5-2014

# The Empirical Study of Size Effect, Book-to-Market Effect in US Security Market

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# THE EMPIRICAL STUDY OF SIZE EFFECT, BOOK-TO-MARKET EFFECT IN US SECURITY MARKET

by

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A paper submitted in partial fulfillment

of the requirements for the degree

of

MASTER OF SCIENCE

in

Financial Economics

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2014

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**ABSTRACT**

Banz (1981) found size effect using data over the period 1926–1975. This paper uses data from last 33 years from NYSE, Amex, and Nasdaq to test the existence of size effect and book-to-market effect. In this paper data is sorted by size and book-to-market ratio across quintiles. I runs the time-series regression taking advantage of CAPM model, Fama-French 3-factor model and Carhart 4-factor model to get three different alpha. With all next-month returns, this paper compares those low size/book-to-market next-month returns with those high size/book-to-market next-month returns and uses t-test to verify the existence of these two effects. This paper indicates that B/M (book-to-market) effect still exists. However, size effect does not exist anymore without the tiny firms (with their stock price under $5). In 1980-1990 period, the big-size firm outperform small-size firm by 0.26 percent.

**INTRODUCTION**

The Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) presents a single-period simple linear relationship between the expected return of the security and the market risk of the security. But there are many empirical evidences suggesting that the traditional CAPM model have deficiencies. Stattman (1980) and Rosenberg et al. (1985) find that average stock return in the US stock markets is positively related to the stock's book value divided by its market value. Banz (1981) examines the empirical relationship between the return and the total market value of NYSE common stocks between 1936 and 1975. He finds that smaller firms (firms with low capitalization) have higher risk adjusted returns than larger firms on average. He also finds that the size effect is not linear and is most significant for the smallest firms in the sample. Banz then conjectures that many investors do not want to hold small stocks because of insufficient information, leading to higher returns on these stocks. Fama and French (1992) find that size of the firms, the book-to-market equity ratio (B/M) capture the cross-sectional variation in expected stock returns by using all non-financial firms' data of NYSE, AMEX, and NASDAQ. They also find that the relationship between expected return and beta unrelated to size is flat. One year later, Fama and French (1993) build the basic FF three-factor model. They define the common risk factors in the returns on stocks and bonds including the size factor SMB (small minus big) and the book-to-market equity ratio (B/M) factor HML (high minus low). They also find there is a negative relation between size and average return and a stronger positive relation between B/M and return. Carhart (1997) adds the momentum factor UMD into FF3-factor model and extends it to Carhart 4-factor model. All these models are widely used in financial studies. Some empirical studies have declared the size effect to be "dead" after the early 1980s. Eleswarapu and Reinganum (1993), Dichev (1998), Chan et al. (2000), Horowitz et al. (2000) and Amihud (2002) find no size premium over their sample periods later than 1980, respectively. Dimson and Marsh (1999) report that small stocks underperformed large stocks by 2.4% over 1983—1997. Hirshleifer (2001) find that the size effect vanished after 1983.

The purpose of this paper is to find out whether size and B/M effects are still existing strongly or vanishing silently from 1980 to 2012 in US stock market. I will test whether firms with small size have higher next-month return than firms with big size. I will also test whether firms with high book-to-market ratios will outperform firms with low book-to-market ratios. Banz (1981) finds that tiny firms have huge size effect. Since there are few tiny firms and they may go bankrupt unexpectedly, I eliminate those tiny firms(stock price per share is below $5) in this paper. I will observe whether the size effect still exists without outliers, and I will find out whether the B/M effect still exists by eliminating negative B/M outliers in the past 33 years. I will first test data of whole period in general and I will equally divide the period into three sub-periods and then continue testing data in these sub-periods: 1980-1990, 1991-2001 and 2002-2012.

This paper will compare the next month stock returns of low company size/(or B/M) with high company size(or B/M). The stock returns include next month raw return, next month abnormal return, CAMP alpha, Fama-French 3-factor alpha and Carhart 4-factor alpha. In different models, alpha is referred to as expected return holding other variables constant. I will sort time series data by size or B/M across quintiles and I will observe the difference between average next-month returns of lowest size (or B/M) quintile (QⅠ,low) and average next-month returns of highest size(or B/M) quintile(QⅤ,high). The calculation of CAPM alpha(Jensen's alpha) is using Capital Asset Pricing Model (CAPM) model: $R_{i,t+1} - R_{f,t+1} = \alpha + \beta_1(R_{m,t+1} - R_{f,t+1}) + \varepsilon_{t+1}$ *, where* $i = 1,2,\ldots,N$. By running the time series regressions of the CAPM model across quintiles, I can get the estimation of intercept which is alpha. Similarly, to calculate Fama-French 3-factor model alpha and Carhart 4-factor model alpha, I run regressions of the Fama-French 3-factor model and the Carhart 4-factor model to get intercepts. The Fama-French 3-factor model is: $R_{i,t+1} - R_{f,t+1} = \alpha + \beta_1(R_{m,t+1} - R_{f,t+1}) + \beta_2 SMB_{t+1} + \beta_3 HML_{t+1} + \varepsilon_{t+1}$ *, where* $i = 1,2,\ldots,N$. The Carhart 4-factor model is: $R_{i,t+1} - R_{f,t+1} = \alpha + \beta_1(R_{m,t+1} - R_{f,t+1}) + \beta_2 SMB_{t+1} + \beta_3 HML_{t+1} + \beta_4 UMD_{t+1} + \varepsilon_{t+1}$ *, where* $i = 1,2,\ldots,N$.

The specific meanings and explanations of each variable in these models will be discussed in section 2. After gathering all five kinds of returns, T-Test is required to see whether the returns' differences between low and high quintiles are significant or not.

The rest of this paper is organized into three sections: data description and methodology, empirical analysis and results, and my conclusion.

## DATA DESCRIPTION AND METHODOLOGY

1. Data

I restrict my analysis to firms with available returns data on the Center for Research in Security Price (CRSP) including all available firms in NYSE, AMEX, Nasdaq from January 1980 through December 2012. The CAPM and Fama-French variables including beta, idiosyncratic volatility, the SMB factor, the HML factor, the UMD factor are also collected from CRSP. The firm's size is equal to the firm's capitalization, which is firm's stock price per share times firm's total shares in the market. All these data are collected from CRSP. The book-to-market ratio is calculated using data from COMPUSTAT. As the stocks with prices under $5 may go bankrupt unexpectedly, I delete the stocks that are under $5. Also, I delete the firms which have their stocks' price above $1000 or have their B/M ratio to be negative to eliminate their influence regarding size and B/M.

2. Methodology

Fama and French (1992) created size decile and book-to-market decile portfolios to analyze data. Similar to Fama and French, I create size quintile and B/M quintile portfolios. In order to compare next-month average returns between low size or B/M portfolio to high size or B/M portfolio, I sort size or B/M by quintiles to get size or B/M quintiles from low to high. With five portfolios called *Q Ⅰ (Low), Q Ⅱ*, *Q Ⅲ*, *Q Ⅳ, Q Ⅴ (High)* either sorted by size or sorted by B/M, I can calculate *Q Ⅰ*

*(Low)* − *Q V (High)*, which is the difference of next-month average returns between *Q I (Low)* and *Q V (High)*. I choose to use student's T-test to test the significance of the difference under the null hypothesis that the mean of two populations are equal. The next-month returns include: next-month raw returns, next-month abnormal returns, CAPM alpha, Fama-French 3-factor model alpha, Carhart 4-factor model alpha. The reason to choose three kinds of alpha is because we can use alpha as the expected return when we hold other variables constant. We can get next-month raw returns directly. For next-month abnormal returns, we can calculate them by using this equation: $AbnR_{i,t+1} = R_{i,t+1} - R_{m,t+1}$, where $R_{i,t+1}$ is next-month raw return, $R_{m,t+1}$ is next-month market return. As I mentioned in section 1, the CAPM alpha, Fama-French 3-factor model alpha, Carhart 4-factor model alpha, as the intercepts, can be estimated by running regressions of the CAPM model, the Fama-French 3-factor model and the Carhart 4-factor model:

$$R_{i,t+1} - R_{f,t+1} = \alpha + \beta_1(R_{m,t+1} - R_{f,t+1}) + \varepsilon_{t+1} \quad (1)$$

$$R_{i,t+1} - R_{f,t+1} = \alpha + \beta_1(R_{m,t+1} - R_{f,t+1}) + \beta_2 SMB_{t+1} + \beta_3 HML_{t+1} + \varepsilon_{t+1} \quad (2)$$

$$R_{i,t+1} - R_{f,t+1} = \alpha + \beta_1(R_{m,t+1} - R_{f,t+1}) + \beta_2 SMB_{t+1} + \beta_3 HML_{t+1} + \beta_4 UMD_{t+1} + \varepsilon_{t+1} \quad (3)$$

where i = 1,2,…,N, $R_{i,t+1}$ is the next-month raw return; $R_{f,t+1}$ is the next-month risk-free rate of return; the intercept α in model (1) is referred to as the CAPM alpha or Jensen's alpha; the intercept α in model (2) is referred to as the three-factor alpha; the intercept α in model (3) is referred to as the four-factor alpha; $SMB_{t+1}$ is the next-month size factor; $HML_{t+1}$ is the next-month B/M factor; $UMD_{t+1}$ is the next-month momentum factor.

**EMPIRICAL ANALYSIS AND RESULTS**

Table 1 Summary Statistics

| Panel A. Summary Statistics | | | | |
|---|---|---|---|---|
| | *Beta* | *Size* | *B/M* | *IdioVolt* |
| | [1] | [2] | [3] | [4] |
| *N* | 853377 | 853377 | 853214 | 853377 |
| *Mean* | 0.8894 | 2947374.10 | 4.2947 | 0.0249 |
| *Std. Dev.* | 3.6318 | 13987703.03 | 90.1966 | 0.0148 |
| *Median* | 0.8739 | 338976 | 0.5784 | 0.0214 |
| Panel B. Correlation | | | | |
| *Beta* | 1.0000 | — | — | — |
| *Size* | 0.0061 | 1.0000 | — | — |
| *(p-value)* | (<.0001) | | | |
| *B/M* | -0.0027 | -0.0087 | 1.0000 | — |
| *(p-value)* | (0.0114) | (<.0001) | | |
| *IdioVolt* | 0.0283 | -0.1288 | -0.0020 | 1.0000 |
| *(p-value)* | (<.0001) | (<.0001) | (0.0630) | |

Panel A of Table 1 summarizes the number of observations, mean, standard deviation and median of beta, size, book-to-market ratio and idiosyncratic volatility.

Panel B presents the correlation among beta, size, book-to-market ratio and idiosyncratic volatility. Beta has highly significant positive correlation with firm’s size. This means bigger firms will have more market premium than small firms. Beta has significant negative correlation with book-to-market ratio. The firms with high book-to-market ratio will get lower risk adjusted market premium than the firms with low book-to-market ratio. Beta has highly significant positive correlation with idiosyncratic volatility. The stocks with high idiosyncratic volatility will get higher risk adjusted market premium than the stocks with low idiosyncratic volatilities. However, many scholars including Andrew Ang (2007) have already found that stocks with recent past high idiosyncratic volatility have low future average returns around the world. This might be an evidence to support ‘beta is dead’. Panel B shows that the firm’s size have highly significant negative correlation with firm’s book-to-market ratio. Bigger firms will have lower book-to-market ratio. With a highly significant negative correlation between firm size and stock’s idiosyncratic volatility of the firm, we can infer that stocks of bigger firms will have lower idiosyncratic volatilities. Panel B also gives us a correlation between firm’s book-to-market ratio and their stock’s idiosyncratic volatilities. It is a negative correlation, though not significant.

Table 2 Next-Month Average Returns Across Quintiles for NYSE, Amex, and Nasdaq firms. All Periods (1980-2012)

| Panel A. Sorts by Size | | | | | |
|---|---|---|---|---|---|
| | *Raw Returns* | *Abnormal Returns* | *CAPM Alpha* | *FF3F Alpha* | *FF4F Alpha* |
| | [1] | [2] | [3] | [4] | [5] |
| *Q I (Low)* | 0.0095 | 0.0008 | 0.0022 | 0.0009 | 0.0014 |
| *Q II* | 0.0105 | 0.0018 | 0.0015 | 0.0004 | 0.0011 |
| *Q III* | 0.0105 | 0.0019 | 0.0011 | 0.0004 | 0.0009 |
| *Q IV* | 0.0010 | 0.0013 | 0.0007 | 0.0002 | 0.0005 |
| *Q V (High)* | 0.0094 | 0.0007 | 0.0004 | 0.0000 | 0.0001 |
| *Q I – Q V* | 0.0001 | 0.0001 | 0.0018 | 0.0009 | 0.0013 |
| *(t-value)* | (0.11) | (0.11) | (4.47) | (2.28) | (3.16) |
| Panel B. Sorts by Book-to-Market | | | | | |
| *Q I (Low)* | 0.0039 | -0.0048 | -0.0060 | -0.0045 | -0.0052 |
| *Q II* | 0.0079 | -0.0007 | -0.0014 | -0.0015 | -0.0015 |
| *Q III* | 0.0100 | 0.0013 | 0.0014 | 0.0000 | 0.0004 |
| *Q IV* | 0.0127 | 0.0041 | 0.0048 | 0.0028 | 0.0037 |
| *Q V (High)* | 0.0153 | 0.0066 | 0.0072 | 0.0051 | 0.0066 |
| *Q I – Q V* | -0.0114 | -0.0114 | -0.0132 | -0.0096 | -0.0118 |
| *(t-value)* | (-23.77) | (-25.32) | (-29.34) | (1.07) | (-25.43) |

Table 2 presents all next-month average returns across quintiles including raw returns, abnormal returns, CAPM alpha, Fama French 3-factor alpha and 4-factor alpha. Column 3-5 are regression results based on model (1)(2)(3). Panel A is sorted by firm's size and Panel B is sorted by firm's book-to-market equity ratio. Quintile portfolios are from low to high. On the bottom of both Panels we have the difference between Quintile 1 and Quintile 5, indicated as $Q\ I - Q\ V$, followed by its t-value. The T-test is under null hypothesis such that the mean of two returns are equal.

There are strange facts in first column and second column of Panel A: Small size firm's next-month average raw return and average abnormal return is higher than big size firm's by 0.01 percent. But after t-test, 0.11 < 1.96, which means this positive difference is not significant. Size effect is not significant for stock's next-month raw returns and abnormal returns. Column 3 of Panel A shows that there is a significant(t-value 4.47 > 2.58) positive difference of CAPM alpha between small size firm and big size firm. Holding market premium constant, the CAPM alpha has size effect. Column 4 of Panel A presents a significant positive difference as t-value = 2.28 > 1.96, which means holding other variables in Fama-French 3-factor model constant, FF3-factor alpha reports size effect. Moreover, FF4-factor alpha also has size effect.

Panel B of Table 2 presents five kinds of next-month average returns sorted by book-to-market ratio across quintiles. The first column has a difference of -1.14 percent, which means the average next-month raw returns of low book-to-market ratio portfolio is 1.14 percent less than high book-to-market ratio portfolio. After calculating t-value, we have 23.77 > 2.58, this gives us a highly significant difference. The difference of Column 2 is -1.14 percent and t-value is -25.32. As 25.32 > 2.58, we have a statistically highly significant negative difference. Which indicates that the firms with high book-to-market ratio will have more next-month abnormal returns than the firms with low book-to-market ratio. T-test of difference(29.34 > 2.58) in Column 3 shows a highly significant negative difference, which means that stock's CAPM alpha will become higher when its book-to-market ratio gets higher. Fama-French 3-factor alpha in Column 4 has a negative difference, but it's not significant(1.07<1.96), which indicates that the CAPM alpha has reported no B/M effect. The next-month FF4-factor alpha's difference in column 5 is -1.18 percent. The t-value is -25.43. As 25.43 > 2.58, there is a statistically highly significant difference between two portfolios of average next-month FF4-factor alpha.

The results are beyond my expectation. The average next-month raw returns and average abnormal returns have no size effect during year 1980-2012. Maybe one reason is that I eliminated all the stocks with prices below $5 as considering their probabilities of bankruptcy is super high. It seems that those tiny firms have played a huge important role in influencing size effect if there still exists size effect. The average next-month CAPM alpha, next-month FF3-factor alpha and next-month FF4-factor alpha all have size effects. On the other hand, the B/M effect is widely visualized. Only next-month average FF3-factor alpha doesn’t report a B/M effect.

Table 3 - Table 5 are three sub periods of Table 2. They present average next-month raw returns, average next-month abnormal returns and the estimated regression results for the average next-month CAPM alpha, FF3-factor alpha as well as FF4-factor alpha across quintiles. The content of Table 3 is average next-month returns across quintiles from 1980 to 1990. Panel A is sorted by size and Panel B is sorted by book-to-market ratio.

Table 3 Next-Month Average Returns Across Quintiles for NYSE, Amex, and Nasdaq firms, 1980-1990

| Panel A. Sorts by Size | | | | | |
|---|---|---|---|---|---|
| | *Raw Returns* | *Abnormal Returns* | *CAPM Alpha* | *FF3F Alpha* | *FF4F Alpha* |
| | [1] | [2] | [3] | [4] | [5] |
| *Q I (Low)* | 0.0093 | -0.0025 | -0.0018 | 0.0021 | 0.0019 |
| *Q II* | 0.0080 | -0.0038 | -0.0041 | 0.0007 | 0.0011 |
| *Q III* | 0.0093 | -0.0025 | -0.0031 | 0.0011 | 0.0017 |
| *Q IV* | 0.0096 | -0.0022 | -0.0026 | 0.0000 | 0.0008 |
| *Q V (High)* | 0.0119 | 0.0001 | 0.0000 | 0.0001 | 0.0006 |
| *Q I – Q V* | -0.0026 | -0.0026 | -0.0018 | 0.0020 | 0.0013 |
| *(t-value)* | (-2.59) | (-2.8) | (0.99) | (2.10) | (1.26) |
| Panel B. Sorts by Book-to-Market | | | | | |
| *Q I (Low)* | 0.0060 | -0.0058 | -0.0067 | -0.0020 | -0.0020 |
| *Q II* | 0.0076 | -0.0042 | -0.0050 | -0.0006 | -0.0002 |
| *Q III* | 0.0082 | -0.0036 | -0.0038 | -0.0002 | -0.0000 |
| *Q IV* | 0.0119 | 0.0000 | 0.0006 | 0.0023 | 0.0028 |
| *Q V (High)* | 0.0145 | 0.0027 | 0.0034 | 0.0047 | 0.0057 |
| *Q I – Q V* | -0.0085 | -0.0085 | -0.0101 | -0.0067 | -0.0077 |
| *(t-value)* | (-7.97) | (-8.79) | (0.40) | (0.69) | (-7.39) |

The first column of Panel A direct to a surprising result. The difference of next-month average raw return between small size portfolio and big size portfolio is negative. After t-test of this difference, as 2.59 > 2.58, it's also significant. It means that in the period of 1980-1990, big size firms have higher average next-month raw returns than small size firms. This result is opposite to size effect. The difference of next-month average abnormal return between small size firm portfolio and big size firm portfolio is -0.26 percent. The t-value is -2.8. As 2.8 > 2.58, there is a significant negative difference. Firms with big size will outperform firms with small size. The difference of average next-month CAPM alpha between small size portfolio and big size portfolio is -0.0018 but it's not significant(0.99 < 1.96). In column 4 of Panel A, there is a significant difference(2.1 > 1.96) of FF3-factor alpha between small size quintile portfolio and big size quintile portfolio which is 0.2 percent. Column 5 of Panel A shows a non-significant positive difference of average next-month FF4-factor alpha. Only FF3-factor alpha reports size effect. Panel B indicates that Raw returns, abnormal returns and FF4-factor alpha report B/M effect. CAPM alpha or FF3-factor alpha don't have B/M effect.

Table 4 Next-Month Average Returns Across Quintiles for NYSE, Amex, and Nasdaq firms, 1991-2001

| Panel A. Sorts by Size | | | | | |
|---|---|---|---|---|---|
| | *Raw Returns* | *Abnormal Returns* | *CAPM Alpha* | *FF3F Alpha* | *FF4F Alpha* |
| | [1] | [2] | [3] | [4] | [5] |
| *Q I (Low)* | 0.0117 | 0.0001 | 0.0038 | 0.0015 | 0.0030 |
| *Q II* | 0.0124 | 0.0008 | 0.0021 | 0.0007 | 0.0028 |
| *Q III* | 0.0131 | 0.0015 | 0.0014 | 0.0006 | 0.0020 |
| *Q IV* | 0.0122 | 0.0007 | 0.0003 | -0.0006 | 0.0002 |
| *Q V (High)* | 0.0113 | -0.0002 | -0.0003 | -0.0016 | -0.0012 |
| *Q I – Q V* | 0.0004 | 0.0003 | 0.0041 | 0.0031 | 0.0042 |
| *(t-value)* | (0.46) | (0.47) | (5.76) | (4.14) | (5.59) |
| Panel B. Sorts by Book-to-Market | | | | | |
| *Q I (Low)* | 0.0048 | -0.0067 | -0.0096 | -0.0056 | -0.0071 |
| *Q II* | 0.0097 | -0.0018 | -0.0023 | -0.0027 | -0.0019 |
| *Q III* | 0.0131 | 0.0016 | 0.0034 | 0.0005 | 0.0022 |
| *Q IV* | 0.0158 | 0.0043 | 0.0074 | 0.0036 | 0.0058 |
| *Q V (High)* | 0.0171 | 0.0056 | 0.0084 | 0.0049 | 0.0078 |
| *Q I – Q V* | -0.0123 | -0.0123 | -0.0180 | -0.0105 | -0.0149 |
| *(t-value)* | (-14.03) | (-14.60) | (-21.41) | (-12.17) | (-16.67) |

Table 4 shows average next-month returns across quintiles from 1991 to 2001. Panel A is sorted by size and Panel B is sorted by book-to-market ratio.

In this period, differences of raw returns and abnormal returns in Panel A are non-significant positive, which means there are no size effects of these two returns. Columns 3, 4, 5 show a significant size effect, which means CAPM alpha, FF3-factor alpha and FF4-factor alpha all report size effects.

Panel B indicates that all the average next-month returns have significant negative difference between low book-to-market ratio quintile portfolio and high book-to-market ratio quintile portfolio. B/M effect exists in this period.

Table 5 Next-Month Average Returns Across Quintiles for NYSE, Amex, and Nasdaq firms, 2002-2012

Panel A. Sorts by Size

| | *Raw Returns* | *Abnormal Returns* | *CAPM Alpha* | *FF3F Alpha* | *FF4F Alpha* |
|---|---|---|---|---|---|
| | [1] | [2] | [3] | [4] | [5] |
| *Q I (Low)* | 0.0077 | 0.0023 | 0.0029 | 0.0011 | 0.0011 |
| *Q II* | 0.0097 | 0.0044 | 0.0035 | 0.0008 | 0.0009 |
| *Q III* | 0.0089 | 0.0035 | 0.0026 | 0.0001 | 0.0002 |
| *Q IV* | 0.0084 | 0.0030 | 0.0023 | 0.0006 | 0.0006 |
| *Q V (High)* | 0.0070 | 0.0017 | 0.0013 | 0.0008 | 0.0008 |
| *Q I – Q V* | 0.0007 | 0.0006 | 0.0016 | 0.0003 | 0.0003 |
| *(t-value)* | (1.15) | (1.25) | (2.96) | (0.51) | (0.62) |

Panel B. Sorts by Book-to-Market

| | *Raw Returns* | *Abnormal Returns* | *CAPM Alpha* | *FF3F Alpha* | *FF4F Alpha* |
|---|---|---|---|---|---|
| *Q I (Low)* | 0.0025 | -0.0029 | -0.0034 | -0.0046 | -0.0047 |
| *Q II* | 0.0066 | 0.0013 | 0.0007 | -0.0008 | -0.0010 |
| *Q III* | 0.0080 | 0.0027 | 0.0022 | 0.0001 | 0.0001 |
| *Q IV* | 0.0105 | 0.0052 | 0.0049 | 0.0026 | 0.0028 |
| *Q V (High)* | 0.0141 | 0.0087 | 0.0082 | 0.0062 | 0.0065 |
| *Q I – Q V* | -0.0116 | -0.0116 | -0.0116 | -0.0108 | -0.0112 |
| *(t-value)* | (-17.85) | (-19.40) | (-19.50) | (-18.00) | (-18.65) |

Table 5 presents results across quintiles in the period of 2002-2012. Panel A is sorted by size and Panel B is sorted by book-to-market ratio. By comparing Q I (Low) with Q V (High) in Panel A, we have all positive difference (Q I – Q V) and only column 3 is significant. Only CAPM alpha reports size effect. Panel B again indicates that all the average next-month returns have significant negative difference between low book-to-market ratio quintile portfolio and high book-to-market ratio quintile portfolio. All the returns report B/M effects in this sub-period.

**CONCLUSION**

Stattman (1980) and Rosenberg et al. (1985) found book-to-market effect. After testing data from 1980 to 2012, I find this book-to-market effect still significantly exist during past 33 years. Banz (1981) find size effect using data over the period 1926–1975. However, he doesn't figure out the reason of size effect. After Banz (1981), some empirical studies have declared the size effect to be "dead" after the early 1980s. Similarly, my empirical results show that size effect is dead without outliers! Based on my empirical studies, by testing overall period from January 1980 to December 2012, small size firm's average next-month raw return and average abnormal return is higher than big size firm's by 0.01 percent but is not significant. However, three average next-month alpha have significant positive differences between small size firm and big size firm. Holding variables constant, all three alpha reports size effect. It's interesting that the expected returns calculated by models are reporting size effects, which is totally different from real world raw returns. When testing sub-period data 1980-1990, I find a significant reversely size effect during this period. The result is that the big size firm outperform small size firm by 0.26 percent. This finding is similar to Dimson and Marsh (1999)'s report which indicates small stocks underperformed large stocks by 2.4% over 1983—1997.

This paper shows that without tiny firms' influence, the size effect has gone away from US stock market. We may need more empirical researches to examine the robustness of the size effect on international equity markets instead of US market. I believe that new researches could break the current deadlock and more related topics regarding size effect would be further discussed by scholars as no one can explain the root of size effect by now.

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