time period e.g. (5) Whole sample and (6) Different Sub-periods of sample.

Panel A of Table 2 reports the monthly momentum returns estimated over the entire sample period and in several sub-periods using the conventional method of Jegadeesh and Titman (2001). Column one and two represents the returns on the Loser and Winner portfolios, respectively. Column three reports momentum returns which is defined as the difference between the loser and winner portfolio. Column four, 'Decile Portfolio Size' represents the average number of stocks in the decile portfolio (loser as well as winner) during each sub-period.[17] Column five titled '%>0' reports the total percentage of the momentum return that is greater than zero in different sample period. In calculating momentum return, first momentum return for the entire sample period from 1926 through 2005 have been estimated and then sub-divide the sample period into eight sub-periods. Though the total number of months in the sample period is 960 (from January 1926 through 2005), due to the *JxK=6x6* strategy and also skipping a month, in total *J+K-1* (11 months) number of months is lost. The first momentum return is realized at the end of the holding period (*J+K=12 month)*. Therefore when the entire sample period is considered the total number of months is brought down to 949 months. Hence during the sub-period 1926 through 1935 the total number of months is 109 (lost 11 observations). Thereafter in all subsequent sub-periods the total number of months is 120.

As shown in Panel A of Table 2 during the entire sample period from 1926 through 2005 monthly momentum return is 0.79 percent (an average of 9.50 percent per

[17] As portfolio is rebalanced in each month we report the average number of stocks included in the decile portfolio during each sub-period.

annum) and is statistically significant. The average portfolio size is 218 stocks. Furthermore 71.88 percent of this momentum return is greater than zero. This is close to the corresponding momentum returns in the study of Kang and Li (2004) who report that from 1926 through 2002, an average of 0.761 percent (9.13 percent annually) momentum return is generated per month. During the early period, from 1926 through 1945 momentum return seems to be relatively low and insignificant. The lowest momentum return of 0.05 percent per month is generated in the sub-period 1936-1945 which is largely due to the market downturn during late 1920s and early 1930s. Also in these two sub-periods the number of stocks in the decile portfolio and the percentage of momentum return that is greater than zero is the lowest among all other sub-periods. In general, after 1946 in all subsequent sub-periods momentum return appears to be close to 1 percent per month and is statistically significant and which is consistent with the findings of Jegadeesh and Titman (1993, 2001).

The highest momentum returns are in the sub-period 1976-1985 of 1.30 percent per month with average portfolio size of 228 stocks. The percentage of positive momentum return during this period is 76.67 percent. Furthermore as time approach to the end of the sample period the size of the decile portfolio augments since more stocks became available in the market in later years. Nevertheless, with the highest number of stocks in the decile portfolio of 559 stocks, the last decade generate only a trivial amount of 0.34 percent momentum return. Correspondingly, Kang and Li (2004) report that momentum profit tends to be only marginally significant in the sub-period 1990-2002. This finding is consistent with Henker, Martens and Huynh (2006) and Hwang and Rubesam (2007) who report momentum return to disappear after 2000s.

[Insert Table 2 Here]

3.3.2 Robustness: Measuring Momentum Returns in Other Sample Periods.

For robustness, momentum returns measured by earlier studies in different sub-periods have been replicated in the sample period of this study. This allows comparing the empirical results of this study with that of he earlier evidences.

3.3.2.1 Measuring Momentum Returns Using the Sub-sample period of Chordia-Shivakumar (2002) and Jegadeesh-Titman (1993) and Other Authors in Earlier Studies

The two renowned studies in the momentum literature are Chordia and Shivakumar (2002) and Jegadeesh and Titman (1993). Panel A of Table 3 reports momentum returns generated when using *JxK=6x6* strategy with the sub-period in the study of Chordia and Shivakumar (2002). The empirical findings confirm momentum returns reported by these authors in different sub-periods. It is evident from the table that the monthly momentum returns is 0.23 percent for the whole sample period from 1926 to 1994. This finding is very close to that reported by Chordia and Shivakumar (2004) who report momentum returns of 0.27 percent per month for the same sample period. In particular, the most significant momentum return is generated in the period 1951-1963 of 0.88 percent while the lowest is reported in pre-1950s from 1926 through 1950 of -0.19 percent. Correspondingly, Chordia and Shivakumar (2002) document 0.83 percent return in the post-1950s while that comes down to -0.61 percent in pre-1950s. The trend of a declining momentum return during the last quarter of the millennium is also evident from the table. For example, an average of 0.67 percent return is generated during the period 1964-1994 while Chordia and Shivakumar (2002) find a return of 0.73 percent for the same period.

[Insert Table 3 Here]

The different strategies of momentum return as examined by Jegadeesh and Titman (1993) have also been replicated. Consistent with the findings of these authors it is documented that momentum returns are all positive and significant over the sample period from 1963 through 1989. Also as evident from Panel B of Table 5, in different combinations of *J* (formation period) and *K* (holding period) an average of 1 percent momentum return can be generated. Following Jegadeesh and Titman (1993) it is also shown that the strategy of *JxK =3x3* earns the lowest return. It is evident that momentum returns is 0.65 percent for this strategy while Jegadeesh and Titman (1993) reports 0.73 percent per month for the same strategy. There is only one difference, though not significant, with the results of Jegadeesh and Titman (1993). The zero-cost strategy that worked best for this study is the one with a strategy of *JxK =9x3,* an average of 1.03 percent return is generated, while Jegadeesh and Titman (1993) document that the highest return of 1.49 percent is generated from the strategy with a formation period of twelve months and holding period of three months, (*JxK =12x3).*

Whilst most of the findings of Chordia and Shivakumar (2002) and Jegadeesh and Titman (1993, 2001) have been reconfirmed, there are small discrepancies between this study and the two previous studies. These deviations may results due to differences in methods and approaches especially in case of handling missing values during the formation and holding period. For instance, there are a considerable number of periods in CRSP dataset when a particular stock was not traded and hence no price record exists.[18] A number of alternative approaches are in practice by researchers in solving this missing-value problem. Each of these approaches of solving the missing values has significant influence on momentum return estimation. Though we follow the conventional method of including only non-missing value stocks in this study, the approaches employed in previous literatures are not clear-cut.

Another reason for differences in estimates can be attributed to data selection procedure and method. For example, we use monthly return of all stocks listed in the NYSE, AMEX and NASDAQ stocks on CRSP. However Jegadeesh and Titman (1993) used a daily frequency of the same dataset and obtained the monthly return by compounding the daily returns. Again these authors skipped a week between the holding and the formation period to mitigate the spurious negative autocorrelation due to the bid-ask bounces, Chordia and Shivakumar (2002) reported their results without skipping a month whilst this study skipped a month in between the formation and the holding period.

To summarize, the empirical evidence show high momentum return for a period of fifty years from 1946 to 1995. Momentum return is comparatively low during the two end of the sample period e.g. pre-1950s and post 1995s. Particularly during the period of C-S (2002) momentum return is statistically and economically significant. The pattern of momentum phenomenon is quite allied with the business cycle. The return is

[18] The most common is to consider only non-missing value stocks in the portfolio and exclude all stocks with any missing value either during the formation period or in the holding period or both. Other approaches includes Simple Approach (If a particular month has no trading then the last recorded price is used for calculating the return). Unconditional mean approach allows that any missing return observations during the period when it was listed on the stock exchange are replaced with the sample estimate of the unconditional mean return. Finally, Regression approach assumes that returns are generated by a factor model and missing returns are replaced with the predicted return obtained from the regression equation. For more details see Hurn and Pavlov (2003)

high during periods when US stock market is rising and generates low returns when market is falling. These views are consistent with many previous literature that established that the profitability of momentum strategy and documented its link with the market movements (see among others Chordia and Shivakumar, 2002; Cooper, Gutierres and Hammeed, 2004 and Avramov and Chordia, 2005).

For robustness other sample periods examined by several earlier researchers have been examined. It is evident that an average of 1.14 percent monthly momentum return during the period 1965 through 1989 which is close to the corresponding momentum return of 1.10 percent in the original Jegadeesh and Titman (1993) sample period. Likewise, Kang and Li (2004) document an average of 1.15 percent monthly momentum return in the same sub-period. Again literature examined momentum return from pre-1950s and post-1950s point of view (see among others Chordia and Shivakumar, 2002 and Kang and Li, 2004). Following those sub-periods, it has been reported that momentum return tends to exhibit significant returns during post- 1950s than pre-1950s. For instance, during the pre-1950s monthly momentum return on average is only 0.45 percent and insignificant. Conversely, during the post-1950s, a significant amount of 0.91 percent momentum return is generated. On the contrary, Chordia and Shivakumar (2002) report a much smaller momentum return of -0.61 percent during the pre-1950s momentum return which is brought up to 0.83 percent in the sub period 1951-1963 and 0.73 percent in 1963-1994 (an average of 0.78 percent in these two sub-periods). Similarly, Kang and Li (2004) document an average of 0.11 percent momentum return during pre-1950s which climbed to 1.04 percent on average after 1950s. Also during the pre-1950 the total percentage of positive momentum return greater than zero is 66.55 percent while that in post-1950 is 75.67 percent.

3.3.2.2 Momentum Returns Excluding Penny Stocks

It is possible that the momentum return as estimated in Table 2 may not reflect the actual return which can be realized by an investor, due to the inclusion of illiquid stocks. This problem of illiquid stocks is corrected by excluding all stocks that were traded for a dollar or less. Following Cooper, Gutierres and Hammeed (2004) stocks priced below $ 1 (also known as penny stocks) are excluded at the beginning of the holding period. Table 4 reports momentum returns excluding penny stocks. Though in the full sample period momentum returns excluding penny stocks are slightly higher than that of the momentum returns inclusion of penny stocks, across different sub-periods in six out of eight sample periods momentum return shrinks when penny stocks are excluded from the sample.

Intuitively, with the exclusion of penny stocks, the average decile portfolio size declines in both the entire sample period as well as in all sub-periods. On average in different sub-periods the number of stocks in the decile portfolio went down by 15 percent. Consistent with the earlier findings weak momentum returns are reported during the sub-periods 1926-1935 and 1935-1945 while a significant momentum return of 12 percent per annum (on average) after 1945. In particular, momentum return is high during the sub-period 1965-1989 of 1.24 percent. It is also confirmed that momentum return are more pronounced in post-1950s compared to pre-1950s. For instance, during the post-1950s average momentum return is 1.14 percent while that is 0.48 percent in pre-1950s. Since momentum return after removing penny stocks confirms that the consistent results are not driven by less liquid stocks this method is used to generated momentum returns throughout this paper.

[Insert Table 4 Here]

3.3.2.3 Momentum Returns Excluding Transaction Cost

Table 5 reports the momentum returns when transaction cost (bid-ask spread) is taken into account. As evident from the table, during the entire sample period momentum returns is 0.16 percent per month (1.92 percent per annum) and is significant at 5 percent level. Notably, when transaction cost is considered momentum return reduces significantly. For example, momentum return excluding transaction costs is only 0.16 percent per month which is 5.6 times less than that of the momentum return including transaction cost of 0.898 per month in Table 4. This evidence is consistent with earlier studies (see among others Korajczyk and Sadka 2004 and Ellis and Thomas, 2004) who report that momentum returns diminishes significantly when transaction costs are taken into account but do not eliminate. During the entire sample period the average size of momentum portfolio was 195 stocks and 67.98% of the momentum return was positive.

In different sub-period momentum returns are observed to be significant during the post-1950s e.g. in sub-periods 1956-1965, 1966-1975 and 1976-1985 momentum returns are 0.34 percent per month, 0.059 percent per month and 0.509 percent per month, respectively and are statistically significant. This is consistent with our findings in Table 2 and Table 4 where momentum returns are positive and significant during the post-1950s period. In the last two sub-periods e.g. in 1986-1995 and 1996-2005 momentum returns are negative. This implies that momentum returns are possible to exploit even after considering the transaction cost, particularly in periods of market upturn. Furthermore the size of the momentum portfolio also increases as the sample period moves from the early period towards the end of the sample period where more stocks became available to be included in the portfolio formation. However, it would be interesting to observe how momentum returns behave when both proportional and non-proportional transaction costs are taken into account. In addition, the impact of transaction cost on the portfolio size and total turnover can be addressed in future research.

Figure 1 presents momentum returns over time. It can be seen from the figure the momentum returns are linked to business cycle. In particular, during market crisis the variation in momentum return is dramatic. For instance, during market downturn in the sub-periods 1926-1935, 1966-1975 and 1995-2005 momentum return performed poorly, whereas from post 1950s to mid 1990s momentum return is comparatively high.

[Insert Figure 1 Here]

To summarize, the empirical evidence show that when momentum returns are measured using the conventional method of Jegadeesh and Titman (2001) for the sample period from January 1926 through December 2005 strong momentum returns of 0.91 percent per month are observed during the post-1950s compare to it's counterpart of only 0.45 percent per month during pre-1950s. This implies that the pattern of momentum phenomenon is allied with the business cycle. In particular, during market downturn the variation in momentum return is dramatic. For instance the trend of momentum returns over time depicts that momentum returns are comparatively weak during the two end of the sample period e.g. pre-1950s and post 1995s when most market crisis are observed in US market.

When momentum returns are measured using the sub-periods of earlier authors, consistent results are reported. Though most of the findings of Chordia and Shivakumar (2002) and Jegadeesh and Titman (1993, 2001) have been reconfirmed, there are small discrepancies between this study which is mainly due to differences in methods and approaches especially in case of handling missing values during the formation and holding period.

It is observed that momentum returns remains after taken into account penny stocks and transaction costs. When momentum returns are measured excluding penny stocks, the results do not differ much from the earlier findings of more pronounced returns during post-1950s compared to pre-1950s except that momentum returns shrinks in some sub-periods. When transaction cost is considered momentum return reduces significantly during the entire sample period and in most sub-periods but do not eliminate entirely.

3.3.3 Regressing Momentum Returns at the Portfolio Level

In this section it is examined if momentum return disappears after adjusting for common components through confirming the hypothesis of a zero alpha in a multiple-regression model at the portfolio level. At first, it is examined if momentum returns remains after adjusting for Fama-French three factors and thereafter it is examined when controlling for macroeconomic variables.

3.3.3.1 Is Momentum Returns Compensation for Firm Level (Fama-French Three Factors) Risk Factors?

Using Equation 2 as described in section 3.2.4.2 momentum returns are regressed on Fama-French three factors. Since the distributions of both the Fama-French three factors are non-normal (as reported in Table 1) and also as the residuals are heteroskedastic, coefficient of the regression are derived from White's heteroskedasticity consistent coefficient covariance. Panel A of Table 6 reports the average coefficients of the regression when the common components are the contemporaneous Fama-French factors on momentum return with a strategy of *JxK= 6x6* and excluding penny stocks. Momentum return are first regressed on Fama-French three factors for the full sample period from 1926 through 2005 and then in each sub-periods. Column two through column five represents the coefficients on the intercept (alpha), Mkt_Rf, SMB and HML and the last column reports the adjusted R-squared of the regression. Panel A of Table 6 shows strong evidence of statistically significant alpha of 0.01 (t=11.64)[19] during the full sample period. However, the coefficient on the three Fama-French factors, Mkt_Rf, SMB and HML are 0.01, -0.03 and -0.02, respectively neither of which are statistically different from zero.

In different sub-periods results, Panel A shows that in six out of eight sub-periods alpha is positive and significant, and more pronounced during the post-1950s. For example, in sub-periods 1946-1955, 1956-1965, 1966-1975, 1976-1985, 1986-1995

[19] All estimates are rounded to nearest figure.

and 1996-2005 alphas are 0.01, 0.01, 0.01, 0.01, 0.02 and 0.01, respectively all of which are statistically significant at one percent level. Conversely, alphas during the pre-1950s are comparatively weak e.g. in sub-periods 1926-1935 and 1936-1945 alphas are 0.01 and -0.001 and are not statistically different from zero. Similar to the findings of Jegadeesh and Titman (1996) who report that the coefficient of Fama-French three factors are negative when regressed against momentum return during the post 1950s. All the three factors of Fama-French are statistically insignificant with the exception of HML which is significant in the sub-periods 1976-1985 and 1986-1995 with coefficients of -0.15 and -0.13, respectively. The above evidence of positive and significant alphas suggests that significant momentum return remains after adjusting for the Fama-French factors.

[Insert Table 6 Here]

Momentum literature claims momentum return is explained once the predictable components of stock returns when measured by lagged variables are considered (see Chordia and Shivakumar, 2002). One may naturally argue that the results in Panel A of Table 6 might differ if the predicted Fama-French three factors as measured by the lag of these variables are accounted for. This is answered by re-estimating the results in Panel B of Table 6. Panel B of Table 6 reports the empirical results when using Equation 3 in section 3.2.4.2 where the risk factors are the lagged Fama-French three factors. The table reports that the conclusion of a positive and statistically significant alpha remains unchanged even when the predictable components of the stock returns are accounted for. In terms of alpha the results in Panel B of Table 6 show that during the entire sample period alpha is positive and significant 0.01 (t=11.91). However the use of lagged variables changes the signs of the coefficients which indicates systematic differences across momentum return when exposed to Fama-French three factors as contemporaneous and lagged variables, though not statistically significant.

Panel B of Table 6 confirms the earlier findings that momentum returns are particularly strong in post-1950s than in pre-1950s. For example, in the sub-periods 1946-1955, 1956-1965, 1966-1975, 1976-1985,1986-1995 and 1996-2005 alphas (t-statistics) are 0.009 (8.64), 0.011 (12.10), 0.007 (3.75), 0.014 (9.01), 0.016 (10.04) and 0.011 (5.33), respectively, while in the sub-period 1926-1935 and 1936-1945 alpha are e.g. 0.007 and -0.002, respectively, which are not significant. The results are consistent in terms of the three Fama-French factors. For instance, in all sub-periods the coefficient on Mkt_Rf and SMB are insignificant except HML which is significant in the sub-periods 1956-1965, 1976-1985,1986-1995 with coefficient of -0.116, -0.136, -0.192 and -0.171 , respectively. Noticeably, adjusted R-squared improves when lagged Fama-French factors are used compared to contemporaneous variables. This partially supports the explanation of earlier evidence that momentum return is better (though not entirely) explained when predicted variables are accounted for.

The findings supplements to momentum literature in two ways; Firstly, it is reported that alpha is positive and significant in different sub-periods and more pronounced during the post-1950s and pre-2000s. Earlier studies that report similar findings of the failure of Fama-French three-factor to explain momentum return, on average, considered a whole sample period. For instance, Jegadeesh and Titman (2001) study the effect on the whole sample period from 1965 to 1989, Fama-French (1996) examined from 1963 through 1993. In this regard our study adds to momentum literature that the results are consistent and significant and are unique in each sub-sample period. Secondly, the empirical results are more pronounced during the post 1950s than pre-1950s, suggesting that the wave of the economic condition has influence on momentum returns. Thirdly, it is shown that even when Fama-French factors are employed as predictor variables the conclusion of statistically significant alpha does not change. This finding leaves room for researchers to rethink about the association between predictor variables and momentum return.

3.3.3.2 Is Momentum Returns Compensation for Carhart Four Risk Factors?

Carhart (1997) introduced an additional risk factor to Fama-French (1993) three factors which captures the one year momentum anomaly of Jegadeesh and Titman (1993). This fourth factor takes into account the momentum effect on stock returns. Considering momentum as a risk factor to account for momentum returns in stock is not very common in momentum studies. In only one study Kang and Li (2007) provides an evidence of the asset-pricing implications of a momentum factor. The intuition of using momentum as risk factors arises from the theoretic asset-pricing implication of a given variable being a factor. The justification is that if momentum returns are compensation for risks then the empirically constructed momentum factor should explain momentum returns. If, on the other hand, momentum returns are not compensations for risks then momentum as a risk factor is unlikely to have any cross-sectional pricing power beyond the momentum portfolios. We test in this thesis if our empirically constructed momentum returns are compensation for momentum risks.

Table 7 reports the empirical findings when our empirically constructed momentum returns are regressed on Carhart four factors. Panel A of Table 7 reports when the four factors are used as a contemporaneous variables and Panel B reports when those are used as lagged variables. As is evident from Panel A of Table 7 during the entire sample period alpha is 0.01 percent per month (0.12 percent per annum) and is statistically significant. This indicates that momentum returns remain after accounting for momentum risk factor. Among the four risk factors, the coefficient of Mkt_Rf and MOM are 0.04 percent and 0.12 percent, respectively and are significant during the entire sample period. This implies that the market premium and the momentum factors have significance influence in explaining momentum returns. During the different sub-period alpha is significant in four out of eight sub-periods and particularly during the post-1950s. For example, in the sub-periods 1956-1965, 1976-1985, 1986-1995 and in 1996-2005 alphas are significant. Interestingly, during these sub-periods the coefficient of momentum is also significant, indicating strong influence over momentum returns. This result is consistent with the study of Kang and Li (2007) who report that during the sub-period from 1965-1989 momentum returns is observed to be strong and that momentum factor display quantitatively strong correlation patterns.

Panel B of Table 7 reports that momentum returns remains when priced for the lagged momentum risk factor. It is evident from the table that during the entire sample period alpha is statistically significant of 0.01 percent per month (0.12 percent per annum). Noticeable the coefficient of MOM is 0.13 percent per month and is significant, indicating its strong influence on momentum returns. During the different sub-periods alpha is significant in five out of eight sub-periods and are mostly observed during the post 1950s. Among the four variables the coefficient of MOM is significant in almost all sub-periods. The findings from Table 7 clearly indicates that momentum returns are not compensation for Carhart's four factors risk and that momentum returns remain once accounted for these risk factors. Nevertheless, it is to be noted that the coefficient of MOM has significant influence in explaining momentum returns.

3.3.3.3 Is Momentum Returns Compensation for Macroeconomic Risk Factors?

The empirical results in Table 6 hold when the only common components are the Fama-French three factors. Chordia and Shivakumar (2002) claim that momentum return can be explained by a parsimonious set of macro economic variables, when the lagged of these variables, are employed at the individual stock level. Motivated by this fact the following section provides evidence on whether the alpha is zero when macroeconomic factors are the common components in the regression model.

Panel A of Table 8 reports the empirical results when Equation 2 as described in section 3.2.4.2 is used to regress momentum returns over contemporaneous macroeconomic variables. The table shows that when contemporaneous macroeconomic variables are used alpha is 0.02 (t=12.63) and significantly different from zero during the entire sample period. One the other hand, the coefficients of all the macroeconomic variables are negative except that of DIV which is positive but insignificant. In the entire sample period only the variable TERM is statistically significant with a coefficient -0.004 (t=-4.63). Similar to the findings of Table 3 except in the sub-period 1936-1945, alpha is positive in all other sub-periods and statistically significant in the post-1950s. For example, in the sub-periods 1946-1955, 1956-1965, 1966-1975, 1976-

1985, 1986-1995 and 1996-2005 and alpha (t-statistics) is 0.01 (9.59), 0.01 (11.31), 0.001 (3.23), 0.01 (8.85), 0.02 (10.42) and 0.01 (8.292), respectively.

[Insert Table 8 Here]

On average the macroeconomic variables are insignificant across different sub-periods except YLD and DEF which are significant in only two sub-period 1986-1995 with coefficient of -0.01 (t=-2.57) and 0.07 (t=3.11), respectively. The above findings of positive and significant alpha confirm that momentum return remains even after adjusted for the market wide contemporaneous macroeconomic factors at the portfolio level.

Panel B of Table 8 reports the results when equation 3 of section 3.2.4.2 is used to regress momentum returns against the lagged macroeconomic variables. The table shows that in the full sample period alpha is significantly different from zero with coefficient 0.01 (t=2.06). Among the four macro economic variables only TERM is significant with a coefficient -0.003 (t=-4.17). Again alphas in the post 1950s are stronger than in pre-1950s. For example, in sub-periods 1946-1955, 1956-1965, 1966-1975, 1976-1985, 1986-1995 and 1996-2005 alphas are 0.01, 0.01, 0.01, 0.01, 0.02 and 0.01, respectively and are all significant at one percent level. The coefficients of all other macroeconomic variables are insignificant in different sub-periods except DIV in the sub-period 1956-1965 with coefficient of 0.02 (t=2.61) and DEF in the sub-period 1986-1995 with coefficient of 0.06 (t=2.18) are significant. In terms of the signs of the coefficients we differ with Chordia and Shivakumar (2002) only insignificantly for DIV and DEF, as those authors report a positive relation while we document negatively linked with momentum return. This possibly is due to the methodological differences e.g. exclusion of penny stocks, handling of missing values and the use of different sub-sample period.

Overall, the empirical results reject the hypothesis of a zero alpha when lagged macroeconomic variables are used as claimed by Chordia and Shivakumar (2002) and suggest that momentum returns are not compensation for risk at the portfolio level when macroeconomic risk factors are used. However the adjusted R-squared improves when lagged variables are used, indicating that the macroeconomic variables have some explanatory power in explaining momentum returns.

3.4 Conclusions

Chapter three of this thesis answers the first question of the study as to whether or not momentum returns are compensation for explained risk factors at the portfolio level. The empirical results of this question summarizes the following answers; Firstly, stocks traded in the NYSE, NASDAQ and AMEX over the period from 1926 through 2005 earns momentum returns of 0.8 percent per month (9.6 percent per annum). Momentum returns is predominantly high and earns more than 1 percent per month during the post-1950s compared to its counterpart in pre-1950. Particularly during the period in the study of Chordia and Shivakumar (2002) e.g. from 1951-1994 momentum returns are statistically and economically significant. The results that momentum strategy earns a return of around 1 percent per month is consistent with several earlier studies e.g. by Jegadeesh and Titman (1993), Chordia and Shivakumar (2002), Kang and Li (2004) who also report momentum returns are approximately 1 percent per month (12 percent per annum). This also holds when penny stocks are excluded and transaction costs are taken into account. In both cases though momentum returns reduces significantly but do not eliminate entirely.

Secondly, the pattern of momentum returns is associated with the business cycle. The return is high during periods when US stock market is rising and generates low returns when market is falling.

Finally, momentum returns are not compensation for Fama-French three factors at the portfolio level. It is reported that statistically significant alpha of 0.01 percent remains when controlled for these firm level risk factors. The results are also robust when lagged Fama-French factors are considered. When Carhart four-factor model is considered with the fourth factor as momentum, momentum returns remains. We report a significant alpha of 0.01 percent per month when momentum is considered as a risk factor. However the risk factor momentum has significant influence in explaining the empirical momentum return both during the entire sample period and in different sub-periods. Finally, momentum returns remain when controlled for macroeconomic variables. When macroeconomic variables are considered a significant alpha of 0.02 percent is reported. The result of positive and significant alpha is also robust when lagged macroeconomic variables are used.

3.5 APPENDIX A: Empirical Tables on Portfolio Level Analysis

Table 1: Summary Statistics

This table reports the summary statistics of Fama-French three factors and four macroeconomic variables from July 1926 through December 2005 (955 months). MKT_ RF is the monthly return on CRSP value-weighted market index in excess of the one-month Treasury bill rate, RF, SMB and HML are the Small-Minus-Big size factor and the High-Minus-Low book-to- market- ratio factor, respectively. The macro factors are dividend yield (DIV), short rate (YLD), term premium (TERM) and the default premium (DEF). DIV is defined as the total dividend payment accrued to the CRSP value-weighted market index over the past twelve months divided by the current price level of the index. YLD is the yield on the three-month Treasury bill. TERM is defined as the yield spread of a ten-year Treasury bond and a three-month Treasury bill and DEF is the yield spread of Moody's Baa and Aaa rated bonds. Panel A represents the descriptive statistics of all these common factors whilst Panel B reports the correlation among the variables.

Panel A: Descriptive Statistics of Fama-French Factors and Macroeconomic Factors

	MKT_RF	RM	RF	SMB	HML	DIV	YLD	TERM	DEF
Mean	0.647	0.951	0.304	0.241	0.406	4.233	3.714	1.529	0.923
Std. Dev.	5.467	5.456	0.255	3.362	3.593	1.379	3.143	1.403	0.379
Skewness	0.220	0.186	1.018	2.220	1.868	1.637	0.877	-0.037	1.129
Kurtosis	10.809	10.782	4.193	25.207	18.499	7.989	3.493	3.265	4.131

Panel B: Correlation Among Fama-French Factors and Macroeconomic Factors

	MKT_RF	RM	RF	SMB	HML	DIV	YLD	TERM	DEF
MKT_RF	1.000	0.999	-0.072	0.351	0.320	-0.134	-0.080	0.077	0.102
RM		1.000	-0.024	0.349	0.321	-0.148	-0.033	0.051	0.115
RF			1.000	-0.055	0.013	-0.292	0.983	-0.541	0.262
SMB				1.000	0.225	-0.010	-0.058	0.095	0.134
HML					1.000	0.002	-0.005	0.036	0.045
DIV						1.000	-0.318	0.228	0.254
YLD							1.000	-0.557	0.242
TERM								1.000	0.362
DEF									1.000

Table 2: Winner, Loser and Momentum Portfolios and Momentum Returns Using Conventional Method

The following table reports the monthly returns for winner, loser and momentum portfolios formed based on past six-month returns and held for the following six months, *JxK =6x6* strategy. The sample period includes January 1926 through December 2005, monthly returns of 22277stocks. Momentum returns are derived by using Equation 1 in section 3.6.2.1. In each month *t* for all NYSE, AMEX and NASDAQ stocks with returns from *t-5* through *t-1* on the monthly CRSP database, the stocks are ranked into decile portfolios according to their returns during the formation period. We skip the month *t* between the formation and the holding period. Decile portfolios are formed monthly by weighting equally all firms in that decile ranking. Winner and Loser are the equal-weighted portfolios of the 10 percent of the stocks with the lowest and the highest returns over the pervious six months, respectively. A long position is taken in the winner portfolio and a short position in the loser portfolio and these positions are held for the following holding (K) months (*t+1 to t+6*). Momentum portfolio is the zero-cost portfolio that buys the winner portfolio and short sells the loser portfolio and is measured by the difference between the winner and the loser portfolios. The column 'Decile portfolio size' reports the average size of the decile portfolio during each sub-sample period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are given in parenthesis. Panel A reports the return of the momentum portfolio while Panel B reports the momentum return when excluding the penny stocks from the sample.

Panel A: Momentum Return						
Sub-Sample Period	**Loser**	**Winner**	**Momentum**	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	1.032	1.824	**0.792**	218	71.88%	949
	(7.136)	(13.974)	(10.124)			
1926-1935	1.346	1.991	0.645	44	57.50%	109
	(1.785)	(3.010)	(1.569)			
1936-1945	2.214	2.262	0.048	54	53.33%	120
	(4.879)	(5.011)	(0.181)			
1946-1955	0.691	1.607	**0.917**	81	85.83%	120
	(2.939)	(6.932)	(10.315)			
1956-1965	0.447	1.506	**1.059**	116	89.17%	120
	(2.078)	(7.693)	(11.573)			
1966-1975	0.320	1.148	**0.828**	209	65.83%	120
	(0.748)	(3.159)	(3.679)			
1976-1985	1.068	2.375	**1.306**	228	76.67%	120
	(4.118)	(8.558)	(8.824)			
1986-1995	0.448	1.620	**1.171**	436	80.83%	120
	(1.372)	(6.216)	(6.997)			
1996-2005	1.753	2.100	0.348	559	65.83%	120
	(4.313)	(5.697)	(1.552)			

Table 3: Sub-Periods of Chordia-Shivakumar (2002) and Jegadeesh-Titman (1993)

Following table reports the monthly momentum return using the sub-periods of two earlier studies, Chordia and Shivakumar (2002) and Jegadeesh and Titman (1993). Panel A shows the monthly momentum return using the four sub-sample periods in the study of Chordia and Shivakumar (2002). Following these authors with a momentum strategy of JxK=6x6 momentum returns have been generated over various sub-sample periods. The column titled ‘%>0’ represents the percentage of the momentum returns that are greater than zero. Panel B reports the momentum returns following different JxK strategies over the sample period from January 1963 through December 1989 as in the study of Jegadeesh and Titman (1993). The t statistics are given in parenthesis. The estimates are reported in percentage.

Panel A: Momentum Return Using the Sub-Period of Chordia and Shivakumar (2002)

Estimation This Study					Chordia and Shivakumar (2002)				
Sub- Period	**Loser**	**Winner**	**Momentum**	**% >0**	**Sub-Period**	**Loser**	**Winner**	**Momentum**	**% >0**
1926-1994	1.400	1.630	0.230	62.560	**1926-1994**	1.340	1.610	0.270	63.260
	(8.637)	(8.637)	(8.637)			(3.390)	(6.060)	(1.100)	
1926-1950	1.970	1.780	-0.190	53.330	**1926-1950**	2.230	1.620	-0.610	56.800
	(5.428)	(5.565)	(-0.931)			(2.450)	(2.820)	(-1.12)	
1951-1963	0.660	1.540	0.880	81.290	**1951-1963**	0.700	1.530	0.830	65.330
	(3.382)	(8.604)	(12.188)			(1.690)	(4.430)	(3.280)	
1964-1994	0.980	1.650	0.670	64.960	**1964-1994**	0.900	1.630	0.730	67.460
	(4.835)	(9.081)	(6.484)			(1.970)	(4.800)	(2.510)	

Panel B: Momentum Return Using the Sub-Period of Jegadeesh and Titman (1993)

Estimation This Study

J	K	3	6	9	12
3	**Loser**	0.770	0.890	0.950	1.050
		(2.620)	(4.348)	(5.587)	(4.765)
	Winner	1.420	1.470	1.510	1.490
		(6.115)	(7.713)	(9.645)	(7.058)
	Momentum	0.650	0.580	0.570	0.450
		(5.644)	(6.190)	(6.911)	(4.158)
6	**Loser**	0.750	0.820	0.900	1.040
		(2.538)	(3.902)	(5.256)	(7.326)
	Winner	1.600	1.650	1.610	1.510
		(6.145)	(8.450)	(10.022)	(10.861)
	Momentum	0.850	0.830	0.710	0.460
		(5.392)	(7.795)	(7.956)	(6.180)
9	**Loser**	0.740	0.830	0.950	1.120
		(2.439)	(3.908)	(5.525)	(7.892)
	Winner	1.770	1.690	1.580	1.470
		(6.625)	(8.448)	(9.649)	(10.349)
	Momentum	1.030	0.860	0.620	0.340
		(6.432)	(8.366)	(7.490)	(5.083)
12	**Loser**	0.770	0.910	1.050	1.230
		(2.521)	(4.192)	(6.114)	(8.679)
	Winner	1.740	1.590	1.490	1.390
		(6.413)	(7.911)	(9.014)	(9.731)
	Momentum	0.970	0.690	0.430	0.160
		(6.036)	(6.964)	(5.657)	(2.788)

Jegadeesh and Titman (1993)

J	K	3	6	9	12
3	**Loser**	0.830	0.790	0.840	0.83
		(1.670)	(1.640)	(1.770)	(1.79
	Winner	1.560	1.580	1.580	1.60
		(3.950)	(3.980)	(3.960)	(3.98
	Momentum	0.730	0.780	0.740	0.77
		(2.610)	(3.160)	(3.360)	(4.00
6	**Loser**	0.660	0.680	0.670	0.76
		(1.280)	(1.350)	(1.380)	(1.58
	Winner	1.790	1.780	1.750	1.66
		(4.470)	(4.410)	(4.320)	(4.13
	Momentum	1.140	1.100	1.080	0.90
		(3.370)	(3.610)	(4.010)	(3.54
9	**Loser**	0.580	0.580	0.660	0.78
		(1.130)	(1.150)	(1.340)	(1.59
	Winner	1.930	1.880	1.760	1.64
		(4.720)	(4.560)	(4.300)	(4.04
	Momentum	1.350	1.300	1.090	0.85
		(3.850)	(4.090)	(3.670)	(3.04
12	**Loser**	0.480	0.580	0.700	0.85
		(0.930)	(1.150)	(1.400)	(1.71
	Winner	1.960	1.790	1.670	1.54
		(4.730)	(4.360)	(4.090)	(3.79
	Momentum	1.490	1.210	0.960	0.69
		(4.280)	(3.650)	(3.090)	(2.31

Table 4: Winner, Loser and Momentum Portfolios and Momentum Returns Excluding Penny Stocks

The following table reports the monthly returns for winner, loser and momentum portfolios formed based on past six-month returns and held for the following six months, *JxK =6x6* strategy. Momentum returns are derived by using Equation 1. The sample period includes January 1926 through December 2005, monthly returns of 22277stocks. In each month *t* for all NYSE, AMEX and NASDAQ stocks with returns from *t-5* through *t-1* on the monthly CRSP database, the stocks are ranked into decile portfolios according to their returns during the formation period. We skip the month *t* between the formation and the holding period. Decile portfolios are formed monthly by weighting equally all firms in that decile ranking. Winner and Loser are the equal-weighted portfolios of the 10 percent of the stocks with the lowest and the highest returns over the pervious six months, respectively. A long position is taken in the winner portfolio and a short position in the loser portfolio and these positions are held for the following holding (K) months (*t+1 to t+6*). Momentum portfolio is the zero-cost portfolio that buys the winner portfolio and short sells the loser portfolio and is measured by the difference between the winner and the loser portfolios. The column 'Decile portfolio size' reports the average size of the decile portfolio during each sub-sample period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are given in parenthesis. The table reports the momentum return when excluding the penny stocks from the sample.

Momentum Return Excluding Penny Stocks						
Sub-Sample Period	**Loser**	**Winner**	**Momentum**	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	0.734	1.632	**0.898**	206	71.35%	949
	(5.342)	(13.092)	(12.338)			
1926-1935	0.806	1.534	0.728	36	59.17%	109
	(1.115)	(2.492)	(1.868)			
1936-1945	1.965	1.789	-0.175	43	51.67%	120
	(4.536)	(4.249)	(-0.799)			
1946-1955	0.640	1.535	**0.896**	71	80.00%	120
	(2.681)	(6.635)	(9.681)			
1956-1965	0.365	1.414	**1.050**	108	85.00%	120
	(1.685)	(7.213)	(10.833)			
1966-1975	0.181	1.078	**0.897**	196	65.00%	120
	(0.432)	(2.985)	(4.100)			
1976-1985	0.956	2.275	**1.320**	217	77.50%	120
	(3.789)	(8.387)	(8.891)			
1986-1995	-0.041	1.459	**1.499**	418	84.17%	120
	(-0.141)	(5.756)	(10.115)			
1996-2005	1.006	1.962	**0.956**	538	68.33%	120
	(2.814)	(5.508)	(4.862)			

Table 5: Winner, Loser and Momentum Portfolios and Momentum Returns Excluding Transaction Cost

The following table reports the monthly returns for winner, loser and momentum portfolios when formed based on past six-month returns and held for the following six months, *JxK =6x6* strategy and excluding the transaction cost. Momentum returns are derived by using Equation 1. Transaction cost is taken from the CRSP dataset. The sample period includes January 1926 through December 2005, monthly returns of 22277stocks. In each month *t* for all NYSE, AMEX and NASDAQ stocks with returns from *t-5* through *t-1* on the monthly CRSP database, the stocks are ranked into decile portfolios according to their returns during the formation period, skipping a month *t* between the formation and the holding period. Decile portfolios are formed monthly by weighting equally all stocks. Winner and Loser are the equal-weighted portfolios of the 10 percent of the stocks with the lowest and the highest returns over the pervious six months, respectively. A long position is taken in the winner portfolio and a short position in the loser portfolio and these positions are held for the following holding (K) months (*t+1 to t+6*). Momentum portfolio is difference between the winner and the loser portfolios. The column 'Decile portfolio size' reports the average size of the decile portfolio during each sub-sample period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are given in parenthesis. The table reports the momentum return when excluding the penny stocks from the sample.

Momentum Return Excluding Transaction Cost						
Sub-Sample Period	**Loser**	**Winner**	**Momentum**	**Portfolio size**	**% > 0**	**No. of Observations**
1926-2005	2.10	2.26	**0.16**	195	67.98%	949
t-stat	*1.949*	*2.187*	*1.969*			
1926-1935	4.234	4.387	0.153	37	46.02%	109
t-stat	*1.179*	*2.112*	*1.346*			
1936-1945	3.723	4.328	0.606	45	51.76%	120
t-stat	*2.876*	*1.209*	*1.110*			
1946-1955	1.582	1.821	0.239	67	75.97%	120
t-stat	*1.290*	*1.223*	*1.352*			
1956-1965	1.110	1.451	**0.341**	99	81.70%	120
t-stat	*2.549*	*6.572*	*9.895*			
1966-1975	0.117	0.176	**0.059**	191	61.97%	120
t-stat	*2.920*	*3.159*	*6.279*			
1976-1985	0.802	1.310	**0.509**	201	70.66%	120
t-stat	*2.822*	*4.943*	*7.399*			
1986-1995	3.140	2.350	**-0.790**	420	66.21%	120
t-stat	*2.630*	*5.480*	*7.612*			
1996-2005	3.022	2.196	-0.825	506	57.19%	120
t-stat	*1.360*	*1.058*	*1.628*			

Table 6: Portfolio Analysis: Momentum Returns Regressed on Fama-French Three-Factor Variable

Ten-year Sub-period Results

Momentum returns are derived by using Equation 1 for the strategy excluding penny stocks with a strategy of *JxK*= 6x6. The following table represents the coefficients and the t-statistics obtained when momentum returns are regressed against the Fama-French three factor variables, e.g. MKT_ RF is the monthly return on CRSP value-weighted market index in excess of the one-month Treasury bill rate, RF, SMB and HML are the Small-Minus-Big size factor and the High-Minus-Low book-to- market- ratio factor, respectively. The regressions are $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*} + \varepsilon_{t*}$ and $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*-1} + \varepsilon_{t*}$ where f is the vector of the Fama-French factors both as contemporaneous and as lagged variables. The regression is carried out separately for each sub-period. The coefficient covariance of the regression is derived from White's heteroskedasticity consistent coefficient covariance. Panel A shows the output for the Fama-French three factor variables when used as contemporaneous variables whilst Panel B reports the regression output when these variables are used as predictor variables over different sub-periods**.** The number in bold fonts represents significance at 1 and 5 percent level, t-statistics are reported in parenthesis and adjusted R-squared is also given.

Panel A: Fama-French Three Factor as Contemporaneous Variables					
Period	**Alpha**	**Mkt_Rf**	**SMB**	**HML**	**Adj R-squared**
1926-2005	**0.009**	0.009	-0.029	-0.016	-0.001
	(11.654)	(0.507)	(-0.671)	(-0.440)	
1926-1935	0.007	0.006	0.038	0.013	-0.024
	(1.826)	(0.117)	(0.385)	(0.132)	
1936-1945	-0.001	0.018	-0.103	0.017	-0.013
	(-0.610)	(0.513)	(-1.116)	(0.215)	
1946-1955	**0.009**	-0.003	-0.055	0.012	-0.018
	(8.521)	(-0.091)	(-0.982)	(0.278)	
1956-1965	**0.011**	-0.014	-0.002	-0.059	-0.016
	(12.110)	(-0.498)	(-0.037)	(-1.071)	
1966-1975	**0.007**	-0.070	-0.040	0.071	0.021
	(3.826)	(-1.255)	(-0.330)	(0.776)	
1976-1985	**0.014**	0.035	-0.043	**-0.148**	0.065
	(8.819)	(1.030)	(-0.743)	(-2.500)	
1986-1995	**0.015**	-0.002	-0.037	**-0.130**	0.006
	(9.889)	(-0.057)	(-0.554)	(-2.073)	
1996-2005	**0.011**	-0.037	-0.103	-0.140	0.021
	(12.110)	(-0.498)	(-0.037)	(-1.071)	
Panel B: Fama-French Three Factor as Lagged Variables					
Period	**Alpha**	**Mkt_Rf_{t-1}**	**SMB_{t-1}**	**HML_{t-1}**	**Adj R-squared**
1926-2005	**0.009**	-0.020	0.019	0.003	-0.001
	(11.914)	(-0.882)	(0.396)	(0.080)	
1926-1935	0.007	-0.035	0.122	0.041	0.004
	(1.799)	(-0.725)	(1.172)	(0.417)	
1936-1945	-0.002	-0.068	0.039	0.063	-0.005
	(-0.819)	(-1.215)	(0.454)	(0.774)	
1946-1955	**0.009**	0.009	-0.045	0.058	-0.001
	(8.647)	(0.319)	(-0.819)	(1.185)	
1956-1965	**0.011**	-0.038	-0.007	**-0.116**	0.019
	(12.108)	(-1.594)	(-0.112)	(-2.175)	
1966-1975	**0.007**	-0.080	-0.026	0.062	0.021
	(3.755)	(-1.457)	(-0.298)	(0.623)	
1976-1985	**0.014**	0.013	-0.036	**-0.136**	0.035
	(9.012)	(0.334)	(-0.634)	(-2.665)	
1986-1995	**0.016**	-0.041	-0.073	**-0.192**	0.039
	(10.046)	(-1.134)	(-1.112)	(-2.845)	
1996-2005	**0.011**	-0.091	-0.090	**-0.171**	0.034
	(5.339)	(-1.802)	(-1.355)	(-2.475)	

Table7: Portfolio Analysis: Momentum Strategy Returns Regressed on Carhart Four-Factor Variables

Ten-year Sub-Period Results

Momentum returns are formed based Equation 1 for the strategy excluding penny stocks with a strategy of JxK= 6x6. The following table represents the coefficients and the t-statistics obtained when momentum returns are regressed against Carhart four factors, e.g. MKT_ RF is the monthly return on CRSP value-weighted market index in excess of the one-month Treasury bill rate, Small-Minus-Big size factor, High-Minus-Low book-to- market- ratio factor and Momentum factor. The regressions are $MR_{t*,6x6} = a + \sum_{j=1}^{n} b_j f_{t*} + e_{t*}$ and $MR_{t*,6x6} = a + \sum_{j=1}^{n} b_j f_{t*-1} + e_{t*}$ where *f* is the vector of the macroeconomic factors both as contemporaneous and as lagged variables. The regressions are carried out separately for each sub-period. The coefficient covariance of the regression is derived from White's heteroskedasticity consistent coefficient covariance. Panel A shows the output for the Carhart four factor variables when used as contemporaneous variables whilst Panel B reports the regression output when these variables are used as predictor variables over different sub-periods. The number in bold fonts represents significance at 5 percent level, t-statistics are reported in parenthesis and adjusted R-squared is also given.

Panel A: Carhart Four Factors as Contemporaneous Variables							**Panel B: Carhart Four Factors as Lagged Variables**						
Period	**Alpha**	**Mkt_Rf**	**SMB**	**HML**	**MOM**	**Adj R-squared**	**Period**	**Alpha**	**Mkt_Rf**	**SMB**	**HML**	**MOM**	**Adj R-squared**
1926-2005	**0.01**	**0.04**	-0.02	0.04	**0.12**	0.05	**1926-2005**	**0.01**	0.01	0.03	**0.06**	**0.13**	0.06
` *t-stat*	10.35	2.45	-0.91	1.82	7.22		***t-stat***	10.24	0.51	1.27	2.85	7.56	
1926-1935	0	0.08	0.05	**0.21**	**0.28**	0.13	**1926-1935**	0	0.03	0.13	**0.22**	**0.26**	0.13
t-stat	0.99	1.49	0.71	2.49	4.32		***t-stat***	0.95	0.56	1.92	2.65	3.97	
1936-1945	0	0.04	-0.08	0.03	**0.11**	0.03	**1936-1945**	0	-0.04	0.07	0.07	**0.13**	0.04
t-stat	-0.87	0.87	-0.82	0.35	2.36		***t-stat***	-0.96	-0.77	0.75	0.93	2.67	
1946-1955	0.01	0	-0.05	0.01	0.01	0.01	**1946-1955**	0.01	0.01	-0.03	0.06	0.02	-0.01
t-stat	1.53	-0.13	-0.8	0.27	0.15		***t-stat***	1.17	0.23	-0.5	1.25	0.44	
1956-1965	**0.01**	-0.01	0.02	-0.01	**0.09**	0.01	**1956-1965**	**0.01**	-0.03	0.02	-0.08	0.07	0.04
t-stat	8.56	-0.23	0.36	-0.19	2		***t-stat***	9.18	-1.13	0.29	-1.36	1.63	
1966-1975	0.01	-0.05	-0.01	0.1	0.1	0.03	**1966-1975**	**0.01**	-0.05	0.02	0.1	**0.17**	0.08
t-stat	1.64	-0.95	-0.15	1.17	1.61		***t-stat***	2.55	-0.9	0.31	1.25	2.81	
1976-1985	**0.01**	0.02	-0.08	**-0.12**	**0.15**	0.15	**1976-1985**	**0.01**	0	-0.06	**-0.11**	**0.1**	0.07
t-stat	8.44	0.52	-1.29	-2.11	3.46		***t-stat***	8.24	0.04	-0.95	-1.94	2.35	
1986-1995	**0.01**	-0.02	-0.01	-0.1	**0.14**	0.06	**1986-1995**	**0.01**	-0.06	-0.04	**-0.16**	**0.15**	0.1
t-stat	9.16	-0.48	-0.15	-1.36	2.66		***t-stat***	9.47	-1.58	-0.68	-2.21	2.88	
1996-2005	**0.01**	-0.01	**-0.12**	-0.12	**0.07**	0.04	**1996-2005**	**0.01**	-0.06	**-0.11**	**-0.15**	**0.08**	0.07
t-stat	4.83	-0.14	-2.24	-1.83	1.9		***t-stat***	4.97	-1.09	-2.09	-2.29	2.28	

Table 8: Portfolio Analysis: Momentum Strategy Returns Regressed on Macroeconomic Variable Ten-year Sub-Period Results

Momentum returns are formed based Equation 1 for the strategy excluding penny stocks with a strategy of JxK= 6x6. The following table represents the coefficients and the t-statistics obtained when momentum returns are regressed against the macroeconomic four factor variables, e.g. DIV, YLD, TERM and DEF. The macro factors are dividend yield (DIV), short rate (YLD), term premium (TERM) and the default premium (DEF). DIV is defined as the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the index. YLD is the yield on the three-month Treasury bill. TERM is defined as the yield spread of a ten-year Treasury bond and a three-month Treasury bill and DEF is the yield spread of Moody's Baa and Aaa rated bonds. The regressions are $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*} + \varepsilon_{t*}$ and $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*-1} + \varepsilon_{t*}$ where *f* is the vector of the macroeconomic factors both as contemporaneous and as lagged variables. The regressions are carried out separately for each sub-period. The coefficient covariance of the regression is derived from White's heteroskedasticity consistent coefficient covariance. Panel A shows the output for the macroeconomic variables when used as contemporaneous variables whilst Panel B reports the regression output when these variables are used as predictor variables over different sub-periods. The number in bold fonts represents significance at 5 percent level, t-statistics are reported in parenthesis and adjusted R-squared is also given.

Panel A: Macroeconomic Four Factors as Contemporaneous Variables

Period	Alpha	DIV	YLD	TERM	DEF	Adj R-squared
1926-1994	**0.015**	0.003	-0.001	**-0.004**	-0.005	0.054
	(12.639)	(1.005)	(-0.571)	(-4.628)	(-0.398)	
1926-1935	0.007	0.010	-0.016	-0.012	-0.038	-0.009
	(1.838)	(1.270)	(-0.491)	(-0.300)	(-0.754)	
1936-1945	-0.001	0.004	-0.012	-0.009	-0.009	-0.030
	(-0.674)	(0.799)	(-0.388)	(-0.256)	(-0.300)	
1946-1955	**0.009**	0.001	-0.015	-0.017	0.003	-0.027
	(9.589)	(0.215)	(-1.103)	(-1.218)	(0.133)	
1956-1965	**0.011**	0.003	-0.003	-0.001	0.027	-0.017
	(11.313)	(0.379)	(-0.202)	(-0.070)	(1.040)	
1966-1975	**0.007**	0.018	-0.004	-0.016	0.017	0.037
	(3.233)	(1.435)	(-0.309)	(-0.950)	(0.637)	
1976-1985	**0.013**	-0.016	0.003	0.000	0.009	0.011
	(8.849)	(-1.855)	(0.513)	(-0.001)	(0.712)	
1986-1995	**0.015**	-0.010	**-0.012**	0.003	**0.068**	0.075
	(10.418)	(-1.065)	(-2.572)	(0.519)	(3.109)	
1996-2005	**0.010**	-0.007	-0.009	0.001	**0.008**	0.060
	(8.292)	(-1.002)	(-1.012)	(0.526)	(2.022)	

Panel B: Macroeconomic Four Factors as Lagged Variables

Period	Alpha	DIV $_{t-1}$	YLD $_{t-1}$	TERM $_{t-1}$	DEF $_{t-1}$	Adj R-squared
1926-1994	**0.014**	0.005	0.001	**-0.003**	0.014	0.054
	(12.064)	(1.069)	(0.690)	(-4.165)	(0.962)	
1926-1935	0.007	0.002	0.018	0.020	0.020	-0.010
	(1.691)	(0.453)	(0.588)	(0.454)	(0.311)	
1936-1945	-0.001	0.006	0.015	0.018	0.013	-0.019
	(-0.575)	(0.964)	(0.463)	(0.651)	(0.391)	
1946-1955	**0.009**	0.000	-0.021	-0.008	0.008	-0.006
	(9.873)	(-0.073)	(-1.489)	(-0.537)	(0.331)	
1956-1965	**0.011**	**0.016**	0.002	-0.002	0.011	0.016
	(10.982)	(2.606)	(0.135)	(-0.137)	(0.367)	
1966-1975	**0.009**	0.020	-0.006	-0.020	0.015	0.039
	(3.859)	(1.142)	(-0.331)	(-1.104)	(0.487)	
1976-1985	**0.013**	-0.009	0.006	0.003	0.017	0.002
	(8.857)	(-1.411)	(0.999)	(0.438)	(1.298)	
1986-1995	**0.015**	0.010	-0.009	-0.008	**0.059**	0.052
	(10.243)	(1.044)	(-1.848)	(-1.277)	(2.177)	
1996-2005	**0.008**	0.016	-0.068	-0.009	0.061	0.047
	(9.172)	(1.012)	(-1.458)	(-1.223)	(1.177)	

4 CHAPTER FOUR: INDIVIDUAL STOCK LEVEL ANALYSIS

4.1 Introduction

This section describes the empirical results of the question as to whether or not momentum returns are compensation to risk when the analysis is performed at the individual stock level. The name 'Individual Stock Level Analysis' is after the fact that the pricing of risk factors are considered at the individual stock level and after the individual stock returns are adjusted for risk momentum returns are calculated on that risk-adjusted returns. For the purpose of the study an alternative momentum strategy has been proposed. Unlike the conventional method of measuring momentum returns where stocks are ranked based on past returns, in the alternative momentum strategy each stock is first adjusted for the common risk factors and then stocks are ranked based on the explained and unexplained risk factors to measure momentum returns. By looking at the momentum returns generated based on these two ranking criterion it is observed whether or not momentum returns are compensation for risk. The analysis is robust to variables employed e.g. (1) Firm level factors (2) Macroeconomic risk factors; the phases of variables e.g. (3) Contemporaneous variables and (4) Lagged variables and to the time period e.g. (5) Whole sample and (6) Different Sub-periods of sample.

4.2 Data and Methodology

4.2.1 Data

For the purpose of investigating if momentum returns are compensation for risks at the individual stock level data have been collected from the Centre for Research in Security Prices (CRSP) of all stocks listed in the three exchanges including, NYSE, AMEX and NASDAQ on a monthly basis. The sample period is from January 1926 through December 2005. All empirical analysis have been conducted on the entire sample period and then further investigation has been made on ten-year sub-period. The selection criteria as described in section 3.2.1 have been considered for the purpose of the analysis. For example, all stocks that are priced above $1 have been selected, stocks that have non-missing observations at the beginning of the holding period and stocks that have at least six consecutive monthly return observations at the beginning of the holding period. The total number of months within this sample period is 960 months and the total number of stocks traded in all the three stock exchanges is 22277 stocks. This results in a total number of 21385920 observations.

4.2.2 Variables Employed

The study on individual stock level employs variables as described in section 3.2.2. For example, the Fama-French three factors and macroeconomic risk factors have been employed as the explained risk factors to investigate if momentum returns are compensation for these firm level and macro level risk factors. Fama-French three factors include return on CRSP value-weighted market index in excess of the one-month

Treasury bill rate (MKT_RF), the small-minus-big size factor (SMB) and the high-minus-low book-to-market-ratio factor (HML). And macroeconomic risk factors includes dividend yield (DIV) which is the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the market index, the short rate (YLD) is the yield on the three-month Treasury bill, the term premium (TERM) is the yield spread of a ten-year Treasury bond over a three-month Treasury bill, the default premium (DEF) is the yield spread between Moody's Baa and Aaa rated bonds.

4.2.3 Methodology

In order to measure if momentum returns is compensation for risk at the individual stock level, at first; an alternative risk-adjusted momentum strategy has been employed to generate momentum returns from individual stock level. Thereafter the momentum returns generated from the (1) Explained risk-adjusted and (2) Unexplained risk-adjusted source have been regressed against the common risk factors used in this study in a multi-factor regression model

Unlike conventional method of measuring momentum returns where stocks are ranked based on the past returns this study proposes an alternative risk-adjusted momentum strategy. Based on this alternative momentum strategy, momentum returns are measured at the individual stock level. This is done by regressing returns of individual stocks against common risk factors. Thereafter momentum returns are measured based on the estimated (1) Explained risk components and the estimated (2) Unexplained risk components. The justification is that if momentum return is a compensation for risk then once the individual stock returns are price for common components there should not be any return generating when stocks are ranked based on the estimated unexplained risk components. It is expected that most momentum returns will generate from explained risk components. The methodology for individual stock level analysis is as follows.

For the purpose two types of momentum returns are defined i.e. (1) Momentum return resulting from the explained risk components and (2) Momentum return generating from unexplained risk components. Three sets of explained risk components are employed in this study e.g. i) Fama-French three factors ii) Macroeconomic factors and iii) Combination of Fama-French and macroeconomic factors. The test is conducted using contemporaneous variables and for robustness lagged variable are also employed. The equation used in the study is as follows.

$$R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} f_t + \varepsilon_{it}, \tag{4}$$

$$R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} f_{t-1} + \varepsilon_{it} \tag{5}$$

where, R_{it} is the return of each stock at time *t*, f_t and f_{t-1} are vectors respectively for factors as contemporaneous and as lagged values of risk factors, β_{ij} is the vector for risk factor α_i and ε_{it} are the constant and the residual, respectively. Once the regression is run the above model is decomposed into two components e.g. estimated explained risk component $(\sum_{j=1}^{n} \hat{\beta}_{ij} f_t)$ and estimated unexplained risk components $(\hat{\alpha}_{it} + \hat{\varepsilon}_{it})$ and construct portfolios based on these two components. For example, stocks are ranked based on $\sum_{j=1}^{n} \hat{b}_{ij} f_t$ using past J months information and form deciles portfolios. The lowest portfolios (loser) are short and the highest portfolios (winner) are long and the positions are held for the subsequent K holding months. Hence at time t^* the momentum return is defined as

$$MR_{t^*}^{Com} = MR_{t^*}^{\sum_{i=1}^{j} \hat{b}_{ij} f_j} = R_{t^*}^{WP^{\sum_{i=1}^{j} \hat{b}_{ij} f_j}} - R_{t^*}^{LP^{\sum_{i=1}^{j} \hat{b}_{ij} f_j}} \qquad (6)$$

where, $MR_{t^*}^{Com}$ is the difference between the winner and loser portfolio sorted based on the estimated common factors and $R_{t^*}^{WP^{\sum_{i=1}^{j} \hat{b}_{ij} f_j}}$ and $R_{t^*}^{LP^{\sum_{i=1}^{j} \hat{b}_{ij} f_j}}$ are the winner and loser portfolio respectively.

In a similar manner momentum returns are measured by ranking stocks based on $\hat{a}_i + \hat{e}_{it}$ and at time t^* the momentum return is defined as and

$$MR_{t^*}^{I} = MR_{t^*}^{a_i + e_{it}} = R_{t^*}^{WP^{a_i + e_{it}}} - R_{t^*}^{LP^{a_i + e_{it}}} \qquad (7)$$

where, $MR_{t^*}^{I}$ is the difference between the winner and loser portfolio sorted based on the estimated alpha and the residual (stock-specific) and $R_{t^*}^{WP^{a_i + e_{it}}}$ and $R_{t^*}^{LP_t^{a_i + e_{it}}}$ are the winner and loser portfolio respectively.

However, these alternative momentum strategies are formed by first estimating the parameters on individual stock where the parameters require using a sixty-month window and a minimum of twenty-four observations. Literature commonly uses a sixty-month window to calculate the parameter estimates to safeguard against potential problems of non-constancy of the estimates (β_i) in a large sample period. In our study inclusion of stocks ranging from twenty-four to sixty observations is allowed with the justification that in the NYSE, AMEX and NASDAQ dataset exclusion of securities with less than sixty-observation will drastically reduce the number of observations.[20] Therefore for each month *t*, the above regression (equation 4) is run for all NYSE, AMEX and NASDAQ stocks with monthly returns on the CRSP database. The momentum returns thus generated is defined as 'Momentum return with Restricted Observations (MR_{t*}^{Res})'.

A summary of the alternative momentum returns are as follows:

1. Momentum return using conventional method with restricted observation

   $$MR_{t*}^{\mathrm{Res}} = R_{t*}^{\mathrm{Res}WP} - R_{t*}^{\mathrm{Res}LP}$$

2. Momentum return generated from stock-specific components (idiosyncratic risk)

   $$MR_{t*}^{I} = MR_{t*}^{\alpha_i+\varepsilon_{it}} = R_{t*}^{WP^{\alpha_i+\varepsilon_{it}}} - R_{t*}^{LP^{\alpha_i+\varepsilon_{it}}}$$

3. Momentum return generated from common components

   $$MR_{t*}^{Com} = MR_{t*}^{\sum_{i=1}^{j}\hat{\beta}_{ij}f_j} = R_{t*}^{WP^{\sum_{i=1}^{j}\hat{\beta}_{ij}f_j}} - R_{t*}^{LP^{\sum_{i=1}^{j}\hat{\beta}_{ij}f_j}}$$

[20] Recent literatures also employ the restriction of at least twenty-four observations see Chordia and Shivakumar (2002).

4.3 Empirical Results on Individual Level Analysis

The purpose of this section is to examine if momentum return remains once controlled common risk factors at the individual stock level. The intuition arises as contemporary momentum literature documents that the effect of momentum return and the explanatory power of market wide common factors are significant at individual stock level (see also Wu, 2001 and Chordia and Shivakumar, 2002).

4.3.1 Measuring Alternative Momentum Returns at the Individual Stock Level Using Fama-French three Factors

For the purpose, an alternative momentum strategy is used. By using Equation 4 for each month *t*, the model $R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} f_t + \varepsilon_{it}$ is estimated for each NYSE, AMEX and NASDAQ stock on the monthly CRSP database, where, R_{it} is the return of each stock at time *t*, f_t is the vector of common components, β_{ij} is the factor loadings α_i and ε_{it} are constant and residual, respectively. Once estimated the model is then decomposed into two components e.g. (1) Estimated explained risk components ($\sum_{j=1}^{n} \hat{\beta}_{ij} f_t$) and (2) Estimated unexplained risk components ($\hat{\alpha}_i + \hat{\varepsilon}_{it}$). Thereafter momentum returns are measured by ranking stocks based on (1) Estimated explained risk components ($\sum_{j=1}^{n} \hat{\beta}_{ij} f_t$) and (2) Estimated unexplained risk components ($\hat{\alpha}_i + \hat{\varepsilon}_{it}$). The formation period is considered from *t-5 through t-1*. A short position is held for the loser portfolio and a long position is held for the winner portfolio for the following *t+1* *through t+6* holding month and at time *t** momentum return is measured as the difference between the return on the winner portfolio and the loser portfolio. The empirical results are derived based on the following assumptions:(i) All penny stocks are excluded at the beginning of the holding period; (ii) A sixty-month window is considered and (iii) A minimum of twenty-four observations is required for parameter estimation.

Panel A of Table 9 reports the results of momentum returns at the individual stock level where contemporaneous Fama-French three factors are considered to be the common risk factors. The results are derived for the whole sample period and then for the sub-sample periods. In panel A of Table 9 column one represent the return on the Loser portfolio, column two shows the returns of the Winner portfolio and column three reports the returns on the momentum portfolio which is measured as the difference between the winner portfolio and loser portfolio. Column four shows the size of the decile portfolio, column six shows total percentage of the momentum return that is greater than zero. Given the assumptions of skipping a month, a strategy of *JxK=6x6* and a window of sixty-month the total number of months in the sample period is 960 (from January 1926 through 2005). A total of 65 months is lost and the first momentum return is realized at the end of the holding period. Therefore when the entire sample period is considered the total number of months is brought down to 895 months. Hence during the sub-period 1926 through 1935 the total number of months is 55 (lost 65 observations). Thereafter in all subsequent sub-periods the total number of months is 120.

[Insert Table 9 Here]

As evident from Panel A of Table 9, during the entire sample period from 1926 through 2005 monthly momentum return ($MR_{t^*}^{UR}$), when stocks are ranked based on the unexplained risk factors or idiosyncratic risk ($\hat{a}_i + \hat{e}_{it}$), is 0.42 percent (an average of 5.04 percent per annum) and is statistically significant. In this 0.42 percent returns, of 61.15 percent of the return is positive and the average portfolio size is 260 stocks. In different sub-periods momentum return seems to be consecutively significant and positive during the post 1940s, e.g. momentum return is 0.71 percent in 1946-1955, 0.75 percent in 1956-1965, 0.55 percent in 1966-1975, and 0.70 percent in 1976-1985 and are significant at one percent level. With the exception in 1936-1945 and 1996-2005 when momentum return is negative e.g. -0.20 percent and -0.03 percent in all other sub-periods the returns are positive.

Panel B of Table 9 reports the results of momentum returns when stocks are ranked based on the explained risk factors ($\sum_{j=1}^{N} \hat{b}_{ij} f_t$). This implies that when controlled for contemporaneous Fama-French factors statistically significant momentum returns ($MR_{t^*}^{ER}$) of 0.37 percent are earned. The total portfolio size is 319 stocks with only 59 percent of the return greater than zero. However, in different sub-periods three out of eight sample periods momentum return is positive and significant. Noticeably momentum returns are particularly strong in post-1950s e.g. momentum return is 0.52 percent (t=3.24) in 1946-1955, 0.37(t=2.6) in 1956-1965 and 0.68 (t=3.8) in 1976-1985. This suggests that momentum returns are linked to the economic cycle as are strong during economic expansions.

Panel A of Table 10 reports momentum returns when the returns are measured based on the alternative momentum strategy and by ranking stocks based on unexplained risk factors. By using Equation 5, $R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} f_{t-1} + \varepsilon_{it}$ as described in section 4.2.3 momentum returns are generated first by adjusting the individual stocks for risk factors (*f*) in the equation e.g. lagged Fama-French three factors and then by ranking the stocks based on the unexplained risk factors e.g. $(\hat{\alpha}_i + \hat{\varepsilon}_{it})$. Panel A of Table 10 reports that $MR_{t^*}^{UR}$ is 0.45 percent and is significant during the whole sample period and with a portfolio size of 260 stocks the percentage of return that is positive is 64 percent. In different sub-periods $MR_{t^*}^{UR}$ is greater than zero and significant in four consecutive sub-periods from 1946 to 1985. For instance $MR_{t^*}^{UR}$ is 0.84 percent in 1946-1955, 0.87 percent in 1956-1965, 0.57 percent in 1966-1975 and 0.9 percent in 1976-1985. Also in the sub-periods 1936-1945 and 1996-2005 momentum return is less than zero e.g. -0.07percent and -0.04 percent, respectively.

[Insert Table 10 Here]

Panel B of Table 10 reports alternative momentum returns when stocks are ranked based on estimated lagged explained risk factors e.g. $(\sum_{j=1}^{n} \hat{\beta}_{ij} f_t)$ where *f* is the vector of Fama-French three factors. Notably, momentum return is more significant in most periods when stocks are ranked based on lagged Fama-French factors as compared when contemporaneous factors are considered. For example, Panel B of Table 10 shows that that in all sub-periods momentum return is positive and statistically significant, except of only three sub-periods e.g. 1936-1945, 1946-1955 and 1966-1975. The percentage of return greater than zero during these periods is on average 54.33 percent. Again during the entire sample period momentum returns generated when stocks are ranked based on explained risk factors, $MR_{t^*}^{ER}$ is 0.38 percent with 59 percent of the return greater than zero.

In sum, our results from Table 9 and 10 provide evidences that momentum returns are significantly high and earns 0.45 percent returns per month when stocks at the individual stock level are ranked based on $MR_{t^*}^{UR}$ than their counterparts $MR_{t^*}^{ER}$ which earn only 0.35 percent per month. This suggests that momentum returns are not compensation for risk when priced for Fama-French three factors at the individual stock level.

4.3.2 Measuring Alternative Momentum Returns at the Individual Stock Level Using Macroeconomic Risk Factors

To examine if momentum returns are compensation for contemporaneous macroeconomic risks at the individual stock level, equation 4 as described in section 4.2.3 is employed. For each stock in each month *t* the equation $R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} f_t + \varepsilon_{it}$ is used where f is the vector of contemporaneous macroeconomic risk factors. Panel A of Table 11 reports the results when macroeconomic variables are used as explained risk components in equation 4. Panel A of Table 11 report an interesting pattern that when stocks are ranked based on the contemporaneous macroeconomic factors $MR_{t^*}^{UR}$ is 0.16 (t=2.57) during the whole sample period of which 63 percent is positive. Again in different sub-periods only in the pre-1950s $MR_{t^*}^{UR}$ is positive and significant e.g. in 1926-1935 $MR_{t^*}^{UR}$ is 1.31 percent, 0.83 percent in 1936-1945 and 0.35 percent in 1946-1955. In the post-1950s $MR_{t^*}^{UR}$ is mostly negative but statistically significant only in two sub-sample periods, e.g. 1976-1985 (-0.3 percent, t= -2.18) and in 1986-1995 (-0.19 percent, t= -1.97).

Noticeably, $MR_{t^*}^{UR}$ is negative during the period from 1956 through 1995. This suggests that there is no momentum returns generating from unexplained risk factors when adjusted for macroeconomic variables. However, during the pre-1950s and post-2000s momentum returns are observed when stocks are ranked based on unexplained risk factors. This implies that the interaction of momentum returns is linked to the market movements. The results supports the findings of Chordia and Shivakumar (2002) who report that momentum returns are explained by a parsimonious set of macroeconomic variables when accounted for the predictive portion of the variables.

[Insert Table 11 here]

Panel B of Table 11 reports momentum returns when stocks are ranked based on the estimated contemporaneous macroeconomic risk factors ($\sum_{j=1}^{n} \hat{b}_{ij} f_t$). The table shows that though during the entire sample period no momentum returns are observed; on average momentum returns are positive and significant in different sub-periods, particularly during the post 1950s. For example, Panel B of Table 11 reports that in 1956-1965 0.20 percent (t=1.879), 1966-1975 0.22 percent (t=1.89), 1976-1985 0.39 percent (t=2.760), 1986-1995 0.21 percent (t=2.064). During the pre-1950s $MR_{t^*}^{ER}$ is negative indicating no momentum return during market downturn e.g. in 1926-1935, 1936-1945 and 1946-1955 $MR_{t^*}^{ER}$ is -1.9 percent (t=-4.84), -0.81 percent (t=-2.71) and -0.28 percent (t=-2.28). $MR_{t^*}^{ER}$ is positive during the post-2000s, though not statistically significant.

Panel A of Table 12 shows momentum returns when generated at the individual stock level and using the alternative momentum strategy. By using Equation 5, $R_{it} = a_i + \sum_{j=1}^{n} b_{ij} f_{t-1} + e_{it}$, in section 3.6.3.1, where f is the vector of lagged macroeconomic risk factors. It is evident from Panel A of Table 12 that during the entire sample period, 1926-2005, there is no momentum when individual stocks are sorted based on estimated unexplained risk factors $(\hat{a}_i + \hat{e}_{it})$. Momentum returns generated based on unexplained risk factors, $MR_{t^*}^{UR}$, is -0.15 percent of which 49.19 percent is positive. The portfolio size is of 247 stocks. Also during the different sub- period momentum returns generated based on $MR_{t^*}^{UR}$ is negative and mostly not statistically significant except of two exceptions in the sub-periods 1944-1955 and 1996-2005 where momentum returns are 0.25 percent and 0.31 percent and are statistically significant.

Panel B of Table 12 reports momentum returns when generated at the individual stock level, by using the alternative momentum strategy and ranking stocks based on estimated explained risk factors e.g. $(\sum_{j=1}^{n} \hat{b}_{ij} f_t)$. As reported in Panel B of Table 12 during the entire sample period $MR_{t^*}^{ER}$ is 0.22 percent and is statistically significant (t-stat=3.614). Also in different sub-periods, momentum returns are positive and significant when stocks are ranked based on estimated explained risk factors. The two exceptions are 1946-1955 (-0.18 percent, t=-2.11) and in 1996-2005 (-2.9 percent, t=-2.268) where there is no momentum. This implies that momentum returns are compensation for macroeconomic risks and is closely linked to economic cycle.

[Insert Table 12 here]

In summary, the results of Table 11 and 12 shows that when macroeconomic factors are considered, significant momentum returns are observed when stocks are ranked based on the estimated explained risk factors by using the alternative momentum strategy. On average a significant return of up to 0.22 percent per month (2.64 percent per annum) is observed. On the contrary, momentum returns generated when stocks are ranked based on the estimated unexplained risk factors are very weak or even zero. This suggests that momentum returns are compensation for macroeconomic risk factors. The results are stronger during market expansions. This is consistent with the findings of Chordia and Shivakumar (2002) and Cooper, Gutierrez, and Hameed (2004) who document that momentum profits are strong in economic expansions, but are nonexistent in recessions. This findings hold for both contemporaneous and lagged macroeconomic variables with more pronounced effect for lagged macroeconomic variables.

4.3.3 Measuring Alternative Momentum Returns at the Individual Stock Level Using both Fama-French three factors and the Macroeconomic Risk Factors Simultaneously

The empirical results at the individual stock level show that the two explained risk factors e.g. Fama-French three factors and macroeconomic factors have different effect on momentum returns. This naturally asks the question as to which factors e.g. the firm level factors or the macroeconomic risk factors, have more significant impact on momentum returns? The following section explores this answer.

Panel A of Table 13 reports the results when both the contemporaneous Fama-French three factors and the contemporaneous macroeconomic factors are taken into account simultaneously at the individual stock level and by using the alternative momentum strategy. For the purpose equation 4 e.g. $R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} f_t + \varepsilon_{it}$ as described in section 4.2.4 are used, where f is the vector of both contemporaneous Fama-French three factors and macroeconomic risk factors. Panel A of Table 13 shows that when momentum returns, $MR_{t^*}^{UR}$, are generated by ranking stocks based on estimated unexplained risk factors, the result is somewhat mixed. During the entire sample period $MR_{t^*}^{UR}$ is 0.034 percent per month. In different sub-periods momentum returns are, on average, very weak.

[Insert Table 13 here]

Panel B of Table 13 reports the results when momentum returns are generated by ranking stocks based on estimated explained risk factors. It is evident from the table that $MR_{t^*}^{ER}$ generates significant momentum returns of 0.015 percent per month. In different sub-periods in 1956-1965 (0.08 percent, t=1.29) and 1976-1985 (0.23 percent, t=2.09) momentum returns are positive and significant. This implies that the impact of macroeconomic variables, on momentum returns, is more compared to its counterpart the Fama-French factors.

Panel A of Table 14 reports the results when both the lagged Fama-French three factors and the lagged macroeconomic factors are taken into account simultaneously at the individual stock level and by using the alternative momentum strategy in equation 5 of section 4.2.3 Stocks are ranked based on estimated unexplained risk factors. The table shows that during the entire sample period, there is no momentum returns generated when stocks are ranked based on estimated unexplained risk factors. In different sub-periods weak momentum returns are observed with few exceptions in one or two sub-periods. For example, $MR_{t^*}^{UR}$ is 0.59 percent in 1926-1935, -1.55 percent in 1936-1945, 0.33 percent in 1946-1955, 0.20 percent in 1966-1975, -0.31 percent in 1976-1985 and 0.46 percent in 1996-2005.

[Insert Table 14 here]

Panel B of Table 14 reports the results when stocks are ranked based on estimated explained risk factors. Equation 5 in section 4.2.3 is used where both the lagged Fama-French three factors and the lagged macroeconomic factors are taken into account simultaneously at the individual stock level. As shown in Panel B of Table 14 during the entire sample period from 1926 through 2005 momentum returns, $MR_{t^*}^{ER}$, of 0.169 percent per month is observed. Again in different sub-periods momentum returns are mixed. For example, in sub-periods 1936-1945, 1946-1955, 1976-1985 and 1996-2005 $MR_{t^*}^{Com}$ is 1.57 percent, -0.27 percent, 0.27 percent and -0.39 percent, respectively and statistically significant.

Interestingly, it is observed that the pattern of momentum returns when generated by ranking stocks on the two lagged common components is similar to that reported in Panel B of Table 12 where lagged macroeconomic factors were considered. This further provides evidence that the impact of macroeconomic variables is far more compared to Fama-French three factors.

4.4 Conclusions

The purpose of this section is to examine if momentum returns are compensation to risk when the examination is performed at the individual stock level. The empirical results provide several findings as follows; firstly, at the individual stock level momentum returns are not compensation for risk when Fama-French three factors are used. Evidence has been provided that statistically significant momentum returns, $MR_{t^*}^{UR}$ of 0.45 percent per month (5.4 percent per annum) are generated when the alternative momentum strategy is used and stocks are ranked based estimated unexplained risk factors. On the other hand its counterpart, $MR_{t^*}^{ER}$, earns momentum returns of 0.35 percent per month (4.2 percent per annum).

Secondly, momentum returns are compensation for risk when macroeconomic risk factors are considered. On average, significant momentum returns of up to 0.22 percent per month (2.64 percent per annum) is observed when stocks are ranked based on the estimated explained risk factors by using the alternative momentum strategy. On the contrary, momentum returns generated when stocks are ranked based on the estimated unexplained risk factors are very weak or even zero. This findings hold for both contemporaneous and lagged macroeconomic variables with more pronounced effect when lagged macroeconomic variables are used. Furthermore, the results are stronger during market expansions.

Thirdly, to a greater extent, momentum returns are compensation for risk when both Fama-French three factors and macroeconomic risk factors are used simultaneously. On average, significant momentum returns of up to 0.20 percent per month (2.40 percent per annum) is observed when stocks are ranked based on the estimated explained risk factors. Also the impact of macroeconomic risk factors is more pronounced on momentum returns compared to Fama-French three factors.

4.5 APPENDIX B: Empirical Tables on Individual Stock Level Analysis

Table 9: Individual Stock Level Analysis: Momentum Return Based on Alternative Strategies Using Contemporaneous Fama-French Factors - Ten-Year Sub-Period Results

The following table reports the monthly returns in percentage based on alternative momentum strategies. For each month *t*, the following model is estimated for each NYSE, AMEX and NASDAQ stock on the monthly CRSP database (using a sixty-month window and a minimum of 24 months of data required): $R_{it} = a_i + \sum_{j=1}^{n} b_{ij} f_t + e_{it}$, where, R_{it} is the return of each stock at time *t*, f_t is the vector of Fama-French factors e.g. the monthly return on CRSP value-weighted market index in excess of the one-month Treasury bill rate, the Small-Minus-Big size factor and the High-Minus-Low book-to- market-ratio factor, b_{ij} is the factor loadings a_i and e_{it} are constant and residual, respectively. Thereafter the model is decomposed into two components e.g. the unexplained risk components ($\hat{a}_i + \hat{e}_{it}$) and the explained risk components ($\sum_{j=1}^{n} \hat{b}_{ij} f_t$). Stocks are ranked based on these two criterions using a formation period *J* of five months (*t-5 through t-1*) and deciles portfolios are formed with the loser the lowest portfolio and winner the highest portfolios. The winner portfolio is held long and the loser portfolio is held short for the following *K* (*t+1 through t+6*) holding month. **T**he momentum return is defined as the difference between the return on the winner and the loser portfolio. The returns exclude all penny stocks. Panel A reports the returns of loser, winner and momentum portfolio where stocks are ranked based on Stock-specific factor, while Panel B reports the same while stocks are ranked based on Common components. The column 'Decile portfolio size' reports the average size of the decile portfolio during each period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are also given.

Panel A: Ranking Based on Unexplained Risk Components								**Panel B: Ranking Based on Explained Risk Components**							
Period		**Loser**	**Winner**	MR_{t*}^{UR}	**Decile Portfolio Size**	**% > 0**	**No. of Months**	**Period**		**Loser**	**Winner**	MR_{t*}^{ER}	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	Return	1.505	1.924	**0.420**	260	61.15%	895	**1926-2005**	Return	1.409	1.789	**0.379**	319	54.00%	895
	t-Stat	10.133	13.895	7.800					t-Stat	10.359	12.521	3.337			
1926-1935	Return	3.380	4.300	**0.920**	64	30.83%	55	**1926-1935**	Return	1.570	1.780	0.210	36	27.25%	55
	t-Stat	3.859	4.816	4.288					t-Stat	3.518	4.055	0.524			
1936-1945	Return	2.490	2.290	-0.200	72	44.17%	120	**1936-1945**	Return	2.175	2.520	0.350	75	63.33%	120
	t-Stat	5.290	5.165	-1.097					t-Stat	4.772	5.687	0.879			
1946-1955	Return	0.830	1.540	**0.710**	90	76.67%	120	**1946-1955**	Return	0.945	1.465	**0.520**	92	65%	120
	t-Stat	3.292	7.362	8.221					t-Stat	5.260	5.435	3.241			
1956-1965	Return	0.720	1.460	**0.750**	108	82.50%	120	**1956-1965**	Return	0.825	1.200	**0.375**	114	55.00%	120
	t-Stat	3.323	8.012	9.033					t-Stat	4.426	5.740	2.600			
1966-1975	Return	0.520	1.070	**0.550**	210	63.33%	120	**1966-1975**	Return	0.600	0.795	0.195	236	51.67%	120
	t-Stat	1.248	2.933	3.677					t-Stat	1.608	2.175	0.696			
1976-1985	Return	1.640	2.350	**0.700**	416	68.33%	120	**1976-1985**	Return	1.515	2.200	**0.685**	494	64.17%	120
	t-Stat	5.618	8.196	6.070					t-Stat	5.989	7.475	3.821			
1986-1995	Return	1.400	1.640	0.230	488	65.00%	120	**1986-1995**	Return	1.475	1.445	-0.030	626	49.17%	120
	t-Stat	4.236	6.351	1.615					t-Stat	5.983	5.309	-0.173			
1996-2005	Return	2.080	2.050	-0.030	526	58.33%	120	**1996-2005**	Return	1.555	2.095	0.545	709	59.17%	120
	t-Stat	5.424	5.741	-0.170					t-Stat	4.572	5.266	1.799			

Table 10: Individual Stock Level Analysis: Momentum Return Based on Alternative Strategies Using Lagged Fama-French Factors

Ten-Year Sub-Period Results

The following table reports the monthly returns in percentage based on alternative momentum strategies. For each month *t*, the following model is estimated for each NYSE, AMEX and NASDAQ stock on the monthly CRSP database (using a sixty-month window and a minimum of 24 months of data required): $R_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} f_{t-1} + \varepsilon_{it}$, where, R_{it} is the return of each stock at time *t*, f_{t-1} is the vector of Fama-French factors, β_{ij} is the factor loadings α_i and ε_{it} are constant and residual, respectively. Thereafter the model is decomposed into two components e.g. the stock specific components ($\hat{\alpha}_i + \hat{\varepsilon}_{it}$) and the common components ($\sum_{j=1}^{n} \hat{\beta}_{ij} f_{t-1}$). Stocks are ranked based on these two criterions using a formation period *J* of five months (*t-5 through t-1*) and deciles portfolios are formed with the lowest (P1) portfolio as the loser and highest portfolios (P10) as the winner portfolio. A long position in taken in the winner portfolio and short position in the loser portfolio and hold the position for the following *K* (*t+1 through t+6*) holding month. **T**he momentum return is defined as the difference between the return on the winner and the loser portfolio. The returns exclude all penny stocks. Panel A reports the returns of loser, winner and momentum portfolio where stocks are ranked based on Stock-specific factor, while Panel B reports the same while stocks are ranked based on Common components. The column 'Decile portfolio size' reports the average size of the decile portfolio during each period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are also given.

Panel A: Ranking Based on Unexplained Risk Components								**Panel B: Ranking Based on Explained Risk Components**							
Period		**Loser**	**Winner**	$MR_{t^*}^{UR}$	**Decile Portfolio Size**	**% > 0**	**No. of Months**	**Period**		**Loser**	**Winner**	$MR_{t^*}^{ER}$	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	Return	1.513	1.963	**0.450**	260	64.00%	895	**1926-2005**	Return	1.465	1.849	**0.385**	319	59.00%	895
	t-Stat	9.941	14.357	6.148					t-Stat	10.917	12.289	5.710			
1926-1935	Return	4.020	4.180	0.160	64	29.17%	55	**1926-1935**	Return	1.475	2.355	**0.880**	36	27.50%	55
	t-Stat	4.125	4.915	0.339					t-Stat	3.663	4.738	3.892			
1936-1945	Return	2.440	2.370	-0.070	72	50.00%	120	**1936-1945**	Return	2.125	2.45	0.325	75	56.67%	120
	t-Stat	5.244	5.186	-0.279					t-Stat	4.973	5.469	1.566			
1946-1955	Return	0.720	1.570	**0.840**	90	84.17%	120	**1946-1955**	Return	1.085	1.24	0.155	92	48%	120
	t-Stat	3.116	7.004	10.606					t-Stat	5.244	5.283	1.731			
1956-1965	Return	0.640	1.510	**0.870**	108	87.50%	120	**1956-1965**	Return	0.95	1.14	**0.190**	114	60.00%	120
	t-Stat	3.046	7.922	10.131					t-Stat	4.560	6.187	2.415			
1966-1975	Return	0.530	1.100	**0.570**	210	63.33%	120	**1966-1975**	Return	0.71	1.045	0.335	236	55.84%	120
	t-Stat	1.275	3.067	2.954					t-Stat	1.763	2.679	1.872			
1976-1985	Return	1.550	2.450	**0.900**	416	75.00%	120	**1976-1985**	Return	1.925	2.155	**0.230**	494	60.83%	120
	t-Stat	5.487	8.672	7.547					t-Stat	7.024	7.055	2.294			
1986-1995	Return	1.430	1.630	0.200	488	65.83%	120	**1986-1995**	Return	1.18	1.565	**0.380**	626	60.00%	120
	t-Stat	4.353	6.296	1.302					t-Stat	4.595	5.270	3.040			
1996-2005	Return	2.160	2.130	-0.040	526	55.83%	120	**1996-2005**	Return	1.62	2.09	**0.470**	709	63.33%	120
	t-Stat	5.653	6.050	-0.185					t-Stat	4.560	5.207	2.332			

Table 11: Individual Stock Level Analysis: Momentum Return Based on Alternative Strategies Using Contemporaneous Macroeconomic Factors

Ten-Year Sub-Period Results

The following table reports the monthly returns in percentage based on alternative momentum strategies. For each month *t*, the following model is estimated for each NYSE, AMEX and NASDAQ stock on the monthly CRSP database (using a sixty-month window and a minimum of 24 months of data required): $R_{it} = a_i + \sum_{j=1}^{n} b_{ij} f_t + e_{it}$, where, R_{it} is the return of each stock at time *t*, f_t is the vector of Macroeconomic factors e.g. dividend yield (DIV) defined as the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the index, short rate (YLD) is the yield on the three-month Treasury bill, term premium (TERM) is defined as the yield spread of a ten-year Treasury bond and a three-month Treasury bill and the default premium (DEF) is the yield spread of Moody's Baa and Aaa rated bonds, b_{ij} is the factor loadings a_i and e_{it} are constant and residual, respectively. Thereafter the model is decomposed into two components e.g. the stock specific components ($\hat{a}_i + \hat{e}_{it}$) and the common components ($\sum_{j=1}^{n} \hat{b}_{ij} f_t$). Stocks are ranked based on these two criterions using a formation period *J* of five months (*t-5 through t-1*) and deciles portfolios are formed with the lowest (P1) portfolio as the loser and highest portfolios (P10) as the winner portfolio. A long position in taken in the winner portfolio and short position in the loser portfolio and hold the position for the following *K* (*t+1 through t+6*) holding month. **T**he momentum return is defined as the difference between the return on the winner and the loser portfolio. The returns exclude all penny stocks. Panel A reports the returns of loser, winner and momentum portfolio where stocks are ranked based on Stock-specific factor, while Panel B reports the same while stocks are ranked based on Common components. The column 'Decile portfolio size' reports the average size of the decile portfolio during each period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are also given.

Panel A: Ranking Based on Unexplained Risk Components								**Panel B: Ranking Based on Explained Risk Components**							
Period		**Loser**	**Winner**	$MR_{t^*}^{UR}$	**Decile Portfolio Size**	**% > 0**	**No. of Months**	**Period**		**Loser**	**Winner**	$MR_{t^*}^{ER}$	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	Return	1.467	1.626	**0.159**	247	63.00%	895	**1926-2005**	Return	1.573	1.503	-0.070	302	50.15%	895
	t-Stat	11.268	10.737	2.571					t-Stat	10.412	11.404	-1.129			
1926-1935	Return	3.220	4.530	**1.310**	64	29.17%	55	**1926-1935**	Return	4.360	3.270	**-1.090**	71	16.67%	55
	t-Stat	3.715	4.441	5.091					t-Stat	4.468	3.816	-4.847			
1936-1945	Return	1.610	2.430	**0.830**	72	59.17%	120	**1936-1945**	Return	2.410	1.600	**-0.810**	75	42.50%	120
	t-Stat	4.892	5.113	2.860					t-Stat	5.073	4.944	-2.717			
1946-1955	Return	0.980	1.330	**0.350**	90	60.00%	120	**1946-1955**	Return	1.310	1.030	**-0.280**	92	43%	120
	t-Stat	5.220	5.120	2.936					t-Stat	4.934	5.538	-2.287			
1956-1965	Return	1.080	0.980	-0.100	108	49.17%	120	**1956-1965**	Return	0.940	1.140	0.200	114	52.50%	120
	t-Stat	6.709	4.764	-0.987					t-Stat	4.537	6.943	1.879			
1966-1975	Return	0.670	0.560	-0.110	210	47.50%	120	**1966-1975**	Return	0.470	0.690	0.220	236	57.50%	120
	t-Stat	1.780	1.431	-0.857					t-Stat	1.189	1.796	1.890			
1976-1985	Return	2.060	1.750	**-0.300**	416	36.67%	120	**1976-1985**	Return	1.690	2.090	**0.390**	494	60.83%	120
	t-Stat	9.263	5.674	-2.180					t-Stat	5.337	9.074	2.760			
1986-1995	Return	1.360	1.170	**-0.190**	488	40.00%	120	**1986-1995**	Return	1.130	1.340	**0.210**	626	62.50%	120
	t-Stat	4.722	4.563	-1.976					t-Stat	4.251	4.539	2.064			
1996-2005	Return	1.720	1.840	0.120	526	53.33%	120	**1996-2005**	Return	1.800	1.840	0.040	709	53.33%	120
	t-Stat	4.522	5.502	0.848					t-Stat	4.972	4.521	0.258			

Table 12: Individual Stock Level Analysis: Momentum Return Based on Alternative Strategies at the Individual Stock Level Using Lagged Macroeconomic Factors as Common Component

Ten-Year Sub-Period Results

The following table reports the monthly returns in percentage based on alternative momentum strategies. For each month *t*, the following model is estimated for each NYSE, AMEX and NASDAQ stock on the monthly CRSP database (using a sixty-month window and a minimum of 24 months of data required): $R_{it} = a_i + \sum_{j=1}^{n} b_{ij} f_{t-1} + e_{it}$, where, R_{it} is the return of each stock at time *t*, f_{t-1} is the vector of macroeconomic factors, b_{ij} is the factor loadings a_i and e_{it} are constant and residual, respectively. Thereafter the model is decomposed into two components e.g. the stock specific components ($\hat{a}_i + \hat{e}_{it}$) and the common components ($\sum_{j=1}^{n} \hat{b}_{ij} f_{t-1}$). Stocks are ranked based on these two criterions using a formation period *J* of five months (*t-5 through t-1*) and deciles portfolios are formed with the lowest (P1) portfolio as the loser and highest portfolios (P10) as the winner portfolio. A long position in taken in the winner portfolio and short position in the loser portfolio and hold the position for the following *K* (*t+1 through t+6*) holding month. **T**he momentum return is defined as the difference between the return on the winner and the loser portfolio. The returns exclude all penny stocks. Panel A reports the returns of loser, winner and momentum portfolio where stocks are ranked based on Stock-specific factor, while Panel B reports the same while stocks are ranked based on Common components. The column 'Decile portfolio size' reports the average size of the decile portfolio during each period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are also given.

Panel A: Ranking Based on Unexplained Risk Components								**Panel B: Ranking Based on Explained Risk Components**							
Period		**Loser**	**Winner**	MR_{t*}^{UR}	**Decile Portfolio Size**	**% > 0**	**No. of Months**	**Period**		**Loser**	**Winner**	MR_{t*}^{ER}	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	Return	1.666	1.511	**-0.155**	247	49.19%	895	**1926-2005**	Return	1.481	1.700	**0.219**	302	52.13%	895
	t-Stat	11.192	11.510	-2.665					t-Stat	11.096	11.186	3.614			
1926-1935	Return	4.01	3.81	-0.200	64	28.33%	55	**1926-1935**	Return	3.89	4.15	0.250	71	19.17%	55
	t-Stat	4.060	4.602	-0.604					t-Stat	4.726	4.234	0.758			
1936-1945	Return	2.86	1.51	**-1.350**	72	27.50%	120	**1936-1945**	Return	1.48	2.93	**1.450**	75	74.17%	120
	t-Stat	6.102	4.429	-6.172					t-Stat	4.420	6.150	6.018			
1946-1955	Return	0.99	1.24	**0.250**	90	59.17%	120	**1946-1955**	Return	1.2	1.02	**-0.180**	92	42.50%	120
	t-Stat	4.139	5.880	3.057					t-Stat	5.734	4.238	-2.109			
1956-1965	Return	1.01	0.97	-0.040	108	47.50%	120	**1956-1965**	Return	0.93	1.03	0.100	114	55.00%	120
	t-Stat	5.987	4.661	-0.383					t-Stat	4.490	6.003	0.863			
1966-1975	Return	0.64	0.72	0.080	210	53.33%	120	**1966-1975**	Return	0.63	0.7	0.070	236	53.33%	120
	t-Stat	1.670	1.787	0.735					t-Stat	1.529	1.803	0.640			
1976-1985	Return	2.19	1.9	**-0.290**	416	49.17%	120	**1976-1985**	Return	1.89	2.18	**0.290**	494	50.00%	120
	t-Stat	8.066	6.448	-2.289					t-Stat	6.188	7.197	2.199			
1986-1995	Return	1.25	1.23	-0.020	488	58.33%	120	**1986-1995**	Return	1.19	1.26	0.070	626	46.67%	120
	t-Stat	4.111	4.959	-0.152					t-Stat	4.644	4.101	0.552			
1996-2005	Return	1.69	1.99	**0.310**	526	65.00%	120	**1996-2005**	Return	1.97	1.69	**-0.290**	709	39.17%	120
	t-Stat	4.489	5.830	2.558					t-Stat	5.406	4.182	-2.268			

Table 13: Individual Stock Level Analysis: Momentum Return Based on Alternative Strategies Using Contemporaneous Fama-French and Macroeconomic Factors

Ten-Year Sub-Period Results

The following table reports the monthly returns in percentage based on alternative momentum strategies. For each month *t*, the following model is estimated for each NYSE, AMEX and NASDAQ stock on the monthly CRSP database (using a sixty-month window and a minimum of 24 months of data required): $R_{it} = a_i + \sum_{j=1}^{n} b_{ij} f_t + e_{it}$, where, R_{it} is the return of each stock at time *t*, f_t is the vector of both Fama-French and Macroeconomic factors, b_{ij} is the factor loadings a_i and e_{it} are constant and residual, respectively. Thereafter the model is decomposed into two components e.g. the stock specific components ($\hat{a}_i + \hat{e}_{it}$) and the common components ($\sum_{j=1}^{n} \hat{b}_{ij} f_t$). Stocks are ranked based on these two criterions using a formation period *J* of five months (*t-5 through t-1*) and deciles portfolios are formed with the lowest (P1) portfolio as the loser and highest portfolios (P10) as the winner portfolio. A long position in taken in the winner portfolio and short position in the loser portfolio and hold the position for the following *K* (*t+1 through t+6*) holding month. **T**he momentum return is defined as the difference between the return on the winner and the loser portfolio. The returns exclude all penny stocks. Panel A reports the returns of loser, winner and momentum portfolio where stocks are ranked based on Stock-specific factor, while Panel B reports the same while stocks are ranked based on Common components. The column 'Decile portfolio size' reports the average size of the decile portfolio during each period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are also given.

Panel A: Ranking Based on Unexplained Risk Components								**Panel B: Ranking Based on Explained Risk Components**							
Period		**Loser**	**Winner**	MR_{t*}^{UR}	**Decile Portfolio Size**	**% > 0**	**No. of Months**	**Period**		**Loser**	**Winner**	MR_{t*}^{ER}	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	Return	1.602	1.636	0.034	247	49.19%	895	**1926-2005**	Return	1.617	1.632	0.015	302	47.23%	895
	t-Stat	11.512	11.632	0.921					t-Stat	11.366	11.431	0.352			
1926-1935	Return	3.700	3.690	-0.010	64	20.00%	55	**1926-1935**	Return	3.570	3.780	0.210	71	25.00%	55
	t-Stat	4.181	4.109	-0.083					t-Stat	4.066	4.174	0.905			
1936-1945	Return	2.280	2.290	0.010	72	45.83%	120	**1936-1945**	Return	2.340	2.260	-0.070	75	50.83%	120
	t-Stat	5.535	5.449	0.032					t-Stat	5.517	5.540	-0.484			
1946-1955	Return	1.060	1.350	**0.290**	90	60.00%	120	**1946-1955**	Return	1.330	1.100	**-0.230**	92	42.50%	120
	t-Stat	5.127	5.499	3.863					t-Stat	5.349	5.303	-3.022			
1956-1965	Return	1.070	1.020	-0.050	108	52.50%	120	**1956-1965**	Return	1.000	1.080	0.080	114	47.50%	120
	t-Stat	5.451	5.596	-0.841					t-Stat	5.411	5.468	1.297			
1966-1975	Return	0.660	0.920	**0.260**	210	58.33%	120	**1966-1975**	Return	0.890	0.640	**-0.240**	236	43.33%	120
	t-Stat	1.670	2.260	2.972					t-Stat	2.115	1.617	-2.597			
1976-1985	Return	2.090	1.930	-0.160	416	45.83%	120	**1976-1985**	Return	1.880	2.110	**0.230**	494	55.83%	120
	t-Stat	7.748	6.310	-1.538					t-Stat	6.036	7.472	2.019			
1986-1995	Return	1.320	1.160	-0.160	488	42.50%	120	**1986-1995**	Return	1.130	1.420	**0.290**	626	60.83%	120
	t-Stat	4.503	4.550	-1.745					t-Stat	4.341	4.701	2.796			
1996-2005	Return	1.790	1.860	0.070	526	54.17%	120	**1996-2005**	Return	1.880	1.840	-0.040	709	45.83%	120
	t-Stat	4.959	5.340	0.817					t-Stat	4.970	4.600	-0.431			

Table 14: Individual Stock Level Analysis: Momentum Return Based on Alternative Strategies Using Lagged Fama-French and Macroeconomic Factors

Ten-Year Sub-Period Results

The following table reports the monthly returns in percentage based on alternative momentum strategies. For each month *t*, the following model is estimated for each NYSE, AMEX and NASDAQ stock on the monthly CRSP database (using a sixty-month window and a minimum of 24 months of data required): $R_{it} = a_i + \sum_{j=1}^{n} b_{ij} f_{t-1} + e_{it}$, where, R_{it} is the return of each stock at time *t*, f_{t-1} is the vector of both Fama-French and macroeconomic factors, b_{ij} is the factor loadings a_i and e_{it} are constant and residual, respectively. Thereafter the model is decomposed into two components e.g. the stock specific components ($\hat{a}_i + \hat{e}_{it}$) and the common components ($\sum_{j=1}^{n} \hat{b}_{ij} f_{t-1}$). Stocks are ranked based on these two criterions using a formation period *J* of five months (*t-5 through t-1*) and deciles portfolios are formed with the lowest (P1) portfolio as the loser and highest portfolios (P10) as the winner portfolio. A long position in taken in the winner portfolio and short position in the loser portfolio and hold the position for the following *K* (*t+1 through t+6*) holding month. **T**he momentum return is defined as the difference between the return on the winner and the loser portfolio. The returns exclude all penny stocks. Panel A reports the returns of loser, winner and momentum portfolio where stocks are ranked based on Stock-specific factor, while Panel B reports the same while stocks are ranked based on Common components. The column 'Decile portfolio size' reports the average size of the decile portfolio during each period. The column titled "% > 0"gives the percentage of Winner minus Loser that are positive. The last column reports the size of each sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at the 5 percent level and t-statistics are also given.

Panel A: Ranking Based on Unexplained Risk Components								**Panel B: Ranking Based on Explained Risk Components**							
Period		**Loser**	**Winner**	MR_{t*}^{UR}	**Decile Portfolio Size**	**% > 0**	**No. of Months**	**Period**		**Loser**	**Winner**	MR_{t*}^{ER}	**Decile Portfolio Size**	**% > 0**	**No. of Months**
1926-2005	Return	1.652	1.567	-0.085	247	52.13%	895	**1926-2005**	Return	1.525	1.695	**0.169**	302	46.30%	895
	t-Stat	11.188	12.080	-1.519					t-Stat	11.525	11.063	2.841			
1926-1935	Return	3.69	4.28	**0.59**	64	30.83%	55	**1926-1935**	Return	4.23	3.96	-0.270	71	15.83%	55
	t-Stat	3.91	5.22	2.33					t-Stat	5.106	4.097	-0.884			
1936-1945	Return	2.99	1.44	**-1.55**	72	25.00%	120	**1936-1945**	Return	1.4	2.97	**1.570**	75	72.50%	120
	t-Stat	6.14	4.56	-6.82					t-Stat	4.532	6.054	6.506			
1946-1955	Return	1.00	1.33	**0.33**	90	64.17%	120	**1946-1955**	Return	1.29	1.02	**-0.270**	92	38.33%	120
	t-Stat	4.26	6.09	3.52					t-Stat	5.914	4.332	-2.937			
1956-1965	Return	0.99	1.03	0.04	108	50.00%	120	**1956-1965**	Return	0.97	1.01	0.040	114	53.33%	120
	t-Stat	5.78	5.05	0.33					t-Stat	4.722	5.883	0.344			
1966-1975	Return	0.63	0.83	**0.20**	210	60.83%	120	**1966-1975**	Return	0.73	0.73	-0.010	236	49.17%	120
	t-Stat	1.59	2.08	2.07					t-Stat	1.791	1.799	-0.106			
1976-1985	Return	2.15	1.84	**-0.31**	416	44.17%	120	**1976-1985**	Return	1.82	2.09	**0.270**	494	52.50%	120
	t-Stat	7.78	6.48	-3.08					t-Stat	6.290	6.676	2.342			
1986-1995	Return	1.28	1.23	-0.06	488	54.17%	120	**1986-1995**	Return	1.19	1.35	0.160	626	51.67%	120
	t-Stat	4.16	5.10	-0.44					t-Stat	4.727	4.269	1.167			
1996-2005	Return	1.62	2.08	**0.46**	526	67.50%	120	**1996-2005**	Return	2.07	1.68	**-0.390**	709	36.67%	120
	t-Stat	4.498	6.001	4.039					t-Stat	5.587	4.159	-3.147			

5 CHAPTER FIVE: DECOMPOSING MOMENTUM RETURNS; WHAT FACTORS CONTRIBUTE TO MOMENTUM RETURNS?

5.1 Introduction

The purpose of this section is to examine the contribution of different risk factors in generating momentum returns. Empirical results of this thesis, so far, shows that momentum returns remains once controlled for explained risk factors. The question that naturally arises is that then what contributes to generate momentum returns. Literature though provide evidences of the sources of momentum returns there is no clear-cut evidence in the earlier studies as to what contributes to momentum returns. In other words, there is no study that quantifies the relative contribution of the explained risk components and the unexplained risk components that derives momentum returns.

5.2 Data and Methodology

5.2.1 Data

In order to investigate the contributions of components in generating momentum returns data have been collected from the Centre for Research in Security Prices (CRSP) of all stocks listed in the three exchanges including, NYSE, AMEX and NASDAQ on a monthly basis. The sample period is from January 1926 through December 2005. The total number of months within this sample period is 960 months and the total number of stocks traded in all the three stock exchanges is 22277 stocks. This results in a total number of 21385920 observations. All empirical analysis have been conducted on the entire sample period and then on ten-year sub-period. The selection criteria as described in section 3.2.1 have been considered for the purpose of the analysis. For example, all stocks that are priced above $1 have been selected, stocks that have non-missing observations at the beginning of the holding period and stocks that have at least six consecutive monthly return observations at the beginning of the holding period.

5.2.2 Variables Employed

This study employs variables as described in section 3.2.2. For example, the Fama-French three factors that include return on CRSP value-weighted market index in excess of the one-month Treasury bill rate (MKT_RF), the small-minus-big size factor (SMB) and the high-minus-low book-to-market-ratio factor (HML) have been used. And macroeconomic risk factors includes dividend yield (DIV) which is the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the market index, the short rate (YLD) is the yield on the three-month Treasury bill, the term premium (TERM) is the yield spread of a ten-year Treasury bond over a three-month Treasury bill, the default premium (DEF) is the yield spread between Moody's Baa and Aaa rated bonds. Both these two sets of variables have been used as contemporaneous and as lagged values.

5.2.3 Methodology

In this section the proportionate contribution of explained risk components and unexplained risk components is measured. The analysis is performed (1) Both at the portfolio level and at the individual stock level, (2) Both by using Firm level factors and macroeconomic risk factors, (3) By using both contemporaneous and lagged variable and (4) At whole sample and at sub-sample of period.

At the portfolio level, momentum returns are first determined by using Equation 2 and Equation 3 as described in section 3.2.4.2 for the contemporaneous and lagged values of the variables. For example, $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*} + \varepsilon_{t*}$ and $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*-1} + \varepsilon_{t*}$ are used where, $MR_{t*,6x6}$ is the momentum return generated by using the conventional method of Jegadeesh and Titman (2001) with a *JxK=6x6* strategy, f_{t*} and f_{t*-1} are the vectors respectively for the common components as contemporaneous and as lagged values of risk factors, respectively, where the risks factors are (1) Fama-French three factors and the risk-free rate is adjusted already and (2) Macroeconomic risk factors, β_j (j=1,….,n) is the vector for risk factors and α and ε_{t*} are the constant and the residuals, respectively. $E(\varepsilon_{t*}) = 0$, $Cov(\varepsilon_{t*}, f_{t*}) = 0$ and ε_{t*}~ *iid (0,•²)*. Thereafter the above two equations are decomposed into explained and unexplained components as $\sum_{j=1}^{n} \hat{\beta}_j f_{t*}$ and $\alpha + \varepsilon_{t*}$. Thereafter the magnitude or the contribution of each of the explained and unexplained components are determined by using the following two equations

$\frac{MR^{ER}}{MR^{ER}+MR^{UR}}$ for the contribution of explained components and (8)

$\frac{MR^{UR}}{MR^{ER}+MR^{UR}}$ for the contribution of unexplained components (9)

At the individual stock level momentum returns are determined first by using equations 4, 5, 6 and 7 in section 4.2.3. Thereafter, similar to the methodology followed for the portfolio level as above , equations 4 and 5 are decomposed into explained and unexplained components as $\sum_{j=1}^{n} \hat{b}_j f_{t^*}$ and $a+e_{t*}$. Thereafter the magnitude or the contribution of each of the explained and unexplained components is determined by using equations 8 and 9.

5.3 Empirical Results on the Contribution of Factors in Generating Momentum Returns

5.3.1 Portfolio Level Analysis

For the portfolio level, momentum return excluding penny stocks with the strategy *JxK =6x6* are regressed against the two common components e.g. Fama-French three factors and the macroeconomic factors. Thereafter the estimated common components ($\sum_{j=1}^{n} \hat{\beta}_j f_{t*}$) and the estimated stock specific components $(\hat{\alpha} + \hat{\varepsilon}_{t*})$[21] are decomposed and their relative importance are examined with respect to the momentum returns generated from the conventional method and the momentum returns generated from the restricted observations.

5.3.1.1 Portfolio Level: Contribution of Fama-French Three Factors Unexplained Risk Factors

Panel A of Table 15 reports the proportionate contribution of explained risk factors and unexplained risk factors in generating momentum returns at the portfolio level. Equation 2 and equation 3 e.g. $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*} + \varepsilon_{t*}$ and $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t-1*} + \varepsilon_{t*}$ as described in section 3.2.4.2 are used to derive the empirical results, where f is the vector of Fama-French three factors. In panel A of Table 15 column one shows the different sub-periods examined in this study, column two reports momentum return across different sub-periods and column three through column seven represents the proportionate contribution of explained risk components and unexplained risk components in isolation. Column eight 'Total' sum ups the total contribution of all components, column nine reports the aggregate contribution of the explained risk components and column ten represents the aggregate contribution of unexplained risk components.

[21] Note that the intercept (alpha) is constant for each sample period while the estimated residual ($\hat{\varepsilon}_t$) is time varying

As reported in panel A of Table 15, during the entire sample period from 1926 through 2005, the contribution of α (alpha) is 5.14 percent and the contribution of $\hat{\varepsilon}_t$ (residual) is 95.92 percent in generating total momentum return of 0.90 percent. Among the Fama-French three factors HML contribute the highest of 0.29 percent while the contribution of SMB is the lowest with only -1.43 percent. When looking at the combined contribution of the two types of risk components, $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ (explained risk components) contributes 1.13[22] percent while $\hat{\alpha} + \hat{\varepsilon}_{t^*}$ (unexplained risk components) contributes 98.87 percent.

[Insert Table 15 here]

The empirical results of different sub-periods show that when considering the pre-1950s and post-1950s period, during pre-1950s the contribution of $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ is up to 11 percent compared to its counter part where the combined contribution of the unexplained risk components, $\hat{\alpha} + \hat{\varepsilon}_{t^*}$, is up to 98 percent. In sub-periods 1936-1945 the contribution of $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ is the highest with 11.35 percent while naturally $\hat{\alpha} + \hat{\varepsilon}_{t^*}$ contributes the lowest of 89 percent in that sub-period. Among the Fama-French three factors, the contribution of Mkt-Rf is the highest in of 1.63 percent in the sub-period 1936-1945 while the contribution of the other two factors e.g. SMB and HML are very

[22] For ease of calculation and measuring relative weights the absolute value of the aggregate contribution of the components are scaled to 100 percent.

low. In the post 1950s the contribution of $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ varies from as low as 1.02 percent to 69 percent in different sub-periods while the contribution of $\hat{a} + \hat{e}_{t*}$ is, on average, more than 80 percent except in the sub-period 1966-1975 when the contribution of the $\hat{a} + \hat{e}_{t*}$ is the lowest to 31 percent only. Among the contributions of the Fama-French three factors, on average, the contribution of Mkt-Rf is the highest and positive with the highest contribution of 27.06 percent in the sub-period 1966-1975. The contribution of SMB and HML in different sub-period varies from very low to even negative.

Panel B of Table 15 reports the proportionate contribution of explained risk components and unexplained risk components in generating momentum returns at the portfolio level when the lagged Fama-French three factors are considered to be the explained risk factors in Equation 2 as described in section 3.2.4.2. The table shows that during the entire sample period e.g. 1926-2005, the contribution of explained risk components $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ is 6 percent while the contribution of the unexplained risk components, $\hat{a} + \hat{e}_{t*}$, is 94 percent. In different sub-periods during the pre-1950s the contribution of $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ is still low and is only 11 percent in the sub-period 1926-1935. On the other hand the contribution of $\hat{a} + \hat{e}_{t*}$ is, on average, 90 percent in different sub-periods during pre-1950s. Among the three Fama-French factors, the contribution of HML seems to be positive and high while the contribution of the other two factors Mkt-Rf and SMB are negative. In post-1950s the contribution of $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ ranges from 3 percent to 21 percent and is the highest in the sub-period 1966-1975. The contribution of $\hat{a} + \hat{e}_{t*}$ during the post-1950s is significantly high and is more than 79 percent in different sub-periods. Among the Fama-French factors the contributions during post-1950s is mixed though HML contributes positively in many sub-periods.

On average, the above findings show that when contemporaneous Fama-French three factors are considered the contribution of explained risk factors is as low as 1.13 percent while the contribution of unexplained risk factors are more than 90 percent in the whole sample period and in different sub-periods. Among the Fama-French three factors, on average Mkt-Rf contributes positively to generate momentum returns. When lagged Fama-French three factors are considered, it is observed that the contribution of explained risk factors improves to 6 percent while the contribution of unexplained risk components is still more than 90 percent. Among the three factors, HML seems to contribute positively and significantly to generate momentum returns.

5.3.1.2 Portfolio Level: Contribution of Macroeconomic Risk Factors and Unexplained Risk Factors

Panel A of Table 16 shows the contribution of macroeconomic risk factors and unexplained risk factors in generating momentum returns at the portfolio level. For the purpose the macroeconomic variables are used in Equation 2 and equation 3 e.g. $MR_{t*,6x6} = a + \sum_{j=1}^{n} b_j f_{t*} + e_{t*}$ and $MR_{t*,6x6} = a + \sum_{j=1}^{n} b_j f_{t-1*} + e_{t*}$ as described in section 3.2.4.2 are used to derive the empirical results, where *f* is the vector of macroeconomic risks. As reported in panel A of Table 16, during the entire sample period from 1926 through 2005, the contribution of α (alpha) is 17.28 percent and the contribution of $\hat{\varepsilon}_t$ (residual) is 73.65 percent in generating total momentum return of 0.90 percent. Among the four macroeconomic variables the contribution of TERM is the highest of 8.8 percent followed by the contribution of DIV of 1 percent. The contribution of the other two variables e.g. YLD and DEF are negative. In aggregate the contribution of the explained macroeconomic risk factors, $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ is 9 percent while the contribution of unexplained risk factors e.g. $\hat{\alpha} + \hat{\varepsilon}_{t^*}$ is 91 percent.

In different sub-periods, the contribution of $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ ranges from 5 percent to 35 percent. Notably, during the market upturn the contribution of $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ is comparatively high than that of its counterpart in the economic downturn. For example, in the sub-period 1966-1975 and 1996-2005 the contribution of $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ is 19 percent and 35 percent, respectively. On the other hand the contribution of the unexplained risk factors is, on average, more than 90 percent in different sub-periods. In particular the contribution of $\hat{\alpha} + \hat{\varepsilon}_{t^*}$ is low during market downturn. For example in the period 1966-1975 and 1995-2005 the contribution of $\hat{\alpha} + \hat{\varepsilon}_{t^*}$ is 81.21 percent and 64.65 percent, respectively. Among the four macroeconomic variables the contribution of TERM and DIV is, on average, positive and significant.

Panel B of Table 16 reports the contribution of lagged macroeconomic risk factors and unexplained risk factors in generating momentum returns at the portfolio level. The table shows that during the entire sample period e.g. 1926-2005, the contribution of explained risk factors, $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ increased to 13 percent while the contribution of the unexplained risk components, $\hat{a} + \hat{e}_{t*}$ is 87 percent. Among the four macroeconomic variables, the contribution of DIV, YLD and TERM are 6.68 percent, 0.15 percent and 11.91 percent, respectively while the contribution of DEF is negative. In different sub-period the contribution of $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ varies with the economic cycle and ranges from 5 percent to as high as 55 percent. In the sub-period 1966-75 and 1996-2005 the contribution of $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ is 40 percent and 55 percent, respectively. On the other hand the contribution of $\hat{a} + \hat{e}_{t*}$, on average, more than 80 percent in different sub-periods. Consistent with the earlier findings the contribution of $\hat{a} + \hat{e}_{t*}$ is low during market downturn. For example in the sub-periods 1966-1975 and 1996-2005 the contributions of $\hat{a} + \hat{e}_{t*}$ is 60.32 percent and 45.39 percent, respectively. Among the four macroeconomic risk factors the contribution of DIV, YLD and TERM are, on, average, positive and significant.

[Insert Table 16 here]

In sum, from the above empirical results it can be concluded that the contemporaneous macroeconomic variables contributes 10 percent in generating momentum returns while unexplained risk factors contributes 90 percent in generating momentum returns. However, when lagged macroeconomic risk factors are considered macroeconomic variables contributes 13 percent while unexplained risk factors contribute 87 percent. Among the four macroeconomic variables DIV and TERM contributes positively in generating momentum returns. The results are robust in different sub-periods. Notably, the contribution of macroeconomic variables are considerably high and is up to 13 percent compared to the Fama-French three factors which contributes only 6 percent in generating momentum returns.

5.3.1.3 Portfolio Level: Contribution of Fama-French Three Factors and Macroeconomic Risk Factors Simultaneously and Unexplained Risk Factors

From the previous empirical results it is apparent that the contribution of Fama-French three factors which are firm level factors and the contribution of macroeconomic risk factors that captures the economic risk are significantly different. A natural question arises as to which factors contributes most when these two factors are taken into account simultaneously. Table 15 reports the proportionate contribution of Fama-French three factors and macroeconomic risk factors when controlled for simultaneously and the contribution of unexplained risk factors in generating momentum returns at the portfolio level. In equation 2 e.g. $MR_{t*,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t*} + \varepsilon_{t*}$ as described in section 3.2.4.2, the f is the vector of contemporaneous Fama-French three factors and macroeconomic risk factors simultaneously.

[Insert Table 17 here]

As reported in Table 17 during the entire sample period e.g. 1926-2005, the contribution of a (alpha) is 12. 82 percent and the contribution of $\hat{e}_t$ (residual) is 57.57 percent in generating total momentum return of 0.90 percent. The combined contribution of unexplained risk factors, $\hat{a} + \hat{e}_{t*}$ is 80.44 percent. On the other hand the contribution of explained risk factors e.g. both Fama-French three factors and macroeconomic risk factors, $\sum_{j=1}^{n} \hat{b}_j f_{t*}$, is 20 percent. Among the three Fama-French factors and four macroeconomic variables the contribution of Mkt-Rf, DIV, TERM and DEF are positive and are 2.26 percent, 18.7 percent, 34.09 and 4.07 percent, respectively. In different sub-periods the contribution of $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ ranges from 3 percent to 81 percent and is more pronounced during economic downturn. In the sub-period 1966-1975 and 1996-2005 the contribution of $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ is 50.06 and 80.79 respectively, whereas in the other sub-periods the contribution is, on average, 20 percent. On the other hand the contribution of $\hat{a} + \hat{e}_{t*}$ is on average more than 80 percent in different sub-periods except in the sub-period 1996-2005 when the contribution is as low as 20 percent.

[Insert Table 18 here]

Table 18 reports the contribution of lagged Fama-French three factors and lagged macroeconomic risk factors when controlled for simultaneously and the and contribution of unexplained risk factors in generating momentum returns at the portfolio level. As is apparent from the table when lagged factors are taken into account the contribution of α (alpha) is 26.59 percent and the contribution of $\hat{\varepsilon}_t$ (residual) is 77.71 percent. The contribution of $\hat{\alpha} + \hat{\varepsilon}_{t*}$ is 86.22 percent. On the contrary, the contribution of explained risk factors, $\sum_{j=1}^{n} \hat{\beta}_j f_{t*}$ is 13.78 percent. Among the different risk factors, SMB, DIV, TERM and DEF contributes 0.97 percent, 32.19 percent, 1.32 percent and 4.16 percent. In different sub-periods the contribution of $\sum_{j=1}^{n} \hat{\beta}_j f_{t*}$ ranges from 3 percent to 82.16 percent and is prominent during market downturn. The contribution of $\hat{\alpha} + \hat{\varepsilon}_{t*}$, however, is on average more than 80 percent in different sub-periods.

Overall, the empirical findings show that when both the contemporaneous Fama-French three factors and macroeconomic factors are considered simultaneously at the portfolio level the contribution of unexplained risk factors is as high as 80.44 percent while the contribution of explained risk factors are only 20 percent. When the lagged explained risk factors are used the contribution of explained risk factors declines to 14 percent and the contribution of unexplained risk factors increases to 86 percent. This suggests that the contribution of explained risk factors in generating momentum returns is more influenced by the contemporaneous factors than lagged variables. One reason for these contradictory results could be the opposite effect of Fama-French three factors and macroeconomic risk factors on momentum returns.

5.3.2 Individual Stock level Analysis

The following section reports the contribution of explained risk factors and unexplained risk factors in generating momentum return at the individual stock level. The analysis has been performed by taking into account the decomposition approach as explained in section 5.2.3. At first momentum returns are generated using the conventional method where stock returns are ranked based on past returns. Thereafter momentum returns are generated at the individual stock level by using the alternative momentum strategy as described in section 5.2.3 Then momentum returns generated based on alternative criteria are compared with respect to momentum returns generated based on conventional method. This allows measuring the relative weights of each risk factor in generating total momentum returns.

5.3.2.1 Individual Stock Level: Contribution of Fama-French Three Factors and Unexplained Risk Factors

Panel A of Table 19 reports the proportionate contribution of contemporaneous Fama-French three factors and unexplained risk factors in generating momentum returns. Column one shows the sub-periods, column two represents momentum return generated based on conventional method, $MR_{t^*}^{\mathrm{Res}}$, column three represents momentum returns generated based on unexplained risk factors, column four shows the momentum returns generated based on Fama-French three factors, column five sums the momentum returns generated based on these two risk factors e.g. ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$). Column six presents the percentage contribution of unexplained risk factors, $MR_{t^*}^{UR}$ in generating momentum returns, column seven shows the percentage contribution of explained risk factors, $MR_{t^*}^{ER}$, in total momentum returns and column nine sum ups the total contribution of all components.

As evident from Panel A of Table 19 that during the entire sample period from 1926 through 2005 the total momentum returns generated from the explained and unexplained risk factors is 0.80 percent per month (9.6 percent per annum). The contribution of unexplained risk factors to generate this 0.8 percent momentum return is 52.57 percent which is slightly higher than that of its counterpart the contribution of Fama-French three factors which is 47.43 percent. In different sub-periods momentum returns generated based on the two risk factors e.g. explained and unexplained risk factors, ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$) ranges from as low as 0.26 percent per month to as high as 1.23 percent per month. The contribution of $MR_{t^*}^{UR}$ in different sub-periods varies from 5 percent to 88 percent. Notably the contribution of $MR_{t^*}^{UR}$ is high during economic upturn, for example in sub-periods 1956-1965, and 1986-1995 the contribution of $MR_{t^*}^{UR}$ is 66.67 percent, 73.83 percent and 88.46 percent, respectively. On the other hand the contribution of Fama-French three factors, $MR_{t^*}^{ER}$ in different sub-periods ranges from 11.54 percent to 94.78 percent. It is evident the contribution of $MR_{t^*}^{ER}$ is high during economic downturn.

[Insert Table 19 here]

Panel B of Table 19 reports the empirical results of the contributions of different risk factors when lagged Fama-French three factors are used. It is apparent from the table that during the entire sample period momentum returns generated from unexplained risk factors, $MR_{t^*}^{UR}$ is 0.45 percent per month (5.4 percent per annum) and momentum returns generated from explained risk factors, $MR_{t^*}^{ER}$, is 0.38 percent per month. The contribution of $MR_{t^*}^{UR}$ during the entire sample period is 53.89 whereas the contribution of $MR_{t^*}^{ER}$ is 46.11 percent. This suggest that momentum returns is generated both by explained and unexplained risk factors. In different sub-period momentum returns generated by both the risk factors e.g. ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$) ranges from 0.51 percent per month to 1.13 percent per month. When measuring the relative contribution of $MR_{t^*}^{UR}$ in different sub-periods it is evident that the contribution of $MR_{t^*}^{UR}$ varies across economic cycle and is high during economic upturn. For example in sub-periods 1946-1955, 1956-1965, 1966-1976 and 1976-1985 momentum returns are 84.42 percent, 82.08 percent, 62.98 percent and 79.65 percent, respectively. On the other hand the contribution of lagged Fama-French three factors varies from 15.58 percent to 92.16 percent in different sub-periods. However, the contribution of $MR_{t^*}^{ER}$ is high during economic downturn. For example in periods 1926-1935 1936-1945 and 1996-2005 the contribution of $MR_{t^*}^{ER}$ is 84.62 percent, 82.28 percent and 92.16 percent, respectively.

In sum, the contribution of unexplained risk factors is more than 50 percent when contemporaneous Fama-French three factors are considered at the individual stock level while the contribution of explained risk factors are more than 40 percent. This contribution also holds when lagged Fama-French three factors are considered.

Furthermore the contribution of explained risk factors is high during economic downturn which suggest that the firm level factors has important impact on momentum returns and that momentum returns are more a contribution of these unique risk factors.

5.3.2.2 Individual Stock Level: Contribution of Macroeconomic Risk Factors and Unexplained Risk Factors

Panel A of Table 20 reports the proportionate contribution of contemporaneous macroeconomic risk factors and unexplained risk factors in generating momentum returns. Column one shows the sub-periods, column two represents momentum return generated based on conventional method, $MR_{t^*}^{\mathrm{Res}}$, column three represents momentum returns generated based on unexplained risk factors, column four shows the momentum returns generated when stocks are ranked based on macroeconomic risk factors, column five sums the momentum returns generated based on these two risk factors e.g. ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$). Column six presents the percentage contribution of unexplained risk factors, $MR_{t^*}^{UR}$ in generating momentum returns, column seven shows the percentage contribution of explained risk factors, $MR_{t^*}^{ER}$, in total momentum returns and column nine sum ups the total contribution of all components.

As shown in Panel A of Table 20, total momentum returns generated based on the two risk factors e.g. ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$) is 0.22 percent per month (2.64 percent per annum). The contribution of $MR_{t^*}^{UR}$ is 68.89 percent whereas the contribution of $MR_{t^*}^{UR}$ is 31.11 percent. In different sub-periods the total momentum returns generated based on the two risk sources ranges from 0.24 to 2.16 percent per month. The contribution of

$MR_{t^*}^{UR}$ in different sub-periods varies form 8.70 percent per month to 88.57 percent per month. It is evident that the contribution of $MR_{t^*}^{UR}$ is the highest in the sub-period 1996-2005 of 88.57 percent. On the contrary, the contribution of $MR_{t^*}^{ER}$ is on average, more than 60 percent in different sub-period and is also varies according to the economic cycle.

[Insert Table 20 here]

Panel B of Table 20 reports the contribution of lagged macroeconomic risk factors and the unexplained risk factors in generating momentum returns at the individual stock level. In the whole sample period momentum returns generated based on the two types of risk factors, ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$), is 0.374 percent. The contribution of $MR_{t^*}^{UR}$ is 41.44 percent while the contribution of $MR_{t^*}^{ER}$ is 58.56 percent. This implies that momentum returns are a compensation for macroeconomic risk and is the effect is higher when lagged macroeconomic risk factors are used. In different sub-periods, total momentum returns as resulted from the risks factors ranges from 0.09 percent to 2.8 percent per month. The contribution of $MR_{t^*}^{UR}$ is, on average more than 40 percent in different sub-periods. On the other hand the contribution of $MR_{t^*}^{ER}$ is more than 70 percent in sub-periods 1956-1965 and 1986-1995 of 71.43 percent and 77.78 percent, respectively. It is observed that the contribution of lagged macroeconomic variables are comparatively stable than that of the contribution of $MR_{t^*}^{UR}$ in different sub-periods.

In sum, the contribution of contemporaneous macroeconomic variables is 31.11 percent while the contribution of unexplained risk factors is 68.89 percent. However, when lagged macroeconomic risks are considered the contribution of explained risk factors are higher than that of the unexplained risk factors. This suggests that macroeconomic risk factors have important implications in resulting momentum returns.

5.3.2.3 Individual Stock Level: Contribution of Fama-French three Factors and Macroeconomic Risk Factors and Unexplained Risk Factors

For robustness of whether the contribution of explained factors are more than that of the unexplained factors when considering both the explained risk factors simultaneously, the results are replicated in Table 21 where both the Fama-French three factors and the macroeconomic risk factors are taken into account simultaneously. Panel A of Table 21 reports when the contribution of explained risk factors, both Fama-French three factors and macroeconomic risk factors simultaneously, and the unexplained risk factors. As shown in the table the total return generated from the two risk factors, e.g. ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$) is 0.049 percent per month (0.588 percent per annum). The contribution of $MR_{t^*}^{UR}$ is 69.39 percent and the contribution of $MR_{t^*}^{ER}$ is 30.61 percent. In different sub-periods momentum returns generated by ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$) ranges from 0.08 percent to 0.52 percent. The contribution of $MR_{t^*}^{UR}$ is, on average, more than 40 percent with the highest contribution in the sub-period 1996-2005 of 63.64 percent. On the other hand the contribution of $MR_{t^*}^{ER}$ is more than 60 percent in different sub-periods and is the highest in the sub-period 1936-1945 of 87.50 percent. Noticeably, when both the Fama-French three factors and the macroeconomic risk factors are considered simultaneously the contribution of $MR_{t^*}^{UR}$ increases in different sub-periods compared to when the risk factors are considered in isolation.

[Insert Table 21 here]

Panel B of Table 21 reports when the contribution of the lagged Fama-French three factors and lagged macroeconomic risk factors are taken into account simultaneously, and the unexplained risk factors. The table reports that the total momentum returns when both risk factors are considered ($MR_{t^*}^{UR} + MR_{t^*}^{ER}$) is 0.25 percent per month (3 percent per annum). The contribution of $MR_{t^*}^{UR}$ declines to 32 percent compared to when contemporaneous variables are used whilst the contribution of $MR_{t^*}^{ER}$ increases to 68 percent. In different sub-periods the contribution of $MR_{t^*}^{UR}$ varies from 27.27 percent to 95.24 percent and is particularly high during economic downturn. On the other hand the contribution of $MR_{t^*}^{ER}$ is, on average, more than 50 percent in different sub-periods and is particularly high during economic upturn. Noticeably the contribution of $MR_{t^*}^{ER}$ is considerably high during the post-1950s.

To summarize, the results show that the contribution of unexplained risk factors is 68.39 percent while that of explained risk factors is 30.61 percent during the entire sample period. The opposite relation holds when lagged Fama-French three factors and lagged macroeconomic factors are considered. In such case, the contribution of unexplained risk factors is 32 percent while that of explained risk factors is 68 percent. This implies that the contribution of lagged risk factors is more prominent on momentum returns.

5.4 Conclusions

This section answers the question as to what contributes to momentum returns. The empirical answers provide some important findings as follows;

At the portfolio level it is observed that when contemporaneous Fama-French three factors are considered the contribution of explained risk factors is as low as 1.13 percent while the contribution of unexplained risk factors are more than 90 percent in the whole sample period and in different sub-periods. The results changes only slightly when lagged Fama-French three factors are considered e.g. the contribution of explained risk factors improves to 6 percent while the contribution of unexplained risk components is still more than 93 percent. Among the three factors, HML seems to contribute positively and significantly to generate momentum returns. Secondly, it is noticeable that when contemporaneous macroeconomic variables are used the contribution is 10 percent while unexplained risk factors contribute 90 percent in generating momentum returns. However, when lagged macroeconomic risk factors are considered macroeconomic variables contributes 13 percent while unexplained risk factors contribute 87 percent. Among the four macroeconomic variables DIV and TERM contributes positively in generating momentum returns. Finally, When both the contemporaneous Fama-French three factors and macroeconomic factors are considered simultaneously at the portfolio level the contribution of unexplained risk factors is as high as 80.44 percent while the contribution of explained risk factors are only 20 percent. The results differ only slightly when the lagged explained risk factors are used.

For example, the contribution of explained risk factors declines to 14 percent and the contribution of unexplained risk factors increases to 86 percent.

This suggests that at the portfolio level the contribution of unexplained risk factors is dominantly high compared to the explained risk factors in generating momentum returns at the portfolio level. The results are in line with the argument forwarded by Kang and Li (2004) that stock-specific sources account for more than fifty percent of the profits in stock returns.

At the individual stock level, however, the contribution of explained and unexplained risk factors is somewhat different. Firstly, when contemporaneous Fama-French three factors are considered the contribution of risk factors is more than 40 percent whilst the contribution of unexplained risk factors is more than 50 percent. The results are robust when lagged Fama-French three factors are used.

Secondly, when contemporaneous macroeconomic risk factors are used these explained risk factors contribute 31.11 percent while the contribution of unexplained risk factors is 68.89 percent. However, when lagged macroeconomic risks are considered the contribution of explained risk factors increase to 58.56 percent than that of the unexplained risk factors of 41.44 percent. This suggests that macroeconomic risk factors have important implications in resulting momentum returns.

Thirdly, when both the Fama-French three factors and the macroeconomic risk factors are taken into account simultaneously, the explained risk factors contribute

30.61 percent, whilst the unexplained risk factors contribute 68.39 percent in generating momentum returns. However, the opposite relation holds when lagged Fama-French three factors and lagged macroeconomic factors are considered. In such case, the contribution of unexplained risk factors is 32 percent while that of explained risk factors is 68 percent. This implies that the contribution of lagged risk factors is more prominent on momentum returns.

This suggests that at the individual stock level, though the contribution of unexplained risk factors is more pronounced compared to its counterpart the contribution of explained risk factors, the explained risk factors have important contribution in generating momentum returns. Therefore it can be concluded that momentum returns are contributions of both explained and unexplained risk factors. And that the contribution of macroeconomic risk factors is particularly important in generating momentum returns.

5.5 APPENDIX C: Empirical Tables on Decomposing Momentum Returns

Table 15: Decomposition At Portfolio Level

Momentum Return and Proportionate Contribution of the Fama-French Factors and the Unexplained Risk Factors: Ten-Year Sub-Period Result

The following table reports the proportionate contribution of the Fama-French three factors in generating momentum return at the portfolio level. Momentum return is estimated based on the strategy described in Table I excluding penny stocks with a strategy of JxK= 6x6. Thereafter the momentum return is regressed on the Fama-French three factors for each sub-sample period separately. The estimated coefficients of the regression are then decomposed into the common components and the stock specific components. The sum of the product of the estimated coefficients and the factors $\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$ and the unexplained risk components $\hat{\alpha} + \hat{\varepsilon}_{t^*}$ is also given. The column title 'Total' gives the total contribution of all the factors in resulting momentum return. Panel A shows the percentage contribution of the Fama-French three factors when used to capture simultaneous effect on momentum return. Panel B reports the proportionate contribution of these factors when used as lagged variables. The numbers are reported in percentage.

Panel A: Proportionate Contribution of Contemporaneous Fama-French Factors and Stock Specific Factors

Period	Momentum $Return_{6x6}$	α	Mkt-Rf	SMB	HML	ε_t	Total	$\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$	$\hat{\alpha} + \hat{\varepsilon}_{t^*}$
1926-2005	0.9	5.14	-0.02	-1.43	0.29	95.92	100	1.13	98.87
1926-1935	0.73	12.69	-2.18	0.7	-1.54	90.32	100	2.85	97.15
1936-1945	-0.18	-2.67	1.63	-16.51	0.19	117.37	100	11.35	88.65
1946-1955	0.9	-53.34	0	2.62	-2.06	152.79	100	0.56	99.44
1956-1965	1.05	-50.33	-8.48	-0.37	9.87	149.31	100	1.02	98.98
1966-1975	0.9	51.87	27.06	10.74	31.12	-20.79	100	68.92	31.08
1976-1985	1.32	134.69	-3.5	-18.02	-2.54	-10.64	100	16.24	83.76
1986-1995	1.5	65.59	0.2	2.64	-11.81	43.38	100	7.61	92.39
1996-2005	0.96	-41	0.55	6.54	9.27	124.63	100	16.36	83.64

Panel B: Proportionate Contribution of Lagged Fama-French Factors and Stock Specific Factors

Period	Momentum $Return_{6x6}$	α	$Mkt\text{-}Rf_{t-1}$	SMB_{t-1}	HML_{t-1}	ε_t	Total	$\sum_{j=1}^{n} \hat{\beta}_j f_{t^*}$	$\hat{\alpha} + \hat{\varepsilon}_{t^*}$
1926-2005	0.9	22.17	-5.37	-1.16	0.22	84.14	100	5.60	94.40
1926-1935	0.73	12.35	-9.15	-7.65	3.12	101.34	100	10.74	89.26
1936-1945	-0.18	-3.5	-4.88	4.93	2.71	100.74	100	2.76	97.24
1946-1955	0.9	-51.47	-2.96	-9.82	13.45	150.79	100	0.67	99.33
1956-1965	1.05	-51.59	-22.15	-0.39	19	155.13	100	3.31	96.69
1966-1975	0.9	52.63	-19.53	9.28	31.53	26.09	100	21.28	78.72
1976-1985	1.32	134.6	4.84	-13.82	-21.44	-4.18	100	18.91	81.09
1986-1995	1.5	66.99	-1.1	-2.36	4.93	31.53	100	1.47	98.53
1996-2005	0.96	-42.58	7.07	16.42	-15.46	134.54	100	8.03	91.97

Table 16: Decomposition at Portfolio Level

Momentum Return and Proportionate Contribution of Macroeconomic Variables and Unexplained Risk *Factors: Ten-Year Sub-Period Result*

The following table reports the proportionate contribution of the Fama-French three factors in generating momentum return at the portfolio level. Momentum return is estimated based on the strategy described in Table I for the restricted observations without penny stocks with a strategy of JxK= 6x6. Thereafter the momentum return is regressed on the macroeconomic variables for each sub-sample period separately. The estimated coefficients of the regression are then decomposed into the common components and the stock specific components. The sum of the product of the estimated coefficients and the factors $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ and the stock-specific components $\hat{a} + \hat{e}_{t*}$ is also given. The column title 'Total' gives the total contribution of the all factors in resulting momentum return. Panel A shows the percentage contribution of the macroeconomic variables when used to capture simultaneous effect on momentum return. Panel B reports the proportionate contribution of these factors when used as lagged variables. The numbers are reported in percentage.

Panel A: Proportionate Contribution of Contemporaneous Macroeconomic Factors and Stock Specific Factors

Period	**Momentum Return$_{6x6}$**	a	DIV	YLD	TERM	DEF	e_t	Total	$\sum_{j=1}^{n} \hat{b}_j f_{t*}$	$\hat{a} + \hat{e}_{t*}$
1926-1995	0.9	17.28	0.99	-0.73	8.8	-0.1	73.65	100	8.97	91.03
1926-1935	0.73	12.84	20.61	-37.54	19.08	4.4	80.61	100	6.55	93.45
1936-1945	-0.18	-1.04	5.74	-0.86	0.39	2.71	93.05	100	7.98	92.02
1946-1955	0.9	-56.38	1.24	-6.59	11.18	1.48	149.08	100	7.31	92.69
1956-1965	1.05	15.76	-0.46	-1.68	0.36	5.9	80.13	100	4.12	95.88
1966-1975	0.9	58.75	29.2	14.3	-62.74	-10.61	70.26	100	18.79	81.21
1976-1985	1.32	125.22	-2.45	1.5	-0.01	-9.9	-14.37	100	8.92	91.08
1986-1995	1.5	65.04	-4.35	-0.11	1.55	7.39	30.49	100	4.48	95.52
1996-2005	0.96	12.35	21	30.9	-11.48	-5.07	52.3	100	35.35	64.65

Panel B: Proportionate Contribution of Lagged Macroeconomic Factors and Stock Specific Factors

Sub- Period	**Momentum Return$_{6x6}$**	a	**DIV$_{t-1}$**	**YLD$_{t-1}$**	**TERM$_{t-1}$**	**DEF$_{t-1}$**	e_t	**Total**	$\sum_{j=1}^{n} \hat{b}_j f_{t*}$	$\hat{a} + \hat{e}_{t*}$
1926-1995	0.9	16.59	6.68	0.15	11.91	-5.91	70.47	100	12.84	87.16
1926-1935	0.73	12.39	11.56	-1.67	18.93	0.57	58.22	100	29.39	70.61
1936-1945	-0.18	-0.86	3.25	6.6	-14.41	-0.09	105.51	100	4.25	95.75
1946-1955	0.9	-58.01	-0.59	25.65	-5.14	0.71	137.39	100	20.63	79.37
1956-1965	1.05	15.74	17.09	2.46	2.27	-1.09	63.52	100	20.73	79.27
1966-1975	0.9	54.42	36.44	1.4	2.05	-0.21	5.9	100	39.68	60.32
1976-1985	1.32	124.43	-6.85	-1.36	16	-31.84	-0.38	100	16.24	83.76
1986-1995	1.5	65.36	-2.74	0.09	-1.46	-5.84	44.58	100	8.30	91.70
1996-2005	0.96	-64.03	174.2	-114.6	-37.83	32.872	109.44	100	54.61	45.39

Table 17: Decomposition at Portfolio Level: Momentum Return and Proportionate Contribution of Fama-French three factors and Macroeconomic Variables Simultaneously and Unexplained Risk Factors: Ten-Year Sub-Period Result

The following table reports the proportionate contribution of the Fama-French three factors in generating momentum return at the portfolio level. Momentum return is estimated based on the strategy described in Table I for the restricted observations without penny stocks with a strategy of JxK= 6x6. Thereafter the momentum return is regressed on the macroeconomic variables for each sub-sample period separately. The estimated coefficients of the regression are then decomposed into the common components and the stock specific components. The sum of the product of the estimated coefficients and the factors $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ and the stock-specific components $\hat{a} + \hat{e}_{t*}$ is also given. The column title 'Total' gives the total contribution of the all factors in resulting momentum return. Panel A shows the percentage contribution of the macroeconomic variables when used to capture simultaneous effect on momentum return. Panel B reports the proportionate contribution of these factors when used as lagged variables. The numbers are reported in percentage.

Contribution of Contemporaneous Fama-French three factors and Macroeconomic Factors simultaneously													
Period	**MR_{6x6}**	a	**Mkt-Rf**	**SMB**	**HML**	**DIV**	**YLD**	**TERM**	**DEF**	e_t	**Total**	$\sum_{j=1}^{n} \hat{b}_j f_{t-1*}$	$\hat{a}+\hat{e}_{t*}$
1926-2005	0.9	12.82	2.26	-2.05	-1.13	18.7	-38.82	34.09	4.07	57.57	100	19.56	80.44
1926-1935	0.73	12.4	-5.42	0.59	-2.87	10.1	-2.78	21.56	-6.24	72.66	100	14.94	85.06
1936-1945	-0.18	-2.48	0.61	-16.29	0.19	0.24	-1.34	0.11	1.88	117.09	100	11.3	88.7
1946-1955	0.9	-53.15	0	2.88	-0.83	-7.78	0.86	-1	3.4	155.64	100	2.35	97.65
1956-1965	1.05	-49.87	1.36	-1.5	7.09	-13.77	-2.75	3.92	-0.97	156.48	100	5.85	94.15
1966-1975	0.9	67.28	25.44	-1.25	-10.29	4.9	-2.98	12.69	11.32	-107.01	100	50.06	49.94
1976-1985	1.32	134.92	-1.61	-6.18	-2.32	-0.63	-214.59	255.31	2.78	-67.65	100	32.75	67.25
1986-1995	1.5	66.24	-2.59	-0.74	-9.25	-1.23	3.76	3.18	-0.74	41.37	100	6.6	93.4
1996-2005	0.96	-72.8	0.28	6.07	9.23	157.79	-90.71	-23.01	21.13	92.01	100	80.79	19.21

Table 18: Decomposition at Portfolio Level: Momentum Return and Proportionate Contribution of Fama-French three factors and Macroeconomic Variables Simultaneously and Unexplained Risk Factors: Ten-Year Sub-Period Result

The following table reports the proportionate contribution of the Fama-French three factors in generating momentum return at the portfolio level. Momentum return is estimated based on the strategy described in Table I for the restricted observations without penny stocks with a strategy of JxK= 6x6. Thereafter the momentum return is regressed on the macroeconomic variables for each sub-sample period separately. The estimated coefficients of the regression are then decomposed into the common components and the stock specific components. The sum of the product of the estimated coefficients and the factors $\sum_{j=1}^{n} \hat{b}_j f_{t*}$ and the stock-specific components $\hat{a} + \hat{e}_{t*}$ is also given. The column title 'Total' gives the total contribution of the all factors in resulting momentum return. Panel A shows the percentage contribution of the macroeconomic variables when used to capture simultaneous effect on momentum return. Panel B reports the proportionate contribution of these factors when used as lagged variables. The numbers are reported in percentage.

Contribution of Contemporaneous Fama-French three factors and Macroeconomic Factors simultaneously

Period	MR_{6x6}	a	Mkt-Rf	SMB	HML	DIV	YLD	TERM	DEF	e_t	Total	$\sum_{j=1}^{n} \hat{b}_j f_{t-1*}$	$\hat{a} + \hat{e}_{t*}$
1926-2005	0.9	26.59	-16.16	0.97	-10.36	32.19	-28.79	1.32	4.16	77.71	100	13.78	86.22
1926-1935	0.73	12.46	-16.74	-7.03	3.52	27.16	-68.13	48.1	3.15	97.51	100	8.31	91.69
1936-1945	-0.18	-2.8	-8.57	6.78	2.91	1.47	-6.9	6.23	-18.27	119.15	100	12.32	87.68
1946-1955	0.9	-53.15	0	2.88	-0.83	-7.78	0.86	-1	3.4	155.64	100	2.35	97.65
1956-1965	1.05	-53.4	-17.71	-0.38	18.64	-9.81	-3.76	2.87	-0.3	163.85	100	8.64	91.36
1966-1975	0.9	191.44	-100.26	8.73	-78.1	51.93	-35.92	-4.61	7.37	-39.59	100	49.84	50.16
1976-1985	1.32	132.73	8.7	-19.11	-17.29	-2.2	1.82	2.98	-7.4	-0.22	100	19.70	80.30
1986-1995	1.5	67.07	-0.29	-0.87	4.14	-4.24	-0.53	1.6	7.27	25.85	100	7.08	92.92
1996-2005	0.96	-81.64	5.58	16.77	-15.87	200.97	-117.74	-45.6	38.05	99.48	100	82.16	17.84

Table 19: Decomposition at Individual Stock Level: Momentum Return and Proportionate Contribution of Fama-French Factors and Unexplained Risk Factors

Ten-Year Sub-Period Result

The following table reports the proportionate contribution of the alternative momentum returns generated based on the two raking criterion e.g. unexplained risk factors and Fama-French three factors. Momentum returns (restricted) require a minimum of twenty-four observation. Momentum return generated based on the stock-specific components and common components are also given. The percentage contribution of the two alternative momentum return is reported. The column title ‘Total’ gives the total contribution of all the factors in resulting momentum return. The numbers in the parenthesis in column six and seven in Panel A and Panel B represents the percentage contribution of $MR_{t^*}^{UR}$ and $MR_{t^*}^{ER}$ when compared to $MR_{t^*}^{Res}$. Panel A shows the percentage contribution of the Fama French three factors when used as contemporaneous variables and Panel B reports the same when lagged Fama-French variables are employed. The numbers are reported in percentage.

Panel A: Contribution of Contemporaneous Fama-French and Unexplained Risk Factors								Panel B: Contribution of Lagged Fama-French and Unexplained Risk Factors							
Period	$MR_{t^*}^{Res}$	$MR_{t^*}^{UR}$	$MR_{t^*}^{ER}$	Sum of $MR_{t^*}^{UR}$ and $MR_{t^*}^{ER}$	% Contribution of $MR_{t^*}^{UR}$	% Contribution of $MR_{t^*}^{ER}$	**Total**	**Period**	$MR_{t^*}^{Res}$	$MR_{t^*}^{UR}$	$MR_{t^*}^{ER}$	Sum of $MR_{t^*}^{UR}$ and $MR_{t^*}^{ER}$	% Contribution of $MR_{t^*}^{UR}$	% Contribution of $MR_{t^*}^{ER}$	**Tota**
1926-2005	0.777	0.42	0.379	0.799	52.57	47.43	100	**1926-2005**	0.77	0.45	0.385	0.835	53.89	46.11	100
1926-1935	-0.01	0.92	0.21	1.13	81.42	18.58	100	**1926-1935**	-0.01	0.16	0.88	1.04	15.38	84.62	100
1936-1945	-0.2	-0.2	0.35	0.55	36.36	63.64	100	**1936-1945**	-0.2	-0.07	0.325	0.395	17.72	82.28	100
1946-1955	0.88	0.71	0.52	1.23	57.72	42.28	100	**1946-1955**	0.88	0.84	0.155	0.995	84.42	15.58	100
1956-1965	0.93	0.75	0.375	1.125	66.67	33.33	100	**1956-1965**	0.93	0.87	0.19	1.06	82.08	17.92	100
1966-1975	0.76	0.55	0.195	0.745	73.83	26.17	100	**1966-1975**	0.76	0.57	0.335	0.905	62.98	37.02	100
1976-1985	1.2	0.7	0.685	1.385	50.54	49.46	100	**1976-1985**	1.2	0.9	0.23	1.13	79.65	20.35	100
1986-1995	1.4	0.23	-0.03	0.26	88.46	11.54	100	**1986-1995**	1.4	0.2	0.38	0.58	34.48	65.52	100
1996-2005	0.79	-0.03	0.545	0.575	5.22	94.78	100	**1996-2005**	0.79	-0.04	0.47	0.51	7.84	92.16	100

Table 20: Decomposition at Individual Stock Level: Momentum Return and Proportionate Contribution of Macroeconomic Risk Factors and the Unexplained Risk Factors

Ten-Year Sub-Period Result

The following table reports the proportionate contribution of the alternative momentum returns generated based on the two raking criterion e.g. stock-specific factors and both Fama-French factors and macroeconomic factors simultaneously. Momentum return (restricted) is generated using a sixty-month window and a minimum of twenty-four observation. Momentum return generated based on the stock-specific components and common components are also given. The percentage contribution of the two alternative momentum return is reported. The column title 'Total' gives the total contribution of all the factors in resulting momentum return. The numbers in the parenthesis in column six and seven in Panel A and Panel B represents the percentage contribution of $MR_{t^*}^{UR}$ and $MR_{t^*}^{ER}$ when compared to $MR_{t^*}^{Res}$. The table shows the percentage contribution of the macroeconomic factors in generating momentum return.

Panel A: Contribution of Contemporaneous Macroeconomic risk and Unexplained Risk Factors								**Panel B: Contribution of Lagged Macroeconomic risk and Unexplained Risk Factors**							
Period	$MR_{t^*}^{Res}$	$MR_{t^*}^{UR}$	$MR_{t^*}^{ER}$	*Sum of* $MR_{t^*}^{UR} and MR_{t^*}^{ER}$	*% Contribution of* $MR_{t^*}^{UR}$	*% Contribution of* $MR_{t^*}^{ER}$	**Total**	**Period**	$MR_{t^*}^{Res}$	$MR_{t^*}^{UR}$	$MR_{t^*}^{ER}$	*Sum of* $MR_{t^*}^{UR} and MR_{t^*}^{ER}$	*% Contribution of* $MR_{t^*}^{UR}$	*% Contribution of* $MR_{t^*}^{ER}$	**To**
1926-2005	0.777	-0.155	-0.07	0.225	68.89	31.11	100	**1926-2005**	0.77	-0.155	0.219	0.374	41.44	58.56	1(
1926-1935	-0.01	-0.2	-1.09	1.29	15.50	84.50	100	**1926-1935**	-0.01	-0.2	0.25	0.45	44.44	55.56	1(
1936-1945	-0.2	-1.35	-0.81	2.16	62.50	37.50	100	**1936-1945**	-0.2	-1.35	1.45	2.8	48.21	51.79	1(
1946-1955	0.88	0.25	-0.28	0.53	47.17	52.83	100	**1946-1955**	0.88	0.25	-0.18	0.43	58.14	41.86	1(
1956-1965	0.93	-0.04	0.2	0.24	16.67	83.33	100	**1956-1965**	0.93	-0.04	0.1	0.14	28.57	71.43	1(
1966-1975	0.76	0.08	0.22	0.3	26.67	73.33	100	**1966-1975**	0.76	0.08	0.07	0.15	53.33	46.67	1(
1976-1985	1.2	-0.29	0.39	0.68	42.65	57.35	100	**1976-1985**	1.2	-0.29	0.29	0.58	50.00	50.00	1(
1986-1995	1.4	-0.02	0.21	0.23	8.70	91.30	100	**1986-1995**	1.4	-0.02	0.07	0.09	22.22	77.78	1(
1996-2005	0.79	0.31	0.04	0.35	88.57	11.43	100	**1996-2005**	0.79	0.31	-0.29	0.6	51.67	48.33	1(

Table 21: Decomposition at Individual Stock Level: Momentum Return and Proportionate Contribution of Fama-French the factors and Macroeconomic Risk Factors simultaneously and the Unexplained Risk Factors

Ten-Year Sub-Period Result

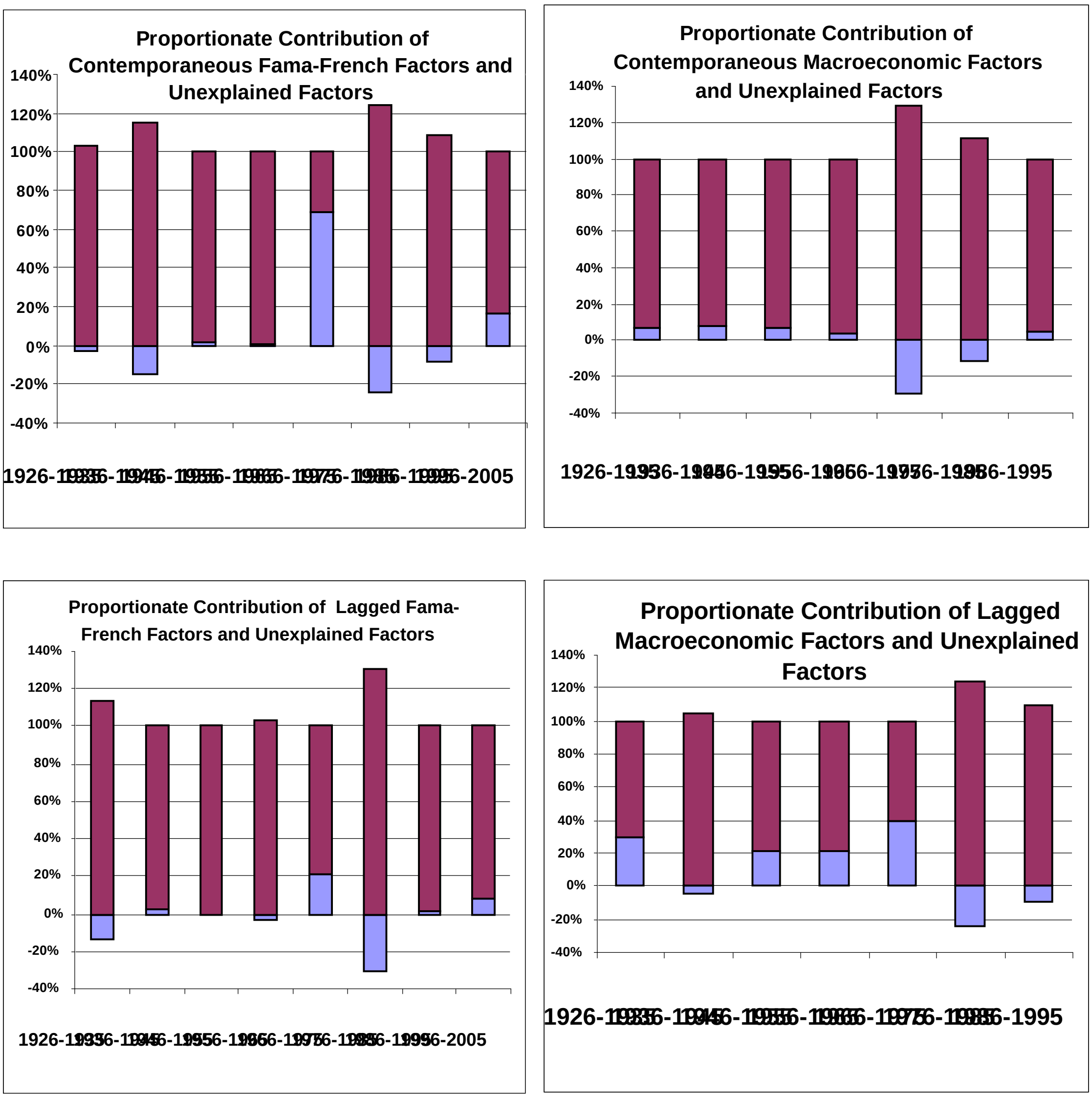
The following table reports the proportionate contribution of the alternative momentum returns generated based on the two raking criterion e.g. stock-specific factors and both Fama-French factors and macroeconomic factors simultaneously. Momentum return (restricted) is generated using a sixty-month window and a minimum of twenty-four observation. Momentum return generated based on the stock-specific components and common components are also given. The percentage contribution of the two alternative momentum return is reported. The column title 'Total' gives the total contribution of all the factors in resulting momentum return. The numbers in the parenthesis in column six and seven in Panel A and Panel B represents the percentage contribution of $MR_{t^*}^{UR}$ and $MR_{t^*}^{ER}$ when compared to $MR_{t^*}^{Res}$. The table shows the percentage contribution of the Fama-French three factors and macroeconomic factors simultaneously in generating momentum return.

Panel A: Contribution of Contemporaneous Fama-French and Macroeconomic Risk Factors Simultaneously and Unexplained Risk Factors							
Period	$MR_{t^*}^{Res}$	$MR_{t^*}^{UR}$	$MR_{t^*}^{ER}$	*Sum of* $MR_{t^*}^{UR} and MR_{t^*}^{ER}$	*% Contribution of* $MR_{t^*}^{UR}$	*% Contribution of* $MR_{t^*}^{ER}$	**Total**
1926-2005	0.777	0.034	0.015	0.049	69.39	30.61	100
1926-1935	-0.01	-0.01	0.21	0.22	4.55	95.45	100
1936-1945	-0.2	0.01	-0.07	0.08	12.50	87.50	100
1946-1955	0.88	0.29	-0.23	0.52	55.77	44.23	100
1956-1965	0.93	-0.05	0.08	0.13	38.46	61.54	100
1966-1975	0.76	0.26	-0.24	0.5	52.00	48.00	100
1976-1985	1.2	-0.16	0.23	0.39	41.03	58.97	100
1986-1995	1.4	-0.16	0.29	0.45	35.56	64.44	100
1996-2005	0.79	0.07	-0.04	0.11	63.64	36.36	100

Panel B: Contribution of Lagged Fama-French and Macroeconomic Risk Factors Simultaneously Unexplained Risk Factors							
Period	$MR_{t^*}^{Res}$	$MR_{t^*}^{UR}$	$MR_{t^*}^{ER}$	*Sum of* $MR_{t^*}^{UR} and MR_{t^*}^{ER}$	*% Contribution of* $MR_{t^*}^{UR}$	*% Contribution of* $MR_{t^*}^{ER}$	**To**
1926-2005	0.77	-0.08	0.17	0.25	32.00	68.00	1(
1926-1935	-0.01	0.59	-0.27	0.86	68.60	31.40	1(
1936-1945	-0.2	-1.55	1.57	3.12	49.68	50.32	1(
1946-1955	0.88	0.33	-0.27	0.6	55.00	45.00	1(
1956-1965	0.93	0.04	0.04	0.08	50.00	50.00	1(
1966-1975	0.76	0.2	-0.01	0.21	95.24	4.76	1(
1976-1985	1.2	-0.31	0.27	0.58	53.45	46.55	1(
1986-1995	1.4	-0.06	0.16	0.22	27.27	72.73	1(
1996-2005	0.79	0.46	-0.39	0.85	54.12	45.88	1(

Figure 2 Contributions of Explained Risk Factors and Unexplained Portion of Momentum Returns of Momentum Return at the Portfolio Level

We plot the proportionate contribution of the estimated common factors i.e. Fama-French three factors and macroeconomic variables (both as contemporaneous and lagged variables) and the estimated stock-specific components in generating momentum return at the portfolio level. We consider momentum strategy with six-month formation and six-month holding periods **(***JxK= 6x6* strategy) and skip a month between the formation and the holding period. The purpose is to evaluate the relative contribution of common components and stock-specific components in generating momentum return.



6 CHAPTER SIX: MOMENTUM RETURNS, UNCERTAINTY AND CREDIT RATINGS.

6.1 Introduction

This section answers the question: Is the uncertainty associated with momentum returns are mere compensation for macroeconomic risk factors? The section provides empirical evidences of momentum returns of credit rated stocks and its association with business cycle and macroeconomic risk factors. The section at first describes momentum returns of different types of credit rated stocks. Thereafter it provide evidences on the interaction of momentum returns of different types of credit rated stocks across National Bureau of Economic Research (NBER) business cycle. Next the section details the results of momentum returns when accounted for common components e.g. Fama-French three factors, market states factors and macroeconomic variables. Finally, the section reports the empirical findings and concludes.

6.2 Data and Methodology

6.2.1 Data

For the purpose of examining if momentum returns of credit rated stocks are compensation for macroeconomic risk factors data have been collected from the Centre for Research in Security Prices (CRSP) for the period from January 1985 through December 2006 on an monthly basis of all stocks that are rated by S&P and listed in the NYSE, AMEX and NASDAQ.

Data on credit rated stocks have been collected for all stocks with the S&P rating from the COMPUSTAT quarterly data files. All stocks that have S&P ratings in the COMPUSTAT database and prices in the CRSP database have been included. Since ratings by S&P vary from very high-credit-rated stocks to very low-credit-rated stocks or even to default, the credit rated stocks have been classified into three categories; (i) 'Investment Grade' are those stocks rated by S&P from AAA to BBB, the numerical score assigned is 1 to 10 (ii) 'Speculative Grade' are those stocks rated from BBB- to C numerical score 11 to 21and (iii) 'Default Grade' are those stocks rated below C, numerical score 22. For S&P credit ratings of stocks it is assumed that last quarter rating will continue in the immediate following quarter for a stock, until the new rating releases at the end of the quarter. For example, the credit rating of a stock in the month of April will be the same as that of in March and will continue till June when the new rating is given. The justification behind this is that this procedure will confirm stability of credit rating among stocks in each quarter. The total number of stocks traded in the three stock exchanges over the period from January 1985 through December 2006 is 21766 and the total number of months during this period is 264. This results in a total number of 5746224 observations.

6.2.2 Statistical Properties of the Data

Table 22 presents the descriptive statistics of the stocks that are rated by S&P which is used for the fourth empirical chapter of this thesis. As shown in Table 2, the total number of stocks traded in the NYSE, NASDAQ and AMEX is 21865 during the research period, from January 1985 through December 2006, with total number of 5772360 observations. The screening procedure for non-missing observations reduces the sample to 1980533 observations stocks-month; for all-stocks, 337745 stocks-months, for all-rated stocks, 1504299 for not-rated stocks, 203795 for 'Investment Grade' stocks, 131581 for 'Speculative Grade' stocks and 2369 for 'Default Grade' stocks. The screening procedure for six consecutive monthly returns leaves us with 21766 observations. We have 4017 stock-month observation for rated stocks, 19402 for not-rated stocks. In the resulting sample the number of stocks-month observations is 2045 for 'Investment Grade' stocks 2661 for 'Speculative Grade' stocks and for 286 'Default' stocks.

[Insert Table 22 Here]

As presented in Table 22, the mean returns for 'All Stocks' is 1.21 percent per month (14.52 percent per annum). The mean returns for 'All Rated' stocks is 1.17 percent per month (14.04 percent per annum) and is slightly lower than that of the 'Not Rated' stocks which is 1.22 percent per month (14.64 percent per annum). The mean returns of the 'Investment Grade' stocks is the highest with 1.32 percent, whilst 'Speculative Grade' stocks have a mean returns of only 1.03 percent per month and 'Default Grade' stocks have a negative mean returns of -4.55 percent per month. The return uncertainty as revealed by the standard deviation of each credit rating category shows that 'Not Rated' stocks have standard deviation of 17.66 percent which is higher than that of rated stocks which is 13.1 percent. Noticeably, the standard deviation of 'Speculative Grade' stocks is 15.43 percent almost twice compared to that of the 'Investment Grade' stocks which are 9.13 percent while the highest standard deviation of 31.54 percent is observed for 'Default Grade' stocks. The third and fourth moments depict that the distribution are mainly positively skewed and fat tailed. Exception is the Default Grade' stocks that are platykurtic (kurtosis= 2.58).

6.2.3 Variables Employed

This section describes in details the variables that have been used for the purpose of this study. The study investigates both empirical and theoretical variables as well as business cycle variables.

6.2.3.1 Fama-French Three Factors

Fama-French three factors include return on CRSP value-weighted market index in excess of the one-month Treasury bill rate (MKT_RF), the small-minus-big size factor (SMB) and the high-minus-low book-to-market-ratio factor (HML).

6.2.3.2 Macroeconomic Variables

Macroeconomic risk factors include; dividend yield (DIV) which is the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the market index, the short rate (YLD) is the yield on the three-month Treasury bill, the term premium (TERM) is the yield spread of a ten-year Treasury bond over a three-month Treasury bill, the default premium (DEF) is the yield spread between Moody's Baa and Aaa rated bonds. Data on macroeconomic variables for the sample period have been provided by Jeff Pontiff.

6.2.3.3 National Bureau of Economic Research (NBER) Business Cycle

In order to investigate if momentum returns of credit rated stocks are compensation for risk or uncertainty two more variables have been used, in addition to the Fama-French three factors and macroeconomic factors. This includes the business cycle as defined by the National Bureau of Economic Research (NBER). According to the NBER business cycle there are three expansion and two contraction periods during the sample period used for the third empirical study. The expansion periods are from December 1982 to August1990, April1991 to March 2001 and December 2001 to December 2006. And the two contraction periods are August 1990 to March 1991 and April 2001to November 2001.

6.2.3.4 Market States Variables

Cooper, Gutierrez and Hameed (2004) hypnotized two variables that are conditioned to the two states of the market e.g. the UP state and the DOWN state. Cooper et al (2004) define that a market is at its UP state if the 36-month lagged average market return (symbolized as LAGMKT) is positive and the market is defined to be at DOWN state if the 36-month lagged average market return is negative. These authors also took into consideration the square of the 36-month lagged average market return ($LAGMKT^2$) for the continuous measure of the market states variables. These two variables have been used in this study to capture if momentum returns of credit rated stocks vary across market states.

6.2.4 Methodology

In order to measure the momentum returns of credit rated stocks the conventional momentum method of Jegadeesh and Titman (2001) has been used. First momentum returns of all stocks that are rated by S&P are measured using the conventional method as described in section 3.5.1. Secondly, momentum returns for all different credit-rated stocks have been calculated. Thirdly, momentum returns are measured over the NBER business cycles. Finally, it is examined if momentum returns remain after priced for several risk factors. For the purpose a multi-factor regression model is employed with three different types of market-wide common risk factors e.g. (1) Fama-French three factors, (2) Market state variables and (3) Macroeconomic variables. The following model has been employed in the study

$$MR_{CR_{t^*, 6x6}} = \alpha + \sum_{j=1}^{n} \beta_j f_t + \varepsilon_t \qquad (10)$$

where, $MR_{CR_{t^*, 6x6}}$ is the momentum return generated at the time t^* for credit rating category CR (=1,2,…4) where (1) 'All Rated' (2) 'Investment Grade'(3) 'Speculative Grade', (4) Default Grade stocks. f_t (=1,2,3) is the factors of market-wide risk factors used in this study e.g. (1) Fama-French three factors, (2) Market State variables and (3) Macroeconomic variables. β_j (j=1,….,n) is the vectors for risk factors and α is the coefficient estimate for constant and ε_t is the residuals, with $E(\varepsilon_t) = 0$, $Cov(\varepsilon_t, f_t) = 0$ and $\varepsilon_t \sim iid\ (0,\bullet^2)$. Using equation 10 it is tested if momentum returns of credit rated companies remain once accounted for three different types of risk factors. The test is that if alpha (α) is significant then there is momentum returns that is unexplained after accounting for each group of common risk components.

6.3 Empirical Results on Momentum Returns, Uncertainty and Credit Ratings

6.3.1 Momentum Returns of Different Types of Credit Rated Stocks

This section provides empirical evidences on the momentum returns of different types of credit rated stocks. The credit rated stocks are categorised into three different types; e.g. Investment Grade, Speculative Grade and Default Grade rated stocks. The results are produced for the formation-holding period (JxK) of 3, 6, 9 and 12. The results are also robust in different sub-periods. The sample period is from January 1985 through December 2006 for all stocks that are traded in the NYSE, NASDAQ and AMEX and are rated by S&P.

6.3.1.1 Using the Formation-Holding (JxK =6x6) Strategy

Table 23 reports the monthly momentum returns for different credit rated stocks by using the conventional method of Jegadeesh and Titman (1993, 2001) over the entire sample period and in the seven sub-periods. Equation 1 in section 3.2.4.1 is used to derive momentum returns of different types of credit rated stocks. The first three columns represent the returns on Loser and Winner portfolios and Momentum returns, respectively. Column four gives the decile portfolio size[23] and column five gives the number of stocks that are rated in each category.

[23] As portfolio is rebalanced in each month we report the average number of stocks included in the decile portfolio during each sub-period.

Panel A of Table 23 presents momentum returns earned by all stocks. They are positive in the entire sample period and in the seven sub-periods. Momentum returns are 0.71 percent per month (8.52 percent, annually) for the full-sample period. The sub-sample period results show that investors have earned the highest momentum returns of 1.04 percent per month and 1.01 percent per month in sub-period 1997-1999 and in the subsequent sub-period 2000-2002, respectively. This prominent momentum return during the late 1990s and early 2000s is usually attributed to the 'technology-boom' in the US market. Notably, the last sub-period 2003-2006 demonstrate that momentum return declined dramatically to 0.29 percent per month and is the lowest among all sub-periods. This is usually attributed as the aftermath of economic downturns during early 2000s.[24] Panel B of Table 21 reports that momentum returns of stocks that are not rated. On average these stocks generate momentum returns of 0.76 percent per month. The pattern of momentum returns of not rated stocks starts with a rising trend and continues till early 1990s when it drops to 0.63 percent per month in the sub-period, then rises again in the late 1990s until it drops again in mid 2000s.

Panel C of Table 23 reports momentum returns for rated stocks. On average credit rated stocks earn momentum returns of 1.22 percent per month during the entire sample period. This is about 60 percent greater than the 0.76 percent momentum returns earned by stocks that are not credit rated. The momentum returns of rated stocks follow a particular pattern across different sub-periods. For example, momentum returns are about 1 percent per month during the early 1980s followed by a decline during early 1990s to 0.33 percent. Thereafter a sharp rise is observed during the late 1990s and

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[24] NBER business cycles report recession in US market in 2001. Details are reported below.

early 2000s to about 2 percent per month. The trend continues until a drastic fall to 0.33 percent per month during mid 2000s.

Credit rated stocks are classified into three categories. Panel D of Table 23 reports momentum returns for ‘Investment Grade’ stocks. Credit rating of ‘Investment-Grade’ rated stocks starts from AAA to BBB. They generate momentum returns of only 0.36 percent per month throughout the research period. Momentum returns are positive and significant in only two out of seven sub-periods, during 1988-1990 and 1997-of 0.61 percent and 1.19 percent, per month respectively. Momentum returns are not significant in 1985-1987, 1991-1993, 2000-2002 and 2003-2006 sub-periods and is negative in 1994-1996 sub-period.

Panel E of Table 23 presents the momentum returns from ‘Speculative Grade’ stocks. Credit rating of ‘Investment-Grade’ rated stocks start from BBB- to C. ‘Speculative Grade’ stocks generate momentum returns of 1.89 percent per month (22.68 percent, per annum). This is more than five times larger than the ‘Investment Grade’ stocks momentum returns of 0.36 percent. Remarkably, except for the last sub-period, 2003-2006, in all sub-periods momentum returns are usually more than 1 percent per month. For example, momentum return in sub-periods 1994-1996 and 1997-1999 are 3.57 percent (42.84 per annum) and 3.68 percent (44.16 per annum) per month, respectively.

Panel F of Table 23 reports momentum returns of ‘Default Grade’ stocks. During the entire sample period ‘Default Grade’ stocks generate momentum returns of only 0.23 percent per month (0.46 percent, annually) and we do not observe any significant momentum returns in any of the sub-periods. During the sub-periods from 1991 through 2002 we do not report momentum returns due to the fact that during these periods the number of 'Default Grade' stocks were less than ten, so decile portfolios could not be formed using the conventional momentum methodology of Jegadeesh and Titman (2001) which we employ in this study.

[Insert Table 23 Here]

Overall, it is observed that momentum returns of credit rated stock is much higher than that of stock that are not credit rated. Among the credit rated stocks, momentum is the highest in 'Speculative Grade' stocks and lowest in 'Default Grade' stocks. On average, 'Speculative Grade' stocks earn momentum returns of more than 1 percent per month, whilst momentum return in 'Investment Grade' stocks is comparatively weak at 0.36 percent per month and weakest for 'Default Grade' stock with 0.23 percent per month. Momentum return of all credit rating categories follows a similar pattern over time. Figure 1 depicts the time pattern of all categories of credit rating stocks during the research period. The time pattern of momentum returns of credit rated stocks starts with a rising trend till mid 1990s then the trend declines and rise again which continues till early 2000s and finally drops again in mid 2000s.

6.3.1.2 Using the Formation-Holding (JxK =nxn) Strategy

Panel A of Table 24 shows that for 'All rated' Stocks momentum return is significant in the entire sample period regardless a change in the JxK strategy. For example, momentum return generated by the credit rated stocks for strategies JxK= 3x3, 6x6, 9x9 and 12x12 during the entire sample period is 0.65 (t=3.76), 1.22 (t=8.33), 1.55 (t=7.28) and 1.23 (t=2.34), respectively. Among the four strategies, momentum return is most significant when JxK=9x9 strategy is employed. In almost all sub-sample period momentum return is statistically significant and earns on average, a momentum return of one percent. This finding supports the conventional momentum return of Jegadeesh and Titman who report that momentum portfolio earns a return of 1 percent per month (12 percent per annum).

[Insert Table 24 Here]

For 'Investment Grade' rated stocks momentum return is significant when JxK=6x6 and 9x9 during the entire sample period. As reported in Panel B of Table 24, momentum return of credit rated stocks when formation and holding period is six and nine are 0.36 percent (t=3.35) and 0.46 percent (t=4.39), respectively. In different sub-sample periods both these strategies e.g. JxK= 6x6x and 9x9 are significant in three out of seven sub-sample periods. However for strategy JxK= 9x9 only momentum return is positive and statistically significant.

Interestingly, for 'Speculative Grade' rated stocks momentum return is significant in all the entire sample period and in different sub-sample periods. Panel C of Table 24 report that momentum return in the entire sample period when *JxK*=3x3, 6x6, 9x9 and 12x12 are used are 1.27 percent (t=5.58), 1.89 percent (t=9.91), 1.40 percent (t=8.17) and 0.35 percent (t=2.21), respectively. Again, among the four different *JxK* strategies e.g. strategy 3x3, 6x6 and 9x9 seems to be economically and statistically significant in almost all the sub-sample period. The return generated by these low grade rated stocks are, on average, more than 1 percent.

The evidences suggest that momentum returns are high among low rated stocks and investors can earn abnormal return by forming and holding strategies for short-term period, e.g. for less than a year.

6.3.2 Momentum Return of Credit Rated Stocks across NBER Business Cycle

Table 25 reports momentum returns for credit rated stocks over the business cycles as defined by NBER. Panel A of Table 25 reports momentum returns for all stocks that are credit rated. On average, credit rated stocks generate 1 percent momentum returns per month during expansions and is consistent with earlier findings in Table 2 for sub-periods. Momentum returns ranges in between 1.31 percent to 0.79 percent per month during the three expansion periods as defined by NBER. Panel B of Table 25 presents momentum returns of ‘Investment Grade’ stocks. For Investment Grade’ stocks momentum is not significant in any of the expansion periods. During the contraction periods credit rated stocks generate momentum returns of more than 2 percent per month. Momentum returns of credit rated stocks is 3.75 percent per month during the early 1990s contraction and 2.39 percent per month during the early 2000s contraction period. Momentum returns of ‘Investment grade’ rated stocks are 2.19 percent per month during the early 1990s contraction period while that is not significant in other contraction period.

Panel C of Table 25 reports momentum returns for ‘Speculative Grade’ stocks. Speculative Grade’ stocks realize positive and significant momentum returns of more than 1 percent per month during expansions. Momentum returns of ‘Speculative Grade’ stocks are significant in both the contraction periods of early 1990s and early 2000s and are 4.99 percent and 3.24 percent per month, respectively.

[Insert Table 25 Here]

One natural question follows from these findings: Why are momentum strategies profitable during contraction and why so for ‘Speculative Grade’ stocks? It can be argued that ‘Speculative Grade’ stocks have the higher business risk. Uncertainty in ‘Speculative Grade’ stocks is even more during the contraction period when credit risk is a major concern and there are more defaults. Intuitively, during contractions momentum investors holding ‘Speculative Grade’ stocks in their portfolio may not make an appropriate balance between their expectations, the magnitude of mispricing and the uncertainty associated in the ‘Speculative Grade’ rated stocks. Furthermore, momentum returns being predicted returns may not reflect the exact business cycle condition at the time when momentum returns are realized.

It has been established that momentum returns are earned mainly by the ‘Speculative Grade’ stocks and during contraction periods. It is possible that momentum returns are a compensation and interaction of the higher uncertainties imposed by the higher business risks of those firms at the firm level and the higher business risks faced by all firms during contraction periods. If momentum returns is a systematic phenomenon and is just a mere compensation to bear systematic risk then one would expect momentum return to disappear once accounted for appropriate market-wide common risk factors. This is explored in the following sections.

6.3.3 Momentum Returns and Explained Risk Factors

With the purpose to investigate if momentum returns of credit rated stocks can be explained by risk factors three sets of common risk components have been employed, e.g. Fama-French three factors, market states variables and macroeconomic variables. These variables have been regressed on the momentum returns of different types of credit rated stocks in equation 10 and by examining the alpha in the equation it is measured if momentum returns can be explained by these common risk components.

6.3.3.1 Can Fama-French Three Factors Explain Momentum Return?

With the purpose to test if stock-specific components can explain momentum returns of credit rated stocks Fama-French factors have been employed in equation 10. Table 26 presents coefficient estimates for equation 10 where f is a vector of the Fama-French three factors. Panel A of Table 26 reports results for all stocks that are credit rated. It is observed that momentum returns are still significant at 1.35 percent per month for credit rated stocks after controlling for the Fama-French three factors. Momentum returns are significantly high above 1 percent per month in several sub-periods. For example, in the sub-periods 1997-1999 and 2000-2002 momentum returns of credit rated stocks are 2.06 percent, and 2.81 percent per month, respectively.

[Insert Table 26 Here]

Panel B of Table 26 reports momentum returns for ‘Investment Grade’ stocks when Fama-French idiosyncratic factors are accounted for. For ‘Investment Grade’ stocks momentum return only 0.46 percent per month after controlling for Fama-French risk factors. In only two sub-periods from 1997-1999 to 2000-2002 ‘Investment Grade’ stocks realized momentum returns of 1 percent per month, respectively. But significant momentum return is not observed in any other sub-periods.

Panel C of Table 26 reports momentum returns of ‘Speculative Grade’ stocks. Momentum returns are still more than 2 percent per month for ‘Speculative Grade’ stocks when Fama-French risk factors are taken into account. In almost all sub-periods momentum returns are economically significant. Momentum returns ranges from 0.84 percent to 4.18 percent per month in sub-periods from 1994-1996 to 2000-2002.

Among the three Fama-French risk factors the coefficient of the variable HML is significant for all rated, ‘Investment Grade’ and ‘Speculative Grade’ stocks and are negatively related to momentum return. In particular, the negative relation between HML and momentum return is observed more during the periods of economic upturns e.g. in sub-periods 1988-199, 1997-1999 and 2000-2002. Fama-French (1993) interpret the average HML return as a premium for a state variable risk related to relative distress. Fama-French (1994) further add that the variation through time in the loadings of industries on HML reflects periods of industry strength or distress. Industries have strong positive HML loadings in bad time and negative leadings during good times.

The empirical result shows that Fama-French three factors cannot explain momentum returns in credit rated stocks. In particular momentum returns of 'Speculative Grade' stocks are more than 2 percent per month when these idiosyncratic risk factors are priced. This finding is consistent with several earlier studies in momentum literature that Fama-French three factors cannot explain momentum returns (see among others Fama and French, 1996; Grundy and Martin, 2001 and Avramov et al 2007).

6.3.3.2 Can Market States Explain Momentum Return?

In order to investigate if market states variables can explain momentum returns of credit rated stocks, the two market states variables e.g. 36-month lagged average market return (LAGMKT) and its square ($LAGMKT^2$) have been employed in equation 10. Table 27 reports coefficient estimates for equation 10 where *f* is the vector of 36-month lagged average market return (LAGMKT) and its square ($LAGMKT^2$). The coefficient estimates for the lagged market returns (LGMKT) is positive and significant. Panel A of Table 27 we reports momentum returns for credit rated stocks when the risks for up and down market states are priced. Momentum returns for credit rated stocks remains significant as measured by the positive alpha of 0.99 percent per month. In different sub-periods momentum is significant and ranges between 1.09 percent and 2.24 percent per month. Momentum profits are especially prominent during the two expansion periods in the US in the late 1980s and late 1990s. Momentum returns of credit rated stocks still remains once accounted for market state variables.

[Insert Table 27 Here]

Panel B of Table 27 reports momentum returns for 'Investment Grade' stocks. The coefficient estimates for $LAGMKT^2$ is significant. Momentum returns for 'Investment Grade' stocks disappear when controlled for market states variable. The coefficient estimates for alpha are not significantly different from zero in the entire sample period and in most sub-sample periods. The LAGMKT variable is mostly positively related to the momentum return, though statistically not significant, indicating that momentum return is high (low) when lagged market return is high (low).

Panel C of Table 27 reports momentum returns for 'Speculative Grade' stocks. The coefficient estimates for the lagged market returns (LGMKT) is positive and significant. Momentum returns for 'Speculative Grade' stocks after controlling for market states factors are significant at 1.64 percent per month in the full sample period and in almost all sub-periods. For example, during 1997-1999 and 2000-2002, momentum returns can be earned from 'Speculative Grade' stocks of 3.46 percent and 3.42 percent, respectively.

Overall, the results clearly depict that momentum returns of credit rated stocks remains significant once controlled for market states risk factors and especially for 'Speculative Grade' stocks.

6.3.3.3 Can Macroeconomic Factors Explain Momentum Return?

With the objective to examine if momentum returns of credit rated stocks can be explained by macroeconomic variables, the lagged of the four macroeconomic variables e.g. dividend yield, short rate, term premium, default premium have been used as risk components in equation 10. Table 28 reports the coefficient estimates for equation 1 when *f* is the vector of lagged macroeconomic variables. Panel A of Table 28 reports results for all stocks that are rated. The coefficient estimates for alpha are significant in the full research period and in all sub-periods except for one. Momentum returns disappear when macro-economic risk factors are taken into account. Panel B of Table 28 reports the coefficient estimates for ‘Investment Grade’ stocks when priced for lagged macroeconomic risk factors. The coefficients for alpha is not significant during the entire sample period, indicating momentum returns disappear when priced for macroeconomic risk factors, except for two sub-periods. Panel C of Table 28 reports momentum returns for ‘Speculative Grade’ stocks when priced for macroeconomic risk factors. The coefficient estimates for alpha is not significant indicating that momentum returns disappear.

[Insert Table 28 Here]

Among the four macroeconomic variables, on average, the coefficient of the term premium (TERM) is significant and is negatively related to momentum return, indicating that momentum return is high for all credit rated stocks when term premium is low. The coefficient of the variable default premium (DEF) is significant but positively related to momentum returns in different sub-period. This positive relation between momentum return and default premium further establishes that momentum returns of ‘Speculative Grade’ stocks are high during contractions. Fama and French (1988) who document that default premium track long-term business conditions and this variable is higher during recession and lower during expansions. Table 29 reports the momentum returns of credit rated stocks and its interaction with contemporaneous macroeconomic variables. In other words, when momentum returns with *f* being a vector of the contemporaneous values of the same macroeconomic variables is estimated in equation 10 and the conclusions do not change.

[Insert Table 29 Here]

In sum, the results from Table 29 shows that momentum return of credit rated stocks disappears once controlled for macroeconomic risk factors and are so for all categories of credit rated stocks.

6.4 Conclusions

The empirical findings from this chapter show that momentum return is significant rated stocks than in not-rated stocks. Again, among the credit rated stocks momentum returns are strongest in 'Speculative Grade' stocks. The returns are more pronounced during the contraction periods of NBER business cycles. On average 'Speculative Grade' stocks earn momentum returns of more than 3 percent per month during contraction periods and more than 1 percent during expansion periods. On the contrary, momentum is not observed in 'Investment Grade' stocks during market expansion and generates returns of more than 1 percent during contraction.

When momentum returns are controlled for common risk components it is reported that momentum returns across all types of credit rated stocks remains once controlled for Fama-French three factors and market states risk factors. In particular the effect is more pronounced among 'Speculative Grade' stocks. Momentum returns of

‘Speculative Grade’ stocks remain high at 2.07 percent per month once controlled for these risk factors. ‘Investment Grade’ stocks earn momentum returns of 0.46 percent when controlled for Fama-French three factors. When controlled for market states factors for ‘Speculative Grade’ stocks momentum return remains high at 1.63 percent once controlled for market states and for ‘Investment Grade’ stocks momentum returns disappear. Finally, when controlled for macroeconomic risk factors and report that momentum returns of all types of credit rated stocks disappear when accounted for macroeconomic risk factors. Among the macroeconomic variables, term spreads and default spreads is observed to have important implications in explaining the momentum returns of ‘Speculative Grade’ stocks. The empirical findings imply that momentum returns could be compensation to the increased uncertainty during economic downturns. The findings have important implication to the investors. Given the recent economic downturn after 2003s in the US market an investor would realize significant momentum return by holding ‘Speculative Grade’ stocks in her momentum portfolio.

6.5 APPENDIX D: Empirical Tables on Momentum Returns, Uncertainty and Credit Ratings

Table 22: Descriptive Statistics of Credit Rated Stocks

This table presents the descriptive statistics of monthly returns across stocks both unrated and rated by Standard & Poor's (S&P) and all stocks listed on CRSP. The sample period is from January 1985 to December 2006. The returns represent the time-series mean of the cross-sectional average return for each month (in percentage and per month). Standard deviation, skewness and kurtosis are computed as the cross-sectional medians over all sample stocks. 'All Rated' imply those stocks rated by S&P, 'Investment Grade' represents stocks rated from AAA to BBB (numerical score 1 to 10), 'Speculative Group' are stocks rated as BBB- to C (numerical score from 11 to 21) and 'Default' represents stocks that rated as D (numerical score 22) by S&P.

Descriptive Statistics						
	All Stocks	**All Rated**	**Not Rated**	**Rated Investment Grade**	**Rated Speculative Grade**	**Rated Default**
Total No. of Stocks (NYSE, NASDAQ and AMEX)	21865	21865	21865	21865	21865	21865
Total No. of Months	264	264	264	264	264	264
Total No. of Observation	5772360	5772360	5772360	5772360	5772360	5772360
No. of All Non-missing Observations	1980533	1980533	1980533	1980533	1980533	1980533
No. of Non-Missing observations	1980533	337745	1504299	203795	131581	2369
No. of Valid Stocks	21766	4017	19402	2045	2661	286
Mean (%)	1.21	1.17	1.22	1.32	1.03	-4.55
Standard Deviation (%)	17.66	13.1	17.64	9.13	15.43	31.54
Skewness	0.827	0.3404	0.8031	0.1589	0.3887	0.3225
Kourtosis	6.8929	4.7874	6.4937	4.3877	4.3489	2.5854

Table 23: Momentum Return of Different Types of Rated Stocks

Three-Year Sub-Sample Period

The following table reports the monthly returns for winner, loser and momentum portfolios formed based on *JxK =6x6* strategy (six-month historic returns held for the following six months). The sample period is from January 1985 through December 2006. In each month *t* for all NYSE, AMEX and NASDAQ stocks with returns from *t-6* through *t-1* on the monthly CRSP database, the stocks are ranked into decile portfolios according to their returns during the formation period (*J*). Decile portfolios are formed monthly by weighting equally all firms in that decile ranking. Winner and Loser are the equal-weighted portfolios of the 10 percent of the stocks with the lowest and the highest returns over the pervious six months, respectively. We long winner portfolio and short Loser portfolio and hold the position for the following holding (*K*) months (*t+1 to t+6*). The month *t* is skipped between the formation and the holding period. At the end of the holding period Momentum portfolio is realized as the difference between the returns on winner portfolio and loser portfolios. Panel A reports the output results for 'All Stocks', Panel B, Panel C, Panel D, Panel E and Panel F reports the output for 'Not Rated', 'All Rated', 'Investment Grade', 'Speculative Grade' and 'Default Grade' stocks. The column 'Portfolio size' reports the average size of the decile portfolio during each period. The column titled "Rated Stocks" gives the number of stocks rated in each sub-sample period. The last column reports the size of sub-sample period. The numbers in bold fonts represent significance at 5 and 1 percent level and t-statistics are given. The table reports the momentum return in percentage, per month and when excluding penny stocks from the sample. A minimum of six-month observation is required for any stocks to be included in the sample.

	PANEL A: ALL STOCKS					**PANEL B: NOT RATED**				
Sub-period	**Loser**	**Winner**	**Momentum**	**Portfolio Size**	**Rated Stocks**	**Loser**	**Winner**	**Momentum**	**Portfolio Size**	**Rated Stock**
1985-2006	0.78	1.49	**0.71**	2135	-	0.94	1.7	**0.76**	602	6481
t-stat	*5.2*	*10.33*	*8.9*			*4.83*	*8.82*	*7.43*		
1985-1987	0.55	1.39	**0.85**	2120	-	0.39	1.41	**1.02**	433	4878
t-stat	*1.12*	*2.61*	*6.01*			*0.67*	*2.37*	*5.05*		
1988-1990	-0.68	0.27	**0.95**	2099	-	-0.92	0.22	**1.14**	457	5343
t-stat	*-1.8*	*0.95*	*5.48*			*-2.32*	*0.74*	*6.7*		
1991-1993	1.78	2.21	**0.42**	2106	-	2.06	2.73	**0.67**	486	5574
t-stat	*5.47*	*8.39*	*2.31*			*5.25*	*7.26*	*2.41*		
1994-1996	0.83	1.41	**0.58**	2151	-	0.76	1.6	**0.84**	639	6726
t-stat	*3.76*	*5.37*	*5.05*			*2.47*	*4.44*	*4.73*		
1997-1999	0.63	1.67	**1.04**	2152	-	1.13	2.03	**0.9**	664	6961
t-stat	*1.58*	*5.4*	*4.86*			*2.4*	*4.83*	*4.29*		
2000-2002	-0.09	0.92	**1.01**	2146	-	-0.11	0.88	**0.99**	575	6122
t-stat	*-0.19*	*1.6*	*2.69*			*-0.16*	*1.07*	*2.19*		
2003-2006	1.97	2.26	**0.29**	2160	-	2.57	2.64	0.06	829	8540
t-stat	*6.22*	*7.1*	*2.35*			*5.83*	*5.95*	*0.28*		

Table 23 Continued

	PANEL C: ALL RATED					PANEL D: INVESTMENT GRADE				
Sub-period	**Loser**	**Winner**	**Momentum**	**Portfolio Size**	**Rated Stocks**	**Loser**	**Winner**	**Momentum**	**Portfolio Size**	**Rated Stocl**
1985-2006	0.43	1.65	**1.22**	131	1327	1.11	1.47	**0.36**	80	800
t-stat	*2.28*	*11.95*	*8.33*			*8.19*	*14.95*	*3.35*		
1985-1987	0.33	1.48	**1.15**	101	1026	1.44	1.73	0.29	61	613
t-stat	*0.67*	*2.72*	*4.06*			*4.47*	*4.08*	*1*		
1988-1990	-1.48	0.42	**1.9**	100	1010	0.16	0.77	**0.61**	62	628
t-stat	*-2.96*	*1.29*	*6.52*			*0.39*	*2.58*	*2.14*		
1991-1993	2.02	2.35	0.33	95	963	2.02	2.03	0.01	65	652
t-stat	*5.14*	*9.72*	*0.92*			*5.59*	*12.93*	*0.03*		
1994-1996	0.72	1.09	0.36	120	1212	1.42	1.15	**-0.26**	77	779
t-stat	*3.02*	*5.13*	*1.92*			*8.68*	*6.42*	*-2.27*		
1997-1999	-0.15	2.2	**2.35**	159	1593	0.9	2.09	**1.19**	96	959
t-stat	*-0.3*	*8.29*	*6.05*			*2.33*	*11.78*	*3.81*		
2000-2002	-1.42	0.96	**2.38**	166	1681	-0.09	0.61	0.7	96	968
t-stat	*-2.71*	*2.09*	*4.61*			*-0.2*	*2.05*	*1.94*		
2003-2006	2.34	2.67	0.33	159	1602	1.79	1.88	0.09	90	903

	PANEL E: SPECULATIVE GRADE					PANEL F: DEFAULT GRADE				
Sub-period	**Loser**	**Winner**	**Momentum**	**Portfolio Size**	**Rated Stocks**	**Loser**	**Winner**	**Momentum**	**Portfolio Size**	**Rated Stocl**
1985-2006	0.13	2.01	**1.89**	51	517	-0.11	0.12	**0.23**	0.29	10
t-stat	*0.53*	*11.78*	*9.91*			*-0.17*	*0.2*	*2.09*		
1985-1987	-0.25	1.41	**1.66**	39	393	3.52	0.18	-3.34	1.04	20
t-stat	*-0.36*	*2.17*	*4.6*			*1.9*	*0.15*	*-1.64*		
1988-1990	-2.1	0.36	**2.46**	36	366	-6.23	-5.78	0.46	0.42	15
t-stat	*-3.56*	*1.03*	*6.99*			*-4.15*	*-4.56*	*1.87*		
1991-1993	2.09	2.87	**0.78**	29	305					
t-stat	*4.27*	*9.14*	*2.03*							
1994-1996	0.3	1.3	**1**	42	431					
t-stat	*0.81*	*4.44*	*2.71*							
1997-1999	-0.81	2.76	**3.57**	63	637					
t-stat	*-1.32*	*7.84*	*7.69*							
2000-2002	-2.03	1.66	**3.68**	68	695					
t-stat	*-3.28*	*2.84*	*5.82*							
2003-2006	2.7	3.15	0.45	68	691	8.49	9.73	1.24	0.19	8
t-stat	*5.03*	*7.44*	*0.93*			*8.67*	*16.4*	*1.63*		

Table 24: Momentum Return of Credit Rated Stocks Using Different JxK Strategies

The following table reports the monthly returns for winner, loser and momentum portfolios formed based on the strategy *JxK*= nxn where n=3,6,9 and 12, respectively . The sample period includes January 1985 through 2006 of all stocks in the CRSP dataset that are credit rated by S&P 500. In each month *t* for all stocks with returns from *t-n* through *t-1* on the monthly CRSP database, the stocks are ranked into decile portfolios according to their returns during the formation period. A month (*t*) is skipped between the formation and the holding period. Decile portfolios are formed monthly by weighting equally all firms in that decile ranking. Winner and Loser are the equal-weighted portfolios of the 10 percent of the stocks with the lowest and the highest returns over the formation month, respectively. Momentum portfolio is the zero-cost portfolio that buys the winner portfolio and short sells the loser portfolio and is measured by the difference between the winner and the loser portfolios. Panel A, B and C report the result of the loser, winner and momentum portfolio of *JxK= 3x3, 6x6, 9x9 and 12x12 strategy*, of 'All rated', 'Investment Grade' and 'Speculative Grade', respectively. The estimates are reported in percentage, the numbers in bold fonts represent significance at the 1 percent and at the 5 percent level of significance and t-statistics are given in parenthesis. The table reports the momentum return when excluding the penny stocks from the sample.

	3x3	6x6	9x9	12x12		3x3	6x6	9x9	12x12		3x3	6x6	9x9	12x12
Sub-period	**Panel A ALL RATED**				**Sub-period**	**Panel B INVESTMENT GRADE**				**Sub-period**	**Panel C SPECULATIVE GRADE**			
1985-2006	**0.65**	**1.22**	**1.55**	**1.23**	**1985-2006**	-0.23	**0.36**	**0.46**	0.21	**1985-2006**	**1.27**	**1.89**	**1.40**	**0.35**
t-stat	*3.76*	*8.33*	*7.28*	*2.34*	***t-stat***	*-1.84*	*3.35*	*4.39*	*2.18*	***t-stat***	*5.58*	*9.91*	*8.17*	*2.21*
1985-1987	**0.89**	**1.15**	**1.26**	**0.78**	**1985-1987**	0.05	0.29	0.52	0.34	**1985-1987**	**0.96**	**1.66**	**1.48**	0.78
t-stat	*3.18*	*4.06*	*3.21*	*2.19*	***t-stat***	*0.16*	*1.10*	*1.80*	*1.41*	***t-stat***	*2.59*	*4.60*	*3.47*	*1.70*
1988-1990	**1.10**	**1.90**	**1.90**	**1.34**	**1988-1990**	-0.22	**0.61**	**0.61**	0.36	**1988-1990**	**1.49**	**2.46**	**2.50**	**1.68**
t-stat	*3.54*	*6.52*	*11.19*	*13.06*	***t-stat***	*-0.77*	*2.14*	*3.14*	*2.46*	***t-stat***	*4.81*	*6.99*	*9.24*	*9.42*
1991-1993	-0.53	0.33	**0.95**	0.31	**1991-1993**	-0.61	0.01	**0.57**	0.24	**1991-1993**	-0.24	**0.78**	**1.87**	0.44
t-stat	*-1.05*	*0.92*	*4.02*	*1.59*	***t-stat***	*-1.30*	*0.03*	*2.17*	*1.07*	***t-stat***	*-0.39*	*2.03*	*7.24*	*1.58*
1994-1996	0.23	0.36	**0.36**	0.10	**1994-1996**	**-0.57**	**-0.26**	0.01	-0.05	**1994-1996**	**1.00**	**1.00**	**0.64**	**0.43**
t-stat	*0.90*	*1.92*	*2.80*	*0.77*	***t-stat***	*-3.58*	*-2.27*	*0.13*	*-0.57*	***t-stat***	*2.34*	*2.71*	*2.85*	*2.08*
1997-1999	**1.21**	**2.35**	**1.58**	**0.83**	**1997-1999**	0.16	**1.19**	**0.94**	0.74	**1997-1999**	**2.33**	**3.57**	**2.49**	**1.08**
t-stat	*2.91*	*6.05*	*9.05*	*6.33*	***t-stat***	*0.45*	*3.81*	*3.72*	*3.85*	***t-stat***	*4.94*	*7.69*	*10.79*	*4.83*

Table 25: Momentum Return of Rated Stocks across NBER Business Cycle

The following table reports the behavior of the monthly returns for winner, loser and momentum portfolios formed based on *JxK =6x6* strategy, excluding penny stocks. The sample period is from January 1985 through December 2006. There are three expansion periods and two contraction periods as defined by the National Bureau of Economic Research (NBER) (http://www.nber.org/cycles.html) during the research sample period. A minimum of six-month observation is required for any company to be included in the sample. Winner and Loser are the equal-weighted portfolios of the 10 percent of the stocks with the lowest and the highest returns over the pervious six months, respectively. Winner portfolio is held long and Loser portfolios is held short for the following holding (K) months (*t+1 to t+6*). The month *t* is skipped between the formation and the holding period. Momentum portfolio is the difference between the returns on winner portfolio and loser portfolios. Panel A reports the output for 'All Rated' stocks whilst Panel B and Panel C reports the output for 'Investment Grade' and 'Speculative Grade' stocks. The column 'No. of Months' represents the size of each sub-period for different business cycle periods. The column titled "Rated Firms" gives the number of companies rated in that sub-sample period. The estimates are reported in percentage, the number in bold fonts represent significance at 1 and 5 percent levels and t-statistics are given.

Momentum Return of Rated Stocks Based on NBER Business Cycle															
				Panel A: All Rated Stocks				**Panel B: Investment Grade Stocks**				**Panel C: Speculative Grade Stocks**			
	Sub-period	**No. of Months**		**Loser**	**Winner**	**Momentum**	**Rated Stocks**	**Loser**	**Winner**	**Momentum**	**Rated Firms**	**Loser**	**Winner**	**Momentum**	**Rated Stocks**
Expansion	**Dec 1982 - Aug 1990**	55		-0.27	1.04	**1.31**	1024	1.13	1.35	0.22	622	-0.82	1.02	**1.84**	384
			t-stat	*-0.84*	*3.52*	*7.11*		*4.92*	*5.27*	*1.19*		*-2.03*	*3.05*	*7.56*	
	Apr 1991- Mar 2001	120		0.68	1.83	**1.15**	1323	1.42	1.71	0.29	824	0.23	2.24	**2.01**	493
			t-stat	*3.01*	*10.98*	*5.16*		*7.95*	*16.32*	*1.70*		*0.79*	*9.93*	*7.23*	
	Dec 2001 -Dec 2006	61		1.39	2.18	**0.79**	1612	1.14	1.47	0.33	913	1.54	2.83	**1.29**	688
			t-stat	*3.11*	*6.46*	*2.46*		*3.93*	*6.30*	*1.70*		*2.72*	*7.21*	*2.73*	
contraction	**Aug 1990 - Mar 1991**	8		-4.19	-0.44	**3.75**	925	-2.40	-0.21	**2.19**	623	-5.43	-0.44	**4.99**	295
			t-stat	*-2.92*	*-0.54*	*5.68*		*-2.22*	*-0.38*	*3.61*		*-3.08*	*-0.35*	*8.86*	
	Apr 2001 -Nov 2001	8		-1.18	1.22	2.39	1691	-0.45	0.59	1.05	964	-1.26	1.98	**3.24**	106
			t-stat	*-0.79*	*3.56*	*1.96*		*-0.53*	*1.81*	*1.59*		*-0.71*	*3.90*	*2.36*	

Table 26: Momentum Return of All Rated Stocks Regressed on Fama-French Three Factors

Winner, Loser and Momentum portfolios are formed based on the strategy described in Table II with *JxK= 6x6* and excluding penny stocks. The following table represents the coefficients and the t-statistics obtained when momentum returns of each type of credit rated stocks e.g. (1)'All Rated', (2)'Investment Grade' and (3) 'Speculative Grade' stocks are regressed over Fama-French three factor variables, e.g. MKT_ RF, SMB and HML. MKT_ RF is the monthly return on CRSP value-weighted market index in excess of the one-month Treasury bill rate, RF, SMB and HML are the Small-Minus-Big size factor and the High-Minus-Low book-to-market- ratio factor, respectively. The regression model is $MR_{t,6x6} = a + \sum_{j=1}^{n} b_j f_t + e_t$ where X is the vector of the Fama-French factors. The regression is carried out separately for each sub-period. The coefficient covariance of the regression is derived from White's heteroskedasticity consistent coefficient covariance. The numbers are reported in percentage and numbers in bold fonts represent significance at 5 and 1 percent level, t-statistics and adjusted R-squared are also given.

Momentum Return of Each Type of Credit Rated Stocks Regressed on Fama-French Three Factors															
	Panel A: ALL RATED					Panel B: INVESTMENT GRADE					Panel C: SPECULATIVE GRADE				
Period	**Alpha**	**Mkt_Rf**	**SMB**	**HML**	**Adj R-Squared**	**Alpha**	**Mkt_Rf**	**SMB**	**HML**	**Adj R-Squared**	**Alpha**	**Mkt_Rf**	**SMB**	**HML**	**Adj R-Squared**
1985-2006	**1.346**	-8.024	-8.774	**-18.567**	3.459	**0.464**	-6.016	-7.388	**-14.635**	0.041	**2.027**	-8.614	-11.560	**-20.318**	2.315
t-stat	*8.848*	*-1.749*	*-1.558*	*-2.728*		*4.111*	*-1.735*	*-1.829*	*-2.982*		*10.253*	*-1.500*	*-1.707*	*-2.417*	
1985-1987	**1.091**	4.364	-1.701	14.152	-8.938	0.152	9.647	-6.139	27.568	0.098	**1.716**	-1.378	9.964	10.832	-11.039
t-stat	*3.581*	*0.969*	*-0.168*	*1.131*		*0.486*	*2.458*	*-0.505*	*2.103*		*4.304*	*-0.257*	*0.847*	*0.540*	
1988-1990	**1.813**	**-16.309**	**-23.611**	-26.484	18.918	0.469	**-14.378**	**-29.280**	**-40.525**	0.314	**2.418**	**-21.057**	-20.476	-27.405	13.649
t-stat	*6.396*	*-2.468*	*-2.190*	*-1.568*		*1.963*	*-2.418*	*-3.090*	*-3.166*		*7.260*	*-2.983*	*-1.666*	*-1.319*	
1991-1993	-0.079	10.015	23.730	19.098	2.930	-0.376	5.922	20.667	24.684	0.042	0.312	23.530	21.278	9.884	6.160
t-stat	*-0.180*	*0.582*	*1.698*	*1.675*		*-0.876*	*0.389*	*1.672*	*2.157*		*0.659*	*1.373*	*1.705*	*0.748*	
1994-1996	0.261	8.584	-9.443	-8.475	0.731	**-0.289**	0.970	-8.498	-4.421	-0.024	**0.840**	14.971	-7.116	-11.025	-3.263
t-stat	*1.257*	*1.171*	*-0.993*	*-0.791*		*-2.580*	*0.260*	*-1.466*	*-0.659*		*2.026*	*1.150*	*-0.352*	*-0.530*	
1997-1999	**2.061**	-4.070	-12.427	**-38.485**	15.703	**1.017**	-9.145	-13.210	**-34.352**	0.165	**3.204**	-2.483	**-21.271**	**-41.501**	13.732
t-stat	*5.578*	*-0.427*	*-1.440*	*-3.294*		*3.292*	*-1.166*	*-1.489*	*-3.037*		*7.420*	*-0.247*	*-2.099*	*-2.699*	
2000-2002	**2.811**	-17.377	-15.323	**-32.943**	7.653	**0.998**	**-15.329**	-10.198	**-25.788**	0.133	**4.178**	-15.564	**-19.743**	**-33.265**	2.413
t-stat	*5.831*	*-1.946*	*-1.691*	*-2.870*		*2.712*	*-2.243*	*-1.508*	*-3.325*		*7.341*	*-1.491*	*-2.039*	*-2.586*	
2003-2006	0.404	-26.667	3.395	32.989	7.612	0.243	-17.557	-0.054	6.966	0.062	0.380	-30.681	11.283	55.091	5.008
t-stat	*1.029*	*-0.982*	*0.168*	*1.650*		*1.086*	*-1.247*	*-0.005*	*0.608*		0.623	-0.785	0.384	1.888	

Table 27: Momentum Return of Rated Stocks Regressed on Market State Variables

The following table represents the coefficients and the t-statistics obtained when momentum returns of each type of credit rated stocks e.g. (1) 'All Rated', (2) 'Investment Grade' and (3) 'Speculative Grade', are regressed over the market state variables e.g. LGMKT' and LGMKT^2' as in Cooper et al (2004). 'LGMKT' and LGMKT^2' is defined as the lagged 36-month market return and the squared of the lagged 36-month market return, respectively. Return on the Winner, Loser and Momentum portfolios are formed based on the strategy described in Table 2 for the *JxK= 6x6* strategy and excluding penny stocks. The regression model is $MR_{t,6x6} = a + \sum_{j=1}^{n} b_j f_t + e_t$ where X is the vector of the two market state variables. The regression is carried out separately for each sub-period. The coefficient covariance of the regression is derived from White's heteroskedasticity consistent coefficient covariance. The number are reported in percentage and numbers in bold fonts represents significance at 1 and at 5 percent level, t-statistics and adjusted R-squared are given. Panel A report the output of 'All Rated' stocks whilst Panel B and Panel C represents the results of 'Investment Grade' and 'Speculative Grade' rated stocks, respectively.

Momentum Return of Each Type of Credit Rated Stocks Regressed on Market State Variables												
	Panel A: ALL RATED				**Panel B: INVESTMENT GRADE**				**Panel C: SPECULATIVE GRADE**			
Period	**Alpha**	**LGMKT**	**LGMKTSQR**	**Adj R-Squared**	**Alpha**	**LGMKT**	**LGMKTSQR**	**Adj R-Squared**	**Alpha**	**LGMKT**	**LGMKTSQR**	**Adj R-Squared**
1985-2006	**0.986**	**7.696**	69.341	2.248	0.212	3.025	**55.897**	1.242	**1.637**	**10.318**	64.18	1.806
t-stat	*5.917*	*2.37*	*1.878*		*1.701*	*1.264*	*2.146*		*7.704*	*2.545*	*1.613*	
1985-1987	**1.085**	16.744	-87.109	4.69	0.315	11.394	-100.12	-4.509	**1.532**	21.717	-88.401	6.859
t-stat	*3.263*	*1.612*	*-0.733*		*0.868*	*1.122*	*-0.871*		*3.827*	*1.542*	*-0.488*	
1988-1990	**1.632**	-1.187	**77.163**	11.297	0.358	-2.24	**76.191**	13.928	**2.135**	2.632	**81.163**	3.364
t-stat	*4.429*	*-0.233*	*3.139*		*1.000*	*-0.447*	*3.01*		*5.053*	*0.424*	*3.018*	
1991-1993	0.13	10.785	51.946	-1.199	-0.02	2.458	1.683	-5.824	0.589	11.869	41.245	-1.228
t-stat	*0.292*	*1.407*	*0.471*		*-0.046*	*0.344*	*0.019*		*1.3*	*1.241*	*0.277*	
1994-1996	0.336	3.144	-14.228	-5.575	**-0.292**	1.685	5.958	-5.284	**1.059**	3.447	-100.414	-5.526
t-stat	*1.613*	*0.321*	*-0.111*		*-2.216*	*0.316*	*0.097*		*2.627*	*0.166*	*-0.386*	
1997-1999	**2.241**	**19.172**	-172.336	-0.75	**1.348**	11.261	-323.647	-1.628	**3.461**	22.392	-216.818	-0.999
t-stat	*4.105*	*2.224*	*-0.484*		*3.269*	*1.365*	*-1.149*		*5.19*	*1.797*	*-0.5*	
2000-2002	**2.201**	18.253	-53.895	5.204	0.557	9.226	-9.379	-0.788	**3.429**	21.558	-47.771	3.888
t-stat	*2.925*	*1.82*	*-0.585*		*1.09*	*1.269*	*-0.147*		*3.716*	*1.737*	*-0.432*	
2003-2006	0.227	-0.734	37.32	-4.144	-0.026	2.159	41.122	-3.329	0.291	-0.995	55.932	-4.116
t-stat	*0.492*	*-0.117*	*0.488*		*-0.092*	*0.541*	*0.597*		*0.451*	*-0.114*	*0.57*	

Table 28: Momentum Return of All Rated Stocks Regressed on Lagged Macroeconomic Variables

The table represents the coefficients and the t-statistics obtained from the regression where momentum returns of each type of credit rated stocks e.g. (1)'All Rated', (2) 'Investment Grade' and (3) 'Speculative Grade' rated stocks are regressed over lagged macroeconomic variables. Momentum returns are formed based on the strategy described in Table 2 for the strategy excluding penny stocks with a strategy of *JxK= 6x6*. The macroeconomic variables are dividend yield (DIV), short rate (YLD), term premium (TERM) and the default premium (DEF). DIV is defined as the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the index. YLD is the yield on the three-month Treasury bill. TERM is defined as the yield spread of a ten-year Treasury bond and a three-month Treasury bill and DEF is the yield spread of Moody's Baa and Aaa rated bonds. The regression model is $MR_{t,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_{t-1} + \varepsilon_t$ where X is the vector of the lagged macroeconomic variables. The coefficient covariance of the regression is derived from White's heteroskedasticity consistent coefficient covariance. The number are reported in percentage and numbers in bold fonts represents significance at 1 and at 5 percent level, t-statistics and adjusted R-squared are given. Panel A, Panel B and Panel C represents the results of 'All Rated' 'Investment Grade' and 'Speculative Grade' stocks, respectively.

	Panel A: ALL RATED						Panel B: INVESTMENT GRADE						Panel C: SPECULATIVE GRADE					
Period	**Alpha**	**DEF**	**DIV**	**TERM**	**YLD**	**Adj R-Squared**	**Alpha**	**DEF**	**DIV**	**TERM**	**YLD**	**Adj R-Squared**	**Alpha**	**DEF**	**DIV**	**TERM**	**YLD**	**Adj R-Squared**
1985-2006	0.42	92.31	-64.61	-10.57	36.41	7.62	1.02	-5.96	-17.12	-19.98	3.37	2.33	0.21	164.69	-110.99	-0.03	60.52	9.27
t-stat	*0.42*	*1.61*	*-1.50*	*-0.34*	*1.40*		*1.48*	*-0.14*	*-0.59*	*-0.96*	*0.21*		*0.16*	*1.96*	*-1.98*	*0.00*	*1.73*	
1985-1987	-4.64	-355.53	12.26	-49.65	**186.64**	48.79	1.00	-427.30	8.17	-122.38	**120.48**	22.87	**-14.41**	-227.12	111.48	11.82	**258.63**	57.91
t-stat	*-1.12*	*-1.62*	*0.12*	*-1.04*	*4.73*		*0.19*	*-1.24*	*0.07*	*-1.66*	*2.94*		*-4.36*	*-0.81*	*0.93*	*0.24*	*8.65*	
1988-1990	12.12	505.60	186.94	**-329.55**	**-242.48**	23.73	2.36	201.20	262.66	**-259.19**	-134.85	28.55	**13.18**	**123.05**	11.72	**-355.01**	-237.82	27.33
t-stat	*1.98*	*1.29*	*0.64*	*-3.86*	*-2.52*		*0.39*	*0.58*	*0.93*	*-3.39*	*-1.48*		*2.22*	*2.80*	*0.03*	*-3.02*	*-1.77*	
1991-1993	12.07	**891.46**	-448.68	-109.48	-71.36	3.67	**10.32**	**966.18**	-434.53	-54.29	-105.72	14.61	3.59	816.94	-21.47	-118.06	-127.08	3.05
t-stat	*1.97*	*2.14*	*-1.03*	*-1.60*	*-0.57*		*2.45*	*2.61*	*-1.30*	*-1.04*	*-1.03*		*0.47*	*1.94*	*-0.04*	*-1.46*	*-0.86*	
1994-1996	-7.97	864.68	**228.46**	**-109.32**	-15.59	31.25	0.36	235.60	103.68	**-79.31**	**-65.48**	13.48	-17.71	**932.91**	**458.78**	**-207.35**	-21.38	31.50
t-stat	*-1.53*	*1.71*	*2.13*	*-2.45*	*-0.35*		*0.09*	*0.68*	*1.50*	*-3.42*	*-2.25*		*-1.82*	*2.08*	*2.49*	*-2.66*	*-0.27*	
1997-1999	-9.44	804.79	349.26	**-327.38**	78.77	37.45	-6.83	112.34	182.82	**-268.42**	143.81	22.38	-15.10	**264.68**	**404.58**	**-437.37**	157.65	56.43
t-stat	*-0.50*	*1.39*	*1.95*	*-5.01*	*0.23*		*-0.43*	*0.23*	*1.30*	*-4.69*	*0.49*		*-0.99*	*2.48*	*2.49*	*-6.41*	*0.57*	
2000-2002	-6.79	-178.28	165.41	228.57	136.66	-1.54	-6.50	-328.52	259.44	**214.00**	94.77	19.42	-2.55	19.74	-221.80	257.54	133.97	1.50
t-stat	*-0.49*	*-0.55*	*0.32*	*1.83*	*1.06*		*-0.72*	*-1.50*	*0.75*	*2.67*	*1.11*		*-0.15*	*0.05*	*-0.31*	*1.71*	*0.89*	
2003-2006	**16.01**	**-797.85**	-383.24	-46.00	-102.24	43.72	**11.32**	**-413.06**	**-223.26**	**-100.90**	**-107.74**	46.73	**20.72**	-112.72	-422.13	-77.16	-128.69	37.05
t-stat	*4.27*	*-4.82*	*-1.87*	*-0.47*	*-1.48*		*4.20*	*-5.11*	*-2.23*	*-2.07*	*-2.48*		*3.37*	*-3.98*	*-1.44*	*-0.51*	*-1.13*	

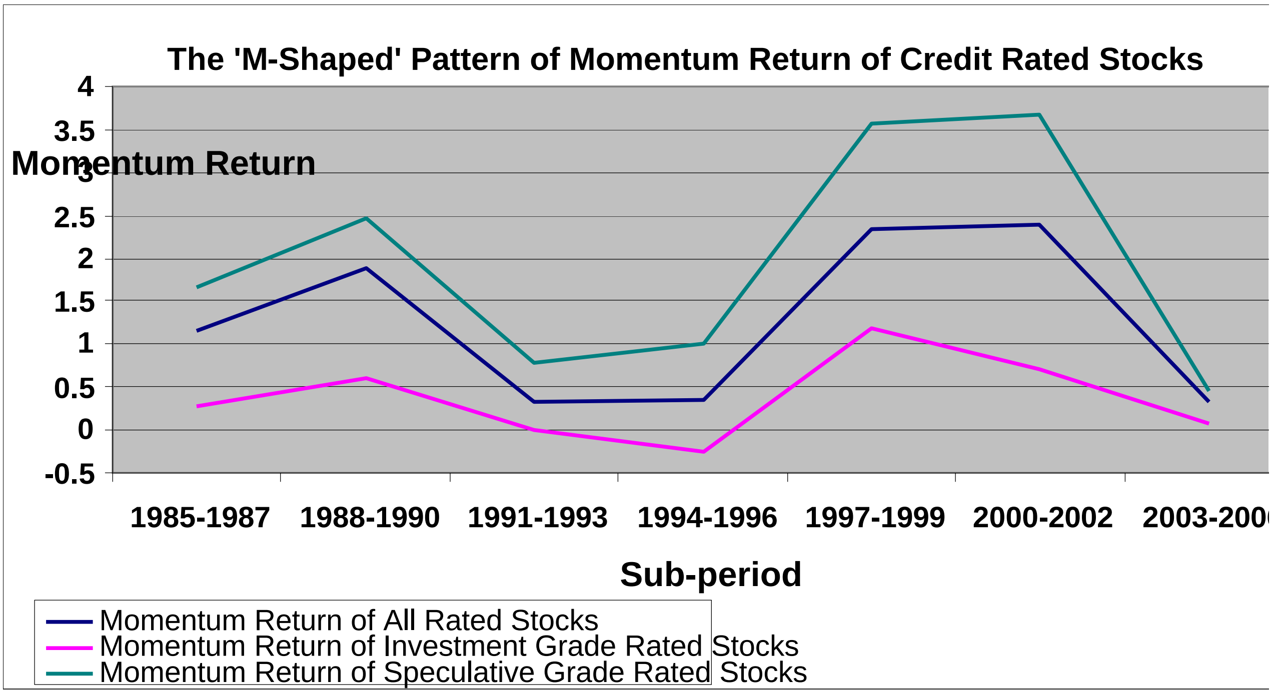
Table 29: Momentum Return of All Rated Stocks Regressed on Contemporaneous Macroeconomic Variables

The table represents the coefficients and the t-statistics obtained from the regression where momentum returns of each type of credit rated stocks e.g. (1)'All Rated', (2) 'Investment Grade' and (3) 'Speculative Grade' rated stocks are regressed over lagged macroeconomic variables. Momentum returns are formed based on the strategy described in Table 2 for the strategy excluding penny stocks with a strategy of *JxK= 6x6*. The macroeconomic variables are dividend yield (DIV), short rate (YLD), term premium (TERM) and the default premium (DEF). DIV is defined as the total dividend payment accrued to the CRSP value-weighted market index over the past 12 months divided by the current price level of the index. YLD is the yield on the three-month Treasury bill. TERM is defined as the yield spread of a ten-year Treasury bond and a three-month Treasury bill and DEF is the yield spread of Moody's Baa and Aaa rated bonds. The regression model is $MR_{t,6x6} = \alpha + \sum_{j=1}^{n} \beta_j f_t + \varepsilon_t$ where X is the vector of the contemporaneous macroeconomic variables. The coefficient covariance of the regression is derived from White's heteroskedasticity consistent coefficient covariance. The number are reported in percentage and numbers in bold fonts represents significance at 1 and at 5 percent level, t-statistics and adjusted R-squared are given. Panel A, Panel B and Panel C represents the results of 'All Rated' 'Investment Grade' and 'Speculative Grade' stocks, respectively.

Momentum Return of Rated Stocks Regressed on Contemporaneous Macroeconomic Factors																		
Panel A: ALL RATED							Panel B: INVESTMENT GRADE						Panel C: SPECULATIVE GRADE					
Period	**Alpha**	**DEF**	**DIV**	**TERM**	**YLD**	**Adj R-Squared**	**Alpha**	**DEF**	**DIV**	**TERM**	**YLD**	**Adj R-Squared**	**Alpha**	**DEF**	**DIV**	**TERM**	**YLD**	**Adj R-Squared**
1985-2006	1.00	22.89	17.96	-37.29	-162.47	0.11	0.50	-17.59	22.88	-44.84	-117.84	-0.13	1.37	57.01	-8.52	-3.59	-176.68	0.00
t-stat	*1.71*	*0.32*	*0.17*	*-0.65*	*-1.76*	0.00	*1.25*	*-0.37*	*0.26*	*-1.07*	*-1.76*	0.00	*1.67*	*0.57*	*-0.06*	*-0.05*	*-1.59*	0.00
1985-1987	4.22	-265.40	-48.57	-135.06	-127.83	-13.48	-1.35	138.52	-54.56	-24.24	-19.80	-17.47	4.66	-271.05	36.46	-174.62	-225.02	-5.93
t-stat	*1.07*	*-0.78*	*-0.37*	*-1.09*	*-0.86*	0.00	*-0.36*	*0.44*	*-0.47*	*-0.20*	*-0.11*	0.00	*0.98*	*-0.69*	*0.21*	*-1.31*	*-1.51*	0.00
1988-1990	-0.90	325.11	-0.58	**365.06**	**-392.13**	44.16	0.58	30.39	-20.36	176.33	**-510.30**	40.23	-3.20	**635.29**	-10.21	**561.29**	-264.05	43.14
t-stat	*-0.52*	*1.78*	*0.00*	*2.88*	*-3.00*	0.00	*0.33*	*0.16*	*-0.12*	*1.46*	*-4.16*	0.00	*-1.65*	*3.10*	*-0.05*	*3.14*	*-1.51*	0.00
1991-1993	0.99	-106.91	16.65	-30.29	-104.76	-12.35	2.71	-353.53	27.16	96.03	-21.99	-9.23	-1.48	248.05	-315.67	-315.74	-200.46	-4.44
t-stat	*0.39*	*-0.30*	*0.03*	*-0.13*	*-0.38*	0.00	*1.13*	*-1.06*	*0.05*	*0.37*	*-0.09*	0.00	*-0.53*	*0.64*	*-0.53*	*-1.11*	*-0.70*	0.00
1994-1996	0.13	48.76	-293.77	-8.68	-200.53	5.63	0.77	-153.68	-39.93	-0.84	-165.93	4.23	-1.72	446.68	-546.50	67.68	-197.87	0.30
t-stat	*0.04*	*0.10*	*-1.40*	*-0.12*	*-1.39*	0.00	*0.42*	*-0.54*	*-0.30*	*-0.02*	*-1.84*	0.00	*-0.32*	*0.54*	*-1.35*	*0.50*	*-0.68*	0.00
1997-1999	**-3.92**	**862.82**	-730.59	-232.96	-137.66	17.96	-0.28	202.19	-79.59	-281.36	-162.26	-6.38	**-4.95**	**1176.31**	-1001.08	-43.07	-162.83	30.72
t-stat	*-2.18*	*3.26*	*-1.24*	*-1.08*	*-0.49*	0.00	*-0.17*	*0.82*	*-0.17*	*-1.58*	*-0.66*	0.00	*-2.45*	*4.04*	*-1.51*	*-0.20*	*-0.64*	0.00
2000-2002	-0.20	175.82	759.02	**-538.67**	-711.50	14.35	-2.01	222.68	401.35	**-354.69**	-425.17	13.77	-0.28	322.19	1249.03	-533.82	-596.23	11.18
t-stat	*-0.09*	*0.96*	*1.19*	*-2.37*	*-1.83*	0.00	*-1.26*	*1.66*	*1.01*	*-2.40*	*-1.61*	0.00	*-0.11*	*1.38*	*1.30*	*-1.83*	*-1.23*	0.00
2003-2006	**7.96**	**-873.91**	-84.23	66.17	344.84	35.46	**2.48**	**-301.11**	38.16	-31.71	**414.23**	28.33	**10.49**	**-1147.04**	-233.74	138.60	468.10	31.84
t-stat	*3.38*	*-3.15*	*-0.49*	*0.42*	*1.73*		*2.13*	*-2.30*	*0.45*	*-0.50*	*2.54*		*2.93*	*-2.76*	*-1.02*	*0.55*	*1.70*	

Figure 3: Momentum Returns of Credit Rated Stocks over Time

For each month *t*, all S&P rated stocks traded on the NYSE, AMEX and listed on the CRSP and COMPUSTAT monthly file are sorted into decile portfolios based on their past six month returns from t-6 to t-1. Thereafter Loser (P1) and Winner (P10) are portfolios are formed. We short Loser Portfolio and Long winner Portfolio and the positions are held for the subsequent 6 months, from t+1 to t+6. Momentum return is the difference between the returns on winner and loser portfolios. The figure plots the momentum return of different credit rated stocks over time e.g. 'All Rated', 'Investment Grade' and 'Speculative Grade' rated stocks. The figure displays a specific pattern of momentum return that is observed in each type of credit rated stocks over different sub-period during the research sample period from January 1985 through 2006.



7 CHAPTER SEVEN: DISCUSSION AND CONCLUSIONS

7.1 Introduction

This chapter presents a summary of the major findings of this thesis, the contribution made to the literature and scope for future research. The chapter also discusses the implications of the empirical results in academia and in real life investment decision. This chapter is organized into three sections. The next section summarizes the main findings. Section three presents implications of the empirical results for the finance researchers and for the investment managers. Section four outlines the potential future research and section seven concludes.

7.2 Summary of Main Findings

7.2.1 Portfolio Level Analysis

The major findings at the portfolio level analysis are as follows; Firstly, momentum returns earn a statistically and economically significant return of 0.8 percent per month (9.6 percent per annum). The returns are predominantly high during post-1950s when the returns are more than 1 percent per month (up to 13 percent per annum). In particular, momentum returns are observed to be the strongest in the period from 1951 to 1994 when US market, on average, was experiencing an economic upturn. This implies that momentum returns is associated with the business cycle. The time series pattern of momentum returns also resembles the business cycle in the US market. Furthermore, the results that momentum strategy earns a return of around 1 percent per month are robust when penny stocks are excluded form the sample. It has also been documented that momentum returns diminishes but does not eliminate entirely once accounted for transaction cost. A significant momentum return of 0.16 percent per month is reported when bid-ask spread is excluded from momentum returns.

At the portfolio level the empirical results suggest that momentum returns are not compensation for both contemporaneous and lagged firm level factors. Statistically significant alpha of 0.01 percent remains when controlled for Fama-French three factors. The application of momentum as a risk factor is not common in momentum literature. We use Carhart (1997) four factor model where in addition to Fama-French three factors a fourth factor momentum is incorporate. We document that momentum return remain when accounted for Carhart’s (1997) four factor. A significant return of 0.01 percent per month is reported, though momentum risk factor has a significant influence in explaining the empirically derived momentum returns. Finally, momentum returns does not disappear entirely when controlled for macroeconomic variables both for contemporaneous and lagged macroeconomic risks. A significant alpha of 0.02 percent per month remains when controlled for macroeconomic risk factors.

7.2.2 Individual Stock Level Analysis

At the individual stock level the empirical results provide evidence that momentum returns are compensation for risk at when Fama-French three factors are used. The results report that momentum returns of up to 0.45 percent per month (5.4 percent per annum) remains once controlled for Fama-French three factors and are statistically significant. When macroeconomic risk factors are employed momentum returns remains unexplained of up to 0.15 percent per month (1.8 percent per annum). However, when lagged macroeconomic risk factors are used momentum returns disappear. This implies that lagged macroeconomic risk factors have important implications on momentum returns. The results further provide useful insight as to the important of the level of analysis and the lag values of the risk factors.

7.2.3 Decomposing Momentum Returns: What Factors Contribute to Momentum Returns?

The empirical results on the investigation of what contributes to momentum returns provide evidence that at the portfolio level; firstly, at the portfolio level momentum returns are more a contribution of unexplained risk factors compared to the explained risk factors. For example, when contemporaneous Fama-French three factors are considered the contribution of unexplained risk factors are more than 90 percent whilst the contribution of explained risk factors is only 1.13 percent. The results are robust when lagged Fama-French three factors are considered. When macroeconomic risk factors are employed the contribution of risk factors improves. For example, contemporaneous macroeconomic variables contribute 10 percent in generating momentum returns and unexplained risk factors contribute 90 percent in generating momentum returns. When lagged macroeconomic risk factors are considered macroeconomic variables contributes 13 percent. Finally, when both the firm level factors and macroeconomic risk factors are used simultaneously, contemporaneous Fama-French three factors and macroeconomic factors contributes 20 percent and the unexplained risk factors is 80.44 percent in momentum returns. The results differ only slightly when the lagged explained risk factors are used. For example, the contribution of explained risk factors declines to 14 percent and the contribution of unexplained risk factors increases to 86 percent.

At the individual stock level, however, the above conclusion does not hold. For example, when contemporaneous Fama-French three factors are considered the contribution of explained risk factors is more than 40 percent whilst the contribution of unexplained risk factors is more than 50 percent. The results are robust when lagged Fama-French three factors are used. When contemporaneous macroeconomic risk factors are used these explained risk factors contribute 31.11 percent while the contribution of unexplained risk factors is 68.89 percent. However, when lagged macroeconomic risks are considered the contribution of explained risk factors increase to 58.56 percent than that of the unexplained risk factors of 41.44 percent. When both the Fama-French three factors and the macroeconomic risk factors are taken into account simultaneously, the explained risk factors contribute 30.61 percent, whilst the unexplained risk factors contribute 68.39 percent in generating momentum returns. However, the opposite relation holds when lagged Fama-French three factors and lagged macroeconomic factors are considered where the unexplained risk factors contributes 32 percent and the explained risk factors contributes 68 percent. This implies that the contribution of lagged risk factors is more prominent on momentum returns than contemporaneous risk factors. The evidences suggest that at the individual stock level, the contribution of both explained risk factors improves considerably, particularly when lagged macroeconomic risk factors are used.

7.2.4 Momentum Returns, Uncertainty and Credit Ratings

The empirical findings show that when uncertainty is measured at the firm level momentum return is significant in credit rated stocks than in not-rated stocks. Among the credit rated stocks momentum returns is the highest among ‘Speculative Grade’ rated stocks. Furthermore momentum returns of credit rated stocks remain once accounted for Fama-French three factors. When momentum returns are controlled for uncertainty at the macroeconomic level momentum returns of Speculative Grade rated stocks are observed to be more pronounced during the contraction periods of NBER business cycles when up to 4.99 percent per month (59.88 percent per annum) momentum returns are earned. When controlled for market states factors for ‘Speculative Grade’ stocks momentum return remains high at 1.63 percent per month (19.56 percent per annum) once controlled for market states risk factors. However, when controlled for macroeconomic risk factors the empirical results report that momentum returns of all types of credit rated stocks disappears. The empirical findings imply that momentum returns could be compensation to the increased uncertainty during economic downturns.

7.3 Implications of the Study

The results of this study have several important implications for both the academia and for the investment professionals. Firstly, the empirical results show that at the individual stock level when macroeconomic risk factors are used momentum returns are compensation for risk. It has also been documented that the lagged variables are particularly crucial in explaining momentum returns. For the researchers this provides important insights as to the importance of the lagged structure and the use of particular risk factors e.g. macroeconomic risk factors in forming momentum portfolios. The empirical results also leaves room for the researchers to rethink on the behavioral explanations of momentum returns that rejects the notion that momentum returns are compensation for risk.

Secondly, the empirical results have important implication in designing momentum strategy. The study proposes a risk-adjusted momentum strategy where the returns are adjusted for risk before forming decile portfolios and then stocks are ranked based on explained risk and unexplained risk factors. This has important implication when forming momentum portfolio based risk factors. For example, a momentum investor who forms portfolios at time *t* (at the beginning of the holding period) may consider the explained risk and unexplained risk factors associated with investing in the momentum portfolio and construct momentum portfolio accordingly. The strategy is risk-effective and free of any presumption but at the same time, unique and convenient to implement in real-life environment. This overcomes the limitations of the momentum strategies in earlier studies where sophisticated models have been proposed by researchers but were difficult to implement.

Thirdly, the relative contribution of the each risk factor and its changes with the business cycle or economic movement would provide important insights in designing momentum strategy. For example, it has been documented that momentum returns are more a compensation for risk when lagged macroeconomic risk factors are considered and is pronounced during market upturn. This will allow investors to take into account the uncertainty associated with business cycle and hold momentum portfolios accordingly.

Finally, the empirical results of momentum returns of credit rated stocks implies that momentum returns could be compensation to the increased uncertainty during economic downturns. Given the recent economic downturn worldwide after the year 2000s, an investor would realize significant momentum return by holding ‘Speculative Grade’ stocks in her momentum portfolio.

7.4 Areas of Future Research

The results of this study have contributed to momentum literature and have improved our understating regarding the issue that momentum returns are compensation for risk. However it would still be interesting to investigate several other dimensions of momentum returns. Firstly, the empirical results of this study have been derived broadly by using firm level factors and macro level risk factors e.g. Fama-French three factors, Carhart four-factor and macroeconomic risk factors. However literature shows that other important risk factors such as industry factors and seasonality have important implications in explaining momentum returns (see among other Moskowitz and Grinblatt, 1999 and Sadka, 2006). Incorporating these risk factors in the study would provide more comprehensive evidences as whether or not momentum returns are compensation for risk. Furthermore, we have incorporated only the proportional transaction cost in this study to show how momentum behaves when transaction cost is accounted for. However, future research can incorporate both proportional and non-proportional transaction costs e.g. effective quote, commission, stamp duty, etc. to investigate if momentum is profitable and the amount of turnover that can be exploited.

Secondly, this study performs all investigation on price momentum. But literature document that other than price momentum another important momentum return is the earnings momentum. It would be worth investigating whether or not momentum returns can still be considered as a compensation for risk when earnings momentum are used and also how the alternative momentum strategy will work when implemented on earning momentum.

Thirdly, it has been documented that momentum returns are not compensation for risk particularly at the portfolio level and when contemporaneous firm level factors are used. This warrants work at the econometric level as well as theoretical. Future work can address the issue of psychological biases and behavioral models for a further explanation of the fact.

Finally, our empirical results show that momentum returns of ‘Speculative Grade’ stocks are significant during both expansions and contractions but much higher during contractions. One possibility of this could be liquidity; as pointed out by Pastor and Stambaugh (2003) that a large portion of momentum returns are accounted by liquidity factors. Furthermore, trading-related market friction as shown by Korajczk and Sadka (2004) could be another good reason. A more complete investigation of momentum returns that combines liquidity and trading-related frictions with macroeconomic variables seems warranted in future research.

7.5 Conclusion

This chapter summarizes the main objective of the thesis which is to investigate if momentum returns are compensation for risk, be it firm level or macro level. The chapter briefly presents the data and the methodology used to achieve the objective of the research. Furthermore, the chapter reports the major empirical findings and conclusions derived from each empirical chapter. In addition, the chapter specifies he implications of the empirical results both for the finance academia and for the investment managers in making real-life investment decisions. Finally, the chapter provides direction of potential future research in this area.

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8 APPENDIX E

An illustration of Measuring Momentum Returns Using Conventional Method

This section illustrates the methodology of measuring momentum return following to the conventional method of Jegadeesh and Titman (2001) using a *JxK =6x6* strategy as an example. In six-month time period from the starting month of the return series the stocks returns over the preceding *J* months is calculated as

$$R_{i,t}^{F} = \frac{1}{J}\sum_{\tau=1}^{J} R_{i,t-\tau}$$

(A1)

where $R_{i,t}^{F}$ is the average stock return of stock *i* at time *t* over the formation period *F*. In our example, suppose that the return series starts from January 1926 and ends in December 2005. Therefore, the first *t* time period for a *JxK =6x6* strategy would be in the month of July 1926. The formation period is from January to June 1926. At time *t* he stocks are ranked based on the past formation period (six-months) return i.e. from January to June 1926 in ascending order and form deciles portfolios with the top portfolio as the loser portfolio and the bottom portfolio as the winner portfolio. [25] In July there will be only two portfolios formed based on the ranking of the returns of the stocks. The winner and loser portfolio are defined as

$WP_t = \{i : R_{i,t}^{F} \in \text{Decile 10}\}$ and

(A2)

[25] As we consider the cumulative return of stock we use arithmetic return and not log returns. Momentum literature largely employs this technique in estimating momentum return.

$LP_t = \{i : R^F_{i,t} \in \text{Decile 1}\}$

(A3)

where WP_t is the winner portfolio (P10) and LP_t is the loser portfolio (P1).

A long position is held in the winner portfolio and a short position in the loser portfolio during the *K* formation period. In our example, the positions are held for the subsequent six months, i.e. *t+1* to *t+6* (from August 1926 to January 1927). The following figure shows the time line of the formation and holding period of the momentum strategy.

Strategy *JxK =6x6*: Time Line

Formation Period (*J*) **_t_** **Holding Period (*K*) time (*t**)**

[Jan-June 1926] [July] [Aug 1926- Jan1927]

[Based on these returns] *[Rank stock, form winner and loser portfolios]* *[Hold winner, short loser]*

This window is rolled over till the end of the sample period. Therefore the last *t* period will be in June 2005 in case of *JxK =6x6* strategy. At the end of the holding period K momentum return is realized. For simplicity we define this time period as *t**. In our example of *JxK=6x6* strategy the first *t** is January 1927 and continues till the end of the sample period. Therefore at *t** momentum return is calculated as the difference between the return from the winner portfolio and the loser portfolio. For instance,

$$MR_{t^*} = R_{t^*}^{WP} - R_{t^*}^{LP} \quad \text{Equation A4}$$

where, MR_{t^*} is the momentum return at time period *t**, $R_{t^*}^{WP}$ and $R_{t^*}^{LP}$ are the returns of winner and loser portfolios, respectively. This procedure of stock ranking, portfolio formation, holding and measuring momentum return at the end of the holding period is repeated till the end of the sample period.