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Four Factors Model in Asset Pricing: Fama&French Three Factors Model is Combined With Liquidity in the Stock Exchange of Vietnam

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Abstract

This paper aims to assess the application of Fama and French three factors models in Vietnam's stock market from January 2007 to December 2011. The selected listing companies must continuously had been listed for at least 2 years and non-stop trading or moved to the other exchange. According that, in 2007 the author selected 162 companies, and in 2008, 2009, 2010 and 2011, there were 204, 308, 382, 382 listed companies were selected in turn. The author also divided them into 6 groups: B/H, B/M, B/L; S/H, S/M and S/L. In which, portfolios B and S are to evaluate the effects of size and risk scale to the profitability rate (size measured by capitalization of the stock market) and portfolios H, M and L are measuring the effects of book to market value. The result are appearing that Fama and French three factor models explaining the relationship between rate of return and risk in superior to CAPM. This research also evaluates the impacts of liquidity and risk of liquidity to stock returns which were listed in

Vietnamese stock market. According to this research, liquidity ratio is the portion between number of share traded and number of share outstanding (this called Liq2) as same as Amihud and Mendelson's research (1986), Datar-Naik and Radcliffe's research (1998), and Wang and Iorio's research (2007). Moreover, the authors also use the alternative approaches to evaluate liquidity: the average of traded value in a month (this called Liq1). Contrary to previous researches, this research shows that correlations between indicators Liq1 and Liq2 and stock returns are positively correlations. Finally, we evaluates four factor model by combing the FF3 and liquidity. The result are appearing this models explaining the relationship between rate of returns and risk in superior to CAPM and FF3. So we suggest the four factor model: FF3 combined with liquidity in evaluating stocks exchange of Viet Nam.

Keywords: FF3, CAPM, GMM, Liquidity, risk and returns, asset pricing, cross-section.

1. Introduction

Capital Asset Pricing Model which was introduced by Sharpe (1964), Lintner (1965) considers the relationship between expected return of an asset and its systematic risk (measured by beta (β)). This model is more controversial today because of the limitations of it such as the perfect market assumption, the difficult of choosing the representative portfolio, values need to be assigned to the risk-free rate of return, the return on the market or the equity risk premium (ERP), ... The paper conducted by Fama and MacBeth (1973) which introduced the method to verify the empirical validation of the CAPM, after that, put a cornerstone for a number of researches testing the appropriateness of the CAPM model in the emerging stock market such as the study handled by Theriou Chatzoglou, Maditinos and Aggelidis (2003) in the Greek stock market, the study of Wang and Iorio (2007) in the Chinese stock market... In the Vietnam stock market, the research by Nguyen Anh Phong (2012) also pointed out that the lack of empirical results of the CAPM model and the desire for an alternative quantitative method with more appropriateness. Therefore, besides the market risk represented by the CAPM, the need for discover the other risks affecting stocks yield listed on the Vietnam stock market is more essential.

2. Overview of the researches

Banz (1981) This is the first empirical study on the relationship between the rate of return with the market price of the stocks listed on NYSE. This study is the premise for the subsequent others evaluating the effect of the risk scale to the rate of return rather than the market risk (beta) in the CAPM model. The result showed that the risk adjusted rate of return of small companies had been higher than the ones of the large companies. This is indicated that the effect of size had existed at least 40 years and this is evidence that the CAPM is no longer suitable. The result showed that the existence of the non-linear relationship between the size with the expected rate of return: on average, the income of small companies is 0.4% higher than the income of large companies. There was a negative correlation between beta and rate of return. Banz concluded that company size may represent risk to the CAPM.

Basu (1983) His study measured the relationship between earnings – price ratios (E/P), firms size with rate of return. The result showed that the stocks with high E / P ratios earned higher average yield than the others with low E/P ratios, and the small firms tended to have a higher average yield than the large ones. The stocks with small size yielded higher average rate of return than the others with large size: the average yield earned by the small stocks is 1.38% per month, while the large firms only produced 0.59% per month. Similarly, the stocks with high E/P ratios had higher average rate of return than the group with low E/P: average yield come from the group with high E/P is 1.38% per month while only 0.72% per month earned by the stocks with low E/P.

Fama and French (1992), Fama and French (1993) The study (1992) evaluating the effects of beta, size and BE/ME (book to market equity) to rate of return showed the relationship between beta with yield is blurring even when only beta was individually considered without any other variables putting into the model, meanwhile the size and BE/ME variables are closely correlated to rate of return. The research (1993) identified five risk factors affecting the rate of return of stocks and bonds, in which, there were three market risks of the stocks: the general market factor, the factor related to size and a factor related to the book to market price (B/M). The two rest factors were belonged to the bond market: the term factor and the risk of default. It is important to note that there was a significant relationship between these five factors and the rate of return of the stocks and bonds. In the reasonable market, the change in profit in the short term had faintly affected the stock price and the BE/ME ratio. The relationship between BE/ME with the profit differences is only significant in the long-term. Those companies had the high BE/ME ratios (market price low relative to book value) tend to prolong the recession. By contrast, the ones with low BE/ME ratios (market price high relative to book value) tend to maintain strongly profitability. Combining with BE/ME, the small stocks tend to be less profitable than large stocks. There were two questions raised up by this result: (1) What is the potential variables of economic condition which create the relationship between the change in earnings and profits with the size and the BE/ME ratios? (2) whether the condition variables which are not aware, make a change in consumption and wealth which will not be recognized by an overall market factor or not and whether there is any relation existing between the risk premium with the size and BE/ME or not ?

Keith S.K. Lam (2002) The study considered the relationship between rate of return with beta, size, financial leverage, BE/ME, E/P in the Hong Kong stock market by the Fama-French method (1992). Like many previous studies in Hong Kong and U.S. stock market, this study indicated that beta is not well-explained the monthly average rate of return in the Hong Kong stock market from 7/1980 to 6/1997; three variables: size, BE/ME and E/P, however, seems to be better in explaining the monthly average rate of return.

Pin Huang Chou, Robin K.Chou, and Jane Sue Wang (2004) They consider the strength in explaining the effect of the size, the book to market (BM) ratio to the rate of return. The research result showed that in general, the forecast ability of the size and the BM factors decreased over the 1982-2001 and 1990-2001 period respectively. The size variable remained significant level in explanation in January. The relationship between the rate of return with the $\ln(\text{ME})$ is inverse (negative correlation), while the relationship between the rate of return with the $\ln(\text{BE/ME})$ is positively associated (positive correlation)

Yuenan Wang and Amalia Di Iorio (2007) In this study, the authors used a market value of equity representing for the size, in addition, the study also examined the impact of other factors to the rate of return of stocks such as liquidity, the B/M ratio (Book to market ratio), E/P, size ... According to Fama and MacBeth (1973), the result showed that the effects of size and B/M are significant at 95%, the effect of size is -0.0041%/month and the effect of the B/M ratio is 0.0206%/month, while the effect of liquidity is -0.0074%/month. However, the effect of liquidity is quite faint, the significance level is not convincing. Nopphanon Homsud, Jatuphon Wasunsakul, Sirina Phuangnark, Jitwatthana Joongpong (2009) This study measured the validation of the Fama and French three factor model in the Thailand stock market from June 2002 to May 2007. The research result showed that the three factors model explaining the effect of the risk factor to the rate of return of stock is better than the traditional CAPM model.

Nguyen Anh Phong (2012), Research show that liquidity is relationship with rate of return when Beta coefficient is brought into research model. The results also show that the combination between liquidity and Beta coefficient explain the result of rate of return clearly (because constants are close to zero). Moreover, this result also shows that correlation between Beta coefficient and liquidity indicators are positively correlations and correlation coefficient is so small. Those prove that using CAPM to forecast rate of return in Vietnamese stock market is not appropriate, but liquidity indicators explain the results of rate of return and risk of stocks which were posted better.

3.The research method

a. Data

The research data is calculated based on the data of companies announced in Hanoi and HCM City Stock Exchange from January 2007 to December 2011, the rate of return data are based on the closing price of last month and early month. The rate of return of the individual stocks is calculated by the formula: $R_t = \ln(P_t/P_{t-1})$, risk-free rate is the 1 year government bond rate. (calculate average per month) The study used the listing companies which continuously had been listed for at least 2 years and non - stop trading or moved to the other exchange. According that, in 2007 the author selected 162 companies, and in 2008, 2009, 2010 and 2011, there were 204, 308, 382, 382 listed companies were selected in turn. All of the stocks are divided into the groups by market value of equity (ME), then there are 5% of stocks in highest and lowest values cleaned out in order to avoid the distortion of data. Market value of equity is calculated based on the number of shares outstanding the previous year (t-1) multiple with the current last month trading price. Every month all the companies are divided into 2 groups: Group with ME above the intersect point (mean value) is the group of large companies (B), group with ME below the intersect point is called the small corporate group (S). BE/ME ratio is divided into 3 groups: group with highest BE/ME (30%) is called the group H, group with medium BE/ME referred to as the group M and the last one with lowest BE/ME is known as the group L. Finally, these groups are combined and then divided into 6 groups: S/L, S/M, S/H, B/L, B/M and B/H. For example, the group S/L includes the small company compared with the company with lowest BE/ME ratio.

Group SMB (Small minus Big) represents the risk scale, SMB is the difference each month between the average rate of return of a small group (S/L, S/M and S/H) compared with the average rate of return of a large group (B/ L, B/M and B/H)

$$SMB = 1/3 (S/H + S/M + S/L) - 1/3 (B/H + B/M + B/L)$$

Group HML (High minus Low) represent risk of the BE/ME ratio. HML is the difference each month between the average rate of return of the two portfolios with high BE/ME (S/H and B/H) compared with the average rate of return of the two groups with low BE/ME (S/L and B/L)

$$HML = 1/2 (S/ H + B/H) - 1/2 (S/L + B/L)$$

According to this research, we use two proxy to represent liquidity. Liq1 is the average of traded value in a month; Liq2 is the portion between number of share traded and number of share outstanding. We devide each liquidity into two porfolios: portfolio with high liquidity and low liquidity. After that we calculate average returns two this portfolios. Average return of high liquidity is called H, and average return of low liquidity is called L. LHLiq is equal average return of low liquidity is called L minus average return of hig liquidity is called L. So we have LHLiq1, LHLiq2 portfolios. Our target to find the risk premium of liquidity in each case.

b.Method

The authors use the model of Fama and French (1993) and applying the method of Fama and French (1996). We use four models:

$$\text{Model 1: } \bar{r}_i - \bar{r}_{RF} = a_i + b_i(\bar{r}_M - \bar{r}_{RF}) + s_i(\bar{r}_{SMB}) + h_i(\bar{r}_{HML}) + e_i$$

$$\text{Model 2: } \bar{r}_i - \bar{r}_{RF} = a_i + b_i(\bar{r}_M - \bar{r}_{RF}) + s_i(\bar{r}_{SMB}) + h_i(\bar{r}_{HML}) + l_{li}(\bar{r}_{LHLiq1}) + e_i$$

$$\text{Model 3: } (\bar{r}_i - \bar{r}_{RF}) = a_i + b_i(\bar{r}_M - \bar{r}_{RF}) + s_i(\bar{r}_{SMB}) + h_i(\bar{r}_{HML}) + l_{2i}(\bar{r}_{LHLiq2}) + e_i$$

$$\text{Model 4: } (\bar{r}_i - \bar{r}_{RF}) = a_i + b_i(\bar{r}_M - \bar{r}_{RF}) + s_i(\bar{r}_{SMB}) + h_i(\bar{r}_{HML}) + l_{1i}(\bar{r}_{LHLiq1}) + l_{2i}(\bar{r}_{LHLiq2}) + e_i$$

where:

\bar{r}_i : the average rate of return of the group i

\bar{r}_M : the average market rate of return

\bar{r}_{RF} : the risk-free rate (the 1 year government bond rate converted into a monthly basis)

\bar{r}_{SMB} : the average rate of return of the portfolio with small minus big

\bar{r}_{HML} : the average rate of return of the portfolio with high BE/ME minus low BE/ME

\bar{r}_{LHLiq1} : the average rate of return of the portfolio with low Liq1 minus high Liq1

\bar{r}_{LHLiq2} : the average rate of return of the portfolio with low Liq2 minus high Liq2

a_i : the intercept coefficient of the group i

$b_i, s_i, h_i, l_{1i}, l_{2i}$: the slope coefficients of the groups i

e_i : random error

4. The result

Table 1 describes the sample data from 1/2007 to 12/2011 categorized by 8 portfolios. In 2007 and 2008 the violation of average rate of return is slightly high, the difference between the highest rate of return with the lowest rate of return also appears as a big gap. For example, in 2007 the highest average rate of return of the group B/H is 54,81% while the lowest average rate of return belongs to the group B/L (-20,58%). The average rate of return of the groups in 2008 and 2011 are below 0 because before 2008 the stock market strongly grow up, after that the crisis coming from US in 2008 makes the market dramatically fall in the downturn. In 2011 because of the affect of the crisis, the high inflation rate, the government conducted a tigh monetary policy; these factors, after that, contributed into the recession of the stock market. The violation in 2011, however, is not high, the standard deviation is below 8%/month, the highest violation is only 7.61%/month. Because of standard deviation is too high and fitful, so we use GMM (General Momentum Method) to evaluate the data instead of using traditional methods. GMM overcome some problems in solving data such as: heteroscedastic, conditionally heteroscedastic, multicollinerrity,...

Table 2 presents the regression results of 8 portfolios applied the CAPM model; the Fama & French model and FF3 combined with liquidity. The CAPM regression results in six portfolios showed the relative high Adj R² coeffiience ranging from 62.78% to 87.23% (the average is 75.24%), the statistical significance level of the slope coefficient reached 99% for all portfolios. The regression results on six portfolios according to FF3 also showed the high Adj R² coeffiience ranging from 84.34% to 93.88% (the average is 89.86%). The significance level of the slope coefficient, however, is not stable, the influence on the BE/ME ratio in portfolios B/M, B/H and B/L is not statistically significant (the pro coefficients are 0.49 and 0.75 respectively for examble). FF3 combined liquidity regression results in six portfolios showed higher Adj R² than CAPM and FF3. However, all the intercept coefficient in FF3 combined with liquidity models is whole lower than CAPM and FF3, so this models explaining the relationship between rate of returns and risk in superior to CAPM and FF3. The average intercept coefficient (constant) of 6 portfolios following the CAPM model is 0.0231, average intercept coefficient

of 6 portfolios applying the Fama and French model is 0.0187, while the average intercept coefficient of 6 portfolios applying the Fama and French combined liq1 and liq2 model are 0.0134 and 0.0036. The smaller intercept coefficients in the Fama and French combined liquidity model, the more significance level of the variables putting into the model compared with the CAPM and FF3.

Table-1. Description data (returns per month)

	S/L	S/M	S/H	B/L	B/M	B/H	Rm	LHLiq1	LHLiq2
Year-2007 (1944 Obs)									
Min	-16.10	-21.50	-22.48	-20.58	-17.35	-12.92	-12.45	-19.73	-28.02
Max	33.13	28.36	35.83	53.46	46.85	54.81	37.37	12.23	0.72
Average	7.28	4.56	3.80	9.23	5.35	7.91	3.90	-1.76	-5.82
S.D	18.14	15.05	16.39	23.18	17.33	19.76	15.25	9.45	8.41
Year-2008 (2448 Obs)									
Min	-31.92	-27.86	-29.48	-24.72	-26.69	-28.53	-23.60	-9.34	-10.91
Max	57.98	30.39	29.40	52.32	29.04	41.45	20.57	2.34	3.94
Average	-5.92	-8.17	-9.73	-4.67	-8.53	-8.09	-7.39	-1.46	-0.67
S.D	25.33	16.85	15.81	22.51	15.20	19.50	13.52	3.78	3.92
Year-2009 (3696 Obs)									
Min	-21.70	-18.57	-19.88	-16.85	-16.80	-17.20	-16.13	-10.32	-5.55
Max	31.83	32.03	37.74	34.37	35.17	34.08	20.42	4.63	2.25
Average	9.46	6.29	3.88	8.82	5.84	7.73	4.83	-3.22	-2.11
S.D	16.16	13.29	14.97	15.36	15.06	15.36	11.39	4.29	2.28
Year-2010 (4584 Obs)									
Min	-18.52	-14.60	-15.93	-10.27	-13.00	-19.52	-9.41	-4.68	-6.54
Max	26.01	22.90	14.05	20.98	14.40	21.83	8.20	1.43	4.05
Average	1.98	0.12	-2.54	1.51	-1.32	-2.15	-1.90	-1.74	-1.38
S.D	11.29	9.71	8.13	7.97	7.21	10.44	5.64	1.79	3.17
Year-2011 (4584 Obs)									
Min	-11.76	-17.96	-21.28	-8.88	-13.82	-17.98	-15.10	-5.49	-3.32
Max	5.18	3.93	1.46	8.86	9.18	5.97	5.66	4.22	3.9
Average	-3.44	-5.34	-8.26	-1.25	-3.48	-6.08	-4.30	-0.62	-0.49
S.D	4.88	6.48	7.17	4.82	6.74	7.61	5.59	2.74	2.29

Table 2 show the coefficient of L1 and L2 are negative, so returns of low liquidity stock is higher than returns of high liquidity stock. Those results are opposite researches which are executed in foreign stock market as same as Datar, Naik and Radcliffe's research (1988), Chan and Faff's research (2005), Wang and Iorio's research (2007). Thus, this research wants to prove followed problems: Firstly, Vietnamese investors only expect to have high rate of return of stocks which have high liquidity, because the stocks which have high liquidity in Vietnamese stock market is Blue-chip stock, they are willing to accept higher risk to get higher rate of return. Secondly, Vietnamese investors invest together, they buy stocks which are high capitalization, easy to trade following the big investor's control and they do not care the risks when index of stock market fall down or having some bad news. For example, on March

2012, some stocks which are warned as same as SAM, NTB... still increase their ceiling prices. And finally, the investors who invest to Vietnamese stock market often have short-investment (this called surfing investment). Therefore, they focus to invest to the stocks which have high liquidity (blue-chip stock) expected high rate of return (if index of stock market grow up), and they also accept high risk (if index of stock market fall down because the stock market is led by those stocks).

Table-2. Regression of CAPM; Fama and French Three factors Model and FF3 combined with Liquidity sorted by portfolios: from Jan 2007 to Dec 2011 (using GMM regression)

	a	b	s	h	l1	l2	Adj.R ²
CAPM							
S/L	0.0207(0.14)	1.06(0.00)					0.6727
S/M	0.0177(0.19)	1.01(0.00)					0.6539
S/H	0.0373(0.04)	1.1766(0.00)					0.6278
B/L	0.0246(0.00)	1.0138(0.00)					0.8600
B/M	0.006(0.50)	0.9124(0.00)					0.8276
B/H	0.0319(0.00)	1.1503(0.00)					0.8723
Fama&French (FF3)							
S/L	0.0211(0.00)	1.0496(0.00)	1.1126(0.00)	-0.416*(0.00)			0.9094
S/M	0.0115(0.05)	0.9269(0.00)	1.1311(0.00)	0.1438(0.39)			0.9388
S/H	0.0245(0.00)	1.02(0.00)	1.2176(0.00)	0.6802(0.00)			0.9159
B/L	0.0263(0.00)	1.0297(0.00)	0.1618(0.24)	-0.1962(0.43)			0.8650
B/M	0.0056(0.51)	0.9046(0.00)	0.2568(0.11)	-0.054(0.75)			0.8434
B/H	0.0236(0.00)	1.0583(0.00)	0.0579(0.49)	0.6931(0.00)			0.9193
Fama&French combined Liq1							
S/L	0.0108(0.06)	0.9589(0.00)	1.3612(0.00)	-0.5153(0.01)	-0.4795*(0.02)		0.9160
S/M	0.0133(0.09)	0.9425(0.00)	1.0884(0.00)	0.1608(0.33)	0.0823(0.64)		0.9380
S/H	0.0169(0.01)	0.9534(0.00)	1.3999(0.00)	0.6074(0.00)	-0.3516(0.09)		0.9177
B/L	0.0180(0.00)	0.9569(0.00)	0.3611(0.00)	-0.2757(0.25)	-0.3844(0.04)		0.8699
B/M	0.0093(0.22)	0.9372(0.00)	0.1676(0.31)	-0.0183(0.93)	0.1721(0.51)		0.8423
B/H	0.0123(0.01)	0.9599(0.00)	0.3274(0.00)	0.5856(0.00)	-0.5197(0.00)		0.9284
Fama&French combined Liq2							
S/L	0.0044(0.55)	0.9122(0.00)	0.7002(0.00)	-0.5558(0.00)		-0.8251(0.03)	0.9201
S/M	0.0044(0.63)	0.8684(0.00)	0.9554(0.00)	0.0842(0.57)		-0.3515(0.31)	0.9401
S/H	0.0038(0.65)	0.8503(0.00)	0.7082(0.00)	0.5075(0.00)		-1.0191(0.00)	0.9286
B/L	0.0031(0.67)	0.8398(0.00)	-0.4079(0.08)	-0.3893(0.03)		-1.1401(0.00)	0.8954
B/M	0.0018(0.86)	0.8735(0.00)	0.1636(0.40)	-0.0855(0.66)		-0.1865(0.67)	0.8416
B/H	0.0042(0.48)	0.9003(0.00)	-0.4162(0.03)	0.5324(0.00)		-0.9487(0.00)	0.9357

Number in parentheses is significant (Sig)
 Significant at 95% confidence interval if Sig <= 0.05
 Significant at 99% confidence interval if Sig <= 0.01
 Significant at 90% confidence interval if Sig <= 0.10

5. Conclusion

This paper research propose two important results: Firstly, liq1 ratio is the the average of traded value in a month and liq2 is the portion between number of share traded and number of share outstanding are relative to the stock returns. But the correlations between indicators LHLiq1 and LHLiq2 and stock returns are negative correlations. This implies that returns of low liquidity stock is higher than returns of

high liquidity stock. Those results are opposite researches which are executed in others stock market. Finally, we evaluate four factors model by combining the FF3 and liquidity. The results are appearing in models explaining the relationship between rate of returns and risk in superior to CAPM and FF3. So we suggest the four factors model: FF3 combined with liquidity in evaluating stocks exchange of Viet Nam.

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