THE STUDY OF FIVE-FACTOR ASSET PRICING MODEL ON THAILAND STOCK MARKET: EVIDENCE FROM A NEW PRICE IMPACT RATIO

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ABSTRACT

This paper examines the role of liquidity in stock returns in a Thai stock market. Using the five-factors include the market factor (market risk premium, MKT), the size factor (small market capitalization minus big market capitalization, SMB), the book-to-market factor (high book-to-market equity ratio minus low book-to-market equity ratio, HML), the momentum factor (winners minus losers, WML) and liquidity factor (LIQ). Our data cover stocks traded in the Stock Exchange of Thailand (SET100) from April 2002 to March 2013. Monthly excess stock returns are computed from nine testing portfolios based on size and book-to-market ratios. Time series regressions following Fama and French (1992) are employed to test the five-factor model on these nine testing portfolios.

The test result shows that the Gibbons-Ross-Shanken (GRS) statistic reject the null hypothesis of zero alphas (risk-adjusted excess return) in every model. However, the five-factor model has the most adjusted-R^2 value compare to other models. In conclusion, the five-factor model is the best model to explain stock returns in Thai stock market. The result also shows that the momentum factor is not found to be priced.

KEY WORDS: Fama-French's three factor model / Carhart's four factor model / Amihud's liquidity / Asset pricing / Thai stock return

39 pages

CONTENTS

LIST OF TABLES

LIST OF TABLES (cont.)

LIST OF FIGURES

CHAPTER I
INTRODUCTION

1.1 Problem Statement and Its Importance

In the present situation of financial market, liquidity plays an important role in influencing asset prices. Investors face liquidity risk when they transfer ownership of their securities. Therefore, investors consider liquidity to be an important factor when making their investment decisions. Liquidity as the key factors of asset is easy to notice; however, it is difficult to define. Thus, the issue of liquidity in asset pricing has become the issue that attracted considerable attention from researchers during past two decades.

Amihud and Mendelson (1986) conducted a study to investigate the role of liquidity in asset pricing by using the bid-ask spread as a measure for illiquidity. They found a positive relation between expected return and illiquidity.

Next, Datar, Naik, and Radcliffe (1998) introduced turnover ratio as a new liquidity measure and showed that they are fine substitutes.

Amihud (2002) introduced a study used stock return to dollar volume ratio as a proxy for illiquidity in explaining liquidity factor. Then, Acharya and Pedersen (2005) developed a liquidity based capital asset pricing model (LCAPM) based on Amihud's study (2002). Later, many studies adapted Amihud's liquidity theory into Fama-French model which is widely used in USA and developed countries. All studies support Amihud's study that illiquid stock yield a higher return than liquid stock, which also known as "Liquidity premium".

Empirical evidence on the liquidity–return relation mainly investigated in US and developed countries markets. However, the study of this relation in emerging markets is still rarely discovered. Therefore, this study will investigate the relation of liquidity and return in Stock Exchange of Thailand (SET) which is emerging market. The main aim of this study is to investigate whether liquidity has significant effect on stock returns in Thailand stock market.

This study will employed the traditional CAPM model, Fama-French three factor model, Carhart four factor model and Liquidity five factor model to investigate the role of liquidity in Thai stock returns. The data used in this study is 100 listed stocks (SET100 Index) from April 2002 – March 2013.

CHAPTER II
LITERATURE REVIEW

2.1 Theories

2.1.1 Capital Asset Pricing Model (CAPM)

The CAPM model proposed by Sharpe (1964) is used to explain an expected return on securities. It suggested that asset with higher risk will give a higher return. However, not all risks affect the return since risks can be reduced by forming a well-diversified portfolio. Therefore, the total risk (which is measured by standard deviation of return) will be eliminated to the only non-diversifiable risk, known as "Systematic risk" (which is measured by beta coefficient). The CAPM is defined by the following equation.

$$E(R_i) - R_f = \alpha_i + \beta_i (R_m - R_f) \quad (1)$$

Where $E(R_i) - R_f$ is expected excess return of stock i, α_i is the intercept of the model.

β_i is a coefficient of systematic risk of stock i, and $R_m - R_f$ is market excess returns.

2.1.2 Fama-French Three-Factor Model

Fama and French (1992) argued that the beta coefficient alone is not enough to explain the expected return on securities. Therefore, the Fama–French model expand the CAPM by adding Size factor (which is measured by market capitalization) known as "Small Minus Big (SMB)" and Value factor (which is measured by book-to-market ratio) known as "High Minus Low (HML)" to the model. The result of their study showed that the three factor model can improve the explanatory power of the return. The three-factor model is defined by the following equation.

$$E(R_i) - R_f = \alpha_i + \beta_i (R_m - R_f) + s_i (SMB) + h_i (HML) \quad (2)$$

Where s_i is a coefficient of the Size factor, SMB is the difference between average returns of small capitalized stock portfolios and average returns of big capitalized stock portfolios, h_i is a coefficient of the Value factor, and HML is the difference between average returns of high book-to-market stock portfolios and average returns of low book-to-market stock portfolios.

2.1.3 Carhart Four-Factor Model

Carhart (1997) constructed four-factor model using Fama-French three-factor model plus an additional Momentum factor, known as "Winner Minus Loser (WML)" to explain the return of an asset. Carhart four-factor model is defined by the following equation.

$$E(R_i) - R_f = \alpha_i + \beta_i (R_m - R_f) + s_i (SMB) + h_i (HML) + w_i (WML) \qquad (3)$$

Where w_i is the coefficient of the Momentum factor, and WML is the difference between average returns of the winner stock portfolios and returns of the loser stock portfolios.

2.1.4 Amihud Five-Factor Model

To capture the liquidity effect, Lam and Tam (2011) employed the five-factor model, which is an extension model of Carhart four-factor model that include Amihud's liquidity factor. Their results revealed that liquidity is an important factor and adding liquidity factor to the model can improve the explanatory power of the stock's expected return .Amihud five-factor model can be written as the following equation.

$$E(R_i) - R_f = \alpha_i + \beta_i (R_m - R_f) + s_i (SMB) + h_i (HML) + w_i (WML) + l_i (\text{Amihud's LIQ}) \qquad (4)$$

Where l_i is the coefficient of liquidity factor, and Amihud's LIQ is the Amihud's liquidity factor.

2.1.5 FGK Five-Factor Model

Florackis, Gregoriou, and Kostakis (2011) argued that Amihud's liquidity factor (2002) has size bias because small stocks has higher Amihud's liquidity factor (Return to Volume ratio) than big stocks. This will forcing that small stocks will be more illiquid than big stocks. Then,Florackis et al. (2011) raised the return to turnover ratio which is free from size bias as a better measure instead of return to volume ratio. FGK five-factor model can be written as the following equation.

$$E(R_i) - R_f = \alpha_i + \beta_i (R_m - R_f) + s_i (SMB) + h_i (HML) + w_i (WML) + l_i (FGK\text{'s } LIQ) \quad (5)$$

Where l_i is the coefficient of liquidity factor, and FGK's LIQ is the Florackis, Gregoriou and Kostakis's liquidity factor.

2.2 Empirical Studies

Eleswarapu and Reinganum (1993) repeated Amihud and Mendelson's study (1986) by employing an updated period using NYSE firms. The study found the positive return of illiquidity relation and found that size effect is significant. They also found that the relationship between bid-ask spreads and return of assets is limited to the January.

Petersen and Fialkowski (1994) found that according to their study, bid-ask spread is a poor proxy for liquidity. Because of difficulty of obtaining bid-ask spreads over the long periods, Lead to the usage of alternative measures of liquidity.

Datar et al. (1998) used turnover ratio (number of shares traded divided by number of shares outstanding) to measure liquidity. The evidence showed that liquidity plays an important role in explaining stock return in NYSE firms.

Amihud (2002) used illiquidity ratio, which is the average across stocks of daily ratio of absolute return to volume, to measure liquidity factor. The advantage of using this ratio is to obtain the long periods of data more easily. The result showed that small firm stocks has more illiquidity than big firms. The result also found that illiquid stocks has higher return than liquid stocks.

Acharya and Pedersen (2005) added Amihud's liquidity factor to the CAPM model to examine the expected stock return of NYSE and AMEX. They found that their model significantly developed the performance of the traditional CAPM.

Liu (2006) introduced new liquidity measure, which is the standardized turnover-adjusted number of zero daily trading volumes, to investigate the role of liquidity in NYSE, AMEX and NASDAQ. The result showed that liquidity is an important source of priced risk.

Keene and Peterson (2007) employed six liquidity measures to examined the return-liquidity relation and found that liquidity is important factor in stock returns.

Nguyen et al. (2007) investigated the role of liquidity on returns by employing liquidity factor to the traditional CAPM and the Fama-French. The data used in the study are NYSE and AMEX. The results support Amihud and Mendelson's study in that liquidity is significantly an important aspect in pricing returns after taking all the factor models into account.

Chan and Faff (2003) using turnover ratio as a liquidity factor to examined Australian stock markets return and stated that turnover ratio affected on stock returns.

Nguyen and Lo (2013) using a listed stocks in New Zealand market to study the relationship of asset returns and liquidity effect. They used Amihud's liquidity factor to measure the liquidity and found that liquidity has not seem to be priced in New Zealand stock market.

Marcelo and Quiros (2006) applied Amihud's liquidity factor to CAPM and Fama-French model to investigate the role of liquidity in Spanish stock market. They found that adding liquidity to the traditional model can significantly improve the explanatory power.

Lam and Tam (2011) investigated the role of liquidity in stock returns and found that liquidity is important factor for pricing returns in Hong Kong stock market. Their results supported Amihud and Mendelson's study (1986).

Ruzhe (2004) employed CAPM and Fama-French model to examine the stock return of Thailand stock market. The results confirmed that Fama-French model can explain the stock return better than CAPM.

CHAPTER III
MATERIALS AND METHODS

3.1 Econometric Method

To examine whether the asset pricing model can capture the expected stock returns, we will employ Fama and French's (1992) time-series regression to all equations (as shown in 2.1.1 – 2.1.5). Then, we will employ the Gibbons-Ross-Shanken (GRS) test (Gibbons, Ross and Shanken, 1989) to test all the pricing errors (intercepts). If the asset pricing model can explain the expected return completely, all the regression intercepts (α_i) should be jointly equal to zero (Cochrane, 2005).

3.2 Factors

3.2.1 Market Excess Return (MKT)

The market excess return (market risk premium, MKT) is an excess return of market portfolio over a risk-free rate of return. SET index data is used in this study as market portfolio, and its monthly return is calculated from the return that does not include dividends, share repurchases and others (due to the limitation of SETSMART database). The data used as a risk-free rate of return is one month yield to maturity (YTM) of T-bill at the beginning of each month.

3.2.2 Size Factor and Value Factor (SMB and HML)

In this study, we employ the data at the end of March of each year from March 2003 to March 2013 in constructing size and value factor. For constructing size factor, we rank all firms on size, measured by market capitalization (Stock price x No. of share outstanding) at the end of March. For constructing value factor, we rank all firms on book-to-market ratio (Book value per share of $\text{March}_{\text{year } t}$ / Stock price of $\text{December}_{\text{year } t-1}$) using fiscal year ending data.

The size factor is split by median into two groups: small stocks (S) and big stocks (B). The value factor is split into three groups: low (L), medium (M) and high (H) book-to-market ratio by using 30th and 70th percentiles as breaking point (stocks in L group are below 30th percentiles and stocks in H group are above 70th percentiles). Then, six portfolios are formed at the intersection of size and book-to-market ratio as shown in Figure 3.1.

As the market capitalization of each firm is not equal, the return of portfolio will calculated by using the weighted return known as "Value-weighted return". Six portfolios' monthly value-weighted return (that does not include dividend) is calculated each month over the 12 months followed portfolio formation. These six portfolios are annually rebalanced at the end of March.

Figure 3.1 SMB and HML Portfolios Formation

		Size (Market Capitalization)	
		S (50)	B (50)
B/M (Book-to-Market Ratio)	H (30)	SH	BH
	M (40)	SM	BM
	L (30)	SL	BL

Notes: S represents the securities group in the 50th percentile which has the small size of market capitalization.

B represents the securities group in the first 50th percentile which has the big size of market capitalization.

H represents the securities group in the first 30th percentile which has the high value of book-to-market ratio.

M represents the securities group in the 40th percentile which has the medium value of book-to-market ratio.

L represents the securities group in the 30th percentile which has the low value of book-to-market ratio.

SH represents the securities group which has the small size of market capitalization and high value of book-to-market ratio.

SM represents the securities group which has the small size of market capitalization and medium value of book-to-market ratio.

SL represents the securities group which has the small size of market capitalization and low value of book-to-market ratio.

BH represents the securities group which has the big size of market capitalization and high value of book-to-market ratio.

BM represents the securities group which has the big size of market capitalization and medium value of book-to-market ratio.

BL represents the securities group which has the big size of market capitalization and low value of book-to-market ratio.

SMB (Small Minus Big) is a size factor, measured by market capitalization. SMB is calculated by the difference between average returns of small stock portfolio (SH, SM and SL) and big stock portfolio (BH, BM and BL).SMBis calculated by the following equation.

$$SMB = \frac{1}{3}(r_{SL} + r_{SM} + r_{SH}) - \frac{1}{3}(r_{BL} + r_{BM} + r_{BH})$$

Where r_{SL}, r_{SM}, r_{SH}, r_{BL}, r_{BM}, and r_{BH} are return of SL, SM, SH, BL, BM, and BH portfolio respectively.

HML (High Minus Low) is value factor, as measured by book-to-market ratio. HML is the difference between average returns of high book-to-market stock portfolio (SH and BH) and low book-to-market stock portfolio (SL and BL).HML is calculated by the following equation.

$$HML = \frac{1}{2}(r_{SH} + r_{BH}) - \frac{1}{2}(r_{SL} + r_{BL})$$

Where r_{SL}, r_{SH}, r_{BL}, and r_{BH} are return of SL, SH, BL, and BH portfolio respectively.

3.2.3 Momentum Factor (WML)

Calculating WML factor, we ranked stocks based on their past cumulative 11-month returns (does not include dividend), except one month. For example, we ranked the return of January to November last year.

Next, we monthly formed two portfolios (the winner and the loser). The winner portfolio includes 30 percent of stocks with the highest past return, while the loser portfolio includes 30 percent of stocks with the lowest past return as shown in Figure 3.2.

Figure 3.2 WML Portfolio Formation

Past cumulative 11-month return		
	Winner (30)	W
	(40)	-
	Loser (30)	L

Notes: W represents the securities group in the first 30th percentile which has the highest past cumulative 11-month return (Winner).

L represents the securities group in the last 30th percentile which has the lowest past cumulative 11-month return (Loser).

WML is the difference between average returns of the Winner stock portfolio and average returns of the Loser stock portfolio. WML is calculated by the following equation.

$$WML = r_W - r_L$$

Where r_W is return of Winner stock portfolio and r_L is return of Loser stock portfolio.

3.2.4 Amihud's Liquidity Factor (Amihud'sLIQ)

Similar to Lam and Tam's study (2011), Amihud's LIQ is constructed as followed. At the end of March each year, firms are sorted by size (market capitalization) and included in two portfolios (Small (S) and Big (B)). The same stocks are independently sorted into three portfolios according to their return-to-volume ratio (most illiquid, medium liquid, and most liquid).

The return-to-volume ratio proposed by Amihud (2002) is calculated by the following ratio

$$RtoV_{it} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{|R_{itd}|}{V_{itd}}$$

Where R_{itd} and V_{itd} are the daily return (does not include dividend) and monetary volume of stock i on day d at month t, respectively and D_{it} is the number of valid observation days in month t for stock i.

Six portfolios are then formed at the intersection of size and return-to-volume ratio as shown in Figure 3.3. The value-weighted monthly returns on the six portfolios are calculated each month over the 12 months following portfolio formation. These six portfolios are annually rebalanced at the end of March.

Figure 3.3 SMB and Return-to-Volume Ratio Portfolios Formation

		Size (Market Capitalization)	
		S (50)	B (50)
Return-to-Volume ratio	Most illiquid (30)	SL1	BL1
	Medium liquid (40)	SL2	BL2
	Most liquid (30)	SL3	BL3

Notes: S represents the securities group in the 50th percentile which has the small size of market capitalization.

B represents the securities group in the first 50th percentile which has the big size of market capitalization.

Most illiquid represents the securities group in the first 30th percentile which has the high value of return-to-volume ratio.

Medium liquid represents the securities group in the 40th percentile which has the medium value of return-to-volume ratio.

Most liquid represents the securities group in the 30th percentile which has the low value of return-to-volume ratio.

SL1 represents the securities group which has the small size of market capitalization and high value of return-to-volume ratio.

SL2 represents the securities group which has the small size of market capitalization and medium value of return-to-volume ratio.

SL3 represents the securities group which has the small size of market capitalization and low value of return-to-volume ratio.

BL1 represents the securities group which has the big size of market capitalization and high value of return-to-volume ratio.

BL2 represents the securities group which has the big size of market capitalization and medium value of return-to-volume ratio.

BL3 represents the securities group which has the big size of market capitalization and low value of return-to-volume ratio.

Amihud’s LIQ is the average of the returns on the low-liquidity stock portfolio minus the returns on the high-liquidity stock portfolio. Amihud’s LIQ is calculated by the following equation.

$$Amihud's\ LIQ = \frac{1}{2}(SL1 - SL3) + \frac{1}{2}(BL1 - BL3)$$

Where r_{SL1}, r_{SL3}, r_{BL1}, and r_{BL3} are return of SL1, SL3, BL1, and BL3 portfolio respectively.

3.2.5 Florackis, Gregoriou and Kostakis Liquidity Factor (FGK’s LIQ)

Similar to Lam and Tam’s study (2011), FGK’s LIQ is constructed as followed. At the end of March of each year, firms are sorted by size (market capitalization) and included in two portfolios (Small (S) and Big (B)). The same stocks are independently sorted into three portfolios according to their return-to-turnover ratio (most illiquid, medium liquid, and most liquid).

The return-to-turnover ratio proposed by Florackis et al. (2011) is calculated by the following ratio.

$$RtoTRit = \frac{1}{Dit}\sum\frac{|Ritd|}{TRitd}$$

Where R_{itd} and TR_{itd} are, respectively, the return (does not include dividend) and turnover ratio of stock i on day d at month t and D_{it} is the number of valid observation days in month t for stock i.

Six portfolios are then formed at the intersection of size and return-to-turnover ratio as shown in Figure 3.4. The value-weighted monthly returns on the six portfolios are calculated each month over the 12 months following portfolio formation. These six portfolios are annually rebalanced at the end of March.

Figure 3.4 SMB and Return-to-Turnover Ratio Portfolios Formation

		Size (Market Capitalization)	
		S (50)	B (50)
Return-to-Turnover ratio	Most illiquid (30)	SL1	BL1
	Medium liquid (40)	SL2	BL2
	Most liquid (30)	SL3	BL3

Notes: S represents the securities group in the 50th percentile which has the small size of market capitalization.

B represents the securities group in the first 50th percentile which has the big size of market capitalization.

Most illiquid represents the securities group in the first 30th percentile which has the high value of return-to-turnover ratio.

Medium liquid represents the securities group in the 40th percentile which has the medium value of return-to-turnover ratio.

Most liquid represents the securities group in the 30th percentile which has the low value of return-to-turnover ratio.

SL1 represents the securities group which has the small size of market capitalization and high value of return-to-turnover ratio.

SL2 represents the securities group which has the small size of market capitalization and medium value of return-to-turnover ratio.

SL3 represents the securities group which has the small size of market capitalization and low value of return-to-turnover ratio.

BL1 represents the securities group which has the big size of market capitalization and high value of return-to-turnover ratio.

BL2 represents the securities group which has the big size of market capitalization and medium value of return-to-turnover ratio.

BL3 represents the securities group which has the big size of market capitalization and low value of return-to-turnover ratio.

FGK's LIQ is the average of the returns on the low-liquidity stock portfolio minus the returns on the high-liquidity stock portfolio. FGK's LIQis calculated by the following equation.

$$FGK's\ LIQ = \frac{1}{2}(SL1 - SL3) + \frac{1}{2}(BL1 - BL3)$$

Where r_{SL1}, r_{SL3}, r_{BL1}, and r_{BL3} are return of SL1, SL3, BL1, and BL3 portfolio respectively.

3.3 Testing Portfolio Formation

Examining if the five-factor model can explain excess stock returns, we built testing portfolios or dependent variables. FollowingFama and French (1993), we use excess returns on value-weighted portfolios formed on the basis of size factor and value factor. The nine testing portfolios are shown in Figure 3.5.

Figure 3.5 Testing Portfolio Formation

		Size (Market Capitalization)		
		S (30)	N (40)	B (30)
B/M (Book-to-Market Ratio)	H (30)	TSH	TNH	TBH
	M (40)	TSM	TNM	TBM
	L (30)	TSL	TNL	TBL

Note: S represents the securities group in the 30th percentile which has the small size of market capitalization.

N represents the securities group in the 40th percentile which has the normal size of market capitalization.

B represents the securities group in the first 30th percentile which has the big size of market capitalization.

H represents the securities group in the first 30th percentile which has the high value of book-to-market.

M represents the securities group in the 40th percentile which has the medium value of book-to-market.

L represents the securities group in the 30th percentile which has the low value of book-to-market.

TSH represents the securities group which has the small size of market capitalization and high value of book-to-market.

TSM represents the securities group which has the small size of market capitalization and medium value of book-to-market.

TSL represents the securities group which has the small size of market capitalization and low value of book-to-market.

TNH represents the securities group which has the medium size of market capitalization and high value of book-to-market.

TNM represents the securities group which has the medium size of market capitalization and medium value of book-to-market.

TNL represents the securities group which has the medium size of market capitalization and low value of book-to-market.

TBH represents the securities group which has the big size of market capitalization and high value of book-to-market.

TBM represents the securities group which has the big size of market capitalization and medium value of book-to-market.

TBL represents the securities group which has the big size of market capitalization and low value of book-to-market.

We categorized stocks based on size into three groups (small, medium and big market capitalization) and on book-to-market ratio (high, medium and low book-to-market ratio). Stocks are separated and ranked into three groups according to a 30:40:30 partitions. Nine portfolios are then formed from intersections of three groups of size and three groups of book-to-market ratios. These nine portfolios are annually rebalanced at the end of March.

The portfolios' excess returns are monthly calculated on the basis of return index (which excludes the effects of dividends, share repurchases and others). The risk-free rate is measured by the one-month yield to maturity of Treasury bill at the beginning of each month.

3.4 DATA

The data employed in this study includes the stocks in SET100 Index (100 listed stock firms), which is rearranged annually from April 2002 to March 2013. This study only use SET100 Index to investigate the role of liquidity instead of all listed stocks because the SET100 Index has the same pattern of turnover ratio as overall stocks (as shown in Figure 3.6). Therefore, SET100 Index can represent the overall market in studying for the liquidity effect.

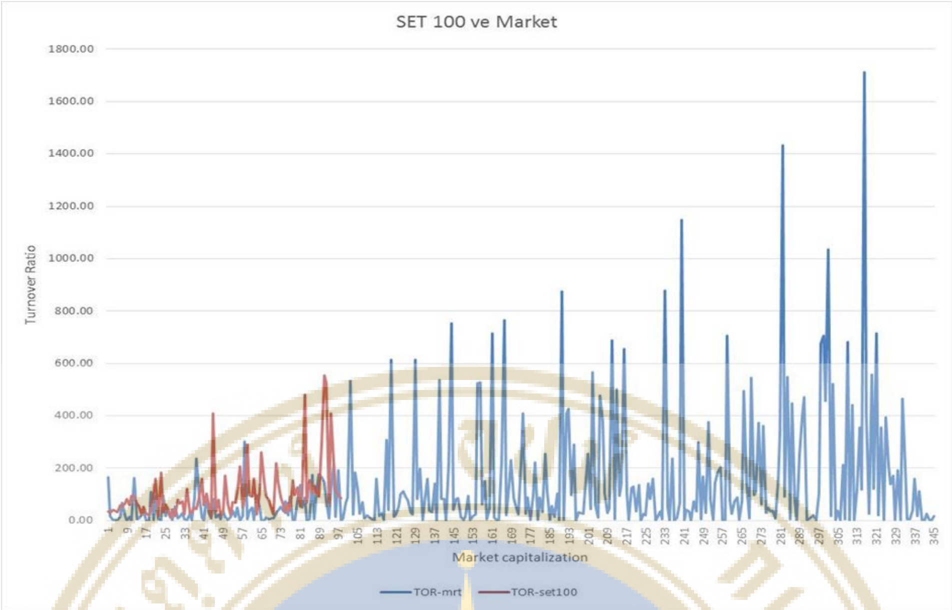

Figure 3.6 Turnover Ratio of SET100 Index and Overall Listed Stocks

The stock price data is obtained from SETSMART database. The risk-free rates are received from 1 month yield to maturity of T-bill at the beginning of each month, collected from the Thai Bond Market Association (TBMA) database.

3.5 DESCRIPTIVE STATISTICS

3.5.1 Factors

Table 3.1 reveals that average monthly excess return of the Big stock portfolio (High market capitalization) is higher than the Small stock portfolio (Low market capitalization) (1.785% vs. 1.098%). The result is contrast to those of North America and Japan market which big stock portfolios have less excess return the small stock portfolio. This is similar to the results from Europe, China and Asia Pacific market. (See Appendix)

The Growth stock portfolio (Low book-to-market ratio) has the higher average monthly excess return than the Value stock portfolio (High book-to-market ratio) (2.719% vs. 0.683%) which is different from other countries.

Table 3.1 Average Monthly Excess Return of Each Factor Portfolio

Portfolio	Percent per month		
	B	S	Avg.
H	0.964	0.402	0.683
M	1.496	0.351	0.924
L	2.896	2.542	2.719
Avg.	1.785	1.098	

Note: average monthly market excess return = 1.204%

Table 3.2 presents the risk of each portfolio, measured by standard deviation of monthly excess return. It shows that the big stock portfolio has lower risk than the Small stock portfolio (7.275% vs. 9.071%) which is alike to Asia Pacific market.

The Growth stock portfolio has higher risk than value stock portfolio (9.227% vs. 7.807%) which is similar to North America, Europe and Japan market.

Table 3.2 Standard Deviation of Monthly Excess Return of Each Factor Portfolio

Portfolio	Percent per month		
	B	S	Avg.
H	6.873	8.742	7.807
M	6.478	8.491	7.484
L	8.475	9.980	9.227
Avg.	7.275	9.071	

Note: standard deviation of monthly market excess return = 5.702%

Table 3.3 draws a comparison between each portfolio's performances on the risk-adjusted return basis measured by the Sharpe ratio. The result shows that the big stock portfolio ratio is higher than the Small stock portfolio (0.238 vs. 0.114). The Growth stock portfolio sufficiently exceeds the Value stock portfolio even on the risk-adjusted return.

Table 3.3 Sharpe Ratio of Monthly Excess Return of Each Factor Portfolio

Portfolio	B	S	Avg.
H	0.140	0.046	0.093
M	0.231	0.041	0.136
L	0.342	0.255	0.298
Avg.	0.238	0.114	

Note: sharpe ratio of monthly market excess return = 0.211

Table 3.4 presents an average monthly excess return, standard deviation of monthly excess return and Sharpe ratio of both Winner and Loser stock portfolios when compared to those of the market. The Winner stock portfolio has higher average monthly excess return than Loser stock portfolio (1.746% vs. 0.891%). Although, The Winner stock has a higher risk than Lower stock (7.935% vs. 7.603%) but the performances on the risk-adjusted return basis measured by the Sharpe ratio of the Winner stock portfolio clearly beat the Loser stock portfolios (0.22 vs. 0.117). The result in this table also shows there is difference in Sharpe ratio between the Winner portfolio and the market (0.220 vs. 0.211).

Table 3.4 Average Monthly Excess Return, Standard Deviation and Sharpe Ratio of Winner and Loser Portfolio

	W	L	Market
Average excess return	1.746	0.891	1.204
Standard deviation	7.935	7.603	5.702
Sharpe ratio	0.220	0.117	0.211

Note: percent per month, except unit of Sharpe ratio which has no unit

The result in Table 3.5 shows that most illiquid stock (High return-to-volume ratio) have a much higher average monthly excess return than that of most liquid stock (Low return-to-volume ratio). We also found that the risk (Which is showed in Table 3.6) of most illiquid stock portfolio is lower than most liquid stock portfolio (8.475% vs. 9.793%). Therefore, when measured risk-adjusted return by using Sharpe ratio (Table 3.7), most illiquid stock portfolio's performance clearly outperform most liquid stock portfolio (0.272 vs. 0.164). The results found in Table 3.5, 3.6 and 3.7, support the Amihud's (2002) and previous studies that Most illiquid stock will yield a higher return than most liquid stock, known as "Liquidity premium".

Table 3.5 Average Monthly Excess Return of Amihud's LIQ Portfolio

Portfolio	Percent per month		
	B	S	Avg.
L1	3.578	1.091	2.334
L2	2.103	1.103	1.603
L3	1.825	0.528	1.176
Avg.	2.502	0.907	

Note: average monthly market excess return = 1.204%

Table 3.6 Standard Deviation of Monthly Excess Return of Amihud's LIQ Portfolio

Portfolio	Percent per month		
	B	S	Avg.
L1	8.685	8.264	8.475
L2	7.886	9.965	8.925
L3	6.320	13.265	9.793
Avg.	7.631	10.498	

Note: standard deviation of monthly market excess return = 5.702%

Table 3.7 Sharpe Ratio of Monthly Excess Return of Amihud's LIQ Portfolio

Portfolio	B	S	Avg.
L1	0.412	0.132	0.272
L2	0.267	0.111	0.189
L3	0.289	0.040	0.164
Avg.	0.322	0.094	

Note: sharpe ratio of monthly market excess return = 0.211

The result in Table 3.8 shows that Most liquid stock have a much higher average monthly excess return than that of Most illiquid stock (1.981% vs. 1.246%). We also found that even though the risk (Which is showed in Table 1-9) of most liquid stock portfolio is higher than most illiquid stock portfolio (9.668% vs. 7.693%), when measured risk-adjusted return by using Sharpe ratio (Table 1-10), most liquid stock portfolio's performance still clearly outperform most illiquid stock portfolio (0.208 vs. 0.184). The results found in Table 3.8, 3.9 and 3.10 support the empirical results founded by Florackis et al. (2011) that most liquid stock will yield a higher return than most illiquid stock.

Table 3.8 Average Monthly Excess Return of FGK's LIQ Portfolio

Portfolio	Percent per month		
	B	S	Avg.
L1	2.206	0.466	1.246
L2	1.917	0.528	1.223
L3	2.516	1.446	1.981
Avg.	2.153	0.813	

Note: average monthly market excess return = 1.204%

Table 3.9 Standard Deviation of Monthly Excess Return of FGK's LIQ Portfolio

Portfolio	Percent per month		
	B	S	Avg.
L1	6.396	8.989	7.693
L2	6.752	8.629	7.690
L3	9.181	10.156	9.668
Avg.	7.443	9.258	

Note: standard deviation of monthly market excess return = 5.702%

Table 3.10 Sharpe Ratio of Monthly Excess Return of FGK's LIQ Portfolio

Portfolio	B	S	Avg.
L1	0.317	0.052	0.184
L2	0.84	0.061	0.173
L3	0.274	0.142	0.208
Avg.	0.292	0.085	

Note: sharpe ratio of monthly market excess return = 0.211

Table 3.11 presents correlations of monthly excess returns of each factor portfolio. It shows that all factor portfolios have high correlations with the market. It also reveals that the Small and Growth stock portfolio (SL) has a lowest correlation with the market (0.584) and all other factor portfolios.

Table 3.11 Correlation Matrix of Monthly Excess Returns of Factor Portfolios

	Market	BH	BM	BL	SH	SM	SL	W	L
Market	1								
BH	0.908	1							
BM	0.931	0.869	1						
BL	0.607	0.541	0.510	1					
SH	0.696	0.669	0.618	0.351	1				
SM	0.845	0.780	0.776	0.458	0.748	1			
SL	0.584	0.469	0.458	0.429	0.445	0.553	1		
W	0.792	0.698	0.735	0.515	0.528	0.657	0.636	1	
L	0.876	0.824	0.822	0.528	0.677	0.780	0.601	0.656	1

Table 3.12 shows correlations of monthly excess returns of Amihud's LIQ portfolio. All factor portfolios have high correlations of excess returns with the market except the Small and medium return-to-volume ratio stock portfolio (SL2) which has the lowest correlation with the market (0.225).

Table 3.12 Correlation Matrix of Monthly Excess Returns of Amihud's LIQ Portfolio

	Market	BL1	BL2	BL3	SL1	SL	SL3
Market	1						
BL1	0.747	1					
BL2	0.775	0.629	1				
BL3	0.927	0.717	0.611	1			
SL1	0.767	0.548	0.705	0.567	1		
SL2	0.225	0.335	0.267	0.129	0.207	1	
SL3	0.686	0.427	0.649	0.526	0.646	0.215	1

Table 3.13 shows correlations of monthly excess returns of FGK's LIQ portfolio. All factor portfolios have high correlations of excess returns with the market except that Small and Most illiquid stock portfolio (SL1) which has the lowest correlation with the market (0.146).

Table 3.13 Correlation Matrix of Monthly Excess Returns of FGK's LIQ Portfolio

	Market	BL1	BL2	BL3	SL1	SL	SL3
Market	1						
BL1	0.883	1					
BL2	0.939	0.829	1				
BL3	0.667	0.610	0.621	1			
SL1	0.146	0.129	0.112	0.099	1		
SL2	0.790	0.653	0.668	0.531	1.161	1	
SL3	0.759	0.600	0.652	0.509	0.184	0.828	1

Table 3.14 provides the average monthly return, Standard deviation of monthly return and Sharpe ratio of MKT, SMB, HML, WML, Amihud's LIQ and FGK's LIQ. We found that SMB have negative average monthly return which is opposite to USA, North America, Hong Kong and Malaysia market, but the return is similar to Europe, Spain and Asia Pacific market. This is because SMB is small stock

minus big stock. Therefore, as small stock portfolio of Thailand, Europe, Spain and Asia Pacific have less return than big stock portfolio, SMB becomes negative.

HML also have a negative average return which are different from other countries. This is because HML is Value stock minus Growth stock. Since the return of Value stock portfolio lower than Growth stock portfolio, HML becomes negative. These imply that in Thai stock market, Growth stock portfolio outperform Value stock portfolio.

FGK's LIQ essentially has a negative average return which is different from Amihud's LIQ. This is because liquidity factor is the most illiquid minus most liquid. Since most illiquid stock of FGK's LIQ portfolio has lower return than most liquid, FGK's LIQ becomes negative.

Table 3.14 Market Risk Premium and Average Returns of SMB, HML, WML, and LIQ

	Rm-Rf	SMB	HML	WML	Amihud's LIQ	FGK's LIQ
Average	1.204	-5.551	-2.406	0.984	1.063	-0.728
Median	1.766	-0.604	-2.270	0.990	1.048	-0.490
SD	5.702	5.880	7.056	6.650	6.383	5.129
Sharpe ratio	0.211	-0.094	-0.341	0.148	0.167	-0.142
Min	-14.660	-32.871	-59.848	-21.608	-17.919	-32.026
Max	14.235	18.126	16.090	15.060	15.896	12.972

Table 3.15 reports the correlation of monthly return of factor portfolios. It reveals that HML, WML, Amihud's LIQ and FGK's LIQ have negative correlations with MKT, while the SMB has the only positive one. It also shows that factor portfolios have low correlation with each other except the correlation between the MKT and the Amihud's LIQ (-0.207).

Table 3.15 Correlation Matrix of Monthly Returns of Factor Portfolios

	MKT	SMB	HML	WML	Amihud's LIQ
MKT	1				
SMB	0.051	1			
HML	-0.083	0.115	1		
WML	-0.029	-0.023	-0.194	1	
Amihud's LIQ	-0.207	0.008	-0.080	0.033	1
	MKT	SMB	HML	WML	FGK's LIQ
MKT	1				
SMB	0.051	1			
HML	-0.083	0.115	1		
WML	-0.029	-0.023	-0.194	1	
FGK's LIQ	-0.001	-0.505	-0.562	-0.002	1

3.5.2 Testing Portfolios

Table 3.16 presents average monthly excess returns of each testing portfolio. The TSL portfolio has the highest average monthly excess return (3.166%), where the TSH portfolio has the lowest (0%). We also found that the average monthly excess return of each testing portfolio vary widely among each other.

The monthly excess return correlations of the testing portfolio shown in Table 3.17 reveal that all testing portfolios have positive correlation with each other.

Table 3.16 Average Monthly Excess Return of Testing Portfolios

	TBH	TBM	TBL	TNH	TNM	TNL	TSH	TSM	TSL
Average	0.843	1.417	2.856	0.921	1.237	2.711	0.000	0.035	3.166
Median	0.994	1.502	2.734	1.148	1.215	3.505	-0.787	-0.014	1.788
SD	7.154	6.501	8.575	7.499	8.093	8.362	9.377	9.025	13.339
Sharpe ratio	0.118	0.218	0.333	0.123	0.153	0.324	0.000	0.004	0.237
Min	-20.201	-16.827	-19.346	-21.960	-18.211	-20.528	-21.900	-19.366	-29.400
Max	24.146	23.354	47.274	26.129	26.474	33.382	27.879	26.139	79.599

Table 3.17 Correlation Matrix of Excess Returns of the Testing Portfolios

	TBH	TBM	TBL	TNH	TNM	TNL	TSH	TSM	TSL
TBH	1								
TBM	0.085	1							
TBL	0.481	0.455	1						
TNH	0.795	0.781	0.474	1					
TNM	0.650	0.618	0.378	0.749	1				
TNL	0.693	0.697	0.457	0.734	0.649	1			
TSH	0.487	0.462	0.190	0.599	0.430	0.423	1		
TSM	0.656	0.671	0.397	0.775	0.640	0.728	0.589	1	
TSL	0.216	0.233	0.285	0.283	0.278	0.446	0.203	0.236	1

CHAPTER IV

RESULTS

4.1 Empirical Results

Table 4.1, 4.2 and 4.3 present the regression results of CAPM, Fama-French three-factor model, and Carhart four-factor model. From these results, we found that market monthly excess return coefficient (β) of all testing portfolio is significantly positive at one percent significant level. In addition, average of βof every model is close to 1.0 (Average of β = 1.16), which is consistent to Fama and French (1993) and Keene and Peterson (2007).

Average adjusted-R^2 of CAPM model is 54% which means CAPM model can approximately explain half of the expected return. When adding factors to form Fama-French three-factor model and Carhart four-factor model, we found that average adjusted-R^2 increase to 71.5% and 71.7% respectively. This means that adding these factors to traditional CAPM can increase the explanatory power to the model.

The SMB coefficients (s) of all models are positively significant at one percent significant level except those existed in the big stock portfolio (TBH, TBM and TBL) which have a significant negative sign. Additionally, the results showed that in every model, SMB coefficients will increase from big stock portfolio to small stock portfolio. Thus, we can interpret that returns of Small stock portfolio are more sensitive to the size factor (SMB) than big stock portfolio.

Almost HML coefficients (h) of all models in every portfolio are significant at one percent significant level. We also found that Value stock portfolios (TBH, TNH and TSH) consisted of HML coefficients which are positive while Growth stock portfolio (TBL, TNL and TSL) contains HML coefficients which are negative.

The results also revealed that WML coefficients (w) are rarely significant, which imply that the momentum factor might not be an important risk factor in Thai stock market.

Table 4.4 and 4.5 shows the regression result of Amihud five-factor model and FGK five-factor model. The result showed that adding liquidity factor to the model can increase the average adjusted-R^2 (Amihud five-factor model is 71.9% and FGK five-factor model is 77.0%).The average adjusted-R^2 of FGK five-factor model can explain more than three-fourths of expected excess return. The results also show Amihud's LIQ coefficient is significant only 2 portfolios (TSM and TNL), while FGK's LIQ coefficient (l) is significant in all portfolio except Medium and Growth stock portfolio (TNL). In conclusion, Amihud's liquidity factor might not be important factor while FGK's liquidity factor is an important risk factor in Thai stock market.

Table 4.1 Time-Series Regressions of CAPM Model

	CAPM			
	α	β	Ad R^2	F
TBH	-0.504	1.113***	0.779	462.03***
	(-1.48)	(-21.49)		
TNH	-0.427	1.139***	0.756	405.97***
	(-1.15)	(20.15)		
TSH	-0.666	1.080***	0.273	50.14***
	(-0.66)	(7.08)		
TBM	0.228	1.054***	0.842	697.77***
	(0.87)	(26.42)		
TNM	0.148	1.137***	0.544	157.28***
	(0.25)	(12.54)		
TSM	-1.297**	1.163***	0.578	180.13***
	(-2.28)	(13.42)		
TBL	2.264**	1.275***	0.305	58.53***
	(2.07)	(7.65)		
TNL	1.479***	1.136***	0.658	252.82***
	(3.16)	(15.90)		
TSL	3.123	1.354***	0.121	18.98***
	(1.53)	(4.36)		
Avg.	0.483	1.161	0.540	253.739

Note: *, **, *** show significant at 10%, 5% and 1% levels respectively. t-stat reported in brackets.

Table 4.2 Time-series regressions of Fama-French Three-Factor Model

	Fama-French					
	α	β	s	h	Ad R^2	F
TBH	-0.279	1.141***	-0.179***	0.413***	0.821	201.57***
	(-0.89)	(24.37)	(-4.06)	(4.51)		
TNH	-0.075	1.143***	-0.143***	0.101***	0.782	157.73***
	(-0.21)	(21.31)	(2.82)	(2.78)		
TSH	1.009	1.097***	0.747***	0.462***	0.560	56.62***
	(1.25)	(9.19)	(6.63)	(5.72)		
TBM	0.357	1.074***	-0.141***	0.094***	0.868	287.73***
	(1.44)	(29.28)	(-4.09)	(3.77)		
TNM	0.304	1.123***	0.245***	-0.007	0.566	57.9***
	(0.51)	(12.62)	(2.91)	(-0.12)		
TSM	-0.875	1.150***	0.373***	0.063	0.647	81.18***
	(-1.63)	(14.45)	(4.96)	(1.17)		
TBL	-0.247	1.220***	-0.791***	-0.788***	0.744	127.87***
	(-0.36)	(12.00)	(-8.25)	(-11.44)		
TNL	1.208***	1.096***	0.287***	-0.194***	0.733	121.03***
	(2.82)	(17.29)	(4.80)	(-4.51)		
TSL	0.484	1.052***	1.879***	-1.616***	0.715	110.35***
	(0.40)	(5.91)	(11.18)	(-13.40)		
Avg.	0.210	1.122	0.285	-0.194	0.715	133.553

Note: *, **, *** show significant at 10%, 5% and 1% levels respectively. t-stat reported in brackets.

Table 4.3 Time-Series Regressions of Carhart Four-Factor Model

	4-Factors						
	α	β	s	h	w	Ad R^2	F
TBH	-0.279	1.141***	-0.179***	0.143***	-0.001	0.820	150.00***
	(-0.88)	(24.25)	(-4.04)	(4.40)	(-0.02)		
TNH	0.019	1.135***	0.143***	0.079**	-0.153***	0.797	129.53***
	(0.05)	(21.90)	(2.92)	(2.20)	(-3.22)		
TSH	1.031	1.095***	0.747***	0.457***	-0.035	0.557	42.19***
	(1.27)	(9.14)	(6.61)	(5.52)	(-0.31)		
TBM	0.349	1.074***	-0.142***	0.096***	0.013	0.867	214.38***
	(1.40)	(29.16)	(-4.08)	(3.76)	(0.38)		
TNM	0.324	1.122***	0.245***	-0.012	-0.031	0.563	43.17***
	(0.53)	(12.55)	(2.90)	(-0.19)	(-0.38)		
TSM	-0.786	1.143***	0.373***	0.042	-0.144**	0.656	63.31***
	(-1.47)	(14.51)	(5.02)	(0.76)	(-2.00)		
TBL	-0.165	1.214***	-0.792***	-0.808***	-0.134	0.746	97.23***
	(-0.24)	(11.97)	(-8.28)	(-11.55)	(-1.44)		
TNL	1.269	1.091***	0.287***	-0.209***	-0.101*	0.738	93.01***
	(2.98)	(17.33)	(4.84)	(-4.81)	(-1.75)		
TSL	0.463	1.054***	1.879***	-1.612***	0.033	0.713	82.15***
	(0.38)	(5.89)	(11.14)	(-13.05)	(0.20)		
Avg.	0.247	1.119	0.285	-0.203	-0.061	0.717	101.663

Note: *, **, *** show significant at 10%, 5% and 1% levels respectively. t-stat reported in brackets.

Table 4.4 Time-Series Regressions of Amihud Five-Factor Model

	Amihud Five-Factors							
	α	β	s	h	w	l	Ad R^2	F
TBH	-0.355	1.156***	-0.181***	0.148***	-0.001	0.069	0.822	121.59***
	(-1.11)	(24.11)	(-4.11)	(4.55)	(-0.03)	(1.49)		
TNH	-0.064	1.152***	0.141***	0.084**	-0.154***	0.075	0.799	105.04***
	(-0.18)	(21.81)	(2.89)	(2.34)	(-3.25)	(1.48)		
TSH	0.959	1.109***	0.745***	0.462***	-0.035	0.064	0.555	33.62***
	(1.16)	(9.01)	(6.57)	(5.54)	(-0.32)	(0.54)		
TBM	0.039	1.076***	-0.142***	0.096***	0.013	0.009	0.866	170.25***
	(1.34)	(28.42)	(-4.07)	(3.75)	(0.37)	(0.25)		
TNM	0.218	1.143***	0.242***	-0.005	-0.032	0.096	0.564	34.82***
	(0.36)	(12.5)	(2.87)	(-0.08)	(-0.39)	(1.09)		
TSM	-0.949*	1.176***	0.369***	0.052	-0.146**	0.147*	0.663	52.47***
	(-1.78)	(14.74)	(5.01)	(0.96)	(-2.04)	(1.92)		
TBL	-0.252	1.232***	-0.794***	-0.803***	-0.135	0.079	0.745	77.69***
	(-0.36)	(11.85)	(-8.29)	(-11.39)	(-1.44)	(0.80)		
TNL	1.105**	1.125***	0.283***	-0.198***	-0.102*	0.149**	0.748	78.58***
	(2.61)	(17.78)	(4.86)	(-4.63)	(-1.81)	(2.46)		
TSL	0.426	1.061***	1.879***	-1.609***	0.033	0.034	0.710	65.23***
	(0.35)	(5.77)	(11.09)	(-12.92)	(0.20)	(0.19)		
Avg.	0.159	1.137	0.282	-0.197	-0.062	0.080	0.719	82.143

Note: *, **, *** show significant at 10%, 5% and 1% levels respectively. t-stat reported in brackets.

Table 4.5 Time-Series Regressions of FGK Five-Factor Model

	FGK Five-Factors							
	α	β	s	h	w	l	Ad R^2	F
TBH	-0.152	1.145***	-0.107**	0.206***	0.018	0.033***	0.828	126.92***
	(-0.48)	(24.88)	(-2.07)	(5.17)	(0.41)	(2.62)		
TNH	0.315	1.146***	0.312***	0.224***	-0.110**	0.076***	0.842	140.86***
	(-1.01)	(25.06)	(6.09)	(5.68)	(-2.59)	(6.12)		
TSH	1.767**	1.122***	1.167***	0.819***	0.072	0.188***	0.672	54.69***
	(2.50)	(10.87)	(10.10)	(9.19)	(0.75)	(6.75)		
TBM	0.268	1.071***	-0.188***	0.055*	0.001	-0.021**	0.870	177.10***
	(1.08)	(29.46)	(-4.62)	(1.76)	(0.03)	(-2.12)		
TNM	0.561	1.130***	0.380***	0.105	0.003	0.031**	0.581	37.36***
	(0.94)	(12.91)	(3.88)	(1.39)	(0.04)	(2.56)		
TSM	-0.320	1.160***	0.640***	0.272***	-0.077	0.119***	0.739	75.05***
	(-0.68)	(16.90)	(8.33)	(4.58)	(-1.21)	(6.44)		
TBL	0.861**	1.251***	-0.206***	-0.303***	0.014	0.262***	0.929	341.30***
	(2.34)	(23.24)	(-3.42)	(-6.51)	(0.29)	(18.03)		
TNL	1.210***	1.089***	0.253***	-0.238***	-0.110*	-0.015	0.737	74.45***
	(2.80)	(17.27)	(3.59)	(-4.37)	(-1.87)	(-0.89)		
TSL	-0.106	1.033***	1.554***	-1.893***	-0.050	-0.146***	0.731	72.16***
	(-0.09)	(5.96)	(8.02)	(-12.64)	(-0.31)	(-3.11)		
Avg.	0.489	1.127	0.423	-0.084	-0.027	0.062	0.770	122.210

Note: *, **, *** show significant at 10%, 5% and 1% levels respectively. t-stat reported in brackets.

Table 4.6 shows t-statistics of intercept coefficients (Alpha, α) of every portfolio in all models. We can notice that the alphas of three out of nine portfolios in the CAPM are significantly different from zero (TSM, TBL and TNL). However, only Fama-French three-factor model have only TNL portfolio which consisted of significant alpha coefficients. In addition, the number of significant intercepts is decreased from three portfolios in CAPM to two portfolios in Five-factor model.

Table 4.6 t-Statistic of Alphas of CAPM, Fama-French Three-Factor, Carhart Four-Factor, Amihud Five-Factor, and FGK Five-Factor Models

Portfolio	CAPM	Fama-French	Carhart	Amihud	FGK
TBH	-1.48	-0.89	-0.88	-1.11	-0.48
TNH	-1.15	-0.21	0.05	-0.18	1.01
TSH	-0.66	1.25	1.27	1.16	2.50
TBM	0.87	1.44	1.40	1.34	1.08
TNM	0.25	0.51	0.53	0.36	0.94
TSM	-2.28***	-1.63	-1.47	-1.78*	-0.68
TBL	2.07**	-0.36	-0.24	-0.36	2.34**
TNL	3.16***	2.82***	2.98	2.61**	2.80***
TSL	1.53	0.40	0.38	0.35	-0.09

Note: *, **, *** show significant at 10%, 5% and 1% levels respectively.

Table 4.7 reports Gibbons-Ross-Shanken (GRS) F statistic. The GRS statistic tests the null hypothesis that all the pricing errors (intercepts, α) are jointly equal to zero. If an asset pricing model is empirically valid, we will not be able to reject the null hypothesis. Table 4.7 presents both the GRS F stats and their p-values of all models. The results in table 4.7 reveals that p-values of all models are significant at one percent significant level, which means the null hypothesis is rejected, the intercepts are not jointly equal to zero. According to the test, the evidence of significant intercepts suggests that there remain unexplained variables in the five-factor model.

Table 4.7 Gibbons-Ross-Shanken (GRS) Statistic

Stat	CAPM	Fama-French	Carhart	Amihud	FGK
GRS F	3.536	2.476	2.502	2.295	2.413
P-Value	0.001***	0.013**	0.012**	0.021**	0.015**

Note: *, **, *** show significant at 10%, 5% and 1% levels respectively.

4.2 Comparison of CAPM, Three-Factor, Four-Factor and Five-Factor Models

To investigate whether the liquidity five-factor model is productive than the CAPM model, Fama-French three-factor model and Carhart four-factor model, we study the improvement in the number of insignificant intercept sand the percentage increase in the adjusted R^2 of the model. If one model is clearly outperformed, we expect to see an increase in the number of insignificant intercepts and the improvement of adjusted R^2.

Although the GRS test in table 4.7 reveals that the intercepts are jointly significantly different from zero, we found that the number of insignificant intercepts is greater for the liquidity five-factor model than for the CAPM model. For example, investigating table 4.6, the number of insignificant intercepts increases from 6 (CAPM) to 7 (Amihud and FGK). Table 4.1, 4.2, 4.3, 4.4 and 4.5 showed that an average adjusted R^2 also increased from 54% (CAPM model) to 71.9% (Amihud five-factor model) and 77% (FGK five-factor model).

The increase in insignificant intercepts together with the increase in adjusted R^2 shows that the liquidity five-factor model significantly improves the explanatory power on the excess expected stock returns over the CAPM model, Fama-French three-factor model and Carhart four-factor model. The results suggested that it is significant to include a liquidity factor in asset pricing models. Therefore, employing the liquidity five-factor model (MKT, SMB, HML, WML and LIQ) as the benchmark model is more appropriate choice than using the traditional CAPM, three-factor or four-factor (MKT, SMB, HML, and WML) model.

However, the regression results in table 4.4 and 4.5 suggested that Amihud's liquidity factor might not be an important factor in asset pricing model while FGK's liquidity factor proved to be an important factor in Thai stock market.

CHAPTER V
CONCLUSIONS

In this study, we examined the importance of liquidity in pricing stock returns in Thai stock market. Previous studies do not adequately address the relations among liquidity and stock returns in Thai stock markets. We hope this study may help highlight on this issue in the literature and further studies.

We investigated whether liquidity has significant effect on stock returns by using five-factor asset pricing model. The five factors include the market factor (market risk premium, MKT), the size factor (small market capitalization minus big market capitalization, SMB), the book-to-market factor (high book-to-market ratio minus low book-to-market ratio, HML), the momentum factor (winners minus losers, WML) and the liquidity factor (LIQ). Although these are well-known factors in explaining stock returns in the USA, their joint effects with liquidity is seldom studied in an emerging study and Asian markets.

Our data cover stocks in SET100 index trade in the Stock Exchange of Thailand (SET) collected from April 2002 to March 2003. We constructed the nine testing portfolios based on size and book-to-market ratios and adopt Fama and French's (1992) time-series regression approach to test the five-factor model on these nine testing portfolios.

After adding a liquidity factor to the model, the number of significant intercepts is reduced and the average adjusted R^2 increase. These results showed that the Five-factor model have more explanatory power than the traditional CAPM model, Fama-French three-factor model and Carhart four-factor model.

The results from Amihud's LIQ portfolio showed that most illiquid stock portfolio has a higher return than most liquid stock. This is similar to Amihud's (2002) and previous studies.

However, FGK's LIQ portfolio showed that most illiquid stock portfolio has lower return than most liquid stock. This is because FGK five-factor model is free from size bias which is similar to Florackis, Gregoriou and Kostakis's (2011) study.

The result also showed that FGK five-factor model has average adjusted R^2 more than Amihud five-factor model, which means that FGK five-factor model can explain stock return better than Amihud five-factor model.

The regression results suggested that Amihud's liquidity factor might not be an important factor in asset pricing model while FGK's liquidity factor proved to be an important factor in Thai stock market.

In addition, the limitation of this study is that data used in this study is the SET100 index that does not include the dividend effect and the monthly value-weight return of each portfolio calculated on the basis of arithmetic mean. In the further study, the researcher can add the dividend yield effect and calculate the monthly value-weight return of each portfolio on the basis of geometric mean for the different results.

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APPENDICES

APPENDIX A: Average Monthly Excess Return and Standard Deviation of Monthly Excess Return in a Various Regions

Table 1 Fama and French's (2012) Average Monthly Excess Return and Standard Deviation of Monthly Excess Return in a Various Regions

	Average monthly return (%)				
	B1	B2	M	S1	S2
Global Monthly Excess Return (%)					
H1	0.53	0.69	0.74	0.79	1.12
H2	0.53	0.60	0.57	0.69	0.83
M	0.49	0.52	0.52	0.59	0.77
L1	0.36	0.43	0.40	0.46	0.48
L2	0.29	0.37	0.21	0.09	0.07
Global Monthly Std. Dev (%)					
H1	5.40	4.78	4.65	4.56	4.38
H2	4.45	4.47	4.47	4.40	4.64
M	4.41	4.50	4.64	4.68	5.09
L1	4.29	4.61	5.19	5.21	5.48
L2	4.62	5.66	5.78	5.87	5.94
North America Monthly Excess Return (%)					
H1	0.64	0.96	1.08	1.08	1.42
H2	0.66	0.84	0.86	0.94	1.04
M	0.62	0.89	0.87	0.95	1.13
L1	0.56	0.73	0.70	0.73	0.75
L2	0.54	0.80	0.90	0.34	0.50
North America Monthly Std. Dev (%)					
H1	5.48	4.79	5.03	5.24	5.43
H2	4.35	4.75	4.67	4.90	5.50
M	4.32	4.76	5.14	5.73	6.42
L1	4.35	5.29	6.02	6.82	7.15
L2	4.84	6.97	7.34	7.77	8.48
Europe Monthly Excess Return (%)					
H1	0.73	0.88	0.86	0.89	0.88
H2	0.76	0.64	0.62	0.78	0.66
M	0.65	0.66	0.62	0.53	0.44
L1	0.52	0.57	0.54	0.42	0.29
L2	0.31	0.39	0.21	0.10	-0.13

Table 1 Fama and French's (2012) Average Monthly Excess Return and Standard Deviation of Monthly Excess Return in a Various Regions (cont.)

	Average monthly return (%)				
	B1	B2	M	S1	S2
Europe Monthly Std. Dev (%)					
H1	6.44	5.81	5.47	5.26	4.89
H2	5.56	5.29	5.30	5.14	4.94
M	5.16	5.10	5.10	5.15	5.21
L1	4.83	4.90	5.32	5.40	5.50
L2	5.09	5.57	6.01	6.13	5.79
Japan Monthly Excess Return (%)					
H1	0.35	0.05	0.13	0.03	0.22
H2	0.18	0.00	-0.16	0.01	0.08
M	-0.10	-0.21	-0.27	-0.13	0.02
L1	-0.10	-0.18	-0.39	-0.37	-0.08
L2	-0.33	-0.50	-0.42	-0.45	-0.17
Europe Monthly Std. Dev (%)					
H1	7.44	6.84	6.97	7.23	7.25
H2	6.02	6.05	6.46	7.08	7.31
M	6.15	6.06	6.72	7.17	7.58
L1	5.99	6.44	7.06	7.78	7.81
L2	6.95	7.51	7.93	8.30	9.32
Asia Pacific Monthly Excess Return (%)					
H1	1.13	1.16	0.92	1.06	1.61
H2	0.94	1.08	1.00	0.79	1.17
M	0.95	0.66	0.88	0.63	0.87
L1	0.97	0.96	0.77	0.51	0.61
L2	0.69	0.90	0.10	0.17	0.39
Asia Pacific Monthly Std. Dev (%)					
H1	8.11	8.49	8.04	7.94	7.42
H2	6.90	6.95	7.04	7.23	7.34
M	6.45	6.35	6.76	6.91	7.36
L1	6.25	6.20	6.88	7.72	8.03
L2	6.52	6.67	7.37	7.21	8.18

Table 2 Davivongs and Pavabutr's (2012) Average Monthly Excess Return and Standard Deviation of Monthly Excess Return in China and Taiwan

	Average monthly return (%)				
	B1	B2	M	S1	S2
China	2.44	2.42	1.75	2.37	1.09
Taiwan	0.62	0.23	-1.17	-2.24	-2.26