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Comparison of the Capital Asset Pricing Model and the Three-Factor Model in a Business Cycle: Empirical Evidence from the Vietnamese Stock Market

Luong Tram Anh[*]

VNU University of Economics and Business, Vietnam National University, Hanoi, 144 Xuan Thuy, Cau Giay, Hanoi, Vietnan

Abstract: Using data from 2010 to 2019, for the first time, the Capital Asset Pricing Model (CAPM) and the Three-factor Model (TFM) are compared in different contexts of the Vietnamese economy (recession and recovery). This paper employs four tests including the t-test, determination coefficient R^2, Chow-test and GRS-test to examine the performance of the two models. Results show the superiority of the TFM over the CAPM in both contexts of the economy, consistent with Fama and French's studies. This promises that the TFM can be used to replace the CAPM in capturing the cost of equity. Another finding is that the two models tend to perform better in recession than recovery. This study contributes to the literature about asset-pricing models and their performances in different economic contexts. Moreover, the findings also offer insights into the use of the CAPM and TFM in developing countries in general and Vietnam, in particular.

Keywords: Capital asset pricing model, three-factor model, business cycle, developing countries.

1. Introduction

1.1. The Capital Asset Pricing Model (CAPM) and Fama-French Three-Factor Model (TFM)

The return is a fundamental factor that affects investment decisions on the stock market. There are many asset-pricing models to determine the variation in stock returns such as the APT model, Capital Asset Pricing Model (CAPM) and Fama-French Three-factor Model (TFM). One of the most important models is the CAPM. Being first introduced by Sharpe (1964) and then developed by Lintner (1965) and Jensen (1968), the CAPM has become one of the most popular asset-pricing models that address the risk-return trade off. Assumptions of this model are summarized as follows [1]:

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[*] Corresponding author.
   E-mail address: tramanh@vnu.edu.vn

i) "Mean-variance-efficiency": All investors make decisions depending on risk and expected returns only.

ii) Homogeneity of investor expectations: All investors have the same beliefs in investments (the expected values and the variance of expected returns).

iii) All investors can borrow and lend any risk-free assets and any risky securities regardless of the amount they borrow or lend.

iv) Capital markets are perfectly competitive. No transaction costs and taxes regardless of investors' investment and transactions.

v) All transactions are made at a certain time.

$$E(\tilde{R}_j - R_f = \alpha_i + \beta_j \left[E(\tilde{R}_M) - R_f \right] + \varepsilon_i \quad (1)$$

Where α_i = the intercept of regression, β_i = the slope of regression, ε_i = the random error; $\tilde{R}_M$ = returns on the market, R_f = free-risk return. In the test of the effectiveness of the CAPM, Fama and French (1992) observed the rate of returns on New York Stock Exchange (NYSE) stocks and concluded that this model could not explain returns between 1941 and 1990, especially between 1963 and 1990 [2]. Besides the risk premium, they added two other factors that influenced returns: the size (ME) and the book-to-market equity (BE/ME) of a company. Thus, the return was explained by three factors and the Fama-French model is:

$E(R_i) - R_f = \alpha_i + \beta_i[E(R_M) - R_f] + s_iSMB + h_iHML + \varepsilon_i$ (2)

Where β_i, s_i and h_i = the slopes in the time-series regression; ε_i = mean-zero regression disturbance; SMB (Small Minus Big) = 1/3 (Small Value + Small Neutral + Small Growth) - 1/3 (Big Value + Big Neutral + Big Growth) (This is the average return on three small portfolios minus the average return on three big portfolios); HML (High Minus Low) = 1/2 (Small Value + Big Value) - 1/2 (Small Growth + Big Growth) (It is the average return on two value portfolios minus the average return on two growth portfolios).

While the TFM is increasingly popular in capturing returns as well as calculating the cost of equity, the CAPM is still the most prevalent model in finance. The comparison between the two models has received a good deal of attention from researchers.

On the one hand, many studies in different periods show the superiority of the TFM over the CAPM. Data from the NYSE, AMEX and American/Canadian Stock Exchange (NASDAQ) between 1962 and 1989 indicated "negative conclusions about the roles of beta in average returns" (Fama and French, 1992) [2]. Research by Fama and French (1993) again proved the negative relation between size and average returns, as well as the strong positive relation between BE/ME and average returns [3]. Fama and French (1996) reaffirmed this conclusion when observing data from 1963 to 1993. They formed portfolios based on P/E, cash flow/price, sales growth and long-term past returns. Consequently, not only the GRS-statistic rejected the CAPM at the 99 per cent confidence level, but also the regression showed large average absolute pricing errors of the CAPM (three to five times greater than those of the TFM) [4]. Fama and French (1996) concluded that the TFM dominated on almost all portfolios except for portfolios formed on short-term past returns [4]. Malin and Ahlem (2007) also tested the two models on the Toronto Stock Exchange and showed that the TFM outperforms the CAPM because the generalized method of moments indicated a lower intercept of the TFM than the CAPM [5]. Furthermore, the sample determination coefficient also proved that the Fama-French model was more reliable. The conclusions of this study are consistent with Fama and French's findings (1992) that firms having a small size and a great BE/ME ratio seem to gain higher returns than those having a large size but a small BE/ME ratio [2]. Billou (2004) extended the Fama and French's study by examining a longer period from 1926 to 2003; however, the results are slightly different. There are two tests in this paper: first, tests on 25 portfolios sorted by size and book-to-market ratio; second, tests on 12 industry portfolios. While results from 25 portfolios support the

TFM, results from 12 portfolios show that the CAPM is better. In conclusion, Billou (2004) said that the Fama-French factors are firm specific; and the performance of the two models based on the type of portfolio grouping [6].

On the other hand, Bartholdy and Peare (2004) advocated the CAPM over the TFM [7]. This research considers two different market factors: The Center for Research in Security Prices (CRSP) Equal-Weighted Index and the Economy Index. Data was collected from the NYSE from 1975 to 1996. The sample determination coefficient of the regression showed that the CRSP Equal-Weighted Index provided the best estimating beta based on the CAPM. In the same way, Grauer and Janmaat (2009) ran data from 1963 to 2005 on the NYSE to compare the two models [8]. To reduce the problem of reduced beta spread, they used repacked 14 real world datasets from Ken French's website in four zero-weight datasets. Ordinary Least Squares (OLS) regression and General Least Squares (GLS) regression were employed to test whether positive slopes of excess returns on betas were rejected or not. As a result, in the tests of 14 standard datasets, the CAPM was supported in only one dataset compared to none for the TFM. In tests of the four repackaged datasets, the CAPM was again better with all positive coefficients (twice higher than the number of positive coefficients of the TFM).

Although there are many researches to discuss the effectiveness of the CAPM and the Fama-French model, the comparisons are mainly made over long periods. This has the potential to lead to inaccurate results because the performance of a company is significantly affected by the business environment. Hence, the intention of this study is to concentrate on the question whether the CAPM and the TFM display in different ways in recession and in recovery. The findings will contribute to the literature on asset-pricing models. Furthermore, studies in this field mainly focus on companies in developed countries; it is necessary to analyze these markets to know whether the two models perform in a different way from developed countries or not. I choose Vietnam because this is a typical developing country with a high growth rate and is a potential destination for both foreign and domestic investors. Identifying a suitable asset-pricing model for this market is important for making decisions about adding stocks to investors' portfolios. The methodology in this study can be a foundation for future studies to evaluate the two models in other developing economies. By updating data until September 2019, this study will provide comprehensive knowledge as well as empirical tests on these two models.

1.2. Economic Cycle

The purpose of this research is to compare the CAPM and the TFM in different business contexts in Vietnam. Therefore, it is necessary to review the literature on economic cycles.

An economic cycle (or business cycle) is alternating periods of recessions and expansions. It seems to be consistent with changes in Gross Domestic Product (GDP). Dow (1998) considered the business cycle in terms of the capacity rate of growth, which is "the rate of output growth at which unemployment tends to remain constant" [9]. Recession looms when the output growth rate falls below the estimated trend of capacity growth, and recovery starts when growth exceeds the capacity growth rate.

However, GDP and unemployment are the only measures to imply the economic cycle. There are a number of factors affecting the output growth rate. Chadha and Warren (2013) clarified the variation in output by considering four sets of residuals: labour supply, productive efficiency, investment and total expenditure [10]. The Economic Cycle Research Institute (ECRI) (2015) has a similar view of the business cycle. There are four variables relating to the business cycle including employment, income, productivity and sales. On occasion, one of these factors can dip, but no recession will occur despite a negative-output growth. Recession really occurs when the four measures all fall together [11].

Knoop (2015) expanded on studies by Chadha and Warren (2013) and ECRI (2015) by considering more indicators to describe an economic cycle, including: Expenditures, Net exports, Labor market variables, Inflation, Financial variables and Expectations. Of these, the unemployment rate and expectations are lagging countercyclical variables [12]. This is because when the economy starts to slow down (or make a recovery), a part of the total labour force can still get jobs (or be re-added by companies).

Turning to the length of an economic cycle, Knoop (2015) concluded that recession and recovery do not follow a regular pattern. The length of time of a recession is also different from that of an expansion [12]. Dow (1998) and Banerji, Layton and Achuthan (2012) agreed that recession could be typically shorter than expansion because an economy tends to take many years to improve to its previous level before the recession [9].

This paper is structured as follows: The first section is the Introduction, reflecting general understandings about the CAPM and the TFM and research problems, research aims and the contribution of this study. The next section provides information about the background of this study. The third section explains materials and methods. The results from three tests on the two models on the Vietnamese stock market are presented in the fourth section. The fifth section summarizes the findings of this paper. The last section gives recommendations for investors and financial managers in Vietnam.

2. The Background of the Study

2.1. The Vietnamese Economy

The Vietnamese economy started to be developed from the Doi Moi economic reform in 1986. Vietnam transformed from one of the low-income nations with a per capita income below $100, to a lower-middle-income country with a per capita income in 2018 of over $2500 [13]. According to Prime Minister Nguyen

Xuan Phuc in dialogue with leaders of multinational corporations on Viet Nam's economy at the World Economic Forum 2019, the Vietnamese economy has reached a high growth rate of 7.08%, making it one of the top growth performers in the region and the world [14]. Vietnam joined the World Trade Organization (WTO) in 2007 and became an official member of the ASEAN Economic Community (AEC) in 2015, making this market become more competitive. However, the Vietnamese economy still has faced many challenges with continuing domestic macroeconomic instability, changes in society and environment issues.

2.2. The Vietnamese Stock Market

Together with the banking system, the stock market plays important roles in allocating funds and supporting the liquidity of the economy. The first stock exchange was launched in 2000 and is known as the Ho Chi Minh City Stock Exchange (HOSE). This is the biggest stock exchange in Vietnam. The Vietnam Stock Index (VN-Index) is the capitalization-weighted index of all the companies listed on the HOSE. After 19 years of operation, the Vietnamese stock market has experienced a dramatic development in both volume and quality. The trading volume per day on the Vietnamese stock market increased rapidly from 4.2 million USD in July 2000, to about 120 billion in June 2019 [15].

3. Materials and Methods

3.1. Materials

For the aims of this study, the monthly returns of the VN-Index and 97 Vietnamese companies were collected from January 30, 2010 to September 30, 2019, obtained from Vndirect Securities Corporation's website. The validity and reliability of secondary data refers to the suitability of data and the reputation of data sources [16]. In terms of measurement validity, the sample includes 97 companies in Forbes's top 50 listed companies in Vietnam

between 2010 and 2019. Based on financial statements audited over five consecutive years, Forbes considers these companies as leading companies having typical features of good Vietnamese firms. Therefore, the data is relevant and suitable for the purpose of this study. In terms of reliability, the assessment is based on the organization providing data and the data collection technique [16]. The data studied was collected from Vndirect Securities Corporation's website. Vndirect was founded in 2006 and is a reputable financial corporation in Vietnam. They provide standardized information about all companies listed on the HOSE. Vndirect is in the Top 4 companies holding the largest market share in HOSE [17]. The information on the Vndirect's website is updated daily from companies' financial reports. Furthermore, regarding the reliability of results, the data was collected during approximately a 10-year period with a sample size of 118. Thus, the number of observations is sufficient to make statistical analysis such as doing regression and undertaking statistical tests. Excel software is employed for statistical analysis.

3.2. Method

Data collected is separated into two periods: the recession from January 2010 to December 2012 and the recovery from January 2013 to September 2019. The reason for splitting is to test whether the performance of the two asset-pricing models is influenced by business contexts.

For the purpose of this study, stocks are sorted monthly based on market value (ME) and book-to-market value (BE/ME). The ME breakpoints are the median of the ME of all securities studied; and the BE/ME breakpoints are the 30th and 70th percentiles (Fama and French, 2015) (Figure 1). As a result, there are six groups: S/L, S/M, S/H, B/L, B/M, B/H (Figure 1).

Time-series regressions are used to evaluate the effectiveness of the CAPM and the TFM. The change in the VN-Index is used as the market return (R_m). The three-month

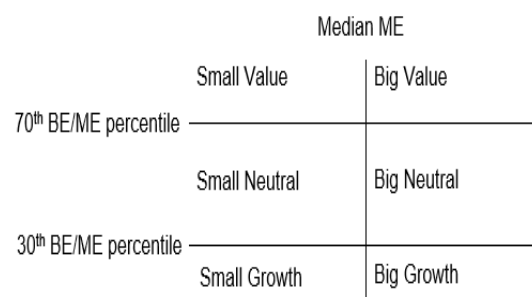Vietnamese Treasury Bill rate is the risk-free rate of interests (R_f).

Figure 1. Benchmark Portfolios.
Source: Fama and French, 2015 [18].

In this study three measures are concerned to compare the two models:

Firstly, the *t-statistic* is employed to test the hypotheses about intercepts and slopes in each single regression. The null hypotheses that each intercept or each slope equals to zero is rejected if the absolute value of the t-statistic is bigger than the critical t value at the $\alpha/2$ level of significance.

$$|t| = \left|\frac{\hat{\alpha}}{se(\hat{\alpha})}\right| > t_{\alpha/2,df} \; ; |t| = \left|\frac{\hat{\beta}_i}{se(\hat{\beta}_i)}\right| > t_{\alpha/2,df}$$

Secondly, the *coefficient of determination (R^2)* is also used to explain the relationship between dependent and independent variables because it implies the explanatory power of factors in describing average returns. The better model should have higher R^2.

The third measure to evaluate the performance of the two models is the *Chow-test*. Due to the ability to test the joint significance of regression coefficients, the Chow-test is also employed to test whether a set of slopes equals to zero in economics. In this study, the S/L portfolio is considered as the base category. There are five dummy variables relating to five portfolios (the S/M, S/H, B/L, B/M and B/H group). The equation i) of the CAPM and equation ii) of the TFM are developed into equation iii) and iv) by adding dummy variables, respectively. To be simple, the intercepts of equation iii) and iv) are noted in terms of α_i.

$$E(\tilde{R}_j) - R_f = \alpha_i + \beta_i X_M + \lambda_1 D_1 X_M +$$

$$\lambda_2 D_2 X_M + \lambda_3 D_3 X_M + \lambda_4 D_4 X_M +$$

$$\lambda_5 D_5 X_M + \varepsilon_i \quad (3)$$

And

$$E(\tilde{R}_j) - R_f = \alpha_i + \beta_i X_M + s_1 SML +$$

$$h_i HML + \lambda_1 D_1 X_M + \lambda_2 D_2 X_M +$$

$$\lambda_3 D_3 X_M + \lambda_4 D_4 X_M + \lambda_5 D_5 X_M +$$

$$\gamma_1 D_1 SMB + \gamma_2 D_2 SMB + \gamma_3 D_3 SMB +$$

$$\gamma_4 D_4 SMB + \gamma_5 D_5 SMB + \delta_1 D_1 HML +$$

$$\delta_2 D_2 HML + \delta_3 D_3 HML + \delta_4 D_4 HML +$$

$$\delta_5 D_5 HML + \varepsilon_i \quad (4)$$

Where X_M is excess returns on the market portfolio over the risk-less portfolio:

$$\left(X_M = \beta_j \left[E(\tilde{R}_M) - R_f \right] \right).$$

D_1 is dummy variables for the S/M portfolio: D_1 is equal to 1 if the observation relates to the S/M portfolio, 0 otherwise. Similarly, $D_2, D_3, D_4 \ and \ D_5$ are respectively for the S/H, B/L, B/M, and B/H. $\lambda_i, \gamma_i \ and \ \delta_i$ are coefficients that represent the extra overhead returns on the S/M, S/H, B/L, B/M, B/H portfolio relative to the returns on the S/L portfolio due to the effect of the market factor, size factor and BE/ME factor, respectively. To test for the joint significance of slopes in equation i) and ii), the null hypothesis of equation iii) (H₀: $\lambda_i = 0$ and the null hypothesis of equation iv) (H₀: $\lambda_i = \gamma_i = \delta_i = 0$ are tested by an F-test. H₀ will be rejected if the value of the F-statistic is higher than the critical value of F(k-1, n-k) with k is the number of independent variables and n is the number of observations (Dougherty, 2011). This means all factors contribute to the explanation of returns. In this case, the greater the F-test, the better the model performs.

Fourthly, a **GRS-test** is employed to test whether the intercepts in equations i) and ii) are jointly zero or not. Gibbons, Ross and Shanken (1989) assumed that disturbance terms for portfolio i in period t are jointly normally distributed each period with $E(\varepsilon_{it}) = 0$ and $E(\varepsilon_{it}, \varepsilon_{it}) = \sum$, and the error terms are serially uncorrelated $(\text{cov}(\varepsilon_{it} r_{pt}) = 0)$ [19]. The GRS-statistic for the regression with T observations, N portfolios and L independent variables is that

$$J = \frac{T - N - L}{N} (1 + \bar{r}_p ' \hat{\Omega}^{-1} \bar{r}_p)^{-1} \hat{\alpha}_0 ' \hat{\Sigma}^{-1} \hat{\alpha}_0$$

Where $\bar{r}_p$ = the factor mean vector; $\tilde{\Omega}$ = the unbiased estimate of the covariance matrix of the factors; $\hat{\alpha}_0$ = the least squares estimator for α_0 based on the N regression equations; $\hat{\alpha}_p ' \equiv (\hat{\alpha}_{1p}, \hat{\alpha}_{2p}, ..., \hat{\alpha}_{Np}); \hat{\hat{\Sigma}}$ = the unbiased residual covariance matrix

In the scope of this study, there are six portfolios and one independent variable for the CAPM and three independent variables for the TFM. The GRS-statistic has a central F distribution under the null hypothesis with degrees of freedom of N and (T - N - L) (Gibbons et al, 1989). The greater value of the J-statistic is more unlikely to imply the zero value of all intercepts, and the model has poor performance.

4. Results

4.1. Splitting Period

The study attempts to split the period from January 2010 to September 2019 to assess the effectiveness of the two asset-pricing models in different economic contexts.

The change of the GDP is the primary factor that is used to describe a business cycle [11]. As can be seen from Figure 2, there were declines in the percentage change of the real GDP from 6.42% in 2010 to 5.25% in 2012. In contrast, from 2013 onwards, the percentage change in real GDP has experienced an upward trend. Based on the definition of ECRI, the change in the real GDP indicates that the Vietnamese economy

experienced a recession from 2010 to 2012 and a recovery from 2013 to 2018.

However, the GDP indicator is not sufficient to describe an economy. There are six main indicators to split the period: i) Expenditures and net exports, ii) Labour market variables, ii) Inflation, iv) Financial variables, v) Capacity and productivity and vi) Expectations (Knoop, 2015). Figures 3, 5, 6, 7 and 8 show an improvement of the Vietnamese economy after 2012. Firstly, after experiencing a downtrend from 2010 to 2012, investment increased significantly to over 1,500,000 billion VND in September 2019 (Figure 3).
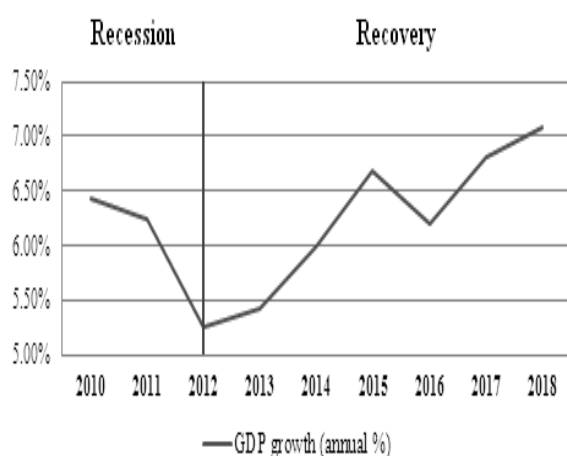

Figure 2. Vietnam's GDP growth
from 2010 to 2018.
Source: General Statistics Officer, Vietnam.

Secondly, Figure 5 shows that the unemployment rate declined from 2010 to 2012, then slightly increased again from 2013. According to Knoop (2015), the unemployment rate is a lagging countercyclical variable, so it tends to grow after recession. Thirdly, from 2012 onwards, the Vietnamese government has been successful in controlling inflation, creating a good environment for doing business in Vietnam (Figure 6). Together with curbing inflation, interest rates also remained around 6 percent from 2015 to 2019, which were considerably lower than the number in 2011 (Figure 7). This policy aims to support

sustainable development of the Vietnamese economy. Finally, "expectation" which is illustrated by the Consumer Confidence Index, declined from 2011 to 2014. This is because expectation is a lagging indicator, so recession from 2010 to 2012 affected consumer expectation after 2012. After that, the recovery of the economy contributed to an increase in the degree of optimism on the Vietnamese market (Figure 8).

In conclusion, almost all of the indicators above (except for net exports) confirm that the Vietnam economy experienced a business cycle from 2010 to 2019. To specify, there was a recession from 2010 to 2012 and a recovery from 2013 to 2019. This is consistent with findings by Dow (1998) about the length of recession and recovery.

4.2. Results of Regression

Based on the conceptual framework, the linear regression analysis is run in order to generate a detailed discussion about the effectiveness of the CAPM and the TFM. The results are for the regressions on the six portfolios formed on size and the book-to-market equity of 97 companies. The outputs for the recession and recovery are presented in Table 1 and Table 2, respectively (Table 1).

Regarding the CAPM, regressions for 97 companies in the recession shows that all intercepts are roughly zero. Moreover, almost all of absolute values of the t-test of alphas are small between 0.0383 to 2.3603, except for the S/L portfolio where the absolute values of the t-test is 3.5651. In addition, the absolute values of betas smaller than 1 illustrates that returns on all portfolios studied were less volatile than the market portfolio. The coefficients of determination R^2 are smaller than 50% in four out of six regressions.

Although the TFM also has approximately zero intercepts, its absolute value of t-test is slightly higher than the CAPM in each

portfolio. Furthermore, in terms of the slopes, betas are lower than 1; while the *s* tends to be positive in small capitalization portfolios and negative in big capitalization portfolios. This indicates that small stocks tend to have greater

returns than big stocks. Another noticeable characteristic is that all R^2 coefficients are considerably high in the TFM compared to those of the CAPM (Table 2).
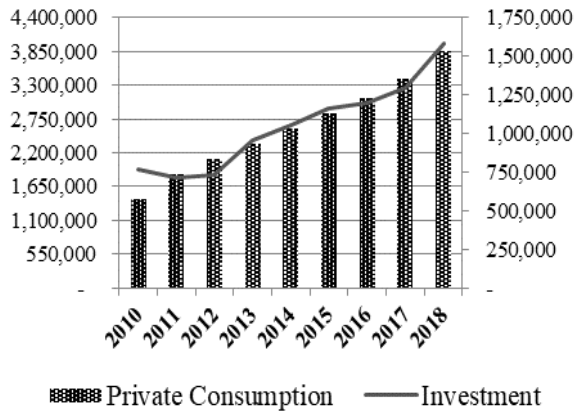

Figure 3. VN consumption (Bil VND).
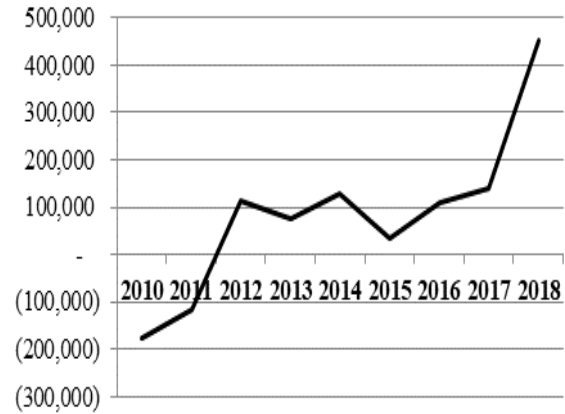*Source:* Moody's Analytics.

Figure 4. VN net exports (Bil VND).
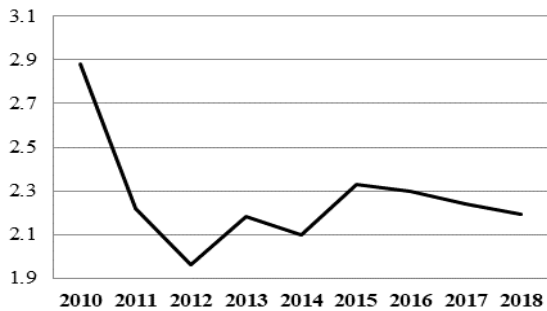*Source:* Moody's Analytics.

Figure 5. Total unemployment rate.
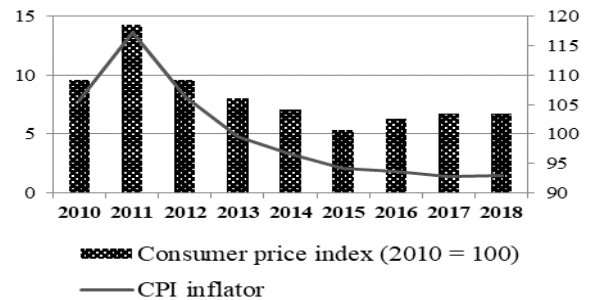*Source:* General statistics office of Vietnam.

Figure 6. Inflation.
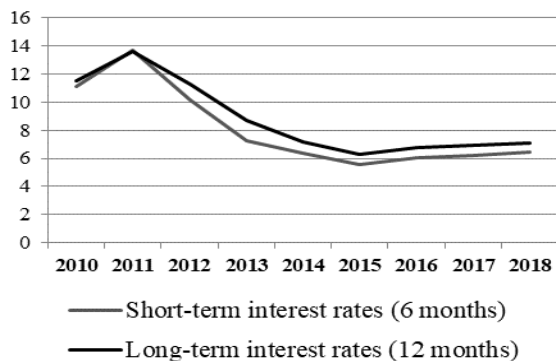*Source:* General statistics office of Vietnam.

Figure 7. Interest rates.
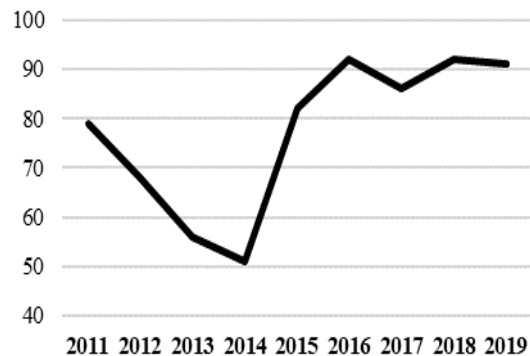*Source:* Asian Development Bank - ADB.

Figure 8. Consumer Confidence Index.
Source: Infocus Mekong Research.

Table 1. CAPM and TFM regressions for the recession (2010 - 2012)

Portfolio		CAPM (1) $E(\tilde{R}_j) - R_f = \alpha_i + \beta_j[E(\tilde{R}_M) - R_f] + \varepsilon_i$			TFM (2) $E(R_i) - R_f = \alpha_i + \beta_i[E(R_M) - R_f] + s_i SMB + h_i HML + \varepsilon_i$				
		α	β	R²	α	β	s	h	R²
Small, Low	Value	-0.0348	0.6501	63.47%	-0.0230	0.7442	0.6677	-0.1820	76.91%
	t(α)	(-3.5651)	(7.5727)		(-2.6947)	(10.050)	(4.0828)	(-1.6952)	
Small, Medium	Value	0.0191	-0.6679	58.15%	0.0255	-0.6573	0.3625	0.2712	66.54%
	t(α)	(1.7017)	(-6.7709)		(2.3210)	(-6.8690)	(1.7153)	(1.9549)	
Small, High	Value	0.0281	0.3363	23.81%	0.0253	0.2474	-0.1612	0.6480	61.92%
	t(α)	(2.3603)	(3.2117)		(2.7373)	(3.0799)	(-0.9089)	(5.5666)	
Big, Low	Value	0.0383	0.2044	6.02%	0.0196	0.1685	-1.0503	-0.7370	78.61%
	t(α)	(2.3973)	(1.4537)		(2.3433)	(2.3143)	(-6.5329)	(-6.9845)	
Big, Medium	Value	-0.0023	-0.0531	0.58%	-0.0207	-0.1529	-1.0379	-0.1422	46.26%
	t(α)	(-0.1650)	(-0.4378)		(-1.8621)	(-1.5800)	(-4.8570)	(-1.0136)	
Big, High	Value	-0.0283	-0.1171	1.35%	-0.0253	-0.2474	0.1612	1.3520	82.21%
	t(α)	(-1.4257)	(-0.6721)		(-2.7373)	(-3.0799)	(0.9089)	(11.613)	
Mean absolute value of R²			26%		69%				
Chow-test		31.0528			38.3783				
GRS-test		4.0724			3.6375				

Source: Author's calculation.

Table 2. CAPM and TFM regressions for the recovery (2013-2019)

Size, BE/ME		CAPM (1) $E(\tilde{R}_j) - R_f = \alpha_i + \beta_j[E(\tilde{R}_M) - R_f] + \varepsilon_i$			TFM $E(R_i) - R_f = \alpha_i + \beta_i[E(R_M) - R_f] + s_i SMB + h_i HML + \varepsilon_i$				
		α	β	R²	α	β	s	h	R²
Small, Low	Value	-0.0277	0.3054	14.05%	-0.0159	0.6480	0.6721	-0.3102	51.72%
	t(α)	(-5.5412)	(3.5943)		(-3.8107)	(8.0026)	(6.3375)	(-3.5881)	
Small, Medium	Value	0.0180	-0.6635	60.06%	0.0254	-0.4650	0.4522	0.1250	70.83%
	t(α)	(5.0438)	(-10.900)		(7.4413)	(-7.0296)	(5.2191)	(1.7691)	
Small, High	Value	0.0174	0.3836	13.32%	0.0202	0.4105	0.2588	0.9729	61.36%
	t(α)	(2.6910)	(3.4847)		(4.1855)	(4.3918)	(2.1144)	(9.7484)	
Big, Low	Value	0.0269	0.6099	38.95%	0.0191	0.4210	-0.5176	-0.5407	63.28%
	t(α)	(5.3265)	(7.0994)		(4.3654)	(4.9685)	(-4.6645)	(-5.9768)	
Big, Medium	Value	0.0082	0.2981	6.90%	-0.0146	-0.3184	-1.4015	-0.3721	65.46%
	t(α)	(1.1384)	(2.4196)		(-2.9669)	(-3.3367)	(-11.214)	(-3.6521)	
Big, High	Value	-0.0142	-0.1913	3.27%	-0.0202	-0.4105	-0.2588	1.0271	61.83%
	t(α)	(-2.0693)	(-1.6344)		(-4.1855)	(-4.3918)	(-2.1144)	(10.2908)	
	Mean absolute value of R2			23%					62%
Chow-test		27.316			41.439				
GRS-test		41.184			39.020				

Source: Author's calculation.

For the CAPM, all intercepts are nearly zero. However, only two out of six intercepts have the absolute value of the t-test smaller than 2.639, indicating that only two alphas are significant at the 99 percent level. Besides, many portfolios are positive to the market factor. Additionally, almost all R^2 coefficients are lower than 50%, implying that the market factor accounts for less than 50 percent in the variation of stock returns in the Vietnamese stock market.

Next, the TFM has all intercepts of zero, but none of them having a t-test smaller than 2.640. The Size effect again appears in this time, when small stocks still seems to have higher returns than big stocks. However, the Value effect is not significant.

5. Discussion

5.1. Discussion about the Effectiveness of the CAPM and the TFM in the Recession

- T-test: In terms of intercepts, if the model performs well, its intercept should be zero with the low value of the t-test. This is because the null hypothesis that the intercept equals to zero cannot be rejected. Looking at the t-statistics of the alphas, the performances of the two models are also similar. The 1 percent critical values of t-tests for the alphas of the CAPM and the TFM are 2.728 (df = 34) and 2.738 (df = 32), respectively. For five CAPM regressions, the null hypothesis (H_0: α=0) cannot be rejected at a 99 percent confidence interval. That implies the fact that the market factor can explain the variation in returns on give stock portfolios. When it comes to the TFM, all regressions having the null hypothesis cannot be rejected at the same level. Therefore, there is no considerable difference between the numbers of regressions having the null hypothesis that cannot be rejected in the two models (five compared to six). In other words, the CAPM and the TFM have similar performance if the value of intercepts and their t-statistics are used as the guideline.

In respect to the slopes of regression, if the model is more effective, its slopes should drift further away from zero with a high value of t-test. This is because the further slopes stray away from zero, the more the factor examined influences the stock returns. As can be seen from Table 1, while all portfolios with small businesses have t-tests higher than critical values at a 99 percent confidence interval, portfolios with big companies have t-tests smaller than the critical values. That means the size of a company can influence the confidence of asset-pricing models.

- Determination coefficient R^2: While the R^2 for the CAPM ranges between 0.58% and 63.47%, the R^2 for the TFM ranges between 46.26% and 82.21%. Examining each portfolio, the R^2 for the TFM is greater than those for the CAPM. For example, the CAPM regression of the S/L portfolio is 14.05%, and the number for the TFM regression is 51.72%. This shows that in recession, the variance of returns can be explained better by the set of three factors than by one factor only.

- Chow-test is to test for the joint significance of the slopes. The better model will have the null hypothesis that slopes are jointly equal to zero is rejected, because that means factors examined have a significant influence on stock returns. Table 1 shows that the TFM demonstrates to be a more effective model than the CAPM, showing a greater F-test than the CAPM (38.3783 compared to 31.0528).

- GRS-test: This test is to examine the hypothesis that all intercepts for a set of portfolios are jointly equal to zero. The better model will have a smaller GRS-statistic because all zero intercepts means that the model selects a correct proxy (or proxies) to describe returns on stocks. The tests for the recession indicate that the CAPM underperforms the TFM. This is illustrated by a value of 4.0724 of the GRS-test for the CAPM as compared to 3.6375 of the GRS-test for the TFM. This result is the same as the result from the Chow-test and R^2 coefficients.

In short, by examining the data on the 97 Vietnamese companies between January 2010

and December 2019, it is found that the TFM is superior to the CAPM in recession. In other words, the set of three factors (market factor, size factor and value factor) can provide a more accurate explanation for the variation in stock returns than the market factor only.

5.2. Discussion about the Effectiveness of the CAPM and the TFM in the Recovery

- T-test: T-statistics of the alphas do not support either the CAPM or the TFM. The 1 percent critical values of t-test for the alphas of the CAPM and the TFM are 2.639 (df = 80) and 2.640 (df = 78), respectively. T-tests cannot reject the null hypothesis (H_0: $\alpha=0$) in two out of six CAPM regressions at a 1 percent level. Regarding the TFM, the t-test rejects the null hypothesis in all portfolios. That means both a set of three factors of the Fama-French model and one factor of the CAPM cannot explain accurately the variation in all stock returns of 97 Vietnamese companies in recovery.

- Determination coefficient R^2: The Determination coefficient shows that three factors can explain returns better than one factor. To be more precise, regarding the TFM, all determination coefficients for 6 portfolios are higher than 50%. In contrast, regarding the CAPM, five out of six determination coefficients are lower than 50%. For this period, the highest R^2 of the CAPM regressions is merely 60.06% for the B/M portfolio. Thus, the TFM captures the variation in stock returns on the Vietnamese companies better than the CAPM does in recovery.

- Chow-test: Using the Chow-test as a measure to compare the effectiveness of the two models, the TFM is again considerably better than the CAPM. This is illustrated in Table 2 where the Chow-test for the Fama-French model is 41.439, but that for the CAPM is 27.316. This is similar to conclusions that are drawn from the comparison of the determination coefficient R^2.

- GRS-test: Together with the determination coefficient and the Chow-test, the GRS-test also indicates that the TFM is the better model in

recovery. The GRS-test for the TFM is 39.020, smaller than the value 41.184 for the CAPM. This implies that intercepts of the TFM are more likely to be jointly zero than the CAPM; or correct proxies are selected to capture stock returns by using the TFM.

Overall, the findings again emphasize the effectiveness of the TFM when explaining the variation in stock returns during the 2013-2019 period. In other words, the combination of market, size and the BE/ME factor has significant impact on returns on Vietnamese stocks in both recession and recovery. This finding is consistent with findings by Malin and Ahlem (2007) and Billou (2004). However, this study conflicts with the findings of the researches by Bartholdy and Peare (2004) and Grauer and Janmaat (2009). The Bartholdy and Peare research and the Grauer and Janmaat research indicate that the CAPM is the better tool to capture average returns, while the results of this study support the TFM. This can be due to the difference in the empirical evidence of the studies. Thus, it is concluded that the effectiveness of the two models depends on the market studied.

5.3. Comparison the CAPM and the TFM in the Recession and Recovery

Table 3 shows the comparison of four tests on the two models in recession and recovery. The most outstanding feature is that the two asset-pricing models tend to capture returns in recession better than in recovery. Although t-tests for alpha support neither the CAPM nor the Fama-French model in recovery, other tests show that both models are more superior in the 2010-2012 period than in 2013-2019 period.

Although this study has provided insights into the effectiveness of the CAPM and TFM, it cannot avoid several limitations. Firstly, due to limited time, this study focuses on the Vietnamese stock market in one economic cycle from 2010 to 2019. Since a developing economy has different characteristics compared to a developed economy, the findings of this study cannot be applied to any other country.

Moreover, to some extent, the research may not represent exactly the performance of the two models because each type of economy is different. Further studies can extend the size of the sample. Secondly, there are two methods to evaluate asset-pricing models. These are, assessment based on stock returns and

assessment based on the cost of capital. However, this study only focuses on stock returns. As a result, the assessment of the effectiveness of asset-pricing models based on the cost of capital can be the future method in further studies.

Table 3. The comparison of two models between recession and recovery

		2010-2012 recession		2013-2019 recovery	
		CAPM	TFM	CAPM	TFM
T-test	Intercepts (the number of regressions having the null hypothesis (H_0: $\alpha = 0$) that cannot be rejected at 99 percent confidence)	5	6	2	0
	Beta (the number of regressions having the null hypothesis (H_0: $\beta = 0$) that can be rejected at 99 percent confidence)	3	3	4	6
Mean absolute value of R^2		26%	69%	23%	62%
Chow-test		31.058	38.378	27.316	41.439
GRS-test		4.0724	3.6375	41.184	39.020

Source: Author's calculation.

6. Recommendations

This study has several important practical implications and recommendations for investors and managers in using asset-pricing models to explain and predict returns on stock markets in different business contexts.

Firstly, although the TFM cannot completely replace the CAPM, this model becomes more and more popular and demonstrates its superiority. As discussed above, the CAPM with the market factor alone can partly capture returns on the Vietnamese stock market. However, going back to the findings of Fama and French (1992), the size factor and the BE/ME factor also have a huge influence on average returns. The results of this research are consistent with Fama and French's findings, so a set of three factors should be used to describe returns accurately. Investors and managers should follow the change of a company's market capitalization together with the stock price to make a correct investment decision. However, it is noticed that the findings of this study do not reject the CAPM;

the findings only recommend the use of the TFM in financial economics.

Secondly, both the CAPM and TFM perform in recession better than in recovery. Hence, the findings suggest that investors and managers should employ these models to capture the variation in returns or calculate the cost of capital in the downturn of the economy. In recovery, together with market, size and the BE/ME factor, other factors such as term premiums, default premiums and the reputation of companies should be considered to describe returns.

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