The Fama-French Three-Factor Model in Vietnam - A Quantile Regression Approach

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Abstract: This paper aims to test the validity of the Fama and French three factor model in the Vietnam stock market by using the data of daily transactions collected from 313 stocks listed on the Ho Chi Minh Stock Exchange (HOSE) in the period from October 2011 until October 2016. Quantile regression is applied to investigate the effects of each factor in the Fama-French model over the entire distribution of excess return. The study result shows the suitability of the Fama and French three-factor model in the Vietnam's context. The excess return of stocks listed on HOSE is positively correlated with two factors in the Fama-French model which are the market risk, the book-to-market value ratio (BE/ME) and negatively correlated with the firm size. This result is consistent with the Modern Portfolio Theory which is based on the idea that the higher risk an investor takes, the higher return he achieves. However, the magnitude of the impact of each factor in the Fama-French model is subject to the quantiles of the excess stock return. In general, at the tail quantiles (lower and upper quantiles) of the excess return distribution, the ceteris paribus, the effect of the risk premium through the beta coefficients and the value premium through BE/ME ratio is stronger than that of the middle quantiles.

Keywords: Fama and French three-factor model, quantile regression, risk premium, size premium, value premium.

JEL Classification: C58 . G12 . G17 . G23 . G32 .

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1. Introduction

The capital asset pricing model (CAPM) is built and developed on the theory of investment portfolio and market portfolio by Markowitz (1952), Sharpe (1964), Treynor (1961) and Lintner (1965). The CAPM describes the relationship between systematic risk and expected return for stocks. However, Fama & French (1992) argued the CAPM is impractical due to the set of strict assumptions. Furthermore, many empirical studies carried out by Banz (1981), Rosenberg, Reid & Lanstein (1985), Chan, Yasushi & Josef (1991) show that in addition to the market risk, there are many factors contributing to the volatility of the financial asset return. One of the important extensions for the CAPM is the three-factor model introduced by Fama et al. (1992).

In addition to the market risk, Fama et al. (1992) identify two other important factors to determine the rate of return on securities - the firm size and the book-to-market value. After the Fama-French three-factor model was first introduced, a number of empirical studies were carried out to test the applicability of the model in many countries including developed and emerging economies. In Vietnam, the first applications of the Fama-French model were in 2008 with the studies of Vuong Duc Hoang Quan & Ho Thi Hue (2008). Since then, the Fama-French model has been widely used. However, most previous studies examined the performance of the model by the mean linear regression. With this research, quantile regression is applied to investigate the effect of each factor in the Fama-French model - the market risk, firm size and book-to-market value - on the securities return over the entire distribution of excess return. Testing the performance of the Fama-French model in the Vietnam securities market by quantile regression will provide convincing empirical evidence on explaining the volatility of the return rate of stocks listed on the Vietnam stock market.

For the purpose of this research, the remainder of this paper proceeds as follows: Section 2 outlines the theoretical basis of the Fama-French three-factor model and some related empirical research; Section 3 describes data, quantile regression method and the application of this method to the Fama-French three-factor model; Section 4 shows the research result and empirically estimates the Fama-French three-model by quantile regression with data collected from the HOSE; Section 5 mentions some key conclusions and implications from the study research.

2. Literature Review

2.1. Theoretical Background

The Fama-French three-factor model is defined by the equation:

$$R_{pt} - R_{ft} = \alpha_{pt} + \beta_p (R_{mt} - R_{ft}) + S_p SMB_t + h_p HML_t + \varepsilon_{pt} \quad (1)$$

Where: R_{pt} - return of portfolio p; R_{mt} - return of market portfolio; R_{ft} - risk-free return; $(R_{pt} - R_{ft})$ - excess return of portfolio p; $(R_{mt} - R_{ft})$ - excess return of market portfolio.

SMB_t (Small minus big) accounts for the size firm factor which computes the premium return that a portfolio manager achieves by investing in stocks with small market capitalization rather than stocks with big market capitalization. Therefore, SMB is also referred to as a size premium.

$$SMB = (SL + SM + SH)/3 - (BL + BM + BH)/3 \quad (2)$$

HML_t (High minus low) accounts for the book-to-market value factor which computes the value premium that a manager achieves by investing in stocks with high book-to-market ratios, also known as value stocks rather than those with low book-to-market ratios, known as growth stocks.

$$SMB = (SH + BH)/2 - (SL + BL)/2 \quad (3)$$

Where: β_p - coefficient of market risk premium for portfolio p; s_p - coefficient of size premium for portfolio p; h_p - coefficient of value premium for portfolio p; α_p - intercept coefficient in the regression, known as an investment's return over its benchmark.

2.2. Empirical Studies

Since the Fama-French model was first introduced in 1992, there have been several empirical studies carried out to test the performance of this model in different economies.

In the three-factor model, Fama & French estimate the role of the risk premium, size premium and value premium as well as other factors in stocks listed on the NYSE, AMEX, and NASDAQ from January 1963 until December 1993. The authors explore that both firm size and book-to-market value play a crucial role in calculating the return of an investment portfolio. Billou (2004) also, empirically examines the Fama-French three-factor model in the NYSE, AMEX, and NASDAQ but in a longer period from July 1926 until December 2003. Furthermore, there

are many studies of the Fama-French model for the developing and emerging economies such as Japan by Charitou & Constantinidis (2004), Australia by Gaunt (2004), India by Bhavna (2006), Brazil by Silva (2006), France by Trimech, Kortas, Benammou & Benammou (2009), Indonesia by Ferdian, Omar & Dewi (2011) and Egypt by Eraslan (2013). All these researches highlight the role of the risk premium, size premium and value premium in explaining the return of securities as well as investment portfolio.

In Vietnam, since some first studies published in the 2000's, the Fama-French three-factor model has become popular. Tran Thi Hai Ly (2010) examines the model with data collected from the HOSE in the period 2004-2007. It is found that the HML positively affects the return of a financial asset while the SML shows the reverse impact. Truong Dong Loc & Duong Thi Hoang Trang (2014) tested the performance of the three-factor model in the Vietnam stock market in the period 2006-2012 and concluded the impact of the SMB and HML on the excess stock return is consistent with the theory.

However, most of the researches carried out on the validity of the Fama-French model assumes that the stock return follows a standard distribution. In practice, this assumption is hardly satisfied as many studies by Levhari & Levy (1977), Knez & Ready (1997), Horowitz, Loughran & Savin (2000) have proved the stock return has a heavy-tailed distribution. With a view to improving this disadvantage, Ma & Pohlman (2008), Allen, Singh & Powell (2011) test the Fama-French model with a quantile regression approach. According to Han & Naiman (2007), the advantage of the quantile regression is its suitability in the event of the regression error not following normal distribution. In addition, it is capable of minimizing the impact of outliers and most importantly examining the impact of each independent variable over the entire distribution of dependent variables rather than just the mean of normal distribution.

Therefore, this research takes advantage of the quantile regression in examining the Fama-French three-factor model in Vietnam's context and evaluating the role of $R_{mt} - R_{fm}$, SML and HML in explaining the excess return of a portfolio at given levels of quantile.

3. Data and Methodology

3.1. Data

The research data is collected from the closing price of 313 stocks listed on the HOSE from October 2011 until October 2016. Based on the company's market

capitalization, the stocks are divided into two groups: small-cap stocks (small (S)) and big-cap stocks (big (B)). In terms of the book-to-market ratio, the stocks are divided into three groups: high (H), medium (M) and low (L). Combining two criteria six portfolios: SL, SM, SH, BL, BM and BH.

3.2. Methodology

For each portfolio, the Fama-French three-factor model defined by equation (1) is estimated relatively by the ordinary least squares and quantile regression. If ($r_{pt} = R_{pt} - R_{ft}$) represents the excess return of portfolio p and ($r_{mt} = R_{mt} - R_{ft}$) represents the excess return of market, the Fama-French three-model can be rewritten as:

$$r_{\tau pt} = \alpha_{\tau pt} + \beta_{\tau p} r_{mt} + S_{\tau p} SMB_t + h_{\tau p} HML_t + \varepsilon_{pt} \quad (4)$$

Where: $\tau \in (0,1)$ - chosen quantile for regression

Koenker & Bassett (1978) first introduced the method of quantile regression in 1978. Traditional method of OLS regression focuses on finding the least squares regression equation to obtain the conditional mean of the response variable. Koenker & Bassett (1978) suggests estimating the regression coefficients on each quantile of dependent covariates that gives the minimum sum of absolute difference at quantile τ.

The conditional quantile function of Y given by X at quantile τ is the function where the coefficient β_τ is estimated that gives the minimum sum of errors at quantile τ:

$$\beta_\tau = \arg\min_{\beta_\tau} \left(\tau \sum_{y_i \geq X_i\beta_\tau} (y_i - X_i\beta_\tau) + (\tau - 1) \sum_{y_i \geq X_i\beta_\tau} (y_i - X_i\beta_\tau) \right) \quad (5)$$

With the application of quantile regression in the Fama-French three-factor model, the result shows the margin impact of risk premium, size premium and value premium on the excess portfolio return at each quantile. In addition, quantile regression reveals the effect of each factor - r_{mt}, SMB, HML - over the entire distribution of excess return without the assumption of normal distribution.

Although quantile regression can be performed at any quantile $\tau \in (0,1)$, the this paper chooses quantiles at 0.10 - 0.25 - 0.5 - 0.75 and 0.90. This combination of quartiles and deciles is commonly used in empirical studies with the quantile regression approach. Quantile regression results on six portfolios - SL, SM, SH, BL, BM, and BH accompanying with the OLS result and quantile coefficients

are illustrated on the graph. Therefore, it is more convenient to compare and recognize the direction of the impact of r_{mt}, SMB, HML at different quantiles of excess returns.

The advantage of the application of quantile regression in explaining the excess stock return has been discussed in several studies. According to Allen et al. (2011), the factor models do not necessarily follow a linear relationship. Further, the traditional method of OLS becomes less effective when it comes to analysing the extremes within a distribution, which is often the key interest of investors and risk managers.

4. Results and Discussion

4.1. Descriptive Statistics

Table 1 illustrates descriptive statistics including the mean, standard deviation, minimum, maximum and the result of standard deviation on each portfolio - SL, SM, SH, BL, BM and BH - as well as the model factors r_{mt}, SMB and HML.

Table 1. Descriptive statistics

	SL	SM	SH	BL	BM	BH	SMB	HML	r_{mt}
Mean	0.173	0.039	-0.052	0.105	0.026	-0.055	0.028	-0.193	-0.008
Median	0.221	0.112	-0.006	0.135	0.093	0.001	0.033	-0.188	0.033
Maximum	3.532	3.730	3.611	3.928	4.029	4.446	2.159	2.760	11.497
Minimum	-4.798	-4.684	-4.984	-5.051	-5.719	-6.142	-1.679	-2.287	-6.877
Standard Deviation	0.939	0.883	1.150	0.955	1.159	1.525	0.503	0.739	1.123
Skewness	-0.463	-0.668	-0.349	-0.723	-0.521	-0.350	0.050	0.099	-0.544
Kurtosis	4.326	5.507	4.270	5.931	4.691	3.807	3.428	3.238	5.449
Jarque-Bera	32265	99638	25944	131870	48733	14076	2393	1190	88647
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

The descriptive statistics reveals that the portfolio returns do not follow normal distribution since the Jarque-Bera test rejects the null hypothesis of the normal distribution of the return. This result has proved the necessity of using quantile regression technique. In general, the mean return of portfolios with small size (SL, SM, SH) is higher than that of portfolios with big size (BL, BM, BH). Similarly, the mean return of portfolios with high book-to-market value ratio (SH, BH) is lower than that of portfolios with low book-to-market value ratio (SL, BL).

The fact that SMB factor having positive mean implies an negative relationship

between the securities return and the firm size. Meanwhile, the HML factor has a negative mean which implies the higher book-to-market value ratio is, the lower return a stock can achieve and vice versa. The result of this descriptive statistics is consistent with previous descriptive statistics on each portfolio and previous studies in Vietnam such as Vuong Duc Hoang Quan et al. (2008).

4.2. Regression Results

4.2.1. Fama-French Three-Factor Model Regression Analysis

The regression result of Fama-French three-factor model via linear regression with the entire data sample collected from 313 stocks listed on the HOSE in the period 2011-2016 is illustrated in column 1, Table 2. The regression result of each portfolio SL, SM, SH, BL, BM and BH are shown in column 2 to column 7. The regression result of entire portfolio is consistent with the theory where the coefficients of the rmt, SMB and HML are positive and statistically significant. Accordingly, an investor will gain higher return at higher risk including market risk, size risk and value risk.

Table 2. Regression result on the entire data sample and each portfolio

Factor	Entire data sample	SL	SM	SH	BL	BM	BH
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
r_{mt}	0.644*** [115.97]	0.716*** [33.20]	0.628*** [40.55]	0.695*** [53.60]	0.684*** [67.24]	0.652*** [48.71]	0.709*** [42.11]
SMB	0.194*** [15.03]	0.712*** [14.25]	0.587*** [16.15]	0.776*** [25.77]	-0.275*** [-11.60]	-0.296*** [-9.53]	-0.338*** [-8.56]
HML	0.470*** [63.66]	-0.00154 [-0.05]	0.434*** [20.89]	1.021*** [59.53]	0.0187 [1.38]	0.442*** [25.06]	0.999*** [44.56]
Intercept	0.0909*** [18.18]	0.125*** [6.43]	0.0767*** [5.45]	0.0947*** [8.12]	0.0883*** [9.61]	0.0923*** [7.67]	0.115*** [7.59]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

The cofficients' magnitude of the excess market return on the stock return is quite similar in all portfolios with ranging from 0.62 to 0.72. In contrast with r_{mt}, the coefficient of size premium SMB on portfolios with small-cap stocks is positive, while the coefficient of size premium is negative with big-cap stocks.

Similarly, the value premium HML has no statistical significance on portfolios with low book-to-market value ratio (SL, BL) but has strongly positive effect on portfolios with high book-to-market value ratio (SM, BM, SH, BH). This result is consistent with studies by Tran Thi Hai Ly (2010), Truong Dong Loc et al. (2014) which use the traditional method of OLS regression to test the performance of the CAPM in the Vietnam context.

4.2.2. Quantile Regression on the Entire Data Sample

The impact of r_{mt}, SMB and HML on the entire data sample is also found positive at all chosen quantiles. The result of quantile regression is illustrated in column 2 to 6, Table 3. Although the regression coefficients are positive across all quantiles, their magnitudes varies between different quantiles. The change in regression coefficients at each quantiles are shown in Figure 1.

Table 3. The regression result of the Fama-French three-factor model on the entire data sample

Factor	OLS	Quantile regression				
		Q10	Q25	Q50	Q75	Q90
	(1)	(2)	(3)	(4)	(5)	(6)
r_{mt}	0.644*** [115.97]	0.741*** [57.47]	0.760*** [106.77]	0.447*** [127.02]	0.668*** [82.89]	0.614*** [43.50]
SMB	0.194*** [15.03]	0.210*** [7,00]	0.151*** [9.09]	0.103*** [12.61]	0.144*** [7.67]	0.342*** [10.38]
HML	0.470*** [63.66]	0.653*** [38,09]	0.468*** [49.38]	0.269*** [57.50]	0.516*** [48.17]	0.621*** [33.07]
Intercept	0.091*** [18.18]	-2.997*** [-257,97]	-1.236*** [-192.54]	-0.00134 [-0.42]	1.417*** [195.24]	3.474*** [272.96]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

Figure 1 includes graphs showing the change in the intercept, coefficients of r_{mt}, SMB and HML at quantiles ranging from 0.01 to 0.99. In this scope of research, the chosen quantiles are expressly the quantiles for the stock return. In the ceteris paribus, high quantiles represent stocks with high rate of return while low quantiles imply stocks with low return. In each graph, the horizontal line demonstrates OLS's coefficients whereas the curve shows the regression coefficients at each quantile. With regard to the market and value premium, the impact of r_{mt} and HML on the stock return is lowest at middle quantiles (0.50) and reaches highest at left tail

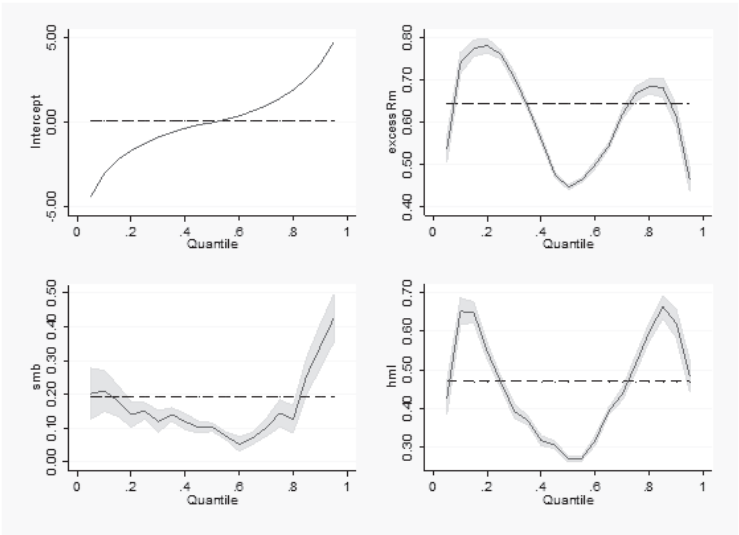

Figure 1. Regression coefficients of three factors in the Fama-French model via quantile

quantiles (0.10 and 0.25). In terms of the size premium, the lowest impact is found at middle quantiles around the median and the highest impact occurs at quantiles in the right tail area.

4.2.3. The Result of Quantile Regression on Each Portfolio

• ***Quantile regression on portfolio SL***

Table 4 demonstrates the OLS and quantile regression results of SL portforlio's excess returns in portfolio SL. The coefficients of r_{mt} and SMB are positive and statistically significant at the 1% level which is consistent with theory of Fama-French while the HML coefficient is negative and has no statistical significance. This result is consistent with the study by Truong Dong Loc et al. (2014). With regard of particular quantiles, the HML factor has no statistical significance at most quantiles, except quantile 0.25. With the entire data sample, the impact of the excess return and risk premium is relatively high at right tail quantiles of distribution and low at middle quantiles.

• ***Quantile regression on portfolio SM***

According to the result of OLS regression illustrated in column 1, Table 5, the risk premium, size premium and value premium have a positive impact and statistical significance to the return of portfolio SM. The OLS regression result only

Table 4. Regression result on portfolio SL

Factor	OLS	Quantile regression				
		Q10	Q25	Q50	Q75	Q90
r_{mt}	0.716*** [33.20]	1.022*** [18.91]	0.798*** [26.65]	0.373*** [32.31]	0.796*** [22.01]	0.713*** [14.15]
SMB	0.712*** [14.25]	1.130*** [9.03]	0.631*** [9.10]	0.263*** [9,81]	0.839*** [10.02]	1.024*** [8.77]
HML	-0.00154 [-0.05]	-0.0018 [-0.03]	0.0802** [2.04]	0.0138 [0.91]	0.0155 [0.33]	-0.0739 [-1.12]
Intercept	0.125*** [6.43]	-3.591*** [-73.93]	-1.310*** [-48.69]	0.0146 [1.41]	1.598*** [49.17]	4.116*** [90.90]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

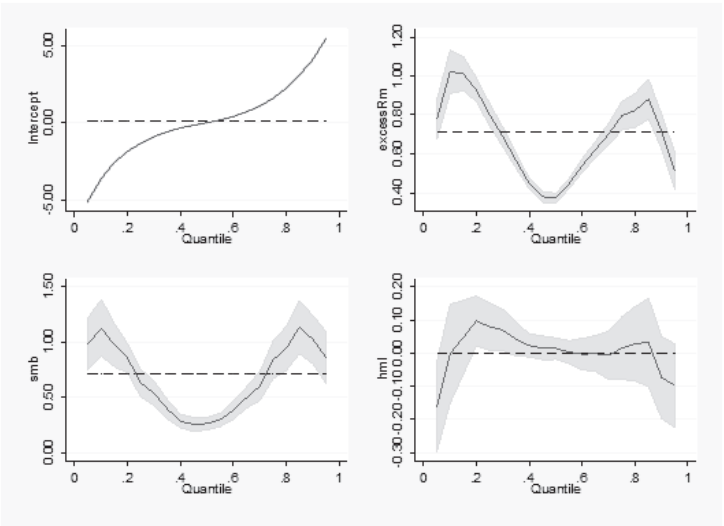

Figure 2. Regression coefficents of portfolio SL via quantile

shows the impact of model factors on the mean of excess return but fails to show different impact at different quantiles for the excess return. Therefore, with the aim of examining the specific impact of each factor on particular quantile in the excess return distribution, quantile regression is carried out. The result of quantile regression technique shows the positive impact of the size premium and value premium on the return of portfolio SM at all chosen quantiles which strengthens the positive relationship and statistical significance of the HML and SMB on the

portfolio return. However, the magnitude of their impacts varies between different quantiles. In general, the impact of model factors at quantiles in two tails of the distribution is higher than that at middle quantiles (quantile 0.5).

• ***Quantile regression on portfolio SH***

Table 6 reveals the regression result of the Fama-French model on portfolio SH. With this portfolio, the regression coefficients of three factors are positive which is consistent with the theory and have statistical significance at every quantile.

Table 5. Regression result on portfolio SM

Factor	OLS	Quantile regression				
		Q10	Q25	Q50	Q75	Q90
r_{mt}	0.628*** [40.55]	0.661*** [17.07]	0.780*** [33.64]	0.408*** [44.03]	0.704*** [28.01]	0.519*** [15.80]
SMB	0.587*** [16.15]	0.729*** [8.03]	0.583*** [10.72]	0.314*** [14.44]	0.604*** [10.25]	0.741*** [9.61]
HML	0.434*** [20.89]	0.513*** [9.89]	0.503*** [16.19]	0.275*** [22.18]	0.489*** [14.53]	0.457*** [10.38]
Intercept	0.0767*** [5.45]	-3.710*** [-105.62]	-1.467*** [-69.71]	0.0339*** [4.03]	1.714*** [75.12]	3.981*** [133.50]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

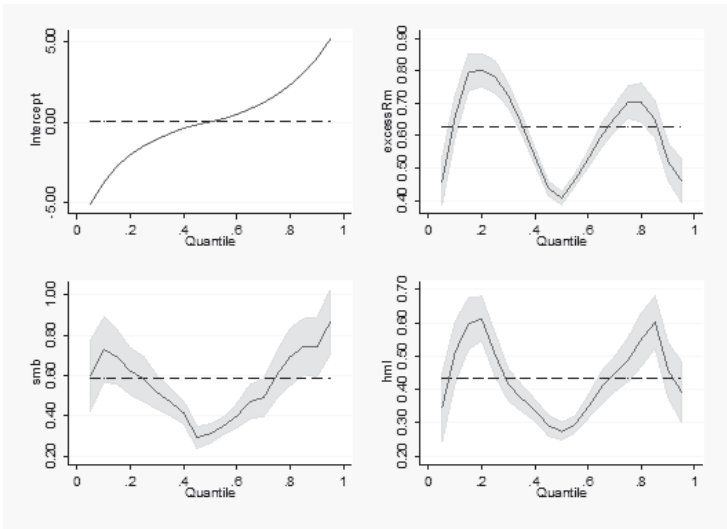

Figure 3. Regression coefficients of portfolio SM via quantile

Table 6. Regression result on portfolio SH

Factor	OLS	Quantile regression				
		Q10	Q25	Q50	Q75	Q90
r_{mt}	0.695*** [53.60]	0.569*** [22.22]	0.801*** [41.80]	0.688*** [54.86]	0.769*** [44.58]	0.564*** [20.93]
SMB	0.776*** [25.77]	0.587*** [9.89]	0.695*** [15.63]	0.645*** [22.15]	0.914*** [22.81]	0.921*** [14.71]
HML	1.021*** [59.53]	0.910*** [26.90]	1.124*** [44.35]	0.921*** [55.56]	1.201*** [52.63]	0.996*** [27.94]
Intercept	0.0947*** [8.12]	-3.657*** [-158.95]	-1.666*** [-96.74]	0.0724*** [6.42]	1.909*** [123.04]	3.895*** [160.64]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

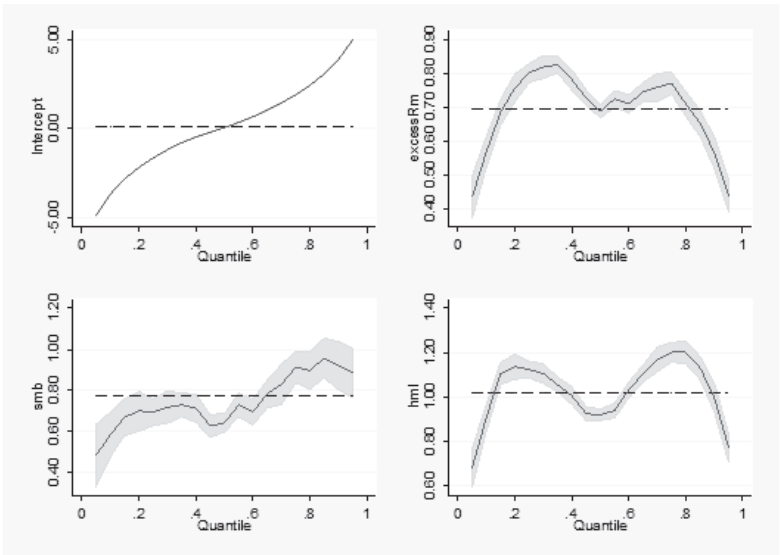

Figure 4. Regression coefficients of portfolio SH via quantile

• ***Quantile regression on portfolio BL***

The regression result on portfolio BL is contrary to the result of portfolio SL, SM, and SH. According to the result of the OLS regression, the coefficient of HML factor has no statistical significance while the SMB coefficient is negative at all quantiles and statistically significant at 1%. With regard to the HML factor, although it is not statistically significant via OLS regression, it is found statistically significant at every quantile. In particular, the coefficient of HML factor is positive

at low quantiles (0.1 - 0.25 - 0.5) and negative at high quantiles (0.75 - 0.9). This phenomenon is quite interesting as the impact of the value premium reverses at different quantiles.

Table 7. Regression result on portfolio BL

Factor	OLS	Quantile regression				
		Q10	Q25	Q50	Q75	Q90
r_{mt}	0.684*** [67.24]	0.816*** [37.38]	0.756*** [68.71]	0.570*** [74.20]	0.689*** [49.72]	0.673*** [24.46]
SMB	-0.275*** [-11.60]	-0.272*** [-5.35]	-0.135*** [-5.25]	-0.177*** [-9.86]	-0.364*** [-11.27]	-0.632*** [-9.85]
HML	0.0187 [1.38]	0.166*** [5.69]	0.0707*** [4.82]	0.0192* [1.88]	-0.0396** [-2.15]	-0.0904** [-2.46]
Intercept	0.0883*** [9.61]	-2.399*** [-121.75]	-1.013*** [-102.02]	0.000624 [0.09]	1.127*** [90.13]	2.924*** [117.67]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

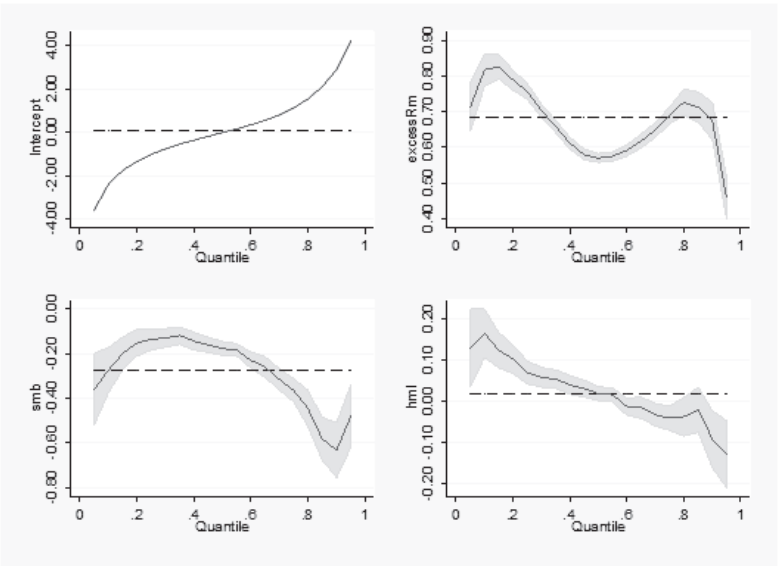

Figure 5. Regression coefficients of portfolio BL via quantile

• ***Quantile regression on portfolio BM***

Table 8 illustrates the result of the quantile regression of the Fama-French model on portfolio BM. The regression coefficient of SMB factor is negative while the HML coefficient is positive with the OLS as well as all quantiles. With regard to

Table 8. Regression result on portfolio BM

Factor	OLS	Quantile regression				
		Q10	Q25	Q50	Q75	Q90
r_{mt}	0.652*** [48.71]	0.728*** [28.21]	0.745*** [47.51]	0.583*** [51.17]	0.653*** [34.25]	0.647*** [20.49]
SMB	-0.296*** [-9.53]	-0.403*** [-6.73]	-0.246*** [-6.77]	-0.212*** [-8.03]	-0.333*** [-7.54]	-0.329*** [-4.49]
HML	0.442*** [25.06]	0.579*** [17.03]	0.423*** [20.53]	0.355*** [23.64]	0.477*** [19.00]	0.554*** [13.33]
Intercept	0.0923*** [7.67]	-2.604*** [-112.31]	-1.171*** [-83.18]	-0.0135 [-1.32]	1.319*** [76.92]	3.101*** [109.29]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

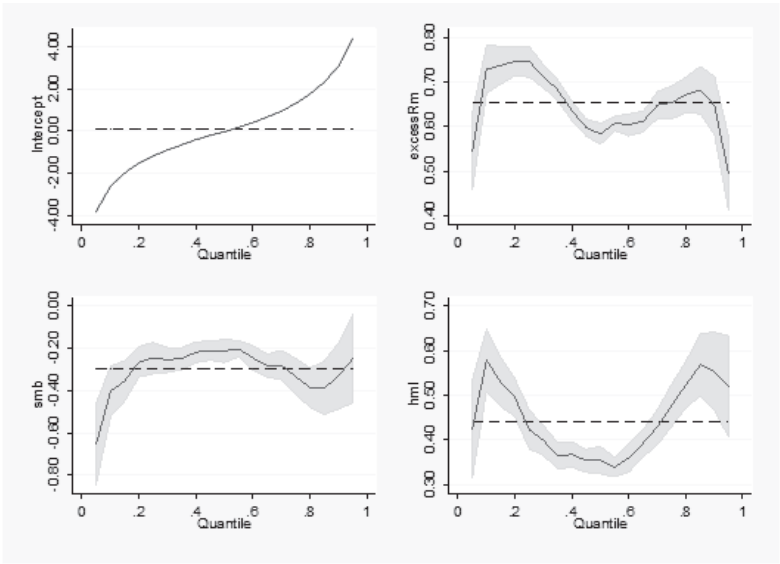

Figure 6. Regression coefficients of portfolio BM via quantile

the market risk, the impact is found significant at the left and right tailed quantiles (0.1 - 0.25 - 0.75 - 0.9) and weakens at middle quantiles, especially at quantile 0.5.

• ***Quantile regression on portfolio BH***

Table 9 shows the result of quantile regression on portfolio BH. The coefficient of HML is positive while the SMB coefficient is negative and statistically significant at every quantile. Unlike other portfolios, the coefficient of r_{mt} is low at tailed

Table 9. Regression result on portfolio BH

Factor	OLS	Quantile regression				
		Q10	Q25	Q50	Q75	Q90
r_{mt}	0.709*** [42.11]	0.662*** [24.17]	0.745*** [47.51]	0.802*** [48.93]	0.751*** [34.64]	0.599*** [17.20]
SMB	-0.338*** [-8.56]	-0.523*** [-8.15]	-0.246*** [-6.77]	-0.302*** [-7.86]	-0.309*** [-6.08]	-0.313*** [-3.84]
HML	0.999*** [44.56]	0.953*** [26.14]	0.423*** [20.53]	0.906*** [41.55]	1.087*** [37.69]	1.256*** [27.10]
Intercept	0.115*** [7.59]	-2.681*** [-108.42]	-1.171*** [-83.18]	-0.00724 [-0.49]	1.497*** [76.47]	3.151*** [100.24]

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

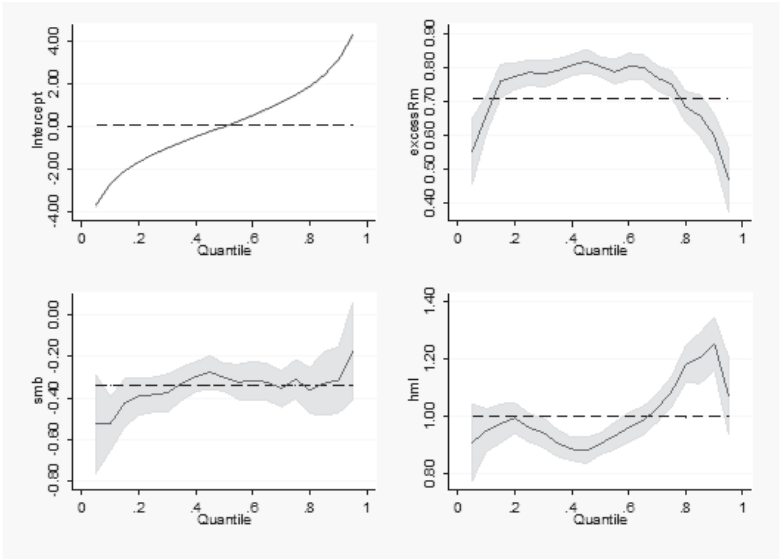

Figure 7. Regression coefficients of portfolio BH via quantile

quantiles (quantile 0.1 and 0.9) and high at middle quantiles (0.25 - 0.5 - 0.75) whereas the coefficient of HML is low at high quantiles in portfolio BH.

The goodness-of-fit test of the Fama-French three-factor model in Vietnam's stock market is quite similar to the regression result in other nations such as the USA (Allen et al., 2011) and India (Sharma, Gupta & Singh, 2016). These studies also found that the impact of three factors in Fama-French model varies between

different quantiles and proved the effectiveness of quantile regression in analysing the Fama-French model.

5. Conclusion and Recommendation

This research is carried out to investigate the performance of the Fama-French model in the Vietnam's context with data collected from 313 stocks listed on the HOSE. The estimated results on the entire data sample by OLS and quantile regression clarifies the suitability of the model in Vietnam's market. In detail, the stock return has a positive correlation with the market risk and the book-to-market value ratio and has an negative correlation with the firm size. This result is consistent with the Portfolio Theory which states an investor will gain higher return at higher risk. However, the direction and magnitude of the impact of each factor vary between different quantiles. Specifically, in the ceteris paribus, high quantiles correspond to the stocks with high return and vice versa. At middle quantiles, the impact of the risk premium and value premium is found significantly strong.

The role of the risk premium in explaining the excess return has been clearly identified in the entire data sample as well as in each portfolio at every quantile.

According to empirical studies, the regression coefficient of the excess market return is positive at every chosen quantile. However, the impact of the size premium and value premium varies considerably between different quantiles and portfolios. In general, with respect to the firm size, the size premium has a positive correlation with the return of small-cap stock portfolio (SL, SM, SH) at every quantile and has a negative impact on the return of big-cap stock portfolio (BL, BM, BH). Thus, investors should take the firm size into consideration before making any investment decision. Although investing in companies with big capitalization is a safe decision, it cannot create satisfactory return. In contrast, a portfolio with small-cap stocks can offer a higher return to the investor. Furthermore, to estimate the magnitude of the impact of firm size, the investor should also well note the portfolio return at different quantiles. With respect to the firm value factor, it is suggested that the investor consider the book-to-market value ratio in different portfolios at specific quantiles to have a wise investment.

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