THE UNIVERSITY OF WESTERN AUSTRALIA

Essays in Asset Pricing

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This thesis is presented for the degree of
Doctor of Philosophy of
The University of Western Australia

UWA Business School

Accounting and Finance

2015

Acknowledgments

I would like to take this opportunity to thank a number of people for their practical and emotional support throughout what has been really a challenging process. First and foremost, I owe a debt of gratitude to my supervisor, W/Professor Richard Heaney for his guidance, tireless advice, encouragement and support not only to issues related to this thesis, but also to issues related to how to approach life. I would also like to thank my coordinating supervisor Professor Sirimon Treepongkarauna for her guidance, valuable feedback, comments and support for all major parts of this work. I also owe debt to Professor Tom Smith for his insightful critiques and recommendations, especially at the early stages of this study.

I would like to extend my heartfelt thanks to Professor Robert Faff and Professor Cameron Truong, my assigned faculty during the AFAANZ Doctoral Symposium 2014 for their constructive feedback, guidance and recommendations especially for the later parts of this study.

I would like to extend gratitude to my PhD colleague and a dear friend Amir Hossein Sabet for his infinite support and guidance, especially with the SAS software, I used for my analysis. Without him, the PhD journey would not have been this memorable and exciting.

I gratefully acknowledge helpful comments received from Bruce Grundy, Louis Piccotti, Alexander Kerl, Stijn Masschelein, Yihui Lan, David Woodliff, Dianne Massoudi and Keith Godfrey,

Lastly, I am forever grateful for the love and support of my family and friends. My parents and my son Daniyal stood by me and motivated me for pursuing the challenges throughout this PhD journey and my life so far.

Abstract

This dissertation follows on an asset pricing theme. Overall, it explores asset pricing tests in the equity and the bond markets and attempts to identify the common risk factors that best explain cross sectional variation in stock and bond returns. The first three studies use US data, while the last study explores European bonds data. The sample period is from January 2002 to December 2012 and the Fama and French (1993) time series framework is used in each of the studies. The first two studies in this dissertation focus on equity markets, while the third and fourth study encompasses the US and European corporate bond markets respectively.

There has been extensive research on asset pricing models. However, despite being a well-researched area, there is little consensus as to which model is most appropriate. Motivated by this gap in literature, this thesis builds on the work of Fama and French (1993) and applies their time series framework to both equity and bonds.

Chapter 2 draws on the link between firm leverage and stock returns as supported by capital structure theory. It examines whether a leverage (LEV) factor exhibits explanatory power over the US stock return variations. The analysis indicates that the LEV factor significantly contributes towards the explanatory power of the fitted models and thus appears to have some explanatory power over U.S. stock returns.

Chapter 3 addresses the question of whether ex-post returns should be used in testing ex-ante asset pricing models. This chapter explores the impact of using IBES mean target price as a proxy for expected price in tests of the CAPM, Fama and French (1993) three factor and the Cahart (1997) four factor models. The analysis suggests that the expectation based proxy of returns performs in a similar manner to realized returns in asset pricing tests and thus the use of realized returns should not adversely bias asset pricing tests.

Chapter 4 and 5 add to the bond pricing literature by applying time-series studies to US and European bonds. Chapter 4 investigates common risk factors within the US

corporate bond returns. The analysis shows that stock market factors do not add explanatory power to the bond return models used in this study. The bond market factor, DEF, dominates all other explanatory variables in regression analysis.

Chapter 5 of this dissertation examines the common risk factors explaining variation within the European corporate bond returns. The results are consistent with Chapter 4 indicating that the European DEF factor also captures much of the variation in European bond returns.

This dissertation enhances our understanding of the asset pricing models within a Fama and French (1993) time series framework for both equity and bond markets. Support is provided for the importance of leverage in asset pricing. The choice between realised returns and expected returns is also explored in this thesis, with the results suggesting that this choice has little impact on the results from time series asset pricing tests. The pricing of corporate bonds is also explored with evidence to confirm the Fama and French (193) result that equity and bond pricing models differ considerably in US market. Finally, it is found that the key pricing factors are common to both US and European corporate bonds.

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Chapter 1 – Introduction

1.1 The focus and importance of research

Equity and bond markets are important in a modern financial system. Portfolio managers often shift funds from stocks to bonds when they anticipate market volatility to increase. The return maximization (risk reduction) achieved by this shift depends on how well managers can predict asset returns (volatilities and co-movements of asset returns). Moreover, in order to make this wealth maximization strategy effective, managers need a well-specified pricing model for both stocks and bonds that will not leave significant components of cross-sectional variation in returns unexplained.

Elton (1999) suggests that reliance on realized returns may bias asset pricing tests. The rationale behind this argument is drawn from the fact that the asset pricing models are ex-ante in nature. Thus, it seems more appropriate to use an ex-ante proxy of returns in empirical tests. Moreover, Asquith et al. (2005) provides evidence that analyst target prices are informative and market participants consider target price information useful in predicting future stock prices. Given the importance of the need to use an ex-ante proxy of returns in asset pricing tests and assuming analyst target price provides a fair proxy for future stock prices, this dissertation contributes to the empirical literature through the use of an ex-ante return proxy in asset pricing tests.

According to McKinsey Global Institute's 'Mapping Global Capital Markets 2011' report, global bond market capitalization is almost twice the capitalization of the global equity market. For instance, in 2010, the global equity market capitalization stood at $54 trillion, while outstanding global debt (including public debt securities, financial and non-financial institution bonds) was $93 trillion (Mapping Global Capital Markets 2011). Similarly, Andersen and Benzoni (2012) state that the market capitalization of the U.S stock market is $21 trillion compared with the size of the U.S bond market at almost $37 trillion. Despite the larger size of the bond market, it is surprising to find that the asset pricing literature focuses so heavily on the stock market. Moreover, prior studies generally explore the bond market within a cross-sectional framework. The cross-sectional tests focus on the explanatory power of factor loadings for test returns in cross-section, while time-series tests focus on pricing errors of given asset pricing models. Recognizing the importance of the US bond market and the scant existing bond market literature, this dissertation investigates asset pricing in both US equity and bond markets within the Fama and French (1993) framework.

In Europe, the bond market accounts for two-thirds of the total securities outstanding in financial markets (AFME, 2014). According to the Deutsche Bank 'Corporate Bond issuance in Europe' report, after the financial crises the availability of bank lending shrank and European corporates started using debt capital markets more intensively. Moreover, strong investor demand also stimulated issuance of corporate bonds. Given the uncertainty and high liquidity associated with corporate bonds, a closer examination of the European corporate bond market is also timely (Corporate Bond Issuance in Europe, 2013). Hence, this dissertation investigates the common risk factors apparent in European bond pricing within the Fama and French (1993) time series framework. This generates deeper understanding of the European corporate bond market and provides insights that will assist investors in their investment decisions.

Roche (2014) explains that over the past decade, the conventional correlation between stock and bond returns has reversed. Historically, stronger (weaker) economic fundamentals tend to attract investors to stocks (bonds). Thus, a rise in equity prices was associated with falling bond prices. However, Roche (2014) points out that over the last few years, as both markets were flooded with liquidity, the equity and bond markets began moving together, distorting the traditional relationship. It appears the two major asset classes (bond and equity) have been rising in unison more recently. Thus, given the importance of the roles of equity and bond in financial markets and claims concerning a change in the relationship between these two asset classes in recent times (Roche, 2014), this dissertation explores the link between the equity and bond pricing by testing how bond specific pricing factors relate to equity returns and equity specific pricing factors explain bond returns.

1.2 Background

1.2.1 Pricing Factors discussed in the literature

1.2.1.1 Equity

The Sharpe (1964) and Lintner (1965) Capital Asset Pricing Model (CAPM) is considered a landmark contribution to the asset pricing literature. It is widely used in applications like estimating cost of capital for firms and evaluating the performance of portfolios both by academics and practitioners. The CAPM proposes a positive linear relationship between the risk and the return of an asset. It relies on two key assumptions. First, investors focus on the mean and variance of the returns of the asset. Second, all assets are exposed to market risk which cannot be eliminated or diversified away. The CAPM implies that since systematic risk (measured by beta) cannot be eliminated, investors demand greater compensation for bearing higher systematic risk and thus systematic risk, is the only component of total risk that is priced. Fama and French (2004) state that the CAPM not only has a strong theoretical background but also the strength of the model lies in the predictions it makes about the relationship between expected return and risk.

As much as it is true that the CAPM is theoretically strong, it is equally known that CAPM lacks empirical support. Several 'return anomalies' have been documented. As these patterns are not explained by the CAPM, they are typically referred to as anomalies. Two of the most prominent anomalies are the size (SMB) effect and the book-to-market (HML) effect. Small-size firms as well as firms with high book-to-market ratios provide higher returns after adjustment for market risk. Fama and French (1992, 1993, 1996) added these two factors (SMB and HML) to the CAPM and reported that these size and book-to-market factors capture most of the cross sectional variation left unexplained by the CAPM. This model, referred to as Fama and French (1992, 1993, 1996) three factor model, has been the predominant asset pricing model in the asset pricing literature. Since the introduction of the Fama and French three-factor model in the early 1990s, many researchers have tested whether the model does a better job than the CAPM model in the US markets. Further, researchers have demonstrated that the three-factor model is better in predicting asset return than the CAPM model in some global markets. For example, Gaunt (2004)reported that the three-factor model was a better predictor for stock returns over the CAPM model in the Australian stock market. Lam (2002), Chen and Zhang (1998), Chui and Wei (1998), Drew (2003) discussed the impact of firm size and book-to-market ratio effects on stock returns in the Hong Kong stock market.

Carhart (1997) established that, in addition to the SMB and the HML, a momentum factor also contains substantial explanatory power in explaining stock returns. The momentum effect was first documented by Jegadeesh and Titman (1993). This effect is based on a simple trading strategy where long-short portfolios are formed based on the past performance of stocks. A long position is taken in the portfolio comprising the stocks that earned highest returns (referred as winners) in the past. Similarly, a short position is taken in the portfolio which consists of the stocks that earn lowest returns (referred as losers) in the past. The difference between the returns on the long and short portfolios is referred to as momentum profit.

(Jegadeesh and Titman, 1993) show that momentum profits are positive and statistically significant on average, indicating that winners stocks (on the basis of returns) in recent months are likely to out-perform loser stocks in subsequent months.

1.2.1.2 Bonds

A review of the literature reveals that there is extensive work in the area of equity pricing. However, relatively little is known about risk premia required in pricing corporate bonds. The empirical evidence suggests that corporate bonds are priced to cater for the possibility of default as well as factors like credit rating of the issuing corporation, type of issue (e.g. senior or subordinated; secured or unsecured) and contractual provisions encompassing settlement details which, in case of a default, are important in estimating corporate bond yields. Fama and French (1993) identify two bond market factors, TERM and DEF, as priced factors in their study of US corporate bonds. They define TERM as the difference between the monthly long-term government bond return and one month T-Bill return; and DEF as the difference between the monthly return on the market portfolio of investment grade corporate bonds and the monthly long-term government bond return. Fama and French (1993) use US non-financial firm data for a period from 1962 to 1989 to investigate the common risk factors which capture the cross-section of average returns in bonds and stocks. Their study indicates at least five common factors in government bond returns. Two term structure factors, TERM and DEF, capture almost all the variation in high grade bond returns. While the stock market factors, market risk premium, SMB and HML do not exhibit explanatory power over government or corporate bond returns.

The momentum and reversal effects are extensively researched for stock prices, yet the same is not true in bond prices (Pospisil and Zhang, 2010). Hottinga et al. (2001) using bond momentum in creating a trading strategy. They show that A-rated bonds exhibit a reversal effect. Gebhardt et al. (2005b) confirm that the reversal effect exists in investment-grade bonds. Khang and King (2004) argue that the reversal effect is due to the firm specific component in bond returns. Pospisil and Zhang (2010) extend analysis of momentum and reversal effects to include both investment grade and high-yield bonds. Their study confirms the reversal effects in the investment grade bonds and shows that prices of high-yield bonds exhibit momentum. Similarly, Jostova et al. (2013) also confirm the momentum effect in US corporate bonds and conclude that the profitability of the momentum strategy is concentrated in the non-investment grade (high yield) bonds.

Bhojraj and Swaminathan (2009) point out the existence of an accrual anomaly in bonds. Their study shows that the corporate bonds issued by firms with low operating accruals outperform corporate bonds issued by firms with high operating accruals. Bhojraj and Swaminathan (2009) argue that this anomaly can be attributed to the inability of market participants to understand the relationship between accruals, future earnings and cash flows.

Chatrath et al. (2012) examine the effect of macroeconomic news releases on corporate bonds. Their study indicates that high-yield bonds are more sensitive to macroeconomic news announcements than investment grade bonds. Moreover, Chatrath et al. (2012) also point out that when the economy performs better (worse) than expectation, investors tend to prefer investing in high yield bonds (Treasury bonds).

De Franco et al. (2009) study the informational role of bond analysts in terms of the impact of their recommendations on bond prices. Their study indicates that as compared to equity analysts, bond analysts add less bias to their investment recommendations. They identify three distinctive bond features resulting in less biased investment recommendations, i) as bond investors are institutional investors, they have access to multiple information sources and are better equipped to utilize bond analysts' recommendations, ii) bonds are rated by independent rating agencies and serve as an independent check on the accuracy and reliability of bond analysts' research, iii) as the value of bonds are established by macro-economic factors like interest rates and historical credit spreads, bond securities with similar cash flows and credit risk may be used as pricing benchmarks for bonds covered by bond analysts. Moreover, as the upside potential in bonds is limited (due to fixed payoff at maturity), the bond investors exhibit greater demand for negative information (De Franco et al., 2009).

Recent studies that examine the effect of liquidity on corporate bond yields suggest that there is a positive and economically significant relationship between corporate bond returns and liquidity and that this is an important determinant of expected corporate bond returns (Houweling et al. (2005), Bao et al. (2011) and Lin et al. (2011)). However, Cai et al. (2007) examine under-pricing in the corporate bond market and indicate that under-pricing is unrelated to subsequent trading and market liquidity. Cai et al. (2007) explain this finding by pointing out that as the trade in bond markets is infrequent, investors do not require a liquidity premium. Dick-Nielsen et al. (2012) analyse the liquidity components of corporate bond spreads before and after the onset of the subprime crises. They conclude that corporate bond spreads increased during the subprime crises indicating that illiquidity resulted in widening spreads. Dick-Nielsen et al. (2012) also argue that flight-to-quality was limited to AAA-rated bonds during the crises period.

1.2.2 Leverage as a Proposed Pricing Factor

The most general definition of capital structure refers to the proportion of debt and equity securities that a firm uses to finance its assets. It is generally a mix of firm long-term debt, short-term debt, common equity and preferred equity. The proportion of debt to total financing is referred to as the firm's financial leverage.

1.2.2.1 Equity

Bhandari (1988) was one of the first to provide empirical evidence on the relationship between financial leverage and expected stock returns. His study reported that leverage carries a positive risk premium. Gomes and Schmid (2010) state that finance literature proposes a straight forward link between capital structure and expected asset returns: an increase in financial leverage is directly proportional to an increase in the risk of the cash flows to equity holders. Thus, increases in financial leverage leads to increases in the required rate of return on equity.

However, there is mixed empirical evidence regarding the existence of a relationship between equity returns and leverage.

Ferguson and Shockley (2003) explain that betas calculated against equity-based proxies are understated and the missing beta risk is related to relative leverage and distress. They further state that a three factor model that includes factors formed on leverage and distress along with the equity market index outperforms the Fama and French (1993) three factor model in cross section analysis. George and Hwang (2010) conduct a cross-sectional study to examine how financial leverage and distress could affect stock returns. Their study documents that average stock returns are negatively related to book leverage. George and Hwang (2010) conclude that both financial leverage and distress are priced factors in the equity market, where book-to-market measures sensitivity to operating distress risk, while leverage measures sensitivity to financial distress risk.

However, Korteweg (2004) argues that testing the relationship between financial leverage and expected stock returns within a cross sectional framework is problematic in terms of controlling for the systematic risk of the firm's assets. He further explains that as firm assets and financial leverage are negatively correlated; adding leverage in a cross-sectional framework can lead to noisy, biased and contradictory results. He suggests that a time series approach should be used as an alternate to cross-sectional tests to formulate more powerful tests of this relationship.

1.2.2.2 Bonds

Leland (1994) shows that capital structure and corporate debt value are interlinked variables. He explains that debt values are linked to the potential for default and bankruptcy and, thus, cannot be determined in isolation from capital structure. Similarly, capital structure decisions cannot be made without considering existing debt value and its effect on firm leverage. Keeping in view this relationship, this dissertation empirically tests whether corporate debt returns depend on leverage. Moreover, it explores the question of whether junk bonds returns and investment-grade bond returns exhibit the same or a different relationship with leverage.

1.2.3 Corporate Bonds

Practitioners use various techniques to analyse information on companies and bond issues in order to evaluate the ability of the issuer to live up to their future obligations. The outcome of this activity known as credit analysis is communicated to investors in the form of credit ratings. Based on these credit ratings, the corporate bond market can be divided into two sectors: the investment grade sector and the non-investment grade sector. Investment-grade bonds have low credit risk, and exhibit a high probability of meeting future payments. Further, Fridson (1994) points out that an investment-grade bond is sensitive to interest rate fluctuations. Macaulay (1938) shows that movements in the long-term interest rates drive the fluctuation in yields of investment-grade bonds. Non-investment grade bonds, also known as high yield or junk bonds, exhibit high credit risk. Macaulay (1938) argues that junk bonds yields are affected both by long-term interest rate and by forecasts of issuing firm earnings.

Reilly and Brown (2011) suggest that there is a substantial equity component in high-yield bonds. Cornell and Green (1991) and Blume et al. (1991) also examine the risk and return of high-yield (junk) bonds and show that junk bonds are less sensitive to interest rate movements and more sensitive to stock market movements. Similarly, Kwan (1996) points out that high-yield bond returns are correlated with equity returns. Ramaswami (1991) confirms that junk bonds have equity-like qualities and that their values move in accordance to issuing firm asset value[1]. He further ascertains that the correlation between bonds and stocks is inversely proportional to bond credit rating; as the credit rating for a bond declines, the correlation between bond and equity returns increases. While, Shane (1994) reports significant positive correlation among junk bond portfolios, treasury bonds and matched equity portfolios. He concludes that junk bonds are essentially hybrid securities.

According to Fridson (1994), the existence of an equity component in junk bonds can be explained by capital structure theory as follows:

'*A corporate bond is a combination of a pure interest rate instrument and a short position in a put on the issuer's equity. The put is triggered by a decline in the value of the issuer's assets to less than the value of its liabilities. A default, in other words, results in the stockholders putting the equity to the bond holders, who then become the company's owners.*'

Fridson (1994) points out that the default risk associated with junk bonds is large enough to enable the equity put to affect junk bond prices substantially[2]. He suggests that equity-related options influence the movement in junk bond prices. He states that it is not surprising that junk bonds do not track government bonds (pure interest instruments).

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[1] Moreover, he recommends that equity-related instruments should be considered as hedging instruments when managing junk bonds portfolios.

[2] Investment grade bonds are issued by high-rated companies and thus the value of the put is negligible and does not affect the price movement of the investment grade bonds.

1.2.4 Link between Equity and Bonds

In order to understand the relation between bond and stocks, it is helpful to consider that the value of both bonds and stocks is driven by the performance of the underlying firm. Stockholders are the owners of the firm, though they have a residual claim on the earnings of the firm. Their claims are addressed only after all the other claims on the firm have been met and this includes debt. In the case of bankruptcy or inability of the firm to meet its debt obligations, the shareholders receive nothing. Thus, equity can be viewed as a call option on the value of the firm, with the debt obligations determining the strike price of this call (Ramaswami, 1991). On the other hand, the bondholders are creditors of the firms and they become the owners of the firm only if the firm is unable to meet its debt obligations (in the event of bankruptcy). In this case, the value of the firm will be less than the sum of its debt obligations. Thus, bondholders can also be seen as the owners of the firm who have sold the call option on the value of the firm to stockholders (Ramaswami, 1991).

Geske (1977) model a coupon-paying risky bond as a compound option. The coupon-paying risky bond is viewed as a combination of firm's equity (risky asset) and government bonds (riskless asset). The proportion of the firm's equity and government bonds that forms the risky bond varies with time and can be viewed as a function of firm's capital structure (debt/equity ratio), volatility of the firm's value and bond characteristics (Geske, 1977).

A review of the literature identifies the equity market as being dynamic and efficient; while the bond market is often argued to be trailing and inefficient (Bittlingmayer and Moser, 2014). Forexample, Downing et al. (2009) shows that stock returns lead bond returns in all credit quality categories. Yet, Bittlingmayer and

Moser (2014) empircally show that high-yield bond returns have an information "edge" and thus provide incremental information about future path of stock prices.

Bonds and equities are interlinked, so much so that junk bonds are considered to be more sensitive to fluctuations in equity markets and less sensitive to the fluctuations in interest rates than investment grade bonds. Given the existing evidence of the association between stocks and bonds, it is important to investigate whether equity specific factors affect bond returns and vice versa. Thus, this dissertation attempts to identify the equity and bond market factors that best explain variation in stock and the bond returns.

1.3 Aims and Motivations

This dissertation is structured around the theme of asset pricing with four motivations. First, the asset pricing framework stems from a number of premises such as investors prefering higher expected returns, avoiding risk and holding well diversified portfolios (Harvey, 2001). Such insights help to assess the fair rate of return for a particular asset (Harvey, 2001). Moreover, such information is critical for investment decision making by corporations in evaluating projects and investors forming portfolios. Despite the importance of an accurate asset pricing model, there is seemingly little consensus as to which model is the most appropriate. Motivated by this, the study contributes to the existing literature by applying and extending the Fama and French (1993) time series framework to both equity and bond markets.

The second motivation of this study is driven by a connection between leverage and stock returns, as supported by the capital structure theory. The existing literature has its limitations in explaining whether leverage is a priced factor in asset pricing tests. The key limitation in testing the relationship between financial leverage and expected stock returns is the need to control for the systematic risk (business risk) of the firm's assets (Korteweg, 2004). As financial leverage and business risk are negatively correlated, cross-sectional studies lead to contradictory results (Korteweg, 2004) Thus, motivated by this limitation of prior studies and given the theoretical link between leverage and asset returns this study aims to provide further empirical evidence concerning this relationship within a time series framework.

Thirdly, although asset pricing models are ex-ante in nature, prior studies rely on ex-post returns in empirical asset pricing tests. This dissertation aims to address this irregularity and investigate the importance of an expectation based proxy for expected return. This study uses Institutional Brokers Estimate System (IBES) mean target price in asset pricing tests using US equities. Evidence in the literature suggests that IBES forecasts provide more precise and less biased predictors of share price (Ramnath et al., 2005), and so this study uses the IBES mean target price in calculation of ex-ante returns in this study

The final motivation is driven by the claim that the traditional relationship between stock returns and bond returns changed after the Global Financial Crises (GFC) (Roche, 2014). This study explores the validity of the claim by reporting empirical tests that assess the impact of the GFC on stock returns and bond returns.

1.4 Research Questions

This dissertation provides new evidence addressing four research questions:

Q.1 Are bond specific factors priced in the equity market?
Q.2 Does the use of expected returns change the results of asset pricing tests?
Q.3 Are equity specific factors priced in the bond market?
Q.4 Can relations documented in Q1 and Q3 be extended outside the US to European asset pricing?

To address the first question, this study apply the Fama and French (1993) time series framework and investigate whether a leverage factor adds explanatory power to the CAPM, the Fama and French (1992, 1993) three factor model or the Cahart (1997) four factor model. This study uses monthly US realized returns for a period 2002-2012 in all asset pricing model tests. The year 2002 is chosen as the first year for the sample to avoid the dot-com bubble crash of 2000 and the downturn that followed. Wollscheid (2012), in their study titled 'rise and burst of dotcom bubble', note that markets showed signs of recovery from the dotcom crash by 2002. Further, the IBES data is available from March 1999, though it took until about 2002 before data set firm coverage began to stabilize. . Thus, a period of 2002 -2012 is used to ensure consistency of sample period throughout the dissertation.

To address the second question, this study use IBES mean target price as a proxy for expected price to construct an expected return proxy and test how well this choice of expected return proxy affects tests of the CAPM, the Fama and French (1992, 1993) three factor and the Cahart (1997) four factor models using US data from January 2002 to December 2012. There is general consensus that market expectations are unobservable but the existing literature indicates that analyst forecasts may represent a viable proxy for market expectations and could serve as a proxy for expected price (Brav et al., 2005).

To address the third question, this study examines the US Corporate bond market to evaluate how equity and bond market factors fare against one another in explaining bond return variation. Fama and French (1993) show that the term structure factors, DEF (default premium) and TERM (term premium), are able to explain almost all the variation in US corporate bond returns except for the 'low grade (LG) bonds portfolio'. This study use the Fama and French (1993) three factor model augmented with two bond factors (DEF, TERM) model to investigate whether

TERM and DEF factors capture variation for the study period. Moreover, the study also test the explanatory power of liquidity (LIQ) and leverage (LEV) factors within the Fama and French (1993) time series framework, in an attempt to better understand bond pricing in the US bond market.

To address the fourth question, the study examine European corporate bonds within the Fama and French (1993) time series framework and evaluate how term structure factors, liquidity (LIQ) and leverage (LEV) factors perform in explaining the cross section variation in the bond returns.

1.5 Organization and Major Findings of this study

Chapter 2 explores the performance of the Fama and French (1993) three factor model, Fama and French (1993) three factor model augmented with two bond factors (DEF, TERM) and leverage (LEV). LEV is included to allow investigation of whether leverage can help explain cross sectional variation in US stock return. Data spans the period from January 2002 to December 2012. There are 296,874 monthly observations and 4,150 US firms in this data set. This study finds that the results are largely consistent with previous findings of the Fama and French (1993) three factor model. The SMB and HML coefficients are correlated with size and book-to-market equity, respectively. However, unlike the original Fama and French (1993) study, the market risk premium, and the SMB and HML factors leave considerable return variation unexplained. This suggests that there may be other factors that capture this variation. The augmented six factor model indicates that the LEV factor carries a positive risk premium for high book-to-market equity firms.

Chapter 3 uses a measure of ex-ante returns in asset pricing tests. The study is conducted for the period from January 2002 to December 2012 and IBES mean target price is used as a proxy for expected price in calculation of expected return. Specifically, this study test the CAPM, the Fama and French (1993) three factor model and the Cahart (1997) four factor model using expected returns. This study finds that the performance of the expectation based proxy is similar to that of the realized returns based proxy with the exception of book-to-market loadings. Assuming IBES mean target price is a good proxy for ex-ante returns, the reliance on the historical returns in asset pricing tests does not appear to adversely bias the results reported in this literature.

Chapter 4 investigates the common risk factors in US corporate bond returns for the period from January 2002 to December 2012 within a Fama and French (1993) time series framework. This study use credit ratings to allocate bonds in the four credit rating based bond portfolios. This study also use Fama and French (1993) portfolio techniques to allocate bonds into 25 ME and BEME (book-to-market equity) bond portfolios using issuing firm equity information. Mimicking portfolio returns based on LEV and LIQ are also added to capture leverage and liquidity effects. This study finds that the DEF factor dominates all the explanatory variables in all the models.

Chapter 5 investigates common risk factors in European corporate bond returns over a period from January 2002 to December 2012 within a Fama and French (1993) time series framework. Consistent with chapter 4 results, this study finds that the DEF factor exhibits considerable explanatory power. Indeed, it explains much of the variation in European corporate bond returns. While, the mimicking portfolio returns based on LEV and LIQ add little explanatory power to the model.

Finally, Chapter 6 summarizes the main findings from this dissertation, discusses its contributions and limitations and suggests future research avenues.

Chapter 2 – Is Leverage priced in the US Equity Market

2.1 Introduction

The formulation of modern portfolio theory by Markowitz (1952) is considered a landmark contribution to the finance literature. It led to the development of the Sharpe (1964) and Lintner (1965) CAPM. The CAPM proposes a linear relationship between the risk and return of an asset. It measures the risk of an asset in terms of the variability of asset returns relative to the returns of a market portfolio. It has been argued that CAPM fails to achieve empirical support for three main reasons. First, the CAPM assumes beta remains constant over time, while in reality beta is time varying in nature (Jagannathan and Wang, 1996). Second, despite the CAPM being ex-ante in nature, most researchers use realized returns as a proxy for expected returns in empirical tests of CAPM (Elton, 2002). Third, proxy market portfolios used in tests of the CAPM do not include all the risky assets and so do not appear to be the true market portfolio (Roll, 1977).

Over the past few decades, several asset pricing models have been introduced in an attempt to better explain variation in the cross-section of returns. For example, Merton (1973) developed the Intertemporal CAPM (ICAPM). Breeden (1979) introduced the Consumption CAPM (CCAPM). Amihud and Mendelson (1986) added a liquidity factor to the CAPM. While, Fama and French (1992) proposed a three factor model including size and book to market value and Carhart (1997) identified momentum as a further explanatory variable.

Further capital structure theory identifies leverage as one of the sources of stock return risk; indicating that the more leveraged a firm is the higher is the risk for the equity holders and therefore the higher return they demand in compensation for this additional risk. Christie (1982) is the first to report a positive correlation between the degree of leverage on a firm's balance sheet and the volatility of its stock.

Despite leverage being recognised as a key source of stock return risk (Figlewski and Wang, 2000), the relationship between leverage and stock returns has not been extensively researched, and the empirical findings concerning this relationship are mixed and sometimes contradictory. Following the Fama and MacBeth (1973) methodology, Bhandari (1988) uses market leverage as a proxy for the underlying risk in cross-sectional regressions and reports that leverage carries a positive risk premium. Fama and French (1992) conduct a similar study and use both log market leverage and log book leverage as proxies for leverage in cross sectional regressions. They argue that the difference between their proxies of market and book leverage, which can be referred to as book to market ratio, does explain average returns. Penman et al. (2007) decompose book-to-price into the enterprise book-to-price ratio (related to operational risk) and a leverage component (pertaining to financing risk). Their study explores the relationship between these components of book-to-price and subsequent stock returns. Penman et al. (2007) report that after controlling for size and book to market factors, the equity returns are either insensitive to, or fall with, leverage. Yet, Nielsen (2006) studies the relationship between the firm’s choice of capital structure and their stock market returns. He concludes that investors are compensated with a higher premium for investing in companies with high levels of debt.

This study investigates whether leverage provides additional explanatory power over US stock returns for the period January 2002 to December 2012. The Fama and French (1993) three factor model and the Cahart (1997) four factor models are used as benchmark models within the Fama and French (1993) time series framework. This study tests whether leverage (LEV) provides an additional explanatory power in the following asset pricing tests. The results indicate that LEV appears to be a priced factor in stock returns. The rest of this chapter proceeds as follows. Section 2.2 reviews the related literature. Section 2.3 describes the data used in the study. Section 2.4 details the methodology. Section 2.5 presents the results and the last section concludes the findings of this chapter.

2.2 Review of Relevant Literature

Section 2.2.1 discusses the CAPM. Section 2.2.2 and 2.2.3 reviews the Fama and French (1993) three factor and Cahart (1997) four factor models. While the last section examines the relationship between equity returns and leverage.

2.2.1 Capital Asset Pricing Model (CAPM)

The CAPM, an ex-ante model, proposes a linear relationship between the risk and the return of an asset. It measures the risk of an asset as the variation of asset returns relative to the market portfolio returns of a market portfolio.

Roll (1977) argued that the original CAPM model was not testable even at the theoretical level. Roll (1977) pointed out that there was no correct and unambiguous tests carried out on the original CAPM model in the literature and predicted that there was no possible way that such tests could be conducted, even in the future. Roll (1988) concludes that the original CAPM model had no power in variation in expected returns. This result was confirmed by Fama and French (1992)

2.2.2 Fama and French (1993) Three Factor Model

Fama and French (1993) proposed a three factor model, stating that the size and book-to-market ratio have significant explanatory power in explaining the cross section of stock returns. They use US non-financial firm data for a period of 1962-1989. They sorted stocks on the basis of size and book to market quintiles, creating 25 portfolios, and fit a three factor asset pricing model to the returns from these portfolios. Fama and French (1993) hypothesized that if the asset prices are rational, both size and book-to-market equity ratio could be proxies for common risk factors relating to average returns. They used slopes and R2 values to show whether mimicking portfolios for risk factors, which were relative to size and book-to-market ratio, captured variation in stock returns. Fama and French (1995) conducted a further study on the relationship between firm size, book-to-market equity ratio and stock returns. They tested whether there was a fundamental economic reason behind those two factors which could affect stock returns. They hypothesized that firm size and book-to-market equity ratio should be able to explain firm earning behaviour since they could be proxies for common risk factors.

Fama and French (1993) also address the behaviour of TERM and DEF factors in explaining stock returns. They show that when only term structure factors (TERM and DEF) are used as explanatory variables, TERM and DEF capture common variation in stock returns. However, when stock market factors (market risk premium, SMB and HML) are added as explanatory variables to the regressions, the TERM and DEF factor statistical significance largely disappears. Fama and French (1993) explain that the impact of TERM and DEF are suppressed by excess market returns and thus in the five factor regression tests used in this dissertation, TERM and DEF explanatory power diminishes. Fama and French (1993) conclude that there is strong common variation in bond and stock returns.

2.2.3 Cahart Four Factor Model

Carhart (1997) proposes a four factor model, using the Fama and French (1993) three factor model plus an additional factor capturing the Jegadeesh and Titman (1993) one-year momentum effect. Jegadeesh and Titman (1993) find that stocks ranked as top performing stocks (on the basis of returns) in recent months are likely to out-perform other stocks in subsequent months. Carhart (1997) establishes that in addition to SMB and HML, the momentum factor also contains substantial explanatory power for stock returns and thus addition of this factor reduces the pricing errors from the CAPM and the three factor model.

2.2.4 Equity Returns and Leverage

The seminal work of Modigliani and Miller (1958) marks a landmark contribution to corporate finance. Numerous studies like Scott (1977), Myers and Majluf (1984), Jensen and Meckling (1979), Baker and Wurgler (2002), Agrawal and Mandelker (1987), Campello (2003) extend the work of Modigliani and Miller (1958), leading to different theories of capital structure including: trade-off, pecking order, agency cost, market timing, capital control and the product cost theories. Similarly, Titman and Wessels (1988), Rajan and Zingales (1995) and Graham and Harvey (2001) use Modigliani and Miller (1958) in examining firm capital structure choice and its relation with firm characteristics.

Fama and French (1993) propose that firm size and book-to-market equity are priced factors in stock returns. However, it is possible that cross-sectional variation in equity returns could also be explained by financial leverage (Aydemir, 2007). Yet, whether leverage contains information above and beyond size and book-to-market equity is arguable. Empirically, the role played by financial leverage has received some attention, but the evidence is mixed. As discussed in chapter 1, the existing studies investigating leverage focus on a cross-sectional framework. However, there is evidence in the literature indicating that testing the relationship of leverage and stock returns within a cross-sectional framework leads to biased results (Korteweg, 2004). Thus, to overcome this potential problem, this study tests this relationship within a time-series approach in this chapter.

2.3 Data and Construction of Key Variables

2.3.1 Data

US equity data is drawn from the Centre for Research Security Prices (CRSP) and the Compustat databases and covers the period from January 2002 to December 2012. The CRSP Annual Update file is used to extract monthly data for price, holding period return, number of shares outstanding, value weighted return index (including dividends) and return on S&P composite index for all listed US firms. The Compustat monthly update (North America) file is used to collect the book equity value (BE) (Compustat, item CEQ – Balance Sheet Data), long term debt (Compustat Item DLTT – Balance Sheet data) and exchange code for all the US listed firms for a period 2002-2012. The Kenneth R. French Data Library[3] is used to download the Fama and French factor monthly data [SML (Small Minus Big and HML (High Minus Low)] and momentum (MOM) for the period 2002-2012. The one month US Treasury Bill rate is obtained from Datastream. The monthly long-term US Government bond yield with 10 years maturity and the monthly Moody's investment

[3] For details refer to http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

grade corporate bond yield are downloaded from Federal Reserve Bank of St. Louis website[4].

The data obtained from CRSP and Compustat is merged in order to ensure that each firm/observation has closing price, book equity and long-term debt data. A firm is included in the final sample only if it has CRSP stock prices for December of year t-1 and June of year t and Compustat book value of common equity for the year t-1. The data is constrained to ensure that the market value of equity (ME) can be calculated for June in period t and book to market (BEME) can be calculated for the year t-1. The final sample consists of 4,150 firms generating 296,874 monthly firm observations spanning the period from January 2002 to December 2012.

2.3.2 Constructing 25 ME and BEME Portfolios

Two accounting ratios are required to form the 25 ME and BEME portfolios. First ME is defined as the price of a security times the number of shares outstanding. Next BEME is the ratio of book equity to market equity. ME is calculated for June in year t, while BEME is calculated at December for the year t-1.

The sample consists of NYSE, AMEX and NASAQ listed stocks. Following Fama and French (1993), this study use NYSE breakpoints for ME and BEME to allocate NYSE, AMEX and NASDAQ stocks to five size quintiles and five book-to-market quintiles. In June of each year t, this study sorts the NYSE stocks by size and book-to-market equity independently. For the size sort, ME is measured at the end of June. For the BEME sort, equity market value and the equity book-to-market are measured for the prior year at the end of December (t-1). I construct 25 portfolios from the intersection of the ME and BEME quintiles and calculate the monthly

[4] For details refer to http://research.stlouisfed.org/fred2/tags/series

value-weighted returns on these portfolios for the period of July in year t to June in year t+1. For example, the first portfolio comprises all stocks assigned to quintile 1 for ME and quintile 1 for BEME. The ME quintile 1 contains the smallest stocks while ME quintile 5 has biggest stocks. The final sample consists of 126 monthly observations for each of the 25 ME and BEME portfolios for the period from January 2002 to December 2012.

2.3.3 Constructing Bond Market Factors

The DEF and TERM factors are calculated following the Fama and French (1993) methodology. The DEF factor is related to the credit quality of the bonds. It is the additional expected return to corporate bonds, relative to government bonds and calculated by taking the difference between the monthly return on a value weighted portfolio of investment grade corporate bonds and the monthly long-term government bond return. The TERM factor is related to the term structure of the interest rates (term risk) and is calculated as the difference between the monthly long-term (10 years) government bond return and one month T-Bill return.

2.3.4 Constructing LEV factor

Based on Bhandari (1988), I assume that firms with high leverage should offer a greater risk premium than firms with low leverage. Leverage is defined as the long-term debt (Compustat Item – DLTT) to market capitalization. To construct the LEV mimicking portfolio, I use the median leverage to split all the stocks in the sample period into two portfolios. Value weighted returns are calculated for all the stocks with leverage above median (H portfolio) and all stocks with leverage below median (L portfolio). The LEV factor is the difference between the returns on the H and L portfolios.

2.4 Methodology

Market risk premium, SMB, HML, MOM, DEF, TERM and LEV are used as explanatory variables within the asset pricing tests described in this study. The excess monthly return on 25 portfolios formed on the basis of ME and BEME are used as dependent variables in time series regressions for the following asset pricing models:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + s_i SMB_t + h_i HML_t + e_{i,t} \quad [2.1]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + s_i SMB_t + h_{i,} HML_t + m_i MOM_t + e_{i,t} \quad [2.2]$$

$$R_{i,t} - R_{f,t} = \alpha_i + t_i TERM_t + d_i DEF_t + e_{i,t} \quad [2.3]$$

$$R_{i,t} - R_{f,t} = \alpha_i + t_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t} \quad [2.4]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + s_i SMB_t + h_i HML_t + t_i TERM_t + d_i DEF_t + e_{i,t} \quad [2.5]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i TERM_t + d_i DEF_t + s_i SMB_t + h_i HML_t + l_i LEV_t + e_{i,t} \quad [2.6]$$

where $R_{i,t}$ is the monthly ex-post equity return on the 25 ME and BEME based portfolios. $R_{f,t}$ is the one month US Treasury Bond return; $R_{m,t}$ is the value weighted return on the S&P composite index; DEF, TERM refer to default and term risks; SMB, HML, LEV and MOM are monthly returns on mimicking portfolios for ME, BEME, LEV and one-year momentum in stock returns; α_i is the intercept; d_i and t_i are the coefficients on default risk and term risk respectively; while s_i, h_i, l_i are the coefficients on SMB, HML and LEV respectively; and $e_{i,t}$ is the error term.

2.5 Empirical Results

2.5.1 Fama and French (1993) Three Factor Model

As a base case, the Fama and French (1993) three factor and Cahart four factor models are fitted to my sample period. The results, reported in Tables A1 and A2 are largely consistent with the findings of Fama and French (1993) that is SMB and HML coefficients are related to size and BEME respectively. However, in their three factor regressions, Fama and French (1993) report that intercepts are close to zero. They find that only three out of the 25 intercepts differ from 0. This result is not apparent in my study. Tables A1 and A2 show that 14 out of the 25 intercepts are statistically significant. This suggests that SMB and HML are unable to capture all the variation in stock returns for more than half of the ME/BEME portfolios during the more recent period covered by this sample. It is pertinent to note that the sample periods chosen for the Fama and French (1993) and the Cahart four factor model studies are different from the sample period used in this research study. Moreover, detailed comparison of the impact of sample period choice is beyond the scope of this dissertation.

2.5.2 DEF, TERM and LEV Factors

Table 2.1 reports results of the Fama French (1993) two factor bond model augmented with the LEV factor for the period from January 2002 to December 2012. The results are consistent with the Fama and French (1993) findings. The t-statistics for the DEF coefficients are positive and significant for more than half portfolios (14 out of 25). The t-statistics on the TERM coefficients are positive and significant for all the portfolios. The t-statistics on the LEV coefficients are positive and significant for all the portfolios. Fama and French (1993) show that when monthly stock returns are regressed on DEF and TERM factors, the R-square ranges from 0.06 to 0.21. However, as shown in Table 2.1; when LEV is added as an additional explanatory variable along with DEF and TERM, the R-square values range from 0.53 to 0.63. This indicates that the Fama and French (1993) two factor model, augmented with LEV factor outperforms the original Fama and French (1993) two factor bond model.[5]

[5] A pearson correlation of 0.13 between LEV and TERM and -0.0045 between LEV and DEF indicates that the results are not driven by correlation.

Table 2.1 – Bond 3 factor model using realized stock returns

$$R_{i,t} - R_{f,t} = \alpha_i + t_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t}$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity										
	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(d)					t(d)		
Small	5.80	6.09	6.40	5.60	3.83	1.96	2.40	2.63	2.29	1.45
2	5.41	5.25	5.97	5.38	3.68	1.99	2.12	2.52	2.15	1.39
3	5.24	5.67	5.42	4.94	3.23	2.06	2.35	2.28	2.00	1.22
4	4.89	5.09	4.64	4.69	3.79	1.94	2.09	1.91	1.88	1.43
Big	4.73	3.95	4.21	4.77	3.59	2.01	1.68	1.77	1.87	1.41
			(t)					t(t)		
Small	7.15	7.10	7.18	7.41	7.52	5.78	6.70	7.05	7.26	6.82
2	7.15	7.15	7.09	7.23	7.32	6.29	6.90	7.15	6.90	6.63
3	7.01	7.04	7.25	7.28	7.23	6.61	6.96	7.30	7.03	6.54
4	7.08	7.13	7.27	7.32	7.19	6.71	7.01	7.16	7.00	6.48
Big	7.10	7.31	7.27	7.05	7.36	7.19	7.45	7.29	6.60	6.89
			(l)					t(l)		
Small	2.46	2.36	2.28	2.26	2.68	4.75	5.31	5.34	5.29	5.81
2	2.14	2.05	2.26	2.49	2.80	4.50	4.72	5.43	5.68	6.05
3	1.95	2.11	2.18	2.36	2.37	4.37	4.99	5.23	5.44	5.69
4	1.80	1.90	2.13	0.19	2.66	4.07	4.46	5.01	5.00	5.72
Big	1.39	1.51	1.78	2.31	2.72	3.37	3.68	4.25	5.17	6.08
			R-square					s(e)		
Small	0.53	0.60	0.62	0.62	0.59	0.12	0.10	0.10	0.10	0.11
2	0.55	0.59	0.63	0.61	0.58	0.11	0.10	0.10	0.10	0.11
3	0.57	0.61	0.62	0.61	0.56	0.10	0.10	0.10	0.10	0.11
4	0.56	0.59	0.60	0.59	0.57	0.10	0.10	0.10	0.10	0.11

Big	0.58	0.59	0.59	0.58	0.59	0.09	0.09	0.10	0.10	0.10
			(α)					t(α)		
Small	-0.39	-0.41	-0.41	-0.42	-0.41	-11.34	-13.67	-14.70	-14.75	-13.10
2	-0.39	-0.39	-0.41	-0.41	-0.39	-12.28	-13.72	-14.85	-14.15	-12.74
3	-0.38	-0.40	-0.41	-0.40	-0.38	-13.09	-14.21	-14.68	-14.12	-12.37
4	-0.38	-0.39	-0.40	-0.40	0.39	-13.14	-14.01	-14.06	-13.86	-12.56
Big	-0.39	-0.39	-0.39	-0.40	-0.39	-14.37	-14.31	-14.16	-13.49	-13.17

Table 2.1 presents the regressions of monthly realized excess stock returns on the bond-market returns, TERM, and DEF and mimicking returns for LEV factor for a period from Jan 2002 to Dec 2012. Rf is the one month US Treasury Bill rate from datastream. The DEF factor is the difference between the monthly long-term government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. In order to form the 25 portfolios, I sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

2.5.3 Fama and French Five Factor Model

Table 2.2 presents the results of the Fama French (1993) five factor model factors for the period from January 2002 to December 2012. Consistent with results reported in Table A1, the SMB coefficients are related to size. However, the same is not noted for the HML coefficients. If HML is related to BEME, then while moving from low to high BEME quintiles; HML coefficients should monotonically increase across every ME quintile. However, HML does not exhibit this relation. When the model is expanded to include bond market factors (DEF and TERM), the t-statistics on the DEF coefficients are significant for more than half of the portfolios (14 out of 25), while the t-statistics on the TERM coefficients are only significant for five portfolios. Overall, the results indicate that the sensitivities of BEME change when the two bond market factors are added as explanatory variables. One possible explanation for this result can be drawn from the Fama and French (1993). In their study, Fama and French (1993) show that there is strong common variation in bond and stock returns only when bond-market factors and stock-market factors are used independently to explain results. It appears from the results in Table 2.2 that when bond market factors are added as explanatory variables to the Fama and French (1993) three factor model, the statistical significance for HML is not so strong. This provides an area for future research. .

Table 2.2 – Fama French 5 factor model using realized stock returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + s_{i,t}\,SMB_t + h_{i,t}HML_t + d_{i,t}DEF_t + t_{i,t}TERM_t + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	1.07	0.96	0.94	0.94	1.01	33.61	59.05	59.91	71.59	64.39
2	1.04	0.97	0.91	0.96	1.04	59.69	76.08	66.05	85.63	54.37
3	1.00	0.96	0.95	0.98	1.05	76.98	73.43	76.20	78.03	51.61
4	1.01	0.99	0.98	1.01	1.06	75.62	91.02	74.45	71.30	44.17
Big	0.98	0.97	0.99	1.04	1.01	106.50	93.37	87.45	64.98	31.97
			(s)					t(s)		
Small	1.20	0.99	0.90	0.80	0.78	9.49	15.32	14.52	15.33	12.40
2	1.03	0.89	0.92	0.97	0.58	14.91	17.62	16.66	21.75	7.65
3	0.75	0.66	0.56	0.62	0.46	14.59	12.60	11.36	12.44	5.63
4	0.42	0.38	0.47	0.33	0.21	7.96	8.84	8.86	5.88	2.25
Big	-0.14	-0.17	-0.06	-0.07	-0.05	-3.90	-4.18	-1.38	-1.04	-0.43
			(h)					t(h)		
Small	0.21	0.24	0.20	0.26	0.49	2.17	4.85	4.22	6.54	10.39
2	0.00	-0.02	0.18	0.32	0.49	-0.03	-0.47	4.32	9.38	8.58
3	-0.06	0.08	0.16	0.31	0.39	-1.49	2.02	4.23	8.37	6.26
4	-0.05	0.01	0.09	0.23	0.47	-1.20	0.19	2.24	5.43	6.56
Big	-0.20	-0.02	0.02	0.39	0.59	-7.20	-0.53	0.52	8.21	6.21
			(d)					t(d)		
Small	0.87	1.47	1.89	1.14	-1.19	1.09	3.63	4.85	3.46	-3.03
2	0.81	0.87	0.51	0.61	-1.57	1.88	2.76	4.39	2.20	-3.29
3	0.91	1.25	0.96	0.30	-1.90	2.82	3.82	3.08	0.97	-3.73
4	0.72	0.84	0.14	0.15	-1.35	2.16	3.10	0.43	0.44	-2.26

Big	1.02	0.22	0.97	0.08	-1.51	4.45	0.84	0.34	0.20	-1.91
			(t)					t(t)		
Small	-0.69	0.17	0.46	0.63	0.30	-1.67	0.81	2.29	3.68	1.47
2	-0.45	0.13	0.54	0.36	0.00	-1.99	0.82	3.02	2.48	-0.01
3	-0.28	0.13	0.45	0.30	-0.21	-1.67	0.75	2.80	1.88	-0.79
4	-0.31	-0.01	0.24	0.12	-0.25	-1.80	-0.08	1.39	0.64	-0.82
Big	-0.08	0.26	0.15	-0.31	0.36	-0.64	1.93	1.02	-1.51	0.88
			R-square					s(e)		
Small	0.96	0.99	0.99	0.99	0.99	0.03	0.02	0.02	0.01	0.02
2	0.99	0.99	0.99	0.99	0.98	0.02	0.01	0.01	0.01	0.02
3	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
4	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
Big	0.99	0.99	0.99	0.99	0.96	0.01	0.01	0.01	0.02	0.03
			(α)					t(α)		
Small	0.03	-0.02	-0.04	-0.04	0.001	2.22	-2.80	-6.01	-7.19	0.01
2	0.02	-0.01	-0.05	-0.03	0.02	2.56	-2.18	-7.04	-5.78	2.36
3	0.01	-0.02	-0.03	-0.02	0.04	1.22	-3.07	-4.82	-3.40	3.72
4	0.01	-0.01	-0.01	-0.01	0.03	1.93	-1.44	-1.29	-0.87	2.73
Big	-0.01	-0.01	-0.001	0.01	0.01	-1.97	-2.18	-0.62	1.16	0.65

Table 2.2 presents regressions of monthly realized excess stock returns on the stock-market returns, $(R_{m,t} - R_{f,t})$, SMB, HML; and the bond market returns DEF and TERM for a period from Jan 2002 to Dec 2012. R_m is the value of monthly weighted return index adjusted for dividends from CRSP. Rf is the one month US Treasury Bill rate from datastream. The DEF factor is the difference between the monthly long-term government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. SMB and HML are the monthly mimicking portfolio returns extracted from Kenneth R. French Data library. In order to form the 25 portfolios, I sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

2.5.4 Stock Market Factors (Market risk premium, SMB, HML) and Bond Market Factors (DEF, TERM) and LEV

Table 2.3 presents the estimates of factor sensitivities for the market risk premium, SMB, HML, DEF, TERM and LEV factors (Model 2.6). The market risk premium coefficients are very large and statistically significant. With two exceptions, the coefficients for SMB are generally related to size. As size increases the SMB coefficients tend to decrease monotonically across all BEME quintiles. Consistent with results reported in Table 2.2, the HML coefficients are not closely related to BEME. Across all size quintiles, while moving from low BEME to high BEME quintiles, the HML coefficients do not follow any clear trend. The t-statistics for SMB coefficients are significant for almost all the portfolios (22 out of 25), while the t-statistics for HML coefficients are significant for somewhat more than half portfolios (15 out of 25).

The t-statistics on the DEF coefficients are significant for around half of the portfolios (13 out of 25), indicating that the DEF factor appears to add some explanatory power to the regression models. Consistent with the Fama and French (1993) study, the TERM factor exhibits few statistically significant coefficients.

The t-statistics for the LEV factor are positive and significant for the high-BEME quintile. One possible explanation for this result can be drawn from the Chen and Zhang (1998) study. They argue that value stocks offer higher returns because they are usually firms under distress, having high leverage and facing substantial uncertainty concerning future earnings. In their study, Chen and Zhang (1998) show that higher returns for value stocks compensate higher risk. As the high-BEME quintile consists of value stocks exhibiting high levels of leverage, investors demand a risk premium for investing in value stocks as a compensation for higher financial risk.

Table 2.3 – Fama French 5 factor model with LEV using realized stock returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i\left[R_{m,t} - R_{f,t}\right] + s_{i,t}\,SMB_t + h_{i,t}HML_t + d_{i,t}DEF_t + t_{i,t}TERM_t + l_{i,t}LEV_t + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity										
	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
	(β)					t(β)				
Small	1.08	0.96	0.93	0.94	1.01	33.60	58.14	59.17	70.52	63.43
2	1.04	0.96	0.91	0.96	1.03	59.59	74.98	65.87	85.18	55.15
3	1.00	0.96	0.95	0.97	1.05	76.14	73.31	77.36	77.13	51.99
4	1.02	0.99	0.98	1.00	1.05	75.96	89.70	76.11	70.29	44.21
Big	0.99	0.97	0.99	1.04	1.00	105.55	95.46	86.84	64.32	32.27
	(s)					t(s)				
Small	1.23	0.99	0.89	0.80	0.77	9.63	15.09	14.24	15.12	12.17
2	1.04	0.88	0.91	0.96	0.55	15.05	17.32	16.44	21.48	7.42
3	0.76	0.64	0.54	0.61	0.43	14.54	12.36	11.21	12.17	5.35
4	0.44	0.38	0.44	0.32	0.18	8.24	8.65	8.68	5.71	1.94
Big	-0.14	-0.16	-0.07	-0.08	-0.10	-3.72	-3.87	-1.60	-1.22	-0.85
	(h)					t(h)				
Small	0.32	0.23	0.15	0.26	0.47	2.57	3.61	2.48	5.01	7.48
2	1.04	-0.04	0.11	0.27	0.35	0.95	-0.80	2.04	6.07	4.82
3	-0.03	0.01	0.07	0.28	0.25	-0.62	0.24	1.43	5.63	3.16
4	0.02	-0.01	-0.01	0.20	0.33	0.32	-0.26	-0.31	3.62	3.55
Big	-0.17	0.06	-0.03	0.34	0.36	-4.79	1.39	-0.63	5.38	2.94
	(d)					t(d)				
Small	0.51	1.49	2.03	1.13	-1.11	0.62	3.48	4.97	3.26	-2.70
2	0.61	0.94	1.73	0.77	-1.13	1.35	2.83	4.83	2.64	-2.34
3	0.83	1.45	1.24	0.41	-1.48	2.45	4.30	3.91	1.27	-2.85
4	0.52	0.89	0.46	0.24	-0.91	1.50	3.13	1.40	0.65	-1.48

Big	0.95	0.00	0.24	0.25	-0.78	3.92	-0.02	0.80	0.61	-0.98
			(t)					t(t)		
Small	-0.63	0.17	0.44	0.63	0.29	-1.51	0.79	2.15	3.66	1.39
2	-0.41	0.12	0.50	0.33	-0.08	-1.83	0.74	2.83	2.30	-0.33
3	-0.27	0.09	0.40	0.28	-0.28	-1.57	0.53	2.56	1.75	-1.10
4	-0.28	-0.02	0.18	0.10	-0.33	-1.60	-0.14	1.09	0.55	-1.08
Big	-0.06	0.30	0.12	-0.34	0.23	-0.52	2.28	0.85	-1.66	0.58
			(l)					t(l)		
Small	-0.29	0.01	0.11	-0.01	0.06	-1.41	0.10	1.12	-0.10	0.60
2	-0.17	0.05	0.18	0.12	0.36	-1.50	0.68	1.97	1.72	2.96
3	-0.07	0.17	0.23	0.09	0.35	-0.79	2.02	2.90	1.14	2.65
4	-0.17	0.04	0.27	0.07	0.36	-1.92	0.62	3.21	0.77	2.36
Big	-0.06	-0.18	0.12	0.14	0.60	-1.04	-2.78	1.58	1.36	2.99
			R-square					s(e)		
Small	0.96	0.99	0.99	0.99	0.99	0.03	0.02	0.02	0.01	0.02
2	0.99	0.99	0.99	0.99	0.99	0.02	0.01	0.01	0.01	0.01
3	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
4	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
Big	0.99	0.99	0.99	0.99	0.96	0.01	0.01	0.01	0.02	0.03
			(α)					t(α)		
Small	0.04	-0.02	-0.05	-0.04	0.00	2.44	-2.76	-6.12	-7.03	-0.10
2	0.02	-0.01	-0.05	-0.03	0.01	2.80	-2.26	-7.37	-6.04	1.88
3	0.01	-0.02	-0.03	-0.02	0.03	1.34	-3.42	-5.41	-3.56	3.29
4	0.01	-0.01	-0.01	-0.01	0.03	2.26	-1.52	-1.89	-0.99	2.33
Big	-0.01	-0.01	0.00	0.01	0.001	-1.75	-1.71	-0.89	0.91	0.14

Table 2.3 presents the regressions of monthly realized excess stock returns on the market risk premium ($R_{m,t} - R_{f,t}$), SMB, HML; and bond market returns DEF, TERM and LEV for a period from Jan 2002 to Dec 2012. R_m is the value of monthly weighted return index adjusted for dividends from CRSP. Rf is the one month US Treasury Bill rate from data stream. The DEF factor is the difference between the monthly long-term government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. SMB and HML are extracted from Kenneth R. French Data library. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the stocks in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the stocks in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low stock portfolios. In order to form the 25 portfolios, I sort the NYSE stocks in June of each

year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

2.5.5 Impact of Global Financial Crises (GFC)

To explore whether my results are sensitive to the GFC, I re-estimate my proposed six-factor model (Fama and French five factor plus LEV) for the pre-GFC period and report results in Table 2.4. With the exception of BEME sensitivities, the results are largely consistent with Table 2.3. The t-statistics for the LEV factor are positive and significant for the high-BEME quintile. This shows that the significance of LEV factor for high-BEME quintile is not driven by GFC. However, it is interesting to note, that for the pre-GFC period, the HML coefficients appear to be related to BEME with three exceptions. While moving from low-BEME to high-BEME quintiles, the HML coefficients follow an increasing trend across every ME quintile, suggesting that HML is priced in the pre-GFC sample period. One possible explanation for this result is that the GFC period was a period of heightened uncertainty and this altered the relationship between the bond market factors, DEF and TERM, and the BEME factor with respect to returns. The GFC was a particularly difficult time for smaller risky firms that relied on bank debt financing as the banking system was severely stressed during this period.

Table 2.4 – Fama French 5 factor model with LEV for Pre-GFC period

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i\left[R_{m,t} - R_{f,t}\right] + s_{i,t}\,SMB_t + h_{i,t}HML_t + d_{i,t}DEF_t + t_{i,t}TERM_t + l_{i,t}LEV_t + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity										
	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
	(β)					t(β)				
Small	1.16	1.00	0.91	0.92	1.00	21.77	36.27	39.81	37.28	34.46
2	1.09	0.95	0.90	0.93	1.05	37.26	47.82	39.76	42.62	33.21
3	1.01	0.95	0.94	0.96	1.04	44.50	36.99	39.75	39.14	31.36
4	1.02	0.98	0.94	0.99	1.06	38.55	45.59	43.51	34.99	25.62
Big	0.95	0.99	0.96	1.04	0.89	57.59	46.80	44.87	46.65	18.76
	(s)					t(s)				
Small	1.26	0.93	0.87	0.80	0.80	9.07	13.03	14.72	12.56	10.62
2	0.96	0.85	0.91	1.03	0.46	12.68	16.49	15.45	18.10	5.61
3	0.69	0.56	0.46	0.59	0.42	11.73	8.49	7.54	9.34	4.91
4	0.40	0.32	0.42	0.24	0.30	5.93	5.68	7.49	3.34	2.85
Big	-0.19	-0.15	-0.02	-0.10	0.03	-4.37	-2.77	-0.44	-1.80	0.26
	(h)					t(h)				
Small	0.42	0.10	-0.09	0.24	0.48	2.38	1.11	-1.23	3.00	5.02
2	-0.08	-0.07	-0.05	0.33	0.59	-0.87	-1.03	-0.70	4.63	5.64
3	-0.17	-0.14	-0.02	0.49	0.49	-2.33	-1.66	-0.26	6.06	4.42
4	0.06	0.06	0.16	0.26	0.74	0.68	0.90	2.32	2.77	5.44
Big	-0.23	0.24	0.19	0.57	0.36	-4.24	3.51	2.64	7.72	2.30
	(d)					t(d)				
Small	2.07	0.71	1.38	1.12	-0.84	1.83	1.23	2.86	2.15	-1.36
2	2.33	1.06	0.70	0.50	-0.84	3.78	2.54	1.46	1.09	-1.25
3	1.23	0.48	0.84	0.18	-1.80	2.56	0.88	1.67	0.36	-2.56

4	0.57	0.46	-0.12	0.00	-1.06	1.03	1.01	-0.27	0.00	-1.22
Big	0.50	-0.67	0.57	0.32	-1.30	1.43	-1.51	1.26	0.68	-1.30
			(t)					t(t)		
Small	-1.63	-0.08	0.60	0.62	0.24	-3.02	-0.31	2.60	2.47	0.81
2	-1.15	0.08	0.64	0.40	-0.20	-3.92	0.41	2.78	1.80	-0.62
3	-0.42	0.36	0.50	0.29	0.01	-1.84	1.41	2.08	1.19	0.03
4	-0.27	0.09	0.54	0.23	-0.40	-1.03	0.43	2.49	0.79	-0.97
Big	0.24	0.31	0.26	-0.46	0.30	1.42	1.48	1.22	-2.04	1.50
			(l)					t(l)		
Small	-0.22	-0.01	0.21	0.14	0.27	-0.95	-0.11	2.12	1.34	2.15
2	-0.02	0.00	0.26	0.13	0.37	-0.19	0.04	2.71	1.39	2.79
3	-0.07	0.11	0.27	0.06	0.22	-0.70	1.05	2.70	0.55	1.60
4	-0.26	-0.03	0.22	-0.01	0.44	-2.37	-0.38	2.40	-0.05	2.55
Big	-0.03	-0.15	0.07	0.07	1.21	-0.45	-1.68	0.74	0.75	2.54
			R-square					s(e)		
Small	0.97	0.99	0.99	0.99	0.99	0.03	0.01	0.01	0.01	0.01
2	0.99	0.99	0.99	0.99	0.99	0.01	0.01	0.01	0.01	0.01
3	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
4	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
Big	0.99	0.99	0.99	0.99	0.97	0.01	0.01	0.01	0.01	0.02
			(α)					t(α)		
Small	0.06	0.001	-0.04	-0.05	0.00	2.75	0.04	-4.93	-4.94	-0.21
2	0.03	-0.02	-0.04	-0.04	0.02	2.61	-2.20	-4.49	-4.29	1.76
3	0.01	-0.02	-0.03	-0.02	0.03	1.09	-1.58	-3.20	-2.52	2.24
4	0.01	-0.01	-0.02	-0.01	0.03	1.25	-0.75	-2.39	-0.76	1.79
Big	-0.01	0.00	-0.02	0.01	-0.03	-2.28	0.14	-2.07	1.11	-1.75

Table 2.4 presents regressions of monthly realized excess stock returns on the market risk premium, $(R_{m,t} - R_{f,t})$, SMB, HML; and the bond market returns DEF, TERM and LEV for the pre-GFC period (Jan 2002 – Aug 2007). R_m is the value of monthly weighted return index adjusted for dividends from CRSP. Rf is the one month US Treasury Bill rate from data stream. The DEF factor is the difference between the monthly long-term government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. SMB and HML are extracted from Kenneth R. French Data library. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the stocks in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the stocks in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low stock portfolios. In order to form the 25 portfolios, I sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

2.6 Conclusion

In this chapter, using the Fama and French (1993) time series framework, I investigate whether the LEV factor is a priced factor in stock returns. The tests are conducted using monthly ex-post returns for a sample period from January 2002 to December 2012.

Capital structure decisions are undoubtedly one of the most important decisions for a firm. The change in leverage ratio affects firm financing capacity, investment and strategic decisions as well as shareholder wealth. Based on capital structure theories, I propose to add the LEV factor as an additional explanatory variable to the Fama French two bond market factor model. The results indicate that not only is the LEV coefficient positive and significant for all the portfolios, but the R-square values are also much higher than those reported in the Fama and French (1993) for their bond factor model. The Fama and French (1993) study shows that when only DEF and TERM are used as explanatory variables, both TERM and DEF capture strong variation. However, the R-square values are below 0.21. When I further augmented the bond market model (DEF, TERM and LEV) with stock market factors (market risk premium, SMB and HML), my findings show that LEV is still priced, particularly for high BEME portfolios. Finally, the results for the three factor model, four factor model and five factor model are consistent with Fama and French (1993) and Cahart (1997). I also check robustness of my six factor model to the GFC period by estimating the model using pre-GFC data, I conclude that GFC has altered the relationship between bond market factors, DEF and TERM, and the BEME factor with respect to equity returns, over the sample period chosen for this study.

Overall this study provides empirical evidence on the impact of capital structure choice indicating that the financial risk imposed by leverage is rewarded by higher returns. I conclude that LEV exhibits some explanatory power in explaining the cross-sectional variation in the Fama and French (1993) two factor model, augmented with LEV factor.

The common features of the tests reported in this chapter are 1) the very high R-square values reported for models that include the market risk premium, SMB and HML and 2) the incidence of statistically significant intercept terms in the regressions. Around half of the intercept coefficients were statistically significant at the 5% level. It may be that this result is time specific though a similar effect is evident in the pre-GFC period test. I leave further analysis of this question to future research.

These results suggest several avenues for further research. First, although asset pricing tests are generally conducted on ex-post returns, the CAPM is an ex-ante model. Thus, it is important to investigate how an ex-ante based security return proxy performs in asset pricing tests (next Chapter). Second, it is worthwhile to investigate whether stock market factors share common variation with bond returns (see Chapter 4). Third, the LEV factor could be included in asset pricing tests to investigate whether LEV is a priced factor in bond returns (see Chapters 4 and 5).

Chapter 3 - Asset Pricing: Evidence from Analyst Target Price Forecast

3.1 Introduction

This chapter reports the use of IBES mean target price to form expected returns in an attempt to test the ex-ante CAPM model using an ex-ante return proxy. The Fama and French (1993) three-factor and the Carhart (1997) four-factor models are also explored within the Fama and French (1993) time series framework using my proposed proxy for ex-ante return. The estimated returns used in this study are 12 month holding period returns[6]. Analyst target prices are analyst estimates of stock price over a 12-month forecast horizon (Glushkov, 2009). Although actual market expectations are unobservable, the existing literature suggests that these analyst forecasts represent a significant portion of market expectations (Brav et al., 2005). Reasons for this proxy choice are as follows. First, recent US literature documents that the market pays significant attention to target price information (Kerl, 2011). Second, researchers and practitioners rely on analyst earnings and growth forecasts as a proxy for market estimates (Brav et al., 2005). Third, Brav and Lehavy (2003) document that target price revisions contain valuable information about future abnormal returns over and above that conveyed in stock recommendations. Finally, the IBES mean target prices that I use in this study appear to be more accurate than Value line forecasts/estimates in terms of forecasting accuracy (Ramnath et al., 2005).

[6] Suitable adjustment is made for overlapping returns where required.

Asset pricing model tests inevitably rely on ex-post returns (historical data) to capture expectations (Brav et al., 2005). Yet, the capital asset pricing model (CAPM) is an ex-ante model. Black (1993) and Brav et al. (2005) note that researchers use ex-post returns to proxy for expected return due to the lack of information about market expectations. However, there is evidence that using ex-post returns as a proxy for ex-ante returns could lead to biased results. Blume and Friend (1973) and Sharpe (1978) point out that noise in ex-post returns is expected to be large and Elton (1999) argues that if information surprises do not cancel out over the period of the study then ex-post returns may not be a fair proxy for expected returns.

Lewellen and Shanken (2002) use the concept of rational learning to explain that ex-post returns appear to be biased estimates of ex-ante returns. Further, Elton (2002) observes that on average ex-post returns for the 1973 – 1984 period, are less than the risk free rate. Similarly, risky long-term bond performance for a period 1927 – 1981, on average, is less than the risk free rate. Based on these observations, Elton (2002) argues that the use of ex-post returns as a proxy for ex-ante returns in testing the CAPM may lead to biased results. This could help to explain the plentiful evidence rejecting CAPM. He suggested that instead of identifying more factors to be added to asset pricing models, it may be more beneficial to look for better proxies of ex-ante return. For example, Brav et al. (2002) conduct cross-section regression analysis using value line target forecasts as a proxy of ex-ante returns to test the CAPM. They documented a positive relation between beta and ex-ante returns. This differs from the Fama and French (1992) finding of no relation between beta and ex-post returns.

Further, it has been shown that investors rely on analyst research when making stock buy and sell decisions (Cliff and Denis, 2005). An important prediction provided by analysts is target prices (Bradshaw and Brown 2012, Kerl 2011, Bilinski and Lyssimachou and Walker 2011). According to Kerl (2011), the year 1997 was the first complete year during which IBES provided analyst target price forecasts. My study provides an analysis of the impact of using an expected return measure based on the IBES mean target price.[7] In this study, analysis draws on the Fama and French (1993) time series framework using US equity data from the period 2002-2012. This well-known model provides a well understood base for the tests reported in this chapter. The rest of this chapter proceeds as follows. Section 3.2 reviews the related literature. Section 3.3 discusses the data used in the study. Section 3.4 details the methodology. Section 3.5 presents the core results, while the last section concludes.

3.2 Review of Related Literature

In this chapter, I use analysts' forecasts in constructing an ex-ante return. Section 3.2.1 reviews the data sources for extracting analyst forecasts data. Section 3.2.2 reviews the literature on the accuracy of target prices. The last section details findings from using ex-ante return in asset pricing tests.

3.2.1 Data Sources of Analyst Target Price

Data sources compiling analyst forecast information include but are not limited to IBES, Value Line, Investext and Zack Investment Research. The Thompson Financial Corporation International Brokerage Estimate System (IBES) provides detailed consensus estimates of measures including GAAP Pro-forma EPS, revenue/sales, net income, price targets, analyst recommendations, pre-tax profit and

[7] Price target forecast reflects the analyst's estimate of the firm's stock price over a specific time horizon, usually a 12-month horizon. GLUSHKOV, D. 2009. Overview of I/B/E/S on WRDS : research and data issues. Wharton: University of Pennsylvania.

operating profit (Glushkov, 2007). IBES covers over 70,000 companies, out of which 24,310 (34.3%) are US firms (Glushkov, 2009). An alternative source of target price estimates is the Value Line Investment survey issued by Arnold Bernhard and Co, which encompasses 91 industries and 1,700 stocks listed on numerous stock exchanges and over-the-counter markets (Philbrick and Ricks, 1991). The value line database is established on the basis of a single forecaster perspective, whereas the IBES database offers consensus forecasts for a range of forecasts. Brown and Kim (1991) suggest that consensus forecasts (which take into account the aggregation principle) reduce the analyst specific error and hence improve the predictive accuracy of the forecasts. Similarly, Brown (1991) compares the relative predictive accuracy of four forecasts composites, average of all forecasts (regardless of the age of forecasts), most recent single forecast, average of most recent three forecasts and 30-day average of forecasts. Brown (1991) concludes that the 30-day average forecasts released by analysts during the last 30 days are more accurate than the single most recent forecast; signifying aggregation improves forecast accuracy.

Ramnath et al. (2005) compare the Value line and IBES analyst earnings forecasts in terms of precision, reliability and the extent to which the respective forecasts proxy for market expectations. In their study, Ramnath et al. (2005) document two possible reasons for the greater accuracy of IBES over Value Line forecasts. First, IBES has a timing advantage such that analysts can update their information any time until the earnings announcement, while Value Line publishes quarterly forecasts for each firm it follows. Second, IBES moderates analyst specific errors by using the aggregation principle, whereas Value Line forecasts do not cater for aggregation. The Value Line forecasts only reflect a single analyst's forecast perspective in its forecasts. Overall, Ramnath et al. (2005) conclude that the IBES forecasts tend to be less biased and more precise.

The Investext database and Zack Investment research provide two further sources used in prior studies to extract target price information. Investext provides in-depth and timely reports for more than 630 investment banks, brokerage firms and research firms globally (Asquith et al., 2005). Zack Investment research produces data feeds for estimates, ratings, earnings report and data investment research reports for US and Canadian traded equities. Compared to IBES, the Investext database coverage is limited, while access to Zack Investment research was limited to 100 global companies. In sum, it would appear that the literature favours the IBES data source, and therefore IBES target price is used in constructing ex-ante returns in this study.

3.2.2 Accuracy of Target Prices

Analyst recommendations assist investors in valuing company assets (Jegadeesh et al., 2004). Bilinski et al. (2011) suggest that, compared to earnings forecasts and stock recommendations, target price forecasts have not received much attention. According to Bradshaw (2011) only a handful of studies explore target price forecasts. In his study, he conducts a literature search on articles dealing with analyst target prices and reveals only 3 published studies that explore the target price measure. A possible explanation for this limited research could be due to limited access to this data (Kerl, 2011)[8]. Studies using analyst recommendations include

[8] For example, the Thompson Financial Corporation's International Brokerage Estimate System (IBES) provides target price data from March 1997.

Womack (1996), Asquith et al. (2005), Bilinski et al. (2011) and Gleason et al. (2012).

Womack (1996) shows stock prices are significantly influenced by revisions in analyst recommendations not only at the time of revision but also for subsequent months. Bilinski et al. (2011) study the determinants of analyst target price (constructed from First Call and IBES database) accuracy across 16 countries including the US, 12 European countries, Japan, Australia and Hong Kong, over a sample period from 2002 to 2009. Their study focuses on two measures of target price. First, a binary variable which is equal to 1 if the target price forecast equals or exceeds the actual stock price anytime during the 12 month period after the target price forecast is issued. Second, measures of absolute difference between the target price forecast and the actual stock price at the end of the 12 month forecast horizon are used. Target price accuracy is then compared with the simple price forecasts formed by the investors (referred as naive price forecasts) on the basis of the information available at the date of the target price issue. Their study documents that during the 12-month forecast period, in 59.1% of cases, the target price reaches the actual stock price with absolute target price error of 44.7%. Moreover, they conclude that target price accuracy achieves or betters the naive price forecast in 74.5% of cases and target price forecast error is 9.8% lower than the absolute naive price forecast error. Lastly, it is found that the accuracy of target price forecasts is superior to price forecasts formed on the basis of industry price-to-earnings ratio and the market return.

Investors appear to value price targets published in stock research reports (Gleason et al., 2012). Sell side analysts have recently (mid 1990s) started including price target information in their research reports (Gleason et al., 2012). Analyst target price reflects the analyst's estimate of stock price level over a specific period, generally a 12-month horizon (Glushkov, 2009). The price target information conveys the analyst's opinion about the worth of the stock and forms the basis of buy and sell recommendations. Asquith et al. (2005) study the association between market returns and the content of analyst reports specific to the US market. They show that 1) during 1997-1999, 54.3% of the stocks achieved target prices recommended by US analysts and 2) market reaction to target price revisions is stronger than that of an equal percentage change in earnings forecast. Asquith et al. (2005) conclude that target price revisions contain new information over and above the communicated by earnings forecasts revisions and stock recommendations. Regardless, it is important to note that Gleason et al. (2012) argue that although price target information is gaining popularity among investors, the evidence on the quality of the analyst forecast is limited.

Brav and Lehavy (2003) study value line target price data over a period from 1997 to 1999 to examine short term market reactions to target price revisions as well as long-term co-movement of target prices and concurrent share prices. They find that target price revisions contain information about future abnormal returns over and above that conveyed by stock recommendations. Brav and Lehavy (2003) argue that as target price forecasts are forward looking, they must be linked with the underlying fundamental value of the firm as much as concurrent stock prices. They conclude that when the ratio of target prices to concurrent stock prices is higher (lower) than the long-term estimated ratio (mean of target price to concurrent stock ratio), the analysts revise their target prices down (up) to the extent that the two ratios become equal. Brav and Lehavy (2003) also document that on average, over a 12-month target price forecast horizon, target prices are 28 percent higher than concurrent market prices; indicating a possible bias in the forecasts. Overall, they document that in the long term (12 month period) the two set of prices (target prices and concurrent market prices) converge validating the role of analysts in correcting forecast errors. This suggests that the ratio of target-to-market prices could be used as a proxy for ex-ante return in asset pricing tests (Brav and Lehavy, 2003).

3.2.3 Studies using Expectations Data in an Asset Pricing Framework

As stated above, it has been claimed that ex-ante measures should be used in asset pricing tests (Elton, 2002). Yet, only a handful of studies use ex-ante return to examine the relation between expected returns and firm characteristics. Examples include Ang and Peterson (1985), Shefrin and Statman (2002) and Brav et al. (2005). Ang and Peterson (1985) were the first to study the relation between expected return and dividend yield using expected return data constructed from Value Line forecasts for a period 1973-1983. They document a negative relation between expected return and firm size and a positive relation between expected return and beta. Shefrin and Statman (2002) study the relation between expected return and firm specific factors (i.e. book to market and market capitalization using ordinal ranking of recommendations as a proxy of expected returns). They report that firms with buy recommendations are generally large stocks and more likely to have low book to market values. Brav et al. (2002) use value line forecasts as a proxy for ex-ante price to study the relation between expected returns and firm characteristics within a cross section framework. Their findings are consistent with Ang and Peterson (1985). They report a positive relation between expected return and beta.

This review of the literature suggests that an expectations based proxy could be useful in asset pricing tests. One possible measure for constructing expected returns is analyst forecasts and various sources of this data are surveyed above. Moreover, within the analyst forecast alternatives, analyst target price is identified as a superior forecast in terms of accurately predicting future stock prices. Finally, IBES is recognized as a reliable data source for collecting target price information. On the basis of these findings, IBES target price is used in calculation of ex-ante returns in this study.

3.3 Data

3.3.1 The IBES Database

In this study, historical data on analyst forecasts drawn from the IBES are used to construct ex-ante returns. The initial sample consists of all monthly price target data for listed US Companies available from the IBES Summary History tape for the period from March 1999 to December 2012. The variables available from the files include company ticker, IBES ticker, cusip number, company name, currency identifier, price target (mean, median, high, low, standard deviation), the number of target prices down one month ago, number of target prices up one month ago and IBES statistical period. The mean price target reflects the analyst consensus estimate of firm stock price at the end of a rolling 12-month forecast horizon. For example, the price target for the March 1999 is a prediction of the price for March 2000. Similarly the price target for April 1999 forecasts the price for April 2000. Thus, every monthly observation covers a 12-month forecast horizon and so monthly forecasts are overlapping as you move from month to month. Brav et al. (2005) use analyst target prices from value line and their data set is also comprised of overlapping observations for expected returns. In their study, Brav et al. (2005) argue that the problem of overlapping observations is not a problem for expected returns; as the expectations are reformed at time t for time t+k and so the expected returns formed at time t are independent of future realizations.

The price target data is adjusted for capitalization changes such as stock splits and dividends. As the price is affected by capitalization changes, the adjustment is necessary to ensure correct calculation of returns. For price target estimates, IBES specifies the date when the estimate is calculated (IBES statistical period) and we use this date for return calculations[9]. IBES provides four forms of price target data. First, the mean price target is the consensus estimate or the arithmetic average of all the price target recommendations given by the analysts individually for a given fiscal period. The second is the median price target and this represents the middle value of price target estimates, when the data is arranged in ascending or descending order. The third is the price target low, which is the smallest value in the range of price target estimates. The fourth is the price target high, which is the highest value within the range of price target estimates. We use the consensus price target in calculation of expected returns. For a given firm, the consensus target price is the mean of all the forecasts provided by the analysts for the firm for the month. IBES updates the data on the Thursday just before the third Friday of every month.

The monthly data for number of shares outstanding, dividend per share, CRSP value weighted return index (including dividends) and return on S&P composite Index for all the listed US firms is collected from the CRSP Annual Update file for the period March 1999 to December 2012. The book equity value

[9] IBES does not provide the date on which the analysts complete the forecast though it is assumed that the forecast is publically available once calculated.

(Compustat, item CEQ – Balance Sheet Data) and exchange code for all the US listed firms for the period from March 1999 to December 2012 is extracted from the Compustat monthly update (North America) file. The Fama and French factor monthly data for SML (Small minus Big) and HML (High minus Low) for the period March 1999 to December 2012 are downloaded from the Kenneth R. French Data Library[10]. The risk free returns (i.e. one year US Treasury Constant Maturity rate (FRTCM1Y)) are obtained from Datastream. The data obtained from IBES and CRSP is merged in order to ensure that each firm/observation has closing price data and consensus target price data. There are 4,150 firms generating 296,874 firm-month observations spanning the period from March 1999 to December 2012.

3.3.2 Constructing 12-month Expected and Realized Returns

The 12 month expected holding period return at month t is calculated as

$$\mathrm{E}_{\mathrm{t,t+12}} = \frac{\mathrm{E_t}\,(\mathrm{P_{t+12}}) + \mathrm{D_{t+12}} - \mathrm{P_t}}{\mathrm{P_t}} \qquad [3.1]$$

where $E_{t,t+12}$ is the expected return for the period from time t to time t+12, $E_t\ (P_{t+12})$ is the expected price at time t+12, observed at time t from IBES, P_t is the actual price observed at time t and D_{t+12} is the expected dividend for the period from t to t+12.

The expected price at time t+12, $E_t\ (P_{t+12})$, observed at time t, is the IBES consensus target price. The initial price P_t observed at time t is obtained from CRSP. D_{t+12} is calculated as the sum of monthly dividends over the period of twelve months from time t to time t+12 assuming that future dividends are known with certainty. The variable $E_{t,t+12}$ is calculated for each month for all the firms for the

[10] For details please refer to http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

entire sample period. The 12 month realized holding returns are also calculated for each month t as follows:

$$R_{t,t+12} = \prod_{i=1}^{12}[1 + R_{t+i}] - 1 \qquad [3.2]$$

$$R_{t+1} = (P_{t+1} - P_t)/P_t$$

The monthly realized SML and HML returns are converted to 12 month returns using Equation 3.2.

3.3.3 Constructing SMB, HML and MOM factors

The SMB and HML mimicking portfolios are constructed following the Fama and French (1993) time series methodology, while the MOM factor is constructed using the Carhart (1997) approach. The SMB factor is constructed to mimic the risk factor in returns related to size. To construct the SMB mimicking portfolio, the NYSE stocks are ranked on size each month for the period 2002-2012. The median NYSE size is then used to split all the NYSE, AMEX and NASDAQ stock into two portfolios, small (S) and Big (B). Value weighted expected monthly returns are calculated using all the stocks in the small and the big portfolios respectively. SMB is the difference between the value weighted expected returns on the small and the big stock portfolios.

The HML factor is constructed to mimic the risk factor in returns related to book-to-market equity. To construct HML mimicking portfolio, the NYSE stocks are ranked on the basis of breakpoints for the bottom 30% (Low) middle 40% (Medium) and top 30% (High) BEME values. The NYSE BEME ranking is then used to allocate all the NYSE, AMEX and NASDAQ stocks to low, medium and high portfolios. Value weighted expected returns are calculated for all the stocks in low and high portfolios respectively. HML is the difference between the value weighted expected returns on high and low stock portfolios.

To construct the MOM mimicking portfolio, all the stocks are ranked into three groups on the basis of top 30% (winners) medium 40% and lowest 30% (losers) return values. The equal weighted eleven month return is calculated for the winner and loser portfolios. The portfolios are reformed monthly. The MOM factor[11] is the difference between the eleven month winner and loser portfolio returns lagged one month. As the first eleven month values of the sample period are used for the calculation of the MOM factor, there are 115 monthly MOM factor values (January 2003 to December 2012) for final analysis.

3.3.4 Constructing Market Returns

Individual stocks and market returns should be consistently calculated. For example, Fama and MacBeth (1973) use monthly data for all common stocks traded on the NYSE exchange as a proxy for expected returns and Fisher's arithmetic index (an equally weighted average of all the returns on all the stocks listed on NYSE) as a proxy market return. In this chapter, the two different proxies for market returns are: 1) the value weighted realized market return based on 12 month realized holding returns for all the stocks in the sample ($R_{mt,t+12}$), and 2) the value weighted expected market return based on the 12-month expected holding returns for all available stocks using IBES target value data $E_{mt,t+12}$. The two proxies are defined as follows:

$$R_{mt,t+12} = \sum_{i=1}^{n} w_{it} \left(R_{it,t+12}\right) \qquad [3.3]$$

$$E_{mt,t+12} = \sum_{i=1}^{n} w_{it} E_{it,t+12} \qquad [3.4]$$

[11] The MOM factor is calculated using monthly realized return data from CRSP as well as expected returns constructed using target price data from IBES.

where w_{it} is the weight of a security i at month t and defined as: $w_{it} = \frac{P_{it}N_{it}}{\sum_{i=1}^{n} P_{it}N_{it}}$, N_{it} is the number of shares outstanding for a security i at month t, $R_{it,t+12}$ is the 12 month realized return at month t for security i and $E_{it,t+12}$ is the 12-month expected return at month t for security i.

3.3.5 Constructing the 25 ME and BEME Portfolios

After constructing the annual stock and market returns, the data set is merged with the Compustat data file to obtain the book equity (BE), market equity (ME) and BEME equity for each stock. A firm is included in the final sample only if it has CRSP stock prices for December of year t-1 and June of year t and Compustat book common equity value for the year t-1. This ensures that ME can be calculated for June in year t and BEME can be calculated for December in year t-1.

The 25 portfolios formed on the basis of ME and BEME are used in analysis in this study. The portfolio construction process is described in detail in Chapter 2 (Section 2.3.2). The expected and realized value weighted returns for these portfolios is calculated for each overlapping 12 month return period from July t to June t+1[12]. This results in a final sample consisting of 126 monthly observations for the period 2002-2012 for each of the 25 ME and BEME portfolios.

3.3.6 Descriptive Statistics of Annual Expected and Realized Returns

Table 3.1 shows the descriptive statistics for the 25 portfolios formed in June each year on size and book to market equity over the period from January 2002 to December 2012. The smallest BEME and largest ME quintile (portfolio 15) contains the greatest number of stocks, while the fewest stocks are recorded in the highest

[12] As previously mentioned, the overlapping observations problem is not an issue for expected returns though it must be adjusted for when using realized returns (Brav et. all, 2005)

BEME and highest ME quintile (portfolio 55). These results are consistent with the findings of Bhushan (1989), who state that firm size influences the analyst's decision to follow a firm and thus the availability of target price data. Jegadeesh et al. (2004) document that analysts prefer to follow high momentum stocks and growth stocks. Further, while panel C indicates that BEME ratios are uniform across the first four BEME quintiles, there appears to be an irregular decrease in the magnitude of BE ratios in quintile 5. Nonetheless, the pattern in average firm size and BE ratios is consistent with the original Fama and French (1993) study. The largest size quintile has the largest fraction of value. The BE ratios record highest values for largest BEME quintile.

Table 3.1 - Descriptive Statistics of 25 stock Portfolios formed on ME and BEME

	Book to market equity (BEME) quintiles				
Size Quintiles	Low	2	3	4	High
	Panel A: Average of annual number of firms in portfolios				
Small	353	575	654	721	527
2	797	833	748	760	334
3	736	702	581	458	208
4	728	672	469	330	190
Big	1,113	673	428	268	87
	Panel B: Average of annual averages of firm size				
Small	243.45	233.19	227.28	211.09	172.64
2	624.04	623.56	615.60	606.01	599.03
3	1,419.43	1,395.82	1,434.21	1,387.55	1,362.71
4	3,485.41	3,467.47	3,378.19	3,321.39	3,401.10
Big	34,623.90	25,829.74	19,725.55	14,482.54	20,764.32
	Panel C: Average of annual BE ratios for portfolios				
Small	0.11	0.39	0.57	0.84	11.09
2	0.15	0.39	0.56	0.83	5.99
3	0.16	0.39	0.56	0.83	5.30
4	0.17	0.38	0.56	0.84	3.84
Big	0.17	0.37	0.56	0.81	2.53

Table 3.I shows the descriptive statistics for the 25 portfolios formed in June each year on size and book to market equity over the period from 2002-2012 (10 years). The smallest BEME and largest ME quintile (portfolio 15) contains the most number of stocks, while the fewest stocks are recorded in the highest BEME and highest ME quintile (portfolio 55). Panel C indicates that BEME ratios are uniform across the first four BEME quintiles, there appears to be an irregular decrease in the magnitude of BE ratios in quintile 5.

Table 3.2 provides Kolmogorov-Smirnov test for the expected and realized 12-month returns conducted by year as well as for the full sample[13]. The p-value for the Kolmogorov-Smirnov tests reported is smaller than 0.05, indicating that expected return distributions are not equal to realized return distributions for our sample of shares. Figure 3.1 plots normal distributions of the pooled expected and realized 12-month returns and shows that the return distributions are not normally distributed and the return distributions for expected returns (dummy = 1) are significantly different

[13] The Kolmogorov-Smirnov Two Sample Test for equality of distribution functions is used to test the equality of the expected and realized return distributions.

from realized return distributions (dummy = 0). Note that, relative to realized return distributions (dummy = 0), the expected return distribution (dummy = 1) exhibits less variance.

Figure 3.1 – Expected Return and Realized Return Distributions

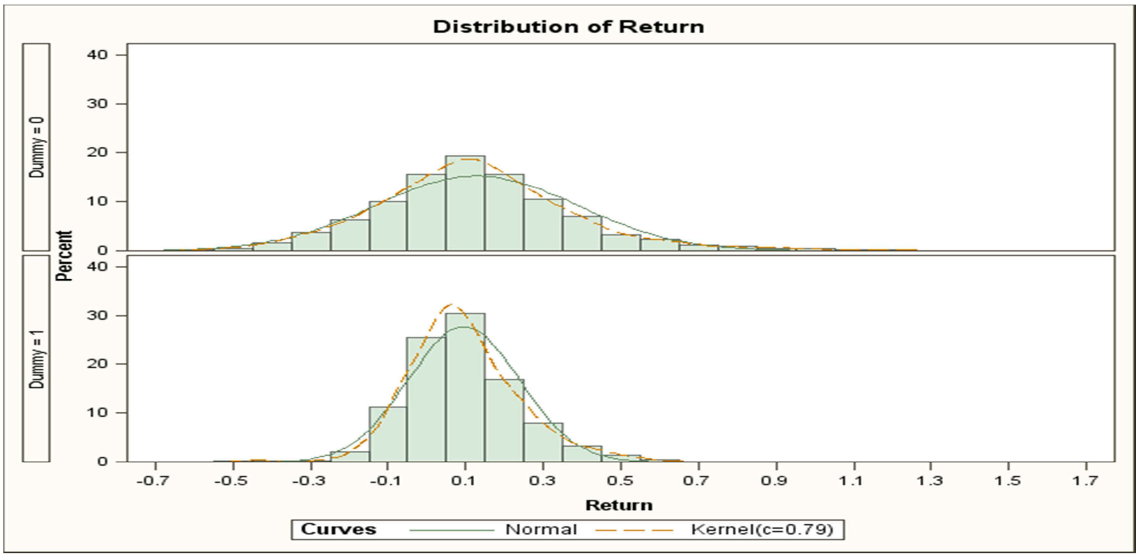

Table 3.2 – Two Sample Kolmogorov-Smirnov Test

Year	D – Value		Combined P-value
	Realized Return	Expected Return	
2001	0.220	-0.093	0.00
2002	0.210	-0.010	0.00
2003	0.090	-0.307	0.00
2004	0.000	-0.787	0.00
2005	0.000	-0.477	0.00
2006	0.010	-0.370	0.00
2007	0.060	-0.170	0.00
2008	0.800	0.000	0.00
2009	0.643	-0.067	0.00
2010	0.003	-0.513	0.00
2011	0.123	-0.303	0.00
Total	0.108	-0.180	0.00

The Kolmogorov-Smirnov Two Sample Test for equality of distribution functions is used to test the equality of distributions. The D-value is the maximum distance between the CDF of the two samples. The p-value of the Kolmogorov-Smirnov tests we report is smaller than 0.05 indicating that expected return distributions are not equal to realized return distributions for our sample of shares.

3.4 Methodology

My key research question in this chapter concerns how asset pricing model tests perform when proxy for expected returns is used in place of historical returns. Using Fama and French (1993) time-series regression approach, I test the following asset pricing models: the CAPM and three-factor model over a period from January 2002 to December 2012 and the four factor model over a period from January 2003 to December 2013. To answer my key question, I test these three models with two proxies of returns: 1) IBES target price based expected returns and 2) realized returns. This results in six different models as follows:

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[E_{m,t,t+12} - R_{f,t,t+12}\right] + e_t \quad [3.5a]$$

$$R_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[R_{m,t,t+12} - R_{f,tt+12}\right] + e_t \quad [3.5b]$$

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[E_{m,t,t+12} - R_{f,t,t+12}\right] + s_i ESMB_{t,t+12}, + h_i EHML_{t,t+12} + e_t \quad [3.6a]$$

$$R_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[R_{m,t,t+12} - R_{f,t,t+12}\right] + s_i SMB_{t,t+12} + h_i HML_{t,t+12} + e_t \quad [3.6b]$$

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[E_{m,t,t+12} - R_{f,t,t+12}\right] + s_{i,} ESMB_{t,t+12} + h_i EHML_{t,t+12} + m_i EMOM_{t,t+11} + e_t \quad [3.7a]$$

$$R_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[R_{m,t,t+12} - R_{f,t,t+12}\right] + s_i SMB_{t,t+12} + h_i HML_{t,t+12} + m_i MOM_{t,t+12} + e_t \quad [3.7b]$$

where $E_{i,t,t+12}$ is the expected return on a portfolio based on expected price at time t to t+12; every monthly observation covers a 12-month forecast horizon, indicating that the forecasts are overlapping. Brav et al. (2005) argue that the problem of overlapping observations is not critical for expected returns; as the expectations are formed at each time t; therefore expected returns are independent of future realizations. The same cannot be said for $R_{i,t,t+12}$, which is the realized return on a portfolio. I use 12 month realized holding returns for each month t, resulting in overlapping data for estimation. A GLS adjustment is used to correct for this problem following Hansen and Hodrick (1980).[14] $R_{f,t,t+12}$ is the one year Treasury Bonds return. $E_{m,t,t+12}$ is the value weighted expected market return. $R_{m,t,t+12}$ is the value weighted realized market return. ESMB, EHML and EMOM are expected returns on mimicking portfolios for the ME, BEME and the one-year momentum premium. SMB, HML and MOM are realized returns on mimicking portfolios for ME, BEME and one-year momentum premium. α is the intercept; β is the market risk sensitivity term, s_i, h_i and m_i are the coefficients on ME, BEME and momentum respectively; and e_t is the error term. Analysis is conducted using excess market returns, SMB, HML (mimicking returns for ME and BEME factors) and MOM.

In order to examine the sensitivity of my findings to the Global Financial Crisis (GFC) period, I re-estimate all six models (Models 3.5-3.7) with a GFC dummy variable. I acknowledge use of a different method for testing sensitivity of my findings to the GFC. This chapter uses 12-month overlapping returns, and pre-GFC period resulted in significant sample attrition. Therefore, I have used a GFC dummy to avoid sample attrition for this Chapter only.

The literature dealing with the identification of the GFC period reveals various possible GFC start and finish time periods. For example, Allen and Carletti (2008) in their study on the role of liquidity in the financial crisis argue that the financial crisis started in August 2007. Taylor (2009) studies the causes of the financial crisis

[14] For details on overlapping data adjustment please see Harri. & Brorsen, B. 1998. The overlapping data problem available at SSRN 76460 and Valkanov. 2003. Long-horizon regressions: Theoretical results and applications. Journal of Financial Economics, 68, 201-232.

and proposed that the GFC began in August 2007. Cornett et al. (2011), for their study, use time variation in the TED spread (difference between three-month London Interbank offer rate and three-month Treasury rate) to identify the crisis period (Summer 2007 to Spring 2009). According to Chor and Manova (2012), the subprime crisis surfaced in the second half of 2007 and the trade flows showed visible signs of recovery in October 2009. Based on the existing literature and visual checking of the data, I choose the period from September 2007 to August 2009 as the GFC period for this study. Hence, I define GFC equal to 1 for the period of September 2007 to August 2009 and zero otherwise.

3.5 Results

3.5.1 The Capital Asset Pricing Model

Tables 3.3A and 3.3B report the CAPM results for expectation and realized return proxies respectively. Key findings to note from Table 3.3A are as follows. The only R-square value exceeding 0.90 is for the big-stock low BEME portfolio. For small-stock and high BEME portfolios, R square values are less than 0.80. Fama and French (1993) find that when the market is used as the only explanatory variable, R square values for small stock and high BEME portfolios are lower than 0.7 for their dataset. They explain this trend in R square values by arguing that these are the stock portfolios for which SMB and HML factors have the most potential to exhibit explanatory power.

Table 3.3B presents the estimates of factor sensitivities for excess market return using historical data. Note the use of GLS for this study, due to overlapping return periods. The results are consistent with Table 3.3A. The market leaves considerable variation unexplained, which infers that other factors might be able to capture this variation.

Table 3.3A - CAPM using annual expected stock returns

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[E_{mt,t+12} - R_{ft+12}\right] + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	1.38	1.30	0.93	0.97	1.61	11.56	14.75	11.07	12.31	15.33
2	1.16	1.15	1.09	0.94	1.17	14.41	17.91	21.97	13.01	10.99
3	1.21	1.03	1.12	1.15	0.86	20.93	24.33	25.59	20.92	7.02
4	1.16	1.25	1.27	1.05	1.16	27.79	31.38	21.42	16.63	9.09
Big	0.71	1.03	1.27	1.57	1.56	36.06	22.14	25.09	17.49	8.96
			R-Square					s(e)		
Small	0.52	0.64	0.50	0.55	0.65	0.11	0.08	0.08	0.07	0.10
2	0.63	0.72	0.80	0.58	0.49	0.07	0.06	0.04	0.07	0.10
3	0.78	0.83	0.84	0.78	0.28	0.05	0.04	0.04	0.05	0.11
4	0.86	0.89	0.78	0.69	0.40	0.04	0.04	0.05	0.06	0.11
Big	0.91	0.80	0.83	0.71	0.39	0.01	0.04	0.05	0.08	0.16
			(α)					t(α)		
Small	0.08	-0.01	0.04	0.09	0.01	5.42	-0.51	4.29	9.10	0.57
2	-0.01	-0.01	0.02	0.05	0.02	-0.85	-2.39	3.43	5.50	1.59
3	-0.08	-0.06	-0.03	0.03	0.06	-11.2	-11.95	-6.29	5.20	4.10
4	-0.13	-0.10	-0.06	0.00	0.02	-25.18	-21.04	-7.87	-0.11	1.39
Big	0.02	0.02	0.00	-0.05	-0.07	7.44	3.53	-0.73	-4.33	-3.24

Table 3.3A presents OLS regressions of annual expected excess stock returns on excess expected stock market return for a period from Jan 2002 to Dec 2012**.** $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from datastream. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table 3.3B – CAPM using annual realized stock returns

$$R_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[R_{mt,t+12} - R_{f,t,t+12}\right] + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity										
	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(b)					t(b)		
Small	1.71	1.23	0.87	0.87	1.00	16.22	16.17	1.58	14.38	18.65
2	1.14	1.21	1.14	1.26	1.11	15.58	29.00	25.38	19.27	15.82
3	1.30	1.45	1.36	1.40	0.83	25.94	39.19	28.90	31.72	13.32
4	1.67	1.26	1.10	1.61	1.00	45.37	42.10	30.25	29.35	23.45
Big	0.92	0.90	0.94	0.77	1.47	46.54	54.62	36.90	21.36	22.48
			(α)					t(α)		
Small	0.25	3.51	0.87	-0.02	-0.08	3.34	0.19	1.68	-0.54	-2.10
2	0.25	0.09	0.02	-0.09	-1.46	4.67	2.96	0.74	-1.99	-1.45
3	0.20	0.04	0.00	-0.10	-3.00	5.56	1.49	0.11	-3.03	-0.59
4	0.15	0.04	-0.01	-0.08	-0.07	5.49	1.98	-0.72	-1.98	-2.42
Big	0.03	0.90	-0.04	-0.07	-0.11	2.10	-2.60	-2.13	-2.68	-2.40

Table 3.3B presents GLS regressions of annual realized excess stock returns on the excess realized stock market return for a period from Jan 2002 to Dec 2012. $R_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from data stream. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

3.5.2 Fama and French Three Factor Model

Table 3.4A contains results from Model 3.6a and presents the estimates of factor sensitivities for excess ex-ante market return, EHML and ESMB factors. Market risk premium and ESMB factors capture much of the variation in expected stock returns. The t-statistics on market risk premium are positive and highly significant. In every BEME quintile, with three exceptions, the ESMB coefficients decrease monotonically from smaller to bigger size quintiles; i.e. ESMB coefficients are related to size. Yet, the EHML coefficients do not appear to be related to the BEME factor. Across all size quintiles, while moving from low-BEME quintiles to high-BEME quintiles, the EHML coefficients do not follow any consistent pattern. The t-statistics on EHML coefficients show a mix of positive and negative statistically significant values.

Note that when ESMB and EHML are added as additional explanatory variables in the regression analysis, the R-square values for all portfolios increase. For the one factor model, R-square values are around 0.67. However, for three factor model, the R-square values increase to around 0.76. Fama and French (1993) argue that market, SMB and HML are correlated and by adding SMB and HML factors to regression, the market beta values collapse to around one. For instance, in the one factor regressions using expected returns (panel A of Table 3.3), the beta values for the biggest-ME and highest-BEME quintile portfolios is 1.56. In the three factor regressions using expected returns (Table 3.4A), the beta values for the same quintile is 1.01.

Table 3.4B contains results from Model 3.6b and presents the estimates of factor sensitivities for ex-post market return, SMB and HML factors estimated using

GLS. The results are broadly consistent with Table 3.4A, indicating that SMB coefficients are related to size, while HML coefficients are not related to the BEME factor. Lastly the intercept values are often statistically significant indicating there may be other factors missing from the specifications. Overall, it appears that the realized returns and expectation based returns perform similarly when using the Fama and French (1993) three factor model. One possible explanation for this result can be drawn from the belief that information surprises tend to cancel out over the period of study and thus realized returns provide an unbiased estimate of expected returns (Elton et al., 2004).

Table 3.4A –Fama French 3 factor model using annual expected stock returns

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[E_{m,t,t+12} - R_{f,t,t+12}\right] + s_i\, ESMB_{t,t+12} + h_i\, EHML_{t,t+12} + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(b)		
Small	1.35	1.15	0.84	0.78	0.98	11.49	10.47	8.14	10.13	10.18
2	1.05	1.02	1.02	0.85	0.85	14.56	12.90	19.52	9.65	8.76
3	1.07	0.91	0.92	0.90	0.87	16.23	17.98	19.51	18.26	13.22
4	1.16	1.13	1.10	0.98	0.83	21.20	25.14	15.15	12.09	5.34
Big	0.84	1.05	1.14	1.10	1.01	46.68	19.06	18.83	13.76	4.90
			(s)					s(t)		
Small	2.62	0.69	0.92	1.75	1.40	9.27	2.58	3.72	9.45	6.06
2	2.01	0.52	0.97	1.63	1.12	11.63	2.73	7.71	11.24	4.10
3	0.89	0.43	0.52	1.18	0.04	5.57	3.55	4.57	9.98	0.12
4	-0.25	0.60	0.15	0.14	1.15	-1.98	5.44	0.85	0.71	3.11
Big	-0.15	0.60	-0.30	-0.83	-0.61	-3.60	4.55	-2.04	-4.26	-1.22
			(h)					t(h)		
Small	-0.88	0.05	-0.15	-0.26	0.74	-5.69	0.31	-1.11	-2.56	5.87
2	-0.50	0.50	-0.23	0.13	0.62	-5.26	0.51	-3.31	1.63	4.15
3	-0.04	0.09	0.20	0.08	0.74	-0.49	1.39	3.17	1.23	3.79
4	0.20	0.02	0.27	0.90	0.24	2.93	0.40	2.83	0.85	1.18
Big	-0.19	-0.25	0.36	1.23	1.31	-8.12	-3.52	4.50	11.66	4.81
			R-Square					s(e)		
Small	0.73	0.66	0.55	0.74	0.83	0.08	0.08	0.07	0.05	0.07
2	0.82	0.74	0.86	0.83	0.66	0.05	0.06	0.04	0.04	0.08
3	0.83	0.85	0.89	0.89	0.37	0.05	0.04	0.03	0.03	0.10
4	0.87	0.91	0.81	0.70	0.47	0.04	0.01	0.05	0.06	0.11

Big	0.96	0.83	0.86	0.86	0.49	0.01	0.04	0.04	0.06	0.15
			(α)					t(α)		
Small	0.15	0.02	0.07	0.14	0.07	10.62	1.33	5.81	15.25	5.77
2	0.05	0.00	0.05	0.11	0.07	5.58	-0.09	7.71	14.49	5.04
3	-0.05	-0.05	-0.01	0.08	0.08	-6.55	-7.74	-2.36	12.77	4.31
4	-0.13	-0.08	-0.05	0.05	0.06	-21.47	-15.53	-5.46	0.54	3.44
Big	0.001	0.03	0.00	-0.05	-0.07	4.46	5.34	-1.07	-5.48	-2.66

Table 3.4A presents OLS regressions of annual expected excess stock returns on the excess expected stock market return and mimicking returns for SMB and HML for a period from Jan 2002 to Dec 2012. $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from datastream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table 3.4B – Fama French 3 factor model using annual realized stock returns

$$R_{i.t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[R_{m,t,t+12} - R_{f,t,t+12}\right] + s_i\, SMB_{t,t+12} + h_i\, HML_{t,t+12} + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

Book to market equity (BEME) quintiles

	(b)					t(b)				
Small	1.43	1.15	0.72	0.73	0.87	13.05	12.27	14.05	16.29	18.72
2	0.99	1.06	1.03	1.15	1.16	13.81	30.81	29.79	21.67	13.88
3	1.27	1.40	1.25	1.34	0.79	22.61	34.28	27.22	26.25	11.62
4	1.59	1.19	1.09	1.65	1.02	38.27	41.87	27.60	24.61	18.27
Big	0.94	0.92	0.95	0.79	1.40	48.51	49.49	32.50	19.22	20.21
	(s)					s(t)				
Small	2.73	1.52	1.10	0.64	0.55	13.07	8.57	11.34	7.49	6.25
2	1.47	0.91	0.55	0.61	0.17	10.79	14.01	8.51	6.10	1.08
3	0.60	0.06	0.41	-0.24	0.12	5.63	0.83	4.74	-2.47	0.97
4	0.34	0.36	0.08	-0.30	0.36	4.28	6.76	1.03	-2.39	3.43
Big	-0.05	-0.09	-0.28	-0.21	-0.55	-1.49	-2.67	3.25	-2.74	-4.20
	(h)					t(h)				
Small	-0.77	-0.79	-0.10	0.21	0.26	-4.34	-5.17	-1.21	2.94	3.46
2	-0.38	0.03	0.13	0.16	-0.37	-3.29	0.63	2.28	1.24	-2.76
3	-0.29	0.19	0.21	0.47	0.14	-3.16	2.86	2.89	5.66	1.30
4	0.16	0.04	-0.03	0.59	-0.33	2.37	0.92	-0.51	0.54	-3.67
Big	-0.05	-0.02	-0.16	0.09	0.77	-1.76	-0.69	-5.03	1.42	6.92
	(α)					t(α)				
Small	0.16	0.16	0.03	-0.07	-0.12	2.17	2.51	0.86	-2.19	-3.93
2	0.20	0.04	-0.01	-0.13	-0.06	4.07	1.87	-0.40	-3.66	-1.14
3	0.19	0.02	-0.03	-0.11	-0.04	4.99	1.01	-0.88	-3.17	-0.89
4	0.12	0.02	-0.02	-0.07	-0.08	4.41	1.20	-0.80	-1.50	-2.06
Big	0.03	-0.02	-0.03	-0.06	-0.12	2.74	-2.05	-1.72	-2.35	-2.70

Table 3.4B presents GLS Regressions of annual realized excess stock returns on the excess realized stock market return and mimicking returns for SMB and HML for a period from Jan 2002 to Dec 2012. $R_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from datastream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

3.5.3 Cahart Four Factor Model – MOM factor constructed using Realized Return Data

Estimates of factor sensitivities for the Cahart four factor model using with expectations based proxy and MOM factor constructed from realized returns are presented in Table 3.5A. These results show that among the four factors, the market risk premium continues to exhibit high t-statistics. Panel A shows that with four exceptions, across all BEME quintiles, as size increases, the ESMB coefficients decrease monotonically, the coefficients appear to be related to size. However, the EHML coefficients, again, do not follow any discernible pattern. Across all size quintiles, while moving from low-BEME to high-BEME quintiles, the EHML slopes increase and decrease randomly. The t-statistics on the MOM coefficients show a mix of negative and positive significant values. On average, when MOM is added as an explanatory variable to three factor regressions, the average of the R square values increases from 0.76 to 0.80. Lastly, Table 3.5A shows that intercepts in 17 out of 25 models are significant, indicating that there may be factors missing from the model specifications.

Table 3.5B contains results for Model 3.7b, which is the Cahart four factor results based on realized returns estimated using GLS. The market beta values are generally close to one and the intercept values are generally significant. The t-statistics on SMB and HML coefficients for realized excess returns regressions are greater than SMB and HML coefficients for expected excess returns regressions (Table 3.5A). The slopes on SMB show a similar trend to that noted by Fama and French (1993). In general, for every BEME quintile, the coefficients on SMB decrease consistently from small to big size quintiles; indicating that SMB is related to size. Contrary to findings reported in Table 3.5A, the HML coefficients appear to be related to BEME for the smallest and biggest quintiles. While moving from low-BEME to high-BEME quintiles, the HML coefficients tend to increase. The coefficients on MOM are small, and with one exception, the t-statistics on the MOM coefficients show a mix of negative and positive values.

Overall, when the realized returns are used, the SMB and HML are related to ME and BEME respectively in the usual manner. However, when the expectation based proxy for returns is used, the Cahart four factor model shows subtle improvement. With inclusion of EMOM, ESMB is related to ME. One possible explanation for this result is the use of a MOM factor is constructed using realized returns. It makes sense to estimate this variable using historical expected value estimates given the nature of the momentum effect. However, we explore the use of an expectation based momentum effect in the next section for completeness.

Table 3.5A – Cahart 4 factor model using annual expected stock returns and MOM

$$E_{i.t.t+12} - R_{f.t.t+12} = \alpha_i + \beta_i \left[E_{m.t.t+12} - R_{f.t.t+12}\right] + s_i\ ESMB_{t.t+12} + h_i\ EHML_{t.t+12} + m_i\ MOM_{t.t+11} + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(b)		
Small	1.26	1.31	0.92	0.70	0.88	9.82	15.64	8.49	8.94	8.19
2	1.06	1.06	0.99	0.5	0.49	15.59	12.25	18.28	7.46	4.05
3	1.06	0.90	0.99	0.92	0.34	15.12	16.94	22.7	16.68	2.37
4	1.10	1.16	1.02	1.07	0.64	20.33	22.83	18.12	14.38	4.54
Big	0.84	0.94	1.16	1.08	1.05	40.74	17.96	18.11	11.97	4.44
			(s)					t(s)		
Small	2.91	0.73	0.87	2.05	1.51	8.96	3.45	3.16	10.31	5.58
2	1.58	0.52	1.27	1.77	1.26	9.18	2.4	9.26	10.49	4.16
3	0.71	0.46	0.45	1.06	0.62	3.99	3.44	4.07	7.59	1.70
4	-0.10	0.49	0.07	0.2	1.13	-0.72	3.86	0.43	1.06	3.17
Big	-0.12	0.71	-0.20	-0.88	-0.57	-2.40	5.40	-1.25	-3.88	-0.95
			(h)					t(h)		
Small	-0.83	-0.18	-0.19	-0.26	0.83	-4.95	-1.62	-1.37	-2.57	5.93
2	-0.25	0.02	-0.32	0.16	0.74	-2.83	0.22	-4.55	1.78	4.69
3	0.07	0.13	0.17	0.09	0.54	0.74	1.87	3.02	1.32	2.84
4	0.15	0.03	0.17	-0.12	0.40	2.14	0.42	1.92	-1.19	2.18
Big	-0.20	-0.18	0.32	1.31	1.22	-7.65	-2.62	3.84	11.12	3.95
			(m)					t(m)		
Small	-0.46	-0.85	-0.82	-0.38	0.24	-1.91	-5.39	-3.99	-2.59	1.20
2	-0.53	-0.39	-0.02	0.12	0.78	-4.18	-2.39	-0.23	0.94	3.44
3	0.05	-0.23	-0.47	0.01	1.35	0.40	-2.31	-5.74	0.06	4.95

4	-0.16	-0.06	-0.30	-0.03	1.59	-1.55	-0.66	-2.43	-0.21	5.99
Big	-0.02	0.43	-0.28	-0.35	0.33	-0.42	4.36	-2.33	-2.08	0.74
			R-Square					s(e)		
Small	0.75	0.83	0.62	0.80	0.84	0.08	0.05	0.07	0.05	0.07
2	0.87	0.77	0.89	0.84	0.72	0.04	0.05	0.03	0.04	0.08
3	0.86	0.88	0.93	0.90	0.51	0.04	0.03	0.03	0.03	0.09
4	0.89	0.92	0.87	0.78	0.65	0.03	0.03	0.04	0.05	0.09
Big	0.96	0.88	0.88	0.87	0.50	0.01	0.03	0.04	0.06	0.15
			(α)					t(α)		
Small	0.26	0.21	0.24	0.24	0.02	5.15	6.32	5.70	7.69	0.47
2	0.14	0.09	0.07	0.10	-0.09	5.29	2.52	3.18	3.44	-1.88
3	-0.07	-0.001	0.08	0.07	-0.19	-2.60	-0.03	4.96	3.23	-3.36
4	-0.10	-0.07	0.02	0.02	-0.28	-4.61	-3.75	0.73	0.67	-4.99
Big	0.01	-0.05	0.05	0.02	-0.14	1.79	-2.48	2.07	0.61	-1.54

Table 3.5A presents OLS regressions of annual expected excess stock returns on the excess expected stock market return and mimicking returns for SMB, HML and MOM for a period from Jan 2003 to Dec 2012. $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from data stream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. MOM factor is an annual mimicking portfolio constructed using monthly realized returns from CRSP. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table 3.5B – Cahart 4 factor model using annual realized stock returns

$$R_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[R_{m,t,t+12} - R_{f,t,t+12}\right] + s_i SMB_{t,t+12} + h_i HML_{t,t+12} + m_i MOM_{t,t+11} + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity
Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
Small	1.65	1.14	0.80	0.71	0.87	12.98	15.69	15.68	13.75	14.90
2	1.13	1.04	1.00	0.92	0.91	14.29	28.22	27.00	20.30	12.07
3	1.32	1.37	1.22	1.26	0.83	20.81	31.31	23.08	19.10	10.02
4	1.66	1.18	0.98	1.40	1.08	43.15	41.62	27.17	21.47	18.00
Big	0.97	0.84	0.90	0.70	1.41	47.57	37.06	28.82	17.24	18.10
			(s)					s(t)		
Small	1.74	1.39	1.02	0.70	0.22	7.37	10.26	10.78	7.20	2.06
2	1.50	0.86	0.59	0.72	0.50	10.18	12.56	8.52	8.54	3.60
3	0.96	0.15	0.50	-0.22	0.11	8.14	1.85	5.08	-1.80	0.73
4	0.13	0.43	0.28	0.02	0.34	1.75	8.19	4.23	0.17	3.04
Big	-0.10	-0.04	-0.18	-0.04	-0.69	-2.61	-0.99	-3.12	-0.59	-4.78
			(h)					t(h)		
Small	-1.38	-0.61	-0.22	0.45	0.40	-6.61	-5.15	-2.69	5.28	4.17
2	-0.68	0.12	0.22	0.50	0.17	-5.23	1.96	3.67	6.78	1.42
3	-0.57	0.16	0.30	0.72	-0.02	-5.48	2.28	3.46	6.64	-0.18
4	-0.22	0.02	0.22	0.55	-0.38	-3.46	0.46	3.64	5.11	-3.86
Big	-0.10	0.15	0.28	0.41	0.75	-3.10	4.00	5.38	6.12	5.86
			(m)					t(m)		
Small	1.56	-0.54	-1.20	-0.81	-1.41	4.16	-2.51	-7.99	-5.33	-8.16
2	0.34	-0.19	-0.54	-0.04	0.13	1.45	-1.79	-4.97	-0.31	0.58
3	0.87	0.24	-0.26	-0.70	0.60	4.67	1.85	-1.68	-3.58	2.44
4	0.09	-0.71	-0.44	-0.58	-0.81	0.81	-8.58	-4.17	-3.00	-4.58

Big	-0.05	0.22	-0.67	-0.62	-0.18	-0.77	3.30	-7.26	-5.24	-0.81
			(α)					t(α)		
Small	-0.13	0.21	0.25	0.08	0.18	-1.18	3.34	5.56	1.88	3.61
2	0.12	0.07	0.08	-0.14	-0.12	1.75	2.28	2.33	-3.50	-1.88
3	-0.02	-0.04	0.001	0.03	-0.18	-0.31	-0.99	0.06	0.51	-2.46
4	0.10	0.16	0.04	0.01	0.07	2.93	6.37	1.32	0.32	1.36
Big	0.05	-0.09	0.09	0.04	-0.08	3.00	-4.33	3.42	1.31	-1.12

Table 3.5B presents GLS regressions of annual realized excess stock returns on the excess realized stock market return and mimicking returns for SMB, HML and MOM for a period from Jan 2003 to Dec 2012. $R_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from data stream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. MOM factor is an annual mimicking portfolio constructed using monthly realized returns from CRSP. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

3.5.4 Cahart Four Factor Model – MOM factor constructed using Expectations Data

Table 3.5C reports results for the Cahart four factor model with an expectations based momentum proxy with EMOM factor constructed from expected returns. Results from this table can be directly compared with those reported in Table 3.5A. The regression analysis is repeated using the EMOM factor constructed from past expectations data rather than historical returns. Estimates of factor sensitivities for the Cahart four factor model are presented in Table 3.5C. The coefficients on the market risk premium are positive and highly significant. Among the four factors, the market risk premium exhibits greatest t-statistics. Table 3.5C shows that with one exception, across all BEME quintiles, as size increases, the ESMB coefficients decrease monotonically indicating that SMB coefficients are related to size. Similarly the EHML coefficients appear to be related to BEME. Across all size quintiles, while moving from low-BEME to high-BEME quintiles, except for the second and fourth BEME quintile, the EHML slopes increase monotonically. The EMOM coefficients show a mix of negative and positive significant values. Moreover, with addition of the ESMB, EHML and EMOM factors as explanatory variables, the beta values for most portfolios collapse towards one. The R-square values presented in Table 3.5C suggest that on average, when EMOM is added as an explanatory variable to three factor regressions, the average R square values increase to around 0.83.

However, an important question is how well risk factors perform in explaining variation in returns. Merton (1973) and Ross (1976) suggest a simple test of whether models explain the cross-section of returns. If this is true then the intercepts in the time-series regression should be statistically insignificantly different from zero. Table 3.5C shows that 19 out of 25 regressions intercepts are significant. This level of rejections suggests that that there may be factors missing from the model specifications.

Table 3.5C - Cahart 4 factor model using annual expected stock returns and EMOM

$$E_{i.t.t+12} - R_{f.t.t+12} = \alpha_t + \beta_t \left[E_{m.t.t+12} - R_{f.t.t+12}\right] + s_i\ ESMB_{t.t+12} + h_i\ EHML_{t.t+12} + m_i\ EMOM_{t.t+11} + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
	(b)					t(b)				
Small	1.15	1.07	0.70	0.86	0.93	8.75	14.49	6.67	7.87	8.38
2	0.93	0.95	1.00	0.87	0.73	13.77	10.95	18.23	8.98	6.48
3	1.05	0.82	0.88	0.97	0.75	14.57	15.9	19.92	17.95	5.87
4	1.01	1.10	1.11	1.06	1.09	20.49	22.36	16.91	13.83	9.17
Big	0.85	1.05	1.06	0.94	1.16	41.31	20.6	17.11	10.94	4.75
	(s)					t(s)				
Small	3.13	1.17	1.28	2.19	1.40	9.87	6.61	5.09	10.99	5.30
2	1.84	0.72	1.25	1.66	0.83	11.43	3.46	9.46	10.77	3.10
3	0.70	0.59	0.67	1.01	-0.09	4.07	4.79	6.28	7.77	-0.32
4	0.03	0.56	0.24	0.22	0.30	0.22	4.74	1.50	1.19	1.06
Big	-0.13	0.50	-0.04	-0.66	-0.75	-2.70	4.09	-0.27	-3.22	-1.29
	(h)					t(h)				
Small	-0.92	-0.35	-0.36	-0.32	0.87	-5.56	-3.81	-2.74	-3.10	6.32
2	-0.36	-0.05	-0.32	0.20	0.90	-4.25	-0.50	-4.60	2.43	6.43
3	0.07	0.08	0.08	0.11	0.82	0.78	1.21	1.53	1.68	5.19
4	0.10	0.001	0.10	-0.12	0.73	1.68	0.05	1.25	-1.28	4.89
Big	-0.20	-0.09	0.26	1.22	1.29	-7.88	-1.49	3.33	11.39	4.26
	(m)					t(m)				
Small	-0.09	-0.23	-0.21	-0.03	0.04	-2.04	-8.91	-5.76	-0.94	1.03
2	-0.13	-0.10	0.02	0.09	0.24	-5.36	-3.31	1.33	4.08	6.11
3	-0.02	-0.08	-0.09	0.06	0.39	-0.74	-4.38	-6.05	3.38	8.80
4	-0.10	-0.06	-0.09	-0.01	0.44	-5.75	-3.65	-3.94	-0.45	10.38

Big	0.01	0.10	-0.10	-0.15	0.10	2.53	5.81	-4.41	-4.78	1.19
	R-Square					s(e)				
Small	0.75	0.87	0.67	0.79	0.84	0.08	0.04	0.06	0.05	0.07
2	0.88	0.78	0.89	0.86	0.77	0.04	0.05	0.03	0.04	0.07
3	0.86	0.89	0.93	0.91	0.65	0.04	0.03	0.03	0.03	0.08
4	0.91	0.93	0.88	0.78	0.77	0.03	0.03	0.04	0.05	0.07
Big	0.95	0.89	0.89	0.89	0.50	0.01	0.03	0.04	0.06	0.15
	(α)					t(α)				
Small	0.24	0.21	0.24	0.18	0.04	6.31	9.97	7.95	7.65	1.20
2	0.13	0.08	0.04	0.04	-0.11	6.71	3.35	2.77	2.46	-3.52
3	-0.05	0.01	0.06	0.02	-0.21	-2.29	0.85	4.83	1.54	-5.89
4	-0.06	-0.04	0.03	0.02	-0.28	-3.91	-2.84	1.38	1.04	-8.82
Big	0.00	-0.04	0.07	0.06	-0.15	-0.40	-2.95	3.81	2.39	-2.21

Table 3.5C presents OLS regressions of annual expected excess stock returns on the excess expected stock market return and mimicking returns for SMB, HML and MOM for a period from Jan 2003 to Dec 2012. The MOM is formed on expected value. $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from datastream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. MOM factor is an annual mimicking portfolio constructed using expected returns. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

The regression results for expected excess returns show that the market risk premium alone is unable to explain all the variation in the cross section of returns. ESMB and EHML possess some additional explanatory power. Moreover, the ESMB coefficients appear to be related to ME. The EMOM factor also possesses explanatory power with significant coefficient values. This finding suggests that investors require compensation for momentum based effects regardless of the proxy for past returns (MOM or EMOM). The results for expected excess returns cannot be compared with prior studies, as to the best of my knowledge, there is no evidence in the literature of a similar study employing expectation based return measures in tests of asset pricing models using time series regressions. Overall, the expected returns and realized returns appear to perform consistently in asset pricing tests.

3.5.5 Impact of GFC

It is relevant to mention here, that even after including the GFC dummy, many of the intercept coefficients are positive and significant. This implies that there may be factors missing from the model. The intercept statistical significance is not an artefact of the GFC. Tables 3.6, 3.7, 3.8 and 3.9 show that regression slopes for pre-GFC period are consistent with results reported in Tables 3.3A, 3.4A, 3.5A and 3.5C.

The t-statistic for the GFC dummy is insignificant for more than half of the portfolios (17 out of 25); while for those that are significant the coefficients are very small in magnitude, indicating my main findings are robust to the GFC period. The coefficients on SMB, HML and MOM and respective t-statistics are consistent with those reported in Tables 3.3A, 3.4A and 3.5A.

Table 3.6 – CAPM with GFC Dummy

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i \left[E_{m,t,t+12} - R_{f,t,t+12}\right] + d_t \text{ dummy} + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	1.34	1.28	1.02	0.90	1.52	10.29	13.29	11.42	9.12	13.42
2	1.19	1.10	1.16	1.00	1.25	13.49	15.86	22.39	12.73	10.80
3	1.15	1.12	1.13	1.18	0.88	18.62	26.14	23.73	19.73	6.58
4	1.16	1.29	1.24	0.98	1.18	25.29	30.35	19.23	14.62	8.47
Big	0.71	1.08	1.26	1.43	1.62	32.98	21.91	22.75	15.39	8.51
			(d)					t(d)		
Small	0.02	0.01	-0.05	-0.02	0.05	0.78	0.51	-2.60	-1.05	2.16
2	-0.01	0.03	-0.04	-0.03	-0.04	-0.71	1.92	-3.44	-1.75	-1.62
3	0.03	-0.04	-0.01	-0.01	-0.01	2.73	-4.80	-0.72	-1.23	-0.41
4	0.00	-0.03	0.01	0.03	-0.01	0.34	-2.45	1.16	2.32	-0.41
Big	0.00	-0.03	0.01	0.07	-0.03	-0.03	-2.71	0.52	3.78	-0.76
			R-Square					s(e)		
Small	0.52	0.64	0.52	0.55	0.67	0.11	0.08	0.07	0.07	0.09
2	0.63	0.73	0.81	0.59	0.50	0.07	0.06	0.04	0.07	0.10
3	0.79	0.85	0.84	0.78	0.28	0.05	0.04	0.04	0.05	0.11
4	0.86	0.89	0.79	0.70	0.40	0.04	0.03	0.05	0.06	0.12
Big	0.91	0.81	0.83	0.74	0.39	0.02	0.04	0.05	0.08	0.16
			(α)					t(α)		
Small	0.08	-0.06	0.04	0.09	0.01	5.40	-0.52	4.43	9.12	0.52
2	-0.01	-0.02	0.02	0.05	0.02	-0.83	-2.45	3.63	5.57	1.63
3	-0.08	-0.06	-0.03	0.04	0.06	-11.53	-12.88	-6.26	5.23	4.09
4	-0.13	-0.10	-0.06	0.00	0.02	-25.09	-21.41	-7.90	-0.15	1.39

Big	0.02	0.02	-0.01	-0.05	-0.07	7.41	3.66	-0.74	-4.62	-3.22

Table 3.6 presents the regressions of annual expected excess stock returns on the excess expected stock market return and GFC Dummy for a period from Jan 2002 to Dec 2012. $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from data stream. $Dummy$ is a binary variable which is assigned a value of 1 for GFC period and 0 otherwise. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table 3.7 - Fama French 3 factor model with GFC Dummy

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_i + \beta_i\left[E_{m,t,t+12} - R_{f,t,t+12}\right] + s_i\, ESMB_{t,t+12} + h_i\, EHML_{t,t+12} + d_i dummy_t + e_t$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	1.24	1.12	0.90	0.77	0.88	10.39	9.70	8.50	9.55	9.08
2	1.02	0.97	1.07	0.81	0.72	13.55	11.80	19.89	9.61	6.10
3	0.99	0.98	0.93	0.91	0.51	15.21	20.19	18.70	17.49	3.31
4	1.11	1.16	1.08	0.91	0.83	20.19	24.90	14.12	11.01	5.10
Big	0.83	1.08	1.14	1.01	1.11	44.23	18.95	17.92	12.66	-5.15
			(s)					t(s)		
Small	2.78	0.72	0.83	1.76	1.55	9.98	2.70	3.32	9.30	6.86
2	2.05	0.61	0.91	1.59	1.03	11.66	3.18	7.28	10.84	3.73
3	1.00	0.33	0.51	1.17	-0.01	6.60	2.91	4.39	9.69	-0.03
4	-0.25	0.55	0.18	0.22	1.15	-1.98	5.04	1.03	1.15	3.02
Big	-0.15	0.55	-0.31	-0.70	-0.75	-3.48	4.17	-2.03	-3.72	-1.49
			(h)					t(h)		
Small	-0.95	0.02	-0.10	-0.26	0.67	-6.29	0.17	-0.78	-2.55	5.50
2	-0.51	0.01	-0.20	0.14	0.66	-5.38	0.14	-2.92	1.82	4.43
3	-0.10	0.14	0.20	0.08	0.76	-1.17	2.27	3.21	1.29	3.86
4	0.20	0.04	0.25	0.05	0.24	2.91	0.73	2.62	0.47	1.18
Big	-0.19	-0.23	0.36	1.17	1.37	-8.02	-3.21	4.45	11.51	5.02
			(d)					t(d)		
Small	0.06	0.02	-0.04	-0.04	0.06	3.05	0.88	-2.10	0.21	3.49
2	0.01	0.03	-0.02	-0.01	-0.04	1.16	2.40	-2.70	-1.29	-1.83
3	0.05	-0.04	-0.001	-0.001	-0.02	4.17	-4.92	-0.54	-0.49	-0.81

4	0.00	-0.02	0.01	0.03	0.00	-0.22	-2.07	1.07	2.39	-0.11
Big	0.00	-0.02	-0.02	0.05	-0.06	0.26	-1.94	-0.17	3.68	-1.51
			R-Square					s(e)		
Small	0.74	0.66	0.56	0.74	0.84	0.08	0.08	0.07	0.05	0.06
2	0.82	0.76	0.87	0.83	0.67	0.05	0.05	0.04	0.04	0.08
3	0.85	0.88	0.89	0.89	0.38	0.04	0.03	0.03	0.03	0.10
4	0.87	0.92	0.81	0.71	0.47	0.04	0.03	0.05	0.06	0.11
Big	0.96	0.84	0.86	0.88	0.50	0.01	0.04	0.04	0.05	0.15
			(α)					t(α)		
Small	0.15	0.02	-0.04	0.14	0.07	11.17	1.39	-2.10	15.16	6.27
2	0.05	0.00	0.05	0.10	0.07	5.66	0.09	7.68	14.39	4.94
3	-0.05	-0.05	-0.01	0.08	0.08	-6.65	-8.79	-2.38	12.65	4.23
4	-0.14	-0.08	-0.05	0.01	0.06	-21.34	-15.85	-5.37	0.73	3.41
Big	0.01	0.03	-0.01	-0.05	-0.07	4.45	5.24	-1.07	-5.46	-2.78

Table 3.7 presents the regressions of annual expected excess stock returns on the excess expected stock market return and mimicking returns for SMB, HML and GFC Dummy for a period from Jan 2002 to Dec 2012. $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from datastream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. $Dummy$ is a binary variable which is assigned a value of 1 for GFC period and 0 otherwise. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table 3.8 - Cahart 4 factor model with GFC Dummy using MOM

$$E_{i,t,t+12} - R_{f,t,t+12} = \alpha_t + \beta_t \left[E_{m,t,t+12} - R_{f,t,t+12}\right] + s_i\ ESMB_{t,t+12} + h_i\ EHML_{t,t+12} + m_i\ MOM_{t,t+12} +$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity										
	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	1.08	1.27	0.97	0.66	0.75	10.36	14.47	8.54	8.05	7.04
2	1.00	0.98	1.04	0.53	0.58	14.37	11.11	18.67	7.53	4.72
3	0.97	0.96	0.99	0.94	0.42	14.14	18.36	21.47	16.11	2.75
4	1.09	1.20	1.19	1.03	0.69	19.03	22.91	16.93	13.21	2.93
Big	0.83	0.98	1.14	0.95	1.18	38.40	18.33	16.90	10.92	4.74
			(s)					t(s)		
Small	3.14	0.78	0.80	2.10	1.67	10.36	3.66	2.89	10.50	6.50
2	1.66	0.62	1.21	1.73	1.13	9.77	2.91	8.94	10.16	3.78
3	0.83	0.38	0.45	1.04	0.53	5.00	2.96	3.99	7.33	1.43
4	-0.09	0.44	0.10	0.26	1.05	-0.59	3.49	0.55	1.38	2.93
Big	-0.12	0.65	-0.18	-0.72	-0.73	-2.29	5.04	-1.08	-3.40	-1.21
			(h)					t(h)		
Small	-0.89	-0.19	-0.20	-0.28	0.79	-5.73	-1.74	-1.26	-2.71	5.96
2	-0.27	0.00	-0.31	0.16	0.77	-3.12	-0.01	-4.44	1.89	4.99
3	0.04	0.15	0.17	0.10	0.56	0.43	2.30	3.00	1.39	2.97
4	0.15	0.04	0.16	-0.13	0.42	2.07	0.63	1.85	-1.36	2.28
Big	-0.21	-0.16	0.31	1.27	0.26	-7.63	-2.47	3.76	11.70	4.09
			(m)					t(m)		
Small	-0.71	-0.90	-0.75	-0.44	0.06	-3.09	-5.61	-3.57	-2.91	0.33
2	-0.62	-0.49	0.04	0.16	0.91	-4.82	-3.06	0.39	1.23	4.01
3	-0.08	-0.14	-0.47	0.03	1.46	-0.61	-1.46	-5.54	0.27	5.21
4	-0.18	-0.01	-0.33	-0.09	1.67	-1.67	-0.09	-2.54	-0.66	6.13

Big	-0.02	0.49	-0.30	-0.53	0.50	-0.52	4.97	-2.46	-3.29	1.10
			(d)					t(d)		
Small	0.09	0.02	-0.02	0.02	0.07	4.58	1.46	-1.42	1.59	3.91
2	0.03	0.04	-0.02	-0.01	-0.05	2.73	2.84	-2.67	-1.34	-2.51
3	0.05	-0.03	0.00	-0.01	-0.04	4.46	-3.95	-0.06	-0.92	-1.57
4	0.01	-0.02	0.01	0.02	-0.03	0.71	-2.41	0.75	1.95	-1.24
Big	0.00	-0.02	0.01	0.06	-0.06	0.46	-2.63	0.88	4.68	-1.60
			R-Square					s(e)		
Small	0.79	0.83	0.63	0.80	0.86	0.07	0.05	0.07	0.05	0.06
2	0.88	0.79	0.90	0.84	0.73	0.04	0.05	0.03	0.04	0.07
3	0.88	0.89	0.93	0.90	0.52	0.04	0.03	0.03	0.03	0.09
4	0.89	0.92	0.87	0.79	0.66	0.03	0.03	0.04	0.05	0.09
Big	0.96	0.89	0.88	0.89	0.51	0.09	0.03	0.04	0.05	0.15
			(α)					t(α)		
Small	0.32	0.22	0.23	0.25	0.06	6.58	6.51	5.18	7.89	1.48
2	0.16	0.11	0.05	0.08	-0.12	5.96	3.24	2.48	2.99	-2.50
3	-0.04	-0.02	0.08	0.06	-0.22	-1.58	-1.04	4.76	2.89	-3.67
4	-0.09	-0.09	0.02	0.03	-0.29	-4.26	-4.32	0.89	1.15	-5.15
Big	0.01	-0.06	0.06	0.06	-0.18	1.84	-3.14	2.22	1.84	-1.91

Table 3.8 presents the regressions of annual expected excess stock returns on the excess expected stock market return and mimicking returns for SMB, HML, MOM and GFC Dummy for a period from Jan 2003 to Dec 2012. $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from datastream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. MOM factor is an annual mimicking portfolio constructed using monthly realized returns from CRSP. $Dummy$ is a binary variable which is assigned a value of 1 for GFC period and 0 otherwise. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table 3.9 - Cahart 4 factor model with GFC Dummy using EMOM

$$E_{i.t.t+12} - R_{f.t.t+12} = \alpha_i + \beta_i \left[E_{m.t.t+12} - R_{f.t.t+12}\right] + s_i \, ESMB_{t.t+12} + h_i \, EHML_{t.t+12} + m_i \, EMOM_{t.t+11} + d_i dummy_t +$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	0.98	1.05	0.78	0.63	0.78	7.45	13.42	7.15	7.10	7.08
2	0.88	0.88	1.06	0.80	0.81	12.49	9.74	18.59	8.94	6.87
3	0.89	0.90	0.90	0.99	0.78	13.37	17.81	19.18	17.28	5.79
4	1.00	1.15	1.10	1.01	1.09	19.05	22.39	15.75	12.55	8.67
Big	0.85	1.08	1.05	0.81	1.28	38.68	20.23	15.90	9.67	4.98
			(s)					t(s)		
Small	3.40	1.19	1.15	2.23	1.63	11.14	6.55	4.56	10.92	6.42
2	1.91	0.83	1.17	1.61	0.71	11.71	3.96	8.88	10.24	2.61
3	0.87	0.47	0.64	0.98	-0.15	5.30	4.06	5.87	7.34	-0.49
4	0.04	0.49	0.25	0.30	0.29	0.36	4.18	1.53	1.59	0.98
Big	-0.13	0.45	-0.02	-0.47	-0.94	-2.56	3.62	-0.15	-2.40	-1.58
			(h)					t(h)		
Small	-0.99	-0.36	-0.32	-0.33	0.80	-6.39	-3.84	-2.48	-3.20	6.18
2	-0.38	-0.09	-0.29	0.21	0.94	-4.51	-0.81	-4.35	2.59	6.72
3	0.02	0.11	0.09	0.12	0.84	0.26	1.89	1.66	1.80	5.24
4	0.10	0.02	0.10	-0.15	0.73	1.59	0.37	1.19	-1.52	4.86
Big	-0.20	-0.08	0.25	1.17	1.35	-7.82	-1.26	3.22	11.68	4.43
			(m)					t(m)		
Small	-0.10	-0.23	-0.21	-0.03	0.03	-2.35	-8.90	-5.76	-0.98	0.93
2	-0.13	-0.10	0.03	0.09	0.25	-5.50	-3.48	1.48	4.15	6.28
3	-0.02	-0.08	-0.09	0.06	0.40	-0.99	-4.56	-6.00	3.42	8.81
4	-0.10	-0.06	-0.09	-0.01	0.44	-5.76	-3.62	-3.93	-0.54	10.33

Big	0.02	0.11	-0.10	-0.15	0.11	2.51	5.94	-4.42	-5.38	1.26
			(d)					t(d)		
Small	0.08	0.01	-0.04	0.01	0.07	4.00	0.56	-2.25	0.95	4.07
2	0.02	0.03	-0.02	-0.01	-0.03	1.93	2.36	-2.73	-1.33	-2.03
3	0.05	-0.03	-0.01	-0.01	-0.02	4.49	-4.57	-1.16	-1.07	-0.80
4	0.00	-0.02	0.00	0.02	0.00	0.62	-2.49	0.33	1.86	-0.21
Big	0.00	-0.01	0.00	0.06	0.00	0.25	-1.82	0.52	4.54	-1.43
			R-Square					s(e)		
Small	0.78	0.87	0.68	0.79	0.86	0.08	0.05	0.06	0.05	0.06
2	0.89	0.79	0.90	0.86	0.78	0.04	0.05	0.03	0.04	0.07
3	0.88	0.91	0.93	0.91	0.65	0.04	0.03	0.03	0.03	0.08
4	0.91	0.93	0.88	0.79	0.77	0.03	0.03	0.04	0.05	0.07
Big	0.96	0.89	0.89	0.90	0.51	0.01	0.03	0.04	0.05	0.15
			(α)					t(α)		
Small	0.25	0.21	0.23	0.18	0.05	7.05	9.95	7.87	7.70	1.63
2	0.13	0.09	0.04	0.04	-0.12	6.94	3.61	2.60	2.34	-3.73
3	-0.04	0.01	0.06	0.02	-0.22	-2.08	0.53	4.72	1.44	-5.92
4	-0.05	-0.04	0.03	0.03	-0.28	-3.83	-3.11	1.40	1.20	-8.24
Big	0.00	-0.04	0.07	0.07	-0.16	-0.38	-3.12	3.83	2.98	-2.34

Table 3.9 presents the regressions of annual expected excess stock returns on the excess expected stock market return and mimicking returns for SMB, HML, MOM and GFC Dummy for a period from Jan 2003 to Dec 2012. $E_{m,t,t+12}$ is the value weighted annual excess return on all the stocks in the 25 ME, BEME portfolios. $R_{f,t,t+12}$ is the one year US Treasury Constant Maturity rate (FRTCM1Y) from datastream. SMB and HML factors are the annual mimicking portfolio returns constructed using expected returns. MOM factor is an annual mimicking portfolio constructed using expected returns. $Dummy$ is a binary variable which is assigned a value of 1 for GFC period and 0 otherwise. In order to form the 25 portfolios, we sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

3.6 Conclusion

I investigate the use of a forward looking measure, IBES mean target price, in calculating a proxy for expected returns, used in asset pricing tests within the Fama and French (1993) time series framework. This follows the recommendation of Korteweg (2004). Although the Brav et al. (2005) study is closest to my study, it is pertinent to note that Brav et al. (2005) use value line target prices in their study of the relationship between expected return and firm attributes and they also rely on a cross-section framework (Fama and French, 1992).

Target price forecasts are the analyst's estimate of the firm's stock price level and these are generally at a 12-month horizon. It has been observed in the literature that the target price predicted by analysts reflects actual stock price movements. Further, Brav and Lehavy (2003) and Bradshaw et al. (2012) provide empirical evidence that analyst target price forecasts are more informative than stock recommendations and earnings forecasts and thus provide a useful proxy for estimating expected returns.

Empirical results for the three factor model using expectations data and realized data are consistent. Indeed, the sensitivities to firm ME are consistent with the Fama and French (1993) study. The SMB coefficients decrease monotonically across each BEME quintile with increases in size. However, HML coefficients do not appear to be related to BEME when using the proxy for expected returns. Unlike the HML results reported in the Fama and French (1993) study, the HML coefficients do not follow the pattern reported by Fama and French (1993) for US data. However, the reason for this deviation in the result is beyond the scope of this dissertation.

The four factor model results using expectations data reveals that SMB is related to size, while, again, the HML coefficients do not follow any discretional pattern. The MOM factor possesses substantial explanatory power. When the four factor model test is repeated using realized data, the SMB and HML coefficients are related to size and book-to-market equity respectively and the MOM coefficients depict a mix of negative, positive and significant values. This result is consistent with the earlier work of Fama and French (1993).

For the analyst target price based regressions, as you move from a one factor to a three factor or to a four factor model, the R-square values increase and the beta values for all portfolios in four factor model approach a value of one. It is pertinent to mention that for each of the one factor, the three factor and the four factor regressions; more than half of the regression intercepts are significant indicating that the models are unable to completely explain the variation in returns. This is also observed in the tests using historical returns. Thus, this is not a problem associated solely with use of my proxy for expected returns.

To cater for the possibility of confounding effects arising from the existence of the GFC period (Sep 2007 to Aug 2009) in the study period, a GFC dummy variable is included in the asset pricing tests. While, these dummy variable coefficients are the statistically significant, the regression R-squares and intercept values suggest my main findings are robust to the GFC period.

One area for future research is to identify other expectation proxies to assess the robustness of the results to expected return proxy choice and assess the impact of using IBES target price in calculation of expected returns relative to alternative expected return estimates.

Chapter 4 – Predictability of US Corporate Bond Returns

4.1 Introduction

Bond markets play a very important role in the financial systems of modern economies. The efficiency of the bond market is an important issue for regulators, investors and financial institutions. Thus, it is extremely valuable to understand the pricing and the impact of liquidity in this market. Though the size of the US corporate bond market ($37 trillion) is almost twice the size of the US stock market ($21 trillion), the existing literature on US corporate bonds is scant (Andersen and Benzoni, 2012). Thus, this study recognizes the importance of the US bond market and devotes attention to analysing US corporate bond returns.

In this chapter, I provide a comprehensive study of the cross-section of US corporate bond returns obtained from the Datastream database and evaluate how certain bond market factors perform against one another in explaining bond return variation. My study differs from existing studies in several ways. First, individual corporate bond returns are used rather than broad bond index returns. Second, the Fama and French (1993) portfolio technique is used to allocate bonds into 25 ME and BEME bond portfolios on the basis of the issuing firm equity characteristics for time series analysis. Third, mimicking portfolio returns, based on leverage, are used in analysis to assess the impact of leverage on corporate debt within the Fama and French (1993) framework. This has not been attempted in this literature to date. Finally Datastream bond data is used for analysis. This data set has not been used in bond studies reported in the literature to date, though it provides a rich alternative source of data for analysis, and the results from this analysis suggest that the data set may prove useful in future research.

In addition to the Fama and French (1993) bond factors (DEF and TERM), I propose to include leverage in pricing bond returns. The idea that changes in leverage affects firm value is well known, yet the impact of leverage has not been investigated in the context of the pricing of corporate bonds. Pogue and Soldofsky (1969) suggest that leverage and profitability influence corporate bond ratings. Hurdle (1974) uses leverage to measure risk and suggests that on the basis of the risk premium hypothesis, high levels of debt should correspond to high rates of return. Thus, I argue that highly levered firms should pay a premium over low levered firms and thus I create a mimicking portfolio for leverage for inclusion in the bond pricing tests.

Recent literature suggests that liquidity risk is priced in US corporate bonds (Lin et al., 2011). Houweling et al. (2005) point out that despite the importance of liquidity in bond pricing, academic studies on bond liquidity are few. Fisher (1959) provides the first study to propose 'issued amount of bond' as a proxy for liquidity and Friewald et al. (2012) argue that while 'issued amount of bond' is crude, it is an intuitive proxy for liquidity. Moreover, investment banks also rely on 'issued amount of bond' as a measure of liquidity in structuring bond indices (Houweling et al., 2005). Thus, based on existing literature, there is support for 'issued amount of bond' as a proxy for liquidity and this is used for analysis in this study.

This study develops a multifactor model for bond pricing. Monthly US corporate bond data is collected from Datastream for the period from January 2002 to December 2012, and bond pricing tests are conducted within a Fama and French (1993) time series framework. The results indicate that the DEF factor dominates all remaining explanatory variables in the model; capturing most of the cross-sectional variation in the bond returns. The rest of the chapter proceeds as follows. Section 4.2 reviews the relevant literature. Section 4.3 discusses the data used in the study. Section 4.4 details the methodology. Section 4.5 presents the results, while the last section concludes.

4.2 Review of Related Literature

Section 4.2.1 elaborates on the importance of credit rating information in making investment decisions and highlights the relevance of US credit ratings in bond pricing; as well as the role of credit ratings in leverage policies. Section 4.2.2 explores the impact of the leverage the bond returns. Section 4.2.3 details the common risk factors identified in the literature to explain the variation in bond returns. Section 4.2.4 examines the impact of liquidity on bonds pricing. Section 4.2.5 explores the alternate liquidity proxies used in bond studies.

4.2.1 Bond Credit Ratings and their Role in Leverage Policies

Corporate bond ratings were developed by Roger Babson, Freeman Putney, Jr., and John Moody prior to World War I to provide a reliable and independent information source to assess the quality of corporate bonds (Pogue and Soldofsky, 1969). It was argued that bond ratings should indicate the investment quality of these securities. There are roughly 150 credit rating agencies worldwide; however, the three most dominant agencies are Standard & Poor's Ratings Services, Moody's Investors Service and Fitch Ratings (White, 2010). Table 4.1 shows that the Securities and Exchange Commission (SEC) in the United States identifies 10 of these agencies as nationally recognized statistical rating organizations. White (2010) documents that the market share (based on revenues or issues rated) of Standard &

Poor's Ratings Services, Moody's Investors Service and Fitch Ratings accounted for around 40 percent, 40 percent and 15 percent of the ratings market respectively.

Table 4.1 – U.S Nationally Recognized Statistical Rating Organizations

Credit Rating Agency	Head Office	Rating Scope	Business Model	Internet Home Page
A.M. Best Company, Inc.	United States	Global-Insurance	Issuer-Pay	www.ambest.com
DBRS	Canada	Global-Corporates and Structured	Issuer-Pay	www.dbrs.com
Egan-Jones Rating Company	United States	Global-Corporates	User-Pay	www.egan-jones.com
Fitch Ratings	United Kingdom	Global-Full Spectrum	Issuer-Pay	www.fitchratings.com
Japan Credit Rating Agency, Ltd.	Japan	Japanese-Full Spectrum	Issuer-Pay	www.jcr.co.jp
LACE Financial Corp.	United States	U.S. Corporates, Global Banks, & Sovereigns	User-Pay	www.lacefinancial.com
Moody's Investors	United	Global-Full	Issuer-	www.moodys.co
Rating and Investment Information, Inc.	Japan	Japanese-Full Spectrum	Issuer-Pay	www.r-i.co.jp
Realpoint LLC	United States	U.S.-Structured Finance	User-Pay	www.realpoint.com
Standard & Poor's (S&P)	United States	Global-Full Spectrum	Issuer-Pay	www.standardandpoors.com

Table 4.1 presents the U.S Nationally Recognized Statistical Rating Organizations (as of August 10, 2010)[15]
Sources: U.S. Securities and Exchange Commission (www.sec.gov/divisions/marketreg/ratingagency.htm); and rating agency.
Note: "Full spectrum" includes banks and other corporations, insurance companies, sovereigns, and structured finance.

Credit ratings agencies assign bond ratings using a scale of letters and figures. For example, the Standard and Poor's(S&P) rating scale is; AAA (highest rating) AA, A, BBB, BB, CCC, CC, C, D (lowest rating). Moreover, modifiers are attached to these letters to further distinguish ratings within classifications. Both Standard and Poor's and Fitch use plus and minus as modifiers, while Moody's use numbers. The bond issues that have credit rating at or above BBB (S&P and Fitch) at or above Baa (Moody's) are categorised as investment grade bonds (Pinches and Mingo, 1973).

[15] IMF 2010. The uses and abuses of sovereign credit ratings, chapter 3 in the 2010 IMF, Global Financial Stability Report

Similarly, bond issues that have a credit rating below BBB or Baa are known as speculative or junk bonds. Table 4.2 presents a comparison of credit rating measures among these three agencies:

Table 4.2 – A comparison of rating agencies credit ratings measures

Rating number (fine)	Rating no. (broad)	S&P	Moody's	Fitch
21 (Highest credit rating)	8	AAA	Aaa	AAA
20	7	AA+	Aa1	AA+
19	7	AA	Aa2	AA
18	7	AA-	Aa3	AA-
17	6	A+	A1	A+
16	6	A	A2	A
15	6	A-	A3	A-
14	5	BBB+	Baa1	BBB+
13	5	BBB	Baa2	BBB
12	5	BBB-	Baa3	BBB-
11	4	BB+	Ba1	BB+
10	4	BB	Ba2	BB
9	4	BB-	Ba3	BB-
8	3	B+	B1	B+
7	3	B	B2	B
6	3	B-	B3	B-
5	2	CCC+	Caa1	CCC+
4	2	CCC	Caa2	CCC
3	2	CCC-	Caa3	CCC-
2	1	CC	Ca	CC
1	1	C	C	C
Default	Default	SD/D		DDD/DD/D

Table 4.2 summarizes the credit rating measures applied by the Standard and Poor, S&P, Moody's and Fitch. The first column displays the consolidated credit rating number related to the finer rating categories, while the second column presents the consolidated rating number related to broader rating categories. Column three, four and five encompasses the equivalent ratings for S&P, Moody's and Fitch.

Investment grade bond issuers typically carry a similar credit profile and thus these issuers are largely uniform in nature. However, issuers of high yield bonds (also known as junk bonds) are diverse in nature. According to (Altman, 1992), the issuers of junk bonds can be broadly grouped in to three categories, fallen angels, high debt companies, and leveraged buyouts. He explains that 25% of the junk bond issuers are comprised of 'fallen angels', another 25% of the junk bond issuers are high debt companies, while 50% of the high-yield bond issuers are leveraged buyouts. Fallen angels are former investment-grade companies that are allocated lower ratings [below BBB (or Baa)] due to deteriorating credit profile (Fridson and Sterling, 2006). High debt companies originally issue junk bonds for normal business purposes but their bonds are rated below investment grade due to above average debt loads (Altman, 1992). Finally, leveraged buyouts are high yield bond issues. These bonds are issued to finance large corporate restructurings (Kaplan and Strömberg, 2008).

Bond ratings hold significance for large corporate borrowers. Pogue and Soldofsky (1969) explain that corporate borrowers often attempt to ensure they do not increase firm leverage beyond the point that leads to a rating downgrade for the firm. According to Donaldson (1961) one possible reason for this behaviour is the common belief that an aggressive debt policy may hamper future flexibility both in terms of the source of funds available to them and the availability of borrowing in the future. Pogue and Soldofsky (1969) conclude that the probability of higher bond rating is inversely related to leverage and directly related to firm size and profitability. They further argue that leverage and profitability have greatest influence over corporate bond ratings. In sum, it is possible that corporate bond ratings may play a role in establishing optimal leverage policies for the firm and thus will have an impact on expected return for financial securities written on the assets of the firm.

4.2.2 Bond Returns and Leverage

The theoretical motivation for this study comes from corporate finance theory, which views leverage as a key variable affecting corporate debt, capital structure and bond returns. Economic theory and market experience suggest that as the debt-to-equity ratio of a borrowing firm increases, lenders demand higher yield to reflect the premium for increased financial risk (Modigliani and Miller, 1958). Myers (1977) suggests that an increase in debt ratio (leverage) adversely effects the returns of existing bondholders. Leland (1994) specifies that corporate debt value and capital structure are interlinked variables. Due to this link, debt values cannot be determined in isolation from firm capital structure. Further, although the idea that a change in leverage affects firm value has been known for decades, its implications for bond pricing have not been fully explored in the literature.

4.2.3 Common Risk factors in Bond Pricing

Corporate bonds are priced to cater for the possibility of default. Factors like credit rating of the issuing corporation, type of issues (e.g. senior or subordinated; secured or unsecured) and contractual provisions encompassing settlement details in case of a default, play a key role in estimating yields on corporate bond issues. Fama and French (1993) study common risk factors which capture the cross-section of average returns in bonds and stocks. In their study, Fama and French (1993) identify at least five common factors in government bond returns. Two term structure factors, TERM and DEF, exhibit substantial explanatory power in explaining almost all the variation in bond returns. The stock market factors, market risk premium, SMB and HML are confined to stock returns and play little or no role in capturing the variation in government or corporate bonds. Lastly, Fama and French (1993) also show that when stock returns are regressed over the three stock market factors (market risk premium, SMB and HML) and two term structure factors (TERM and DEF), TERM and DEF exhibit explanatory power.

In examination of the cross-sectional determinants of expected corporate bond returns, Gebhardt et al. (2005a) use two approaches: the Daniel and Titman (1997) portfolio approach, and the Fama and MacBeth (1973) cross-sectional approach. While the Daniel and Titman (1997) portfolio approach examines cross-sectional variation in bond returns specific to characteristics, the Fama and MacBeth (1973) methodology investigates the cross-sectional relationship between individual bond returns and equity market beta and firm characteristics.

The Gebhardt et al. (2005a) study covered the sample period from December 1973 to January 1996. Their study uses characteristics such as corporate bond ratings and duration to proxy for default and term risk. In their test, they document a significant positive relationship between yield to maturity and average bond returns. Further, Gebhardt et al. (2005a) suggest that an empirical model comprising DEF and TERM and the yield to maturity may be useful in estimating the cost of debt. Consistent with the Fama and French (1993) study, Gebhardt et al. (2005a) also find that the TERM and DEF factors explain more than 90% of the variation in corporate bond returns.

4.2.4 Bond Returns and Liquidity Factors

Liquidity risk is priced in security markets (Houweling et al., 2005). Evidence of priced liquidity risk is mixed in the bond market. For bond markets, empirical studies like Amihud and Mendelson (1991), Fleming (2002) and Strebulaev (2003) rely on US Treasury market data, where bonds are issued regularly and price data is easily available. Amihud et al. (1991) and Fleming (2002) report statistically significant liquidity premiums while Strebulaev (2003) rejects the illiquidity premium explanation for the pricing effect of liquidity.

Houweling et al. (2005) use the Brennan and Subrahmanyam (1996) methodology to study the pricing of liquidity risk in the cross-section of euro corporate bonds. Based on the rationale that yields are forward-looking, Houweling et al. (2005) use bond yield to maturity (YTM) as a proxy for bond expected return. They use nine distinct proxies of corporate bond liquidity and construct mutually exclusive portfolios for each proxy. The results for their study show that the premium between liquid and illiquid portfolios depends on eight out of nine possible liquidity proxies, with the amount outstanding and yield dispersion proxies exhibiting the greatest explanatory power over the premium.

Bao et al. (2011) estimate the level of illiquidity in the corporate bond market and its impact on bond valuation. Using transaction level data for period 2003-2009, their study reveals that bond illiquidity increases with bond age and maturity while it decreases with issuance size. Overall, their study concludes that at an aggregate level, illiquidity is a key factor in explaining time variation in bond indices for different ratings. Moreover, in a cross-sectional framework, a bond level illiquidity measure is able to explain the bond yield spreads with some economic significance (Bao et al., 2011).

Lin et al. (2011) examine the role of liquidity risk in the pricing of corporate bonds within a cross-section framework for a period January 1994 to March 2009. Their study uses market-wide liquidity as an additional variable within their corporate bond pricing model. Lin et al. (2011) conclude that even after controlling for default and term betas, market risk factors, bond characteristics, the level of liquidity and ratings, liquidity risk still exhibits a positive and economically significant relationship with corporate bond returns and that liquidity risk is an important determinant of expected corporate bond returns.

4.2.5 Liquidity Proxies

Both direct and indirect liquidity measures are used to proxy for liquidity in bond and equity markets. Examples of direct liquidity measures include quoted bid-ask spreads, trade size, trade frequencies and trading volume. Houweling et al. (2005) point out that as corporate bond transactions mostly occur in the over-the-counter market, direct liquidity measures are less reliable and hard to obtain. For this reason, researchers rely on indirect liquidity proxies that are based on bond characteristics and day end prices (Houweling et al., 2005). Commonly used indirect liquidity measures include issued amount of bond, yield volatility, missing prices and yield dispersion. Lesmond et al. (1999) introduces a transaction cost estimator (LOT) based on the rationale that marginal investors trade only if the expected gain from trade exceeds the cost of trading. Bekaert et al. (2007) illustrate that zero returns can be used as a reasonable proxy for illiquidity. Chen et al. (2007) point out a potential drawback of using the LOT model for estimating liquidity. They explain that the LOT model relies on zero returns, to estimate liquidity effects on price. However, the sequence of prices of newly issued and mid-year bonds may not reveal zero returns, thus leading to an invalid LOT estimate. (Chen et al., 2007).

Fisher (1959) is the first to propose the use of issued amount of bond as a proxy for liquidity. He reasons that as large issues trade more often, the 'issued amount of bond' serves as a proxy for direct liquidity. Similarly, Friewald et al. (2012) also use issued amount of bond as a proxy of liquidity. They argue that bond characteristics such as bond age, bond maturity, bond issued amount and bond coupon are crude measures of liquidity, however these measures make intuitive sense. Further, most investment banks rely on issued amount as a liquidity measure in structuring their bond indices; for example Lehman Brothers use this measure as a liquidity criterion for their Euro-Aggregate Corporate Bond index (Houweling et al., 2005).

Most studies predict a positive relation between bond issued amount and liquidity (Houweling et al., 2005). For example, Crabbe and Turner (1995) explain that larger issues have lower information costs as they are owned and analysed by more investors. The same is not true for smaller issues, as information is not as widely disseminated; therefore, small issues tend to have higher yields due to illiquidity (Crabbe and Turner, 1995). Similarly, Sarig and Warga (1989) and Amihud and Mendelson (1991) argue that smaller bond issues tend to get caught in buy-and-hold portfolios, leading to a reduced tradable amount and lower liquidity. In sum, it would appear that the literature favours, the 'issued amount of bond' in bond studies, and therefore the 'issued amount of bond' is used as a proxy for liquidity in this study.

4.3 Data

4.3.1 Data Sources of Bond Prices

To date, a number of studies involving the use of bond price information have utilized data sources like Datastream, TRACE, National Association of Insurance Commissioners Database (NAIC), Fixed Income Securities Database (FISD), Lehman Brothers Fixed Income Database (LBFI) and Bloomberg. There have been concerns associated with each of these datasets. For example, Lin et al. (2011) argues that the TRACE database covers a short horizon, which leads to noisy parameter estimates. As a consequence, the majority of the studies extracting bond level information for US bonds use the FISD database to supplement the TRACE database. Gebhardt et al. (2005a) point out that the LBFI database relies on matrix prices. He argues that matrix prices are considered less reliable than dealer quotes and so the LBFI database is also flawed. Moreover, as the NAIC database only covers corporate bonds held by life insurance companies, property and casualty insurance companies and health maintenance organizations, it is limited in its coverage of the bond market (Warga, 2000). Table 4.3 summarizes the strengths and weaknesses of these databases.

Table 4.3 - A comparison of Alternate Bond Databases

Database	Strengths	Weaknesses
Datastream	Global research database - 50 years of historical data for over 175 countries and 60 markets worldwide.	Bond studies have rarely used Datastream solely for extracting bonds data.
TRACE	TRACE database is commonly used in the bond literature focusing on US debt. TRACE database covers price, time and size of transaction data for all the publically traded corporate bonds. As of 2011, TRACE comprises of 17 thousand corporate bond issues.	TRACE database covers a short horizon. Bond studies use the FISD database to generally supplement the TRACE database.
LBFI	LBFI Database is comprised of monthly price, accrued interest, return data and descriptive data such as coupons, ratings and callability for all US investment grade corporate bonds issued since 1973. It holds a comprehensive set of bond prices for constructing benchmark bond indices.	Reliance on Matrix prices which are considered to be less reliable than dealer quotes.
FISD	The FISD database includes issue details on over 100,000 corporate, U.S. Agency, U.S. Treasury, and supranational debt securities. FISD provides US corporate bonds data (maturing in 1990 or later) on coupon rates, periodicity of coupon payments, maturity, credit rating, bond type information and sinking fund provisions.	FISD database provides bond level information only. Thus this database cannot be used solely for conducting bond pricing studies.
NAIC	NAIC database is comprised of issuer, issuer CUSIP, trade date, dealer information, price, size of trade, type of institution, and type of transaction since 1994.	Coverage is limited to life insurance companies, property and casualty insurance companies and Health Maintenance organizations.
Bloomberg	Provides data on the mid quotes, coupon rates, and maturity date, etc. for all the active corporate bonds for both US and international markets.	Focuses more on its investor clientele.

Table 4.3 presents strengths and weaknesses of alternate bond databases

I use Datastream in this study as it covers both active and inactive US corporate bond historical data over the study period. Datastream is recognized as a global research database which holds up to 50 years of historical data for over 175 countries and 60 markets worldwide. Datastream encompasses time series data for 10,000 plus data-types, for over 35 million instruments and indicators across all asset classes and more than a million financial instruments, securities and indicators. The coverage includes but is not limited to historical prices, volume details and total return indices for over 80,000 fixed income securities and more than 60,000 warrants, convertibles, CD's, domestic and international issues covering 32 markets.

4.3.2 The Datastream Database

Bessembinder and Maxwell (2008) indicate that prior to 2002, corporate bonds primarily traded in an opaque market. Bond quotes were available to market professionals on request and so bond prices at which transactions were completed were not disclosed publically. Consistent with this observation, corporate bonds and equity data are downloaded from Datastream to cover the period from January 2002 to December 2012. The monthly total return index data (RI) for all the US corporate bonds is extracted from DataStream and this is used to calculate bond returns. The RI[16] is calculated by Datastream as:

$$RI_t = RI_{t-1} * \frac{[P_{i,t} + A_{i.t} + NC_t + CP_t]}{(P_{t-1} + A_{t-1} + CP_{t-1})} \quad [4.1]$$

[16] The RI equation is extracted from Datastream database.

Where RI_t is the total return, P_{it} is the clean price, A_{it} is the accrued interest, NC_t is the next coupon (adjustment is made when a bond goes ex-coupon) and CP_t is the value of any coupon received on t or since t-1.

The initial sample consists of 2,305 corporate bonds with 222,100 monthly observations over a period of 132 months. The difficulty in using data from Datastream is to match bond data with equity data. Datastream does not have a common identifier to match bond issuers with parent equity companies. In this study, the bond issuers are matched manually with the parent equity companies. In many instances, it is not possible to trace whether the parent company is a guarantor for the bond issue. Thus, all such bonds for which the parent company role as a guarantor is ambiguous are dropped from the sample. Once the bond issuers are matched with the parent equity companies, the sample size is reduced to 1,284 bonds, however, the total number of bonds varies from year to year. The monthly data for market value (MV), market to book (MTBV), credit ratings (BSPL), principal amount of bonds, or issued amount (AISD), and the one month US Treasury Bill rate are also extracted from Datastream in creating a matched dataset. To be included in my sample in any month, each bond issuing company must have data for RI, MV, MTBV, long-term debt, AISD and BSPL. Table 4.4 shows that the resulting sample contains 921 corporate bonds with 57,160 bond-month observations.

Table 4.4 – Sample Selection Process

	Observation remaining
Initial Data (2,305 bonds)	222,100
Matching bond issuers with parent equity companies (1,284 bonds)	100,768
Merge bond file with MV and MTBV data (992 bonds)	910,538
Merge bond file with BSPL data (928 bonds)	57,888
Filter the data file so RI, MV, MTBV, BSPL are not missing (921 bonds)	57,160
Final sample (921 bonds)	57,160

Long-term US Government Bond returns with 10 year maturity are downloaded from Federal Reserve Bank of St Louis website[17]. The rates are quoted as nominal rates per annum and they are converted to a rate per month. The CRSP monthly value weighted equity market return index is extracted from CRSP. While the monthly US broad investment grade bond index data (item – SBBIGBI) is downloaded from Datastream. The Fama and French monthly factors [SMB (small minus big) and HML (high minus low)] for the period from January 2002 to December 2012 are extracted from Kenneth R. French Data Library[18].

4.3.3 Constructing Four Credit rating Portfolios

Four bond portfolios are formed on the basis of credit ratings using the Standard and Poor's ratings with monthly rebalancing. To form the four portfolios, credit rating breakpoints are used to assign all the bonds in the sample by credit rating, Aaa, A, Baa and LG. For example, the first quartile Aaa comprises all bonds bearing a credit rating AAA, AA, AA+ and AA-, while the fourth quartile portfolio, the LG portfolio, comprises all the bonds which have credit ratings below BBB, commonly called junk bonds. The monthly value weighted returns for these portfolios are calculated for the period from July t to June t+1,with rebalancing, each year. This results in a final sample consisting of 120 monthly observations for the period from January 2002 to December 2012 for each of the four credit rating portfolios.

4.3.4 Constructing 25 ME and BEME Portfolios

Book equity (BE), market equity (ME) and BEME for each bond issuing company is obtained from Datastream. A firm is included in the final sample only if

[17] For details please refer to http://research.stlouisfed.org/fred2/tags/series
[18] For details please refer to http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

it has bond prices for December of year t-1 and June of year t and book common equity value for the year t-1. This ensures that ME can be calculated for June in period t and BEME can be calculated for the year t-1.

There are 25 bond portfolios formed on the basis of ME and BEME in this study. To form the 25 portfolios, I sort, the bonds in June of each year t, by firm size based on market equity and by book to market equity independently. For the size sort, ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December in the year t-1. NYSE equity based breakpoints for ME and BEME are used to assign all the bonds in the sample to ME and BEME quintiles. The 25 ME and BEME portfolios are constructed from the intersection of ME and BEME quintiles. For example, the first portfolio is comprised of all bonds assigned to quintile 1 for ME and quintile 1 for BEME. The value weighted monthly bond returns for these portfolios are calculated for the period from July year t to June year t+1. This results in a final sample consisting of 120 monthly observations for the period from January 2002 to December 2012 for each of the 25 ME and BEME portfolios.

4.3.5 Construction of Key variables of Interest

4.3.5.1 Monthly Realized Returns and Term Structure Factors (DEF & TERM)

The monthly holding period return at month t is calculated as

$$R_{i,t} = \frac{RI_{i.t} - RI_{i,t-1}}{RI_{i,t-1}} \qquad [4.2]$$

The DEF and TERM factors are calculated following the Fama and French (1993) methodology. The DEF factor is the default risk factor in returns defined as the difference between the monthly return on a value weighted market portfolio of all investment-grade corporate bonds available for the month and long-term government bond return for the month (Fama and French, 1993). The TERM factor represents the slope of the yield curve and is defined as the difference between the monthly long-term world government bond return index and one month US T-Bill rate.

4.3.5.2 Constructing Leverage (LEV) and Liquidity (LIQ) Factors.

The LEV factor is constructed to mimic the risk factor in bond returns that is related to leverage. Leverage is computed as the long-term debt (Item Long-term Debt-Datastream) to market capitalization of equity (Item MV-Datastream). To construct the LEV mimicking portfolio, the median corporate leverage is used to split the bonds in two portfolios: 1) a portfolio containing all bonds with leverage above median (H) and 2) a portfolio containing all bonds with leverage below median (L). The monthly value weighted realized returns are calculated for high and low leverage portfolios. The LEV factor is the difference between value weighted realized returns on H and L bond portfolios.

The LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct the LIQ mimicking portfolio, the median AISD is used to split all the bonds in two 1) portfolio containing all bonds with AISD above median (B) and 2) portfolio containing all bonds with AISD below median (S). The monthly value weighted realized returns of all bonds in these two portfolios are calculated. The LIQ factor is the difference between the value weighted realized returns on the S and B bond portfolios.

4.3.6 Descriptive Statistics

Table 4.5 provides summary statistics on the four portfolios formed on bond credit ratings over the period from January 2002 to December 2012. The difference in bond returns across the four rating portfolios makes intuitive sense. It is interesting to note that the Aaa rated bonds and low grade (LG) bonds have an average return difference of 0.16% per month (or an annual credit spread of 1.92% per annum). This is largely due to the recent GFC period. The difference in returns across rating portfolios for the pre-GFC period appears larger relative to the average returns difference for the overall sample period. The Aaa rated bonds and LG bonds have an average return difference of 0.48% per month (5.8% per annum) for the pre-GFC period. As shown in Figure 4.1, the average return pattern across the credit rating portfolios is consistent with Avramov et al. (2009) who argue that firms with low credit risk realize higher returns. As we move from Aaa rated bonds to LG bonds, the standard deviation also increases monotonically. For example the standard deviation for Aaa bonds is 1.84%, while it is 3.08% for LG bonds. This is in line with higher risk assets attracting higher expected returns (Avramov et al., 2009).

Figure 4.1 - Average monthly returns and standard deviations

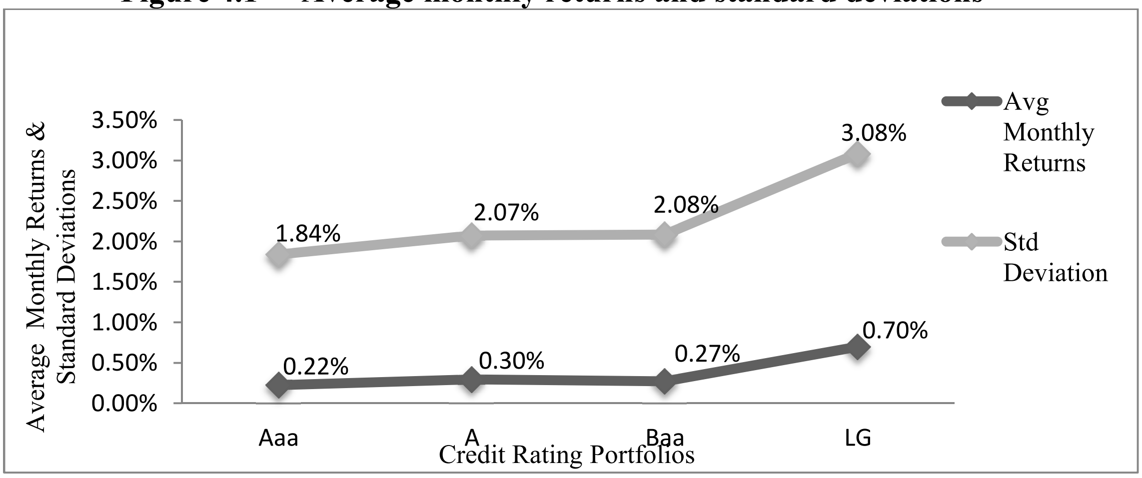

Figure 4.1 represents the average monthly returns and standard deviation of the bond portfolios formed on the basis of credit rating for a period from Jan 2002 to Aug 2007. Aaa rating bonds and LG bonds have an average return difference of 0.48% per month. As we move from Aaa rated bonds to LG bonds, the standard deviation consistently increase i.e. the standard deviation for Aaa bonds is 1.84%, while it is 3.08% for LG bonds.

Over the sample period, the average risk premium for the default factor (DEF) is 0.40% per month, while the average risk premium for the term factor (TERM) is 0.20% per month. The average default premium of 0.40% is very low compared to its standard deviation of 2.10%. However, the magnitude of the default premium is comparable to the difference in the average returns of 0.48% per month between the Aaa rated bonds and the LG (Low grade) bonds for the pre-GFC period. Note that the average risk premium for the DEF factor for the GFC period (Sep 2007 – Aug 2009) is 0.68% per month. A high DEF premium during the GFC is consistent with the Fama and French (1993) argument that the value of DEF premium is high when economic conditions are weak and default risks are high[19].

Figure 4.2 shows that the average firm size (as measured by market capitalization), with one exception, tends to decrease with worsening credit rating. The one exception is the highest credit-rated bond issuing firms that have an average market capitalization of $0.92 billion. This is somewhat smaller than the next credit rating group with capitalization of $2.19 billion. The lowest rated bond issuing firms have an average market capitalization of $0.20 billion which is considerably smaller than the mean capitalization of the other groups. Based on the Amihud (2002) argument that firm size proxies for liquidity, this result is consistent with the proposition that better rated firms tend to be larger. It is also generally found that the market for better rated securities is more liquid than that for weaker ranked firms.

The link between bond yields and holding period of returns can be expressed using the Fisher (1966) duration equation:

$$\frac{dP_{it}}{P_{it}} = -D_{it} * dr_{it} \qquad [4.3]$$

with discrete approximation $\frac{\Delta P_{it}}{P_{it}} = -D_{it} * \Delta r_{it}$, where ΔP_{it} is the change in bond price, while P_{it} is the initial bond price; D_{it} is the duration of the bond i at time t and

[19] Table A3 presents the DEF and TERM factor statistics.

Δr_{it} is the change in yield to maturity of bond i at time t. The expression $\frac{\Delta P_{it}}{P_{it}}$ reflects the expected holding period return for the bond given a change in the bond yield. Equation [4.3] suggests that bond yield and holding period return are inversely related. That is, a decline in prevailing yields results in capital appreciation. Thus, an expected increase in liquidity will tend to decrease bond yields and increase holding period returns, all else held constant.

Figure 4.2 - Average firm size in millions

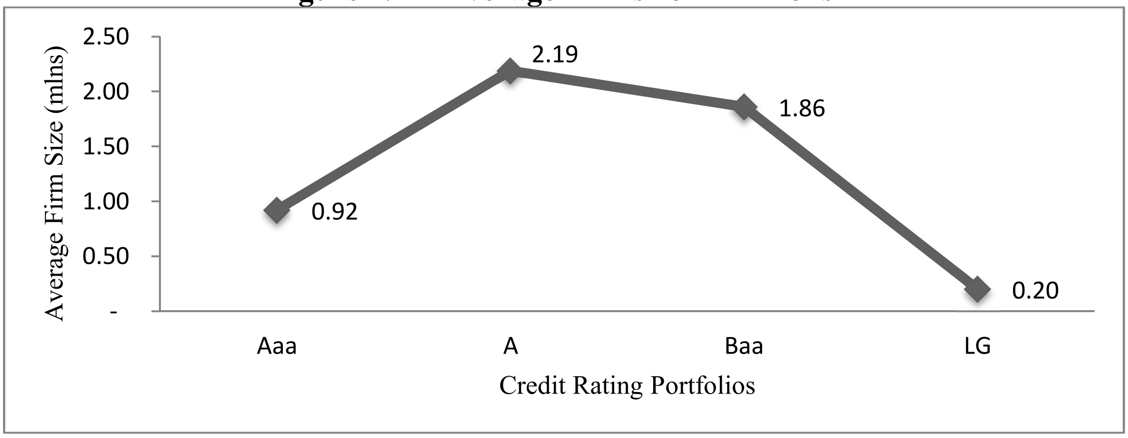

Figure 4.2 presents the average firm size (as measured by market capitalization of equity) for the bond portfolios formed on credit rating for a period from Jan 2002 to Dec 2012. With the exception of Aaa rated bond portfolio, the firm size decreases with decrease is credit rating.

Figure 4.3 shows that leverage, computed as the long-term debt to market capitalization of equity, is increasing monotonically with credit risk (that is, from 0.101 for Aaa rated bonds to 1.172 for LG bonds).

Figure 4.3 – Average Leverage

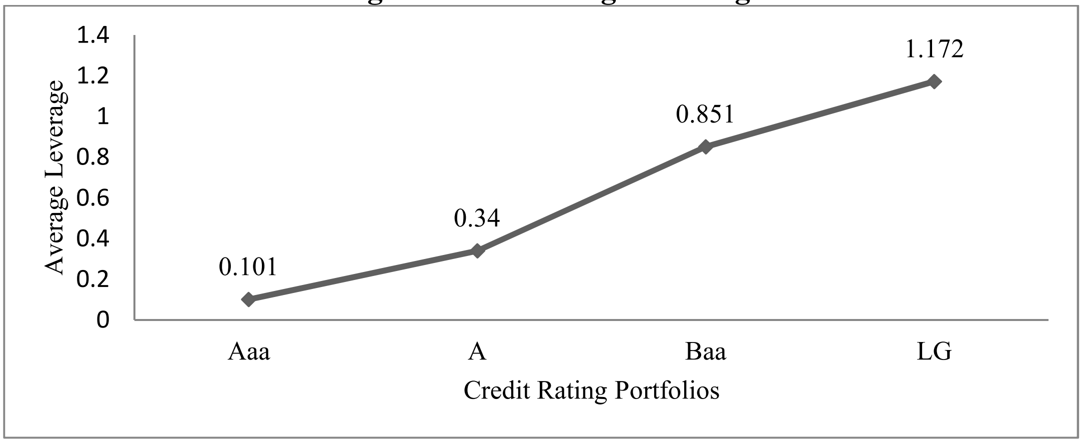

Figure 4.3 presents the average leverage for the bond portfolios formed on credit rating for a period from Jan 2002 to Dec 2012. The average leverage increases monotonically with the decrease in credit ratings. Leverage is computed as the long-term debt to market capitalization of equity.

Kisgen (2006) is among the first to study the relationship between credit ratings and capital structure. He argues that firms at the upper range of rating boundaries tend to reduce leverage to avoid downgrades. This is consistent with the leverage patterns across the credit rating portfolios for this sample. Overall, I find that low-rated bonds are smaller in terms of firm size, yield higher returns, have larger standard deviation in returns, are less liquid and exhibit higher leverage than higher-rated bonds.

Table 4.5 – Descriptive Statistics of four credit rating bond portfolios

Portfolio	Statistics		Leverage	Size	Return	
					overall	Pre GFC
Aaa	Number of bonds	26				
	Mean		0.101	922,672	0.005	0.0022
	Median		0.096	859,238	0.006	0.0040
	Range		0.253	1,200,014	0.138	0.1080
	Std Deviation		0.046	275,682	0.021	0.0184
	Min		0.008	411,494	-0.074	-0.0610
	Max		0.262	1,611,508	0.064	0.0470
A	Number of bonds	182				
	Mean		0.340	2,189,159	0.005	0.0030
	Median		0.231	2,161,786	0.006	0.0028
	Range		2.133	2,486,260	0.132	0.1226
	Std Deviation		0.306	590,780	0.022	0.0207
	Min		0.029	1,220,755	-0.079	-0.0705
	Max		2.163	3,707,014	0.052	0.0521
Baa	Number of bonds	320				
	Mean		0.851	1,860,938	0.007	0.0027
	Median		0.356	1,712,944	0.009	0.0045
	Range		16.632	2,184,744	0.239	0.1163
	Std Deviation		1.894	526578	0.027	0.0208
	Min		0.000	1,062,993	-0.131	-0.0636
	Max		16.632	3,247,737	0.108	0.0526
LG	Number of bonds	164				
	Mean		1.172	205,819	0.006	0.0070
	Median		0.693	177,341	0.002	0.0065
	Range		22.839	395,093	0.348	0.2300
	Std Deviation		1.899	101,338	0.042	0.0308
	Min		0.000	68,144	-0.103	-0.0693
	Max		22.839	463,237	0.245	0.1607

Table 4.5 shows the descriptive statistics for the four bond portfolios formed on credit ratings for a period from Jan 2002 to Dec 2012. The average returns for pre GFC period (Jan 2002 – Aug 2007) show that Aaa rating bonds and LG bonds have an average return difference of 0.48% per month. The average risk premium for the default factor (DEF) is 0.4% per month, while average risk premium for the term factor (TERM) is 0.20% per month. The average firm size (as measured by market capitalization) with one exception decrease monotonically with worsening credit rating. While, the leverage increases monotonically with credit risk, from 0.101 for Aaa rated bonds to 1.172 for LG bonds.

Table 4.6 shows the descriptive statistics for the 25 bond portfolios formed on the basis of issuing firm ME and BEME over the period from January 2002 to December 2012. Panel A shows that the smallest-ME and largest-BEME quintile (portfolio 51) contains the most number of bonds while the fewest bonds are recorded in the highest-BEME and highest-ME quintile (portfolio 55). On average, each of the five portfolios in smallest size quintiles is less than 0.31% of the combined value of bonds in the 25 portfolios and the combined value of the five portfolios in the largest ME quintile represents 61% of the combined value of the 25 portfolios. Further, the portfolio of bonds in the largest-ME and smallest-BEME quintile (Portfolio 15) alone; accounts for more than 15% of the combined value of 25 portfolios. Panel C indicates that across all ME quintiles, as we move from low to high BEME quintiles, the BE ratios increase monotonically. Panel D indicates that small firms are more levered than large firms for three of the five BEME quintiles. This pattern can be explained in light of the argument that the cost of issuing debt and equity is related to firm size. Titman and Wessels (1988) explain that small firms have to pay much more for new equity issues than large firms, therefore, small firms prefer to borrow and thus are more leveraged than large firms.

In sum, the smallest-ME and largest-BEME quintile (Portfolio 51) contain most firms. The largest ME quintile has the largest fraction of value and the BE ratios record highest values for largest BEME quintiles. These results are roughly consistent with the equity portfolio characteristics reported by the Fama and French (1993) study.

Table 4.6 – Descriptive Statistics of 25 ME/BEME Bond Portfolios

	Book to market equity (BEME) quintiles				
Size Quintiles	Low	2	3	4	High
	Panel A: Average of number of firms				
Small	44	33	63	77	125
2	68	70	120	89	76
3	87	88	100	88	66
4	74	91	101	104	71
Big	79	95	75	51	32
	Panel B: Average annual firm size average				
Small	957.39	1,127.04	1,534.72	1,225.83	1,145.37
2	3,571.10	3,561.79	2,988.02	3,002.07	3,607.68
3	7,842.62	7,612.45	8,084.66	7,292.06	7,199.42
4	21,034.50	19,527.84	17,164.53	18,647.50	18,756.54
Big	61,693.21	43,401.03	44,569.63	47,378.22	45,192.41
	Panel C: Average annual BE ratios				
Small	0.09	0.31	0.49	0.62	1.04
2	0.13	0.33	0.45	0.61	1.02
3	0.16	0.31	0.45	0.60	1.00
4	0.16	0.30	0.47	0.61	0.88
Big	0.14	0.31	0.45	0.63	0.89
	Panel D: Average annual Leverage ratio				
Small	2.18	0.48	0.70	1.15	1.27
2	1.14	0.57	0.51	0.32	0.25
3	0.72	0.46	0.41	0.50	0.49
4	0.79	0.54	0.62	0.45	0.59
Big	1.36	0.91	1.06	0.59	0.55

Table 4.6 shows the descriptive statistics for the 25 portfolios formed in June each year on size and book to market equity over the period from 2002-2012 (10 years). The smallest-ME and largest-BEME quintile (portfolio 51) contains the most number of bonds, while the fewest bonds are recorded in the highest-BEME and highest-ME quintile (portfolio 55). Panel B indicates that largest-ME quintile has the largest fraction of value and panel C shows that BE ratios record highest values for largest-BEME quintiles.

4.4 Methodology

This study uses the Fama and French (1993) time series framework. Monthly excess returns on bonds are regressed on the market risk premium, term structure factors, TERM and DEF, and the mimicking returns on LEV and LIQ. The basic asset pricing question tested in this study concerns how the LEV and the LIQ factors perform in explaining cross sectional variation in bond returns.

The Fama and French (1993) three factor and five factor models and a proposed seven factor model using data from the period from January 2002 to December 2012 are tested in this study. These are listed below:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i\, TERM_t + d_i DEF_t + e_{i,t} \qquad [4.4]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i\, TERM_t + d_i DEF_t + s_i SMB_t + h_i HML_t + e_{i,t} \qquad [4.5]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i\, TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t} \qquad [4.6]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i\, TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i,t} \qquad [4.7]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i\, TERM_t + d_i DEF_t + s_i\, SMB_t + h_i HML + l_i LEV_t + sl_i LIQ_t + e_{i,t} \qquad [4.8]$$

where $R_{i,t}$ is the monthly realized bond returns on credit rating based portfolios. $R_{f,t}$ is the one month U.S. Treasury bill rate and $R_{m,t}$ is the monthly value weighted stock return index from CRSP. DEF, TERM refer to default risk and term risk; SMB, HML, LEV and LIQ are monthly returns on mimicking portfolios for ME, BEME, leverage and issued amount of bond (AISD) (proxy for liquidity); α_i is the intercept; d_i and t_i are the coefficients on default risk and term risk; while s_i, h_i, l_i and sl_i are the coefficients on SMB, HML, LEV and LIQ respectively; and $e_{i,t}$ is the error term.

Models 4.4 and 4.5 are Fama and French (1993) original three and five factor models. In Models 4.6 and 4.7, LEV and LIQ factors are added to model 4.4 respectively. Finally, Model 4.8 combines all the bond factors and the Fama and French (1993) equity factors. A series of robustness checks are conducted by re-estimating for Models 4.6, 4.7 and 4.8 using monthly excess realized bond returns on 25 ME/BEME based portfolios (Section 4.6.1) and pre-GFC period (Section 4.6.2).

4.5 Results

Tables 4.7A and 4.7B present the Fama and French (1993) three-factor and five factor models using monthly realized bond excess returns over a period of January 2002 to December 2012. The R-square ranges from 0.13 for low-grade bonds to 0.98 for high-grade bonds. For high-grade bonds, TERM and DEF factors clearly explain the variation in bond returns. However, for low grade bonds, there appears to be considerable variation left unexplained. It is important to note that the market risk premium, SMB and HML factors are unable to capture this unexplained variation in bond returns. Overall my findings are consistent with Fama and French (1993).

Table 4.7A - 3 factor bond pricing model using realized bond returns

$$R_{i.t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + m_i\, TERM_t + d_i\, DEF_t + e_{i,t}$$

Dependent variable: Excess returns on 4 bond portfolios formed on credit ratings

	Aaa	A	Baa	LG
(β)	0.01	0.001	-0.02	-0.21
t(β)	0.93	0.36	-0.64	-2.76
(m)	0.17	0.59	3.52	5.68
t(m)	0.29	1.87	2.67	1.59
(d)	0.95	0.99	1.07	0.33
t(d)	34.55	66.30	17.11	1.98
R-square	0.92	0.98	0.76	0.13
s(e)	0.01	0.003	0.01	0.04
(α)	0.001	0.0001	-0.001	-0.01
t(α)	0.68	0.79	-1.07	-0.88

Table 4.7A presents the regressions of US monthly realized excess bond returns on the excess realized stock market return, TERM and DEF factors for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term government bond return observed at the end of the month (from Federal Reserve Bank of ST LOUIS website) and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term government bond return observed at the end of the month and one month T-Bill rate. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

Table 4.7B - Fama French 5 factor model using realized bond returns

$$R_{i.t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + s_i\ SMB_t + h_i\ HML_t + m_i\ TERM_t + d_i\ DEF_t + e_{i,t}$$

Dependent variable: Excess returns on 4 bond portfolios formed on credit ratings

	Aaa	A	Baa	LG
(β)	0.01	0.01	-0.03	-0.25
t(β)	0.67	1.92	-0.95	-2.64
(s)	0.04	-0.04	-0.01	0.1
t(s)	1.65	-2.88	-0.25	0.6
(h)	-0.02	-0.01	0.04	0.05
t(h)	-0.99	-0.99	0.98	0.38
(m)	0.11	0.73	3.43	5.25
t(m)	0.18	2.41	2.56	1.44
(d)	0.95	0.99	1.07	0.33
t(d)	34.41	69.08	17.00	1.92
Rsquare	0.93	0.98	0.76	0.14
s(e)	0.01	0.003	0.01	0.04
(α)	-0.02	0.0001	-0.0001	-0.01
t(α)	-0.99	0.55	-0.99	-0.8

Table 4.7 B presents the regressions of US monthly realized excess bond returns on the excess realized stock market return and mimicking return for SMB, HML, TERM and DEF for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. SMB and HML factors are the monthly mimicking portfolio returns extracted from Kenneth R. French Data library. The DEF factor is the difference between the monthly long-term government bond return observed at the end of the month (from Federal Reserve Bank of ST LOUIS website) and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term government bond return observed at the end of the month and ONE month. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios re used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.5.1 Equity Market Risk Premium, TERM, DEF and LEV

Table 4.8 contains results for Model 4.5 and presents the estimates of factor sensitivities for excess equity market return, TERM, DEF and LEV factors using credit rating portfolios for the period from January 2002 to December 2012. With the exception of the LG portfolio, the DEF factor captures almost all the variation in bond returns. The t-statistics for the DEF coefficients are large, positive and highly significant. The t-statistics for the TERM coefficients are significant for two of the four bond portfolios, Baa and the LG portfolio. The LEV coefficients are insignificant for all credit rating portfolios. It is surprising to note that the market risk premium is negative and significant for LG portfolio only, similar to Table 4.7A[20]. This result is not consistent with previous findings reported by Fama and French (1993) study.

Table 4.8 – 4 factor bond pricing model using credit rating bond portfolio returns

$$R_{i.t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t}$$

	Aaa	A	Baa	LG
(β)	0.01	0.001	-0.01	-0.22
t(β)	0.76	0.46	-0.53	-2.72
(m)	-0.02	0.56	3.30	8.69
t(t)	-0.04	1.68	2.35	2.12
(d)	0.95	0.99	1.07	0.40
t(d)	35.23	67.70	17.50	2.25
(l)	0.003	0.002	0.002	-0.01
t(l)	1.03	-0.16	0.18	-1.28
R-square	0.92	0.98	0.76	0.15
s(e)	0.01	0.00	0.01	0.00
(α)	0.001	0.001	-0.001	-0.01
t(α)	1.00	0.72	-0.90	-1.35

Table 4.8 presents the regressions of monthly realized excess bond returns on the excess realized stock market return TERM, DEF and mimicking returns for LEV. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.5.2 Equity Market Risk Premium, TERM, DEF, LEV and LIQ

Estimates of factor sensitivities for the equity market risk premium, term structure factors, LEV and LIQ for the credit rating portfolios (Model 4.6) for the period January 2002 to December 2012 are presented in Table 4.9. These results show that among the four factors, the DEF factor is highly significant. The t-statistics for the TERM factor coefficients are only significant for the A grade bond portfolio.

[20] Results reported in section 4.6.2.1 indicates that this result is GFC driven.

The market risk premium coefficients are not significant for any of the four credit rating portfolios. The t-statistics for the LIQ coefficients are positive and significant for high grade bond portfolios (A and Aaa grade bond portfolio) but negative and significant for low grade bond portfolio (Baa and LG grade bond portfolio). Consistent with findings from Table 4.8, the t-statistics for the LEV coefficients are not significant for any of the four credit rating portfolios. Note the significant improvement of R-square for LG bond portfolio when LIQ is added. It appears LIQ factor is important in pricing LG bonds.

Table 4.9 – 5 factor bond pricing model using realized credit rating bond portfolio returns

$$R_{i.t} - R_{f.t} = \alpha_i + \beta_i \left[R_{m.t} - R_{f.t}\right] + t_i TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i.t}$$

	Aaa	A	Baa	LG
(β)	-0.001	-0.00	0.04	-0.14
t(β)	-0.27	-0.73	1.48	-1.65
(t)	0.38	0.82	1.63	5.90
t(t)	0.63	2.53	1.34	1.47
(d)	0.96	0.99	1.03	0.33
t(d)	36.87	71.73	19.74	1.95
(l)	0.003	0.002	0.002	0.001
t(l)	1.58	0.45	-0.85	-1.86
(sl)	0.002	0.001	-0.01	-0.01
t(sl)	3.20	3.75	-6.50	-3.29
R-square	0.93	0.98	0.83	0.23
s(e)	0.001	0.001	0.01	0.04
(α)	0.001	0.001	-0.001	-0.01
t(α)	1.21	0.96	-1.40	-1.58

Table 4.9 presents the regressions of monthly realized excess bond returns on the excess realized stock market return, TERM, DEF and mimicking returns for LEV & LIQ for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for Liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.5.3 Stock Market Factors (market risk premium, SMB, HML) and bond market factors (DEF, TERM and LEV) and LIQ

Table 4.10 contains results for Model 4.8 and presents the estimates for the factor sensitivities for the market risk premium, SMB, HML, DEF, TERM and LEV factors for the credit rating portfolios. These results indicate that the bond market factors exhibit substantial explanatory power for the bond returns. While the stock market factors do not add noteworthy explanatory power to the bond factor model. The t-statistics for the DEF coefficients are large, positive and significant for three out of four portfolios (Aaa, A, Baa). However, the t-statistics for the TERM coefficients are only significant for A-grade bond portfolio. The LEV factor is insignificant for all portfolios, indicating the LEV factor does not add explanatory power to the model. Similarly, the market risk premium, SMB and HML are not significant for any of the four credit rating portfolios. Consistent with findings in Table 4.9, the t-statistics for the LIQ coefficients are positive and significant for high-grade bond portfolios (Aaa and A) but negative and significant for the low-grade bond portfolios (Baa and LG). It appears that stock market factors are not important in pricing bond returns, though holding period returns are sensitive to the LIQ factor.

Table 4.10 – 7 factor bond pricing model using realized credit rating bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i\,TERM_t + d_i DEF_t + s_i\,SMB_t + h_i HML_t + l_i LEV_t + sl_i LIQ_t + e_{i,t}$$

	Aaa	A	Baa	LG
(β)	-0.01	0.00	0.04	-0.15
t(β)	-0.58	0.58	1.29	-1.55
(t)	0.29	0.95	1.68	5.63
t(t)	0.48	2.99	1.37	1.38
(d)	0.95	1.00	1.04	0.33
t(d)	36.96	73.58	19.88	1.90
(s)	0.05	-0.03	-0.07	0.04
t(s)	2.19	-2.17	-1.41	0.28
(h)	-0.02	-0.01	0.04	0.03
t(h)	-0.92	-1.24	1.08	0.28
(l)	0.0001	0.0003	-0.0001	0.0002
t(l)	1.64	0.48	-0.90	-1.83
(sl)	0.001	0.001	-0.001	-0.01
t(sl)	3.40	3.74	-6.64	-3.22
R-square	0.93	0.98	0.84	0.23
s(e)	0.01	0.00	0.01	0.04
(α)	0.00002	0.00001	-0.0001	-0.01
t(α)	1.32	0.72	-1.46	-1.46

Table 4.10 presents the Regressions of monthly realized excess stock returns on the bond market returns DEF, TERM, LEV and the stock-market returns, $R_{m,t} - R_{f,t}$, SMB, HML and LIQ for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. SMB and HML are the monthly mimicking portfolio returns extracted from Kenneth R. French Data library. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for Liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.6 Robustness Checks

4.6.1 ME/BEME based Portfolios

4.6.1.1 Equity Market Risk Premium, TERM, DEF and LEV

Table 4.11 shows the estimates of factor sensitivities for excess market return, TERM, DEF and LEV factors (Model 4.6) for the 25 ME and BEME portfolios for period January 2002 to December 2012. With four exceptions, the market risk premium is not significant, indicating that market factor has almost no explanatory power for corporate bond returns.

The TERM factor is significant for 8 out of 25 portfolios. The DEF factor captures considerable variation in bond returns. The t-statistics for the DEF coefficients are positive, for all but one instance, and highly significant. The DEF coefficients do not follow any discernible pattern across size or BEME quintiles. The coefficients for the LEV factor are statistically significant for two portfolios. On average the R-square values are around 0.57. The only R-square values exceeding 0.90 are for the small-ME and high-BEME portfolios. One possible explanation could be that the small-ME and the high- BEME portfolios consist of bonds issued by firms that tend to have lower earnings and are relatively distressed and thus load strongly on the DEF factor. In sum, the bond returns strongly load on the DEF factor.

Table 4.11 – 4 factor bond pricing model using realized ME/BEME bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i\,[R_{m,t} - R_{f,t}] + t_i TERM_t + d_i DEF_t + l_i LEV_t + e_t$$

Dependent variable : Excess bond returns on 25 bond portfolios formed on size and book-to-market equity
Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(b)					t(b)		
Small	-0.22	-0.36	-0.13	0.00	0.00	-1.20	-2.73	-0.88	0.04	0.44
2	-0.10	-0.35	-0.04	0.01	0.01	-2.41	-2.80	-1.06	0.58	0.86
3	-0.03	0.01	-0.07	-0.02	0.02	-0.64	0.22	-1.96	-0.66	1.27
4	-0.03	-0.02	-0.05	-0.02	-0.03	-1.11	-0.35	-1.40	-0.74	-0.86
Big	-0.05	-0.03	-0.01	-0.05	-0.02	-1.20	-0.92	-0.29	-1.49	-0.40
			(t)					t(t)		
Small	16.35	14.49	8.47	4.59	0.98	1.38	2.21	1.15	0.96	1.46
2	2.51	5.13	3.84	0.82	1.03	0.88	0.83	2.05	0.90	1.58
3	-0.69	5.74	0.54	2.89	2.60	-0.28	2.00	0.30	1.77	2.60
4	1.75	5.99	3.76	0.98	1.33	1.48	1.91	2.06	0.87	0.73
Big	3.83	2.78	5.31	3.45	-1.28	1.67	1.94	3.27	2.09	-0.57
			(d)					t(d)		
Small	0.17	0.66	0.89	1.07	0.92	0.40	2.33	2.78	5.13	31.17
2	0.84	0.74	1.09	0.94	1.04	9.15	2.63	13.37	23.62	36.42
3	0.76	0.62	0.94	1.08	0.95	6.99	4.93	11.79	15.18	21.81
4	1.00	0.66	0.91	1.07	0.80	19.50	4.83	11.48	21.58	9.18
Big	0.82	0.75	1.01	1.15	1.05	8.25	11.96	14.34	15.91	9.54
			(l)					t(l)		
Small	-0.01	-0.01	0.00	0.00	0.00	-1.95	-3.08	-1.52	-0.95	0.91
2	0.00	0.00	0.00	0.00	0.00	-0.69	0.18	1.77	0.24	0.49
3	0.00	0.00	0.00	0.00	0.00	0.53	-1.59	-0.34	2.37	-1.71

4	0.00	0.00	0.00	0.00	0.00	0.57	1.69	0.83	1.22	0.17
Big	0.00	0.00	0.00	0.00	0.00	0.42	-1.53	-0.20	-0.11	-0.12
			R-Square					s(e)		
Small	0.06	0.19	0.10	0.21	0.91	0.10	0.06	0.07	0.05	0.01
2	0.55	0.15	0.67	0.85	0.93	0.02	0.06	0.02	0.01	0.01
3	0.34	0.22	0.59	0.72	0.83	0.02	0.03	0.02	0.01	0.01
4	0.80	0.28	0.60	0.83	0.51	0.01	0.03	0.02	0.01	0.02
Big	0.44	0.60	0.70	0.73	0.51	0.02	0.01	0.01	0.01	0.02
			(α)					t(α)		
Small	-0.03	-0.01	-0.003	-0.002	0.001	-1.34	-1.30	-0.19	-0.01	0.24
2	0.00	0.0001	-0.01	0.0001	-0.002	0.04	0.20	-1.74	0.35	-0.82
3	0.01	-0.01	0.00	-0.01	0.02	1.11	-2.70	0.05	-1.74	1.27
4	0.0001	-0.01	-0.001	-0.001	0.0003	0.04	-1.41	-1.25	-0.32	0.48
Big	-0.05	-0.001	-0.01	-0.001	0.0002	-1.20	-0.02	-2.08	-0.77	0.92

Table 4.11 presents the regressions of monthly realized excess bond returns on the excess realized stock market return TERM, DEF and mimicking returns for LEV for a period from Jan 2002 to Dec 2012. $\mathbf{R}_{\mathbf{m},t}$ is the value of monthly weighted return index from CRSP. $\boldsymbol{R}_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. In order to form the 25 portfolios, we sort the bonds in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.6.1.2 Equity Market Risk Premium, TERM, DEF, LEV and LIQ

Table 4.12 reports estimates of market risk premium, TERM, DEF, LEV and LIQ (Model 4.7) for the 25 ME and BEME portfolios. The results are largely consistent with findings shown in Table 4.11. The market risk premium is insignificant for all the 25 portfolios, implying that the market factor has almost no explanatory power for bond returns. With one exception, the t-statistics for the DEF coefficients are large, positive and highly significant, indicating that the DEF factor captures much of the variation in bond returns. The t-statistics for the TERM coefficients are significant for only 4 of the 25 portfolios. However, the t-statistic for the LIQ coefficients exhibit significance for 16 out of 25 portfolios and the coefficients generally have negative sign, implying that the LIQ factor has considerable explanatory power for bond returns. There is little evidence of the positive coefficients reported for Aaa and A portfolios in Table 4.9 when using the ME/BEME based portfolios. Further, when LIQ is added as an explanatory variable, the R-square values remain little changed. Overall, the DEF factor appears to dominate all the explanatory variables in the regression as it captures much of the cross sectional variation in the bond returns.

Table 4.12 – 5 factor bond pricing model using realized ME/BEME bond portfolio returns:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_f, t] + t_i TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i,t}$$

Dependent variable : Excess bond returns on 25 bond portfolios formed on size and book-to-market equity

Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(b)					t(b)		
Small	-0.05	-0.21	0.09	0.14	-0.01	-0.27	-1.62	0.62	1.50	-0.76
2	-0.07	-0.23	0.02	0.01	0.00	-1.81	-1.81	0.47	0.31	-0.01
3	-0.02	0.07	-0.06	0.01	0.03	-0.49	1.21	-1.51	0.43	1.45
4	-0.01	0.05	-0.02	0.02	-0.02	-0.59	0.78	-0.44	1.02	0.57
Big	-0.03	0.00	0.03	-0.01	-0.03	-0.71	0.11	1.15	-0.19	-0.53
			(t)					t(t)		
Small	11.14	9.86	1.49	0.26	1.50	0.96	1.54	0.22	0.06	2.31
2	1.64	1.03	2.02	0.97	1.40	0.57	0.17	1.17	1.04	2.15
3	-0.89	3.88	0.11	1.75	2.43	-0.35	1.37	0.06	1.10	2.38
4	1.37	3.71	2.65	-0.24	1.03	1.14	1.22	1.47	-0.24	0.55
Big	3.16	1.83	3.86	2.07	-1.07	1.35	1.30	2.53	1.32	-0.47
			(d)					t(d)		
Small	0.03	0.55	0.72	0.97	0.93	0.09	2.02	2.47	5.02	33.31
2	0.82	0.70	1.05	0.94	1.05	8.97	2.56	14.12	23.47	37.50
3	0.75	0.57	0.93	1.05	0.94	6.87	4.73	11.59	15.42	21.53
4	0.99	0.61	0.89	1.04	0.79	19.30	4.64	11.46	23.75	8.98
Big	0.81	0.73	0.98	1.11	1.06	8.06	12.01	14.98	16.49	9.52
			(l)					t(l)		
Small	-0.01	-0.01	-0.01	-0.001	0.0001	-2.46	-3.76	-2.44	-1.77	1.57
2	-0.002	-0.001	0.0001	0.0001	0.0002	-0.87	-0.45	1.12	0.36	0.93
3	0.0004	-0.001	-0.001	0.0002	-0.001	0.46	-2.15	-0.52	1.90	-1.81

4	0.002	0.0002	0.001	0.003	0.001	0.32	1.18	0.37	0.44	0.07
Big	0.0002	-0.001	-0.001	-0.001	-0.002	0.20	-2.10	-0.96	-0.80	-0.04
			(sl)					t(sl)		
Small	-0.03	-0.02	-0.04	-0.02	0.001	-2.86	-3.44	-4.84	-4.56	3.78
2	-0.001	-0.02	-0.01	0.0001	0.0002	-1.49	-3.07	-4.97	0.75	2.66
3	-0.002	-0.01	0.001	-0.01	-0.002	-0.36	-3.12	-1.09	-3.40	-0.77
4	-0.001	-0.01	-0.01	-0.01	-0.001	-1.48	-3.53	-2.91	-5.69	-0.77
Big	-0.001	-0.003	-0.01	-0.01	0.0002	-1.36	-3.20	-4.53	-4.15	0.58
			R-Square					s(e)		
Small	0.14	0.27	0.26	0.34	0.92	0.08	0.06	0.06	0.04	0.01
2	0.56	0.22	0.74	0.85	0.93	0.02	0.06	0.02	0.01	0.01
3	0.34	0.29	0.59	0.75	0.83	0.02	0.03	0.02	0.01	0.01
4	0.80	0.36	0.63	0.87	0.51	0.01	0.03	0.02	0.01	0.02
Big	0.45	0.63	0.75	0.77	0.51	0.02	0.01	0.01	0.01	0.02
			(α)					t(α)		
Small	-0.04	-0.02	-0.01	0.14	0.0002	-1.52	-1.54	-0.46	1.50	0.45
2	0.00	0.00	-0.01	0.01	-0.001	0.08	0.08	-2.18	0.31	-0.71
3	-0.02	-0.02	0.001	-0.01	0.0001	-0.49	-2.97	0.01	-1.99	1.45
4	-0.001	-0.01	-0.001	-0.001	0.0001	-0.04	-1.66	-1.44	-0.66	0.45
Big	-0.001	-0.001	0.03	-0.001	0.0002	-0.27	-0.19	1.15	-1.04	0.96

Table 4.12 presents the regressions of monthly realized excess bond returns on the excess realized stock market return, TERM, DEF and mimicking returns for LEV & LIQ factors for a period from Jan 2002 to Dec 2012. $\boldsymbol{R_{m,t}}$ is the value of monthly weighted return index from CRSP. $\boldsymbol{R_{f,t}}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for Liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. In order to form the 25 portfolios, we sort the bonds in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.6.1.3 Stock Market Factors (market risk premium, SMB, HML) and bond market factors (DEF, TERM and LEV) and LIQ

Table 4.13 reports the estimates for market risk premium, SMB, HML, TERM, DEF, LEV and LIQ factors (Model 4.8) for the 25 ME and BEME portfolios. The t-statistics for the DEF coefficients are large, positive and highly significant for almost all the portfolios (24 out of 25), indicating that the DEF factor again captures much of the variation in bond returns. The market risk premium, SMB and HML are insignificant for most of all the portfolios, indicating that equity market factors have little explanatory power for the bond returns. The t-statistics on TERM coefficients are significant for only four out of 25 portfolios. While the t-statistics on LEV coefficients are significant for only five out of 25 portfolios, the t-statistics for the LIQ coefficients are significant for more than half portfolios (16 out of 25) and virtually all with negative coefficients.

Table 4.13 – 7 factor bond pricing model using realized ME/BEME bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i TERM_t + d_i DEF_t + s_i SMB_t + h_i HML_t + l_i LEV_t + sl_i LIQ_t + e_{i,t}$$

Dependent variable : Excess bond returns on 25 stock portfolios formed on size and book-to-market equity

	Book to market equity (BEME) quintiles									
Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(b)					t(b)		
Small	-0.03	-0.28	0.29	0.30	-0.03	-0.12	-1.83	1.75	2.80	-1.66
2	-0.13	-0.15	-0.01	0.02	0.02	-2.81	-1.02	-0.15	0.99	1.19
3	-0.02	-0.02	-0.05	-0.001	0.03	-0.33	-0.32	-1.12	-0.14	1.19
4	0.001	-0.001	0.01	0.0001	-0.001	0.01	-0.03	0.28	0.04	-0.02
Big	-0.06	0.0001	0.02	-0.01	-0.04	-1.06	0.13	0.55	-2.13	-0.61
			(t)					t(t)		
Small	10.66	9.18	3.23	1.79	1.33	0.89	1.42	0.47	0.40	2.04
2	0.20	0.93	1.88	1.18	1.60	0.07	0.15	1.07	1.25	2.46
3	-0.79	3.05	0.13	1.58	2.50	-0.30	1.10	0.07	0.98	2.43
4	1.49	3.30	2.81	-0.45	1.33	1.23	1.07	1.53	-0.44	0.71
Big	2.97	1.90	3.74	1.28	-0.99	1.25	1.33	2.45	0.85	-0.45
			(d)					t(d)		
Small	0.04	0.55	0.72	0.97	0.93	0.11	1.98	2.48	5.13	33.33
2	0.85	0.63	1.06	0.95	1.05	9.46	2.33	14.15	23.52	37.83
3	0.77	0.59	0.92	1.06	0.95	6.90	5.00	11.38	15.29	21.69
4	0.99	0.61	0.88	1.04	0.80	19.11	4.65	11.29	23.72	9.09
Big	0.81	0.73	0.99	1.11	1.09	8.04	12.01	15.19	17.20	10.23
			(s)					t(s)		
Small	-0.02	0.09	-0.14	-0.16	0.02	-0.04	0.34	-0.53	-0.93	0.81
2	-0.08	0.39	-0.04	-0.05	-0.02	-0.97	1.62	-0.63	-1.35	-0.75
3	-0.09	-0.04	0.06	0.00	-0.06	-0.87	-0.36	0.76	-0.04	-1.60
4	0.02	-0.01	0.01	0.01	-0.13	0.54	-0.06	0.16	0.29	-1.53

Big	-0.02	-0.05	-0.06	0.10	-0.23	-0.27	-0.98	-1.09	1.62	-2.29
			(h)					t(h)		
Small	0.05	0.12	-0.37	-0.29	0.03	0.16	0.60	-1.79	-2.15	1.52
2	0.17	-0.33	0.08	-0.02	-0.04	2.62	-1.70	1.42	-0.56	-1.93
3	0.05	0.26	-0.05	0.05	0.03	0.60	3.05	-0.86	0.98	1.12
4	-0.05	-0.12	-0.06	0.05	0.04	-1.44	1.28	-1.03	1.46	0.67
Big	0.08	0.03	0.08	0.13	0.19	1.05	0.65	1.77	2.89	2.55
			(l)					t(l)		
Small	-0.01	-0.01	-0.001	-0.001	0.0001	-2.45	-3.71	-2.49	-1.83	1.58
2	-0.001	-0.001	0.001	0.001	0.0002	-0.74	-0.41	1.11	0.35	0.96
3	0.001	-0.001	-0.001	0.0001	-0.001	0.44	-2.26	-0.48	1.87	-1.85
4	0.001	0.001	0.0002	0.0001	0.0001	0.34	1.17	0.35	0.42	0.01
Big	0.001	-0.001	-0.001	-0.001	-0.001	0.20	-2.10	-1.02	-0.85	-0.04
			(sl)					t(sl)		
Small	-0.03	-0.02	-0.04	-0.02	0.0001	-2.87	-3.32	-4.99	-4.79	3.86
2	-0.001	-0.02	-0.01	0.00	0.0002	-1.46	-3.01	-4.95	0.64	2.61
3	-0.001	-0.01	-0.001	-0.01	-0.001	-0.43	-3.23	-1.00	-3.35	-0.89
4	-0.001	-0.01	-0.001	0.00	-0.001	-1.43	-3.49	-2.94	-5.66	-0.96
Big	-0.001	0.00	-0.01	-0.01	0.0003	-1.33	-3.24	-4.66	-4.21	0.09
			R-Square					s(e)		
Small	0.14	0.28	0.29	0.39	0.92	0.09	0.06	0.06	0.04	0.01
2	0.60	0.25	0.74	0.85	0.94	0.02	0.06	0.02	0.01	0.01
3	0.34	0.35	0.60	0.75	0.83	0.02	0.02	0.02	0.01	0.01
4	0.81	0.37	0.64	0.87	0.53	0.01	0.03	0.02	0.01	0.02
Big	0.46	0.64	0.76	0.79	0.57	0.02	0.01	0.01	0.01	0.02
			(α)					t(α)		
Small	-0.04	-0.01	-0.01	-0.001	0.0001	-1.44	-1.38	-0.71	-0.59	0.68
2	0.0001	0.0001	-0.01	0.0001	-0.001	0.69	0.09	-2.08	0.22	-0.96
3	0.0001	-0.01	0.0002	-0.01	-0.001	1.06	-2.82	0.02	-1.89	-0.39

4	-0.001	-0.01	0.00	-0.001	0.0001	-0.11	-1.54	-1.52	-0.52	0.34
Big	-0.001	0.00	-0.01	-0.001	0.0002	-0.17	-0.21	-2.46	-0.67	0.98

Table 4.13 presents the Regressions of monthly realized excess stock returns on the bond market returns DEF, TERM, LEV and the stock-market returns, $\mathbf{R_{m,t}} - \mathbf{R_{f,t}}$, SMB, HML; and LIQ for a period from Jan 2002 to Dec 2012. $\boldsymbol{R_{m,t}}$ is the value of monthly weighted return index from CRSP. $\boldsymbol{R_{f,t}}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. SMB and HML are the monthly mimicking portfolio returns extracted from Kenneth R. French Data library. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for Liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. In order to form the 25 portfolios, we sort the bonds in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.6.2 Pre-GFC Period

4.6.2.1 Equity Market Risk Premium, TERM, DEF and LEV

In order to ensure that the results for Table 4.8 are not driven by the GFC, I re-estimate Models 4.6-4.8 for the pre-GFC period. Table 4.14 shows the factor sensitivity estimates for excess market return, TERM, DEF and LEV factors using the credit rating portfolios for a period from January 2002 to August 2007 (pre-GFC period). The market risk premium is not significant for any of the four credit rating portfolios. This suggests significant negative coefficients observed for the full sample period might be driven by the GFC period. With the exception of the LG portfolio, the DEF factor captures almost all the variation in bond returns. The t-statistics for the TERM coefficients are only significant for the A grade bond portfolio.

The LEV coefficients are negative and significant for the Aaa grade bond portfolio, insignificant for the A grade bond portfolio and positive and significant for the Baa and the LG grade bond portfolios. It is surprising to note that the t-statistics for the LEV coefficients for Aaa grade bond portfolio are negative and significant. Yet, high-graded bonds have low levels of leverage and thus leverage will have little effect on returns. In effect, the LEV factor does not capture variation in high-graded bonds returns. However, loadings on leverage are significant for low-graded bonds. These lower investment grade and junk bonds have higher leverage, which induces more risk and therefore, these securities must offer higher returns to attract investment. This provides one explanation for the positive and significant LEV coefficients for Baa and LG bond portfolios.

The intercepts are not significantly different from zero for bond portfolios. The R-square values presented in Table 4.14 suggest that on average, when LEV is added as an explanatory variable to the three factor model (Table 4.7A); the R square values only improve slightly for Aaa and A bond portfolios. However, the Baa bond portfolio witnesses a substantial increase in R-square, 0.76 to 0.94. Although, the R-square value for the LG bond portfolio increases to 0.32, there is still considerable variation left to be explained by other factors. In sum, the model including both the DEF factor and LEV factors explains 95% of the variation in Aaa grade bond portfolio returns. The model capture almost all the variation in A grade bond portfolio returns. Yet, for Baa bond portfolio returns, the model explains 94% of cross sectional variation.

Table 4.14 – 4 factor bond pricing model using realized credit rating bond portfolio returns for pre-GFC period

$$R_{i.t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t}$$

	Aaa	A	Baa	LG
(β)	-0.03	0.01	0.01	-0.10
t(β)	-1.63	1.20	0.76	-1.08
(t)	0.87	0.74	1.02	4.31
t(t)	1.67	3.27	1.72	1.39
(d)	0.91	1.05	1.01	0.57
t(d)	31.19	83.11	30.58	3.32
(l)	-0.001	-0.0001	0.0001	0.001
t(l)	-2.05	-0.75	3.20	2.28
R-square	0.95	0.99	0.94	0.32
s(e)	0.001	0.001	0.001	0.03
(α)	-0.001	0.0002	0.0001	0.0001
t(α)	-0.94	0.34	0.69	0.66

Table 4.14 presents the regressions of monthly realized excess bond returns on the excess realized stock market return, TERM, DEF and mimicking returns for LEV for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.6.3.2 Equity Market Risk Premium, TERM, DEF, LEV and LIQ

Table 4.15 presents the factor sensitivities for the market risk premium, term structure factors, LEV and LIQ for pre GFC period (January 2002 – August 2007). Consistent with Table 4.9 results, the DEF factor exhibits high t-statistics, and the t-statistic for the TERM coefficient are generally positive and significant for the A grade bond portfolio. Comparing the full sample period results (Table 4.9) with pre-GFC period results (Table 4.15), it appears that the GFC period might have changed the return structure of the bonds.

For the pre-GFC period, the LIQ factor exhibits explanatory power for the low grade bond portfolio (Baa portfolio) only. However, when the GFC period is included in the regression tests, the LIQ factor captures variation for all the credit rating bond portfolios indicating that GFC might have led to a change in basic pricing relationship in bond returns. The R-square values presented in panel C are consistent with Table 4.6 (Panel –C) values. Lastly Panel C shows that for all the credit rating portfolios, the intercepts are not significantly different from zero.

Even after adding LIQ as an explanatory variable, the R-square for the LG bond portfolio does not improve, indicating the bond pricing model needs further development if it is to explain variation in the LG bonds.

Table 4.15 – 5 factor bond pricing model for pre-GFC period

$$R_{i.t} - R_{f.t} = \alpha_i + \beta_i\,[R_{m.t} - R_{f.t}] + t_i TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i.t}$$

	Aaa	A	Baa	LG
(β)	-0.03	0.01	0.02	-0.10
t(β)	-1.59	1.13	1.01	-1.00
(t)	0.86	0.77	0.81	3.94
t(t)	1.60	3.31	1.40	1.24
(d)	0.91	1.05	1.01	0.57
t(d)	30.93	82.67	31.81	3.32
(l)	-0.001	0.0001	-0.01	0.0002
t(l)	-0.94	0.35	-1.01	0.10
(sl)	-0.001	0.0001	-0.01	-0.01
t(sl)	-0.23	0.66	-2.36	-0.76
R-square	0.95	0.99	0.95	0.32
s(e)	0.001	0.001	0.001	0.03
(α)	-0.0001	0.0001	0.0001	-0.0001
t(α)	-0.85	0.72	-1.24	-0.12

Table 4.15 present the Regressions of monthly realized excess bond returns on the excess realized stock market return, TERM, DEF and mimicking returns for LEV & LIQ for a period from Jan 2002 to Aug 2007. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for Liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.6.3.3 Stock Market Factors (market risk premium, SMB, HML) and bond market factors (DEF, TERM and LEV) and LIQ

Table 4.16 presents the factor sensitivities for the bond market factors and equity market factors. The results are consistent with those in Table 4.15. The DEF factor shows high t-statistics for all the four portfolios. While the TERM factor is significant for the A-grade bond portfolio only. As noted in Table 4.9, the LIQ factor explanatory power diminishes for all the portfolios but the Baa-grade portfolio. The market risk premium, HML and LEV are insignificant for all the portfolios.

However, the t-statistics for SML coefficients are generally negative and significant for the Baa-grade bond portfolio. The R-square values are consistent with those in Table 4.15. Hence, stock market factors do not appear to be important in bond pricing.

Similar results are noted for pre-GFC period for ME/BEME analysis (not reported separately here).

Table 4.16 - Fama French 7 factor model for Pre-GFC period

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + t_i\, TERM_t + d_i DEF_t + s_i SMB_t + h_i HML_t + l_i LEV_t + sl_i LIQ_t + e_{i,t}$$

	Aaa	A	Baa	LG
(β)	-0.03	0.01	0.02	-0.05
t(β)	-1.61	1.44	1.24	-0.44
(t)	0.73	0.86	0.97	4.93
t(t)	1.32	3.60	1.66	1.52
(d)	0.90	1.05	0.02	0.57
t(d)	29.27	79.10	31.27	3.15
(s)	0.04	-0.02	-0.05	-0.17
t(s)	1.49	-1.49	-2.10	-1.17
(h)	0.00	-0.01	0.01	-0.09
t(h)	-0.07	-0.68	0.36	-0.52
(l)	-0.001	-0.002	0.0001	-0.0001
t(l)	-0.74	0.31	-1.31	0.05
(sl)	-0.001	0.002	-0.01	-0.01
t(sl)	-0.06	0.59	-2.65	-0.83
R-square	0.95	0.99	0.95	0.35
s(e)	0.001	0.001	0.001	0.03
(α)	-0.0001	0.0002	-0.0001	-0.0001
t(α)	-0.52	0.56	-1.62	-0.20

Table 4.16 presents the regressions of monthly realized excess stock returns on the bond market returns DEF, TERM, LEV and the stock-market returns, $R_{m,t} - R_{f,t}$, SMB, HML and LIQ for a period from Jan 2002 to Aug 2007. $R_{m,t}$ is the value of monthly weighted return index from CRSP. $R_{f,t}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and one month US Treasury Bill rate. SMB and HML are the monthly mimicking portfolio returns extracted from Kenneth R. French Data library. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for Liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

4.7 Conclusion

This chapter provides analysis of the factors explaining variation in US corporate bond returns using individual corporate bond data within the Fama and French (1993) framework. The data sample is obtained from the Datastream database for a period from January 2002 to December 2012. Factors considered are the stock market risk premium, TERM, DEF, and mimicking portfolios returns on SMB, HML, LIQ and LEV. Following Fama and French (1993), I use two portfolio construction approaches; one is based on credit ratings, and the other is based on issuing firm equity characteristic (ME and BEME) breakpoints. As a base case, the Fama and French (1993) three factor and five factor models are tested using US corporate bond returns. The results are consistent with the Fama and French (1993) findings. I find that with the exception of the LG grade bond portfolio, the TERM and the DEF factors explain most of the variation in credit rating based bond portfolio returns. Moreover, SMB and HML factors have limited explanatory power over bond returns.

Building on the theoretical relationship between leverage and bond returns, as well as empirical evidence that liquidity is priced in bond returns, I extend the Fama and French (1993) three factor model by including mimicking returns on LEV and LIQ factors. The tests are conducted for both full sample and pre-GFC periods. The DEF factor dominates all other factors for both full and pre-GFC samples, capturing most of the cross sectional variation in the bond returns. The LEV factor is insignificant for all the credit rating portfolios for the full sample period. However, for the pre-GFC period, the LEV factor is priced for the low credit rating portfolios. As indicated in Section 4.3.6 (Figure 4.3), the low credit rating firms exhibit high levels of leverage indicating that investors require a higher premium for high levels of leverage. When the LIQ factor is added as an explanatory variable, the LEV factor loses explanatory power. The LIQ factor exhibits explanatory power for all the credit rating portfolios for the full sample period. However, when the 6 factor model is re-estimated for the pre-GFC period, the LIQ factor loses its explanatory power for each of the credit rating portfolios, except for the Baa grade bond portfolio. Prior to the GFC, the LIQ factor was priced only for the low grade bond portfolio returns. In sum the GFC has an impact on the basic pricing relationship evident in bond returns.

These results suggest several avenues for further research. First, the LIQ and the LEV factors may be tested in other bond markets to assess whether these results are robust across different bond markets. Second, the impact of the LIQ factor could be further investigated to assess the importance of crises on this factor and its impact on bond prices more generally.

Chapter 5 – Factors Explaining Variation in European Corporate Bonds

5.1 Introduction

The G30 Report "Long Term Finance and Economic Growth", published in March 2013, stresses the use of the debt market as a potential source of financing rather than through banking systems. In order to encourage expansion of the European corporate bond market, it is critical to explore the market in terms of pricing mechanisms. Bruno Biais and Dow (2006) state that in Europe, the bond market dominates the equity market, with its capitalization equal to two-thirds of the capitalization of the equity market. Despite the key role of the bond markets in Europe, there has been much less academic attention devoted to European bond markets. Thus, in order to better understand the European bond market, it is worthwhile investigating whether this bond market behaves in a similar manner to the US bond market and whether common risk factors capturing variation in US bonds also hold for European bonds. Specifically, in this chapter, I provide a study of the cross section of European corporate bond returns and evaluate how certain bond market factors fare against one another in explaining European bond return variation.

Recent empirical work on US corporate bonds (Fama and French (1993) and Gebhardt et al. (2005a)) rely on a two factor asset pricing model based on the DEF and TERM factors in pricing corporate bonds. Further, Lin et al. (2011) suggest that liquidity risk is priced in the US corporate bond market. Similarly, for the European market, Houweling et al. (2005) find that, despite the importance of liquidity risk in the corporate bond pricing models, there are few academic studies on bond liquidity. In their study, Houweling et al. (2005) use the Brennan and Subrahmanyam (1996) methodology to study the pricing of liquidity risk in the cross-section of European corporate bonds. Overall, their study concludes that at an aggregate level, with respect to the credit risk factor, illiquidity is a key factor in explaining time variation in bond indices for different ratings. Thus, in light of the findings by Houweling et al. (2005), I include a liquidity factor to explore its explanatory power within the Fama and French (1993) framework.

Pogue and Soldofsky (1969) show that the probability of higher bond rating in the US market is inversely related to leverage and directly related to firm size and profitability. They further suggest that leverage and profitability influence corporate bond ratings. Thus, a leverage factor, measured as the ratio of long–term debt to market capitalization of equity, is included in the asset pricing tests.

Analysis draws on the Fama and French (1993) time series framework using European data for the period from January 2002 to December 2012. When the Fama French (1993) three factor asset pricing model is tested on European bond return data, the results are consistent with the Fama and French (1993) findings and my US findings (Chapter 4), indicating that DEF factor captures much of the variation in the European bond returns. Unlike the US findings, the liquidity and leverage factors add little explanatory power to the model developed here.

The rest of the chapter proceeds as follows. Section 5.2 reviews the related literature. Section 5.3 discusses the data used in the study. Section 5.4 details the methodology. Section 5.5 presents the core results, while the last section concludes.

5.2 Review of Related Literature

Section 5.2.1 explores international bond studies conducted to explain the variation in bond returns. Section 5.2.2 examines the impact of liquidity on bond pricing. Section 5.2.3 elaborates the importance of credit rating information in making investment decisions and highlights the relevance of US credit ratings for international bond markets.

5.2.1 International Bond Studies

The international asset pricing models of Solnik (1974), Stulz (1981) and Adler and Dumas (1983) identify global risk factors as possible explanations for differential expected returns for assets traded in different countries. Yet, few studies analyse government bond markets outside the US market. For example, Ilmanen (1995) analyses time variation in long-term government bond excess returns in six countries to examine whether this variation can be explained with a simple asset pricing model. The study documents that when relative wealth is low and real bond yields and term spreads are high, excess bond returns in all six countries are high. Ilmanen (1995) concludes that expected excess returns are highly correlated across international bond markets and one global risk factor (based on wealth-dependent relative risk aversion) is able to capture almost all the variation in the international bond returns. However, Driessen et al. (2003) analyse government bond returns across the US, Germany and Japan for different maturities and identify five common factors that determine international government bond returns. Pérignon et al. (2007) also examine the possibility of a common factor explaining the term structure of US, German and Japanese Government bond returns with different maturities. They conclude that a single global risk factor related to changes in the level of the term structure is sufficient to explain international bond returns. Overall, there is little evidence of research that studies common risk factors which capture the cross-section of average returns in European corporate bonds within the Fama and French (1993) framework. As previously mentioned, the bond market dominates the equity market in Europe. Thus, it is useful to explore the common risk factors that capture variation in European corporate bonds, not only to better understand the market, but also to help investors in their investment decisions.

5.2.2 Bond Returns and Liquidity Factors

Chapter 4 explores the literature on liquidity, indicating that liquidity risk maybe a priced factor in corporate bond returns. The G30 Report "Long Term Finance and Economic Growth", published in March 2013, emphasizes the importance of liquidity in long-term financing, but does not elaborate on the role of liquidity with respect to bond secondary markets. In secondary markets, transaction costs and liquidity are important as these characteristics of the market could affect market yields that corporates must offer on their bond issues to attract investors. As compared to US bonds, there are fewer studies investigating the effect of liquidity risk in the pricing of European Corporate bonds (Houweling et al., 2005). Overall, liquidity shocks are assumed to have a substantial effect on bonds and so, it is important to study the effect of liquidity risk in analysis of bond holding period returns for international corporate bond markets as well as for the U.S market. In view of the support from the literature (discussed in Chapter 4), I use the 'issued amount of bond' as a proxy for liquidity in this study.

5.2.3 Bond Credit Ratings

The influence of credit rating on European bond prices does not appear to have been well-researched to date (Steiner and Heinke, 2001). Steiner and Heinke

(2001) note that there are still doubts as to whether non-US investors rely on US rating agencies for their investment decisions and, moreover, if the US rating agencies provide relevant information for the pricing of European bonds.

Chamberlain et al. (1995) argue that, if the US based ratings agencies, which rate international bond issues, lack country-specific credit standards knowledge, then it is possible that non-US bond ratings are more informative than US bond ratings. Further, Warga (1997) shows that the relationship between excess bond returns and rating actions in the international markets appears to be independent of rating agency. However, Steiner and Heinke (2001) show that the relevance of US credit ratings is increasing in international markets, especially in the European market. In their study, Steiner and Heinke (2001) examine whether US credit rating agencies provide relevant information for international capital markets as well as whether non-US investors rely on US rating agencies for their financial decisions. They observe significant bond price reactions to downgrade announcements and negative watch-listing; while bond upgrade announcements and positive watch-listing do not result in increased bond prices. Furthermore, they conclude that in addition to actual yield level and issuer type, issuer nationality is a key determinant of price reaction after downgrades (Steiner and Heinke, 2001). Overall, US credit ratings appear to be relevant for the international bond markets. Thus, I use Standard and Poor (S&P) ratings of European bonds in this study.

5.3 Data

5.3.1 Data Sources of Bond Prices

I use Datastream International in this study because it covers both active and inactive international corporate bond historical data. Moreover, Datastream offers access to a large number of European bonds, along with fairly extensive bond specific information. The focus on Datastream bond data and its comparison with alternate databases is addressed in detail in chapter 4 (section 4.3.1).

5.3.2 The Datastream Database

The European corporate bonds and equity data used in this study are drawn from Datastream and cover the period from January 2002 to December 2012. All European bonds data is extracted in US Dollars to reflect investment in European bonds for a US investor. The monthly total return index (RI) from Datastream is used in calculation of holding period return estimates for all the available European corporate bonds.

The initial sample consists of 1,212 European corporate bonds with 46,238 monthly observations over a period of 132 months. The monthly data for credit ratings (BSPL), amount issued (AISD) and the one month US Treasury Bill rate is also extracted from Datastream. To be included in the sample for any month, each bond must have data for RI, BSPL and AISD. The resulting sample contains 689 corporate bonds with 30,842 bond-month observations.

As mentioned in chapter 4, Datastream does not have a common identifier to match bond issuers with the parent equity companies. Hence, I maintained two separate data sets; one for creating credit rating portfolios and the second for creating ME and BEME portfolios.

For the ME and BEME portfolio sample data, the bond issuers are matched with the parent equity companies. This process reduces the sample size to 435 bonds, however the total number of bonds varies each year. The monthly data for share market value (MV) and market to book value of equity (MTBV) is collected from

Datastream for companies that issued or guaranteed the debt. To be included in the ME and BEME portfolios sample in any month; each bond must have data for RI, AISD, MV, MTBV, and BSPL for the issuing company equity. The resulting sample contains 435 European corporate bonds with 17,565 bond-month observations. Overall, 30,842 bond-month observations are used for forming credit rating portfolios, while 17,565 bond-month observations are used for forming ME and BEME portfolios. Table 5.1 presents the sample selection process.

Table 5.1A – Sample Selection Process (2002 – 2012)

	Observation remaining
Initial Data (1,212 European corporate bonds)	46,238
Merging bond RI file with BSPL data (774 bonds)	42,135
Merge bond file with AISD data (750 bonds)	39,132
Filter the data file so RI, BSPL and AISD are not missing (689 bonds)	30,842
Final sample (689 bonds)	30,842

Table 5.1B – Description of sample for ME and BEME portfolio creation

	Observation remaining
Final European corporate bonds sample (689 bonds)	30,842
Matching bond issuers with parent equity companies (435 bonds)	17,565
Merge bond file with MV and MTBV data (435 bonds)	17,565
Filter the data file so RI, BSPL, AISD, MV & MTBV data are not missing	17,565
Final sample for ME and BEME Portfolio Creation (435 bonds)	17,565

The measurement of market wide performance of the European market is difficult. The Datastream database discontinued European (ECU) Bond Indices as of December 31, 1998 and although, the Bloomberg database has a Euro Broad Investment-grade bond index (EuroBIG), the inception date of the index is September 2009. Thus, I use the monthly data for the non-US investment grade bond index as a proxy for the European bond market. This index appears to provide a reasonable proxy for the European market. Moreover, Datastream does not provide data for the long-term European market government bond market, the European market treasury bills data or European equity market index. Bloomberg does provide data for a long-term European market government bond index but it does not start until September 2004. Thus, I use monthly data for the long-term world government bond index as a proxy for the return on long rated European government bonds, the one month US Treasury Bills rate as a proxy for the short rate and MSCI world equity index as a proxy for the equity index in this study.

5.3.3 Constructing Monthly Realized Returns and Term Structure Factors

Following Chapter 4, the monthly holding period return for bond i at month t is calculated as

$$R_{i,t} = \frac{RI_{i.t} - RI_{i,t-1}}{RI_{i,t-1}} \quad [5.1]$$

where $RI_{i.t}$ is the total return on bond i observed at time t and $RI_{i.t-1}$ is the total return observed at time t-1. The DEF and TERM factors are constructed following the Fama and French (1993) methodology.

5.3.4 Credit Rating Portfolios

Following Fama and French (1993), I form four portfolios using credit rating breakpoints to assign all the bonds in the sample by bond credit rating, (Aaa, A, Baa and LG). The fourth quartile LG comprises of all the bonds which have credit ratings below BBB, commonly called junk bonds. The monthly value weighted return for these portfolios is calculated for each month over the period from July of year t to June of t+1. This result in a final sample of 132 monthly observations for the period 2002-2012 for each of the four credit rating portfolios.

5.3.5 Constructing Six ME and BEME Portfolios

Book equity (BE), market equity (ME) and BEME equity are obtained from Datastream for each bond issuing company. There are six portfolios formed on the basis of ME and BEME for this European bond sample due to sample size restrictions. To form the six portfolios, I sort, the bonds in June of each year t, by size and by book to market equity independently. For the size sort, ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December in the year t-1 and BE is reported during year t-1. Size breakpoints are used to assign all the bonds in the sample to small equity (S) and Big equity (B) groups given the median size values. The BEME breakpoints for the bottom 30% (Low), middle 40% (Medium) and top 30% (High) are used to assign all the bonds in the sample to Low, Medium and High BEME firm groups. The six ME and BEME portfolios are constructed from the intersection of ME and BEME groups. For example, the first portfolio is comprised of all bonds assigned to the small (S) equity group for ME and the low (L) group for BEME based on issuing firm equity characteristics. The value weighted month returns for these portfolios are calculated for the period from July t to June t+1. The final sample consists of monthly observations for the period from January 2002 to December 2012 for the six ME and BEME portfolios.

5.3.6 Constructing LEV and LIQ Factors.

Hurdle (1974) used leverage to measure risk. She indicates that on the basis of the risk premium hypothesis, high levels of debt should correspond to high rates of bond return. Thus, highly levered firms should offer higher returns than low levered firms. The LEV factor is constructed to mimic the risk factor in bond returns related to leverage as described in Chapter 4. Leverage is computed as the ratio of long-term debt (Item Long-term Debt-Datastream) to market capitalization of equity (Item MV-Datastream). To construct LEV mimicking portfolios, the median leverage is used to split the bonds in two portfolios: 1) portfolios consisting of all bonds with issuing firm leverage above median (H) and 2) portfolios consisting of all bonds with issuing firm leverage below median (L). Value weighted realized returns are calculated for all the bonds in H and L groups. Finally, monthly value weighted realized returns are calculated for the H and the L portfolios. The LEV factor is the difference between the value weighted realized returns on the H and the L bond portfolios.

As set out in Section 5.2.2 above, the principal amount (Item AISD-Datastream) is used as a proxy for liquidity (LIQ). The LIQ factor is constructed to mimic the premium to liquidity. To construct LIQ mimicking portfolios, the median AISD is used to split all the bonds in two portfolios: 1) portfolio with AISD below median (S); 2) portfolio with AISD above median (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally, monthly value weighted realized returns are calculated for small and big portfolios. The LIQ factor is the difference between the value weighted realized returns on S and B bond portfolios.

5.3.7 Descriptive Statistics

Table 5.2 provides summary statistics on the four portfolios formed on bond credit ratings over the period 2002-2012. The difference in returns across rating portfolios displays noticeable variation. Figure 5.1 shows that the Aaa rated bonds and LG bonds have an average return difference of 0.16% per month. With one exception, as we move from Aaa rated bonds to LG bonds, the standard deviation increases. For example the standard deviation for Aaa rated bonds is 3.5%, while it is 4.00% for LG bonds.

Figure 5.1 -Average Monthly Returns and Standard Deviations

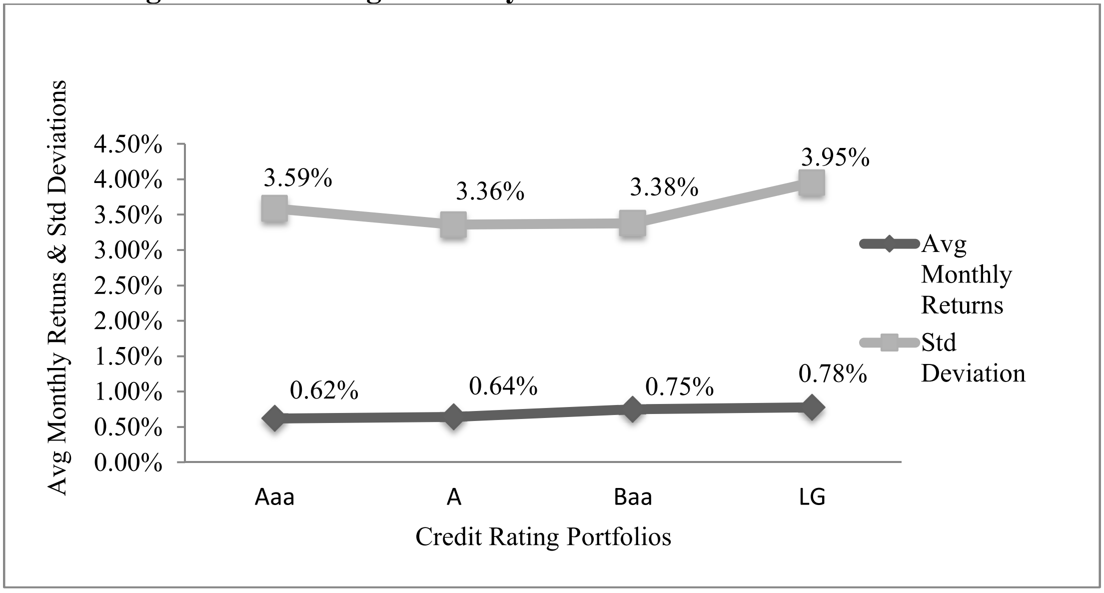

Figure 5.1 represents the average monthly returns and standard deviation of the bond portfolios formed on the basis of credit rating for a period from Jan 2002 to Dec 2012. Aaa rating bonds and LG bonds have an average return difference of 0.16% per month. As we move from Aaa rated bonds to LG bonds, the standard deviation consistently increase i.e. the standard deviation for Aaa bonds is 3.59%, while it is 3.95% for LG bonds.

The average firm size (as measured by market capitalization), with one exception, decreases monotonically with worsening credit rating (Panel A – Figure 5.2). The highest credit-rated bonds have an average market capitalization of $1.13 billion, while the lowest rated bonds have an average market capitalization of $0.66 billion. Based on the Amihud (2002) argument that firm size proxies for liquidity, this result is consistent with the proposition that higher credit rated firms are more liquid than lower credit rated firms. Finally Panel B of Figure 5.2 shows that the leverage, increases monotonically with credit risk, that is, from 0.181 for Aaa rated bonds to 0.897 for LG bonds.

Figure 5.2a - Average firm size in millions

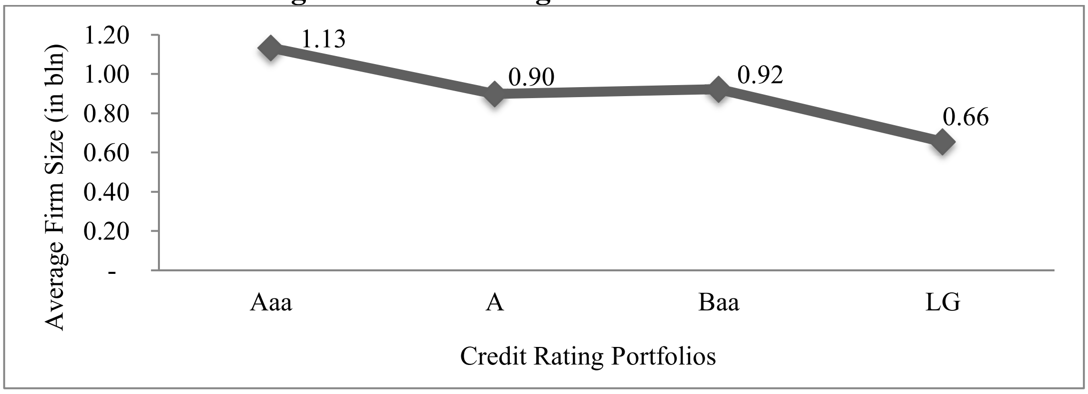

Figure 5.2a presents the average firm size for the bond portfolios formed on credit rating for a period from Jan 2002 to Dec 2012. With the exception of Baa rated bond portfolio, the firm size decreases with decrease is credit rating.

Figure 5.2b - Average Leverage

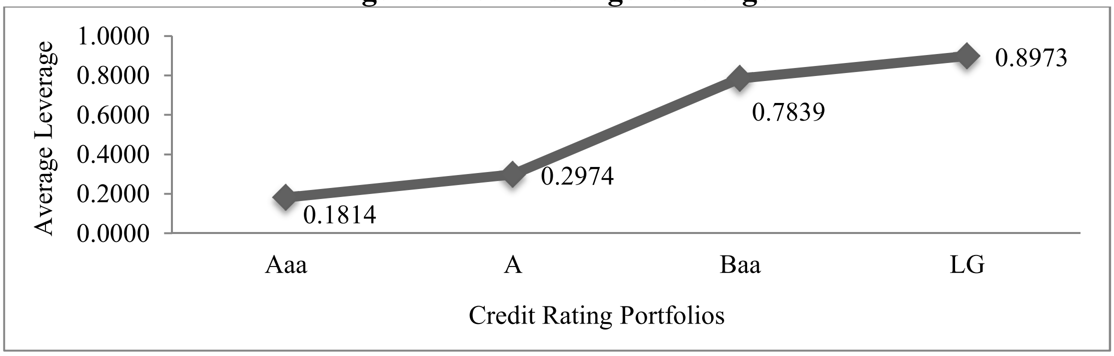

Figure 5.2b presents the average firm size for the bond portfolios formed on credit rating for a period from Jan 2002 to Dec 2012. The average leverage increases monotonically with the decrease in credit ratings.

Table 5.2 – Descriptive Statistics for four credit rating bond portfolios

Portfolio	Statistics		Return	Leverage	Size
Aaa	Number of Bonds	75			
	Mean		0.0062	0.1814	1,132,825
	Median		0.0070	0.2030	1,211,145
	Range		0.2389	0.1709	1,020,333
	Std Deviation		0.0359	0.0567	376,330
	Min		-0.1420	0.0972	575,970
	Max		0.0968	0.2681	1,596,304
A	Number of Bonds	268			
	Mean		0.0064	0.2974	897,828
	Median		0.0073	0.2229	830,096
	Range		0.2141	0.6756	584,843
	Std Deviation		0.0336	0.1467	216,026
	Min		-0.1233	0.1290	618,147
	Max		0.0909	0.8046	1,202,990
Baa	Number of Bonds	274			
	Mean		0.0075	0.7839	923,280
	Median		0.0089	0.6652	1,017,700
	Range		0.2023	1.5022	511,217
	Std Deviation		0.0338	0.3798	161,696
	Min		-0.1161	0.4964	612,097
	Max		0.0862	1.9986	1,123,314
LG	Number of Bonds	72			
	Mean		0.0078	0.8973	655,404
	Median		0.0063	0.7093	670,153
	Range		0.2706	2.5066	556,004
	Std Deviation		0.0395	0.4356	146,289
	Min		-0.1610	0.4541	280,813
	Max		0.1096	2.9607	836,816

Table 5.2 shows the descriptive statistics for the four bond portfolios formed on credit ratings. The average returns show that Aaa rating bonds and LG bonds have an average return difference of 0.16% per month. The average risk premium for the default factor (DEF) is -0.06% per month, while average risk premium for the term factor (TERM) is 0.72% per month. The average firm size (as measured by market capitalization of equity) with one exception decrease monotonically with worsening credit rating. Lastly, the leverage increases monotonically with credit risk i.e. from 0.181 for Aaa rated bonds to 0.897 for LG bonds.

Given sample size, I focus on 6 ME/BEME portfolios in the analysis that follows. Table 5.3 shows the descriptive statistics for the six bond portfolios formed in June each year on size and book to market equity over the period from 2002-2012. Panel A shows that the big-ME and medium-BEME portfolio (portfolio 22) contains the greatest number of bonds, while the fewest bonds are recorded in the high-BEME and big-ME portfolio (portfolio 23). On average, each of the two smallest ME portfolios accounts for less than 12% of the combined value of bonds in the six portfolios. The combined value of the three big-ME portfolios is 88% of the combined value of six portfolios. Further, the bonds in the big-ME and low-BEME portfolio (Portfolio 21) alone, account for more than 31% of the combined value of the six portfolios. Panel C indicates that across all ME portfolios, as we move from low to high BEME portfolios, the BE ratios increase monotonically. Panel D indicates that across all BEME quintiles, as we move from small to big ME portfolios, leverage decreases monotonically. This pattern is consistent with the argument that cost of equity issue is high for small firms and thus small firms are inclined towards borrowing and hence more leveraged than large firms (Titman and Wessels, 1988).

Table 5.3 - Descriptive statistics for six ME/BEME bond portfolios

	Book to market equity (BEME)		
Size	Low	Medium	High
Panel A: Average of number of firms			
Small	88	116	89
Big	100	131	87
Panel B: Average annual firm size average			
Small	11,385.28	10,805.09	6,483.86
Big	77,374.08	66,793.57	76,011.69
Panel C: Average annual BE ratios			
Small	0.178	0.566	1.248
Big	0.290	0.545	0.99
Panel D: Average annual leverage ratio			
Small	0.826	0.717	2.527
Big	0.345	0.527	0.590

Table 5.3 shows the descriptive statistics for the six portfolios formed in June each year on size and book to market equity over the period from 2002-2012 (10 years). The Big-ME and Medium-BEME bond portfolio (portfolio 22) contains the most number of bonds, while the fewest bonds are recorded in the Big-ME and High-BEME portfolio (portfolio 23). Panel B indicates that Big-ME portfolios have the largest fraction of value and panel C shows that BE ratios record highest values for High-BEME portfolios. Finally in Panel D across all BEME portfolios, leverage decreases monotonically from small-ME to Big-ME portfolios.

In summary, the number of firms, average firm size and BE ratio are consistent with those reported by Fama and French (1993). The big-ME and high-BEME portfolio (Portfolio 23) contain the least number of bonds. The big-ME and low-

BEME portfolio (portfolio 21) has the largest fraction of value and the BE ratios record highest values for high BEME portfolios.

A comparison between US and European bond markets reveals differences in terms of bond credit rating portfolio returns, market capitalization and leverage. The US Aaa bond portfolio return (Table 4.5) of 0.22% is considerable lower than the European Aaa bond portfolio return of 0.62% (Table 5.2). However, for the US bonds, the Aaa bond portfolio and LG bond portfolio have an average return difference of 0.48% per month, while the European bond analysis shows an average return difference of 0.16% per month between the Aaa bond portfolio and LG bond portfolio. The average US market capitalization falls between a range of $2.18 billion and $0.66 billion (Table 4.5). While for the European bonds, the average market capitalization falls between a range of $1.13 billion and $0.66 billion (Table 5.2). This indicates that in terms of market capitalization, the US bond market is considerably larger than the European bond market. Moreover, a comparison of average leverage for the US bond credit rating portfolio (Figure 4.3) with that of European bond credit rating portfolio (Figure 5.2b) indicates that the US firms are much more highly levered than European firms.

Overall, I conclude that firms that issue low-rated bonds are smaller, yield higher returns, have greater standard deviation in returns, are less liquid and more levered than firms that issue more highly rated bonds.

5.4 Methodology

This study uses the Fama and French (1993) time series framework. Monthly returns for European bonds are regressed on the R_{mt}, TERM, DEF and mimicking portfolio returns on the LEV and the LIQ factors. The basic asset pricing question tested in this study is how DEF, TERM, LEV and LIQ perform in explaining the cross-sectional variation in European bond returns. Tests conducted for the, one – three – five factor models over a period of 2002 – 2012 are presented as:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + m_i\, TERM_t + d_i DEF_t + e_{i,t} \quad [5.2]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + m_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t} \quad [5.3]$$

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + m_i TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i,t} \quad [5.4]$$

where $R_{i,t}$ is the monthly realized bond returns on credit rating based portfolios. $R_{m,t}$ is the MSCI world equity index; $R_{f,t}$ is the one month US Treasury bill rate; DEF, TERM represents default risk and term risk respectively; LEV and LIQ are monthly returns on mimicking portfolios for leverage and bond principal amount (proxy for liquidity); α_i is the intercept; d_i and m_i are the coefficients on default risk and term risk; while l_i and sl_i are the coefficients on LEV and LIQ respectively; and $e_{i,t}$ is the error term.

Model 5.2 is the Fama and French (1993) original three factor model. In Models 5.3 and 5.4, LEV and LIQ factors are added respectively. I run a series of robustness checks by re-estimating Models 5.2, 5.3 and 5.4 using monthly realized bond returns on six ME/BEME based portfolios (Section 5.6.1) and Pre-GFC Period (Section 5.6.2).

5.5 Results

5.5.1 Equity Market Risk Premium, TERM and DEF

Table 5.4 reports results of the Fama and French (1993) three-factor model using monthly realized European excess bond returns over a period of January 2002 to December 2012. Fama and French (1993) establish that common variation in US bond returns is dominated by the bond market factors, TERM and DEF. Stock market factors capture some variation only in the low-grade bond portfolio (LG). The regression results using European bond data are consistent with the Fama and French (1993) hypothesis. The only R-square value below 0.90 is for the LG bond portfolio. These results are some-what stronger than those reported in Chapter 4 for U.S bonds, particularly for Baa and LG bond portfolios. Consistent with the Fama and French (1993) results, the t-statistic on the DEF factors are large, positive and significant. The t-statistics on TERM coefficients are insignificant for all the portfolios. This result is consistent with those in Chapter 4, indicating that the European term structure factor (DEF) explains almost all the variation in European bond returns.

The Fama and French (1993) study shows that the stock market factor is significant for the low grade bond portfolio only (LG). Yet, results in Table 5.4 indicate that the stock market factor is positive and significant for Baa credit rating portfolio[21]. This differs considerably from the US results reported in Chapter 4 (Table 4.5) where the TERM and DEF factor clearly explain the variation in the US bond returns, while the stock market factor is insignificant for all the portfolios.

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[21] Section 5.6.2 shows that this result is driven by GFC.

Table 5.4 – 3 factor bond pricing model using realized bond returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + e_{i,t}$$

Dependent variable: Excess returns on four credit rating bond portfolios

	Aaa	A	Baa	LG
(β)	0.26	-0.01	0.05	-0.01
t(β)	0.01	-0.58	2.59	-0.02
(m)	0.01	-0.01	0.02	-0.04
t(m)	0.14	-1.43	0.67	-0.80
(d)	1.01	0.98	0.94	1.03
t(d)	37.80	107.70	33.99	21.85
Rsquare	0.92	0.99	0.91	0.79
s(e)	0.01	0.01	0.01	0.01
(α)	-0.01	0.01	0.01	0.01
t(α)	-0.57	0.02	1.05	0.76

Table 5.4 presents the regressions of monthly realized excess bond returns on the excess realized equity market return, TERM and DEF for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return observed at the end of the month (from Datastream) and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term government bond return observed at the end of the month and monthly 4 week T-Bill rate (from Federal Reserve Bank of St Louis website). The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

5.5.2 Equity Market Risk Premium, TERM, DEF and LEV

Table 5.5 presents the estimates of factor sensitivities for excess R_{mt}, TERM, DEF and LEV factors for credit rating portfolios. DEF is large, positive and significant for all of the four credit rating portfolios, indicating that DEF has significant explanatory power for corporate bond returns. The stock market factor is positive and significant for Baa credit rating portfolio[22]. The t-statistics on TERM and LEV coefficients are not significant for any of the bond portfolios. The R-square values presented in Table 5.5. There is a slight increase in the R square for Baa rated bond portfolios over that reported for the three factor model, though little change otherwise. It appears LEV is not priced in European bond returns.

[22] Section 5.6.2 shows that this result is driven by GFC.

Table 5.5 - 4 factor bond pricing model using realized credit rating bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t}$$

Dependent variable: Excess returns on four bond portfolios formed on credit ratings

	Aaa	A	Baa	LG
(β)	-0.01	-0.01	0.05	-0.01
t(β)	-0.16	-0.19	2.53	-0.06
(m)	0.01	-0.02	0.02	-0.04
t(m)	0.27	-1.54	0.64	-0.78
(d)	1.00	0.98	0.94	1.03
t(d)	36.24	104.40	32.41	20.97
(l)	-0.01	0.01	0.01	-0.01
t(l)	-1.33	1.17	0.23	-0.14
Rsquare	0.92	0.99	0.90	0.79
s(e)	0.01	0.01	0.01	0.01
(α)	-0.01	0.01	0.01	0.01
t(α)	-0.68	0.30	1.06	0.75

Table 5.5 presents the regressions of monthly realized excess bond returns on the excess realized equity market return, TERM and DEF for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return observed at the end of the month (from Datastream) and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term government bond return observed at the end of the month and monthly 4 week T-Bill rate (from Federal Reserve Bank of St Louis website). LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

5.5.3 Equity Market Risk Premium, TERM, DEF, LEV and LIQ

Estimates of factor sensitivities for the R_{mt}, term structure factors, LEV and LIQ are presented in Table 5.6. Consistent with Table 5.5, the DEF factor exhibits high t-statistics. The stock market factor is positive and significant for Baa credit rating portfolio[23]. The t-statistic on the LIQ coefficients is only significant for the Baa grade bond portfolio. One possible explanation for this result can be drawn from the Cai et al. (2007) study. They indicate that since the trades in the bond market are infrequent, investors do not require a liquidity premium. The TERM and LEV coefficients are not significant for any of the four credit rating portfolios. Table 5.6

[23] Section 5.6.2 shows that this result is driven by GFC.

also indicates that the intercepts are not significantly different from zero. Overall, consistent with findings in Chapter 4, the DEF factor alone explains much of all the variation in all the four credit rating bond portfolios. Even after adding LIQ and LEV as explanatory variables, the R-square for the bond portfolios does not improve much, indicating that LIQ and LEV factors do not add much explanatory power to European bond pricing. This implies that both US and European bonds largely load on DEF factor..

Table 5.6 - 5 factor bond pricing model using realized credit rating bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i\,[R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i,t}$$

Dependent variable: Excess returns on four bond portfolios formed on credit ratings

	Aaa	A	Baa	LG
(β)	-0.01	-0.01	0.05	-0.01
t(β)	-0.18	-0.18	2.60	-0.05
(m)	0.01	-0.02	0.01	-0.05
t(m)	0.44	-1.61	0.37	-0.87
(d)	1.01	0.99	0.92	1.03
t(d)	35.87	101.69	32.04	20.30
(l)	-0.01	0.01	-0.01	-0.01
t(l)	-0.64	0.80	-0.71	-0.43
(sl)	0.01	-0.01	-0.01	-0.01
t(sl)	1.42	-0.67	-2.27	-0.74
Rsquare	0.93	0.99	0.91	0.79
s(e)	0.01	0.01	0.01	0.02
(α)	0.01	-0.01	-0.01	0.01
t(α)	0.21	-0.12	-0.34	0.22

Table 5.6 presents the Regressions of monthly realized excess bond returns on the excess realized bond market return, DEF, TERM and mimicking returns for LEV, LIQ factors for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and monthly T-Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

5.6 Robustness Check

5.6.1 Six ME/BEME Based Portfolios

5.6.1.1 Equity Market Risk Premium, TERM and DEF Factors

Table 5.7 shows the estimates of factor sensitivities for excess $R_{m,t}$ TERM, and DEF factors for six ME and BEME portfolios. The t-statistics on DEF coefficients are large, positive and highly significant for all the portfolios, indicating that DEF factor has considerable explanatory power for corporate bond returns. The DEF factor captures variation in three of the six ME and BEME portfolios. The t-statistics for the TERM coefficients and stock market factor are insignificant for all the six ME/BEME bond portfolios. The only R-square value below 0.9 is for the small-ME and high-BEME bond portfolio. In sum, consistent with findings reported in Chapter 4, the bond returns strongly load on the DEF factor.

Table 5.7 – 3 factor bond pricing model using realized ME/BEME bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + e_{i,t}$$

Dependent variable : Excess bond returns on six bond portfolios formed on size and book-to-market equity

	Book to market equity (BEME) Portfolios					
Size Portfolios	Low	Medium	High	Low	Medium	High
		(β)			t(β)	
Small	0.01	-0.01	0.03	0.76	-0.39	1.01
Big	-0.02	0.01	-0.01	-0.30	0.80	-1.10
		(m)			t(m)	
Small	-0.03	-0.02	0.07	-1.34	-0.94	1.62
Big	0.01	0.01	-0.01	0.09	0.67	-1.10
		(d)			t(d)	
Small	0.96	0.99	0.93	44.18	43.04	23.53
Big	0.98	0.98	0.99	84.72	67.86	52.44
		R-Square			s(e)	
Small	0.94	0.94	0.82	0.01	0.01	0.01
Big	0.98	0.97	0.96	0.01	0.01	0.01
		(α)			t(α)	
Small	-0.01	0.01	0.01	-0.22	0.72	1.04
Big	0.01	-0.01	0.01	0.71	0.54	0.16

Table 5.7 presents the regressions of monthly realized excess bond returns on the excess realized bond market return, TERM, DEF factors for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and monthly T-Bill rate. In order to form the six portfolios, I sort the bonds by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). The size breakpoints are used to assign all the bonds to two groups Small(S) and Big (B). The BEME breakpoints for the bottom 30% (Low), middle 40% (Medium) and 30% top (High) BEME values are used to assign all the bonds in the sample to Low, Medium and High groups. The six ME-BEME portfolios are constructed from the intersection of ME and BEME groups. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

5.6.1.2 Equity Market Risk Premium, TERM, DEF and LEV

Table 5.8 presents the estimates of factor sensitivities for excess $R_{m,t}$, TERM, DEF and LEV factors for credit rating portfolios. The $R_{m,t}$ is insignificant for all of the six ME/BEME portfolios, indicating that stock market factor exhibits no explanatory power for European corporate bond returns. Consistent with findings in Chapters 4 and 5, the t-statistics on DEF coefficients captures much of the variation except for the bond portfolio. The t-statistics for the TERM and LEV coefficients are not significant for any of the bond portfolios. In sum, the DEF factor alone explains almost all the variation in the six ME/BEME bond portfolios.

Table 5.8 – 4 factor bond pricing model using realized ME/BEME bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t}$$

Dependent variable : Excess bond returns on six bond portfolios formed on size and book-to-market equity

Book to market equity (BEME) Portfolios

Size Portfolios	Low	Medium	High	Low	Medium	High
		(β)			t(β)	
Small	0.03	-0.01	0.02	0.20	-0.65	0.82
Big	-0.01	0.01	-0.02	-0.15	1.08	-1.45
		(m)			t(m)	
Small	-0.02	-0.02	0.08	-1.15	-0.84	1.65
Big	0.01	0.01	-0.01	0.05	0.56	-0.66
		(d)			t(d)	
Small	0.96	0.98	0.93	42.33	41.18	22.53
Big	0.99	0.98	0.99	81.63	65.80	50.25
		(l)			t(l)	
Small	-0.01	-0.01	-0.01	-1.74	-0.92	-0.44
Big	0.01	0.01	-0.01	0.45	1.05	-1.33
		R-Square			s(e)	
Small	0.95	0.94	0.82	0.01	0.01	0.01
Big	0.98	0.97	0.96	0.01	0.01	0.01
		(α)			t(α)	
Small	-0.01	0.01	0.01	-0.32	0.64	1.00
Big	0.01	-0.01	-0.01	0.73	-0.45	-0.04

Table 5.8 presents the Regressions of monthly realized excess bond returns on the excess realized bond market return, DEF, TERM and mimicking returns for LEV, LIQ factors for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and monthly T-Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. In order to form the six portfolios, I sort the bonds by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). The size breakpoints are used to assign all the bonds to two groups Small(S) and Big (B). the BEME breakpoints for the bottom 30% (Low), middle 40% (Medium) and 30% top (High) BEME values are used to assign all the bonds in the sample to Low, Medium and High groups. The six ME-BEME portfolios are constructed from the intersection of ME and BEME groups. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

5.6.1.3 Equity Market Risk Premium, TERM, DEF, LEV and LIQ

Table 5.9 reports estimates of equity market risk premium, term structure factors, liquidity and leverage for the six ME and BEME portfolios. The t-statistics on DEF coefficients are significant for all the portfolios, implying that DEF factor captures strong common variations in bond returns. The t-statistics for the TERM, LEV and LIQ coefficients are insignificant for all the six ME/BEME portfolios. Overall, consistent with findings in Chapter 4, the DEF factor appears to dominate, capturing most of the cross sectional variation in the European bond returns.

Table 5.9 – 5 factor bond pricing model using realized ME/BEME bond portfolio returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i\,[R_{BM,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i,t}$$

Dependent variable : Excess bond returns on six bond portfolios formed on size and book-to-market equity

	Book to market equity (BEME) Portfolios					
Size Portfolios	Low	Medium	High	Low	Medium	High
		(b)			t(b)	
Small	0.01	-0.01	0.02	0.21	-0.64	0.85
Big	-0.01	-0.01	-0.02	-0.16	-0.48	-1.43
		(m)			t(m)	
Small	-0.03	-0.02	0.01	-1.16	-0.98	1.44
Big	0.01	0.01	-0.02	0.16	0.53	-0.74
		(d)			t(d)	
Small	0.95	0.97	0.91	40.85	40.14	21.83
Big	0.99	0.98	0.99	79.97	64.03	49.06
		(l)			t(l)	
Small	-0.01	0.01	-0.01	-1.66	-1.33	-1.16
Big	0.01	0.01	-0.01	0.81	0.87	-1.49
		(s)			t(s)	
Small	-0.01	-0.01	-0.01	-0.28	-1.20	-1.80
Big	0.01	-0.01	-0.01	0.96	-0.20	-0.71
		R-Square			s(e)	
Small	0.95	0.94	0.83	0.01	0.01	0.01
Big	0.98	0.97	0.96	0.01	0.01	0.01
		(α)			t(α)	
Small	-0.01	0.01	-0.01	-0.42	-0.12	-0.16
Big	0.01	-0.01	-0.001	1.14	-0.48	-0.40

Table 5.9 presents the Regressions of monthly realized excess bond returns on the excess realized bond market return, DEF, TERM and mimicking returns for LEV, LIQ factors for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and monthly T-Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. In order to form the six portfolios, I sort the bonds by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. While for the BEME sort, book to market equity is calculated at the end of December last year (t-1). The size breakpoints are used to assign all the bonds to two groups Small(S) and Big (B). the BEME breakpoints for the bottom 30% (Low), middle 40% (Medium) and 30% top (High) BEME values are used to assign all the bonds in the sample to Low, Medium and High groups. The six ME-BEME portfolios are constructed from the intersection of ME and BEME groups. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

5.6.2 Pre-GFC Period.

Findings in Tables 5.10, 5.11 and 5.12 are consistent with those reported in Tables 5.4, 5.5 and 5.6, respectively. The t-statistic on DEF coefficients are positive and significant for all regressions, indicating my main findings are robust to the GFC period. It is pertinent to mention here that when the model is run for pre-GFC period, the market risk premium is insignificant. This shows that market risk premium significance was driven by the GFC.

Table 5.10 - 3 factor bond pricing model for Pre-GFC Period

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + e_{i,t}$$

Dependent variable: Excess returns on credit ratings bond portfolios

	Aaa	A	Baa	LG
(β)	-0.04	0.02	0.18	-0.01
t(β)	-1.29	1.88	1.40	-0.24
(m)	-0.03	-0.02	0.11	0.03
t(m)	-1.30	-0.92	1.97	0.57
(d)	1.05	0.98	0.88	0.83
t(d)	55.77	89.75	19.65	16.51
R-square	0.98	0.99	0.87	0.81
s(e)	0.01	0.01	0.01	0.01
(α)	-0.01	-0.01	0.01	0.01
t(α)	-0.88	-1.44	0.44	1.65

Table 5.10 presents the regressions of monthly realized excess bond returns on the excess realized bond market return, TERM and DEF for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and monthly 4 week T-Bill rate (from Federal Reserve Bank of St Louis website). The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

Table 5.11 - 4 factor bond pricing model for Pre-GFC period

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + l_i LEV_t + e_{i,t}$$

Dependent variable: Excess returns on four credit rating bond portfolios

	Aaa	A	Baa	LG
(β)	-0.04	0.02	0.17	-0.02
t(β)	-1.15	1.69	1.06	-0.41
(m)	-0.03	-0.01	0.11	0.04
t(m)	-1.29	-0.88	1.97	0.60
(d)	1.05	0.98	0.88	0.83
t(d)	54.98	88.64	19.35	16.25
(l)	0.01	-0.01	-0.01	-0.01
t(l)	0.04	-0.60	-0.33	-0.59
R-square	0.98	0.99	0.87	0.82
s(e)	0.01	0.01	0.01	0.01
(α)	-0.01	-0.01	0.01	0.01
t(α)	-0.84	-1.53	0.35	1.47

Table 5.11 presents the Regressions of monthly realized excess bond returns on the excess realized bond market return, DEF, TERM and mimicking returns for LEV, LIQ factors for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and monthly T-Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. Value weighted realized returns are calculated for all the bonds in small and big groups. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

Table 5.12 - 5 factor bond pricing model for Pre-GFC period

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i [R_{m,t} - R_{f,t}] + m_i TERM_t + d_i DEF_t + l_i LEV_t + sl_i LIQ_t + e_{i,t}$$

Dependent variable: Excess returns on four credit rating bond portfolios

	Aaa	A	Baa	LG
(β)	-0.04	0.02	0.17	-0.03
t(β)	-1.01	1.60	1.95	-0.53
(m)	-0.02	-0.01	0.08	0.01
t(m)	-0.72	-1.08	1.49	0.24
(d)	1.06	0.98	0.86	0.81
t(d)	55.30	85.58	18.62	15.53
(l)	0.01	-0.01	-0.01	-0.01
t(l)	0.83	-0.88	-0.94	-1.03
(sl)	0.01	-0.01	-0.01	-0.01
t(sl)	2.12	-0.88	-1.66	-1.30
R-square	0.98	0.99	0.87	0.82
s(e)	0.01	0.01	0.01	0.01
(α)	0.01	-0.01	-0.01	0.01
t(α)	0.56	-1.75	-0.71	0.41

Table 5.12 presents the Regressions of monthly realized excess bond returns on the excess realized bond market return, DEF, TERM and mimicking returns for LEV, LIQ factors for a period from Jan 2002 to Dec 2012. $R_{m,t}$ is the MSCI World equity index from Datastream. $R_{f,t}$ is the one month US Treasury Bill rate observed at the end of the month. The DEF factor is the difference between the monthly long-term world government bond return index observed at the end of the month and the monthly return on a value weighted market portfolio of all investment-grade corporate bonds. The TERM factor is the difference between difference between the monthly long-term world government bond return index observed at the end of the month and monthly T-Bill rate. LEV factor is constructed to mimic the risk factor in returns related to leverage. To construct LEV mimicking portfolio, the median leverage is used to split all the bonds in two groups i.e. High (H) and Low (L). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for High and Low portfolios. LEV is the difference between the value weighted realized returns on High and Low bond portfolios. The principal amount (Item AISD- Datastream) is used as a proxy for liquidity. LIQ factor is constructed to mimic the risk factor in returns related to liquidity. To construct LIQ mimicking portfolio, the median AISD is used to split all the bonds in two groups i.e. small (S) and Big (B). Value weighted realized returns are calculated for all the bonds in small and big groups. Finally monthly value weighted realized returns are calculated for small and big portfolios. LIQ is the difference between the value weighted realized returns on small and big bond portfolios. The four corporate bond rated Aaa, A, Baa and LG (below Baa) portfolios are used as dependent variables in the excess return regressions. Value weighted monthly percent returns on the portfolios are calculated from July of year t to June of t+1.

Similar results are noted for pre-GFC period for ME/BEME analysis (not reported separately here).

5.7 Conclusion

In this chapter, I provide analysis of the factors explaining variation in European corporate bond returns within the Fama and French (1993) framework using a data sample obtained from Datastream for a period from January 2002 to December 2012. As the literature has focused on US bonds to date, similar work using European bond data is not apparent in the literature. This study considers the impact of $R_{m,t}$, TERM, DEF, and mimicking portfolio returns on LIQ, LEV within the corporate bond pricing model and investigates whether these factors are priced. Two portfolio construction approaches; credit ratings and ME/ BEME are used in the study. The Fama and French (1993) three factor model using European bond returns are consistent with Fama and French (1993) findings for their US bond data and with the results reported in Chapter 4. I find that European DEF factor explains much of the variation in European bond returns and the LIQ and LEV factors adds little explanatory power to European pricing model. However, the stock market factor is significant for Baa credit rating portfolio. Moreover, exclusion of the GFC period from analysis results in quite varied market effects subject to model choice.

A comparison between US and European bond markets reveals that 1) in terms of market capitalization, the US bond market is considerably large than European bond market and 2) the US firms are much more highly levered than European firms. Despite the above mentioned differences between the two markets, both the US and European bond returns strongly load on DEF factor (Section 4.5 & 5.5). The only difference between findings in the US and European studies is the LIQ factor. While LIQ appears to have no impact in European bond pricing at all, it does add explanatory power in explaining US LG bonds. Also note high R-square values and almost zero intercepts reported in Chapter 4 and 5 indicates that the model is a good fit for US and European bonds.

These results suggest several avenues for further research. First, other LIQ proxies could be used within the asset pricing tests to investigate the sensitivity of liquidity proxy choice. Second, it might be interesting to conduct a more in-depth analysis of the relationship between the stock market factor and credit rating bond portfolios for pre-GFC and post-GFC periods.

Chapter 6 - Summary

6.1 Introduction

This dissertation follows on an asset pricing theme. In each chapter, I address different research questions. Chapter 2 introduces analysis and the impact of leverage effect on asset prices. Chapter 3 empirically tests whether expectation based returns perform better than realized returns in asset pricing model tests. Chapter 4 investigates whether equity and bond specific factors are priced in US bond markets. Finally, Chapter 5 examines the factors that might price European bond returns. Section 6.2 provides a summary of the key findings of this dissertation. Section 6.3 details the contributions of this study to the existing literature. Finally Section 6.4 lists some of the limitations and offers extensions of this study.

6.2 Summary of findings

The first three studies of this dissertation focus on the US equity and bond market, while the last study explores the European corporate bond market. The sample period spans January 2002 to December 2012 and the Fama and French (1993) time series framework is relied upon in all chapters. The first two studies of this dissertation focus on US equity markets, while the third and fourth studies encompass the US and European corporate bond markets, respectively.

Chapter 2 investigates whether the LEV factor has explanatory power over variation in US stock returns. As a benchmark, monthly realized US stock return data for a period from January 2002 to December 2012 is used to test the Fama and French (1993) two factor, Fama and French (1993) three factor and Fama and French (1993) five factor models. The results are largely consistent with the Fama and French (1993) study. Moreover, the LEV factor is added to the above models to investigate its impact on U.S. stock returns. The results indicate that the LEV factor significantly contributes towards the explanatory power of the models and thus appears to have some explanatory power over U.S. stock returns.

Chapter 3 examines the impact of using a proxy for expected return in asset pricing tests. IBES mean target price is used to construct expected returns in tests of the CAPM, Fama and French (1993) three factor and the Cahart (1997) four factor models. Chapter 3 concludes that when an ex-ante based return is used in asset pricing tests, the results are consistent with the Fama and French (1993) study, with the exception of BEME sensitivities, which do not perform as expected. Thus, Chapter 3 suggests that use of realized returns in the literature to date does not adversely bias asset pricing tests relative to my expected return proxy. The expectation based proxy of returns performs in a similar manner to realized returns in asset pricing tests reported in this dissertation based on the method set out in Fama and French (1993).

Chapter 4 explores common risk factors within the US corporate bond returns. The bond market factors, (DEF, TERM and LEV) and the stock market factors, market risk premium, (SMB, HML and LIQ) are used as explanatory variables within the Fama and French (1993) time series framework. I conclude that stock market factors do not add explanatory power over the bond returns used in this study. The bond market factor, DEF, dominates all the explanatory variables in regression analysis. Moreover, the study indicates that LIQ and LEV coefficients are sensitive to the GFC. The LIQ factor is priced for the full sample period but loses its explanatory power for the pre-GFC period for all the credit rating portfolios except for the Baa bond portfolio. The LEV factor is priced for the low credit rating portfolios for the pre-GFC period. However, the LEV factor explanatory power diminishes for the full sample period.

Chapter 5 of this dissertation analyses the common risk factors explaining variation within the European corporate bond returns using the Fama and French (1993) time series framework. The results are consistent with those reported in Chapter 4 with the European DEF factor capturing much of the variation in European bond returns, while the LEV and LIQ factors add little explanatory power over cross-sectional variation in the European bond returns.

It is pertinent to mention that the asset pricing models tested in this dissertation appear to better fit for bond analysis. Chapter 4 and 5 (bond analysis) report very high R-square values and very few statistically significant intercept coefficients relative to equity analysis reported in Chapter 2 and 3.

6.3 Contributions of the study

This dissertation contributes to the existing literature in several ways. First, I revisit the common risk factors in the US equity and bond returns, and extend the analysis to European corporate bonds. I introduce the LEV factor within the time-series framework and demonstrate that LEV could provide an additional priced factor in US equity market. The LEV factor is included in my model based on the argument that more highly levered firms are required to pay a premium to attract investors. This result is consistent with the theoretical view which identifies leverage as one of the sources of stock return risk (Bhandari, 1988).

Second, I contribute to the existing asset pricing literature by, using a proxy for ex-ante asset returns, rather than relying on realized returns. Yet, the study shows that when the IBES mean target price is used to form expected returns, the results are quite similar to those from realized returns, with the exception of BEME sensitivities. Thus, this study contributes to the literature by providing empirical evidence supporting the argument that the use of ex-post returns do not appear to adversely bias asset pricing tests previously reported in the literature given the IBES target price based expected return proxy.

Third, I contribute to the existing literature by investigating the European corporate bond returns within a time series framework. The bond market factors (DEF, TERM), LIQ and LEV are tested in the time series analysis of European corporate bond returns. The study provides empirical evidence that the bond market factor (DEF) is a key factor in European bonds market.

Finally, I contribute to the existing literature focusing on corporate bond pricing in the US bond market by adding a LEV factor in the corporate bond pricing tests to assess the impact of leverage on corporate bond returns. Moreover, I also contribute to the asset pricing literature by testing stock market factors along with bond market factors in the time series analysis of US corporate bond returns. The study provides empirical evidence that neither stock market factors nor the LEV factor add explanatory power in the US corporate bond returns.

Overall this dissertation enhances our understanding of the asset pricing model tests within a Fama and French (1993) time series framework for both equity and bond markets. This dissertation also shows that stock market specific factors and LEV are relevant for the US equity market, while DEF and, to same extent, LIQ factors capture variation in returns in both US and European bond markets.

6.4 Limitations and Extensions for Future Research

6.4.1 Bond market factors and BEME sensitivities

Findings from Chapter 2 for the Pre-GFC period show that when the bond market factors are added to Fama and French (1993) three factor model, the BEME sensitivities diminish. One extension to this study is to conduct more in-depth analysis to explore the effects of GFC on the relationship between the bond market factors and BEME sensitivities with longer time series.

6.4.2 Alternate Expectation Based Proxies in Asset pricing tests.

The second study uses IBES mean target price to construct an expectation based proxy in the tests of the CAPM, the Fama and French (1993) three factor model and the Cahart (1997) four factor model. One possible limitation of the study is that the sample only includes those firms which have analyst following which leads to a sample selection bias. A useful extension to this study could be to use alternate expectation based proxies in the asset pricing tests. Alternatively, sample selection adjustment could be applied given suitable instruments can be identified.

6.4.3 Sample Attrition

The third and fourth studies investigate the impact of common risk factors on the returns on US and European corporate bonds returns. The Datastream database is used to extract the bond data for both US and European bond markets. One possible limitation of using this database is sample attrition. The Datastream database does not have a common identifier for the equity and bond markets securities issued by the same firm. As the third and fourth studies of dissertation use equity information for forming portfolios, all the firms for which issuer company information was not available were dropped from the sample in constructing ME/BEME portfolios resulting in sample attrition. One possible way to overcome this limitation is to rely on other database like Eikon database (Thomson Reuters) though this is beyond the scope of the present thesis.

6.4.4 Bond Pricing for other markets

The LEV and bond market factors are added as explanatory variables in the asset pricing tests in the US and European bond markets. A possible extension to this study is to test the LEV and bond market factors in other developed and developing markets to assess the generalizability of these factors.

6.4.5 Impact of GFC – Bond Portfolios and Stock Market premium

Findings in Chapter 5 indicate that during the GFC period, the stock market factor holds significant explanatory power for the bond portfolio returns. It might imply that during the financial crises, the bond market follows the equity market. Yet, the same result is not reported for US bonds (Chapter 4). Thus, one possible extension of this study could be to carry out further analysis to investigate why European bond returns might be sensitive while US bonds are not to the equity market factor during the crisis period.

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Appendix

Table A1 – Fama French 3 Factor model using realized stock returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + s_i SMB_t + h_i HML_t + e_{i,t}$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity
Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	1.05	1.00	1.00	1.00	1.01	53.85	88.09	86.12	99.85	100.77
2	1.03	1.00	0.99	1.00	1.02	93.37	120.00	95.38	123.69	79.31
3	1.00	1.00	1.00	1.00	1.01	114.02	114.02	115.57	112.72	72.79
4	1.01	1.00	1.00	1.02	1.02	113.00	141.79	119.6	112.42	67.59
Big	1.00	0.99	1.01	1.02	1.04	157.61	109.45	138.35	104.74	49.86
			(s)					t(s)		
Small	1.22	0.88	0.81	0.72	0.76	10.93	13.55	12.21	12.46	13.23
2	1.07	0.86	0.83	0.88	0.59	16.93	17.94	14.07	18.97	8.02
3	0.82	0.66	0.54	0.53	0.54	16.40	13.20	10.96	10.41	6.76
4	0.48	0.41	0.44	0.26	0.25	9.34	10.10	9.14	5.03	2.87
Big	-0.13	0.05	-0.06	-0.09	-0.14	-3.51	-1.38	-1.55	-1.66	-1.18
			(h)					t(h)		
Small	0.21	0.22	0.16	0.23	0.51	2.30	4.26	2.89	4.96	10.99
2	0.00	-0.04	0.01	0.31	0.53	-0.09	-1.16	2.73	8.21	8.86
3	-0.09	0.03	0.11	0.33	0.42	-2.28	0.69	2.83	7.95	6.51
4	-0.07	-0.02	0.10	0.25	0.51	-1.61	-0.73	2.47	5.85	7.27
Big	-0.23	0.04	0.01	0.15	0.58	-7.69	-1.14	0.30	9.25	5.96
			R-Square					s(e)		
Small	0.97	0.99	0.99	0.99	0.99	0.03	0.02	0.02	0.02	0.00

2	0.99	0.99	0.99	0.99	0.98	0.02	0.01	0.02	0.01	0.02
3	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
4	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.02	0.03
Big	1.00	0.99	0.99	0.99	0.96	0.01	0.02	0.01	0.02	0.04
			(α)					t(α)		
Small	0.03	0.01	0.05	0.00	-0.01	5.76	4.03	1.87	-1.50	-4.77
2	0.02	0.01	0.00	-0.01	-0.01	8.06	4.05	0.10	-3.47	-2.13
3	0.01	0.01	0.04	-0.01	-0.01	7.07	4.02	1.86	-2.16	-1.58
4	0.01	0.01	0.00	0.00	0.00	7.12	4.28	1.03	0.53	-0.45
Big	0.01	0.00	0.00	0.00	0.00	4.74	0.65	2.23	0.06	-0.37

Table A1 presents the regressions of monthly realized excess stock returns on the market risk premium ($R_m - Rf$) and mimicking returns for SMB and HML factors for a period from Jan 2002 to Dec 2012. R_m is the value of monthly weighted return index adjusted for dividends from CRSP. Rf is the one month US Treasury Bill rate from datastream. SMB and HML are extracted from Kenneth R. French Data library. In order to form the 25 portfolios, I sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table A2 - Cahart 4 factor model using realized stock returns

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i \left[R_{m,t} - R_{f,t}\right] + s_i SMB_t + h_i HML_t + m_i MOM_t + e_{i,t}$$

Dependent variable : Excess returns on 25 stock portfolios formed on size and book-to-market equity

Book to market equity (BEME) quintiles

Size Quintiles	Low	2	3	4	High	Low	2	3	4	High
			(β)					t(β)		
Small	1.04	1.00	1.00	1.00	1.01	54.58	86.79	86.25	101.49	99.36
2	1.02	1.00	0.99	1.00	1.02	93.71	119.25	96.66	127.82	78.67
3	1.00	1.00	1.00	1.00	1.00	117.67	112.2	119.11	115.94	71.85
4	1.00	1.00	1.00	1.01	1.02	117.45	140.18	119.59	111.02	66.51
Big	0.99	0.98	1.01	1.02	1.05	162.39	111.35	137.27	103.08	50.20
			(s)					t(s)		
Small	1.18	0.88	0.82	0.73	0.76	10.98	13.47	12.45	12.96	13.18
2	1.05	0.86	0.85	0.89	0.6	16.96	18.06	14.54	19.99	8.10
3	0.80	0.66	0.56	0.54	0.53	16.80	13.08	11.64	11.04	6.64
4	0.46	0.40	0.45	0.26	0.24	9.48	9.97	9.36	5.07	2.80
Big	-0.14	-0.09	-0.06	-0.09	-0.11	-3.98	-1.79	-1.42	-1.64	-1.00
			(h)					t(h)		
Small	-0.07	0.24	0.26	0.35	0.53	-0.55	3.20	3.38	5.45	8.03
2	-0.12	0.01	0.25	0.43	0.60	-1.79	0.18	3.74	8.39	7.04
3	-0.23	0.02	0.24	0.46	0.34	-4.28	0.36	4.38	8.03	3.73
4	-0.22	-0.06	0.17	0.28	0.48	-3.99	-1.36	3.05	4.64	4.73
Big	-0.32	-0.18	0.05	0.42	0.78	-8.16	-3.01	1.13	6.48	5.66
			(m)					t(m)		
Small	-0.24	0.01	0.09	0.10	0.02	-3.10	0.33	1.87	2.65	0.52
2	-0.10	0.05	0.10	0.10	0.06	-2.42	1.39	2.51	3.37	1.17
3	-0.12	-0.006	0.11	0.11	-0.07	-3.65	-0.16	3.25	3.17	-1.15

4	-0.14	-0.03	0.06	0.03	-0.03	-3.92	-1.19	1.82	0.77	-0.48
Big	-0.09	-0.11	0.04	0.00	0.17	-3.54	-3.07	1.28	0.05	2.02
	R-Square					s(e)				
Small	0.97	0.99	0.99	0.99	0.99	0.03	0.02	0.01	0.01	0.01
2	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
3	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.014	0.02
4	0.99	0.99	0.99	0.99	0.98	0.01	0.01	0.01	0.01	0.02
Big	0.99	0.99	0.99	0.99	0.96	0.01	0.01	0.01	0.01	0.03
	(α)					t(α)				
Small	0.03	0.01	0.01	0.00	-0.01	5.84	1.03	1.95	-1.44	-4.74
2	0.02	0.01	0.00	-0.01	-0.01	8.13	4.11	0.19	-3.49	-2.09
3	0.01	0.01	0.00	0.00	-0.01	7.28	3.99	2.05	-2.12	-1.63
4	0.01	0.01	0.00	0.00	0.00	7.38	4.24	1.10	0.56	-0.46
Big	0.01	0.00	0.00	0.00	0.00	4.83	0.65	2.28	0.06	-0.30

Table A2 presents the regressions of monthly realized excess stock returns on the market risk premium ($R_m - Rf$) and mimicking returns for SMB, HML and MOM factors for a period from Jan 2002 to Dec 2012. R_m is the value of monthly weighted return index adjusted for dividends from CRSP. Rf is the one month US Treasury Bill rate from datastream. SMB and HML and MOM extracted from Kenneth R. French Data library. In order to form the 25 portfolios, I sort the NYSE stocks in June of each year t, by size and by book to market equity independently. For the size sort, the ME is calculated at the end of June each year t. For the BEME sort, book to market equity is calculated at the end of December last year (t-1). NYSE breakpoints for ME and BEME are used to assign all the stocks in the sample (NYSE, NASDAQ & AMEX stocks) to ME and BEME quintiles. The 25 ME-BEME portfolios are constructed from the intersection of ME and BEME quintiles. The value weighted return on the portfolios is calculated each year from July of year t to June of year t+1.

Table A3 - Descriptive Statistics of US TERM and DEF Factors

Statistics	DEF Factor	TERM Factor
Mean	0.004	0.002
Median	0.004	0.002
Range	0.148	0.004
Standard Deviation	0.021	0.001
Min	-0.091	0.000
Max	0.057	0.003

Table A3 shows the descriptive statistics for the US TERM and DEF for a period from Jan 2002 to Dec 2012.