STOCKHOLM SCHOOL OF ECONOMICS

Master's Thesis in Finance

BOOK-TO-MARKET EFFECT AND FAMA FRENCH MODEL IN BEAR – BULL MARKETS

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Abstract

Book-to-market Effect is one of the facts that cannot be explained by market factor in CAPM. The premium between the returns on high and low B/M portfolios is asserted to be the compensation for the associated risk, therefore HML risk factor was formed in order to capture the risk premium in the studies of Fama and French (1992, 1993, 1996). In my study, I show that B/M effect is essentially relevant in bear markets. The mean monthly premium is found to be 0,54% (annual 6,68%) for the whole period, July 1963 – February 2006. On the other hand, the analyses of the premium in bear and bull market conditions give the respective results of 1,87% (24,9% per annum) for bear markets and 0,14% (1,69% per annum) for bull markets. High bear market mean premium and insignificant bull market premium reflect that the underlying risk is associated with mainly bear market characteristics and priced through only bear markets. Assuming that the associated risk increases in bear market condition, this finding provides evidence in favor of the risk based explanation for the premium rather than an irrational markets explanation. Furthermore, observing the risk exposures in bear and bull markets leads to the examination of 3 Factor Fama French model through both market types. 3 Factor model uses constant exposures to risk underlying the HML premium. However, it is seen that, for 10 out of 25 Fama French portfolios, HML coefficients are different in bear – bull markets at 1% significance level. For all of these portfolios, bull market coefficients are smaller than the ones in bear markets resulting in certain misevaluation of risk exposures and excess returns.

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Introduction

Whether markets are efficient or not is a very controversial issue in finance. According to the efficient market hypothesis, it is not possible to consistently outperform the market as all the information is already reflected in prices. Therefore, the only way to get higher returns is to take higher levels of risk. By the same logic, additional risks undertaken are rewarded with higher returns. At this point, it is crucial to determine the common risk factors in stock markets because by only doing this, stock returns can be explained successfully under the assumption of efficient markets.

Asset pricing theories have always attracted scholars' attention both for understanding historical return behaviors and for estimating future asset returns. Furthermore, by the notion of relevant risk factors in calculating stock returns, risk-return trade-off is being explained much better.

CAPM (Capital Asset Pricing Model) is the most influential and widely used one factor pricing model. The model estimates the expected return of a stock, given the return for a theoretical risk free asset, market return and the stock's sensitivity to the market risk. In other words, nondiversifiable market risk is the only risk factor that is used in the model and it is sufficient to explain the risk-return trade-off with an efficient market portfolio. Therefore, the model's success depends on whether any persistent excess return can be made without taking additional market risk through β's or not.

On the other hand, multifactor asset pricing models attempt to explain the stock returns by using more than one risk factor. Fama-French Three Factor Model has probably been the most popular among multifactor models. In addition to market risk, three factor model takes into account two more factors as systematic risk factors which cannot been diversified and result in consistently higher returns; risks regarding small firms and high book-to-market equity firms.

The existence of a premium for high book-to-market ratio company stocks has been the result of other studies performed before its inclusion to the Fama-French Model. Stattman (1980), Rosenberg, Reid and Lanstein (1985) and Chan, Hamao and Lakonishok (1991) pointed out the premium for high book-to-market stocks. Finally, Fama and French (1992) stated that book-to-market ratio effect exists and it is even stronger than the size effect in its relation to stock returns.

In my thesis, initially, I am going to observe the existence of the risk and the premium in both bear and bull markets. Then, I am going to inquire the strength of the model based on the principle question of whether book-to-market ratio effect exists in same amount in both bear and bull market characteristics and it does not depend on this market condition. I believe that it might be contributory in the examination of economical explanations of the factors in Fama-French model.

Outline

In the second section, I am going to draw a theoretical framework combined of explanatory information on relevant terms and findings of previous studies. By this background, my purpose, hypotheses and conclusions can be observed much more effectively. The following section is about my hypotheses. In the fourth section, the data and the methodology are going to be explained. Fifth section is devoted to the statement of analysis and empirical results which is going to enable me to discuss the results and make conclusions in the last section. At the end, there are suggestions for further studies.

Theoretical Framework

Efficient Markets:

Before inquiring the question of whether markets are efficient or not, one should see the reason to seek more efficient markets. Italian mathematician, Girolamo Cardano, wrote in 1565 that 'the most fundamental principle of all in gambling is simply equal conditions. To the extent to which you depart from that equality, if it is in your opponents favor, you are a fool, and if in your own, you are unjust.' Being totally different than gambling, financial markets are as competitive as the former. This means that existence of consistent winners is accompanied with consistent losers. However, the principle goal of financial markets is to match those who want capital and those who have it. Although the probability of outperformance highly attracts capital and provides liquidity, making the financial markets more efficient does result in an environment where people believe the price incorporates all public information and they are less concerned about paying too much. Thus, in a financial market being more efficient, investors would require a smaller premium for lending capital to the firms.

The efficient market hypothesis was first expressed by Louis Bachelier, a French mathematician, in his 1900 PhD thesis, "The Theory of Speculation' where he developed the mathematics and statistics of Brownian motion and deduced that "*The mathematical expectation of the speculator is zero*" That was 65 years before Samuelson (1965) explained efficient markets in terms of a martingale.

In 1923, Keynes stated that investors on financial markets are rewarded not for knowing better than the market what the future has in store, but rather for risk bearing, which is a consequence of the EMH. In addition, numerous studies with the conclusion 'forecasters cannot forecast' have favored the idea of an efficient financial market.

In his statement of the hypothesis, Fama (1970) defined an efficient market as one in which security prices always fully reflect the available information. The hypothesis principally based on three assumptions; first, investors are generally assumed to be rational. Second, some irrational investors cancel each other's effect in overall as they are random. Finally, in case of irrational investors in similar ways, rational arbitrageurs eliminate their influence on prices.

Although EMH became strong theoretical and empirical basis in finance, much opposition arose as well mostly under the field of behavioral finance. Basically, any possible explanation of the systematic stock returns favors the market efficiency over behavioral finance. On the other hand, an anomaly is defined as a price distortion resulting from either structural factors or behavioral biases. At that point, the attempt to explain anomalies which contradicts efficient market hypothesis and capital asset pricing model is essential in understanding stock returns in the context of additional systematic risks or irrational market behavior.

Risk and Return – Asset Pricing Models

Most simply, we can assess risk as the level of uncertainty. According to the risk-return trade off, in financial markets, low levels of uncertainty are associated with low returns while high risk levels come with high expected returns. In other words, investors require higher premia for higher risk levels and in a market with rational investors, reward of high return level is the result of high risk beared.

By definition, the overall risk premium for a given asset is its expected return above the risk free interest rate. The excess return over the risk free interest rate is the premium that the investors earn for the risk of holding the asset in the relevant time interval. Academics who believe that the returns in financial markets are in total drawn by the rational behavior instead of investor misevaluation and biases, have come up with models to explain the returns by taking into account the risk premia relevant.

Although it was known that higher levels of risk generally yield higher excess returns, CAPM (Capital Asset Pricing Model) is the first common model to quantify this risk and the reward for bearing it. Markowitz (1959) attempted to explain portfolio selection problem by using expected returns and variances of return. He concluded that, the optimal portfolio is the one which is mean-variance efficient. In other words, investors should hold portfolios with the highest expected returns for a given level of variance. Based on the work on Markowitz, Sharpe (1964) and Lintner (1965) observed the whole market and concluded that, if the investors are homogeneous in their expectations, all should hold optimal mean - variance efficient portfolios. This would result in a mean-variance efficient market portfolio which is the sum of all invested portfolios.

$$E\left(R_{it} - R_{ft}\right) = \alpha + \beta_{im}[E\left(R_{mt} - R_{ft}\right)]$$

According to the model, the intercept, α should be zero. β_{im}, coefficent for a given stock i, captures the entire cross sectional variation of expected returns. In other words, market beta is the only explanatory variable and the amount of exposure to market risk is taken as the overall risk exposure for the given premium.

Even though CAPM has been essential in estimating stock returns, several anomalies started to be asserted by scholars. An anomaly is referred as existence of a group of stocks with same characteristic that causes them to place above or below the mean - variance efficient portfolio. In other words, the market beta is seen to be insufficient to estimate their returns resulting in a persistent overvaluation or undervaluation.

One of the first anomalies asserted was price to earnings (P/E) ratio effect. Basu (1977) stated that, market portfolio is not mean-variance efficient relative to portfolios based on price to earnings ratios. Specifically, company stocks with low price to earnings ratio have higher returns in average when compared to the portfolio of stocks with high price to earnings ratio. He asserted that stock returns are biased and price to earnings ratio is an indicator of this bias. In his study where he observed returns of portfolios on P/E ratio over the period 1957-1971, two lowest P/E portfolios yield 13.5% and 16.3% while two highest P/E portfolios yield returns of 9.3% and 9.5% annually. Although this premium was supported by the fact that the average returns persistently increase when moving from low P/E to high P/E portfolios, their exposure to market risk did not increased, even decreased in some cases.

Another anomaly, size effect was stated by Banz (1981). According to the findings of Banz, firms with high market capitalization have consistently lower returns in average than it is estimated by CAPM. On the other hand, firms with low market capitalization yield higher levels of excess returns than it should have been according to the theory of market portfolio is mean-variance efficient.

Ratio of book-to-market equity (B/M) of a firm has been stated as a source of anomaly which contradicts the mean-variance efficient market hypothesis. Stattman (1980) and Rosenberg, Reid and Lanstein (1985) found positive relation between book-to-market ratio and average return for U.S. stocks. Furthermore, Chan, Hamao and Lakonishok (1992) found the same relationship for the Japanese stocks.

Under the light of these studies about anomalies contradicting CAPM, Fama and French (1992, 1993) made a thorough analysis of stock returns with regard to the certain characteristics of firms. These included E/P ratio, leverage, size and B/M ratio. As the result of their studies concerning the dates 1963-1991, they asserted that size and B/M ratio with the market beta are sufficient to describe cross section of expected stock returns.

By forming 100 portfolios with intersections of 10 size and 10 B/M portfolios, they observed that, in average there is monthly 0.99% difference between the returns of highest and lowest B/M portfolios. In addition to this 12,55% annual premium, the evidence showed that the B/M effect is consistent when moving from low to high B/M portfolios. Moreover, without controlling for size, lowest B/M portfolio earns in average monthly 1.53% less than the highest B/M portfolio.

A similar relationship was observed between size and returns. 12 portfolios formed on size reflect the negative relationship between size and average returns. Lowest ME portfolios earn up to monthly 0.74% more than the highest ME portfolios. Therefore, Fama and French came up with a three factor model with market beta, and two mimicking factors for the returns proxied by B/M ratio and size. As a result of their examination of average monthly returns for 25 portfolios sorted by size and B/M, they described the excess return for a given stock by using its exposure to market risk and to the relevant risks which are the reasons for the premia of high B/M firms and small firms. In other words, being different from CAPM, three factor model takes into account two additional factors that cause investors to demand higher premia for holding small firm stocks and high B/M firm stocks. Specifically, in the below formula, SMB (small minus big) stands for the excess return between small and large firm stocks; HML (high minus low) stands for the excess return between high B/M and low B/M firm stocks.

$$(R_{it} - R_{ft}) = \alpha + \beta(R_{mt} - R_{ft}) + s(SMB_t) + h(HML_t)$$

By capturing the previously asserted anomalies in their model, Fama and French provided a better explanation of cross section of expected stock returns. On the other hand, oppositions rise mostly on the economical explanation underlying the additional risk premia. Even though in the study, it is stated that the premia should result from a rational explanation of relevant risks rather than an irrational market behavior, a satisfactory explanation is left for future studies.

Discussion on risk factors: Underlying Economic Explanation

According to Fama and French (1993, 1996), the premia for high B/M firms and small firms are the results of risk undertaken. Simply, it is asserted that, high B/M firms and small firms are historically poor economical performers. In other words, these two groups have the stocks for distressed firms which have been poor earners relative to low B/M firms and large firms. Therefore, this relationship between the fundamental values and market returns implies that B/M and size proxy for risk factors in returns.

According to Chan, Chen and Hsieh (1985) size effect is relevant to a kind of default risk which is priced as a premium in returns. Furthermore, Chan and Chen (1991) assert that, the earning prospects of distressed firms are more sensitive to economic conditions resulting in a premium for holding these kinds of firms.

On the other hand, it is also asserted by some scholars that, book-to-market ratio and size effects cannot be explained by a factor model and the premia are irrelevant economically. Although two premia are claimed to be existing in different countries' markets for long decades, according to some studies (Black (1993) and MacKinlay (1995)), the premia for high book-to-market and small firms are simply result of chance.

Another contradictory explanation is that, the two anomalies are due to investor overreaction to firm performance and irrational market behavior. In other words, it is an example of market inefficiency and persistent misevaluation in financial markets.

DeBondt and Thaler (1987) studied stock returns on the basis of 'winner – loser performances', seasonality and firm characteristics. They concluded that, outperformance of previous losers is due to investor overreaction. Specifically, using monthly return data between 1926 and 1982 for stocks listed on the New York Stock Exchange they formed portfolios of the 50 most extreme winners and 50 most extreme losers. It was reported that over the following five-year test periods the portfolios of past losers outperformed the portfolios of winners by average of 31.9%.

Lakonishok, Shleifer and Vishny (1994) examined the premium between high B/M and low B/M stocks principally based on its economical explanation. By using monthly returns for 10 portfolios sorted by B/M ratio he concluded that the premium exists on average 10.5% yearly. The explanation for the premium is by different means than the ones in the study of Fama and French (1992). It is asserted that, the premium appears due to the mistaken preferences of investors. Specifically, low B/M stocks are preferred more, as these stocks are past outperformers and believed to be future outperformers as well. Moreover, in the paper, the performances of value and glamour stocks are examined through 'bad and good times' through the process of dividing months into worst, bad, good and best. By using the equal weighted CRSP index as market benchmark, they conclude that, somewhat value stocks outperform the glamour stocks in general.

Moreover, as an opposition to Fama and French factors, Daniel and Titman (1997) examined whether the return patterns of characteristic sorted portfolios are really consistent with a factor model at all. They inquired the existence of relevant factors associated with size and book-to-market and the so called risk premia. They concluded that, there is no specific risk factor relevant to size and book-to-market and a systematic return premium does not exist about the 3 factors asserted by Fama and French. According to their study of the time period 1973 – 1993, they asserted that size and book-to-market premia results from the common characteristics of firms rather than a compensation of risk. The reason for the similar behavior of stocks with same size or book-to-market ratio is that, they simply move at the same time and they are affected by the same factors. Furthermore, closest economical explanation for the premia between different classes of stocks is concluded as misevaluation and market inefficiency.

In their paper on the causes of size and book-to-market effects, Davis, Fama and French (1998) defended compensation for risk against the behavioral explanation of Daniel and Titman. After using a similar approach of sorting stocks on characteristics (size and B/M) and risk loadings, they concluded that the relations between average return and firm characteristics (size and BE/ME) are better explained by a three-factor risk model than by the behavioral hypothesis that investor overreaction causes characteristics to be compensated irrespective of risk loadings. In the study where they examined the stock returns with regard to risk loadings and firm characteristics for 68 years starting in 1929, it is asserted that, the results in Daniel and Titman (1997) are special to their observation period of 20 years. Specifically, by taking into account the attached risk loadings of firms, they found that the premium for value stocks and small firm stocks are in average 0.46% and 0.20% monthly.

While there is ample evidence in favor of consistent higher average returns for small firm stocks and high B/M firm stocks, the economic explanation for this still remains questionable in most of the studies. Therefore, the fact that underlying economic factors are not defined by certainty supports behavioral explanations.

In addition to the studies of behavioral approaches, others attempt to concentrate on the underlying economic factors in order to explain the observed premia by the associated risk.

Ferguson and Shockley (2003) presented a model with market beta and two factors for firm leverage and distress. In other words, by replacing size and B/M effects with leverage and distress which are claimed to be the economic reasons, they attempted to explain stock returns. In this study between 1964 and 2000, even though they concluded that their model in general outperforms the Fama French model, they asserted that SMB and HML might capture the relative distress that changes over time better than leverage and distress portfolios.

In their study of London Stock Exchange between 1979 and 2002, Agarwal and Poshakwale (2006) examined the relation between distress risk and size and high B/M ratio effects. They found that distress risk has no monotonic relation with B/M ratio while it has some relation with size. Specifically, although highest B/M quintile portfolios have highest failure rates, this does not decline when one moves to lower B/M quintiles. Moreover, it is concluded that although 3 factor model explains stock returns better than CAPM in the UK, its explanatory power is significantly less compared to the US.

Griffin and Lemmon (2002) suggested that among firms with the highest distress risk, the difference in returns between high and low B/M stocks is more than twice as large as that in other firms. Therefore, they assert that this large return differential cannot be explained by the three-factor model or by differences in economic fundamentals. As a result, the authors relate this fact to irrational markets arguments. However, it also reflects that the B/M effect is much stronger within the firms which have already high distress risk. In other words, it is normal to expect the difference in returns low, given the small distress risk associated with certain stocks if B/M effect results from kind of distress risk.

According to Vassalou and Xing (2004), both size and B/M effects can be viewed as default effects. Furthermore, the default risk is systematic and priced in the cross section of expected stock returns. While using five portfolios sorted by B/M and five by size, they divide the portfolios into five quintiles according to their default likelihood and the time period of 1971 – 1999 is examined on the basis of default risk and size, B/M effects.

Specifically, they found that the size effect exists only within the quintile with the highest default risk. In that segment of the market, the return difference between small and big firms is around 45% annually. A similar result is obtained for the B/M effect. The B/M effect exists only in the two quintiles with the highest default risk. Within the highest default risk quintile, the return difference between value and growth stocks is around annual 30%, and goes down to 12.7% for the stocks in the second highest default risk quintile. There is no B/M effect in the remaining stocks of the market.

According to Zhi Da and Pengjie Gao (2006), a rise in a firm's default likelihood results in decrease of holdings and selling pressure causing liquidity risk to rise. When the liquidity risk returns to normal in the subsequent month, the stock price recovers explaining the first month abnormal return earned by stocks with high default likelihood. In other words, higher returns are compensation for providing the liquidity when there is the liquidity risk. It is also asserted that, size and book-to-market premia are resulted from the higher risk associated with the small and high B/M firms. This explanation of Zhi and Pengjie supports the rational explanation for the premia.

Bear and Bull markets: B/M ratio effect and FF coefficients

A bear period is defined as a downward trend in financial markets accompanied with investor pessimism and high motivation to sell. On the other hand, a bull period refers to an upward trend where there is increasing investor confidence and substantial motivation to buy with the expectation of capital gains. Macroeconomic changes are the underlying reason for a bear or bull period. In addition, expectations and investor reactions to information are determinants in bear and bull period formation. While a decline in the market is defined as a bear period when there is at least 15% decrease in the index, a bull period is associated with at least 40% increase. Even though not all sources agree on the stated measures exactly, these are the definitions provided by Global Financial Data.

Market condition is a good concentration point in examining the validity of asset pricing models. Specifically, observing the claimed anomalies or 'risk premia' in bear and bull markets separately is contributory in understanding the economic explanation of relevant risks. Moreover, it provides a naturally formed two non overlapping periods in order to test the pricing models.

Black (1972), Levy (1974) and Son-Nan Chen (1982) observed significant differences in asset pricing models with regard to bear and bull periods. Furthermore, in their examination of downside risk factor, Ang and Chen (2002) found that after controlling for market beta, size and B/M effects, the expected return on a portfolio of stocks with the greatest downside correlations exceeds the expected return on a portfolio of stocks with the least downside correlations by annual 6.55%. Therefore, they concluded that downside correlations capture the asymmetric nature of risk better.

Furthermore, According to Coggi and Manescu (2004), the constant model coefficients assumption of Fama French model is one of its limitations. They tested the model in four sub-periods of 10 years between 1963 and 2002 and concluded that unconditional Fama French model performs very poor in some sub-periods, especially in last years.

A recent study on the robustness of Fama French model in bear and bull periods was performed by Lawrence, Karels, Mishra and Prakash (2006). They have examined the 25 Fama French portfolio returns for the period 1963 – 2002 and found that in general the model performs equally well in both bear and bull periods. In the study, 3 factor regression model is run through each adjacent bear – bull periods and the results for a given bear period is compared with the consecutive bull period. One limitation is that, 4 of the 9 bear periods are omitted due to insufficient data. Therefore, 9 comparisons could be made to see the robustness of the model by the inclusion of 5 bear and 5 bull periods. It is concluded by the authors that, the model performs equally well in both periods. On the other hand, in 45 of the compared 225 (9×25) portfolios, the null hypothesis of coefficient equality in bear and bull periods is rejected.

Hypotheses

I divide my study mainly into two parts. While in the first part I attempt to examine the book-to-market ratio premium in bear and bull markets, in the second part I aim to observe the Fama French model based on the model coefficients in market downturns and upturns.

Part 1: Book-to-market Ratio Premium in Bear and Bull Markets

It is concluded in previous studies including the one of Fama and French (1992) that, high B/M stocks have historically higher average excess returns than low B/M stocks. Here, I check whether the premium for high B/M stocks exists in same amount in both bear and bull market conditions. At the starting point, I expect to realize higher premium in bear market conditions in other words, to reject the first hypothesis given below.

In the relevant previous studies, the economical explanations for the existence of the premium come after the discovery of the premium. In addition, the underlying economical reasoning for the premium is different for different scholars as discussed in the previous section. As Fama and French (1992) state; high B/M stocks have higher average returns because they are riskier due to the distress they include.

I believe that, the results regarding market condition will help in the economical explanation of the premium. Specifically, what leads me to have this idea is the structure of risk relevant to the high returns of high B/M stocks. Because these firms have high exposure to the underlying risk, it is possible to evaluate them as even riskier in a decreasing market where the economical standing is poor and the expectations are negative. On the other hand, in a rising market, it is logical to judge these stocks less risky due to the strong economical environment. Thus, if the investors are attaching the risk to the bear markets, the premium should also be priced in only bear periods.

$H_0 =$ Book-to-market ratio premium does not depend on the market condition (bear or bull) and exists in same amount in both market periods.

$H_1 =$ Book-to-market ratio premium does not exist in bull periods and it is only relevant to bear market.

Part 2: Fama French Model Coefficients in Bear and Bull Markets

As the next step, my objective is to observe the Three Factor Model with regard to the existence of the B/M premium. According to the model, book-to-market equity is one of the three factors with the size and market factor. It is stated that the premium is already priced and while the excess return for a stock is calculated for a past period or estimated for a future interval, the effect of the premium should be taken into consideration. Therefore, the model relies on its coefficients' power to estimate equally well in both bear and bull periods.

Here, my goal is to see any potential difference in the behavior of the model due to the market condition. I perform analyses for each of the 25 portfolios with regard to bear and bull periods and check whether there is any change in coefficients which would signal possible misevaluations driven by the insensitivity of the model to market conditions.

$H_2 =$ Model coefficients vary in bear and bull market conditions for most of the portfolios or for portfolios with specific attitudes (eg. Small, big, low B/M, high B/M)

Different coefficients are to be expected at least for some of the portfolios due to changing market conditions. If the risk premium for high B/M stocks exists only in bear markets or in different amounts in bear and bull markets, then misevaluation of the returns by the model might occur. Specifically, if the risk premium varies substantially in bear and bull periods and this is due to the economical structure of the risk, then there might be problem caused by assuming uniform coefficient in the model.

Data and Methodology

Data Description

The initial data includes the monthly returns for 25 portfolios constructed by Fama and French. The data range starts at July, 1963 and ends at February, 2006. This data of 512 months starts at the same month with what Fama and French (1992, 1993) used in their papers 'The Cross Section of Expected Stock Returns' and 'Common Risk Factors in the Returns on Stocks and Bonds'. However, data range roughly covers an additional 15 years compared to the stated Fama French studies. This broader data set is taken from the website of Dr. Kenneth French.

Construction procedure of the portfolios is explained in details in Fama and French (1992 and 1993). Specifically, as stated by Fama and French, all nonfinancial firms listed in NYSE, AMEX and NASDAQ, having their COMPUSTAT annual industrial files of income statement and balance sheet data are included in the sample. The data range starts at 1963 due to the fact that book value of common equity is hardly available prior to 1962 and the data had been heavily biased toward big historically successful firms.

A firm's market equity at the end of year t-1 is used to compute its market value. Market equity for June of year t is used to calculate firm size. Finally, data on total book assets, book equity and earnings are from its fiscal year ending in any month of calendar year t-1. In order to include a stock in one of the portfolios for any month, all the above data should exist for the firm.

25 portfolios are formed by sorting stocks based on firm size (ME) and book-to-market equity ratio (BE/ME). The portfolio SMB (small minus big) mimics the risk factor in returns related to size. It is the difference between the average of returns for small portfolios and the average of returns for large portfolios. On the other hand, the portfolio HML (high minus low) captures the risk factor in returns related to book-to-market equity ratio (B/M). Similarly, it is calculated by the difference between the average of returns for high B/M portfolios and the average return for low B/M portfolios. 25 portfolios are created from the intersections of the size and B/M quintiles. I am going to observe both the difference between HML in bear and bull markets and individual portfolio returns to determine any increasing pattern in quintile returns.

Here, I use value weighted monthly returns on the portfolios. First, it enables me to make healthier examination of the Fama French findings as they use value weighted returns. More importantly, by using value weighted returns instead of equal weighted ones, the high variance of stock returns are decreased since returns are negatively related to firm size.

I use S&P 500 index to identify the bear and bull market periods. The reason is that, the index captures most of the market and gives a quiet satisfying view for the direction of the market. I use S&P 500 composite index instead of an equally weighted index due to the principal fact that I aim to concentrate on the expectations and investors' evaluation of future rather than the raw returns as a result of past events. I believe that, even though an equally weighted index would be a better benchmark in comparison of B/M sorted portfolio returns, S&P 500 value weighted index is a better signal for people's expectations for the future. Therefore, it is a better benchmark to identify bear and bull periods as well as investors' perception of future events. Because the so-called risk attached to the high B/M premium depends on the future rather than the history, it is more useful to take S&P 500 composite index as market index.

Bear and bull markets are identified on the basis of definitions stated in the previous studies and in Global Financial Data. It is already explained in detail in previous section. Shortly, bull market covers an at least 40% increase while bear market has at least 15% decrease. The bull and bear periods are listed in table 1.

Table 1

Consecutive Bull and Bear Periods

Consecutive 10 bull and 9 bear periods between July 1963 and February 2006. Global Financial Data definitions for bear and bull markets are used (at least 15% decrease to define bear markets, at least 40% increase to define bull periods).

Bull Periods	Bear Periods
June 1963 – January 1966	February 1966 – September 1966
October 1966 – November 1968	December 1968 – May 1970
June 1970 – December 1972	January 1973 – September 1974
October 1974 – December 1976	January 1977 – February 1978
March 1978 – November 1980	December 1980 – July 1982
August 1982 – August 1987	September 1987 – November 1987
December 1987 – June 1990	July 1990 – October 1990
November 1990 – June 1998	July 1998 – August 1998
September 1998 – March 2000	April 2000 – September 2002
October 2002 – February 2006	

On the other hand, while identifying the bear and bull periods in the data, I varied from some of the previous studies for several times. Most of this is due to the selection of starting and ending months of the bear and bull periods. Although almost all of the bear and bull period borders are same with the closest study made by Lawrence et al.(2006), there are still some months which I consider the opposite with what was identified in their study. Furthermore, while Global Financial Data associates a bear or bull period with a market high and market low, interpretation of starting and ending dates is left to the reader.

In order to give an example, October, 1974 is included in bear market period in Lawrence et al. (2006). The closing value of the index for September is 63,54. Due to the fact that the index decreased to 62,28 in October and became the lowest point, October is included as a bear month as well. However, the index rises to 73,9 by the end of October being the first month of a bull period. Therefore, October is a clear bull month in which the returns are positive and the market rises by around 18%. There are few months in the data which are similar to October, 1974 in this sense. As a result, through the data, I have 10 bull periods and 9 bear periods coming one after the other.

Methodology

As stated in the hypotheses section, for the first part, the so-called premium for high book-to-market ratio stocks are examined in bear and bull periods. It is checked whether the premium depends on the market condition (bear-bull). For this purpose, I identify each month as bear or bull and see the average premium for bear and bull months. I observe the equality of means in HML (average difference in returns of highest B/M quintile portfolios and lowest B/M quintile portfolios) for bear and bull markets. I examine the difference in premia in different subsamples as well. Initially, I divide the sample into two equally long subsamples and check for the difference in premia in each (Before and after Jan. 1985). Secondly, I test the equality of mean HML premia through bear – bull markets before and after 1990. By this task, I aim to observe any change in premium differences due to the very long bull markets after 1990.

I test the equality of means through two sample t-test with unequal variances. Due to different variances, Satterthwaite's approximation is used for calculation of p-values. Below is the satterthwaite's approximation of degrees of freedom where n_1 and n_2 are number of observations for each market type and s_1 and s_2 are the associated standard deviations.

$$degrees\ of\ freedom = \frac{(n_1 - 1)(n_2 - 1)}{(n_1 - 1)(1 - c)^2 + (n_2 - 1)c^2}$$

$$c = \frac{s_1^2/n_1}{s_1^2/n_1 + s_2^2/n_2}$$

As next step, I test whether the bull market average HML value is different from zero. For 392 bull months, I observe the mean HML premium and its difference from zero through t-test.

For 25 portfolios, If we name 1a, 1b,..., 1e the highest B/M quintile portfolios and 5a, 5b,..., 5e the lowest quintile portfolios, HML in any given month for bear and bull markets are determined as below;

$$HML = (R_{1a} + R_{1b} + R_{1c} + R_{1d} + R_{1e})/5 - (R_{5a} + R_{5b} + R_{5c} + R_{5d} + R_{5d})/5$$

For the second part, the aim is to see whether the Fama French coefficients perform equally well in both bear and bull periods. In order to test this, I run a regression by including four new regressors (resulting from the interaction of a market condition dummy variable with the three risk factors as well as the constant in the Fama French model. As we remember, below stated three factor model regression does result in three coefficients for each of the 25 portfolios.

$$(R_{it} - R_{ft}) = \alpha + \beta(R_{mt} - R_{ft}) + s(SMB_t) + h(HML_t)$$

By the help of a dummy variable, I test the hypothesis of whether the coefficients depend on market condition or not. In addition, I include three more coefficients, β_1, s_1 and h_1 to the same regression to see any change in three factor coefficients. In other words, my objective is to observe any significant value for β_1, s_1 and h_1 in the regressions done for each of the 25 portfolios. If the model consistently explains the returns for each portfolio through different market conditions, the additional coefficients should not be significant. The dummy variable and the main equation that I run on each portfolio returns are given below.

$$D_t = 1 \; if \; month \; t \; is \; in \; bull \; period$$

$$D_t = 0 \; if \; month \; t \; is \; in \; bear \; period$$

$$(R_{it} - R_{ft}) = \alpha + \alpha_1 D + \beta(R_{mt} - R_{ft}) + \beta_1[D \times (R_{mt} - R_{ft})] + s(SMB_t) + s_1(D \times SMB_t) + h(HML_t) + h_1(D \times HML_t)$$

Specifically, the derivatives with regard to the three factors in the Fama French model are $\beta, s \; and \; h$;

$$\frac{d[(R_{it} - R_{ft})]}{d[(R_{mt} - R_{ft})]} = \beta, \qquad \frac{d[(R_{it} - R_{ft})]}{d[(SMB_t)]} = s \quad and \quad \frac{d[(R_{it} - R_{ft})]}{d[(HML_t)]} = h$$

On the other hand, in the regression with the dummy variable we have the derivatives as $(\beta + \beta_1 \times D), (s + s_1 \times D) \; and \; (h + h_1 \times D)$;

$$\frac{d[(R_{it} - R_{ft})]}{d[(R_{mt} - R_{ft})]} = (\beta + \beta_1 \times D),$$

$$\frac{d[(R_{it} - R_{ft})]}{d[(SMB_t)]} = (s + s_1 \times D) \quad and \quad \frac{d[(R_{it} - R_{ft})]}{d[(HML_t)]} = (h + h_1 \times D)$$

Therefore, the results are based on the question, whether the below equalities are sustained or not for 25 portfolios;

$$\beta = (\beta + \beta_1 \times D)$$

$$s = (s + s_1 \times D)$$

$$h = (h + h_1 \times D)$$

Once more, my objective in this study is to observe the book-to-market ratio premium in bear and bull markets. However, while examining the Fama French model in part 2, I check not only the HML coefficients but also the coefficients of market factor and SMB factor. This is due to the fact that any possible change in one of the coefficients might be accompanied with changes in other coefficients and only by observing all three factors, conclusions can be drawn on the success of model estimation in bear and bull periods.

In order to analyze the estimated returns obtained by 3 factor Fama French model, in addition to the modified model with dummy variables, I run the standard 3 factor model as well through the extended data range of July, 1963 to February, 2006. By this, comparison of exposures to risk and estimated excess returns between two models can be made.

Results

B/M Effect in Bear and Bull Markets

As a first step, I compare monthly average returns for high B/M and low B/M stocks in bull and bear market conditions. In order to perform this task, I use Fama French 25 portfolios and observe the average premium between highest B/M quintile portfolios and lowest B/M quintile portfolios after controlling for size. The data consists of 512 months; 392 bull months and 120 bear months.

My first hypothesis, H_0 is strongly rejected enabling us to conclude that B/M premium highly depends on the market condition. Specifically, the average monthly premium for holding high B/M portfolios instead of low B/M portfolios for the whole period is 0,54% (annual 6,68%). This average monthly premium is 1,87% (annual 24,9%), when there is a bear market condition. On the other hand, in bull periods, the average premium is monthly 0,14% (annual 1,69%). Therefore, the monthly difference between the average premium in bear and bull markets is as high as 1,74%

Although examining portfolio returns instead of individual returns decreases much the volatility of monthly returns, standard deviations for the portfolios are as high as 3,2% in bull months and 4,3% in bear months. However, in two sample t-test with unequal variances, the difference between the bull and bear periods is tested and a t-value of 3,99 reflects a significant difference between the premia relative to each of the two market conditions. Table 2 indicates the results for the two sample test.

Table 2

HML Premia in bear – bull conditions between July, 1963 – February, 2006: Two-sample t-test with unequal variances

For the unequal variances of two groups, Satterthwaite's approximation is used. The difference between the average premia in bear and bull conditions is significantly different from zero.

Group	Obs	mean	Std. Dev.	95% confidence interval	
Bear	120	1,874	4,392	1,08	2,67
Bull	392	0,138	3,295	-0,19	0,47
Overall	512	0,545	3,653	0,23	0,86
Difference (bear – bull)		1,736		0,88	2,59
t-value		3,999			
Pr(T > t)		0,000	Satterthwaite's degree of freedom		162,079

As a suplementary information, SMB, premium between small and big company stocks as well as the market return through bear and bull markets are summarized in tables 3A and 3B.

Table 3a

SMB premium between July, 1963 – February, 2006

SMB premium is calculated in the similar way as HML premium calculation;

$$\mathrm{SMB} = (\mathrm{R}_{1a} + \mathrm{R}_{1b} + \mathrm{R}_{1c} + \mathrm{R}_{1d} + \mathrm{R}_{1e})/5 - (\mathrm{R}_{5a} + \mathrm{R}_{5b} + \mathrm{R}_{5c} + \mathrm{R}_{5d} + \mathrm{R}_{5d})/5$$

Where the average of returns on five portfolios of largest size quintile is deducted from the average of five portfolios of smallest size quintile for each month.

Group	Obs	Mean	Std. Dev.
Bear	120	-0,25	5,30
Bull	392	0,52	4,40
Overall	512	0,34	4,63

Table 3b

Market Return between July, 1963 – February, 2006

Market return is the monthly return on S&P 500 Index.

Group	Obs	Mean	Std. Dev.
Bear	120	-2,31	4,56
Bull	386	1,58	3,73
Overall	506	0,65	4,27

Furthermore, I observe the HML premia in subsamples by dividing the data into two; Before and after January 1985. By choosing the subsamples as stated, I observe the premia through two periods of same duration. Appendix A includes the results for the premia in two subsamples. Simply, it is seen that, even though the premia are different in two subsamples, the difference between bear period premium and bull period premium is significantly different in both subsamples. Below, table 4 summarizes the results.

Table 4

HML Premia before and after January, 1985

Before 1985			After 1985		
Group	Obs	Mean	Group	Obs	Mean
Bear	81	1,52	Bear	39	2,61
Bull	177	0,228	Bull	215	0,064
Overall	258	0,63	Overall	254	0,455
Difference (bear – bull)		1,292	Difference (bear – bull)		2,546
t-value		3,078	t-value		2,493
Pr(T > t)		0,0012	Pr(T > t)		0,0083

Second examination of subsamples that I go through is about the HML premia through bear and bull markets before and after 1990. By this, I aim to observe the difference between the premia in bull and bear markets in two subsamples as well as the different overall premia most probably resulting from the very long bull periods after 1990. Table 5 summarizes the results for this analysis. Results can be found in Appendix B.

It can be seen that average overall premium is smaller in the second period starting at 1990. This is because; compared to the number of bear months after 1990, the number of bull months is very high. When we examine the premium in bear and bull months seperately, it is seen that bear market average premium is much higher for the second part of the data. (1,563% before 1990, 2,6% after 1990). On the other hand, bull market mean premium is lower in this second part (0.248% before 1990, -0,026% after 1990). As a result, difference between premia in bear – bull markets before 1990 is double of the one after 1990. From this fact, I conclude that, in the latter part of the data, the findings of very high B/M premium in bear markets and no premium in bull markets are even more evident. I believe that relatively lower t-value of 2,351 in the analysis of difference in premia after 1990 is especially due to small number of bear months observed resulting in higher standard deviation.

Table 5

HML Premia before and after January, 1990

Before 1990			After 1990		
Group	Obs	Mean	Group	Obs	Mean
Bear	84	1,563	Bear	36	2,6
Bull	234	0,248	Bull	158	-0,026
Overall	318	0,596	Overall	194	0,462
Difference (bear – bull)		1,315	Difference (bear – bull)		2,626
t-value		3,367	t-value		2,351
Pr(T > t)		0,0005	Pr(T > t)		0,0118

In addition, I examine the returns for all Fama French (FF) 25 portfolios to see the increasing pattern in average monthly returns while moving from low B/M to higher B/M portfolios. This pattern can be seen in Table 5 (pp. 446) in Fama French (1992). The average monthly premium between 10 highest B/M portfolios and 10 lowest B/M portfolios is stated as 0,99% for the time period July 1963 – December 1990. Furthermore, there is a constant pattern in the average portfolio returns so that, one expects to earn higher returns moving in the direction of higher B/M quintiles.

Here, I would like to check for the same pattern with the extended data of July 1963 – February 2006 and also observe the effect of bear and bull market conditions by analyzing the pattern in each separately. Table 6a and 6b reflects the average value weighted monthly returns for bull and bear markets respectively.

Table 6a

Mean returns for 392 bull months between July, 1963 – February, 2006

Size \ B/M	Low	2	3	4	High
Small	2,06	2,39	2,24	2,36	2,53
2	2,19	2,12	2,31	2,26	2,31
3	2,14	2,21	2,04	2,08	2,25
4	2,14	1,97	2,06	2,11	2,13
Large	1,84	1,84	1,73	1,73	1,85

Table 6b

Mean returns for 120 bear months between July, 1963 – February, 2006

Size \ B/M	Low	2	3	4	High
Small	-3,63	-2,21	-1,55	-1,06	-1,20
2	-3,38	-2,05	-1,54	-1,14	-1,01
3	-3,17	-2,00	-1,45	-1,14	-0,90
4	-2,67	-2,19	-1,49	-1,15	-1,14
Large	-2,26	-1,93	-1,54	-1,16	-1,49

As a result, It can be concluded that the average premium for high B/M stocks are mostly due to the very high premium in bear market periods. On the other hand, The premium is small in bull markets indicating that the so-called premium is essentially produced by bear market characteristics. Moreover, the pattern of constant increase in average portfolio returns, moving from lower B/M quintiles to higher ones is very sharp in bear periods while there is not a clear pattern in bull markets. Specifically, as it can be seen in tables 6a and 6b, the premium between highest and lowest B/M quintile portfolios vary from 0,77% to 2,43% in bear markets while the it varies from -0,01% to 0,47% in bull markets.

Therefore, if we assume that the HML premium is caused by an associated risk as it is explained by Fama and French (1993), it can also be concluded that the exposure to the undertaken risk is essentially relevant in bear market times. In other words, when it is a bull market, the premium that investors require for holding higher B/M stocks is very low compared to the premium asked for holding the same stocks when the market is going down. This case is to be discussed in more details in the next section.

As a next step, I test the null hypothesis, H_1 to see whether the B/M premium exists in bull markets. It is seen that, the t-statistic is not significant. In other words, we cannot reject the null hypothesis of 'premium in bull markets is zero'. While there exists a low average premium in bull markets (0,14%), it is not significantly different from zero. Table 7 reflects the test result.

Table 7

HML premium in bull market conditions (July, 1963 – February, 2006)

Variable	Obs	Mean	Std. Dev.	95% confidence interval	
HML	392	0,1379	3,2956	-0,19	0,465

Ho: mean = 0 t = 0,8286 Degrees of freedom = 391

Volatility and Return: Sharpe Ratio

Before the examination of Fama French model, I would like to point out one dimension of risk; volatility

Volatility for a given stock price is mostly measured by its standard deviation in a certain time horizon. It is used to quantify the associated risk in the stock return in terms of the level of variations in returns. Sharpe ratio is used to measure how well a stock or a portfolio performs given its risk in terms of standard deviation. Table 8a and 8b reflects the mean returns and standard deviations for the 25 FF portfolios.

Table 8a

Mean monthly returns on 25 FF portfolios between July 1963 – February 2006

Size \ B/M	Low	2	3	4	High
Small	0,73	1,31	1,35	1,56	1,66
2	0,89	1,15	1,41	1,46	1,53
3	0,90	1,22	1,23	1,32	1,51
4	1,01	0,99	1,23	1,35	1,37
Large	0,88	0,96	0,96	1,05	1,07

Table 8b

Standard deviations for monthly returns on 25 FF portfolios between July 1963 – February 2006

Size \B/M	Low	2	3	4	High
Small	8,18	6,98	5,98	5,58	5,87
2	7,40	6,00	5,33	5,12	5,70
3	6,78	5,42	4,88	4,71	5,36
4	6,01	5,10	4,82	4,65	5,29
Large	4,75	4,51	4,27	4,19	4,78

It is seen that, while mean monthly returns on portfolios increase in higher B/M quintiles, standard deviations of the portfolios do not. On the contrary, standard deviations are generally higher for lower B/M portfolios. In other words, taking into account the volatility of portfolios by itself, one should expect higher returns on lower B/M quintiles. However, it seems that portfolios with lower standard deviations yield consistently higher mean returns. Therefore, Sharpe ratio or any measure of performance given the certain risk level is consistently higher for high B/M stocks due to both lower standard deviations and higher returns. This fact implies either very high market irrationality or any type of risk other than volatility risk associated with high B/M stocks.

Furthermore, this pattern is same in both bear and bull markets. The analysis of portfolio standard deviations in bear and bull markets can be seen in tables 9a and 9b respectively. Higher B/M portfolios yield more on average despite their low volatility risk in both bear and bull markets.

Table 9a

Standard deviations for monthly returns on 25 FF portfolios through bear markets between July 1963 – February 2006

Size \ B/M	Low	2	3	4	High
Small	9,99	8,28	6,86	6,67	6,67
2	8,66	7,17	6,25	5,99	6,69
3	8,07	6,36	5,82	5,39	6,19
4	7,19	6,03	5,55	5,16	5,74
Large	5,09	4,91	4,76	4,39	5,31

Table 9b

Standard deviations for monthly returns on 25 FF portfolios through bull markets between July 1963 – February 2006

Size \B/M	Low	2	3	4	High
Small	7,03	6,16	5,38	4,95	5,32
2	6,43	5,22	4,66	4,54	5,12
3	5,80	4,69	4,24	4,21	4,85
4	5,10	4,35	4,24	4,19	4,89
Large	4,20	3,98	3,80	3,89	4,32

Fama - French Model in Bear and Bull Markets

In this part, I test the performance of Fama French model in bear and bull periods through the hypothesis H_2. Three coefficients (β_1, s_1 and h_1) are included in the 3 factor model and by the inclusion of a dummy variable to control for the market condition, I test whether the coefficients are significantly different from each other in bull and bear markets. Below the previously introduced model is restated.

$$(R_{it} - R_{ft}) = \alpha + \alpha_1 D + \beta(R_{mt} - R_{ft}) + \boldsymbol{\beta_1}[D \times (R_{mt} - R_{ft})] + s(SMB_t) + \boldsymbol{s_1}(D \times SMB_t) + h(HML_t) + \boldsymbol{h_1}(D \times HML_t)$$

As a result of the regressions for FF 25 portfolios, the coefficient h_1 is significant in 1% level for 10 portfolios out of 25. Furthermore, in all 10 regressions with significant h_1, the coefficients are negative implying that the bull market coefficients are significantly smaller than the ones in bear market environment. (D=1 when the market is bull). Moreover, coefficient s_1 is significant in 6 portfolios by 1% level. Finally, coefficient β_1 is significant in 2 of the 25 portfolios. Table 10 reflects the number of coefficients (β_1, s_1 and h_1) significant in different significance levels. The HML coefficients, h *and* $(D \times h_1)$ and corresponding t values are summarized in Table 11.

Table 10

Number of portfolios in which the stated coefficients; β_1, s_1 and h_1 are significant in the regressions over 25 portfolios.

coef.\ sig. level	1%	5%	10%
h_1	10	1	-
s_1	6	3	5
β_1	2	5	1

Table 11

HML coefficients h and $(D \times h_1)$ for bear and bull markets

For bear markets, the coefficient of HML is $h + (0 \times h_1) = h.$ On the other hand, in bull markets, the coefficient is $h + (1 \times h_1) = h + h_1$. Therefore, first rows of each size quintile stands for the HML coefficient for bear markets and second rows for the coefficient changes in bull markets. Finally, third rows reflect the significance values. The portfolios with significant difference in bear – bull market coefficients are shaded.

Size \ B/M		Low	2	3	4	High
Small	Bear	-0,076	0,449	0,563	0,666	0,697
	Δbull	0,083	-0,159	-0,139	-0,099	0,075
	t-value	0,560	-1,310	-1,580	-1,290	1,120
2	Bear	-0,139	0,457	0,579	0,732	0,817
	Δbull	-0,121	-0,282	-0,195	-0,168	-0,008
	t-value	-1,140	**-3,900**	**-3,540**	**-3,200**	-0,150
3	Bear	-0,292	0,382	0,596	0,753	0,845
	Δbull	-0,015	-0,222	-0,169	-0,221	-0,084
	t-value	-0,160	**-3,550**	**-2,990**	**-4,110**	-1,320
4	Bear	-0,312	0,416	0,580	0,703	0,741
	Δbull	0,012	-0,264	-0,211	-0,161	-0,034
	t-value	0,160	**-4,220**	**-3,360**	**-2,700**	-0,440
Large	Bear	-0,361	0,187	0,294	0,532	0,644
	Δbull	-0,061	-0,203	-0,141	-0,080	0,032
	t-value	-1,370	**-3,440**	**-1,990**	-1,110	0,340

Comparison of Model Estimations; An Example

I would like to illustrate the potential misevaluation of the excess return for an asset by the use of Fama French 3 factor model.

In order to define the excess return of the S2-BM2 portfolio (intersection portfolio of second size quintile and second B/M quintile) for a certain month, the below stated 3 factor FF model is used. The associated coefficients are obtained by the regressions through the extended time period of July 1963 – February 2006. The regression coefficients for the model with dummy variables and the ones for the FF 3 factor model through July 1963 – February 2006 are included in the Appendices C and D respectively. Below, the excess return is calculated with the model regardless of whether the given month is a bear or bull month.

$$(R_{it} - R_{ft}) = -0{,}077 + 1{,}098(R_{mt} - R_{ft}) + 0{,}728(SMB_t) + 0{,}265(HML_t)$$

On the other hand, for the same portfolio, the modified model with dummy variables to identify bear and bull markets is below;

$$\begin{aligned}(R_{it} - R_{ft}) = {} & 0{,}01 - 0{,}146 \times D + 1{,}131(R_{mt} - R_{ft}) - 0{,}027[D \times (R_{mt} - R_{ft})] \\ & + 0{,}878(SMB_t) - 0{,}209(D \times SMB_t) + 0{,}457(HML_t) - 0{,}282(D \times HML_t)\end{aligned}$$

If the given month is bull month, the average values for the associated three factors and the risk free rate are as following; $(R_{mt} - R_{ft}) = 1{,}44\%$, $SMB_t = 0{,}41\%$, $HML_t = 0{,}16\%$ and $R_{ft} = 0{,}44\%$

After calculating the mean excess return, $(R_{it} - R_{ft})$, on the portfolio by using the standard FF model, we get 1,85%. Alternatively, if we use the modified model, the resulting average excess return is 1,76% for the period July 1963 – February 2006. The monthly misevaluation due to the bull market condition is on average 0,09% (annual 1,09%). It can be seen that the misevaluation is relatively low for the portfolio even though the coefficients are significantly different for bear – bull markets. This relatively small misevaluation in average is caused by two reasons. First of all, the average HML factor is as low as 0,16% due to the fact that it is a bull month. Therefore, any change in coefficients affect in small amount when multiplied by the HML factor. Secondly, around 80% of the overall data is considered as bull months and the general HML coefficient (0,265) in 3 factor model is close to the total bull market HML coefficient (0,175) in the model with dummy variables.

Alternatively, if the given month is a bear month, the average values for the factors are as follows; $(R_{mt} - R_{ft}) = -2{,}7\%$, $SMB_t = -0{,}2\%$, $HML_t = 1{,}75\%$ and $R_{ft} = 0{,}56\%$

Three factor FF model results in an excess return of -2,72% while the modified model gives the return as -2,42%. Therefore, there is a mean monthly misevaluation of -0,3% (yearly 3,67%) on the portfolio. This difference is primarily due to the significant difference in HML coefficients, 0,192 (0,457 – 0,265) and very high monthly HML premium in bear markets (1,87%).

For 10 of the 25 portfolios the coefficients are significantly different in bear and bull markets in 1% level resulting in misevaluation of the relation between asserted risk factors and premia. The misevaluation in returns is relatively small for bull markets primarily due to the fact that HML premium is generally very low in this market condition. Alternatively, the misevaluation of risk factor in the explanation of returns is higher in bear markets resulting from the high premium and high difference in coefficients.

One important point is that, the above stated differences in excess returns by the use of two models are the mean misevaluations for the whole data, July 1963 – February 2006. However, the effect of the difference in coefficients is especially observable through the months when the return on HML portfolio is very high or low. Stock returns have high standard deviations and the HML factor varies between -10% and 14% through the data range. For instance, if we observe the certain month when the HML premium is 13,8% (February, 2001), it is seen that the misevaluation of the B/M risk exposure is 2,65% (0,192 × 13,8%). The estimated excess return for the month is -8,20% by using three factor FF model. On the other hand, it is -5,98% by using the modified model with regard to the bear market condition (April, 2000 – September, 2002). As a result, the difference between the excess returns obtained by the application of two models for that given month is 2,22% (30,15% per annum). When we look at the actual return on the portfolio for the given month, it is -3,01%. Therefore, it can be concluded that, the exposure to the underlying risk for the HML premium is not fully captured by the FF model resulting in a high undervaluation of the portfolio excess return.

It is obvious that, in bear markets, the risk relevant to the HML premium is not fully covered for some of the portfolios. In addition, the exposure to the risk is reflected in a higher amount than its actual value in bull periods. The difference between the estimated excess returns using the two models depends on returns of market, HML and SMB portfolios. In the months when these premia are high, the difference between the predicted returns is high due to the levels of high risk.

When the R-squares are examined for the regressions, it is seen that they vary from 0,73 to 0,93. (Table 12). The average R-square of the model is 0,87. On the other hand, we can observe that in 21 of 25 portfolios, R-squares are over 0,9 in the study of Fama and French, 1993 (Table 6, p.25). Moreover, the average R-square are stated as almost 0,95. However, relatively low R-squares here are mainly due to the extended data range. When the Fama French 3 factor model is performed through 1963 – 2006, it is seen that being almost same, R-squares are slightly lower than the ones obtained by the modified model with dummy variables.

Table 12

R-squares of the modified model

$$(R_{it} - R_{ft}) = \alpha + \alpha_1 + \beta(R_{mt} - R_{ft}) + \boldsymbol{\beta_1}[D \times (R_{mt} - R_{ft})] + s(SMB_t) + \boldsymbol{s_1}(D \times SMB_t) + h(HML_t) + \boldsymbol{h_1}(D \times HML_t)$$

Size \ B/M	Low	2	3	4	High
Small	0.76	0.78	0.84	0.86	0.91
2	0.85	0.89	0.92	0.92	0.93
3	0.86	0.90	0.90	0.90	0.90
4	0.88	0.89	0.87	0.88	0.84
Large	0.93	0.87	0.80	0.78	0.73

The similarity in R-squares of two models is caused by the fact that, the inclusion of dummy variables does not bring any new information. It rather distributes the existing information between the two market conditions. FF model predicts stock returns by using three factors and it is very common that, the missing role of one factor is cancelled by the other factors. However, while a certain stock has significantly higher exposure to the risk underlying the HML factor through a bear period, the extent of bearing this risk can be underestimated by the FF model. However, the undervaluation of excess return resulting from this fact can be cancelled by an overvaluation in the other model risk factors. Thus, the model can predict the returns still well even though it includes different than actual exposures to the associated risks.

Discussion of the Results

I would like to draw my conclusions in three dimensions. First, the premium standing for the risk captured by the HML factor is shown to be different in bear and bull periods. From the standing point of Fama and French, who claim that the premium is a reward for the undertaken risk, it can be concluded that the exposure to this risk is very low in bull markets. This finding is especially important in breaking down the risk accurately into bull and bear markets in the sense that it is relevant mostly in bear periods when the expectations are low and there is wide pessimism through the market.

Secondly, economic explanation for the risk underlying the premia is still not agreed upon. This provides a standing for a behavioral approach with its assertion of irrational market reaction as the cause of premia. Better understanding of the premium enables us to say more about the risk itself.

Finally, three factor FF model uses the returns on HML, SMB and Market portfolios and the associated risk exposures to predict the excess returns. Three factors stand for the premia earned as a reward for bearing certain risks. Therefore, the model includes HML as a factor due to the fact that high B/M stocks outperform low B/M stocks consistently which cannot be explained by market factor in CAPM. After associating the premium for holding higher B/M stocks with mainly bear market condition, the amount of exposures to risk determined in three factor FF model has been the other point to examine. It is observed that, for 10 out of 25 portfolios, the exposures to the risk underlying the HML factor are different in bear and bull markets.

B/M Effect in bear – bull markets

In order to mention once more, the mean monthly premium between highest and lowest quintiles is 0,54% for the whole data. The examination of bear and bull periods' premia separately results in 0,14% for bull markets and 1,87% for bear markets. In addition, while there is a clear pattern of increasing returns for higher B/M portfolios in bear markets, the returns are close to each other in bull markets and there is not a sharp pattern.

The difference between the mean premia in bear and bull markets (1,73%) is significant and different from zero in both subsamples (before and after 1985). While we cannot conclude that the premium is zero in bull markets, the low mean premium of 0,14% is not significantly different from zero. On the other hand, it is obvious that the so-called overall premium of monthly 0,54% is produced by the very high premium in bear markets. Therefore, leaving the discussion on the underlying explanation of the premium to the next part, I conclude that the premium is associated with only the conditions in bear markets. Higher B/M stocks outperform the low B/M stocks consistently when there is a bear market condition.

HML Premium: Compensation for risk or irrational market reaction?

B/M anomaly is defined as a risk premium in many studies like the ones of Fama and French (1992, 1993 and 1996). On the other hand, it is seen as a contradiction to rational market theories by other studies of behavioral point of view (Daniel and Titman, 1997 and Lakonishok et al. 1994).

According to the rational explanation for the premium, higher returns arise due to the higher risk undertaken by holding stocks with high B/M ratios. The economical reason for the risk captured by the HML factor is open to discussion. It is already mentioned that the premium is not caused by the higher volatility of returns and by the uncertainty of varying returns. On the contrary, standard deviations for higher B/M portfolios are lower. A kind of distress, default risk is pronounced by most of the studies.

I believe that findings about the B/M effect in bear and bull markets in the first part of this study are relevant in understanding the source of HML premium. The fact that higher B/M stocks outperform the low B/M stocks consistently through bear markets implies the existence of the exposed risk in only bear markets. Therefore, it is important to take into account the bear market characteristics. Specifically, the expectations are very low mostly due to the factors about the bad performance of general economy. This supports the fact that premium is sourced by a kind of default risk and uncertainty which is normally very high in bear markets. On the other hand, in bull markets, it is not surprising to observe the exposure to the risk much lower as a risk of default for distressed firms are low. The theory of high default risk in bear markets is favored by the evidence from Vassalou and Xing (2004) where they showed that average LFI (default likelihood indicator) of all firms vary greatly with business cycle and increase substantially during recessions. Thus, I here conclude that this sharply increased level of risk in bear markets is the driver of the B/M effect. Furthermore, my findings of very high premium for high B/M stocks in bear markets and insignificant premium in bull markets provides evidence for the risk based explanation.

As it is mentioned before, Griffin and Lemmon (2002) defined the distress risks associated with each portfolio and concluded that for the stocks with highest exposure to distress risk, the HML premium is twice as high as premia for stocks which have lower exposure to distress risk.

In addition, my study results on the role of bear – bull markets in determining the risk exposure are best in line with the results of Vassalou and Xing (2004). To restate once more, they associated the default risk levels for each B/M and size quintile. As a result, they observe the B/M effect only in the highest two default risk quintiles. Therefore, the premium is relevant only if the stocks are exposed to default risk. Here I conclude that, stocks with higher B/M ratios outperform the ones with low B/M ratios only when they have exposure to the risk arising in bear market conditions.

I believe that expectations of investors are very determining in the formation of the premium. Bear and bull markets are key factors in shaping the expectations of market players. It is logical to see that in bear markets, investors demand a high premium for holding stocks with higher default risks. It is hard to claim that existence of premium in only bear markets provides evidence on the investor overreaction case in which past outperformers are preferred much more than the past underperformers by misjudgment. In other words, it brings doubt on the assertion that investors overreact to low B/M stocks which performed better previously and they are expected to yield higher returns in the future as well. Specifically, bear and bull periods follow each other and very high premium in bear markets can hardly be explained by 'overreaction in only one market condition' On the other hand, it is due to the pessimistic market characteristic where high B/M stocks are affected more in the sense that they are held with only high demand for returns.

Very high level of premium in bear periods supports the fact that investors demand the premium for undertaking increased risk arising due to the bear market characteristics. To sum up, a risk based economic explanation for the premium between returns of stocks with high and low B/M ratios makes more sense than a behavioral explanation. In addition, premium levels in bear – bull market conditions reflects that future expectations are priced in the financial markets.

Risk exposures in Fama French Model

When the model is used in explaining stock returns taking into account the market condition, for 10 out of 25 portfolios, the coefficient of HML risk factor is different for bear and bull markets by 1% significance level. Therefore, excess return for a given asset can be misvalued due to its exposure level to the risk underlying the HML factor.

B/M effect is shown to be consistent through the study of Fama French (1992). In addition, the premium between high B/M and low B/M stock returns is stated as a consequence which cannot be explained by CAPM. Therefore, the premium is explained by an additional factor, HML. However, in calculation of excess returns, same exposures to the risk associated with the HML premium is used for bear and bull markets. After concluding that this risk is only relevant to bear market characteristics and the stocks are exposed to that risk essentially in bear markets, it is better to take into account the market type in calculation of excess returns.

Furthermore, one could expect that, HML coefficients in bull markets should be all insignificant if there is no associated risk at all. However, while being in significantly smaller amounts for 10 out of 25 portfolios in bull markets, coefficients exist and do not vary in bull – bear markets for the rest of the portfolios. This might be due to the fact that, even though the premium is close to zero in bull markets, the associated risk underlying the B/M effect exists in certain amounts. In other words, while it is not priced in financial markets through bull periods, the risk remains in smaller amounts and it is only priced through bear markets. This is logical in the sense that in bull markets as well, there is uncertainty about the future. In a market upturn, holding an asset, which has high exposure to the relevant risk through bear periods, is not fully independent from that risk as the market may turn into bearish anytime. Therefore, I believe that this fact is about the timing of the premium (through bear markets) and the risk structure (high level of risk associated with mainly bear market characteristics and uncertainty of the next bear period time).

In order to summarize my conclusions;

B/M Effect is essentially associated with bear market characteristics where the mean annualized premium for holding high B/M stocks is as high as 24,9% (1,87% for bull markets).

Economically, observing that the B/M effect is mostly relevant to bear market conditions provides evidence on the fact that underlying explanation for the premium is risk based rather than market irrationality.

3 factor Fama French model uses same exposure levels in both market conditions however, for 10 out of 25 portfolios, exposures to the risk underlying HML premium are significantly different for bear and bull periods. In addition, for all 10 portfolios, bull market risk exposures are smaller than the bear market ones.

Suggestions for Further Studies

It is already found by several studies (e.g. Vassalou, Xing, 2004) that default risk is an important determinant in B/M effect. Moreover, it is stated here that the premium exists mainly in bear market conditions. Both of the facts are in line in the sense that the amount of B/M effect increases sharply when the stocks are exposed to higher risk. In addition, deafult likelihood through recession times are previously shown to be very high. Therefore, it would be interesting to make a study on the relationship between the number of defaults in bear – bull markets and the B/M effect.

The average R square of three factor model is 0,93 in the study of July 1963 – December 1991 made by Fama and French (1993). However, it is seen that the average R-square of three factor Fama French model decreases to 0,87 for the extended time period used here (July 1963 – February 2006). Therefore, it would be interesting to analyze the bad performance of the model after 1991. Finally, It would be contributory to identify fully the underlying reasons of the HML premium.

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Appendices

Appendix A

Premia in bear – bull conditions for two equal subsamples (before and after January, 1985): Two-sample t test with unequal variances

Before 1985

Group	Obs	Mean	Std. Dev.	95% confidence interval	
Bear	81	1,52	3,17	0,82	2,22
Bull	177	0,228	3,04	-0,223	0,68
Overall	258	0,633	3,13	0,25	1,02
Difference (bear – bull)		1,29		0,463	2,12
t-value		3,078			
Pr(T > t)		0,0012	Satterthwaite's degree of freedom		149,522

After 1985

Group	Obs	Mean	Std. Dev.	95% confidence interval	
Bear	39	2,61	6,2	0,6	4,62
Bull	215	0,063	3,49	-0,4	0,53
Overall	254	0,455	4,118	-0,054	0,96
Difference (bear – bull)		2,546		0,486	4,6
t-value		2,4935			
Pr(T > t)		0,0083	Satterthwaite's degree of freedom		42,4853

Appendix B

Premia in bear – bull conditions for two subsamples (before and after January, 1990): Two-sample t test with unequal variances

Before 1990

Group	Obs	Mean	Std. Dev.	95% confidence interval	
Bear	84	1,563	3,13	0,88	2,24
Bull	234	0,248	2,89	-0,13	0,62
Overall	318	0,596	3,01	0,263	0,93
Difference (bear – bull)		1,315		0,543	2,08
t-value		3,367			
Pr(T > t)		0,0005	Satterthwaite's degree of freedom		137,4

After 1990

Group	Obs	Mean	Std. Dev.	95% confidence interval	
Bear	36	2,6	6,45	0,42	4,78
Bull	158	-0,026	3,81	-0,62	0,57
Overall	194	0,462	4,52	-0,178	1,1
Difference (bear – bull)		2,626		0,37	4,88
t-value		2,351			
Pr(T > t)		0,0118	Satterthwaite's degree of freedom		40,7325

Appendix C

Regression Results for the Modified Model with Dummy Variables; July, 1963 – Feb., 2006

$$(R_{it} - R_{ft}) = \alpha + \alpha_1 D + \beta(R_{mt} - R_{ft}) + \beta_1[D \times (R_{mt} - R_{ft})] + s(SMB_t) + s_1(D \times SMB_t) + h(HML_t) + h_1(D \times HML_t)$$

Coefficient Terms

α_1	Change in alpha term for bull market (D=1 for bull, D=0 for bear)
α	Alpha term for bear market
β	Coefficient for bear market premium
β_1	Δ in market premium coefficient for bull market
s	SMB coefficient for bear market
s_1	Δ in SMB coefficient for bull market
h	HML coefficient for bear markets
h_1	Δ in HML coefficient for bull market

Below are the regression results for each of the stated variables; tables for associated t-statistic values follow the coefficient tables.

α

Size \ B/M	Low	2	3	4	High
Small	0,215	0,315	0,189	0,487	0,140
2	0,180	0,010	- 0,010	0,105	0,381
3	0,428	0,000	- 0,055	- 0,248	0,240
4	0,722	- 0,257	- 0,160	- 0,197	- 0,089
Large	0,228	- 0,241	- 0,204	- 0,485	- 0,640

t

Size \ B/M	Low	2	3	4	High
Small	0,490	0,870	0,720	2,130	0,710
2	0,570	0,040	- 0,060	0,670	2,340
3	1,560	0,000	- 0,320	- 1,550	1,270
4	3,160	- 1,380	- 0,860	- 1,110	- 0,390
Large	1,710	- 1,370	- 0,960	- 2,260	- 2,330

$\boldsymbol{\alpha_1}$

Size \ B/M	Low	2	3	4	High
Small	- 0,612	- 0,258	- 0,209	-0,290	0,058
2	- 0,379	- 0,146	0,168	- 0,011	- 0,488
3	- 0,514	0,057	0,017	0,227	- 0,330
4	-0,645	0,159	0,134	0,192	- 0,122
Large	- 0,098	0,251	0,163	0,328	0,467

t

Size \ B/M	Low	2	3	4	High
Small	- 1,240	- 0,640	- 0,710	-1,140	0,260
2	- 1,070	- 0,610	0,910	- 0,060	- 2,680
3	- 1,680	0,270	0,090	1,260	- 1,560
4	- 2,520	0,770	0,640	0,970	- 0,480
Large	- 0,660	1,280	0,690	1,370	1,520

β

Size \ B/M	Low	2	3	4	High
Small	1,456	1,297	1,088	1,092	1,000
2	1,320	1,131	1,029	1,035	1,119
3	1,275	1,108	1,018	0,947	1,077
4	1,233	1,145	1,022	0,969	1,009
Large	0,941	0,954	0,886	0,787	0,944

t

Size \ B/M	Low	2	3	4	High
Small	16,660	18,120	20,940	24,200	25,550
2	21,160	26,580	31,650	33,440	34,690
3	23,510	30,150	30,540	29,870	28,780
4	27,270	31,130	27,590	27,640	22,250
Large	35,730	27,410	21,200	18,560	17,410

$\boldsymbol{\beta_1}$

Size \ B/M	Low	2	3	4	High
Small	- 0,260	- 0,212	- 0,051	- 0,133	0,028
2	- 0,084	- 0,027	- 0,028	- 0,032	0,010
3	- 0,104	- 0,039	- 0,011	0,054	0,040
4	- 0,104	- 0,079	0,037	0,088	0,159
Large	0,035	0,043	0,047	0,181	0,051

t

Size \ B/M	Low	2	3	4	High
Small	- 2,490	- 2,480	- 0,820	- 2,460	0,590
2	- 1,120	- 0,530	- 0,720	- 0,870	0,260
3	- 1,610	- 0,880	- 0,260	1,420	0,890
4	- 1,920	- 1,790	0,840	2,090	2,930
Large	1,100	1,040	0,940	3,580	0,780

s

Size \ B/M	Low	2	3	4	High
Small	0,801	0,870	0,819	0,773	0,989
2	0,738	0,878	0,769	0,704	0,852
3	0,479	0,561	0,587	0,524	0,643
4	0,189	0,316	0,365	0,317	0,446
Large	- 0,286	0,026	0,057	0,103	- 0,015

t

Size \ B/M	Low	2	3	4	High
Small	7,200	9,550	12,380	13,460	19,840
2	9,290	16,220	18,580	17,860	20,750
3	6,940	11,980	13,830	12,980	13,490
4	3,280	6,740	7,740	7,100	7,730
Large	- 8,520	0,600	1,070	1,910	- 0,220

s_1

Size \ B/M	Low	2	3	4	High
Small	0,183	0,053	0,019	0,054	- 0,027
2	- 0,044	- 0,209	- 0,082	- 0,076	- 0,116
3	0,009	- 0,095	- 0,189	- 0,083	- 0,092
4	- 0,057	- 0,122	- 0,159	- 0,111	- 0,092
Large	0,058	- 0,179	- 0,192	- 0,180	0,133

t

Size \ B/M	Low	2	3	4	High
Small	1,400	0,490	0,240	0,810	- 0,460
2	- 0,480	- 3,280	- 1,680	- 1,640	- 2,410
3	0,110	- 1,730	- 3,790	- 1,750	- 1,650
4	- 0,840	- 2,220	- 2,880	- 2,110	- 1,360
Large	1,470	- 3,450	- 3,080	- 2,840	1,650

h

Size \ B/M	Low	2	3	4	High
Small	- 0,076	0,449	0,563	0,666	0,697
2	- 0,139	0,457	0,579	0,732	0,817
3	- 0,292	0,382	0,596	0,753	0,845
4	- 0,312	0,416	0,580	0,703	0,741
Large	- 0,361	0,187	0,294	0,532	0,644

t

Size \ B/M	Low	2	3	4	High
Small	- 0,610	4,430	7,640	10,430	12,570
2	- 1,580	7,580	12,570	16,700	17,900
3	- 3,800	7,330	12,620	16,780	15,950
4	- 4,870	7,990	11,060	14,170	11,540
Large	- 9,680	3,800	4,960	8,860	8,380

h_1

Size \ B/M	Low	2	3	4	High
Small	0,083	- 0,159	- 0,139	- 0,099	0,075
2	- 0,121	- 0,282	- 0,195	- 0,168	- 0,008
3	- 0,015	- 0,222	- 0,169	- 0,221	- 0,084
4	0,012	- 0,264	- 0,211	- 0,161	- 0,034
Large	- 0,061	- 0,203	- 0,141	- 0,080	0,032

t

Size \ B/M	Low	2	3	4	High
Small	0,560	- 1,310	- 1,580	- 1,290	1,120
2	- 1,140	- 3,900	- 3,540	- 3,200	- 0,150
3	- 0,160	- 3,550	- 2,990	- 4,110	- 1,320
4	0,160	- 4,220	- 3,360	- 2,700	- 0,440
Large	- 1,370	- 3,440	- 1,990	- 1,110	0,340

Appendix D

Regression Results for 3 Factor Fama French Model through the extended data: July, 1963 – February, 2006

$$(R_{it} - R_{ft}) = \alpha + \beta(R_{mt} - R_{ft}) + s(SMB_t) + h(HML_t)$$

α

Size \ B/M	Low	2	3	4	High
Small	-0,446	0,004	0,031	0,197	0,181
2	-0,146	-0,077	0,134	0,105	0,004
3	-0,037	0,057	-0,032	0,012	0,029
4	0,141	-0,144	0,002	0,044	-0,061
Large	0,205	0,010	-0,034	-0,099	-0,235

t

Size \ B/M	Low	2	3	4	High
Small	-2,40	0,03	0,28	2,05	2,20
2	-1,11	-0,84	1,94	1,60	0,07
3	-0,33	0,73	-0,46	0,18	0,37
4	1,47	-1,83	0,03	0,59	-0,64
Large	3,65	0,15	-0,38	-1,09	-2,04

β

Size \ B/M	Low	2	3	4	High
Small	1,268	1,141	1,038	0,988	1,025
2	1,247	1,098	1,008	1,006	1,111
3	1,190	1,075	1,008	0,977	1,088
4	1,147	1,088	1,042	1,024	1,106
Large	0,953	0,984	0,919	0,914	0,989

t

Size \ B/M	Low	2	3	4	High
Small	28,18	31,02	38,97	42,60	51,17
2	39,00	49,32	59,87	62,89	66,50
3	42,74	56,46	58,04	58,90	56,36
4	49,12	56,76	54,10	56,25	47,16
Large	69,96	54,17	42,57	41,41	35,49

s

Size \ B/M	Low	2	3	4	High
Small	0,944	0,915	0,834	0,817	0,969
2	0,709	0,728	0,709	0,649	0,770
3	0,491	0,492	0,451	0,459	0,575
4	0,155	0,229	0,247	0,232	0,374
Large	-0,245	-0,105	-0,084	-0,034	0,076

t

Size \ B/M	Low	2	3	4	High
Small	16,20	19,22	24,17	27,18	37,34
2	17,13	25,27	32,55	31,34	35,61
3	13,63	19,96	20,06	21,40	23,04
4	5,13	9,23	9,93	9,86	12,32
Large	-13,93	-4,5	-3,01	-1,19	2,13

h

Size \ B/M	Low	2	3	4	High
Small	-0,023	0,335	0,469	0,597	0,747
2	-0,220	0,265	0,443	0,616	0,817
3	-0,300	0,228	0,478	0,603	0,794
4	-0,301	0,230	0,436	0,596	0,727
Large	-0,397	0,047	0,196	0,480	0,663

t

Size \ B/M	Low	2	3	4	High
Small	-0,34	6,01	11,64	17,00	24,61
2	-4,54	7,87	17,38	25,45	32,29
3	-7,13	7,94	18,20	24,03	27,16
4	-8,53	7,96	14,96	21,61	20,48
Large	-19,27	1,72	6,00	14,38	15,72