THE FAMA-FRENCH FIVE FACTOR MODEL:

EVIDENCE FROM VIETNAM

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Abstract

Fama and French (2015a) introduce new asset pricing model with five factors that captures profitability and investment patterns, in addition to traditional size and value characteristics (Fama and French, 1993). We document evidence that the Fama-French five-factor model (2015a) can explain more asset-pricing anomalies than traditional CAPM and the three-factor model (Fama and French, 1993) and show that importance of the value factor is not lessened by inclusion of the profitability and investment factors in the Vietnamese stock market. We also discover that in Vietnam where the government owns large stake in major large listed companies, traditional asset pricing models fail to capture average returns on state-owned enterprises (SOE).

Keywords: Fama-French five factor model, asset pricing, state ownership, SOE, Vietnam

JEL Codes: G11, G12, G14

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1. Introduction

Over the past 50 years of capital asset pricing model (CAPM of Sharpe, 1964 and Lintner, 1965) and 20 years of the Fama-French three factors introduction, it became clear that there are anomalies that these models cannot explain. Among the anomalies such as idiosyncratic volatility (Ang, Hodrick, Xing, and Zhang, 2006), momentum (Jegadeesh and Titman, 1993), liquidity risk (Pastor and Stambaugh, 2003), there are profitability and investment patterns that burden different models from explaining the cross-sectional variation in expected returns. In the recent paper on the five-factor model, Fama and French (2015a) suggest to use profitability and investment factors, in addition to existing factors (market, size and value) to capture patterns in average stock returns. Numerous empirical studies also point out the strong profitability and investment effects in assets returns (Hou, Xue & Zhang, 2014; Novy-Marx, 2013; Titman et al., 2004).

The new five-factor model (Fama and French, 2015a) tries to explain the relationship between these new variables and stock expected returns from the dividend discount model perspectives and the valuation theory. The implication from this theory is that 1) higher book-to-market ratio implies higher expected returns, 2) higher expected earnings (operating profitability as a proxy) would lead to higher expected returns, 3) higher expected growth in book equity imply higher expected returns, and 4) book-to-market value is a noisy proxy for expected return (we would expect the value factor to be absorbed by other factors in the model). Hence, Fama & French (2015a, 2015b) findings also suggest that value factor (i.e. the book-to-market ratio) is redundant for explaining returns in the five-factor model that performs better in terms of describing the expected stock returns.

However, when testing on international markets, Fama and French (2015b) find evidence that the five-factor model performs better in North America and Europe and for big stocks. Their findings also suggest that Japanese stock returns have little relation to new factors. Cakici (2015) reports similar results. In his paper, he compared the three factor, four factor and five factor models on 23 developed stock markets. He finds strong evidence for the five-factor model in North America, Europe, and global market. The results show that profitability and investment factors merely do not exist in Japan and Asia Pacific portfolios. The author concludes that with inclusion of the two new factors, the value factor becomes redundant in North America, Europe, and Global portfolios, but not in the Asia Pacific region. Hence, it is more appropriate to assess the performance of the Fama-French five-factor model at a country or regional levels.

Motivated by these studies, we empirically test all major asset pricing models for fast-growing market of Vietnam, where state ownership plays an important role in the structure of Vietnamese equities. Recently, Fang, Wu and Nguyen (2015) study the three-factor model using idiosyncratic risk-sorted portfolios. Notably, they only test the three-factor model on portfolios formed on size and book-to-market. While their study finds support for the three-factor model, the methodology of creating three factors does not follow Fama and French (1993) methodology. In addition, their model test results suggest that CAPM might be a better choice as size and value factors fail to explain the returns of value-weighted portfolios sorted on idiosyncratic risk. As with most findings in the finance literature, some studies also document other capital anomalies such as liquidity in Vietnam. Batten et. al. (2014) show the positive relationship between liquidity and Vietnamese stock returns during the global financial crisis.

This paper aims to add to the international empirical literature on asset pricing tests with a detailed investigation of the Vietnamese stock market, the youngest in the ASEAN region, where the economy has gone through massive privatization process over the past decade.

The stock market of Vietnam, under the government initiative, was established on 28th July 2000 with the opening of Hochiminh Stock Exchange. During the 2000-2005 period, the stock market witnessed very few listings. In 2005, there were 44 listed companies with total market capitalisation of VND 5 trillion. With the establishment of Hanoi Stock Exchange in the same year and country's favourable economic conditions, by the end of 2009 there were 541 listed companies with total market capitalisation of VND 620.5 trillion, equivalent to 40% GDP. During this year, Vietnam established the third stock market (UPCoM) to provide a pathway for small companies to trade their shares on an exchange, thus limiting over-the-counter market, increasing transparency and liquidity for Vietnamese firms.

After persistent and robust growth during the 2006-2007 period, the stock market of Vietnam was hit by the Global Financial Crisis and affected by the government's tightening monetary policies to control inflation and stabilize the economy, leading to continuous and significant drop in stock prices. The stock market of Vietnam has been gradually stabilizing since 2008.

The first listed companies were primarily state-owned enterprises (SOEs). According Business Innovation and Development Committee, in August 2009, the country had more than 1500 enterprises fully owned by state. With the goal to restructure Vietnam's economy and increase the efficiency of SOEs performance through privatisation of government-owned companies, state gradually sold its stake in SOEs through initial public offerings (IPOs) and listing on stock exchanges. However, the government still keeps the largest ownership proportion in many of listed companies. Vietnamese stock market is one of the two countries in the world operating under the communist regime where the state has high intervention into

the country's economy. The paper would present new empirical evidence on a country with distinctive political and economic regimes.

In finance literature, state ownership was analysed in conjunction with firm performance, capital structure and corporate governance. Trade-off theory, pecking-order theory and the issue of information asymmetry and agency cost theory were the main theories that link ownership structure to the company profitability and value of a firm. Empirical studies provide mixed or contradictory evidence from developed countries, developing markets or transitional economies. McConnell and Servaes (1990) analyze the linkage between ownership structure and financial performance of firms (measured by ROA, ROE). Fama and Jensen (1983) show that the increase of managerial ownership would lead to the increase of entrenchment of managers. Most of those studies state that excessive managerial ownership would cause damage to the financial performance of firms, and managerial ownership should remain at a proper level for businesses. Some studies also claim that state-owned enterprises (SOEs) exhibit higher level of managerial entrenchment than other types of businesses.

Lin and Zhang (2009) analyse bank ownership structure in China during 1997 - 2004 years and find that the "Big Four" state-owned commercial banks are less profitable, are less efficient, and have worse asset quality than other types of banks. Cornet at al. (2010) also analyse the impact of government ownership on performance of banks. State-owned banks operated less profitably, held less core capital, and had greater credit risk than private firms, but have more stable operations during unfavourable market conditions and survive better during financial crisis.

As economic theory dictates, state ownership is likely to be superior only under specific circumstances. Shleifer (1998) defines these circumstances rather narrowly as situations in which: 1) opportunities for cost reduction that lead to deterioration of quality are significant and non-contractible; 2) innovation is relatively unimportant; 3) competition is weak and

consumer choice is ineffective; and 4) mechanisms for reputation-building that bring customers back in the future are also weak. In this context, the state ownership is needed in order to reach certain "social goals" that are not automatically realized in a free market. Motivated by this idea, we would like to have a special attention to SOEs and consider them as a separate group in our analysis. This paper studies the relationship between state ownership structure and stock returns in context of an transitional economy that is not fully integrated with the global economy. There has not been much researched in the context of state ownership and stock returns relationship and this paper is the first one to analyze this topic for Vietnam.

Our research deals with the following questions: 1) which asset pricing model (CAPM, Fama-French three factor or Fama-French five factor) best describes the behaviour of the stock market of Vietnam, 2) does the value factor become redundant for explaining the stock returns in a developing economy after including new factors into asset pricing model, 3) whether the state ownership structure plays an important role in describing stock returns.

Our study has four contributions to the current asset pricing literature. First, this is the first and comprehensive study on forecasting power of all major asset pricing models (CAPM, Fama and French three-factor and five-factor models) in the context of Vietnamese equity market. Second, we question whether the new factors from the five-factor model (Fama and French, 2015a) can absorb the effect of the value factor on expected returns of Vietnam's stocks. The paper provides further evidence on controversy regarding the redundancy of the value factor in the presence of profitability and investment factors in the model (Fama and French, 2015a, 2015b; Cakici, 2015, Chiah et al., 2015). Third, this is the first study to analyse the state-ownership relationship of Vietnamese listed firms with expected returns. Lastly, this is the first paper in extant literature that uses the Fama and French five-factor model (2015a) in asset pricing testing for a developing country.

The remainder of this paper is organised as follows. In Section 2, we describe data and methodology used in our analysis, including factor design and construction of test portfolios), with a detailed analysis of state ownership – stock return relationship in Vietnam. Section 3 provides empirical results on the Fama-French five-factor model (2015) as compared to CAPM and the three-factor framework (Fama and French, 1993) with a focus on state ownership structure of listed firms. Section 4 verifies whether the value factor is redundant for explaining stock expected returns in Vietnam. Section 5 provides concluding remarks.

2. Data and methodology

2.1. Data

The analysis of this study is conducted for all common stocks traded on Hochiminh and Hanoi Stock Exchanges (inclusive of UPCoM) at monthly and daily frequency from August 2007 to July 2015. The source of data is Datastream database that includes adjusted closing prices, trading volume, market-to-book ratios, market capitalization, revenue, administrative expense, interest expense, cost of goods sold, total assets and state ownership. An interbank offer rate is used as the risk-free rate to be consistent with previous studies on Vietnam.

We exclude all stocks with daily returns of greater than 50% in absolute terms and monthly returns of more than 200%. To reduce the impact of infrequent trading, all stocks with no return data for the previous 10 consecutive business days are excluded from the analysis in that specific month. In addition, stocks with no return data for more than 10 business days in a month will be omitted from the sample during that month[1]. We also exclude all stocks with negative book-to-market ratios from the sample to be consistent with Fama and French (1993 and 2015a) methodology. To be in the sample on a specific date, in addition to having

[1] Angelides (2010) removes all the stocks that have less than 5 observations during a month.

required accounting data[2] as prescribed by Fama and French, companies must have a valid trade and not delisted prior to the formation period.

Table 1 presents the coverage of stocks used in our sample. Hence, we have 135 stocks in December 2007 and 438 stocks in 2015, accounting for 1,113,948 daily and 50,112 monthly observations in total.

Table 1. Sample coverage for Vietnamese stock market

Co is the number of listed companies during a year. MCap is market capitalization in trillions Vietnamese Dong (VND) as at the end of a year. Value and Volume are annual trading value (in trillions of VND) and trading volume (in millions of shares) of all stocks. OP and Inv are the average operating profitability ratio and the average investment ratio per stock, respectively, as defined using Fama French methodology (2015a). BM is the average book-to-market ratio per stock. Data are obtained from Datastream from July 2007 to August 2015.

Year	Co	MCap	Value	Volume	OP	Inv	BM
2007	135	334.5	267.6	2.610	0.0523	0.689	0.442
2008	189	148.3	120.5	5.261	0.0563	0.278	0.885
2009	279	371.0	445.9	18.79	0.0579	0.331	0.928
2010	400	453.1	408.0	19.12	0.0655	0.342	0.813
2011	421	308.9	137.6	11.27	0.0709	0.151	1.488
2012	442	383.4	193.2	18.77	0.0770	0.046	1.879
2013	425	446.9	229.7	22.09	0.0747	0.069	1.939
2014	460	542.2	523.1	40.16	0.0783	0.125	1.416
2015	438	623.1	255.8	18.83	n/a	n/a	1.319

By applying the Fama and French (1993, 2015a) methodology, for inclusion in a portfolio in July of each year (annual rebalancing), a stock must have market equity data for December of the previous year and June of a current year; non-missing (positive) book-to-market ratio for December of the previous year; non-missing revenues and at least one of the following: cost of goods sold, sales, general and administrative expenses, or interest expense at the end of the fiscal year (December) ending in the previous year; total assets data at the end of the fiscal year ending in year *t*-1 and *t*-2.

[2] To reduce the noise in computing variables, we exclude several stocks with extreme values of book-to-market ratio (higher than 8.0), operating profitability ratio (more than 100%), investment ratio (higher than 4.0).

2.2. Fama-French five factor design

We follow the Fama-French methodology in constructing risk factors (Fama and French, 1993, 2015a).

2.2.1. Market factor (MKT)

MKT is the average excess return on market portfolio constructed from our sample of stocks. MKT is value-weighted using market capitalization as at the end of month *t*-1. Excess return of each stock is calculated as monthly percentage change in stock's price less interbank offer rate of Vietnam.

2.2.2. Size factor (SMB)

To form a size portfolio in July of year *t*, stocks are sorted by the market equity as at the end of June of each year *t*. The stocks are allocated to two size portfolios (small and large) depending on whether their market equity is above or below the median. These two portfolios will be annually rebalanced with average returns calculated under value-weighted approach. The size factor (SMB) is the return difference between the average returns on the small firms' portfolios and the average returns on big firms' portfolios.

2.2.3. Value factor (HML)

The book-to-market sort uses market equity at the end of December of *t*-1 and book-to-market ratio for the fiscal year ending in calendar year *t*-1. Three portfolios are formed using the breakpoints of 30-70 percentiles. These portfolios will be annually rebalanced with average returns calculated under value-weighted approach. From these independent sorting we construct six portfolios from the intersection of two size and three book to market portfolios (SL, SN, SH, BL, BN, BH). The value factor (HML) is the return difference between the high book-to-market portfolios and the low book-to-market portfolios.

2.2.4. Profitability factor (RMW)

This factor uses accounting data for the fiscal year ending in calendar year *t*-1. For portfolios formed in June of year *t*, profitability is defined as annual revenues minus cost of goods sold, interest expense, and selling, general, and administrative expenses, all divided by book equity. Three portfolios are formed using the breakpoints of 30% and 70%. These portfolios will be annually rebalanced with average returns calculated under both equal-weighted and value-weighted approach. We construct six portfolios from the intersection of two size and three profitability portfolios (SR, SN, SW, BR, BN, BW). RMW factor is the return difference between the average returns on the high (robust) profitability portfolios and the average returns on the low (weak) profitability portfolios.

2.2.5. Investment factor (CMA)

For portfolios formed in June of year *t*, CMA uses the change in total book equity in the fiscal year *t*–1 compared to the fiscal year *t*–2. Three portfolios are formed using the breakpoints of 30% and 70%. These portfolios will be annually rebalanced with average returns calculated under both equal-weighted and value-weighted approach. We construct six portfolios from the intersection of two size and three investment portfolios (SC, SN, SA, BC, BN and BA). CMA factor is the return difference between the average returns on the conservative investment portfolios and the average returns on the aggressive investment portfolios.

Table 2 presents the summary statistics of all factors. Panel A shows that the factors have negative market premium, consistent with Fang et al. (2015a). The market premium (mean Rm) for Vietnam is -0.65% per month, the size premium (mean SMB) and the value premium (mean SMB) is 0.38% and 0.61%, respectively. The monthly premium for profitability and investment has the value of 0.34% and 0.095% during the 2008-2015 period.

Table 2. Summary statistics for Fama-French factors for Vietnamese stocks

Panel A reports the summary statistics for the Fama-French monthly risk factors. Panel B reports the time-series correlation between the factors.

In July of year *t*, we form 2 size portfolios based on market capitalization as at the end of year *t*-1 and use median as breakpoint. These two portfolios will be calculated using monthly returns and rebalanced annually. The size factor (SMB) is the return difference between the average returns on the small firms portfolios and the average returns on big firms portfolios containing large firms. We then construct six portfolios from the intersection of two size and three book to market portfolios (SL, SN, SH, BL, BN, BH) based on 30th and 70th percentiles. The value factor (HML) is the return difference between the average returns on the high book- to-market portfolios and the average returns on the low book-to-market portfolios. Similarly, we construct six portfolios from the intersection of two size and three profitability portfolios (SR, SN, SW, BR, BN and BW). Profitability factor (RMW) is the return difference between the average returns on the robust profitability portfolios and the average returns on the weak profitability portfolios. Six portfolios are from the intersection of two size and three investment portfolios (SC, SN, SA, BC, BN and BA). Investment factor (CMA) factor is the return difference between the average returns on the conservative investment portfolios and the average returns on the aggressive investment portfolios. All portfolios are value-weighted and returns are in percentage. Rm is the value-weighted return on market portfolio of all sample stocks minus the one-month interbank offer rate. The factor returns are calculated as follow (Fama and French, 2015a):

$$SMB = \frac{SH+SN+SL}{3} - \frac{BH+BN+BL}{3} + \frac{SR+SN+SW}{3} - \frac{BR+BN+BW}{3} + \frac{SC+SN+SA}{3} - \frac{BC+BN+BA}{3}$$

$$HML = \frac{(SH-SL)+(BH-BL)}{2}\ ;\ RMW = \frac{(SR-SW)+(BR-BW)}{2}\ ;\ CMA = \frac{(SC-SA)+(BC-BA)}{2}$$

Rm is the value-weighted average return on all stocks of our sample. Statistics reported are the mean, median, standard deviation (st.dev), maximum (max), minimum (min), skewness and kurtosis. Sample is from September 2008 to July 2015.

Panel A: Summary statistics

	Mean	median	st.dev	skewness	Kurtosis	min	max
Rm	-0.6515	-0.3419	8.4841	-0.0244	3.7537	-24.5724	23.9020
SMB	0.3788	0.4292	5.4333	0.0002	3.9358	-13.8800	17.0364
HML	0.6131	0.0437	4.6690	0.9480	5.9929	-9.7787	17.7413
RMW	0.3420	0.1480	3.7990	-0.1730	5.3969	-12.4874	12.7709
CMA	0.0954	0.5641	3.5138	-0.4653	3.5054	-10.0403	7.9172

Panel B: Correlation

	Rm	SMB	HML	RMW	CMA
Rm	1				
SMB	-0.0640	1			
HML	0.1287	0.3821	1		
RMW	-0.0844	-0.5832	-0.4928	1	
CMA	-0.2159	0.1076	0.4888	-0.2730	1

Panel B shows the correlations between the factors. Consistent with Fama and French (2015a), profitability (RMW) is negatively correlated with all factors. There is positive and high correlation between HML and CMA, indicating high B/M firms tend to be low-

investment firms. The results also show that smaller companies with low B/M tend to be more profitable. While we find the same negative correlation between Rm and RMW, CMA, our results show different results for SMB and HML. In our case, there is no evidence of correlation between Rm and SMB. While RMW and CMA are each negatively correlated with Rm as Fama and French (2015a) report, there is no correlation between SMB and Rm, similar to that of Australia (Chiah et al., 2012).

2.3. Asset pricing tests

We compare the performance of CAPM with three multi-factor models of Fama and French (1993, 2015a):

CAPM: $$R_{p,t} = \alpha_p + \beta_p MKT_t + \varepsilon_{i,t} \quad (1)$$

Three factor model: $R_{p,t} = \alpha_p + b_p MKT_t + s_p SMB_t + h_p HML_t + \varepsilon_{p,t}$ (2)

Five factor model: $R_{p,t} = \alpha_p + b_p MKT_t + s_p SMB_t + h_p HML_t + r_{i,t} RMW_t + c_{i,t} CMA_t + \varepsilon_{p,t}$ (3)

Five factor model without HML:

$$R_{p,t} = \alpha_p + b_p MKT_t + s_p SMB_t + r_{i,t} RMW_t + c_{i,t} CMA_t + \varepsilon_{p,t} \quad (4)$$

where $R_{p,t}$ is the returns of portfolio p in month t; SMB_t, HML_t, RMW_t and CMA_t are the factor-mimicking portfolios for size, value, profitability and investment of Vietnamese equities; and MKT_t is the monthly excess returns on Vietnam's stock market portfolio.

We investigate the explanatory power of the new five-factor model on the variation of stock returns by looking at the adjusted R^2, GRS test statistics (Gibbons, Ross, and Shanken, 1989) and the Sharpe ratio for the intercept, SR(α). GRS tests whether the regression intercepts are jointly equal to zero. As Merton (1973) suggests, the intercept is indistinguishable from zero if an asset pricing model completely captures expected returns. According to Lewellen et al. (2010), the smaller SR(α), the less unexplained average returns, hence, the better the model.

2.4. Portfolio characteristics

We form nine 3x3 portfolios to test asset pricing models. All stocks are allocated to three different portfolios at the end of December of each year based on market capitalization using breakpoints 33rd and 67th percentiles. In the second sort, we further sort each size portfolio into three sub-portfolios based on book-to-market, profitability and investment. The average portfolio monthly returns are calculated from July of year t+1 using value-weighted approach. The portfolios are rebalanced on an annual basis.

As we also want to investigate the return and other characteristics of state-owned equities (SOE), we form 2 sub-portfolios for each size portfolio using similar approach above, with one sub-portfolio containing all firms that have government stake in shares and the other sub-portfolio where the firms are entirely private.

Table 3 reports characteristics of single-sorted portfolios. Fama-French (2015a and 2015b) report that the five-factor model fail to capture the low average return on small stocks. Our study suggests that Fama-French model can explain return behaviour of small cap equities of Vietnam, but it has difficulty in explaining high average returns of stocks with average book-to-market and profitability as well as low average returns of portfolio with average investment ratio. The highest earning portfolio is the one with average book-to-market and/or portfolio containing only state-owned enterprises. The loser portfolio over the sample period is the portfolio with average investment ratio.

Overall, the univariate results of Table 3 support dividend discount model dictating that higher book-to-market ratio, higher profitability ratio or lower expected growth in book equity (investment) implies higher expected return (with the exception of the portfolios with average B/M, profitability or investment). One interesting finding from our ownership structure analysis shows that state-owned enterprises have significantly higher average

returns despite they invest less aggressively and have lower profitability and book-to-market ratios, compared to private (non-SOE) firms.

Table 3. Characteristics of value-weighted single-sorted portfolios

The table provides time-series averages of excess returns (average percentage monthly returns in excess of the interbank offer rate of Vietnam), book-to-market (B/M), profitability (OP) and investment (Inv) ratios in July of year *t* to June of year *t*+1 for portfolios formed in December of year *t*-1 on single sort of book-to-market, profitability or investment. Portfolio breakpoints are 33rd and 67th percentiles. Each of the ratios for a portfolio in a given year is the value-weighted average of the ratios for the firms in the portfolios. Firms in the columns Ownership are sorted on ownership structure. If the companies have state share of ownership, they are classifies as SOE, if the company has no ownership stake, they will join non-SOE group. There are 50 listed equities in our sample that belong to the SOE group. Column Low is the characteristics for portfolios of stocks with low book-to-market ratio. Column Ave (under Book-to-market) is the characteristics for portfolios of stocks with average book-to-market ratio. Column High is characteristics for portfolios of stocks with high book-to-market ratio. Column Weak is characteristics for portfolios of stocks with low profitability ratio. Column Ave (below Profitability) is characteristics for portfolios of stocks with average profitability ratio. Column Robust is the characteristics for portfolios of stocks with high profitability ratio. Column Conserv is the characteristics for portfolios of stocks with low investment ratio. Column Ave (below Investment) is characteristics for portfolios of stocks with average investment ratio. Column Aggr is characteristics for portfolios of stocks with high investment ratio. The sample is from September 2008 to July 2015.

	Book-to-market			Profitability			Investment			Ownership	
	Low	Ave	High	Weak	Ave	Robust	Conserv	Ave	Aggr	SOE	non-SOE
Return	-0.04	0.54	0.48	-0.36	0.09	0.08	-0.06	-0.37	0.41	0.42	0.03
B/M	0.57	1.18	1.64	1.23	1.07	0.66	1.01	0.88	0.65	0.67	0.78
OP	0.29	0.15	0.08	0.02	0.04	0.31	0.18	0.21	0.27	0.22	0.25
Inv	0.24	0.19	0.11	0.13	0.18	0.23	0.13	0.16	0.27	0.14	0.23

Table 4 provides detailed summary statistics for three sets of 9 double-sorted portfolios to be used in asset pricing tests. The two last columns show the sort on size and state ownership structure of the firm. Panel A shows the average returns for each portfolio. Panel B reports the average book-to-market (B/M) ratio for a portfolio, while the panel C and D show the profitability and investment ratios of each portfolio.

Panel A reports no obvious univariate relationship between the average returns and B/M, profitability and investment of listed firms across all portfolios. As mentioned earlier, there are patterns in return portfolios with average book-to-market, profitability and investment discussed earlier in Table 3. For size-B/M sort, our results show the highest returns in the portfolio with average B/M (book-to-market); this result is consistent across all size groups.

Table 4. Characteristics of double-sorted portfolios

The table provides time-series averages of returns, excess returns, book-to-market, profitability and investment ratios in July of year t to June of year t+1 for portfolios formed in December of year t-1 on double sort of size and a combination of book-to-market, profitability and investment. The portfolio formation and book-to-market, profitability and investment ratios follow Fama-French (2015a) methodology. Each of the ratios for a portfolio in a given year is the value-weighted average of the ratios for the firms in the portfolios. Firms in the columns Ownership are sorted on size and ownership structure. If the companies have state share of ownership, they are classifies as SOE, if the company has no ownership stake, they will join non-SOE group. There are 50 listed equities in our sample that belong to the SOE group. Panel A shows the monthly average excess returns of portfolios (in percentages). Panel B provides time-series averages of monthly returns in excess of the Vietnam's interbank offer rate. Panel C, D, E show the book-to-market, profitability and investment times-series averages for a portfolio. Column Low is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and low book-to-market ratio. Column Ave (below Book-to-market) is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and average book-to-market ratio. Column High is the characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and high book-to-market ratio. Column Weak is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and low profitability ratio. Column Ave (below Profitability) is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and average profitability ratio. Column Robust is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and high profitability ratio. Column Conserv is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and low investment ratio. Column Ave (below Investment) is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and average investment ratio. Column Aggr is characteristics for portfolios of stocks sorted on size (Small, Medium and Large) and high investment ratio. The sample is from September 2008 to July 2015.

	Book-to-market			Profitability			Investment			Ownership	
	Low	Average	High	Weak	Average	Robust	Conserv	Average	Agg	SOE	non-SOE
Panel A: Return											
Small	0.91	1.06	0.91	0.89	0.41	1.27	1.32	0.53	0.99	1.86	0.75
Medium	-0.20	0.42	0.44	0.46	-0.00	0.32	0.54	0.07	0.20	0.29	0.20
Large	-0.25	0.87	0.25	-0.25	0.25	0.09	-0.18	-0.29	0.29	0.38	0.00
Panel B: Book-to-market											
Small	1.16	1.52	1.97	1.55	1.54	1.51	1.52	1.61	1.48	0.44	1.50
Medium	0.89	1.23	1.69	1.28	1.28	1.27	1.36	1.31	1.16	0.19	1.26
Large	0.49	0.85	1.37	1.09	0.86	0.59	0.92	0.75	0.62	0.63	0.71
Panel C: Profitability											
Small	0.03	0.03	0.04	0.01	0.02	0.06	0.04	0.02	0.04	0.05	0.03
Medium	0.08	0.09	0.08	0.01	0.04	0.17	0.08	0.08	0.09	0.06	0.09
Large	0.32	0.23	0.13	0.03	0.08	0.37	0.21	0.26	0.28	0.23	0.27
Panel D: Investment											
Small	0.20	0.20	0.10	0.18	0.14	0.18	0.11	0.19	0.21	0.19	0.16
Medium	0.26	0.17	0.12	0.12	0.22	0.19	0.11	0.20	0.23	0.15	0.18
Large	0.27	0.18	0.15	0.16	0.20	0.24	0.14	0.18	0.27	0.13	0.24

The size effect is found in all portfolios. There is a clear size effect in all portfolios sorted by size and investment. Small firms have higher average returns, B/M despite the evidence that they are less profitable and invest less than large-cap firms. It is not surprising to see that investment patterns of SOEs are opposite of non-SOEs. Private firms tend to take more aggressive approach of investment. Multivariate regressions would provide a clearer picture on the average return behaviour in the Vietnamese market.

We also perform our sort on the state holdings of a firm and suggest that there is a return premium for state entities with small-cap firms having highest returns. There is a size effect in all portfolio characteristics of private firms. Portfolio of small-sized private firms has highest B/M. There is no clear size effect for SOEs in portfolio returns and book-to-market.

Although the Fama-French sort does not provide much information on univariate characteristics of portfolios sort on size and B/M, profitability and investment, our sort on ownership structure provides some interesting findings. Profitable private firms (non-SOEs) tend to provide lower returns to investors and invest more aggressively than SOEs. As Fama French also note, these characteristics should be interpreted with caution as this univariate characteristics can differ from multivariate regression results.

3. Empirical results on asset pricing tests

Table 5 reports the results of asset pricing tests using portfolios with different sorting approach. The last two columns report our findings for portfolios constructed based on the state ownership structure of a firm. The testing period is from September 2008 to July 2015. The Newey – West (1987) *t*-statistics are given in parenthesis. Panels A and B report the CAPM and Fama-French three-factor test results whereas Panels C and D show the results for Fama-French five-factor with and without HML factor.

In the summary results of models, the test statistics show that the new model can account for more anomaly than the traditional asset pricing models of CAPM and the three-factor. Consistent with Fama and French results (2015a), the five-factor model tested on Vietnamese stock market performs best in relation to explaining the average returns of three sets of 9 portfolios sorted B/M, profitability and investment (column All of adjusted R-squared). The average of adjusted R-squared for all double-sorted portfolios improves from 89.58% (the three-factor model) to 90.49% (the five-factor model) with the lowest performing model CAPM at 73.98% average adjusted R-squared. Our result is consistent with average adjusted

R-squared for Asia Pacific region (Fama and French, 2015b). Similar results of superiority of the five-factor model over the three-factor is found for Australian stock market (Chiah et. al., 2015).

We also find a strong support for the systematic risk domination over the asset returns, usually observed in the countries undergoing privatization process (Diamonte et at., 1996). The results in Panel C for ownership structure show that the private firms are more sensitive to general market conditions (low B/M stocks in size-B/M portfolios have high beta coefficient and *t*-stat) than SOEs.

There is a strong negative RMW for the large-sized portfolios of high B/M and conservative investment style in Panel C imply that the mega-cap portfolios contain stocks whose returns behave like those of unprofitable value firms and invest conservatively. Overall, Table 5 shows the five-factor model performs relatively well in explaining the expected returns of 27 portfolios sorted on book-to-market, profitability and investment. The average adjusted R-squared is 0.740, 0.896, 0.895 and 0.905 for CAPM, three-factor, five-factor without HML and five-factor with all five variables, respectively. GRS fails to reject all of the models, providing the preference for five-factor model as the best one among all tested. However, as in case with Australia (Chiah et al., 2015), we find Sharpe ratio of intercepts, SR(α), has the lowest values for the three-factor model. All models perform best in describing returns of large stocks.

Panel B shows that there is significant abnormal return (alpha) in the portfolio with small-cap and robust profitability, unexplained by the three-factor model. Panel C provides evidence that this abnormal return disappears when we include profitability and investment factors into a model. The alpha *t*-statistic has improved much in the majority of portfolios in Panel C as compared to Panel B. Hence, we can suggest that some anomalies can be eliminated from previous versions of asset pricing models by including two new factors.

Fama and French (2015a) report that the five-factor model produces lower GRS statistics than the original three-factor model (the lowest GRS test statistic as compared to the three-factor model is produced by the five-factor model in the portfolio sorted on size and profitability). Our results in Table 5 shows that the largest improvement of the five-factor model is produced for the portfolio sorted on size and investment (Inv) where GRS test statistic is at its lowest of 0.78.

Notably, Fama and French (2015a) report that HML is redundant for describing U.S. average returns during the 1962-2013 period, but it is not redundant for explaining average returns in any region (Fama and French, 2015b) during the 1990-2014 period. They observe strong positive relationship between book-to-market ratio and average returns of Japanese equities. Our results on Vietnamese stock market also provide evidence that without the value factor (HML), the asset pricing model with only market, profitability and investment factors, performs worse than the traditional three-factor model with market, size and value factors. Consistent with Fama and French (2015b) findings in Europe, Japan and Asia Pacific region, we provide evidence that HML is not redundant in Vietnam. The results for slope for HML (*h*) for almost all portfolios in Panel C of Table 5 report statistically important relationship with expected returns. Notably, the investment and profitability effect disappears when we include HML into our regression (Panel C of Table 4), thus contradicting the Fama French's finding on value factor redundancy for the US market. Hence, it is more likely that HML (book-to-value) absorbs the returns of the investment portfolio (CMA). Table 6 will provide further investigation of the value factor redundancy.

Similar to Japan (Fama and French, 2015), GRS test statistic cannot reject all the asset pricing models applied to Vietnamese stock market. However, unlike the case of Japan, the five-factor model largely absorbs the profitability and investment patterns in average returns of Vietnamese equities as in the North America, Europe and Asia Pacific region.

Table 5. Regression results

The table provides multivariate regression results of 27 portfolios sorted on size- book-to-market, size-profitability and size- investment. Portfolios are formed in July of year t to June of year t+1 from stock sorted in December of year t-1. The stocks are sorted into three size groups (Small, Medium and Large). Stocks are then allocated to three book-to-market (B/M), profitability (OP), investment (Inv) or state-ownership groups (ownership: SOE or non-SOE). The portfolio formation and book-to-market (HML), profitability (RMW) and investment (CMA) factor construction follow Fama-French (1993, 2015a) methodology. The first table (Summary results of models) describes the average adjusted R-squared of all portfolios sorted by size and a combination of B/M, profitability, investment (All) and the average adjusted R-squared of size-SOE (SOE) and size-nonSOE sorted (non-SOE) portfolios. The adjusted R-squared of each portfolio are given in Panels A to D. GRS is the Gibbons, Ross, and Shanken's (1989) test statistic. We apply this test for portfolios formed by size and a combination of book-to-market, profitability and investment. SR(a) is the Sharpe ratio for intercepts. The second table (Panel A-D) reports the results of model tests. Column Low is the regression results for portfolios of stocks sorted on size (Small, Medium and Large) and low book-to-market ratio. Column Ave (below Book-to-market) is the regression results for portfolios of stocks sorted on size (Small, Medium and Large) and average book-to-market ratio. Column High is the regression results for portfolios of stocks sorted on size (Small, Medium and Large) and high book-to-market ratio. Column Weak is the regression results for portfolios of stocks sorted on size (Small, Medium and Large) and low profitability ratio. Column Ave (below Profitability) is the regression results for portfolios of stocks sorted on size (Small, Medium and Large) and average profitability ratio. Column Robust is the regression results for portfolios of stocks sorted on size (Small, Medium and Large) and high profitability ratio. Column Conserv is the regression results for portfolios of stocks sorted on size (Small, Medium and Large) and low investment ratio. Column Ave (below Investment) is the regression results for portfolio of stocks sorted on size (Small, Medium and Large) and average investment ratio. Column Aggr is the regression results for portfolio of stocks sorted on size (Small, Medium and Large) and high investment ratio. Ownership column shows the regression results for companies classified into state-owned (SOE) and non-state-owned (non-SOE) groups. Panel A shows the coefficients, the associated Newey-West t-statistics and adjusted R-squared of CAPM: $R_{p,t} = a_p + b_p MKT_t + e_{i,t}$. Panel B provides the coefficients, the associated Newey-West t-statistics and adjusted R-squared of Fama-French three factor model: $R_{p,t} = a_p + b_p MKT_t + s_p SMB_t + h_p HML_t + e_{i,t}$. Panel C reports the coefficients, the associated Newey-West t-statistics and adjusted R-squared of Fama- French five factor model: $R_{p,t} = a_p + b_p MKT_t + s_p SMB_t + h_p HML_t + r_p RMW_t + c_p CMA_t + e_{i,t}$. Panel D reports the coefficients, the associated Newey-West t-statistics and adjusted R-squared of Fama-French five factor model without HML: $R_{p,t} = a_p + b_p MKT_t + s_p SMB_t + r_p RMW_t + c_p CMA_t + e_{i,t}$. The sample is from September 2008 to July 2015.

	Adjusted $\bar{R}^2$			GRS			SR(a)		
Summary results of models	All	SOE	non-SOE	B/M	OP	Inv	B/M	OP	Inv
CAPM	0.7398	0.5971	0.8099	1.16	1.45	0.86	1.11	0.90	0.79
Fama-French 3 factor	0.8958	0.6721	0.9618	1.03	1.43	0.97	0.59	0.31	0.36
Fama-French 5 factor w/o HML	0.8949	0.6755	0.9570	1.19	1.30	1.09	1.01	0.95	0.75
Fama-French 5 factor	0.9049	0.6715	0.9630	0.92	1.03	0.78	0.73	0.64	0.65

Table 5. Continued

	Book-to-market			Profitability			Investment			Ownership	
	Low	Ave	High	Weak	Ave	Robust	Conserv	Ave	Aggr	SOE	non-SOE
Panel A: CAPM											
						a					
Small	0.010	0.011	0.009	0.010	0.004	0.013	0.014	0.006	0.011	0.025	0.014
Medium	-0.001	0.004	0.004	0.006	0.000	0.003	0.005	0.001	0.003	0.009	0.009
Large	-0.002	0.009	0.004	-0.002	0.004	0.001	-0.002	-0.003	0.004	0.010	0.007
						t (a)					
Small	1.249	1.362	1.088	1.090	0.609	1.573	1.682	0.791	1.158	2.347	1.957
Medium	-0.211	0.827	0.723	0.922	0.033	0.504	0.875	0.106	0.482	1.622	1.692
Large	-0.779	2.295	0.907	-0.563	0.942	0.319	-0.293	-0.786	0.943	1.422	3.281
						b					
Small	1.103	1.034	0.995	1.070	0.969	1.057	1.021	1.001	1.084	1.029	1.018
Medium	1.068	0.983	0.964	1.108	0.996	0.947	0.946	0.941	1.115	0.902	1.009
Large	1.004	0.985	1.165	0.982	1.207	0.985	0.992	0.959	1.116	0.992	1.035
						t (b)					
Small	10.462	9.959	10.708	10.661	10.737	9.609	10.395	11.055	8.272	8.909	11.144
Medium	13.386	12.773	14.744	12.551	13.497	11.429	13.409	13.668	12.631	15.838	14.668
Large	28.597	15.980	24.020	17.896	19.736	29.777	11.938	21.460	18.107	9.849	31.456
						Adjusted R^2					
Small	0.639	0.610	0.580	0.594	0.646	0.617	0.602	0.657	0.584	0.458	0.659
Medium	0.763	0.764	0.712	0.768	0.734	0.716	0.722	0.764	0.772	0.689	0.809
Large	0.913	0.837	0.857	0.840	0.868	0.908	0.795	0.850	0.863	0.644	0.961

Table 5. Continued

	Book-to-market			Profitability			Investment			Ownership	
	Low	Ave	High	Weak	Ave	Robust	Conserv	Ave	Aggr	SOE	non-SOE
Panel B: Fama-French 3 factor model											
						a					
Small	0.007	0.006	0.002	0.004	-0.001	0.009	0.008	0.001	0.005	0.022	0.009
Medium	-0.002	0.001	-0.002	0.002	-0.003	-0.000	0.001	-0.003	0.001	0.007	0.005
Large	-0.000	0.008	-0.000	-0.005	0.003	0.003	-0.003	-0.002	0.005	0.012	0.007
						t (a)					
Small	2.009	1.608	0.663	0.928	-0.230	2.370	2.191	0.442	1.257	2.587	4.926
Medium	-0.638	0.358	-0.523	0.428	-0.788	-0.091	0.173	-1.020	0.213	1.483	1.889
Large	-0.049	2.186	-0.020	-1.288	0.621	1.418	-0.622	-0.631	1.313	1.836	4.083
						b					
Small	1.161	1.064	0.986	1.090	0.988	1.096	1.044	1.026	1.116	1.058	1.041
Medium	1.117	0.992	0.935	1.110	1.020	0.950	0.933	0.950	1.147	0.915	1.016
Large	1.009	0.964	1.121	0.961	1.198	0.978	0.964	0.971	1.103	0.976	1.027
						t (b)					
Small	21.726	27.435	30.151	25.066	21.473	21.678	17.307	17.333	18.318	10.028	48.062
Medium	26.691	17.121	22.262	14.706	19.164	14.792	16.762	24.824	18.986	14.700	26.176
Large	37.727	15.167	26.551	15.226	18.733	37.370	12.241	21.880	21.618	9.509	38.063
						s					
Small	1.118	1.040	0.891	1.073	0.886	1.089	1.021	0.888	1.130	0.820	0.986
Medium	0.765	0.528	0.445	0.532	0.713	0.506	0.466	0.578	0.698	0.408	0.547
Large	-0.242	-0.206	-0.023	0.070	0.074	-0.331	-0.126	0.087	-0.319	-0.442	-0.161
						t (s)					
Small	9.808	10.823	14.012	10.462	16.622	10.412	13.105	11.355	7.819	3.718	18.824
Medium	8.425	5.789	6.743	3.590	6.927	4.123	5.845	6.921	5.704	3.515	8.314
Large	-5.932	-2.209	-0.264	0.851	0.565	-6.701	-1.139	1.078	-3.045	-3.205	-4.041
						h					
Small	-0.171	0.183	0.639	0.339	0.251	0.078	0.270	0.153	0.195	0.063	0.247
Medium	-0.251	0.174	0.663	0.280	0.085	0.262	0.452	0.202	-0.049	0.054	0.219
Large	-0.200	0.182	0.605	0.341	0.172	-0.094	0.324	-0.118	0.002	-0.030	0.012
						t (h)					
Small	-1.322	1.522	5.953	3.996	3.431	0.675	3.524	1.363	1.809	0.269	4.639
Medium	-2.663	1.675	9.412	2.936	0.776	2.247	4.237	2.974	-0.422	0.371	3.023
Large	-3.576	2.232	6.116	4.950	1.419	-1.762	2.819	-1.469	0.025	-0.225	0.348
						Adjusted R^2					
Small	0.886	0.901	0.939	0.913	0.925	0.901	0.908	0.899	0.883	0.576	0.971
Medium	0.900	0.880	0.938	0.879	0.902	0.843	0.889	0.921	0.890	0.748	0.945
Large	0.957	0.848	0.923	0.875	0.874	0.960	0.812	0.850	0.890	0.693	0.970

Table 5. Continued

	Book-to-market			Profitability			Investment			Ownership	
	Low	Ave	High	Weak	Ave	Robust	Conserv	Ave	Aggr	SOE	non-SOE
Panel C: Fama-French 5 factor model											
						a					
Small	0.008	0.005	0.002	0.006	0.001	0.006	0.008	0.002	0.005	0.023	0.009
Medium	-0.001	0.001	-0.000	0.004	-0.003	-0.000	0.002	-0.002	0.001	0.007	0.005
Large	-0.000	0.008	0.002	-0.001	0.006	0.001	0.000	-0.001	0.003	0.010	0.008
						t (a)					
Small	2.144	1.197	0.548	1.546	0.268	1.642	2.070	0.687	1.117	1.544	2.124
Medium	-0.273	0.234	-0.181	1.047	-0.729	-0.111	0.451	-0.715	0.141	1.548	4.335
Large	-0.102	2.166	0.575	-0.357	1.344	0.707	0.027	-0.313	0.923	0.023	0.009
						b					
Small	1.142	1.027	0.961	1.051	0.971	1.072	1.078	1.003	1.030	1.052	1.026
Medium	1.088	0.978	0.933	1.075	1.009	0.944	0.942	0.949	1.099	0.909	0.997
Large	1.008	0.948	1.105	0.925	1.167	0.985	1.038	0.985	1.037	1.026	1.005
						t (b)					
Small	22.860	30.197	27.805	23.614	25.120	27.697	19.177	18.781	19.645	8.199	53.332
Medium	30.184	19.937	24.241	16.379	18.539	16.797	18.763	26.035	24.406	13.076	31.711
Large	32.371	12.516	28.052	19.455	19.600	41.217	15.025	17.407	23.546	9.074	40.002
						s					
Small	1.044	1.055	0.868	0.895	0.799	1.214	1.107	0.805	1.042	0.750	0.969
Medium	0.657	0.529	0.395	0.372	0.690	0.501	0.428	0.533	0.640	0.384	0.507
Large	-0.238	-0.236	-0.132	-0.158	-0.107	-0.247	-0.172	0.051	-0.335	-0.263	-0.212
						t (s)					
Small	7.248	9.599	11.748	6.944	12.699	11.738	11.475	8.016	6.589	3.293	14.426
Medium	7.764	4.686	5.125	2.298	5.774	3.641	4.605	5.748	4.747	2.714	6.921
Large	-4.034	-2.692	-1.513	-2.161	-0.863	-5.530	-2.071	0.550	-3.115	-1.684	-5.916
						h					
Small	-0.176	0.362	0.723	0.295	0.217	0.332	0.221	0.156	0.465	0.006	0.289
Medium	-0.252	0.236	0.610	0.244	0.104	0.281	0.368	0.151	0.089	0.053	0.256
Large	-0.192	0.216	0.545	0.228	0.089	-0.027	-0.051	-0.220	0.266	-0.033	0.050
						t (h)					
Small	-1.176	2.549	6.174	3.036	2.726	2.780	2.036	1.084	3.275	0.014	4.364
Medium	-1.889	2.051	10.033	1.982	0.897	2.604	3.134	2.485	0.716	0.297	3.434
Large	-2.565	1.833	4.820	3.483	0.579	-0.421	-0.403	-2.363	2.455	-0.198	1.101
						r					
Small	-0.198	0.135	-0.016	-0.493	-0.249	0.464	0.200	-0.219	-0.093	-0.215	-0.022
Medium	-0.285	0.034	-0.160	-0.442	-0.051	-0.003	-0.144	-0.146	-0.082	-0.062	-0.085
Large	0.016	-0.061	-0.317	-0.661	-0.518	0.256	-0.317	-0.149	0.094	0.472	-0.114
						t (r)					
Small	-1.119	0.822	-0.130	-3.293	-2.402	3.533	1.518	-1.321	-0.474	-0.437	-0.268
Medium	-1.958	0.252	-1.854	-2.955	-0.360	-0.020	-1.013	-1.591	-0.600	-0.385	-1.084
Large	0.188	-0.333	-3.100	-7.794	-2.715	3.698	-1.910	-1.012	0.619	2.133	-1.980
						c					
Small	-0.102	-0.336	-0.200	-0.178	-0.063	-0.323	0.226	-0.129	-0.674	0.008	-0.109
Medium	-0.161	-0.123	0.030	-0.167	-0.072	-0.046	0.111	0.034	-0.365	-0.034	-0.134
Large	-0.011	-0.114	-0.041	-0.114	-0.105	-0.009	0.682	0.152	-0.553	0.275	-0.152
						t (c)					
Small	-0.683	-2.546	-1.639	-1.558	-0.611	-2.195	1.477	-1.084	-3.785	0.020	-1.246
Medium	-1.057	-0.920	0.330	-1.167	-0.485	-0.250	0.783	0.385	-2.600	-0.148	-1.295
Large	-0.114	-0.675	-0.387	-1.020	-0.614	-0.111	3.554	0.985	-4.852	1.036	-2.842
						Adjusted R^2					
Small	0.886	0.908	0.941	0.926	0.929	0.923	0.911	0.901	0.907	0.567	0.972
Medium	0.905	0.879	0.939	0.892	0.901	0.839	0.890	0.921	0.897	0.742	0.945
Large	0.956	0.845	0.928	0.917	0.889	0.966	0.869	0.852	0.915	0.706	0.972

Table 5. Continued

	Book-to-market			Profitability			Investment			Ownership	
	Low	Ave	High	Weak	Ave	Robust	Conserv	Ave	Aggr	SOE	non-SOE
Panel D: Fama-French 5 factor model without HML											
						a					
Small	0.007	0.007	0.006	0.008	0.002	0.008	0.009	0.003	0.008	0.023	0.011
Medium	-0.003	0.002	0.004	0.006	-0.002	0.001	0.004	-0.001	0.001	0.008	0.007
Large	-0.001	0.010	0.005	0.000	0.006	0.001	-0.000	-0.003	0.005	0.010	0.008
						t (a)					
Small	1.707	1.753	1.401	2.027	0.776	2.154	2.364	1.038	1.801	2.738	4.940
Medium	-0.669	0.658	1.015	1.477	-0.553	0.325	1.067	-0.338	0.282	1.600	2.796
Large	-0.738	2.700	1.535	0.116	1.533	0.611	-0.051	-0.688	1.430	1.468	4.610
						b					
Small	1.120	1.071	1.049	1.087	0.998	1.112	1.105	1.022	1.086	1.053	1.061
Medium	1.057	1.007	1.008	1.104	1.022	0.978	0.987	0.968	1.110	0.915	1.028
Large	0.985	0.974	1.172	0.952	1.178	0.982	1.032	0.958	1.070	1.022	1.011
						t (b)					
Small	21.433	31.255	22.768	24.044	28.730	28.486	17.532	19.373	18.169	10.474	42.183
Medium	28.717	19.565	17.804	14.703	20.834	16.773	18.851	26.925	23.407	14.209	27.147
Large	35.875	14.813	19.114	20.960	18.380	40.817	14.448	19.482	20.551	9.402	37.767
						s					
Small	1.011	1.123	1.003	0.950	0.839	1.276	1.148	0.834	1.128	0.751	1.023
medium	0.610	0.573	0.509	0.417	0.710	0.553	0.496	0.561	0.657	0.394	0.555
Large	-0.273	-0.196	-0.030	-0.115	-0.090	-0.252	-0.182	0.010	-0.285	-0.269	-0.202
						t (s)					
Small	7.095	8.856	8.122	7.381	11.275	10.737	11.564	7.328	6.302	3.100	12.968
Medium	6.835	5.239	4.875	2.709	6.185	4.209	4.957	6.207	5.254	3.004	7.707
Large	-4.954	-2.151	-0.321	-1.477	-0.746	-5.287	-2.039	0.104	-2.539	-1.898	-5.870
						r					
Small	-0.150	0.035	-0.215	-0.574	-0.309	0.372	0.139	-0.262	-0.221	-0.216	-0.102
Medium	-0.215	-0.031	-0.328	-0.509	-0.080	-0.081	-0.246	-0.187	-0.107	-0.076	-0.155
Large	0.069	-0.121	-0.467	-0.724	-0.543	0.264	-0.303	-0.088	0.021	0.481	-0.128
						t (r)					
Small	-0.777	0.214	-0.908	-3.767	-2.784	2.573	0.970	-1.817	-1.163	-0.528	-1.023
Medium	-1.205	-0.258	-2.156	-3.949	-0.537	-0.646	-1.874	-1.889	-0.806	-0.492	-2.119
Large	0.939	-0.795	-3.577	-7.491	-3.032	4.114	-2.033	-0.598	0.131	2.162	-2.629
						c					
Small	-0.207	-0.118	0.234	-0.001	0.067	-0.123	0.359	-0.036	-0.395	0.012	0.064
Medium	-0.312	0.019	0.397	-0.020	-0.010	0.123	0.333	0.125	-0.311	-0.002	0.020
Large	-0.126	0.016	0.286	0.023	-0.051	-0.025	0.652	0.020	-0.394	0.255	-0.122
						t (c)					
Small	-1.539	-0.737	1.755	-0.010	0.666	-0.807	2.620	-0.293	-2.148	0.049	0.770
Medium	-2.420	0.143	2.695	-0.187	-0.069	0.642	2.129	1.372	-2.419	-0.009	0.179
Large	-1.592	0.106	2.184	0.181	-0.339	-0.343	3.791	0.145	-4.055	1.151	-2.583
						Adjusted R^2					
Small	0.884	0.896	0.887	0.919	0.924	0.913	0.907	0.900	0.889	0.573	0.962
Medium	0.898	0.872	0.889	0.886	0.900	0.830	0.872	0.919	0.897	0.744	0.937
Large	0.951	0.840	0.896	0.910	0.890	0.967	0.871	0.846	0.907	0.709	0.972

As mentioned previously, there are return differences between stocks that have state ownership and the ones without any government involvement. The two last columns of Table 5 provide interesting results on Vietnam: most of anomaly that asset pricing models cannot explain comes from the firms with state ownership structure. We see that state-owned firms are much less sensitive to market conditions than the public firms. Similar to Fama and French (2015a), we also observe the discrepancy in univariate characteristics of the firms (Table 4) and multivariate regression results for profitability and investment (Panel C of Table 5), but for firms sorted on state ownership criteria. In this case, we would report that portfolio contains stocks of large state-owned enterprises whose returns behave like unprofitable firms. Panel C reports that the large state corporations are less profitable than the public firms, but the former are more profitable than micro-cap stocks. All asset pricing models can perform well in describing the stock price variation of private companies but cannot explain largely the variation in the average returns of SOE equities.

4. Is HML redundant?

As our previous asset pricing tests suggest, the Fama-French five factor model works the best and has superiority over the three factor model when we include HML into the model. To further test our hypothesis of HML redundancy and see the relationship of the factors, we run regression of each factor on the other four remaining to find whether the explanatory variables can absorb the factor or not. Table 6 shows the results of 5 regressions (in columns) with Rm, SMB and HML, RMW and CMA as dependent variable in each of the regressions. In the first model where the dependent variable is the return on market portfolio (Rm), the average market returns being left unexplained by the model is negligible as the effect is absorbed by HML (0.61% per month, t-stat=2.34) and CMA (-0.97% per month, t-stat=-2.24) factors. The same happens when running the test on HML, i.e. the value effect is absorbed by both market and investment (CMA). Consistent with the results we get from Panel B of Table

2 where the correlation between HML and CMA is found to be highest, the average HML returns is captured by the exposures of HML to CMA and Rm. However, unlike Fama French results that show CMA and RMW absorbing all the effects of HML, our test reports that the average CMA returns is captured to a greater extend by its exposures to HML; RMW cannot absorb HML. Notably, we find similar controversy about the RMW and SMB with highest negative correlation (Panel B of Table 2). Table 6 shows that in multivariate regression, RMW largely absorbs SMB effect. Hence, the evidence suggests that in Vietnam, adding HML improves the mean-variance efficient tangency portfolio produced by combining the risk-free asset, the market, size, profitability and investment portfolios. The results reported here further support our finding on the value factor in Table 5.

Table 6. Testing a Fama-French factor by regressing the remaining variables of the five-factor model.

The table reports the results of time-series regressions with each of the variables being regressed by the remaining of the five factors. Rm is the value-weighted excess return on the market portfolio, SMB is average return on the portfolio sorted on size. HML is the value factor with size and book-to-market sort. RMW is the profitability factor. CMA is the investment factor. All factors are 2x3 portfolios constructed using Fama-French (1993, 2015a) methodology. Newey-West *t*-statistic is given in parentheses. The sample is from September 2008 to July 2015.

	Rm	SMB	HML	RMW	CMA
SMB	-0.39		0.19*	-0.34***	-0.13
	(-1.39)		(1.67)	(-3.73)	(-1.18)
HML	0.61**	0.27*		-0.18	0.40***
	(2.34)	(1.84)		(-1.30)	(4.56)
RMW	-0.39	-0.76***	-0.28		-0.15
	(-0.99)	(-5.14)	(-1.25)		(-0.94)
CMA	-0.97**	-0.30	0.60***	-0.15	
	(-2.24)	(-1.22)	(4.25)	(-0.89)	
Rm		-0.12	0.12**	-0.05	-0.13**
		(-1.63)	(2.06)	(-0.96)	(-2.29)
Constant	-0.01	0.00	0.01	0.01*	-0.00
	(-0.66)	(0.92)	(1.57)	(1.84)	(-0.36)
Adj.R2	0.117	0.362	0.414	0.415	0.314

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Conclusion

In this paper, we empirically examine three asset pricing models for Vietnamese stock market during the 2008-2015 period. The GRS test cannot reject all the asset pricing models in their power of capturing the average returns. Test results (average adjusted R-squared and GRS test statistic) point out the superiority of Fama-French five-factor model over CAPM and three-factor model while Sharpe ratio of alpha gives preference for three-factor model in explaining the returns of portfolios sorted on size and a combination of book-to-market, profitability and investment. Our findings suggest that the value factor (HML) has a relationship with portfolio returns and its effect is not absorbed by profitability and investment factors when including together in the five-factor model (Fama and Fama, 2015a). Our study also reports evidence of the return premium on state-owned equities in Vietnam, that is state-owned enterprises have significantly higher average returns than private firms although the former invest less aggressively and have lower profitability and book-to-market ratios than private (non-SOE) firms. Profitable private firms (non-SOEs) tend to provide lower returns to investors and invest more aggressively than SOEs. The mega-cap portfolios contain stocks whose returns behave like those of unprofitable value firms and invest conservatively. Our novel finding is that the asset pricing models fail to capture the average returns of state-owned enterprises. Contrary to the international evidence (Fama and French, 2015b) that shows the returns of small equities are not explained by the capital asset pricing models, the five-factor model fails to capture the high returns of the portfolios that contain stocks with average book-to-market and profitability and cannot explain low returns of equities with average investment ratio. We also show that investors holding the portfolio with average book-to-market or focusing only on SOE stocks during the sample period would earn highest returns. The loser portfolio over the sample period is the one that contains stocks with average investment ratio.

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