Which Factors Explain Stock Returns on the Shanghai Stock Exchange Market?

A Panel Data Analysis of a Young Stock Market

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Abstract
This paper studies factors that influence the stock return on the Shanghai Stock Exchange (SSE) market. To achieve this goal, a stock-fixed effects model is estimated using a panel data sample comprising 100 companies listed on the SSE market during the 72-month period from January 2002 to December 2007. I find that number of trades and book-to-market value in both up and down markets have a significant and positive impact on stock returns during the studied period, whereas stock returns were negatively affected by systematic risk in both up and down markets although less so in up markets. Price to earnings ratio did not show any significant effect on stock returns on the SSE. My overall results indicate that SSE did not satisfy the efficient market hypothesis during the studied period from January 2002 to December 2007.

Key-words
Panel data analysis, CAPM, Shanghai Stock Exchange market, stock return, systematic risk, book-to-market value, number of trades
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1. Introduction

This research is a continuation and extension of the work done by Wong et al. (2006) in the paper “The Cross-Section of Stock Returns on The Shanghai Stock Exchange”. They studied about whether the relevant factors of systematic risk, market value, book-to-market ratio, floating equity and average return from the Shanghai Stock Exchange (SSE) are related to stock return by cross-section analysis during the time period from February 1995 to December 2002. Since during the recently ten years, there are new relevant factors been studied as a key factor influencing in the stock return. Therefore, I apply those factors to my research by panel data analysis based on a data sample from SSE market during the period 2002 to 2007.

In previous studies, the “size effect”, raised by Banz (1981) has been shown to be a very relevant factor to estimate the stock return by panel data research. Market value and book-to-market value of a listed company are also found to be key factors in estimating stock returns in addition to the systematic risk found by Fama and French (1992). In their research, they found that those two factors are significant to the return on U.S. stock market during 1963–1990 periods. In addition to the theory of market value and book-to-market value studied in the paper by Wong et al. (2006), other factors such as liquidity has also been introduced into the analysis of stock returns. From other school research, liquidity plays a very important role in the study of pricing financial securities. In another words, the liquidity parameter highlights the importance of further research, as market liquidity has a large impact on portfolio investment returns. Another new thought is the uneven return during one year, so I will also estimate the average return on SSE market to see whether there is unusual return in January. In my research paper, all those above key factors will be considered as important variables to study.

Many academic researchers are more interested in US or UK stock market, as China stock markets are young and under the special Chinese political regulation, there are few research papers studying on the Shanghai Stock Exchange (SSE) market. Therefore, my paper will study which factors are related to stock return based on SSE market.
Compared to market value and book-to-market, instead of systematic risk, a controversy relationship between trading activities and stock return is more obvious (Benston and Hagerman, 1974; Gallant et al., 1992; Hiemstra and Jones, 1994; Lo and Wang, 2000). The main contribution of my paper is to study the impact systematic risk, book-to-market value, market value, price to earnings ratio, average return and number of trades on stock return on the SSE market using panel data estimations with stock-specific fixed effects.

The sample data are taken from SSE A-share market. Only domestic investors are allowed invest in this market and it is also segmented from other equity markets, such as future market. The time period of sample data is from January 2002 to December 2007. In the sample, I chose 100 listed companies during the period. The 100 stocks are randomly taken out as test sample. In addition, I chose the sample data during such period to avoid the recovery and recessionary time, since the economic crisis in 1999 and 2008 may cause a bias on the hypothesis test and have lag effect as well.

This empirical part of the paper can be seen as a test of the efficient market hypotheses, which states that the return for a single stock should only be related to its systematic risk. A stock-fixed effect panel estimator is employed to test the hypotheses.

From the test results, I found that some variables beside the systematic risk have a certain relation with stock return. There is a positive relation between number of trades and stock return. The factor of number of trades provides important information that the return is huge when speculators could receive a gain from a different stock ending price, so that other speculators will follow his step. Thus, it leads to a large scale trading volume on stock market. The book-to-market value variable also has a positive relation with stock return. However, factors of systematic risk, average return and market value all have a negative relationship with stock returns. In addition, the price to earnings ratio has no influence on the stock return according to my panel data analysis.

The rest of this paper is organized in the following structure. In section 2, I review international evidence on stock returns. Section 3 provides a short description of the background and characteristics of the SSE (Shanghai Stock Exchange). In section 4, I discuss the theoretical background and the efficient market hypotheses. The section ends with my research hypotheses to be tested in the empirical part. Section 5 presents data and variables to
be used in the regression analysis. The empirical strategy is presented in section 6, while the results are shown in section 7. The paper ends with conclusions in section 8.

2. Literature Review

This paper studies what key factors affect the stock return on the Shanghai Stock Exchange (SSE) during the period 2002 to 2007 and can be seen as a continuation and extension of the study by Wong et al. (2006). Wong et al. (2006) studied the effect of systematic risk, market value, book-to-market value, floating equity and average stock returns on individual stock returns at the SSE by cross-section analysis during the time period from February 1995 to December 2002. They found that listed companies with smaller size and higher book-to-market value have higher returns in up markets, defined as markets that had higher average return than the risk-free interest rate, whereas stock returns were insignificantly related to the size of the firm and to book-to-market value in down markets.

Sharpe (1964), Lintner (1965) and Black et al. (1972) developed the Capital Asset Pricing Model (CAPM). The random walk theory, that claimed the stock prices to follow a random evolution over time, was questioned by the CAPM, which related the average return to the stock’s systematic risk. In securities field, this CAPM is used to explain the investment return of a stock on the appropriate theoretically way through combination systematic risk factor with expected return of the market and the expected return of a theoretical risk-free investment return. Black et al. (1972) used both methods of panel data regression and cross-section data regression to estimate the connection between stock return and systematic risk by CAPM. They found those economic hypotheses are consistent with the results by a test of capital market equilibrium. It means the systematic risk factor can be a key variable that influences the stock return. Besides, they also found the possibility of other factors affecting the stock return. Fama and Macbeth (1973) found that stock returns and systematic risk has a linear relationship in the NYST during the period from Jan 1926 to Jun 1968, whereas Fama and French (1998) found that systematic risk has a weak relation with stock returns and that stock returns has no connection with firm size during the period 1941 to 1990.
Furthermore, other researchers claimed that the effect of systematic risk is non-existent, since when systematic risk is used as the only explanatory variable in explaining stock return there is only a very weak relationship with stock returns.

With the development of empirical study and research, various schools thoughts came out based on the knowledge of the Sharpe-Lintner-Black Model. Banz (1981) introduced the concept of a “size effect” on the New York Stock Exchange (NYSE). He found that the market value of stocks has a certain relation with stock return on NYSE. In addition, he also found that smaller firms always obtain higher returns than larger firms on the NYSE.

Later research introduced new explanatory factors into the analysis. Fama and French (1992) found that higher return stocks always have a background of higher book-to-market value based on the analysis on US market during the period from 1962 to 1990. They also find that “… although the size effect has attracted more attention, book-to-market equity has a consistently stronger role in average returns” (Fama and French, 1992, p. 428).

The research on the Japanese stock market also proved a strong relationship between book-to-market value and stock returns by Chan et al. (1991). They found that this relation particularly reflected the performance of portfolio stock investment. Fama and French (1998) find that the higher volatility of stock returns comes with a positive parameter of book-to-market value in the emerging markets during a short time period. However, Chen and Zhang (1998) argued that no matter if the parameter of book-to-market value is higher or lower, most stocks always has a low investment risk as long as stock markets is within the up market period. Drew and Barry (2001) find that the factors of firm size and book-to-market value affect the expected stock returns based on the research from 35 emerging equity markets during the period from 1985 to 2000. They conclude that there is a negative relationship between firm size and stock returns, and is a positive relationship between book-to-market value and stock returns.

In recent studies, some academic researches study about the relation between abnormal return and market value on the particular stock exchange period. The research focused on January, the returns in January are larger than the stock returns in the other eleven months of the year. The main reason for the abnormal returns in January is that January is regarded as a period when many companies share important information and that information may have a
big impact on the price and return of firms, especially for smaller firms. Keim’s (1983) research shows that there is a negative relation between abnormal returns and firm size specially happened in January during the period 1963 to 1979 on NYSE and AMEX common stock market. L’Her et al. (2004) find that factor of firm size is significantly stronger variable related to stock return on January rather than in any other months in the Canadian stock market using the approach of Fama’s and French’s three factor pricing model during July 1960 to April 2001. Furthermore, they also find that the factor of book-to-market value has a positive and higher significant effect in down markets.

However, some other research comes to the opposite conclusions. Kothari, Shanken, and Sloan (1995) argued that the factor of book-to-market value is weaker and less connected to the stock return. Their research estimated stock returns by cross section regression using COMPUSTAT data. The systematic risk factor is estimated by time series regression of annual portfolio returns which is equal to weighted market index of annual return. Keim (1983) think that it is related to the tax-loss selling issue, that investors may want to sell stocks to gain an immediate tax deduction according to the income tax law on US market. Reinganum (1983) also studied on the same topic on Australian stock market, and also showed that book-to-market value on January has more correlation with return than in any other month.

Basu (1983) found that the P/E ratio can explain the stock return together with systematic risk and other factors on the U.S stock market. Ball (1978) argued that the P/E ratio could be higher in up markets when the risk and expected returns are higher since average earnings per share in up markets are lower than it is in down markets. Ball (1978) also argued that the price to earnings ratio together with market value, leverage and book-to-market value affect the expected stock returns.

There is also other research studying additional key factors to the systematic risk for explaining stock returns. Jegadeesh and Titman (1993) believed that the history records of stock return are good hints to predict current stock return. Fama and French (1993) and Lakonishok et al. (1994) found that future stock return can be predicted by the relative factors analysis through variables of current stock price, market value, book-to-market value and earnings per share.

Karpoff (1987) found that price volatility and number of trades have a positive relation
with stock returns. Schwert (1989) found that expected monthly volatility has a positive relation to volume growth rates. Grundy and McNichols (1989), Holthausen and Verrecchia (1990) and Kim and Verrecchia (1991) found that trade size has a positive relation with price volatility. Jones et al. (1994) found that daily number of trades and average trade size could explain daily price volatility through a sample analysis from Nasdaq stock market. Furthermore, the number of trades can provide important information what average trade size regards as a trivial role in the volatility volume relation.

However, Kyle (1985) and Admati and Pfleiderer (1988) found that a monopolist can control the trade activity by splitting investments approach into many small trades, so that the factor of trade size is an adverse information. Barclay and Warner (1993) argued that venture investment of course considers the problem of abandon trading volume. Therefore they can camouflage big trading volumes to be several medium sized trades. Huang and Stoll (1996) also argued that institutional investment in Nasdaq dealing with many large trades are negotiated previously and motivated by giving credible guarantee. On the other hand, Small Order Execution System (SOES) must control trades volume to balance the Nasdaq market, and the maximum size of SOES trades is 1,000 shares per trade. This is a formal characteristic between Nasdaq and NYSE. The former serves for qualified and small technique corporations.

3. The Shanghai Stock Exchange

Since 1978, a highly centralized planned economy has been gradually reforming into a flexible market economy. On November 26, 1990, the first stock exchange was launched with an initial listing of eight A-shares in Shenzhen Stock market and Shanghai market. It rushes to grow up to 884 listed companies, and its total market value is 178,000 billion Yuan (US$ 27,212 billion)$^1$ by the end of 2010. The total market capitalization of China A-shares in Shenzhen and Shanghai stock market is about slightly close to 36 percent of China’s GDP$^2$.


Nowadays, China stock ranks second in the world in terms of market capitalization.

In China stock market, there are two types of shares to be traded. The first one called A-shares, is traded by Renminbi denominated shares, which only mainland citizens can buy and sell. The other one called B-shares, and is also traded by Renminbi denominated shares, while only foreigners and residents of Hong Kong, Macao and Taiwan could buy and sell those shares. Since 2001, B-shares are opened to domestic investors and trade unit by US dollars. Both types of A-shares and B-shares follows the China securities law of voting power and claims earnings and assets of company annual report per year.

There are three main weighted stock indices on the SSE, which are the SSE Composite Index (SSEI), A-share Index (AI) and B-share Index (BI). SSEI includes all the listed stocks as a basic and primal index since stock market was built on December 19, 1990. AI includes all listed A-shares and built as same date as SSEI. BI includes all listed B-shares and built on February 21, 1992. The other stock indexes are SSE 180 Index, SSE 50 Index, and SSE 380 Index, separately built on July 1, 2002, January 4, 2004 and November 29, 2010.

SSE 180 Index also called SSE Constituent Index, adjusted by SSE 30 Index, comprising 180 component stocks that are actively traded, and having a representative quality industry of high market value, reputation track and good records. SSE 50 Index follows a science way, and picks up 50 stocks that are high market capitalization and volatility volume which volatility volume shows effective quality stocks of integration condition on SSE. SSE 380 Index consists of emerging blue chips, because the Growth Enterprise Market (GEM) was open on August 28, 2009 and this index support for GEM.

The SSE listed companies have unique form of their share capital structure compared with any other stock markets around the World. The A-shares consists of state shares, legal entity shares and public shares. Government controls the state shares, namely state-owned, partially state-owned enterprises or institutions own legal entity shares. Normally, legal entity shares and state shares own 60 percent of total shares issued. And those shares are forbidden to be traded on stock exchange market, because government wants to the keep the operation right of state-ownership. Besides, employee owned shares cannot be traded on SSE market until the employees’ stocks has been published on SSE market at least one and half years. However employees’ shares only have small percentage of total shares. The rest of them are
public shares which count for about 30 percent of total shares to be spread in the market.³

There are common properties for individual investors. Those investors have self-investment behavior and speculation phenomenon. Individual investors prefer to join the stock market trading by them instead of hiring an agent company, to collect exclusive information from criticism by special channel, and to be whispered by investment institution to make their own investment in a short period. Even when the listed companies have the danger signals on indexes, investors still ignore those danger signals and only keep eye on the different of stock ending price to make quick profit, for example indexes of price per earnings ratio and turnover ratio are larger higher than average indexes of US and UK shares.

4. Theoretical Framework and Hypotheses

4.1 CAPM

In financial theory, the Capital Asset Pricing Model (CAPM) is used to explain the investment return of a risky asset. If this is a portfolio investment which it includes different level risk of asset investment, this model calculates how much the portfolio investment risk index reflect on non-diversifiable risk which is as known as systematic risk and market risk.

The return from an individual stock should only be related to its systematic risk and not to the stock’s idiosyncretic risk according to the basic CAPM. To see this, first consider the capital market line (CML), which shows the expected return and the standard deviation for combinations of the market portfolio and a risk-free asset (Figure 1).

³ http://www.csric.gov.cn/pub/newsite/
The slope of the CML is,

\[
\frac{dE\left[R_p\right]}{d\sigma_p} = \frac{E[R_m] - R_f}{\sigma_m}
\]  

(1)

where \(R_m\) and \(R_f\) denote the return from the market portfolio and a risk-free asset, respectively, and \(R_p\) the return from the combined portfolio. The standard deviation for the combined portfolio and the market portfolio is given by \(\sigma_p\) and \(\sigma_m\). Next, to get the expected return for a single stock, first assume we create a portfolio consisting of the market portfolio and a single stock. The expected return and the standard deviation for this portfolio are,

\[
E\left[R_p\right] = aE[R_i] + (1-a)E[R_m]
\]

\[
\sigma_p = \left[a^2\sigma_i^2 + (1-a)^2\sigma_m^2 + 2a(1-a)\sigma_{i,m}\right]^{1/2}
\]

(2)

where \(a\) represent stock investment and \((1-a)\) market portfolio investment. Varying the share of capital invested in stock \(i\) affect both the expected portfolio return as well as the standard deviation of the portfolio. This can be traced out as a continuous graph in the
expected return/standard deviation dimensions. The slope of that graph is obtained by first taking the derivative of the expected portfolio return and standard deviation with respect to the share of capital invested in the stock and then realize that the equilibrium level of $\alpha$ must be equal to zero since the market portfolio already comprises the optimal amount of stock $i$. Hence, the slope is given by,

$$\frac{dE[R_p]}{d\sigma_p} = \frac{\partial E[R_p]}{\partial \sigma}/\partial \alpha\bigg|_{\alpha=0} = \frac{E[R_i] - E[R_m]}{(\sigma_{i,m} - \sigma_m^2)/\sigma_m}$$

(3)

This slope is the same as in equation (1), which implies that,

$$\frac{E[R_m] - R_f}{\sigma_m} = \frac{E[R_i] - E[R_m]}{(\sigma_{i,m} - \sigma_m^2)/\sigma_m}$$

(4)

or,

$$E[R_i] = R_f + \beta_i\left(E[R_m] - R_f\right)$$

(5)

$$\beta_i = \frac{\sigma_{i,m}}{\sigma_m^2}$$

Thus, the expected return on a single stock is a linear function of only its systematic risk $\beta$, i.e. the risk affecting the market as a whole. The idiosyncratic risk can be completely reduced by diversification and does not yield any return premium.

### 4.2 Efficient-Market Hypothesis

In financial theory, the efficient-market hypothesis (EMH) states that the stock market is informationally efficient. This hypothesis asserts that investors cannot make any excess return above what is consistent with the stock’s systematic risk since prices always
incorporates all relevant information.

Efficient market hypothesis has three key-points: first of all, all the investors are rational in the market. All the listed companies in this financial market are managed by rational supervision and management. The current stock price is determined by the firm’s future expected profits, and strictly made by decision between the risk and expected income for the company. Secondly, stock price directly reflect to the balance of demand and supply through those rational investors. The total amount of buyers is equal to the total number of sellers. If it is found that the equilibrium is broken, it will go through the process of buying or selling to make stock price changed back to the equilibrium point again. Thirdly, stock price can reflect to value of this asset, namely information efficient. When information is updating, stock price is simultaneously changed.

This theory states that it is impossible to “beat the market” because of stock market efficiency and of share prices reflected on all relevant information. In another words, stocks always are traded at their real market value. It is impossible for investors to buy undervalued stocks or sell stocks on over market prices. Therefore, in such a financial market investors cannot gain through stock expert selection or market timing.

There are three main types of the efficient market hypothesis, which are “weak-form efficiency”, “semi-strong form-efficiency”, and “strong-form efficiency”. Weak-form efficiency means that stock price cannot well reflect through strategy and technology analysis depending on past price. In this form, it is thought that excess return cannot be gain by investment strategies of historical stock data during long term period. The stock price is considered as the random walk and no track can be followed. This weak form efficiency implies that excess return in the market is inefficiencies. Strong-form efficiency denotes that stock prices reflect all information, whatever public or private investor. No one can earn excess returns in this market. Semi-strong form-efficiency is in the middle situation, which means either fundamental analysis or technology analysis of stock price and history data can gain the excess return.
4.3 Research Hypotheses

Motivated by the explanations and methodology of theory and empirical reviews, my paper focuses on the whether the variables of systematic risk, book-to-market value, market value, P/E ratio and number of trades can explain the stock return. If there are any factors having a significant relation with stock returns, I will find which factor will have the largest effect on the explanation of stock returns by panel data analysis.

Hypothesis 1: Only factor of systematic risk has significant impact on the stock returns of SSE and, hence, the market satisfies the semi-strong EMH.

Hypothesis 2: Other factors beside the systematic risk – book-to-market value, market value, P/E ratio and number of trades – have significant effects on stock return on the SSE market.

5. Descriptive Data and Statistics

In the sample, I randomly chose 100 listed companies. The test period of my sample is from January 2002 to December 2007. I chose the sample data during such period, because of avoiding a recovery and recessionary time. Economic crisis on 1999 and 2008 may have a bias on the hypothesis tests and lag effect.

The variables of market value, number of number of trades, PE ratio use lag data of one month, as the return is calculated based on the ending price differ of stocks from precious and current month.

In addition, the data of month-end closing price, month-end market value, P/E ratio, number of trading, SSEI, and AI and dividends are collected from SSE official website. In the meanwhile, the year-end data of book value is also provided by annual report from SSE official website.

All the stocks have follows information: 1. Closing prices by month end, and also
adjusted by stock dividends; 2. Cash dividends; 3. Book value of stock equity from annual report by year end; 4. Market value of stock equity by month end; 5. Number of trades by month end; 6. P/E ratio of stocks by month end.

The following subsections describe the variables and Table 1 provides descriptive statistics for all variables except for the systematic risk, which is estimated using the market model in section 6.1 and further elaborated on in section 7.1.

Table 1. Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price/earnings ratio</td>
<td>108</td>
<td>228</td>
<td>3.53</td>
<td>3,025</td>
</tr>
<tr>
<td>Market value, logarithm</td>
<td>11.8</td>
<td>1.25</td>
<td>9.19</td>
<td>16.90</td>
</tr>
<tr>
<td>Book-to-market value, logarithm</td>
<td>0.45</td>
<td>0.90</td>
<td>−5.37</td>
<td>3.39</td>
</tr>
<tr>
<td>Number of trades, logarithm</td>
<td>1.45</td>
<td>1.37</td>
<td>−2.66</td>
<td>5.76</td>
</tr>
<tr>
<td>Average return</td>
<td>0.04</td>
<td>0.08</td>
<td>−0.15</td>
<td>0.38</td>
</tr>
<tr>
<td>Stock return</td>
<td>0.04</td>
<td>0.17</td>
<td>−0.77</td>
<td>1.89</td>
</tr>
</tbody>
</table>

Note: Complete variable descriptions in section 5.

5.1 Market Beta

The systematic risk normally uses parameter beta $\beta$, which describes the relation between variation in stock returns and variation in the return of the whole financial market. A zero $\beta$ means that return of an asset has independently changed from the market returns. A positive $\beta$ indicates that the stock return vary positively with the financial market as a whole whereas a negative $\beta$ indicates a negative relationship.

5.2 Price/Earnings Ratio

The P/E ratio (price to earnings ratio) measures the price for buying a share relative to the annual net income, or profit, earned by the firm per share. P/E is a valuation tool to estimate company capital structure. The higher P/E ratio means that investors are willing to
pay more for each unit of net income, and this stock has a higher investor price than stocks with lower P/E ratios. The P/E ratio can also be interpreted as the number of years it takes to retrieve the price paid for the stock given that profits remain the same over time and that the inflation and discounting factor are zero. In other words, the P/E ratio is an index to reflect the current investor demand – higher P/E ratio indicates higher relative demand for the stock.

P/E ratio relates the stock price to expected return, so that P/E ratio could reflect the current net income of the company. If stock price goes up, the P/E ratio will also go up without a change in net income. According to some rules of thumb, the price of a share is considered underestimated if the P/E ratio is below 14; normal for the range 14–20; overvalued for the range 20–28 and being the subject of a speculative bubble if the P/E ratio is above 28.4

Ball (1978) looks at the P/E ratio as an integrated omitted risk factors on expected return. From his theory, the current earnings present future earnings. Therefore, there is a low price related to its earnings when the higher risk stock has a higher expected return. In another words, the P/E ratio is a factor to estimate the expected returns whatever the missing factors of risk are. However a negative earning cannot proxy for further earning. Thus, all corporations with a negative earning will be removed in the sample. P/E ratio use one month lag data, because the return is calculated by ending price of precious month decrease from ending price of current month.

5.3 Market Value

Market value estimates a price by buyer offer and by seller acceptable that offer in a competitive market. In the security market, market value is the current trading price on the stock market.

In China stock market, market value includes tradable shares and non-tradable shares instead of the pure tradable share. Therefore, I will define market value as the total number of A-shares outstanding (including shares owned by states, legal entity, employee and public)

4 http://www.pe-ratio.com/determining_share_prices.php
multiplied by market price per share. The variables of market value use lag data of one month, as the return is calculated by different value of ending price between precious month and current month.

5.4 Book-to-Market Value

All the data of my sample are from listed companies that follow the financial year-end of December 31 on the SSE. According to the China security law, the listed firms require to publish company annual report in the next financial year before April 30. Banz and Breen (1986) suggest that using data from calendar year \( t-1 \) is better to match the returns from May of year \( t \) to April of year \( t+1 \) for avoiding look-ahead bias in the regression results. Thus, it is right way to analyze explanation data of current stock return by annual report for previous year of the financial condition. For example of financial 2002, the accounting data match all fiscal year ends in calendar year on 2001. The gap of 4 month is reservation between fiscal year end and the return tests.

The variable book-to-market value uses lag data of 16 month. It is because all the financial data from annual reports regards the previous financial year and annual reports are normally published in April. Thus, the total lag period is 16 months.

Book-to-market value creates a value of company by comparing the book value and its market value. The book value means the accounting value and has no influence in the stock market fluctuation (Griffin and Lemmon, 2002), while market value is determined by stock market through corporation market capitalization.

5.5 Number of Trades

The factor of number of trades means a given traded stock number divided by the number of shares outstanding of that stock. It is used as a measure of volume level and can be regarded as a measure of trading activity.

Since each trade will happen on buyer initiation or seller initiation related by the trade
price to prevailing bid or asking quotes, so it has a problem of trade volume to be wrongly counted. As the number of trades and quotes may be recorded twice, I employ Lee and Ready (1991) and ignore the records of quotes that are less than five seconds before the trades and only recognizing the prevailing quotes within thirty minutes of the trades. The factor of number of trades will be collected by month end data in each share. Number of trades use lag data of one month, because the return is calculated by the different ending price from previous month to current month.

5.6 Stock Return

Stock return is calculated by changes in closing prices between two consecutive months. It is because the short interval returns can explain systematical cross-temporal covariance and abnormality. The stock price will be adjusted for dividends when calculating the stock return according to the following formula,

$$ R_{it} = \frac{p_{it} - p_{i,t-1} + div_{it}}{p_{i,t-1}} $$

(6)

$R_{it}$ means the return of stock $i$ in month $t$; $p_{it}$ is the closing price of stock $i$ in the end of month $t$; $p_{i,t-1}$ is the closing price of stock $i$ in the end of month $t-1$, $div_{it}$ is the cash dividend of stock $i$ paid in month $t$.

Based on the same principle, the market return is given by,

$$ R_{mr} = \frac{I_{t} - I_{t-1}}{I_{t-1}} $$

(7)

$I_{t}$ means the A-share Index (AI) at the end of month $t$ and $I_{t-1}$ means the market index AI in the end of month $t-1$. 
6. Empirical Framework

There are two main steps in estimating the impact of the different variables on stock returns. The first step consists of estimating the systematic risk component (the so-called beta value) for each stock using the “market model”. This is done under the assumption that the systematic risk may change over time and will therefore generate a long series of beta values for each stock. The estimated beta values are then used in the second step, where the effect on stock returns is estimated and the hypotheses tested.

6.1 Market Model

During first data preparing step, the beta value need to be calculated separately for each stock and each month. To achieve this, I base the estimation of the systematic risk on return data for the previous three years or more specifically on monthly return for the period \( t = -36 \) to \( t = -1 \). The beta value is estimated for each individual stock using the so-called Market Model,

\[
R_i = \alpha_i + \beta_i (R_m) + \epsilon_i
\]  

(8)

where \( \beta_i \) means the estimated systematic risk for stock \( i \) in period 0. By repeatedly estimating model (8) for each stock and each month after the first three years in the data set, I get 35 estimated beta values for each stock.

6.2 Regression Specification

Considering the up or down market, it could be a condition to influence in the evaluation of the relationship between stock return and beta value. Thus, my database uses the

---

5 As short sample period will limit the length of time series T, SSE may have a possible non-stationary nature of beta. Herrera and Lockwood (1994) chose a moving data of 36 months on emerging markets.
indicator by interest rate. If the market return is larger than interest rate, it regards as up market. Conversely, if market return is smaller than or equal to interest rate, it looks as down market. The indicator is set as dummy variable $UP$. To estimate the regression formulation, the interaction variable uses the dummy variable to multiply the variables of beta and book-to-market value\(^6\). Thus, all relevant eight variables are beta, interaction beta in up market, market value, number of trades, price to earnings ratio, average return, book-to-market value, and interaction book-to-market value in up market.

The panel (time series and cross-section) regression model to estimate the regression analysis by follows formulation,

$$
R_{it} = r_0 + r_1 \beta_{i,t-1} + r_2 \beta_{i,t-1} * UP_{i,t-1} + r_3 \ln(MV_{i,t-1}) + r_4 \ln(BM_{i,t-1}) + r_5 \ln(BM_{i,t-1}) * UP_{i,t-1} + r_6 \ln(NT_{i,t-1}) + r_7 \frac{PE_{i,t-1}}{AR_{i,t-1}} + r_8 AR_{i,t-1} + \varepsilon_{i,t}\tag{9}
$$

$$
\varepsilon_{i,t} = a_i + b_{i,t}
$$

$\beta_{i,t-1}$ means the estimated beta value for stock $i$ in month $t-1$; $\beta_{i,t-1} * UP_{i,t-1}$ represents the interaction variable between the beta value and the indicator for up market. $MV_{i,t-1}$ means the market value of stock $i$ in month $t-1$; $BM_{i,t-1}$ means the book-to-market value of stock $i$ in month $t-16$, $NT_{i,t-1}$ means the number of trade of stock $i$ in month $t-1$; $PE_{i,t-1}$ means the price to earnings ratio of stock $i$ in month $t-1$; $AR_{i,t-1}$ means the average return of stock $i$ during the last six months; $\ln(BM)_{i,t-16} * UP_{i,t-1}$ represents interaction variable for book-to-market value in up markets. The regression is estimated using a panel estimator with stock-fixed effects.\(^7\)

---

\(^6\) I cannot use other interaction variables because of severe multicollinearity.

\(^7\) A Hausman test conformed that the appropriate model to estimate the relationship is the fixed effects model.
7. Test Results

7.1 Estimates of Systematic Risk – Beta

Table 2 shows the estimation results of systematic risk. The mean value of beta is 1, which it can explain the average stock price is consistent with SSE market price volatility. From Figure 1 of estimated beta value, it also proved that the mean value is at 1 and peak curve is sharp.

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Estimated beta</th>
<th>Smallest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 %</td>
<td>0.28</td>
<td>1</td>
</tr>
<tr>
<td>5 %</td>
<td>0.45</td>
<td>2</td>
</tr>
<tr>
<td>10 %</td>
<td>0.60</td>
<td>3</td>
</tr>
<tr>
<td>25 %</td>
<td>0.80</td>
<td>4</td>
</tr>
<tr>
<td>50 %</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>75 %</td>
<td>1.20</td>
<td>1</td>
</tr>
<tr>
<td>90 %</td>
<td>1.39</td>
<td>2</td>
</tr>
<tr>
<td>95 %</td>
<td>1.52</td>
<td>3</td>
</tr>
<tr>
<td>99 %</td>
<td>1.87</td>
<td>4</td>
</tr>
</tbody>
</table>

The minimum beta value is −0.12 and the maximum value is 3.65, yielding a range of estimated beta values of almost 4. From the standard deviation and the mean value we can deduct that about 95 percent of the beta values on the SSE lies within 1±0.73 if we assume that systematic risk is normally distributed (which it appear to be from looking at Figure 2).
7.2 Correlation Analysis

From the Table 3, it specifically shows the correlations between all seven variables. Stock return has a poor positively correlation with number of trades, price to earnings ratio, average return, market value and book-to-market value, while it has weak negative correlation with systematic risk. The parameter of systematic risk has no correlation with market value, and low correlation with the other variables. However, the correlation between market value and number of trades are 0.76. In addition, the correlation between number of trades and average return, and the correlation between average return and market value in logarithm are also big, namely 0.52 and 0.43, respectively.
Table 3. Correlation matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Stock return</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Systematic risk, Beta</td>
<td>−0.05</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Number of trades, logarithm</td>
<td>0.11</td>
<td>0.10</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Price/earnings ratio</td>
<td>0.03</td>
<td>0.10</td>
<td>0.10</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Average return</td>
<td>0.05</td>
<td>0.22</td>
<td>0.52</td>
<td>0.21</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Market value, logarithm</td>
<td>0.04</td>
<td>0.00</td>
<td>0.76</td>
<td>0.01</td>
<td>0.43</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>(7) Book-to-market value, logarithm</td>
<td>0.07</td>
<td>−0.03</td>
<td>0.09</td>
<td>0.02</td>
<td>0.13</td>
<td>0.03</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Complete variable descriptions in section 5.

7.3 Regression Analysis

Table 4 summarizes the results of the panel data regressions. The satisfactory levels of all 7 estimation are from 0.18 to 0.22. In the regression 1, I use factors of beta and the interaction variable of beta in up markets to estimate the hypothesis. Then I got the results for the beta parameter that it is negative and significant to stock return on SSE market during Jan 2002 to Dec 2007. The interaction variable is positive and significant indicating that the systematic risk is less negative for stock returns in up markets.

In regression 2 to 7, I added one more factor in each regression to estimate whether those factors are significant. In regression 7, I added the interaction variable between book-to-market value and the indicator variable for up markets to estimate whether the results differ in the different markets.

Table 4 shows that the estimated coefficients of beta, number of trades, market value and book-to-market value in down markets are all significant at level of 1 percent to stock return. As the parameter of price to earnings ratio have very small value of coefficient and is insignificant means that this factor have no relationship with stock returns.
Table 4. Regression results, panel regression with stock-specific fixed effects

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha</td>
<td>-0.195***</td>
<td>-0.193***</td>
<td>-0.193***</td>
<td>-0.176***</td>
<td>-0.199***</td>
<td>-0.195***</td>
<td>-0.192***</td>
</tr>
<tr>
<td></td>
<td>(-14.97)</td>
<td>(-14.35)</td>
<td>(-14.33)</td>
<td>(-12.59)</td>
<td>(-14.22)</td>
<td>(-14.21)</td>
<td>(-13.87)</td>
</tr>
<tr>
<td>Beta, interaction</td>
<td>0.140***</td>
<td>0.136***</td>
<td>0.137***</td>
<td>0.141***</td>
<td>0.146***</td>
<td>0.140***</td>
<td>0.137***</td>
</tr>
<tr>
<td></td>
<td>(27.93)</td>
<td>(29.47)</td>
<td>(29.36)</td>
<td>(30.36)</td>
<td>(31.55)</td>
<td>(28.12)</td>
<td>(20.91)</td>
</tr>
<tr>
<td>Number of trades, log.</td>
<td>-</td>
<td>0.011***</td>
<td>0.012***</td>
<td>0.012***</td>
<td>0.022***</td>
<td>0.044***</td>
<td>0.040***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.02)</td>
<td>(5.09)</td>
<td>(7.03)</td>
<td>(10.63)</td>
<td>(9.84)</td>
<td>(9.84)</td>
</tr>
<tr>
<td>Price/earnings ratio</td>
<td>-</td>
<td>-</td>
<td>-2.9E-05</td>
<td>-1.2E-05</td>
<td>-1.2E-05</td>
<td>9.2E-06</td>
<td>8.6E-06</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-1.42)</td>
<td>(-0.58)</td>
<td>(1.13)</td>
<td>(0.64)</td>
<td>(0.60)</td>
</tr>
<tr>
<td>Average return</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.259***</td>
<td>-0.070</td>
<td>-0.070</td>
<td>-0.158***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-5.04)</td>
<td>(-1.29)</td>
<td>(-2.89)</td>
<td>(-2.88)</td>
<td>(-2.88)</td>
</tr>
<tr>
<td>Market value, log.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.060***</td>
<td>-0.053***</td>
<td>-0.053***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-9.57)</td>
<td>(-8.04)</td>
<td>(-8.03)</td>
</tr>
<tr>
<td>Book-to-market value, log.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.051***</td>
<td>0.045***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4.36)</td>
<td>(3.28)</td>
</tr>
<tr>
<td>Book-to-market value, log. inter</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.01)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.146***</td>
<td>0.130***</td>
<td>0.131***</td>
<td>0.105***</td>
<td>0.797***</td>
<td>0.692***</td>
<td>0.690***</td>
</tr>
<tr>
<td></td>
<td>(11.68)</td>
<td>(10.69)</td>
<td>(10.76)</td>
<td>(8.09)</td>
<td>(10.70)</td>
<td>(8.79)</td>
<td>(8.76)</td>
</tr>
<tr>
<td>F-value</td>
<td>426.9***</td>
<td>316.1***</td>
<td>238.7***</td>
<td>210.8***</td>
<td>208.0***</td>
<td>194.4***</td>
<td>174.3***</td>
</tr>
<tr>
<td>R²</td>
<td>0.182</td>
<td>0.190</td>
<td>0.188</td>
<td>0.194</td>
<td>0.212</td>
<td>0.218</td>
<td>0.219</td>
</tr>
<tr>
<td>No. of obs.</td>
<td>3,252</td>
<td>3,252</td>
<td>3,252</td>
<td>3,252</td>
<td>3,252</td>
<td>3,252</td>
<td>3,252</td>
</tr>
</tbody>
</table>

Note: t-statistics based on robust standard errors reported in parentheses (White, 1980). *, ** and *** denote significance at the 10-, 5- and 1-percentage level, respectively.

It illustrates that the factors of number of trades and book-to-market value have a positive relationship with stock return. However, the parameters of beta, average return and market value negatively impact on the stock returns.

Table 4 also shows that the parameter of average return is significant, except when factors of beta, number of trades, price to earnings ratio and market value are estimated in the same regression. The main reason of this result could be multicollinearity between market value and average return that makes it hard to identify the two variable’s separate contribution to the effect on stock returns. However, it is again significant when parameters of
book-to-market and the interaction between book-to-market value and the indicator variable for up markets are added in regression 6 and 7.

All regression results of $R^2$ are bigger when more factors are added in the regression estimations except when the factor of price to earnings ratio is introduced. This is due to that the price to earnings ratio is not a significant factor to impact on the stock return on SSE market.

To conclude the results, I have to reject H1 and accept H2. The summary for my research is that beta is not a unique factor that can explain the stock return. However, more factors like book-to-market value, market value, average return and number of trades all have the certain relationship with the stock return on SSE market through panel data analysis.

### 7.4 Non-January effect Regression Analysis

Table 5 shows all the results from the panel data regressions analysis when excluding the month of January and only using data from February through December. The satisfactory levels of all seven estimation regression are from 0.17 to 0.21. All the data results are as similar as the results for full year panel data regressions even though the effect of systematic risk seems to be somewhat less negative when excluding January from the analysis.

In conclusion, I rejected H1 and accepted H2. The similar results for my research are that beta is not the only factor to explain the stock return, but may other factors have a certain relationship with the stock return on SSE through panel data analysis, such as beta in the down market, book-to-market value in down market, market value and number of trades.
Table 5. Regression results, panel regression with stock-specific fixed effects, excluding January

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>-0.175*** (-13.86)</td>
<td>-0.173*** (-13.12)</td>
<td>-0.174*** (-13.16)</td>
<td>-0.160*** (-11.66)</td>
<td>-0.183*** (-13.24)</td>
<td>-0.181*** (-13.33)</td>
<td>-0.178*** (-13.03)</td>
</tr>
<tr>
<td>Beta, interaction</td>
<td>0.136*** (27.07)</td>
<td>0.132*** (28.31)</td>
<td>0.133*** (28.12)</td>
<td>0.136*** (29.02)</td>
<td>0.141*** (30.43)</td>
<td>0.136*** (27.51)</td>
<td>0.133*** (20.24)</td>
</tr>
<tr>
<td>Number of trades, log.</td>
<td>- 0.010*** (4.64)</td>
<td>0.011*** (4.70)</td>
<td>0.019*** (6.21)</td>
<td>0.040*** (9.76)</td>
<td>0.038*** (9.26)</td>
<td>0.038*** (9.26)</td>
<td></td>
</tr>
<tr>
<td>Price/earnings ratio</td>
<td>- -2.67E-05 (-1.23)</td>
<td>-1.31E-05 (-0.68)</td>
<td>1.59E-05 (0.91)</td>
<td>9.21E-06 (-0.56)</td>
<td>8.66E-06 (0.53)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average return</td>
<td>- - -0.216*** (-4.14)</td>
<td>-0.043 (-0.77)</td>
<td>-0.120** (-2.11)</td>
<td>-0.119** (-2.10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market value, log.</td>
<td>- - - -</td>
<td>- - -0.057*** (-9.23)</td>
<td>-0.051*** (-7.98)</td>
<td>-0.051*** (-7.97)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Book-to-market value, log.</td>
<td>- - -</td>
<td>- - -</td>
<td>- 0.043*** (3.59)</td>
<td>0.037*** (2.65)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Book-to-market value, log. inter</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>0.009 (1.03)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.125*** (10.24)</td>
<td>0.111*** (9.21)</td>
<td>0.112*** (9.32)</td>
<td>0.091*** (7.02)</td>
<td>0.747*** (10.17)</td>
<td>0.660*** (8.63)</td>
<td>0.658*** (8.59)</td>
</tr>
<tr>
<td>F-value</td>
<td>397.4*** 284.5***</td>
<td>214.0*** 187.6***</td>
<td>190.8*** 170.1***</td>
<td>152.3***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.174</td>
<td>0.178</td>
<td>0.178</td>
<td>0.183</td>
<td>0.200</td>
<td>0.214</td>
<td>0.205</td>
</tr>
<tr>
<td>No. of obs.</td>
<td>3,070</td>
<td>3,070</td>
<td>3,070</td>
<td>3,070</td>
<td>3,070</td>
<td>3,070</td>
<td>3,070</td>
</tr>
</tbody>
</table>

Note: Robust standard errors reported in parentheses. *, ** and *** denote significance at the 10-, 5- and 1-percentage level, respectively (White, 1980).

8. Conclusions

Although there are many empirical studies of stock return by panel data analysis, there are few research on the SSE. To enrich the understanding of stock return on SSE market, I examined whether a number of factors are related to stock return, such as systematic risk in up and down markets, book-to-market value in up and down markets, market value, price to earnings ratio, average return and number of trades. Using monthly data of trade ending price,
number of trades, price to earnings ratio, market value, book value, and A-share Index, I calculated the stock return for each stock and estimated the relationship between stock return and the exogenous variables.

In my results, I found that the factors of beta in up and down markets, number of trades, market value, book-to-market value in up and down markets are significant to stock return on SSE market during Jan 2002 to Dec 2007. The factors of number of trades, book-to-market value in up and down markets are positively significant, while factors of beta in up and down markets and market value are negatively significant. Price to earnings ratio has no significant impact on stock return. The average return is significant, except when factors of beta, market value, price to earnings ratio and number of trades are estimated in the panel data regression. This might be due to the introduction of multicollinearity for this particular explanatory variable constitution.

I also find that excluding January had little impact on the estimated coefficients. The main effect was that systematic risk tends to be somewhat less negative when only including data for February through December in the regressions. The factors of number of trades, book-to-market value in up and down markets are positively significant to stock return on SSE, while factors of beta in up and down markets and market value are negatively significant. Price to earnings ratio did not show any significant impact on stock returns on SSE during the period January 2002 to December 2007.

Taken together, the results from my analysis of SSE show that stock returns were significantly related to other factors besides systematic risk, which indicates that the market did not satisfy the efficient market hypothesis 1 during the studied period.
References


*From internet:*
