温州肯恩大学
WENZHOU-KEAN UNIVERSITY

An empirical analysis of small firm effect on A-share stock in Shanghai Exchange

In Partial Fulfillment of the Requirements

for the Bachelor of Science in Finance

by

CAO Yang

1025553

May, 2020

An Empirical Analysis of Small Firm Effect on A-share stock in Shanghai Exchange

Cao, Yang

1025553

Abstract

Although small firm effect has been tested for many years in various stock markets, there is still not a unified statement of this market phenomenon. This study aims to verify the existence of small firm effect (SFE) in the A-share stock market of Shanghai Stock Exchange during the period from January 2015 to May 2017. This research uses both the Capital Asset Pricing Model (CAPM) and the three-factor model to test the relation between firm size, BTM ratio, market risk, and stock returns. The result indicates that the CAPM can well explain the relationship between the excess stock return and firm size and display a small firm effect in Shanghai A-share stock market from 2015 to 2017. This result can be a reference to prove the existence of small firm effect in the Chinese stock market and work as guidance to help investors make better investment decisions.

Table of Contents

Introduction

Small firm effect (SFE) is known as a market anomaly that small-cap stocks outperform large-cap stocks over a long time period. To put it simply, it refers to a negative relationship between the firm size and the stock return. Banz(1981) firstly observed the existence of SFE in the New York stock exchange and found that the annual stock return of small firm stock portfolios was 19.8% higher than that of large firm stock portfolios. After this great finding, many scholars started giving heed to this market anomaly, trying to verify whether this phenomenon was widespread in capital markets and what reasons lead to this phenomenon.

Through about thirty years' study, researchers have found some characteristics of the small firm effect. The most interesting one is the time variation of the small firm effect. Many have observed that the small firm effect is not a continuous phenomenon. In some capital markets, the small firm effect will disappear first for several years and then reappear again. Besides, the famous January effect carried out by Keim (1983) indicates that small firm effect is mostly concentrated in January. Those findings of empirical studies make it difficult to draw a unified conclusion of the small firm effect. Furthermore, the different structures and regulations of each stock market will also influence the existence of small firm effect. Thus, the study of small firm effect should focus on the long period in different stock markets.

The Chinese small firm effect research was first carried out by Weigen Jin and Songxing Song in 1995, and the result of the study indicated a strong small firm effect in the Shanghai stock exchange. After that, Chinese researchers continued doing lots of empirical studies in Chinese stock markets and obtained many achievements. However, many of these studies focus on the time period when the capital market in China was immature. So the result of these studies on small firm effect cannot be applied on nowadays stock market directly. Besides, the time span of

the previous studies was very large, which is good for reducing the probability of occasionality. Nevertheless, a study carried out by Amel-Zadeh (2011) points out that the small firm effect disappears in the bear market and reappears in the bull market. Therefore, the large time span of the study may mix the stock performance in bear and bull market, so that the result of the study may be unreasonable. Thence, it is necessary to do the small firm effect in Chinese stock by analyzing the latest stock performance in either the bear market or the bull market.

The latest bull market in the Chinese capital market happened in 2014 and the latest bear market began from 2015 until now. Since the bull market only existed for a short period, this paper only studies the stock performance in the bear market to test the presence of small firm effect in the Chinese market. Compared with the western mature stock market, the Chinese stock market is established late and has some trade limitations at first. Before 2015, the state-owned shares and legal person shares are not allowed to circulate when the company is listed. The reform of the split share structure in 2015 marks the gradual openness and maturity of the Chinese Stock market.

Although the Chinese stock market is still less developed than the mature stock market, it has huge prospects. China as the biggest developing country has manifested a bright future of its economic development recently. More and more investors have shown their interests in the Chinese stock market. Researches on small firm effect in such prosperous stock market can provide useful information to investors, so that help them make better investment decisions.

This essay aims to verify the existence of small firm effect in Shanghai A-share stock market during the period between 2015 and 2017. The essay adopts both the Capital Asset Pricing Model (CAPM) and the Fama and French three-factor Model (1993) to analyze the relation

between risk factors (firm size, book-to-market (BTM) ratio, and market risk) and stock returns. The result of this study can prove the existence of small firm effect in the Chinese stock market and work as a reference to help A-Share investors in Shanghai stock exchange to make better investment decisions.

Literature Review

Theories of small firm effect

There are many asset pricing models used to estimate the expected stock return. The most famous one is the Capital Asset Pricing Model (CAPM) which created by Sharpe (1964), Lintner (1965) and Black (1972). This model implies the idea that market risk (beta) is the only systematic risk that will influence the stock return. There is a positive relationship between stock return and market risk (Black, Jensen, & Scholes, 1972). However, the SFE is a counterexample that rejects this model. Banz (1981) found that the small firms had larger stock returns than large firms in the New York Stock exchange even after the risk adjustment (Banz, 1981). Thus, the small firm effect was defined as a market anomaly since the excess return of small firms cannot be explained by CAPM.

Many claimed that small firm effect was not a market anomaly and there should exist other risk factors, except for market risk, that will influence the stock return. Chan, Hamao and Lakonishok (1991) carried out the small firm effect in the Japanese stock market on the period from 1971 to 1988 and found that there was a significant relationship between BTM ratio and stock return (Chan, Hamao &Lakonishok, 1991). Besides, other unsystematic risks, such as the P/E ratio, also show a strong correlation with the stock return (Keim, 1990). Therefore, new

asset pricing models emerged as times require. The most famous one was the Fama and French (1993) three-factor Model, which focuses on the impact of firm size, book-to-market (BTM) ratio and market risk on the stock return. In the three-factor model, firm size and BTM ratio are viewed as proxies for some unknown systematic risks (Fama &French, 1993). Fama and French (1993) did not recognize SFE as a market anomaly but considered that small-cap stocks have higher risks than large-cap stocks.

Empirical results of small firm effect

Although new ideas and pricing models were introduced, there was not a unified statement about the existence of the small firm effect yet. To affirm the presence of the small firm effect, researchers have done lots of empirical studies in different countries, but the results are various.

A significantly negative relation between stock return and firm size was found in Ho Chi Minh City stock exchange during the period from 2009 to 2014 in the service sector (Duy & Phuoc, 2016). Duy and Phuoc (2016) attributed this phenomenon to the weak efficiency of the Vietnamese stock exchange. However, in the manufacturing stock sector of Dhaka stock exchange in Bangladesh, there was a significant positive relation between stock return and a negative relation between leverage and stock return during the period from 2008 to 2012, though the effect was limited (Abdullah, Parvez, Karim, & Tooheen, 2015). Both the Ho Chi Minh City stock exchange and the Dhaka stock exchange are emerging markets, but one exists small firm effect and one not exists.

In the mature stock market, the existence of small firm effect also varies significantly over time. After the first observation of small firm effect by Banz (1981), the small firm effect was also be observed in other stock markets, such as in Australia, Belgium, Canada, Finland, France,

Germany and so on (Van Dijk, 2011). However, at the beginning of the 21st century, it was found that small firms were found underperformed large firms in both the US and the UK stock market exchange (Duy & Phuoc, 2016). Thus many researchers claimed the death of small firm effect. However, the return of small-cap stocks exceeded that of large-cap stocks again in the post-2001(Van Dijk, 2011). Furthermore, an international study has found that small firm effect was still existed but limited to the smallest-decile stocks (Moor & Sercu, 2013). Thus, it is premature to conclude the disappearance of small firm effect.

Researches have observed the disappearance and recovery of small firm effect within the stock market. Amel-Zadeh (2011) stated that size effect disappeared in the German stock market, but the dissolution just happened in the downturn period of the stock market. The low return of small firms can be ascribed to the damage caused by the bearish market. More specifically, the momentum effect in the bear market will conceal the small firm effect. In the period of the bull market, the small firm effect appears again (Amel-Zadeh, 2011).

Further studies were needed to verify the presence of the small firm effect. In recent studies, the noises in the calculation of stock returns and the standard errors in the evaluation of the size premium both influence the judgment of size effect (Van Dijk, 2011). More importantly, although many theories and models have been created to interpret the size effect, the return patterns of small and large stocks still cannot be explained clearly. (Van Dijk, 2011). Besides, according to Amel-Zadeh (2011), further investigations are useful to prove whether the structure and the maturity of the stock market are significant factors that influence the result of recent studies.

Empirical studies of small firm effect are also carried in the Chinese stock market. Gan, Hu, Liu, and Li (2013) observed a strong negative correlation between stock return and firm size in the Chinese A-share stock market during the period from 1995 to 2005. Furthermore, another empirical study made by Hu, Chen, Shao, and Wang (2019) also found that small stocks in the Chinese market outperformed large stocks from 1990 to 2016. Both of the studies adopted the three-factor model to testify the relation between firm size and stock return since many studies have proved the less validity of the CAPM (Gan, Hu, Liu, Li, 2013),

The CAPM is weak to explain the abnormal return of small firms because the model ignores the unsystematic risks which also have an influence on the stock return (Pandey& Sehgal, 2016). In the economic level, compared with large firms, small firms have higher operational risk and financial risk. The firm size and BTM ratio, in fact, represent these risk attributes, and in some degree explains the difference of stock returns (Pandey& Sehgal, 2016).

The three-factor model created by Fama and French (1993) tests the relationship between firm size, BTM ratio, and stock return. Both firm size and BTM ratio are considered as proxies for systematic risks, which could interpret the abnormal stock returns in the stock market (Fama & French, 1993). By applying this model, Gan, Hu, Liu & Li (2013) found a negative correlation between stock return and firm size and a positive relation between BTM ratio and stock return (Gan, Hu, Liu & Li, 2013). However, Hu, Chen, Shao, and Wang (2019) claimed that there was only a significant small firm effect in the Chinese stock market, but no steady value effect.

However, according to Pandey and Sehgal (2016), the three-factor model is still not perfect to interpret some abnormal returns of small firm portfolios. More factors should be considered to analyze the presence of the small firm effect. Potential factors related to the abnormal stock

return of small firms can be liquidity risk, infrequent trading, changing business conditions, momentum, missing book values, dividend yield effects, financial distress risk, exchange risks and so on (Moor & Sercu, 2013). Among all these factors, dividend yield shows a strong relationship with the risk-adjusted stock returns (Moor & Sercu, 2013). Many researchers have tried employing various factors to testify and explain the small firm effect. For instance, a six alternative size measures model was used in an empirical study of India. The six size measurement includes market capitalization, enterprise value, net working capital, total assets, net sales and net fixed assets (Pandey& Sehgal, 2016). By testing the relation between stock returns and all these size measurements, a strong and robust size effect was indicated in the Indian stock market (Pandey& Sehgal, 2016).

Research Design

This research is a descriptive study that aims to find the relationship between firm size and excess stock returns in Shanghai A-share stock market from 2015 to 2017. The research use panel data to regression analysis so that finding the explaination of the difference excess stock returns among various stock portfolios. The null hypothesis is that there was no small firm effect in Shanghai A-share market in the period from January 2015 to May 2017.

Data

Since the literature review disclosed that small firm effect varies in different stock markets and different time periods, the research scope is limited to Shanghai A-share stock market from the time period from 2015 to 2017. Shanghai stock exchange was China's first stock market which established in 1990. After thirty years' development, this stock exchange has become relatively standardized, so the stock price of the firms listed in Shanghai stock exchange is reliable. The

data from the period between 2015 and 2017 can exactly reflect the real situation in the capital market. Besides, compared with other stock boards, such as the B-share stock market or the second board, the A-share stock market has more serious supervision and strict regulations. Therefore the stock price in the A-share stock market is more reasonable.

The population of the study is 1546 listed companies in Shanghai A-share stock market and the sample size is 200 randomly selected A-share stocks. The study period is from January 2015 to May 2017, 29 months in total. The independent variables are market premium (monthly market index and monthly risk-free rate), monthly market value and monthly BTM ratio of individual stocks. Since China has no short-term government bond, the risk-free rate is obtained from the three-month fixed deposit interest. The dependent variable is the monthly stock return of individual stocks. All of the data is collected from the CSMAR database and the database of the Central University of finance and economics.

Model

This study adopts both the CAPM and the three-factor model to find the relation between firm size and stock returns. The CAPM model has two risk factors: the risk-free rate and the market risk. The pricing formula and the regression formula of this model are as following:

$$E(R_{it}) = R_{ft} + \beta_i E(R_{mt} - R_{ft})$$

$$R_{it} - R_{ft} = \alpha_{it} + \beta_i (R_{mt} - R_{ft})$$

Where $E(R_{it})$ is the expected return of a stock or a portfolio at time t, R_{ft} is the risk free rate at time t, R_{mt} is the market risk at time t, R_{Mt} - R_{ft} is the market risk premium, $R_{it} - R_{ft}$ is the excess return of stock, α_{it} is the intercept term, ε_t is the error term and β_i is the factor coefficient.

Compared with the CAPM model, the three-factor model adds size risk and value risk factors to predict the return of stocks. The pricing formula and the regression formula of this model are as following:

$$E(R_{it}) = R_{ft} + \beta_i [E(R_{mt} - R_{ft})] + s_i E(SMB_t) + h_i E(HMI_t)$$

$$R_{it} - R_{ft} = \alpha_{it} + \beta_i [(R_{mt} - R_{ft})] + s_i SMB_t + h_i HMI_t + \varepsilon_{it}$$

Where SMB_t is the size premium and HML_t is the value premium. β_i, s_i, h_i are factor coefficients. For both the two pricing models, it assumes that the random error term has a mean value of zero and the variance follows the normal distribution. Besides, for the three-factor, it also assumes that there is no linear correlation between explanatory variables.

Six Stock Portfolios

The explanatory variables in the CAPM model are easy to collocate, but the explanatory variables of the three-factor model are needed to be calculated. To get the three dependent variables in the three-factor model, the study follows the research method carried by Fama and French (1993) that divides the sample stocks into six stock portfolios. The first step is to divide the 200 sample firms equally into two large groups based on the median of the market value of the sample stocks. The small size portfolio contains firms whose market value is smaller than the median, and the big size portfolio contains firms whose market value is larger than the median. Then, divide the sample into three BTM ratio portfolios independently. The highest thirty-percent firms are in the high-BTM ratio stock portfolio, the lowest thirty-percent are in in the low-BTM ratio stock portfolio, and the middle forty-percent are in the middle-BTM ratio stock portfolio. The final portfolios are the six intersections of the two size and the three BTM groups: big-size and high-BTM ratio stock portfolio (BH), big-size and middle-BTM ratio stock portfolio (BM), big-size and low-BTM ratio stock portfolio (BL), small-size and high-BTM ratio

stock portfolio (SH), small-size and middle-BTM ratio stock portfolio (SM), and small-size and low-BTM ratio stock portfolio (SL).

The next step is to calculate the average monthly return of each stock portfolio. The individual monthly stock return can be obtained directly from the CSMAR database. Collect the individual monthly stock return of firms in each stock portfolio and then calculate the average monthly return of each portfolio. Since the study period is 29 months from January 2015 to May 2017, the previous steps are repeated 29 times for each month. So there are 29 observations for each stock portfolio and 116 observations in total.

After computing the average monthly stock return for each stock portfolio, the three dependent variables Rm - Rf, SMB, and HMI can be calculated. The market risk factor is the difference between the market index and the risk-free rate. The formula is as follows:

$$RM - Rf = \text{Market Index} - \text{Risk free rate}$$

The firm size factor is the difference between the monthly average returns of the small-size stock portfolios and that of the big-size stock portfolios. The formula is as follows:

$$SMB = [(SL + SM + SH) – (BL + BM + BH)]/3$$

The BTM ratio factor is the difference between the monthly average returns of two high-BTM ratio stock portfolios and that of two low-BTM ratio stock portfolios. The formula is as follows:

$$HML = [(SH+BH) – (SL+BL)]/2$$

Since all these variables are systemic risks in the three-factor model, the study needs to use the whole market data to calculate, which is hard to operate since the study only sample 200 firms. So the study directly collects the monthly data of these three variables from the database of the Central University of finance and economics. After finding all the variables, the study will adopt the CAPM and three-factor mdel to do the regression analysis of each portfolio resepctively, and

then compares the intercept and coefficients of each portfolio to analysis the existence of small firm effect.

Result

Summary Statistics

Figure 1 to Figure 6 shows the monthly excess stock return of the six stock portfolios from January 2015 to May 2017. It is clear that there was a dramatic decrease in excess stock return for all stock portfolios in July 2015 and January 2016 which are two worst time periods for the Chinese stock market. The stock price varition pattern of each portfolio seems the same in general.

Figure 1. Monthly Excess Return of BH Stock Portfolio

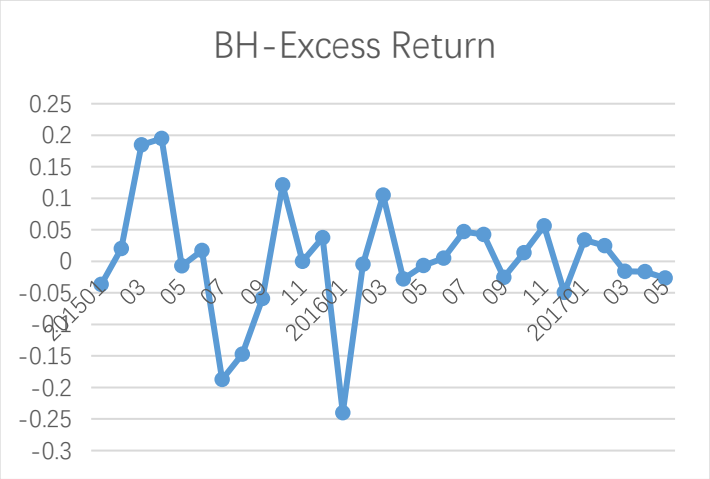

Figure 2. Monthly Excess Return of BM Stock Portfolio

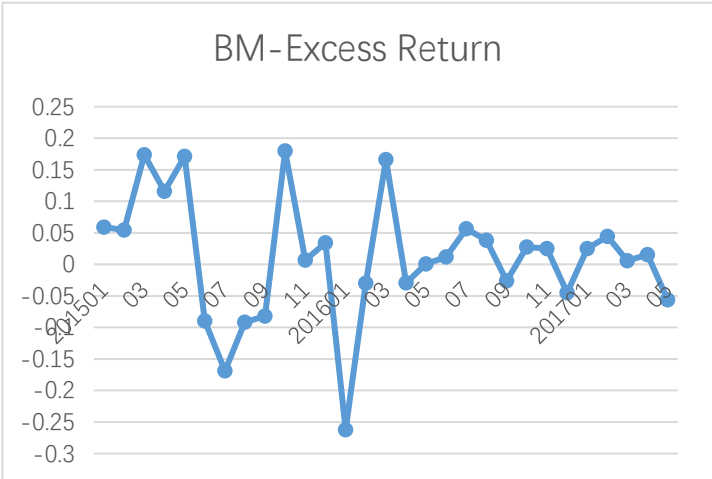

Figure 3. Monthly Excess Return of BL Stock Portfolio

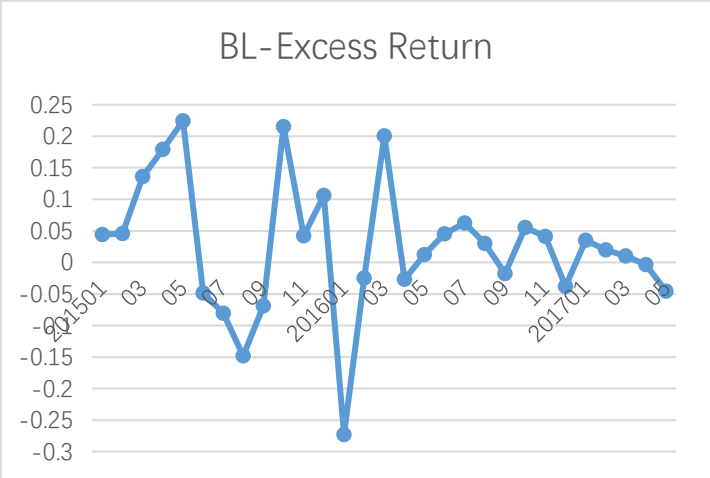

Figure 4. Monthly Excess Return of SH Stock Portfolio

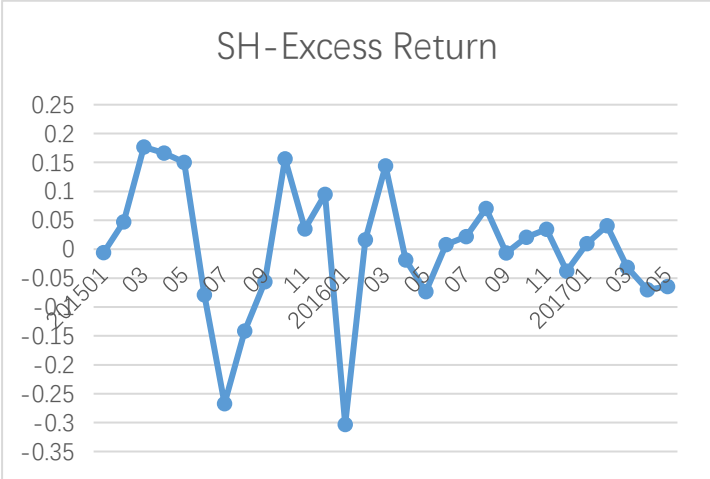

Figure 5. Monthly Excess Return of SM Stock Portfolio

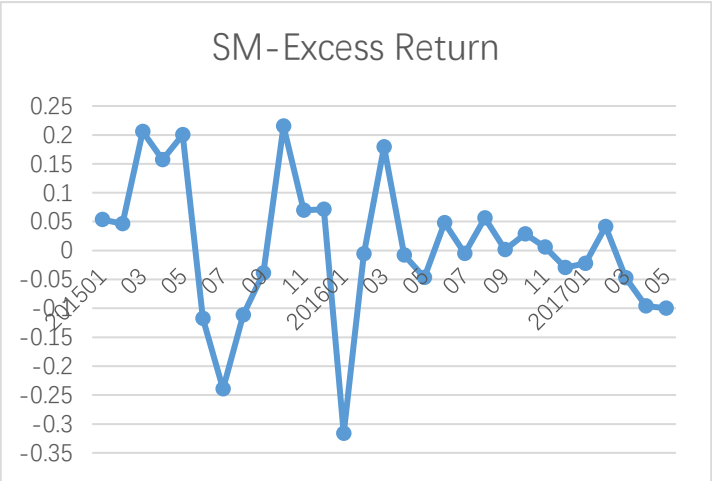

Figure 6. Monthly Excess Return of SL Stock Portfolio

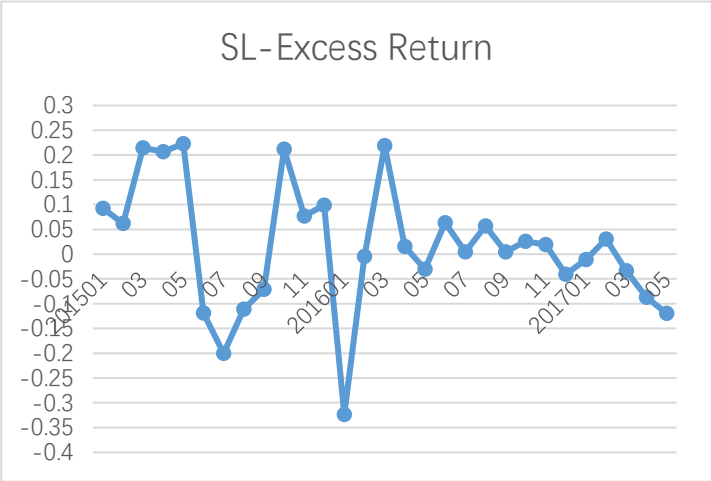

Table 1 indicates the monthly excess stock return for six stock portfolio of 29 months. The data indicates a positive relationship between firm size excess stock return and a negative relative between BTM ratio and return. In the three BTM stock portfolios, the big size stock portfolio (BH, BM, BL) has a higher excess return than the small size stock portfolio (SH, SM, SL) respectively.

Table 1. Monthly Excess Stock Return for Six Portfolios (Jan. 2015 – May 2017)

	Excess Return				
Portfolio	**Mean**	**St.Dev.**	**Minimum**	**Maximun**	**Rage**
BH	0.00191	0.09125	-0.23988	0.19479	0.43467
BM	0.01126	0.09886	-0.26227	0.17955	0.44182
BL	0.02512	0.10610	-0.27299	0.22441	0.49740
SH	0.00134	0.11312	-0.30307	0.17683	0.47990
SM	0.00682	0.12211	-0.31652	0.21515	0.53167
SL	0.01630	0.12864	-0.32371	0.22280	0.54651

The standard deviation of each stock portfolio shows that the stock return of small size firms is more volatile than that of large size firms. Similarly, the stock of low BTM ratio firms is more volatile than that of middle BTM ratio firms and high BTM ratio firms. The more volatility of the stock return indicates more risks of the stock, thus providing more compensates for

investors. It is clearly shown in Figure 7 that small size and high BTM ratio stock portfolio has the largest average monthly excess stock return for 29 months and the big size and low BTM ratio stock portfolio has the smallest monthly excess stock for 29 months.

Figure 7. Mean of Six Stock Portfolio for 29 months.

Table 2 indicates the correlation between the three risk factors: risk premium factor (Rm-Rf), size factor (SMB) and value factor (HML). There is no significant correlation between risk premium factor and value factor. However, there is a significant positive correlation between risk premium factor and size factor. Besides, the size factor also has a positive relationship with the value factor at a significant level of 0.01. Thus the size value of the three-factor model may not be reasonable to explain the excess stock return of stock portfolios.

Table 2. Correlation of the Three Risk Factors.

	Mean	St.Dev.	Rm -Rf	SMB	HML
Rm -Rf	0.0076	0.099	1	-	-
SMB	0.0242	0.055	0.576**	1	-
HML	-0.0020	0.054	-0.333	-0.700**	1

* $p<0.05$ ** $p<0.01$

CAPM Regression Result

Table 3 presents the CAPM regression result of the monthly excess stock return. The CAPM implies that all the risks are captured by the risk premium factor, so when the coefficient of beta is zero, the intercept should also be zero. The data in Table 3 shows that the intercept value of BH, SH and SM stock portfolios are negative, while the intercept value of BM, BL and SL stock portfolios are positive. However, only the intercept value of the BL stock portfolio is statistically significant at the level of 1%. The other five intercepts are not statistically significant. This means that except for the BL stock portfolio, the intercept of the other five stock portfolios can be considered equal to zero. So the CAPM model performs well to explain the relationship between firm size and excess stock return.

Table 3. CAPM Regression Result

	Regression results on the CAPM （Jan. 2015 — May 2017）					
	BH	**BM**	**BL**	**SH**	**SM**	**SL**
Intercept	-0.00450 (-0.07670)	0.00399 (0.79906)	0.01742 (2.83048)**	-0.00695 (-1.16170)	-0.00209 (-0.30604)	0.00686 (1.02782)
β	0.84946 (12.35108)**	0.96234 (18.79725)**	1.02024 (16.17851)**	1.09719 (17.90954)**	1.17863 (16.87206)**	1.24963 (18.27170)**
R^2	0.84405	0.93403	0.91301	0.95169	0.91948	0.97447

*** Significant at the 0.05 level (2-tailed). ** Significant at the 0.01 level (2-tailed).**

The result also displays that the market factor has a significant positive relationship with the excess stock return of the six stock portfolios. The coefficient of beta for each stock portfolio is at a significant level of 1%. The coefficient of the BH and BM stock portfolio is less than 1, while the coefficient of the other four stock portfolios is large than 1. This means when the

whole market has a positive excess stock return, all of the six stock portfolios will also have positive excess stock returns. And the excess stock return of the BH and BM stock portfolio will be worse than the whole market, the excess stock return of the other four stock portfolios will be better than the whole market.

Besides, in the same BTM stock portfolio, the coefficient of small-cap stocks is large than the coefficient of the large-cap stocks. So there is a significant negative relationship between firm size and excess stock return. It is easy to understand that small firms should have more risks than large firms so that providing more compensates to investors. Similarly, in the same size stock portfolio, the coefficient of the high BTM ratio stock portfolios is the lowest, and the coefficient of the low BTM ratio stock portfolios is the highest. Therefore, there is also a significant negative relationship between the BTM ratio and the excess stock return.

Among the six stock portfolios, the SL stock portfolio has the highest coefficient (1.24963), and the BH stock portfolio has the lowest coefficient (0.84946). These findings are signs that there are size effect and value effect in Shanghai A-share stock market. Keep other variable constant, the small-cap stocks have higher excess return than the large-cap stock, and the low-BTM ratio stock portfolios have higher excess stock return than the high-BTM ratio stock portfolios.

Furthermore, the adjusted R square of the six stock portfolios is all large than 0.8, which indicates that the regression line has a good fitting degree to the observations. In general, the adjusted R square of small-cap stock portfolios is large than the adjusted R square of large-cap stock portfolios. Thus, the market factor in the CAPM model can explain the excess stock return of small-cap stocks better.

Overall, except for the BL stock portfolio, the other five stock portfolios have the zero intercept, so the CAPM model can well explain the excess return of stocks for most portfolios. And the market risk factor has a significant positive relationship with the excess stock return. Therefore, the CAPM model can sufficiently explain the excess return of stocks in Shanghai A-share market. The regression result indicates that there is small firm effect in the Chinese stock market.

Three-factor model Regression Result

Table 4 shows the three-factor model regression result of the monthly excess stock return for the six stock portfolios from January 2015 to May 2017. The three-factor model implies that all the risks are captured by the market risk premium, size factor and value factor, so when the coefficient of these three factors is zero, the intercept should also be zero. However, Table 4 shows that the intercept value of the BM and BL stock portfolio is positive, and the BH, SH, SM, and SL stock portfolios have a negative intercept. Furthermore, the intercept of the SH and SM stock portfolio has a significant level of 0.01, and the intercept of the BL is at a statistically significant level of 0.05. The other three intercepts are not statistically significant. This indicates that the BL stock portfolio will have positive excess stock returns, and the SH and SM stock portfolios will have negative excess stock returns when not consider the influence of market risk, firm size, and BTM ratio. Therefore, the three-factor model is only well performed to explain the excess stock return of BH, BM and SL stock portfolios.

The coefficient of the market risk reveals a significant positive relationship between the excess market return and the excess stock return. The market risk factor is at a significant level of 0.01 of each stock portfolio in the regression model. Besides, the market risk coefficient of each stock portfolio approach to 1, which discloses a strong relationship between the market factor and

excess stock return. However, the similarity of the beta coefficient of each stock portfolio means that the market factor cannot well explain the difference of excess stock return between portfolio since each portfolio has the same sensitivity to the market risk.

Table 4. Three-factor model regression Result

	Regression results on the three-factor model（Jan. 2015 — May 2017）					
	BH	**BM**	**BL**	**SH**	**SM**	**SL**
Intercept	-0.00558 (-1.27231)	0.00513 (0.91327)	0.01602 (2.31541)*	-0.02018 (-3.67123)**	-0.01731 (-4.08392)**	-0.00658 (-1.44855)
β	0.94179 (20.18338)**	0.93696 (15.67998)**	0.96064 (13.04465)**	0.96590 (16.50968)**	0.95645 (21.20887)**	1.04334 (21.57177)**
S	0.06671 (0.60456)	-0.05889 (-0.41674)	0.05801 (0.33309)	0.61855 (4.47086)**	0.69986 (6.56269)**	0.61659 (5.39103)**
h	0.62331 (6.39972)**	-0.24287 (-1.94726)	-0.22406 (-1.45765)	0.37208 (3.04691)**	0.01771 (0.18813)	-0.04214 (-0.41741)
R^2	0.95278	0.92638	0.90303	0.91948	0.91016	0.92241

*** Significant at the level of 0.05 (2-tailed). ** Significant at the level of 0.01(2-tailed).**

The coefficient of firm size in the BM stock portfolio is negative, but the coefficient in the other five stock portfolios are positive. It seems like there is a positive relation between firm size and excess stock return. However, the size factor cannot explain the excess stock return of the large-cap stock portfolios since none of the coefficients of the large size portfolios is statistically significant. Nevertheless, the regression result indicates a strong positive relationship between firm size and excess stock return in small size stock portfolios at a significant level of 0.01. Thus, the size factor can explain the excess return of small size firms. Besides, according to the result, in small size portfolios, the middle BTM ratio firms have the highest excess return.

As shown in the regression results, the coefficient of value factor is only significant in the BH and SH stock portfolio. For both BH and SH stock portfolios, there is a strong positive relationship between BTM ratio and excess stock returns at a significant level of 0.01. Since the BH and SH stock portfolios are in the same BTM ratio portfolio, the result indicates that when stocks have a high BTM ratio, the large-cap stock has higher excess stock returns than the small-cap stock.

Overall, the three-factor model can only explain the excess return of stock for the BH, BM and SL stock portfolios. For the BH portfolio, both market risk factor and value factor shows a significant positive relationship with the excess stock return at the significant level of 0.01, the size factor cannot be used to explain the excess return of the BH portfolio. However, for the SL portfolio, only the market factor and the size factor have a significant positive relationship with the excess stock return at a significant level of 0.01. The three-factor model is poorly to prove the existence of small firm effect in Shanghai A-share market.

Conclusion

Result Analysis

The aim of the study is to testify the existence of small firm effect in Shanghai A-share market on the time period from January 2015 to May 2017 in which there was a bear market in the Chinese stock market. This study uses both the CAPM and the three-factor model to analyze 200 sampling firms for 29 months. Compared with the three-factor, the CAPM performs better to explain the excess return of stock portfolios and indicates that there is a significant negative relationship between firm size and excess stock return in the bear market. This result is different from the finding of Amel-Zadeh (2011) that the small firm effect disappears in the downturn

period of the stock market and reappears in the bull stock market. This may due to the different marekt structures and regulations between Chinese and German stock marekt.

In this study, the three-factor model fails to explain the excess stock return of the BL, SH and SM stock portfolio. For the BH, BM and SL stock portfolios, only the market factor has significant explanatory power for all these three portfolios, the size factor and the value factor are only significant for one of the three portfolios respectively. Therefroe, it is unable to compare the coefficient of the size and value factors between stock portfolios. As a result, the three-factor model is unable to draw a conclusion of the existence of small firm effect. In conclusion, the regression result of the CAPM model indicates a negative relationship between firm size and excess stock return, so there was small firm effect in Shanghai A-share stock exchange during the period from January 2015 to May 2017.

Contributions

There are two implications of the result of the study. Firstly, as an empirical analysis of small firm effect in Shanghai A-shares stock exchange, this study can work as evidence to prove the existence of small firm effect in Chinese stock markets. Moreover, since fewer studies of small firm effect are carried out in the Chinese stock market, this study can provide information on this topic, which on one hand updates previous research findings, on the other hand, provides information for further researches on this topic. Secondly, since more investors are showing their interests in Chinese stock marekt, the result of the studies can work as a reference for investors to make a reasonable investment decision. Instead of only considering the systematic risk of the market, investors should also pay attention to the firm size as well as the BTM ratio of the firm.

Limitations

There are also several limitations existing in this study. Firstly, the sample size and the study period of the research is limited. The study only focuses on 200 sampling listed firms, but there are 1546 firms in Shanghai A-share stock market, so the result of the study cannot be applied to the whole market. Moreover, the research only studies the relation between firm size and stock returns from January 2015 to May 2107. It is possible that the result will be different if the study expands the study period as the small firm effect will vary significantly over time. Besides, the research analysis stock performance of stock portfoliod in the bead market but not eliminates the influence of momentum effect which has an influence on the existence of small frim effect.

The final limitation can be the model the study applies. The result of this study indicates that the CAPM is better to explain the abnormal exceed return of firms than the three-factor. However, the CAPM model has been proved by many studies that it only has weak explanatory power, the three-factor model is more comprehensive. Nevertheless, the three-facto model performs poorly in this research. I think this may because of the significant correlation the size factor has with the market factor and the value factor. The correlation of risk factors violates the assumption of the three-factor model that there should no linear correlation between explanatory variables. Therefore, further studies are needed to test the validity of the three-factor model when the explanatory variables are linear independent. Besides, according to recent studies, factors such as skewness, short-term reversal, medium-term momentum, volatility also have an impact on firms' stock returns. While the three-factor model does not conider these factors. Therefore, more studies are needed to focus on more risk factors to explain the abnormal exceed return of firms.

References

Abdullah, M. N., Parvez, K., Karim, T., & Tooheen, R. B. (2015). The impact of financial leverage and market size on stock returns on the Dhaka stock exchange: Evidence from selected stocks in the manufacturing sector. *International Journal of Economics, Finance and Management Sciences*, *3*(1), 10-15.

Amel-Zadeh, A. (2011). The return of the size anomaly: Evidence from the German stock market. *European Financial Management*, 17(1), 145-182.

Asness, C., Frazzini, A., Israel, R., Moskowitz, T. J., & Pedersen, L. H. (2018). Size matters, if you control your junk. *Journal of Financial Economics*, 129(3), 479-509.

Banz, R.W. (1981). The relationship between return and market value of common stocks, *Journal of Financial Economics*, 9, pp. 3-18.

Black, F., Jensen, M. C., & Scholes, M. (1972). The capital asset pricing model: Some empirical tests. *Studies in the theory of capital markets*, 81(3), 79-121.

Chan, L.K.C., Hamao, Y. & Lakonishok, J. (1991). Fundamentals and stock returns in Japan. *Journal of Finance*, 46, 1739-1789.

Duy, N. T., & Phuoc, N. P. H. (2016). The relationship between firm sizes and stock returns of service sector in Ho Chi Minh City stock exchange. *Review of European Studies*, 8(4), 210-219.

Fama, E., & French, K. (1995). Size and book-to-market factors in earnings and returns. *Journal of Finance*, 50, 131-155.

Gan, C., Hu, B., Liu, Y. G., & Li, Z. (2013). An empirical cross-section analysis of stock returns on the Chinese A-share stock market. *Investment Management and Financial Innovations*, 10(1), 127-136.

Gandhi, P., & Lustig, H. (2015). Size anomalies in US bank stock returns. *The Journal of Finance*, 70(2), 733-768.

Hu, G. X., Chen, C., Shao, Y., & Wang, J. (2019). Fama–French in China: size and value factors in Chinese stock returns. *International Review of Finance*, 19(1), 3-44.

Keim, D. B. (1983). Size-related anomalies and stock return seasonality: Further empirical evidence. *Journal of financial economics*, 12(1), 13-32.

Keim, D.B. (1990). A new look at the effect of firm size and E/P ratio on stock return. *Financial Analysts Journal*, 46 (2), pp. 56-68.

Moor, L. D., Sercu, P. (2013). The smallest firm effect: An international study. *Journal of International Money and Finance*, 32(1), 129-155.

Pandey, A., & Sehgal, S. (2016). Explaining size effect for Indian stock market. *Asia- Pacific Financial Markets*, 23(1), 45-68.

Songxing, S., & Weigen, J. (1995). An Efficient and Practical Study of Shanghai Stock Market. *ECONOMIST*, 4, 107-128.

Van Dijk, M. A. (2011). Is size dead? A review of the size effect in equity returns. *Journal of Banking & Finance*, 35(12), 3263-3274.