UNIVERSITY OF VAASA

FACULTY OF BUSINESS STUDIES

ACCOUNTING AND FINANCE

HONG NHUNG HOANG

X103109

LIQUIDITY AND STOCK RETURNS: EVIDENCE FROM TAIWAN STOCK MARKET

Master's thesis in Finance

2017

VAASA 2017

TABLE OF CONTENT

LIST OF TABLES AND FIGURES

UNIVERSITY OF VAASA

Faculty of Business Studies:	Accounting and Finance
Author:	Nhung Hoang
Topic of the thesis:	Liquidity and Stock Returns: Evidence from Taiwan market
Name of the supervisor:	Anupam Dutta
Degree:	Master of Science in Economics and Business Administration
Master's Programme:	Finance
Year of entering the university:	2014
Year of completing the thesis:	2017
	Pages: 70

ABSTRACT

This study investigates the relationship between liquidity and stock returns in Taiwan market over the period of 2007 to 2014. The study's major contribution to literature about liquidity is the concentration on an active emerging market where attracts an increasing amount of inflowing funds. Both Fama – French model and CAPM Three Moment model augmented by liquidity factor are utilized in the test. Simultaneously, this paper also examines if during January and the period before and after New Lunar Year holiday, the most important cultural event that might vastly affects trading behaviors, the above relation would vary or not.

The empirical finding suggests that there is a positive link between illiquidity ratio, which is proxy for liquidity level as on the line with Amihud's paper (2002), and stock returns in Taiwan market. However, during January, the effect of liquidity on stock returns disappears, while during period around New Lunar Year holiday, liquidity impact is still figured out, yet its extent is eroded. Therefore, it is suggested that during these special occasions, other factors not addressed in this study have greater impacts on stock returns and they absorb a part of liquidity explanatory power.

KEYWORD: Liquidity, Stock return, Taiwan stock market, January effect, New Lunar Year.

1. INTRODUCTION

In modern finance, asset pricing plays a crucial role, and hence numerous studies with a variety of methodology have been conducted, resulting in various asset pricing models explaining the relationship between stock returns and risk factors. Drawbacks of one model have influences on the development of the new ones. One of the pioneers in this field is traditional asset pricing model, CAPM, that concentrates on the importance of stock returns' sensitivity to market risk (beta as proxy). Nonetheless, CAPM strongly relies on its strict assumptions and from rigorous test of CAPM, researchers figured out some results that were not consistent with the traditional CAPM, but could be explained by zero - beta CAPM. Furthermore, a lot of evidence about other risk factors was found, such as price/earnings ratio, company size, book – to – market ratio. Fama and French three factors model emerged and would be able to explain the association between stock returns and risk factors related to firm characteristics including size and book – to – market ratio. However, the drawback of these models lies on their assumptions that assume an uncorrelated relation between traders' transaction and asset prices, contrary to reality that transaction cost and information asymmetry do exist. For this reason, another factor which could be a valid proxy for risk was proposed – liquidity.

The first research on liquidity and stock returns is the study of Amihud and Mendelson (1986). Since then, whether liquidity is an important attribute of asset pricing or not is still controversial. Kyle (1985) stated that "Liquidity is a slippery and elusive concept, in part because it encompasses several transactional properties of markets. These include tightness, depth and resiliency". Many studies have examined the influence of liquidity on stock return by different approaches and reached mixed results. Some studies are in favour of liquidity premium theory, for instance, Amihud and Mendelson (1986), Datar, Naik and Radcliffe (1998) and Amihud (2002), whereas some others ignore the impact of liquidity on stock returns. For example, Fama and French (1992) indicates that liquidity is already subsumed by the combination of size and book – to – market ratio, thereby no need to be measured, and Eleswrapu and Reingnum (1993) which only finds evidence of liquidity premium in January.

Additionally, it is interesting that there are a lot of papers studying the dynamics of stock market to cultural events and many of them show evidence about this connection.

1.1. Purpose of the study

Emerging markets barely achieve diversification in ownership structure, and liquidity might be a culprit. Chuhan (1992) states that one of the main reason impeding foreign investments in emerging market is liquidity

In this master thesis, the first investigated issue is whether the relationship between liquidity and stock return exists in Taiwan stock market or not. If the relation is proved in Taiwan stock market, the scope of this study incorporates the extent and direction of this connection. Moreover, in this study two models (Liquidity – Augmented Three – moment CAPM and Fama – French three factor modes) are employed to test this relationship.

In addition, this thesis also examines how calendar effects including January effect and New Lunar Year (henceforth NLY) effect, affect liquidity – stock returns relationship. Simultaneously, a comparison between January effect and NLY effect on above link could be achieved.

Research items on these concepts including NLY effect are new in Taiwan stock market which attracts increasing flows of fund in recent years and has high potential of economic growth, whereupon the most important cultural event in Taiwan, NLY, might be a compelling issue. These features are the main motivation and contribution of this thesis to academic financial literature.

1.2. Research hypotheses

The following hypotheses are proposed in this master thesis:

Hypothesis 1: There is a positive relationship between illiquidity measure and stock expected returns in Taiwan stock market.

Furthermore, to deepen the research in this stock market, we place the second hypothesis:

Hypothesis 2: The relationship would be altered in January months and during one – week – periods before and after New Lunar Year holiday.

1.3. Structure of the study

The rest of the thesis is structured as follows. Chapter 2 provides an in – depth literature review of previous studies on the relationship between liquidity and stock returns in both developed markets and emerging markets. Moreover, this chapter also goes through several intriguing papers about calendar effects. Chapter 3 discusses the theoretical base of this thesis, followed by chapter 4 which presents data and methodology utilized to examine issues in the study. Chapter 5 reveals overview picture of Taiwan market as well as descriptive statistics and empirical results. Finally, chapter 6 concludes main points obtained from the analysis and proposes some likely limitation of the study, simultaneously.

2. LITERATURE REVIEW

The research of Amihud and Mendelson (1986) is one of the first material proving the link between microstructure and asset pricing. They argue that investors with longer investment horizons would hold illiquid assets. In this research, authors utilize a Fama – MacBeth (1973) portfolio formation procedure and suggest bid – ask spread that indicates buying premium and selling concession as a natural measure of illiquidity and figured out an increasing and concave function between observed asset returns and transaction costs. In other words, positive link between stock returns and illiquidity is recorded.

Eleswarapu and Reinganum (1993) also employ bid – ask spread as proxy for liquidity to investigate the seasonal behaviour of liquidity premium in asset pricing. Based on the criteria of Amihud and Mendelson (1986), this paper forms 49 equally – weighted portfolios and discover that liquidity premium is significantly priced only during January. Specifically, in January months, the relations between expected returns and liquidity risk are significant. Moreover, size effect is significant as suggested in this paper even after controlling for spreads, different from Amihud and Mendelson's results.

Brennan and Subrahmanyam (1996) studies the relationship between risk – adjusted return and both variable and fixed cost component of transaction cost which is intra – day continuous data on transaction and quotes to measure liquidity. Results are significant with variable costs, while insignificant in case of fixed costs. Authors propose two possible reasons to such finding that is either poor proxy for the fixed and variable costs or problem in Fama – French model.

Chen and Kan (1996) reveal that liquidity is not priced, then they conjecture an important point that the asset pricing models used in those studies might not adjust for risk adequately.

Datar, Naik, and Radcliffe (1998) uses turnover rate as proxy to liquidity and General Least Square method to test the relation between liquidity and stock return, and examine whether this relationship is still significant or not after controlling for firm size, book – to – market ratio, and beta. Turnover rate is the ratio of number of share traded to number of share

outstanding, quantifying trading frequency. Moreover, as indicated in the paper of Amihud and Mendenson (1986), equilibrium liquidity and trading frequency have strong correlation, so that turnover ratio can be used to measure liquidity. The results of this paper are on the line of Amihud and Mendelson's research. However, January effect proves no influence on this relation.

Chalmers and Kadlec (1998) find positive relation between liquidity and stock return when using the amortized effective spread obtained from quotes and subsequent transactions that is proxy for spread's cost over investors' holding period. This measure is approximately equal to the product of spread and share turnover that can enormously different among stocks with similar spread.

Chui and Wei (1998) examines the hypothesis of Hopenhayn and Werner (1996) on NYSE, AMEX and Nasdaq stocks by using identical method and variables as Datar, Naik and Radcliffe (1998). Nevertheless, the result is only significant in non – January month, thereby, this paper would be considered as a supplement to Datar (1998).

Amihud (2002) enhances the study of liquidity and stock returns. To be specific, a new measure of liquidity level is adopted, called ILLIQ – daily price response associated with one dollar of trading volume. The author utilizes a 1964 – 1997 NYSE sample and points out that the ex-ante stock excess return increases as the expected illiquidity of the stock market rises over time. Additionally, this paper separates expected and unexpected component of illiquidity level and figures out unexpected market illiquidity negatively affecting contemporaneous stock price. These outcomes are alleged to be more profound for small firms' stocks.

Another new proxy for liquidity is introduced in the paper of Pastor and Stamburgh (2001) which is liquidity beta indicating stock's sensitivity to innovation in aggregate liquidity. This proxy is based on order flow and volume related return reversals and the research states a positive relation between stock sensitivity to aggregate liquidity and expected returns. This result is robust when including size, value and momentum factors.

Chan and Faff (2005) applies time series version of Fama and Macbeth (1973) to confirm the role of liquidity in asset pricing and uses Generalized Method of Moment estimation on Liquidity - Augmented Fama – French three factor model to eliminate errors – in – variable problem in the two – pass Fama and Macbeth (1973). Finding of this paper supports the association between liquidity (measured by share turnover) and stock returns.

Liu (2006) proposes an innovative way of defining illiquidity for individual stocks that is the standardized turnover – adjusted number of zero daily trading volumes over the prior 12 months. This new measure reflects various features of liquidity, for instance, trading speed (the most concentrated one), trading quantity and trading cost. By this new method, it is detected that illiquid stocks tend to be small firms and high book-to-market value stocks. This research points out the drawbacks of both CAPM and Fama – French that fail to account for liquidity risk, and then comes up with the liquidity – augmented two – factor model that provides a more comprehensive explanation for asset returns.

Thomas and Dazhi (2015) sheds light on this relation in G7 market with an expansion regarding to information set consisting of domestic Fama – French price factors, time series elements and global Fama – French factors, which results in testing the reaction of different stock characteristics to illiquidity effect. A positive relation between excess stock return and market illiquidity is traced, while a negative correlation is found between excess stock return and the innovation of firm – level illiquidity.

There is an abundance of research items focusing on US stock market – the most liquid market and now the attention has shifted to emerging markets.

Jun, Marathe and Shawky (2003) find that stock returns in emerging countries, including Taiwan, Korea and Malaysia are positively correlated with aggregate market liquidity. Proxies for liquidity used in the research are turnover ratio, trading value and the turnover-volatility multiple. The positive correlation between stock returns and market liquidity is consistent with the findings in developed market. Nevertheless, the positive correlation in a cross-sectional analysis seems to be different from studies in developed markets.

Baekaert, Harvey and Lundblad (2007) conducts a study in 19 emerging market over period from 1993 to 2003 by means of the proportion of daily zero firm returns averaged over month and VAR analysis. A link between systematic variation in liquidity and expected return is significant. Unexpected liquidity is positively related to stock returns.

Lischewski and Voronkova (2012) investigate the influence of size, value and liquidity on stock return in the most advanced stock market in Central and Eastern Europe – Poland. Results in this market are supportive to those in matured markets in terms of market, size, book – to – market yet could hardly fully explain entire equity premium even when include liquidity factor in the model. Liquidity factor though plays a role in reducing occurrence of the statistically significant risk adjusted excess return, has no evidence as a priced factor in in this market.

Wang, et al. (2012) studies impacts of liquidity on stock returns in Taiwan market by forming 14 style portfolios based on single and joint criteria in terms of size and liquidity. Highly liquid stocks significantly outperform benchmark in both short – term and long – term regardless of market being bearish or bullish. Therefore, a new investment style could be developed.

Wenbi and Miaozhen (2013) conducts an interesting research on liquidity premium based on Three – moment Capital Asset Pricing Model which complement co-skewness to the model. Authors run both cross – sectional regression and time – series analysis on the sample. However, the result shows that through time series regression, Three – Moment CAPM does not fully capture liquidity risk, while cross – sectional test prove the existence of liquidity premium in investigated market.

Tiebe and Andre (2014) investigates the association between liquidity and stock return in 16 African countries during the period from 1995 to 2010 by fixed effect model, stock return lagged variable and system generalized method of moments. Simultaneously, authors include macroeconomic factors and use turnover rate as proxy for liquidity. A positive impact of liquidity on stock return is recorded when South Africa is excluded from the sample.

Yang (2015) proposes a new measure of liquidity that is the combination of illiquidity ratio of Amihud (2002) and the proportion of zero – return days to examine how stock price depends on trading volume as well as transaction cost. In addition, this paper also test the relation between liquidity – return autocorrelation and information asymmetry in Chinese stock market.

Regarding to impact of cultural events on stock market, there are quite a few studies in different markets.

Famous January effects have been explored in many papers. For example, the article, "Size – related anomalies and stock return seasonality: Further empirical evidence" of Keim (1983), which points out abnormal return in January.

It is reported that there is an abnormal increase in stock return on the day prior to holidays in US stock market, which is investigated by Lakonishok and Smidt (1988), Pettengill (1989), Ariel (1990), Cadsby and Ratner (1992) an Cervera and Keim (2000).

Besides, in Asian stock markets, Chan, Khanthavit and Thomas (1996) carry out their study and document positive returns on the day prior to holiday and negative return on the day following holiday in India, Malaysia and Singapore markets.

By contrast, negative returns before the cultural and religious festivals and subsequent positive returns are indicated in ten Middle – East countries in the research of Abadir and Spiedridijk (2005)

New Lunar Year effect could be considered as new object compared to January effect and hence there are not as much number of research items about it as the sources of famous January effect. One of the intriguing paper is "Stock returns, firm size, liquidity and the festivities effect: Asian evidence" (2012) of Abd Sukor that examines influences of Chinese New Year (is the same as New Lunar Year) and Eid ul – Fitr holiday on stock returns of five Asian countries, say Hong Kong, Indonesia, Malaysia, Singapore and Taiwan. The motivation of this study lies on the fact that every year, a huge amount of money is expensed to prepare for NLY holiday, which is likely to affect investors' liquidity before holiday. The

results are not out of their expectation that abnormal returns before holiday is much lower than post – holiday period. Besides, the analysis also points out that this result is more evident for smaller firms.

Interestingly, Congsheng Wu (2013) uses Chinese American Depositary Receipts (ADRs) in order to obtain trading data even during NLY holiday when stock market in China is closed. Results are different from Sukor's paper. Specifically, higher average returns than the rest of the year are detected prior to festival while the opposite is recorded in the week after festival. During holiday, positive effect is explored but eliminated when controlling for the US market returns.

Through the overview of several paper in emerging markets, it is obvious that there is no mutual pattern in this relationship among these markets. A possible explanation is that the level of integration to global economy of each emerging market is distinct

3. THEORY

3.1. Liquidity

3.1.1. Definition

Liquidity is generally accepted, especially after recent financial crisis, as one of the notable characteristics of assets and portfolios. In general, it can be defined that liquidity is the ability of an asset to be quickly converted into cash to prevent loss or make profit. When investors are desire to execute a transaction at a favourable price, they have to confront the trade-off that is transacting immediately at a current bid or ask price or insisting on trading at an advantageous price. Liquid stocks could meet the immediate trading demand of investors with comparatively low costs of immediate execution.

There are several dimensions that need concerning when researching on liquidity including immediacy, transaction costs and price impact (positive impact of order flows or transaction volume on price change). These are background to establish the measure of liquidity in empirical studies. For instance, bid – ask spread (Amihud & Mendelson, 1986) is natural measure of liquidity that is the sum of the buying premium and selling concession in immediate execution, while Amihud (2002) use illiquidity ratio as a proxy for liquidity that could reflect effects of order flows on price, and Liu (2006) utilizes zero daily trading volume which is stated to incorporates immediacy, transaction costs as well as price impact to calculate liquidity.

3.1.2. Risk and liquidity risk

Risks are the uncertainties or volatility related to outcomes in the future, for example, the case that actual return on an investment will be lower than expected return. Risks are usually measured by variance or standard deviation.

Liquidity risk – the future uncertainty of liquidity level - is the possibility when investors might face difficulties to trade and are unable to transact quickly enough to prevent or

mitigate losses. This risk is alleged as an inherent property of securities. Quantifying the level of risks generally entails a lot of challenges, and in the scope of finance, there is no exception.

There are several specific forms of liquidity risk that is proposed in the work of Luo Dengve (2010)

The first suggestion to measure the volatility of liquidity is the variance of future liquidity level. The second proposition derives from traditional asset pricing model in which only a part of risk, namely systematic risk, is compensated. Accordingly, solely a portion of volatility in liquidity level, called systematic liquidity risk or commonality in liquidity, will be subjected for risk compensation and other part of liquidity risk is eliminated by diversification. The commonality in liquidity indicates an interaction between the liquidity level of different securities, specifically the same trend in the direction of movement, which is explained by the impact of common market factors. Chordia, Roll and Subrahmanyam (2000) and Huberman & Halka (2001) shed light on this concept in New York stock market. Afterwards, systematic liquidity is also indicated in the research of Brockman & Chung (2002) in order – driven Hong Kong market, while Feng-ming and Tan Hui (2005) investigate this notion in China market. Nevertheless, there are few of research items further studying the link between systematic liquidity risk and asset pricing.

Gibson and Mougeot (2004) is one of the few researching cases pondering on this issue. In this paper, liquidity risk is expounded as how sensitive market portfolio excess return is when aggregate market liquidity changes and the result is significant, meaning that systematic liquidity risk is priced.

Furthermore, reviewing papers on the relation between liquidity risk and asset pricing, we can conclude that this relationship could be investigated on two levels

(1) From the perspective of the overall market
(2) From the perspective of the individual securities or portfolios

However, in reality, it is far from easy to segment the impacts of various kinds liquidity risk on asset pricing.

3.2. Asset pricing model

The study of liquidity impact on stock return is based on the studies of capital asset pricing models that formalize the risk – return trade – off theoretical framework. One of the first theoretical base is the Markowitz mean – variance efficient frontier that is a set of all risky portfolios of which expected return reach the maximum at a certain level of risk. The model is constructed as below:

Return:

$$E(r_P) = \sum_{i=1}^{n} w_i E(r_i) \qquad (1)$$

n = *the number of securities;*

w_i = *the proportion of the funds invested in security i;*

r_i, r_P = *the return on ith security and portfolio p;*

$E(r_p)$ = *the expected return*

Risk

The variance of a single security is the expected value of the sum of the squared deviations from the mean, and the standard deviation is the square root of the variance. The variance of a portfolio combination of securities is equal to the weighted average covariance of the returns on its individual securities:

$$Var(r_p) = \sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov(r_i, r_j) \qquad (2)$$

Covariance can also be expressed in terms of the correlation coefficient as follows:

$$Cov(r_i, r_j) = \rho_{ij}\sigma_i\sigma_j$$

ρ_{ij} : correlated coefficient between the rates of return on security i, r_i , and the rates of return on security j, r_j , and σ_i , and σ_j represent standard deviations of r_i and r_j respectively. Therefore:

$$Var(r_p) = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j \qquad (3)$$

Capital market line:

$$E(r_i) = r_F + \frac{E(r_M) - r_f}{\sigma_M} \times \sigma_P \qquad (4)$$

With the slope is:

$$\frac{E\ (r_{M-}\ r_F)}{\sigma_M}$$

Security market line:

$$E(r_i) = r_F + \frac{\sigma_{iM}}{\sigma_M^2}[E(r_M) - r_F] \qquad (5)$$

Or

$$E(r_i) = r_F + \beta_i[E(r_M) - r_F] \qquad (6)$$

This is traditional CAPM that indicates only two moments, mean and variance. However, this model is under the basis of stringent assumptions. The first assumption is that investors are deemed to risk – averse, utility – maximizing and rational individuals. The second one indicates markets as being operating without frictions comprising transaction cost and taxes. Besides, that investors are presumed to plan for the same single holding period and have

homogeneous expectation is the content of next assumptions. Simultaneously, all investments are assumed to be infinitely divisible and no investor is large enough to influence security price. In other words, all investors are price takers. These assumptions are clearly trigger model's drawbacks that are pointed out in the paper of Hanoch and Levy (1970) and Levy and Sarnat (1972), for instance. For that reason, beta is not persuasive to fully capture risks. Salumelson (1970) supposes that given everything equal, investors would prefer the portfolio with positive skewness to negative skewness; thus, three Moment CAPM is suggested in Kraus & Litzenberger's research (1976) that sorts risk into three components: systematic risk, non-systematic risk and systematic skewness with important assumptions:

(1) A positive marginal utility for wealth (u'>0)
(2) Decreasing marginal utility for wealth (u"<0)
(3) Non – increasing absolute risk aversion, which implies skewness.

Equation:

$$\bar{R_\iota} - R_f = b_0 + b_1\beta_i + b_2\gamma_i \qquad (7)$$

$\beta_i = \frac{\sigma_{iM}}{\sigma_M^2}$*: market beta of ith risky asset*

$\gamma_i = \frac{m_{iMM}}{m_m^3}$*: market gamma or systematic skewness of the ith risky asset*

σ_M^2 *and* m_m^3 *are the variance and the third moment of the market returns, respectively.*

$\sigma_{iM} = E[(R_i - \bar{R_\iota})(R_m - \overline{R_m})]$ *is the covariance between return on security i and market return.*

$m_{iM} = E[(R_i - \bar{R}_i)(R_m - \bar{R}_m)^2]$ *is the co-skewness between return on security i and market return.*

The coefficients b_1 and b_2 depend on market risk premium and the elasticity of substitution between the skewness and the variance of market portfolio return.

$$beta = \frac{E[(R_i - E(R_i))(R_m - E(R_m))]}{\sigma_m^2} \quad (8)$$

$$gamma = \frac{E[(R_i - E(R_i))(R_m - E(R_m))^2]}{m_m^3} \quad (9)$$

Harvey and Siddique (2000) documents a pertinent point that there is a correlation between beta and gamma, and hence the relation of beta to returns can be inferred to the association of gamma to return. This proposition is also clearly indicated on the calculation formula of beta and gamma.

The next part will present Fama – French three factor model which is one of the most common asset pricing model to assess the significance of stock return determinants. Fama & French (1992) compiles the evidence about the drawbacks of CAPM and simultaneously the finding of previous studies that illustrate the limitation of using beta as the sole risk factor in explaining expected stock return. Additionally, when adding size, earning – price, debt – equity and book – to – market ratio one by one, each factor plays a role on expected stock return; however, when combining these factors in model, the impact of size and book – to – market ratio seems to cover that of earning – price and debt – equity.

From this background, Fama and French (1993), take a step forward by measuring SMB which is the return on a portfolio of small – size stocks minus that of large – size stocks as the proxy for size factor, as well as HML (the return on a portfolio of stocks with high book – to – market portfolio and that of stocks with low book – to – market ratio), and then including it in the asset pricing model, forming the three – factor model:

$$E(R_i) - R_f = \beta_{iM}[E(R_M) - R_f] + \beta_{is}E(SMB) + \beta_{ih}E(HML) \quad (10)$$

In this research, authors use time series approach of Black, Jensen and Scholes (1972) to confirm that mimicking portfolios on size and book – to – market ratio significantly explain the variation in returns. Equally important, the intercepts are statistically close to zero, which supports the impact of size and book – to – market ratio factors on cross – sectional stock returns.

4. DATA AND METHODOLOGY

4.1. Data

Dataset consists of all stocks on Taiwan Stock Exchange from January 2007 to December 2014. Monthly and daily data on returns, trading volume, number of shares outstanding are obtained from Thomson Reuter Database. Daily data of stock market index from Taiwan Stock Exchange Weighted Index (TWSE – index) is accumulated from Yahoo finance.

New Lunar Year is a crucial cultural holiday in some Asians country and is defined according to lunar calendar which is different to Gregorian calendar. Moreover, the date of New Lunar Year in Gregorian calendar changes year by year. Data on New Lunar Year is collected from Gregorian – Lunar Calendar Conversion Table on Hong Kong Observatory Website. The following table indicates exact date of New Lunar Year over the period of 2007 to 2014:

Year	**Date**
2007	17th Feb
2008	7th Feb
2009	26th Jan
2010	14th Feb
2011	3rd Feb
2012	23rd Jan
2013	10th Feb
2014	31st Jan

Taiwan stock market closes during holiday, in turn, in this paper we study the impact of holiday by examining the period of one week before holiday and one week after the closure of the market.

Size variable is the natural logarithm of the market capitalization of the firm and the book – to – market ratio is calculated as the ratio of book value to market value at the end of year.

In this study, we use illiquidity ratio (ILLIQ) as the proxy for liquidity risk. This measure is the most appropriate in emerging market because bid – ask spread data is difficult to collect in long period and is unconvincing in this market, additionally it is a poor proxy for actual transaction cost. Besides, turnover rate that has strong theoretical appeal and whose data is easy to obtain might be distorted in this market due to a huge number of individual investors who are attracted by short – term profit, leading to high trading frequency and high turnover rate, as a result. For these reason, Illiquidity ratio that captures price, volume and volatility impact and employ readily available data of stock price and volume is the best choice in this case. Also, this ratio should have positive relation with illiquidity measure from microstructure data.

Applying the computation in the research of Amihud (2002), illiquidity ratio is calculated as follows:

$$ILLIQ_{iyd} = |R_{iyd}|/VOLD_{iyd} \quad (11)$$

Illiquidity ratio directly reflects price change in response to order size (trading volume), in other word, daily price impact of order flow. This ratio is expected to have positive relationship with expected return.

R_{iyd}: the return on stock i on day d of year y

$VOLD_{iyd}$: daily trading volume in dollar of stock i

We compute monthly average of illiquidity for each stock i.

$$ILLIQ_{ity} = \frac{1}{D_{it}} \sum_{t=1}^{Diy} ILLIQ_{iyd} \qquad (12)$$

$D_{it:}$ the number of days for which data are available for stock i in month t.

Stocks admitted to the analysis must meet the following requirements:

(i) Stock has return and volume data for at least 200 days during year y – 1 and stock must be listed at the end of year y – 1.

(ii) Outliers – stocks with annual average illiquidity are at the highest or lowest 1% tail of distribution are eliminated from the sample.

After using these criteria, there are between 371 and 541 stocks satisfies and included in this analysis.

Table 1

Number of firms in the sample for each year

Year	Total number of stocks available	Sample	**%**
2007	651	371	56.99%
2008	663	470	70.89%
2009	684	422	61.70%
2010	717	500	69.74%
2011	743	541	72.81%
2012	761	455	59.79%
2013	775	433	55.87%
2014	787	501	63.66%
Average	722.625	461.625	63.93%

Table 1 indicates the number of firms satisfying the criteria to be included in our sample and compares that figure to the total number of available stocks.

Table 2

Market capitalization of sample stocks and all stocks

YEAR	**SAMPLE**			
	Maximum	Minimum	Median	Mean
2007	731440	6000	86400.00	116807.9
2008	19106830	2870	93605	474667
2009	24540810	5120	212895	809624.9
2010	63094410	9500	250595	1092588
2011	64879080	6120	153440	849556.9
2012	86597390	4780	171600	965421
2013	91784590	10360	216220	1026080
2014	1.16E+08	9000	195400	1010909
	ALL STOCKS			
2007	3917845	1	8773	51755.37
2008	1892397	8	4935	27288.83
2009	5223454	16	9570.5	52530.53
2010	3893456	12	12315	62627.02
2011	2926535	14	7991	46581.37
2012	8659739	12	9493	64411.18
2013	9178459	4	12126	66741.43
2014	2297415	9	12331	52915

Table 2 shows the comparison of all stock versus sample. It is clear that our sample discards a number of small stocks when the minimum of stock market capitalization of the sample is significantly higher than that of all stocks. Moreover, the same situation is recorded in the value of mean and median.

4.2. Portfolio formation

In this paper, we use joint criteria to sort stocks into various portfolio. Size in all months of year t is presented by the market capitalization at the end of year y – 1. First, all stocks are ranked on size and split into two groups: Big and Small (50:50), then calculating book – to – market ratio at the end of year *y – 1* and partition stocks into three group (High, Medium, Low) based on ranked book – to – market ratio (30:40:30). Similarly, calculating monthly average illiquidity for each company in year *y – 1* and categorizing firms into very liquid (V), moderately liquid (N) and illiquid (I) with the split 30:40:30.

By joining these three criteria, we form 18 portfolios (S/L/V, S/L/N, S/L/I, S/M/V, S/M/N, S/M/I, S/H/V, S/H/N, S/H/I, B/L/V, B/L/N, B/L/I, B/M/V, B/M/N, B/M/I, B/H/V, BH/N, B/H/I). By this way of constructing portfolios, the effect of size and book – to – market factors would be controlled.

Subsequently, monthly returns are calculated for each portfolio. This figure is deducted by risk – free rate to obtain monthly excess returns which are dependent variable is the test. Risk – free rate proxy is extracted from interest rate of three – month Taiwanese government bonds.

SMB is obtained by taking the difference in each month between the simple average of returns on the nine small portfolios and nine big portfolios.

HML is the difference between in each month between the average returns of six highest book – to – market portfolios and the six lowest book – to – market portfolios.

Likewise, IMV mimicking portfolio is computed for each month by taking the difference between the average returns of the six most illiquid portfolios and the six most liquid portfolios

Betas and gammas of portfolio are estimated from model:

$$R_{pty} - R_f = a_{py} + \beta_{py}(R_{mty} - R_f) + \gamma_{py}(R_{mty} - R_f)^2 + e_{pty} \quad (13)$$

When BETA and GAMMA are estimated, obtained values are assigned to all individual stocks in portfolio. By means of this procedure, we would avoid measurement errors when estimating beta and gamma for individual firms.

From table 3, it is obvious that illiquid portfolios are the least popular ones with both average number of stock and minimum number of stock in portfolio are smallest among all sorts of portfolio in the sample.

4.3. Methodology

In this paper, we analyze the relationship of liquidity and stock return on the basis of Fama – Frech three – factor asset pricing model augmented by the liquidity factor and CAPM Three – Moment.

We first consider Fama – French augmented by liquidity factor and apply robust OLS regression on panel data of portfolio returns and risk factors.

$$R_{it} - R_{ft} = b_i(R_{mt} - R_{ft}) + s_i SMB_t + h_i HML_t + l_i IMV_t + \varepsilon_{it} \quad (14)$$

R_{it}: the return of portfolio i in month t

R_{mt} and R_{ft}: market return and risk – free rate in month t

SMB_t, HML_t, IMV_t: the excess return on proxy portfolios for the size factor, book – to – market factor and illiquidity factor.

Subsequently, time series analysis is separately conducted on each portfolio to study how liquidity risk's impact on stock returns varies with different firm characteristics

Tests are also for January months only, as well as one week before and one week after New Lunar Year holiday of Taiwan market to examine the calendar and holiday effects on liquidity risk factor.

After experimenting liquidity effect on liquidity – augmented Fama – French model, this paper investigates the relationship between liquidity and stock return by means of CAPM Three Moment augmented by liquidity factor.

Similar to the procedure with Fama – French model, we utilize robust OLS to panel data and time series regression of the excess return of 18 portfolios on the following model:

$$R_{it} - R_{ft} = \beta_{m,it}(R_{mt} - R_{ft}) + \gamma_{it}(R_{mt} - \overline{R_m})^2 + \beta_{l,it} IMV_t + \varepsilon_{it} \quad (15)$$

R_{it}: the return of portfolio i in month t

R_{mt} and R_{ft}: market return and risk – free rate in month t

$\bar{R}_m$: average stock market return

From preliminary tests, model is free from serial correlation problem but faces heteroskedasticity issue, thereby Robust Least Squares Test is employed to eliminate heteroskedasticity.

Table 3

Average number and minimum number of companies in portfolios

Portfolio	Size	Book to market	Illiquidity	Average Number of Stocks	Minimum
1	SMALL	LOW	VERY LIQUID	21.375	18
2			MEDIUM	26.625	19
3			ILLIQUID	21	16
4		MEDIUM	VERY LIQUID	26.625	20
5			MEDIUM	37	31
6			ILLIQUID	27.75	23
7		HIGH	VERY LIQUID	21.25	17
8			MEDIUM	27.125	22
9			ILLIQUID	20.75	17
10	BIG	LOW	VERY LIQUID	21.25	17
11			MEDIUM	27.375	22
12			ILLIQUID	21	17
13		MEDIUM	VERY LIQUID	27.75	22
14			MEDIUM	36.25	29
15			ILLIQUID	27.375	22
16		HIGH	VERY LIQUID	21.375	17
17			MEDIUM	26.875	22
18			ILLIQUID	20.875	17

5. EMPIRICAL RESULTS

5.1. Background

5.1.1. Taiwan macroeconomy

Taiwan, the 4th largest economy in Asia, is a dynamic economy and a promising market with huge potential. Based on the statistics of World Economic Forum (WEF) and International Institute for Management Development (IMD) this country is the 14th most competitive and 13th dynamic economy in the world. Moreover, with roughly 418 billion US dollars of currency reserve, Taiwan holds the 5th rank in the worldwide chart. By dint of this vast amount of reserve, central bank is able to keep the competitiveness of currency under control. With regards to economic sectors, Taiwan's economy largely depends on service sector that contributes more than 60 percent to GDP, followed by industry sector (approximately 33 percent) and agriculture (around 2 percent). Low inflation environment and robust private consumption also featured Taiwan economy.

Importantly, due to small domestic market, Taiwan's economy is significantly driven by export and the major export products are electronic and IT ones. Particularly, Taiwan plays a central role in the global electronics supply chain. Their main importers are China, the US and European countries. These points would be an explanation for the aftermath of global crisis on Taiwan's economy.

Equally important, there are some controversial issues still clearly visible in the economy. Interest rate is cutting lower and lower, which might lead to negative real rate and hence asset bubbles, private and corporate overleverage are likely to arise. This could cast a doubt on outlook growth, especially when export recently has been undergoing the worst slump ever. Besides, low household income, particularly in service industry, remains a chronic issue that has caused brain drain since long time ago. As shown in a survey of Business Weekly, 62.3% of Taiwanese aged 20 to 35 plan to work abroad due to low salary in Taiwan. If the government is unable to find a remedy for such issue, talent deficiency that might hurt the

economy in the long – term is not far from reality. Besides, aging population and increasing public debts are also big concerns of Taiwan economy.

During investigated time span, both ups and downs did occur in the economy. Before global financial crisis, GDP growth rate was experiencing promising signals and reached 6.52% in 2007. However, since Taiwan's economy is globally integrated and export plays a crucial role in the economy, Taiwan's economy was vulnerable to global market, and hence undergoing an immensely tough time when GDP growth plunged to around zero in 2008 and even negative in 2009 (-1.57%). To be specific, a significant decline was recorded in private consumption, gross fixed capital formation as well as export and import. Along with economic recession when all economic sectors experienced a downturn in production value, unemployment rate was increasing from 4% in 2007 to 6% in 2009. Also, earning growth of employees hit a low at -5% in 2009 as another indication of turmoil time. In order to combat against crisis, central bank released easing monetary policy by reducing policy rate by 12.5 basis points to 1.75% that remains quite low at the present time though a slight increase occurred in 2011.

After 2009, when global economy became better, world demand started to recover and global trade witnessed optimistic signs, Taiwan economy was also benefited from that because of high export dependence and quite high extent of globalization in Taiwanese firms. GDP growth bounced up to positive level of 10.63% in 2010, thanks to the recovery in all GDP components and all business sectors. Total GDP increase from 12.96 trillion TWDs in 2009 to 14.11 trillion TWDs in 2010. Also, unemployment rate decreased from 5.85% in 2009 to 5.21% in 2010 and 3.96% in 2014. Nevertheless, the phenomenal GDP growth in 2010 is only temporary because after this year, the rate dropped to 4 percent in 2011 and then around 2 percent in 2012 and 2013 before going up again to 3.93% in 2010. The same pattern was also reported in monthly earning of employees. In 2010, the earning growth rose to more than 5% before declining to around 0% in the next two year, then retracing to 4% in 2014. Though the year 2014 charted an upturn in the economy, this positive signal is considered as largely depending on Apple's production that would end when products were launched. Besides, as

presented in prior graph, interest rate is maintained at low level (1.875%) to implement easing monetary policy with the purpose of promoting economic growth.

5.1.2. Taiwan Stock market

5.1.2.1. Introduction of Taiwan Stock Exchange

Taiwan stock exchange Corporation (TWSE) was founded in 1961 and officially operated as a stock exchange in 1962 and is the main equities market in Taiwan, under the supervision of Financial Supervisory Commission. The objectives of TWSE are to generate capital, create profitable opportunities and promote economic growth. Furthermore, TAIEX (or TSEC) is capitalization – weighted index of all listed common stocks traded on the Taiwan Stock Exchange. Table 4 presents main features of TWSE.

Table 4

Overview of Taiwan Stock Exchange

Full name	**Taiwan Stock Exchange**	
Abbreviation	TWSE	
Index	TAIEX Reuters: .TWII Bloomberg: TWSE:IND	
Official website	http://www.twse.com.tw	
Currency of trade	Taiwan New Dollar (TWD) and dual - currency system of TWD - CNY (Chinese Yuan) for ETFs	
Trading day	Monday - Friday (GMT + 8)	
Trading hours	Regurlar trading	9:00-13:30 or orders will be matched at 1:33 pm for closing if the reference price of certain stocks rises or falls more than 3.5% of the last reference price 1 minute before market closes
	After - hour fixed trading price	14:30

(Continued)

	Odd - lot trading		14:30
	Block trading	Non - paired trade	9:00-17:00
		Paired trade	8:00-8:30 & 9:00-17:00
	Auction		After 16:00
	Tender offer		After 16:00
Order type and validity	Limit orders, valid the entire day		

Minimum Tick size

Price Range	Equity product	Stock warrant	Convertible Bond & Bond with Warrant	ETFs	Corporate Bond	Foreign Bond	Central Registered Government Bond
0.01 - 5	0.01	0.01	0.05	0.01	0.05	0.01	0.01
5 - 10		0.05					
10 - 50	0.05	0.10					
50 - 100	0.10	0.50		0.05			
100 - 150	0.50	1.00					
150 - 500			1.00				
500 - 1000	1.00	5.00					
≥ 1000	5.00		5.00				

Board lot	Stock	Bond	Beneficiary Certificate/TDR/Warrant
	1000 shares	Face value: NT$100 000	1000 units
Cancelling orders	Orders can be cancelled before execution and cannot change quantity and price at the same time, cannot increase quantity		
Matching priority	Strict price - time precedence hierarchy or traded through negotiation, auction, tender or other means in special cases		
Matching principles	Through Fully Automated Securities Trading, orders enter into the system at an earlier time must be executed in full before an order at the same price entered at a later time is executed		
Settlement	TWSE implements multilateral net settlement on daily basis. The settlement day is T+2. The unsettled position cannot be deferred to the next day.		

Source: http://twse.com.tw/en/

Figure 1 shows the clear graphical demonstration of Taiwan stock market classified by sectors based on market capitalization.

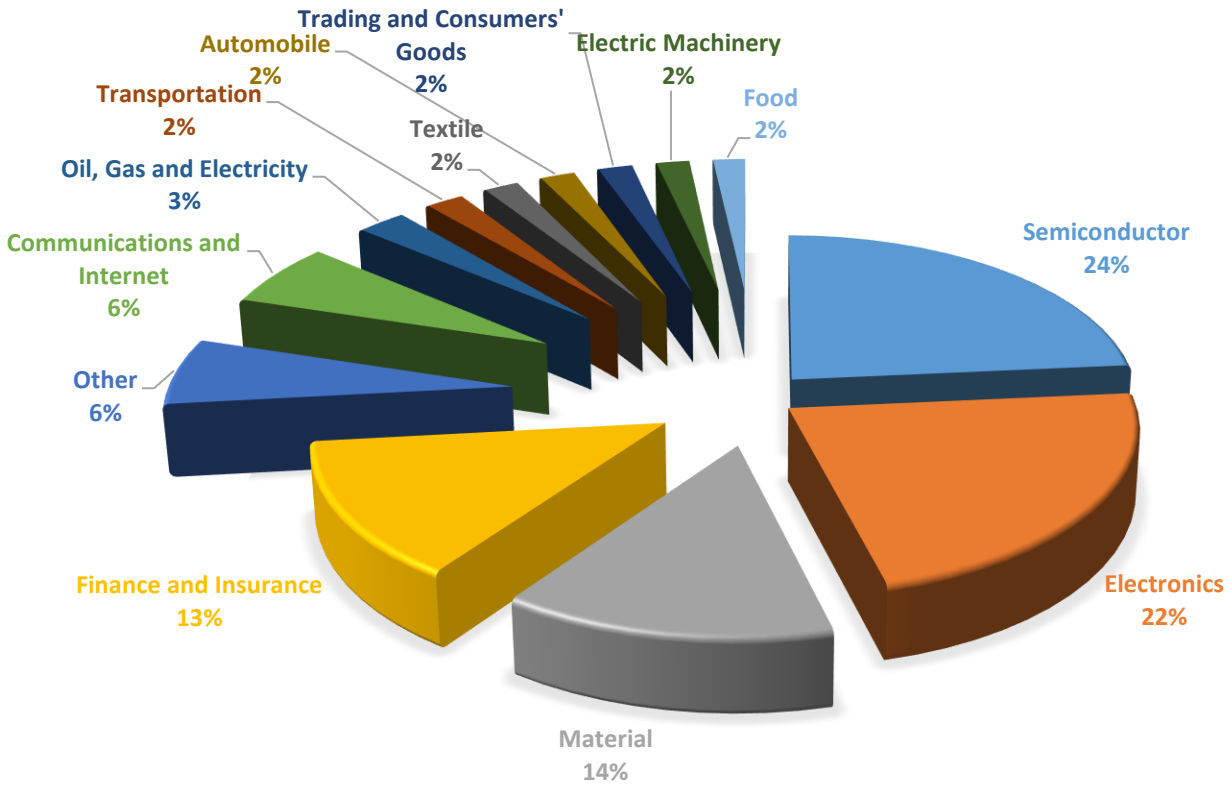

Figure 1. Vietnamese stock market categorized by sector - market capitalization

One of the striking point is that semiconductor and electronic sectors are the biggest contributors in Taiwan stock market in terms of market capitalization. These figures are on the line of the fact that these sectors are the largest ones in the economy and hence it is understandable when they also account for a huge part in stock market. The second biggest group consists of material and finance and insurance service sector. This points also explain the link between stock market and overall economy. Global crisis hurts Taiwan's export and hence the biggest sectors of the economy suffer, as a consequence, and a decline in their profitability performance is a negative signal to investors. Analysts always actively work on

any notable symptom that heralds forthcoming events. Therefore, leading moves in stock market can properly be foreshadow the economy's future state.

5.1.2.2. Stock market performance

From table 5, it could be extrapolated that the number of listed companies are increasing through period with 698 listed firms in 2007 to 880 listed firms in 2014 and total market capitalization in 2014 is 26.89 trillion TWDs. Except in 2008, market capitalization account for an increasing part of GDP in all other years of investigated period.

Taiwan stock market started the year 2007 with a rise in early period as the continuation of active trading in global market at the end of 2006. However, affected by sub – prime mortgage crisis, TAIEX began to fall and hit the bottom at 7,344.56 points in March, before a temporary recovery in the next 3 months thanks to foreign investment. Under the uncertainties from crisis and deterioration of investors' confidence, market index value continued to decrease even though US FED was lowering interest rate to ease off pressure on global market. A gloomy picture was also seen in 2008 when market capitalization was just as a half as that figure in 2007 and trading value was only around 26 trillion TWDs when compared with more than 33 trillion TWDs in 2007. As statistical data, in terms of stock price, only 27 stocks rose, whereas 647 stocks fell. Consequently, turnover rate also fell from 153.28% to 145.45%. The culprit of such contraction is again global crisis that now even more adverse. By contrast, the year 2009's scenario was much brighter than previous year, which is different from the overview of Taiwan's economy since stock market is more sensitive and usually signals for upcoming phenomena in the economy. In this year, because of positive signal of global economy as well as favourable policies of the government along with improvement in cross – strait relationship and the return of capital overseas, stock market rocketed up. To specify, market capitalization, with more than 21 trillion TWDs, was mostly double that value in 2008 and turnover rate also escalated significantly to 178.28%. The same trend was documented in trading volume and trading value. Concurrently, 705 stocks witnessed an improvement in their price while only 10 stocks underwent a reduction. These signals indicated that market is drastically bullish and investors' confidence rose

sharply. In 2010, global economy vastly recovered and Taiwan economy also bounced back with 10.63% of GDP growth, the highest rate in 21 years. At the same time, Taiwan stock market kept the upward momentum of last year and TAIEX grew 9.6% during this year. However, the upturn is now steady, not as dramatical as previous year. The impact of economic flourish in 2010 remained in the first half of 2011 before a sudden change occurred as a consequence from the upheaval of European debt crisis and the lowering of the US sovereign debt rating by S&P. Taiwan economy was by no means immune from the such global impact. Accordingly, TAIEX diminished by 21.18% compared to 2010, total market capitalization shrunk by 4.59 trillion TWDs and oversold by 27 billion TWDs by foreign and mainland area investors. Worse still, the number of shares traded and its value also went down. Nonetheless, amid recession there was still a bright point when there was a total of 46 newly listed companies thank to the effort of TWSE in expanding market scale by internationalization process. In 2012, along with inherent global factor, new regulations for capital gains tax and premium increase for the second generation of Taiwan's National Health Insurance program were imposed. Total trading value decreased to 23.93 trillion TWDs (23.38% lower than in 2011). The overall turnover rate also indicated a downtrend. However, this trend was ended in 2013, when a steady upturn was recorded in both 2013 and 2014. Except in turnover rate, all other indicators including market capitalization, trading volume and trading value revealed an uptrend and outperformed most other regional exchanges in Asia. It is also noteworthy that foreign share holdings reached a new high (38.3%) by the end of 2014, demonstrating the increasing attention of international investors to Taiwan's listed companies.

Table 5

Stock market performance indicators of Taiwan stock market over period 2007 – 2014

		2014	2013	2012	2011
Number of listed companies		880	838	809	790
Number of listed shares		666 533	648 800	625 798	602 677
Market Capitalization		26 891 503	24 519 560	21 352 161	19 216 183
Trading Volume		566 992	543 162	530 706	650 941
Trading Value		21 898 537	18 940 933	20 238 166	26 197 408
Market Capitalization (%GDP)		167	168	152	140
Turnover rate	Volume	85	84	85	109
	Value	84.63	82.64	97.33	119.87
		2010	**2009**	**2008**	**2007**
Number of listed companies		758	741	718	698
Number of listed shares		581 128	577 290	569 040	555 864
Market Capitalization		23 811 416	21 033 640	11 706 527	21 527 298
Trading Volume		817 567	1 088 769	778 910	887 186
Trading Value		28 218 676	29 680 471	26 115 408	33 043 848
Market Capitalization (%GDP)		175	168	92	166
Turnover rate	Volume	139	188	138	160
	Value	136.74	178.28	145.45	153.28

Unit: million shares, million TWD

Source: http://twse.com.tw/en/

Figure 2 shows the variation of market return over the investigated period. As depicted, a significant volatility can be seen from the figure. Specifically, market excess return was hovering around 0% with the low (-0.06%) in 2007 and 2008 when market volatility is also the most pronounced compared to other sub – periods, and the high in 2009 (over 0.06%). Following this high is a decrease in three consecutive years before a recovery was documented in the last two year of surveyed period. Such results are consistent with the evaluation from table 5 and the ups and downs of global economy. There are a lot of studies investigating the cointegration of US market and stock markets in Asian, for instance, Seth and Sharma (2015) that points out the causality relationship between these market, especially during crisis, explaining the such spill-over from the US sub – prime mortgage crisis. Figure 3 provide a more comprehensive picture of stock market. It is not surprising that the mean of market return was approximately 0% as global financial crisis profoundly hurt a lot of economies all around the world and Taiwan market is not an exception. It also obvious from market return distribution that market return prevalently fluctuated between -1% and 1%. With regards to market risk premium, its average during this period is negative but very close to zero.

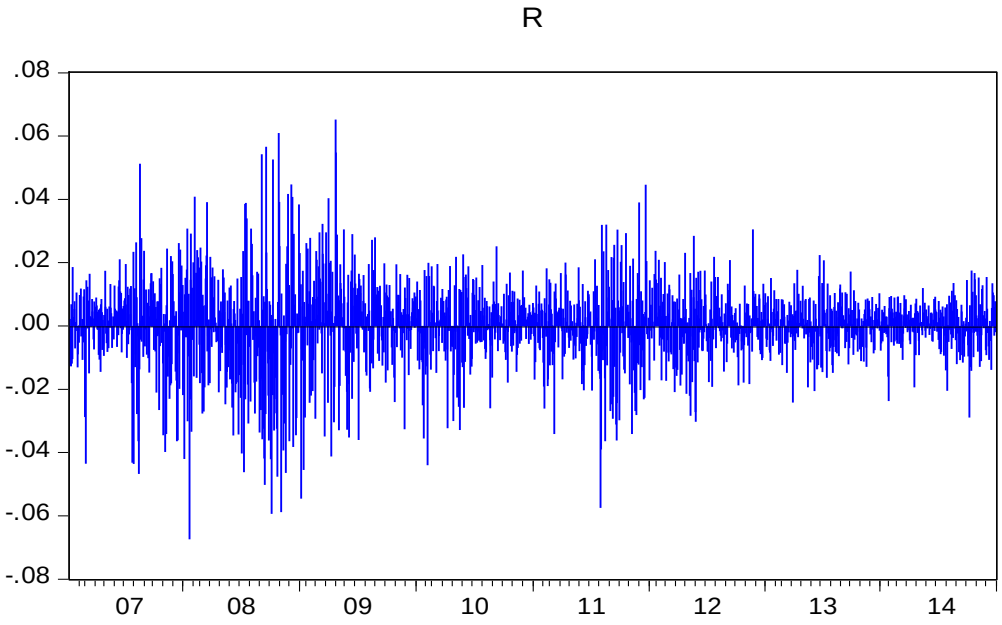

Figure 2. Market return fluctuation over period 2007 – 2014

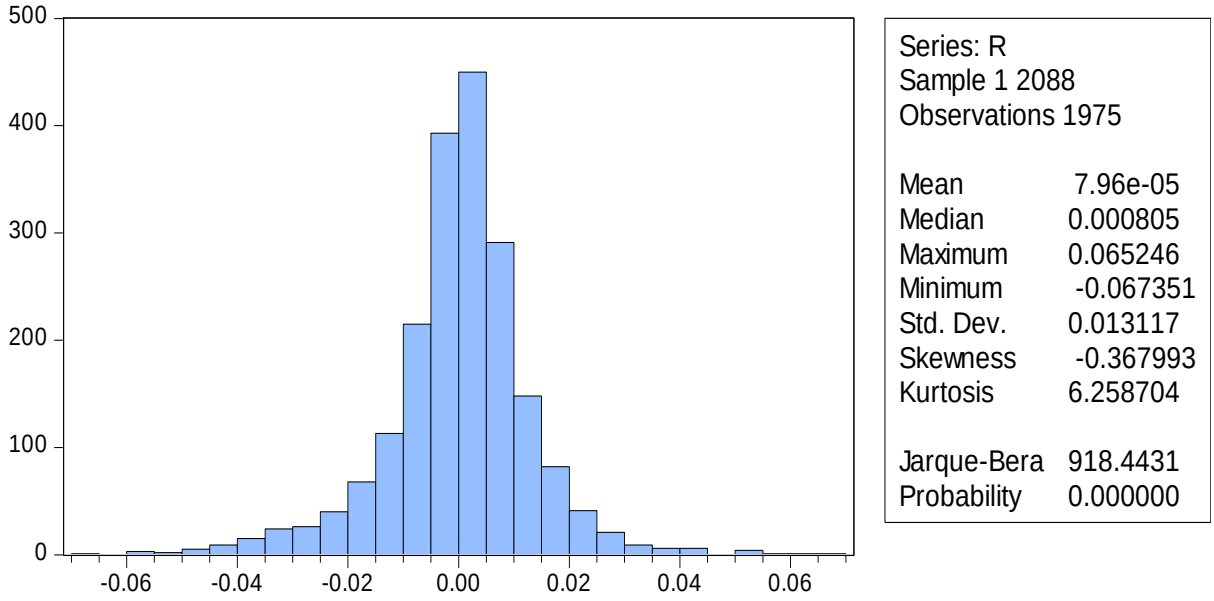

Figure 3. Market return distribution and summary statistics

5.2. Descriptive statistics

As can be seen from table 6, portfolios' returns in reported period vary from -1.95% to 1.00% and monthly average return is roughly 0% (-0.13%), reflecting relatively poor performance of stock returns. However, this is not bizarre since gloomy results were seen in the overall market as well. Standard deviation of portfolio return is roughly 0.41%. Besides, the obtained skewness statistics for portfolio returns is negative, corresponding to the return distribution that is skewed to the left. Kurtosis statistics is higher than 3, implying fatter tail of portfolio returns' distribution than normal distribution. Jarque – Bera test is also conducted to confirm about normality of the distribution and as expected, the null hypothesis about normal distribution is rejected at 1% level. Therefore, it could be inferred that mean and variance are inadequate to indicate the distribution of the return, suggesting higher order of moment in asset pricing model. In spite of non – normality feature, according to Central Limit Theorem, when sample is adequately large, sample mean will be approximately normally distributed. Therefore, this point does not alleviate the appropriation of regression method.

Table 6

Summary Statistics for Portfolio Returns

The table reports the summary statistics for portfolio returns in the analysis. Portfolios are sorted by size, book – to market and ILLIQ ratio. Jarque – Bera is used to test normality of portfolio returns. The number in parentheses is the p – value.

Number of Observation	1728
Mean	-0.0013
Median	-0.0009
Maximum	0.0100
Minimum	-0.0195
Std. Dev.	0.0041
Skewness	-0.5637
Kurtosis	4.6600
Jarque-Bera	289.9116 (0.0000)

Table 7 is the summary of some basic statistics at individual firm level. During examined period, stock returns range from -6.32% to 5.11% with the mean equal to 0.0010% and standard deviation of 0.63%. Besides, mean value of market excess return is negative in this period.

With the purpose of controlling for other stock characteristics, size, book – to – market, beta, gamma and ILLIQ variables are collected. In this sample, the range of book – to – market ratio is from 0.0416 to 11.3354 with the mean of 0.9507 and standard deviation of 0.5508. Besides, size variable is recorded with its value varying from 7.9621 to 14.8750 and mean value and standard deviation standing at 11.7856 and 1.1258, respectively. With regards to

beta, when this variable is computed at the security level, many likely measurement errors occur. Therefore, it is calculated at portfolio level and then assigned to individual stocks in respective portfolio. Beta has minimum value of 1.0675 and maximum value of 1.2470 with the mean equal to 1.1725 and standard deviation of 0.0497. Similarly, gamma is also determined at portfolio level before assigned to individual security. In this sample, the range of this variable varies from -3.3736 to 4.6038 and the mean is equal to 4.0782, while standard deviation is at 0.343.

Also, illiquidity ratio variable is also presented on the table with its minimum and maximum value of 0.0000 and 0.1921, respectively. 0.0002 is the mean value of this variable, whereas 0.0021 is its standard deviation.

Table 7

Basic Statistics

The table presents basic statistics of variables for the period 2007 – 2014. Returns are the logarithm of changes over a month of stock prices. Book – to – market variable is the ratio of book value to market value. Size is computed by taking the natural logarithm of firm's market capitalization's previous month. ILLIQ is monthly average of daily ILLIQ, while beta and gamma of individual firms are the firm's assigned portfolio beta and gamma.

	Mean	Maximum	Minimum	Std. Dev.
Book - to - market	0.9507	11.3345	0.0416	0.5508
ILLIQ	0.0002	0.1921	0.0000	0.0021
Size	11.7856	14.8750	7.9621	1.1258
$R_m - R_f$	-0.00102	0.0070	-0.0087	0.0029
$(R_m - \overline{R_m})^2$	1.12E-05	0.0002	9.8E-10	2.47E-05
Beta	1.1725	1.2470	1.0675	0.0497
Gamma	4.0782	4.6038	-3.3736	0.3430
return	1.02E-05	0.0511	-0.0632	0.0063

Table 8 indicates important relationships among factor returns as well as correlation of estimated beta and gamma. As can be seen from panel A, stock excess return is negatively associated to market risk factor while that correlation to ILLIQ is positive, which is a stronger initiative to study the relationship between liquidity and stock returns. Equally important, size and book – to – market variable have statistically significant correlation (-0.4090), which triggers multicollinearity problem in the model. Therefore, size is regressed on book – to – market variable and residual from this stage (named size_resid) is obtained and used in the analysis instead of size value. From Panel C, the relation between size_resid and book – to – market variable is obviously insignificant, indicating that multicollinearity is solved. Besides, size residual is also negatively correlated to stock return whereas positive correlation between book – to – market variable and stock excess return is recorded. Also, there is no significant evidence about the correlation of illiquidity to book – to – market value and size (in case of size, the correlation is significant at 10% only and the magnitude of the correlation is modest). Either small or insignificant correlation between illiquidity ratio and others risk factor suggests that liquidity is an underlying factor steering stock expected return. Interestingly, correlations on the table simultaneously suggest strong positive link between beta and firm size, indicating that big firms tend to have higher beta. This proposition conflicts to ordinary conclusion when studying in developed markets. Furthermore, illiquidity is negatively correlated to beta, which implies that high beta stocks are prone to be illiquid.

Beta and gamma are highly correlated with correlation coefficient of 0.9997 and p – value equal to 0.0000. This is consistent to the inference from the way these variables are computed and hence proposing advanced explanatory power of CAPM Three Moment over CAPM Two Moment. However, panel B presents the correlation between variables in CAPM three – moment model and when taking into account the correlation of stock excess return to market risk factor and co-skewness factor, the former is negative (corr = -0.1926) and significant at 1% level while the latter is negative but insignificant. Therefore, gamma's relevance in explaining stock excess returns is in doubt.

Table 8

Correlation between variables

Table 8 reports time series averages of monthly cross – sectional correlation of variables in asset pricing tests. Return is the natural logarithm of stock price changes over a month. Book – to – market variable is the ratio of book value to market value, while size stands for natural logarithm of firm's total market capitalization. ILLIQ represents illiquidity ratio, $ILLIQ_{ity} = \frac{1}{D_{it}} \sum_{t=1}^{Diy} ILLIQ_{iyd}$. Panel A provides information about the correlations of variables liquidity augmented three – factor model, whereas correlations of variables in CAPM three moment augmented by liquidity are presented in panel B. p – value is in the parenthesis.

PANEL A: CORRELATION MATRIX ANALYSIS IN THREE-FACTOR MODEL					
	Return		**Book-to-market**	**Size**	**ILLIQ**
Return	1				
$\mathbf{R_m - R_f}$	-0.1926	1			
	(0.0000)	-			
Book-to-market	0.0977	-0.029	1		
	(0.0000)	(-0.2283)	-		
Size	-0.054	0.1532	-0.409	1	
	(0.0000)	(0.0000)	(0.0000)	-	
ILLIQ	0.0239	-0.119	0.0075	-0.0106	1
	(0.0000)	(0.0000)	(-0.1737)	(-0.0544)	-

PANEL B: CORRELATION MATRIX FOR ANALYSIS IN THREE-MOMENT CAPM				
	Return	**ILLIQ**	$\mathbf{R_m - R_f}$	$\mathbf{(R_m - \overline{R_m})^2}$
Return	1			
	-			
ILLIQ	0.0239	1		
	(0.0000)	-		
$\mathbf{R_m - R_f}$	-0.1926	0.119	1	0.0504
	(0.0000)	(0.0000)	-	(0.036)
$\mathbf{(R_m - \overline{R_m})^2}$	-0.0614	0.0424	0.0504	1
	(0.1107)	(0.0782)	(0.036)	-

(Continued)

PANEL C: CORRELATION BETWEEN SIZE RESIDUAL AND OTHER VARIABLES					
	Return	$\mathbf{R_m - R_f}$	**Book-to-market**	**ILLIQ**	**Size_resid**
Return		-0.1926			
		(0.0000)			
$\mathbf{R_m - R_f}$	-0.0003	1			
	(0.958)	-			
Book-to-market	-0.0978	-0.029	1		
	(0.0000)	(-0.2283)	-		
ILLIQ	0.0239	-0.119	0.0075	1	
	(0.0000)	(0.0000)	(0.1737)	-	
Size_resid	-0.0154	0.216	5.20E-05	-0.0083	1
	(0.0053)	(0.0000)	(0.9925)	(0.1342)	-

It is indicated in table 9 that market risk premium is negative but very close to 0. Besides, the mean return for other risk factors is positive though relatively small and just above zero percent.

Table 9

Mean value of market excess return and factor returns

	$R_m - R_f$	*SMB*	*HML*	*IMV*	$(R_m - \overline{R_m})^2$
Mean	-0.00095	6E-05	6.32E-05	2.5E-05	1.12E-05
Standard Deviation	0.003115	0.000553	0.000678	0.001034	2.47E-05
Kurtosis	1.312044	0.949021	0.979162	0.595693	35.10068
Skewness	0.0722	-0.04214	0.672645	-0.04358	5.270471
Minimum	-0.01002	-0.00169	-0.00136	-0.00321	9.8E-10
Maximum	0.007527	0.001519	0.002404	0.002826	0.000201

In general, descriptive statistics indicate a relation as forecasted in the previous section. To be more precise, econometric analyses are performed to investigate the significance of these relations and are presented in the next part.

5.3. Econometric Analyses

This section concentrates on empirical results from hypotheses testing of the link between illiquidity ratio and stock expected excess returns, as well as the alternation of this relation in January and before and after New Lunar Year holiday. Firstly, we define whether the relation between liquidity and stock return is significant or not. The results are reported in table 10, 11, 12 and 13.

5.3.1. Liquidity effect tested on liquidity – augmented Fama – Frech model

According to table 10, the relationship between excess returns and all investigated risk factors in the model is statistically significant. To specify, size factor market risk has negative impact on portfolio's excess return, as opposed to book – to – market and liquidity factor. This outcome is different from the one acquired in developed market. Nonetheless, it is not unpredictable since there only 20% investors in Taiwan market are institutional investors and their trading accounts for only 8% of total turnover. Not all individual investors are well – equipped by good investment skills and relatively easy to be affected by psychological effect, in addition the reality that the main objective of non – institutional investors is short – term profit and they are inclined to invest in small firms, which could drastically affect market movement. By contrast, mature market with high percentage of institutional traders pay more attention to blue – chips. The result is consistent to several other studies on emerging markets that are designated with different characteristics to developed market, and hence phenomena might differ from those happen in matured market. "Size, value and liquidity. Do they really matter on an emerging stock market" of Lischewski and Voronkova (2010) and "Liquidity and Return Relationship in an Emerging market" of Batten and Vo (2014) are two examples that yield identical results as in this paper. Importantly, as expected, the relationship between illiquidity ratio and portfolio excess return is positive (0.3081) and strongly significant (z-stat = 6.4327). This implies that the more illiquid asset, the higher its expected excess return. It is also noteworthy that R^2 of this estimation (0.5698) is smaller than that of Fama – French (1993) that is around 0.9. A possible explanation is about the difference in sample size.

Equally important, intercept is though significant at 1% level has the magnitude close to zero, illustrating that factors included in the model quite well explain excess returns.

Wald test is also conducted to test the null hypothesis that estimated coefficients are equal to zero. It is clear from panel B that the null hypothesis is strongly rejected (F-stat = 1200.195 and Chi-square = 4800.781). Therefore, the relationship between risk factors including market risk, size, book – to – market and liquidity are statistically significant.

Table 10

Estimation of liquidity – augmented Fama – French (1993) model factor betas

Panel A of the table reports the market, size (SMB), book – to – market (HML) and liquidity (IMV) beta estimates of the regression:

$$r_{it} = b_{it}r_{mt} + s_{it}SMB_t + h_{it}HML_t + l_{it}IMV_t + \varepsilon_{it}$$

r_{it} denotes monthly excess for portfolio i in month t ; r_{mt} is the excess market return ; SMB_t is the return on a "small minus big" mimicking portfolio in month t, HML_t is the return on "high minus low" mimicking portfolio and IMV_t stands for " illiquid minus very liquid" mimicking portfolio in month t. ε_{it} is error term of the estimation. Corresponding z-statistics is included in the table, along with standard error and p-value. Panel data comprises of monthly data of 18 portfolios during the period of 2007 – 2014.

Panel B present the result of Wald test for estimated coefficient of the model. F-statistic and Chi-square value are reported with p-value.

Panel A				
		Std. Error	**z-statistic**	**p-value**
c	-0.0023	5.24E-05	-44.2732	0.0000
$\boldsymbol{b_i}$	-1.1540***	0.0170	-67.8583	0.0000

(Continued)

s_i	-0.3646***	0.0898	-4.0579	0.0000
h_i	0.1932***	0.0726	2.6606	0.0078
l_i	0.3081***	0.0479	6.4327	0.0000
Adjusted R-squared		0.5698		
Panel B: Wald Test				
F-statistic	1200.195		(0.0000)	
Chi-square	4800.781		(0.0000)	

(*), (**), (***) denote to the significant at 10%, 5% and 1% level, respectively.

In order to study how impact of liquidity factor on stock excess return varies with different stock characteristics, time series regressions are utilized for each portfolio with extreme-characteristic stocks. Stocks with medium characteristics are excluded in order to conduct a test for portfolios with contrast properties only.

Table 11 indicates the results of time series test for portfolio returns. It is striking that when testing on portfolio of small stocks with either high or low book – to – market ratio, size effect and value effect are both generally insignificant. On the contrary, market risk factor proves to has the most noticeable impact on stock excess returns among four factors. Beta value is negative (less than -1.0) and highly significant at 1% level in all portfolios. Liquidity factor also has significant impact at 1% level on portfolio returns but only in cases of illiquid portfolios, which is on the line with the research of Chan and Faff (2005). Its impact on very liquid portfolio is insignificant. The coefficient of liquidity factor is 0.8656 (z-stat=3.63) for low book – to – market portfolio and 1.0992 (z-stat=5.10) for high book – to – market portfolio. This outcome indicates that, among small stocks portfolio, impact of liquidity factor on portfolio of high book – to – market ratio stocks is stronger than that on portfolio of low book – to – market stocks.

However, regarding to big stock portfolios, size effect is significant in both low and high book – to – market value portfolios. The same pattern is obtained in liquidity factor and market factor as in case of small portfolios. It is interesting because in a lot of papers, size effect is proved to be more pronounce with small stocks, as opposed to outcome of this analysis that size effect is more significant in portfolios of big stocks. Simultaneously, HML beta is solely significant in high – book – to market portfolios.

In general, book – to – market value effect is consistently insignificant in almost all portfolios, while size effect is recorded in portfolios with big stocks and high book – to – market ratio. Market risk factor's impact on stock excess return is significantly negative and strong. Liquidity impact is significant and positive in all cases of illiquid portfolios. Moreover, stronger influence of illiquidity was reported on small stocks (0.8656 and 1.0992 for low and high book – to – market portfolio respectively) compared to big stocks (0.8599 and 0.8547 for low and high book – to – market portfolio respectively). However, the difference is not noticeable especially when extending the test to medium size portfolios. These findings are in favor of the argument that illiquidity factor is an independent variable that explain stock excess returns.

Besides, intercepts obtained from every time series test are statistically close to zero (approximately -0.002), which supports to our conclusion about impact of market risk and liquidity risk on stock excess return.

Table 11

Time series estimation of beta factors of Fama – French model augmented by liquidity factor for portfolio with extreme characteristics

The table reports the market, size (SMB), book – to – market (HML) and liquidity (IMV) beta estimates of the regression:

$$r_{it} = b_{it}r_{mt} + s_{it}SMB_t + h_{it}HML_t + l_{it}IMV_t + \varepsilon_{it}$$

r_{it} denotes monthly excess for portfolio i in month t ; r_{mt} is the excess market return ; SMB_t is the return on a "small minus big" mimicking portfolio in month t, HML_t is the return on "high minus low" mimicking portfolio

and IMV_t stands for " illiquid minus very liquid" mimicking portfolio in month t. ε_{it} is error term of the estimation. Corresponding t-statistics is included in the parentheses.

			Factor beta estimate				
			b_i	s_i	h_i	l_i	$Adj\text{-}R^2$
Small	Low	Illiquid	-1.1348***	-0.1892	-0.5555	0.8656***	0.5665
			(-13.3955)	*(-0.4225)*	*(-1.5362)*	*(3.6287)*	
		Very liquid	-1.1421***	-0.1678	-0.1608	-0.1633	0.5755
			(-16.9726)	*(-0.4717)*	*(-0.5599)*	*(-0.8620)*	
	High	Illiquid	-1.1635***	-0.0124	0.4051	1.0992***	0.5537
			(-15.2125)	*(-0.0308)*	*(1.2408)*	*(5.1034)*	
		Very liquid	-1.2155***	0.1490	0.3833*	-0.1029	0.5789
			(-24.2065)	*(0.5614)*	*(1.7884)*	*(-0.7277)*	
Big	Low	Illiquid	-1.0872***	-0.7300**	-0.2148	0.8599***	0.5632
			(-15.7849)	*(-2.0048)*	*(-0.7307)*	*(4.4336)*	
		Very liquid	-1.1114***	-1.2500**	0.0081	-0.4470	0.4155
			(-10.5520)	*(-2.2450)*	*(0.0179)*	*(-1.5072)*	
	High	Illiquid	-1.1860***	-1.1947***	0.9787***	0.8547***	0.5395
			(-17.6883)	*(-3.3704)*	*(3.4196)*	*(4.5266)*	
		Very liquid	-1.1211***	-1.1924**	0.5709*	-0.1652	0.5276
			(-14.1170)	*(-2.8402)*	*(1.6843)*	*(-0.7388)*	

(*), (**), (***) denote to the significant at 10%, 5% and 1% level, respectively.

5.3.2. Liquidity effect tested on liquidity – augmented CAPM Three Moment model

To robust the test of liquidity effect, we include additional factor, say higher moment co-skewness $[E(R_m) - \overline{R_m}]^2$ to adopt Liquidity Augmented CAPM Three Moment model for the test. Table 12 reports the result of scrutinizing impact of liquidity on stock excess return by CAPM three moment augmented by liquidity. Like the results from Fama – French model, impact of market risk on stock excess return is negative, while illiquidity risk has positive effect on excess returns. Intercept value in all regression is also statistically close to zero. However, there is no testimony about the significance of systematic co-skewness on excess return. Therefore, in this analysis, CAPM three moment model indicates no innovation and improvement when compared with traditional CAPM. Interestingly, R^2 value of Fama – French model is just slightly higher than R^2 of CAPM model. Therefore, it is possible that size and value effect are negligible compared to overwhelming power of market risk as well as illiquidity risk. For these reasons, it could be inferred that in the scope of this analysis, the explanatory power of liquidity augmented Fama – French model and CAPM three moment model are identical and market risk factor and illiquidity factor are two significant determinants of stock excess returns.

Wald test is also conducted to test the null hypothesis that estimated coefficients are equal to zero. It is clear from panel B that the null hypothesis is strongly rejected (F-stat = 1637.940 and Chi-square = 4913.821). Therefore, the relationship between risk factors including market risk and liquidity are statistically significant.

On table 13, similar pattern as in the test on Fama – French model is reported. Moreover, gamma, again, is statistically insignificant (in fact, co-skewness risk factor is only significant in several cases of portfolios with medium characteristics), which contributes to the above finding.

Table 12

Estimation of liquidity – augmented CAPM Three Moment model factor betas

Panel A of the table reports the market beta, systematic co-skewness gamma and liquidity (IMV) beta estimates of the regression:

$$E(R_{it}) - R_{ft} = \beta_{m,it}[E(R_{mt}) - R_{ft}] + \gamma_{it}[E(R_{mt}) - \overline{R_m t}]^2 + \beta_{l,it}E(IMV_t)$$

r_{it} denotes monthly excess for portfolio i in month t; r_{mt} is the excess market return and IMV_t stands for " illiquid minus very liquid" mimicking portfolio in month t. ε_{it} is error term of the estimation. Corresponding z-statistics is included in the table, along with standard error and p-value. Panel data comprises of monthly data of 18 portfolios during the period of 2007 – 2014.

Panel B present the result of Wald test for estimated coefficient of the model. F-statistic and Chi-square value are reported with p-value (in the parentheses)

Panel A				
		Std. Error	**z-statistic**	**p-value**
c	-0.0024	5.64E-05	-41.9634	0.0000
$\boldsymbol{\beta_{m,i}}$	-1.1761***	0.0168	-69.9762	0.0000
$\boldsymbol{\gamma_i}$	-1.0988	1.9775	-0.5557	0.5784
$\boldsymbol{\beta_{l,i}}$	0.3146***	0.0474	6.6353	0.0000
Adjusted R-squared		0.5633		
Panel B: Wald test				
F-statistic	1637.940		0.0000	
Chi-square	4913.821		0.0000	

(*), (**), (***) denote to the significance at 10%, 5% and 1% level, respectively.

Table 13

Time series estimation of beta factors of CAPM Three Moment model augmented by liquidity factor for portfolio with extreme characteristics

The table reports the market beta, systematic co-skewness gamma and liquidity (IMV) beta estimates of the regression:

$$E(R_{it}) - R_{ft} = \beta_{m,it}[E(R_{mt}) - R_{ft}] + \gamma_{it}[E(R_{mt}) - \overline{R_m t}]^2 + \beta_{l,it}E(IMV_t)$$

r_{it} denotes monthly excess for portfolio i in month t; r_{mt} is the excess market return and IMV_t stands for "illiquid minus very liquid" mimicking portfolio in month t. ε_{it} is error term of the estimation. Corresponding t-statistics is included in the parentheses.

Risk factor estimate						
			$\boldsymbol{\beta_{m,i}}$	$\boldsymbol{\gamma_i}$	$\boldsymbol{\beta_{l,i}}$	$\boldsymbol{Adj\text{-}R^2}$
Small	Low	Illiquid	-1.1499***	-16.3082	0.7954***	0.5640
			(-13.5137)	*(-0.9963)*	*(3.3326)*	
		Very liquid	-1.1348***	-0.1892	-0.5555	0.5665
			(-13.3955)	*(-0.4225)*	*(-1.5362)*	
	High	Illiquid	-1.1669***	1.0047	1.1590***	0.5417
			(-15.3164)	*(0.0686)*	*(5.4242)*	
		Very liquid	-1.2680***	-4.8790	-0.0291	0.5273
			(-20.3867)	*(-0.4078)*	*(-0.1666)*	
Big	Low	Illiquid	-1.1171***	4.3921	0.7863***	0.5435
			(-16.0284)	*(0.3276)*	*(4.0223)*	
		Very liquid	-1.1425***	-4.3546	-0.2276	0.5584
			(-15.1397)	*(-0.3000)*	*(-1.0752)*	
	High	Illiquid	-1.2717***	-18.2441	0.9076***	0.5161
			(-17.6433)	*(-1.3158)*	*(4.4895)*	
		Very liquid	-1.2323***	-23.5257	-0.1471	0.5216
			(-15.4838)	*(-1.5367)*	*(-0.6592)*	

(*), (**), (***) denote to the significant at 10%, 5% and 1% level, respectively.

5.3.3. Liquidity effect in January and New Lunar Year

This section examines the dynamics of illiquidity factor during January and New Lunar Year holiday as they are well-known calendar effects that could significantly affect stock market in many countries. New Lunar Year is the most distinctly important holiday in only some Asian countries including Taiwan. Therefore, it is highly likely that impact of NLY is stronger than January effect in Taiwan market. Separating daily data of January month as well as five day before and after NLY could help us study their impact and make comparison subsequently.

5.3.3.1. Liquidity effect in January

Conventionally, it is believed that with the purposes of employing tax loss, termed as "tax loss selling hypothesis" (Branch, 1977) and to facilitate window dressing, fund managers tend to sell losing stock before year – end and subsequently creating high demand to buy back stocks in January, leading to so – called January effect. Though vastly affected by Chinese culture with strong link to lunar calendar, January effect is still expected in Taiwan stock market since almost all economic activities are based on Western calendar, for example, tax, fund performance evaluation and bonus pay-out. Nevertheless, from the table below, mean value of stock excess return and illiquidity ratio are still hovering around 0 value, which is similar to mean return of whole sample, foreseeing no arbitrage opportunity for investors and no impact of January month on liquidity effect dynamic. In regards of market factor, market risk premium, though still small, is now positive (0.07%) and close to normal distribution. As other anomalies, it is probably because of investors' high awareness about the phenomenon that they time their trade and collectively act and hence the opportunities are quickly faded away.

Table 14

Summary statistics of stock returns in January

The table presents basic statistics of variables for January months during period 2007 – 2014. Excess returns are the logarithm of daily changes of stock prices minus risk free rate. ILLIQ is daily illiquidity ratio.

	Excess return	**Market risk premium**	**ILLIQ**
Mean	-0.0020	0.0007	0.0002
Median	-0.0019	0.0016	0.0000
Maximum	0.0245	0.0069	0.0449
Minimum	-0.0456	-0.0062	0.0000
Std. Dev	0.0060	0.0036	0.0016
Skewness	-0.3326	-0.2148	18.2101
Kurtosis	5.4319	2.8163	406.3297
Observations	3672.0000	3691.0000	3658.0000

The most critical point in table 15 is that the correlation of illiquidity ratio and stock excess return is insignificant, while the correlation of market risk and size as well as book – to – market value are highly significant. These significant correlations are consistent with the statistics of whole sample.

Table 15

Correlation of stock excess return and risk factors in January

Table 15 reports correlation of variables in January months over 2007 – 2014 period. Excess returns are the logarithm of daily changes of stock prices minus risk free rate. ILLIQ represents daily illiquidity ratio.

	return	**market risk premium**	**size**	**book-to-market**	**ILLIQ**
return	1.0000	-0.4534	-0.0458	0.0944	0.0169
		(0.0000)	(0.0056)	(0.0000)	(0.3083)

In order to verify the relation of risk factors and stock excess return in January, a test on daily data of January months in investigated period on stock returns and risk components are performed.

Table 16 indicates that market risk factor is the only factor driving stock excess return with the coefficient equal to -0.76 (t-stat = -37.86). Book – to – market variable though statistically significant at 1%, has coefficient value of -0.0006 that is too marginal. Similarly, intercept value is also negligible, which implies the dominant role of market risk on stock excess return in January. This result is inverse to the finding in the paper of Eleswarapu and Reingamum (1993) yet on the line with the results of Chui and Wei's research (1999) that confirms liquidity impact on stock excess return in non – January month only. Also, in their research Cheung and Court (1999) found no evidence about January effect in Hong Kong market. Possible reason for such disappearance of liquidity effect might be mentioned reason about the distinction between emerging and developed market. Another problem might derive from the measure of liquidity as pointed out in the book of Lhabitant and Grogoriou (2008), "Stock Market Liquidity: Implication for Market Microstructure and Asset Pricing". The author explains that if using microstructure – based measures, such January seasonal behaviour of liquidity effect will not be present.

Table 16

Estimation of liquidity – augmented Fama – French (1993) model factor betas for January month

Panel A of the table reports the market, size (SMB), book – to – market (HML) and liquidity (IMV) beta estimates of the regression:

$$r_{it} = b_{it}r_{mt} + s_{it}SMB_t + h_{it}HML_t + l_{it}IMV_t + \varepsilon_{it}$$

r_{it} denotes daily excess for stock i in day t ; r_{mt} is the excess market return ; SMB_t is the return on a "small minus big" mimicking portfolio in day t, HML_t is the return on "high minus low" mimicking portfolio and IMV_t stands for " illiquid minus very liquid" mimicking portfolio in month t. ε_{it} is error term of the estimation. Corresponding z-statistics is included in the table, along with standard error and p-value.

Panel B present the result of Wald test for estimated coefficient of the model. F-statistic and Chi-square value are reported with p-value (in the parentheses).

Variable	Coefficient	Std Error	z-statistic
b_i	-0.7598***	0.0201	-37.8599
s_i	0.0000	0.0001	0.9082
h_i	-0.0006***	0.0001	-3.8754
l_i	-0.0570	0.0461	-1.2349
c	-0.0015**	0.0007	-2.1302

5.3.3.2. New Lunar Year effect

Table 17 reports some important statistics for one – week period before and after NLY holiday over investigated period. Before holiday, excess return is negative (-0.14%) though close to zero, and hence lower than mean excess return of whole sample. This phenomenon might come from the abnormal excess demand of cash to prepare to the biggest holiday of the year. Moreover, this occasion is considered as true new year in Taiwan and hence some psychological factors also involved in investors' trading behaviour. For instance, investors have demand to liquidate losing stocks to not bring bad luck to their new year. The superstition effect is addressed in the article of Chung, Darrat and Lin (2014) that alleges superstitious behaviours in countries having strong ties to Chinese cultural heritage including Taiwan. Surprisingly, a new computer trading mechanism in England was recently formed and solely based on superstitious belief in numerology and lunar phases. By contrast, higher average return is reported in the week after NLY (0.39%). This amount is higher than mean excess return of whole period. The reason is likely to be investors huge desire of buying stocks after massive selling before NLY holiday. Besides, it is noteworthy that high bonus is paid before NLY holiday, which might be an explanation of improvement in post – NLY holiday excess return. Market risk premium also enhances after NLY holiday. The NLY

effect could be considered as true "turn – of – the – year" effect in Taiwan market. As reported in the paper namely Financial Anomalies: Evidence from Chinese A-shares (2010) written by Su et al., abnormal return in this occasion is deemed as liquidity effect. However, illiquidity ratio after NLY holiday is slightly higher than the ratio before holiday that is approximately the same to the ratio of the throughout investigated time span. Also, excess return skewness is positive for both week before and after holiday and kurtosis statistics drops significantly to nearly normal distribution level after the holiday. This means that stock excess returns after this holiday trading break are more clustered around mean value.

Table 17

Summary statistics of stock returns for period before and after NLY holiday

The table presents basic statistics of variables for weeks before and after NLY holiday during period 2007 – 2014. Excess returns are the logarithm of daily changes of stock prices minus risk free rate. ILLIQ is daily illiquidity ratio.

	PRE - HOLIDAY			**POST - HOLIDAY**		
	excess return	market risk premium	ILLIQ	excess return	market risk premium	ILLIQ
Mean	-0.0014	-0.0042	0.0002	0.0039	-0.0013	0.0003
Median	-0.0022	-0.0027	0.0000	0.0003	-0.0003	0.0000
Maximum	0.2059	0.0184	0.1683	0.1703	0.0348	0.8004
Minimum	-0.1894	-0.0454	0.0000	-0.1427	-0.0335	0.0000
Std. Dev	0.0227	0.0127	0.0021	0.0247	0.0137	0.0086
Skewness	0.31	-1.43	45.00	0.37	0.20	74.59
Kurtosis	6.28	5.85	2872.45	4.60	3.80	6131.08
Observations	17667	17667	17433	14397	14397	14397

From table 18 below, market risk and illiquidity element are two factor significantly correlated to stock excess return in both a – week – period before and after NLY holiday. However, different from statistics obtained in whole sample, in this special case, market risk premium is positively correlated to stock excess return. These correlations are stronger than in whole sample. The change in sign of correlation might attribute to abnormal high trading frequency around NLY holiday that derives from trading behaviour of individual investors.

Table 18

Correlation of stock excess return and risk factors before and after NLY

Table 9 reports correlation of variables in period before and after NLY holiday over 2007 – 2014 period. Excess returns are the logarithm of daily changes of stock prices minus risk free rate. Book – to – market variable is the ratio of book value to market value, while size stands for natural logarithm of firm's total market capitalization. ILLIQ represents daily illiquidity ratio.

	Excess return	Market risk premium	size	Book-to-market	ILLIQ
Excess return		**PRE - HOLIDAY**			
	1.0000	0.1169***	-0.0034	0.0118	0.0375***
		(0.0000)	(0.6565)	(0.1192)	(0.0000)
		POST - HOLIDAY			
	1.0000	0.1149***	-0.0055	-0.0194	0.0309***
		(0.0000)	(0.5062)	(0.0197)	(0.0002)

In order to study whether the difference between pre – holiday and post – holiday period statistics is significant or not, a mean difference test is conducted and results are presented in table 19.

It can be inferred from the table that mean excess return in post – holiday period is significantly higher than that in pre – holiday period (t-stat = -25.62) while illiquidity level change of the period before and after NLY period is insignificant. This raises a suspicion about the role of liquidity impact on the behaviour of stock excess return as forecasted during the time around NLY holiday.

Table 19

Statistics of mean difference test of stock excess return and stock liquidity for one – week period before and after NLY holiday

	EXCESS RETURN		ILLIQUIDITY	
	BEFORE	AFTER	BEFORE	AFTER
Mean	-0.0015	0.0051	0.0002	0.0003
Variance	9.21E-05	0.0001	1.64E-06	1.84E-05
Pearson Correlation	-0.1122		0.1169	
t Stat	-25.62		-1.24	
P(T<=t) one-tail	1.02E-133		0.1060	
t Critical one-tail	2.3273		1.2817	
P(T<=t) two-tail	2.05E-133		0.2120	
t Critical two-tail	2.57		1.64	

In order the test the impact of liquidity on excess return before and after NLY holiday, regression on daily data of 5 days before and after holiday is undertaken and results are presented in table 20. Table 20 indicates that before NLY, size effect and book – to – market value effect has no impact on stock excess return, while all other factors has significantly effect on stock excess return. To specify, market beta is at 0.2038 (t-stat = 17.92), and dramatically, illiquidity beta is equal to 0.5154 (t-stat = 7.52). The magnitude of illiquidity impact on stock excess return is much higher than in regression of full-length period. This could be explained by high trading demand before upcoming long holiday.

The same pattern is seen in the post - holiday period though less profound in both the power of market risk factor and illiquidity factor, especially in terms of the latter when the coefficient is now only at 0.09 (t-stat = 4.26).

Wald test is also done in both case and null hypothesis about zero equality is strongly rejected since F – statistics and Chi square value are huge (presented in table 13), which confirms the significance of above stated impacts.

Results of this test combined with mean difference test indicate that there is inadequate evidence to conclude liquidity effect as the driving factor of NLY abnormal return, which suggests other factors that are not included in the model vastly affecting stock excess return after holiday period. Also, R^2 of model before and after NLY holiday is low, confirming the significance of other factors in explaining phenomenon pre-and post – NLY holiday. The explanatory power of this determinant reduces impact of market risk factor as well as illiquidity factor.

In general, in both case of January month and one – week – period after NLY holiday, liquidity effect on stock excess return is deteriorated.

Table 20

Estimation of liquidity – augmented Fama – French (1993) model factor betas before and after NLY holiday

Panel A of the table reports the market, size (SMB), book – to – market (HML) and liquidity (IMV) beta estimates of the regression:

$$r_{it} = b_{it}r_{mt} + s_{it}SMB_t + h_{it}HML_t + l_{it}IMV_t + \varepsilon_{it}$$

r_{it} denotes daily excess return for stock i in day t ; r_{mt} is the excess market return ; SMB_t is the return on a "small minus big" mimicking portfolio in day t, HML_t is the return on "high minus low" mimicking portfolio and IMV_t stands for " illiquid minus very liquid" mimicking portfolio in month t. ε_{it} is error term of the estimation. Corresponding z-statistics is included in the table, along with standard error and p-value.

Panel B present the result of Wald test for estimated coefficient of the model. F-statistic and Chi-square value are reported with p-value (in the parentheses).

PRE - HOLIDAY			
		Std. Error	z-Statistic
$\boldsymbol{b_i}$	0.2038***	0.0114	17.9193
$\boldsymbol{s_i}$	-0.0001	0.0001	-0.8880
$\boldsymbol{h_i}$	0.0006**	0.0003	2.1721
$\boldsymbol{l_i}$	0.5154***	0.0686	7.5117
c	-0.0011	0.0014	-0.7895
Wald Test			
Test Statistic			p-value
F-statistic	94.4971		0.0000
Chi-square	377.9884		0.0000
POST - HOLIDAY			
Variable	Coefficient	Std. Error	z-statistic
$\boldsymbol{b_i}$	0.1686***	0.0136	12.3751
$\boldsymbol{s_i}$	-0.0003*	0.0001	-1.8956
$\boldsymbol{h_i}$	-0.0009**	0.0004	-2.4564
$\boldsymbol{l_i}$	0.0922***	0.0217	4.2564
c	0.0068***	0.0019	3.6465

(continued)

Wald Test		
		p-value
F-statistic	44.4092	0.0000
Chi-square	177.6368	0.0000

6. CONCLUSIONS AND LIMITATIONS

6.1. Conclusions

This thesis investigates the relationships between liquidity and expected stock returns in Taiwan stock market over period from 2007 to 2014. Daily data on sample is extracted for the analysis.

There has been a lot of studies on determinants of stock returns, and liquidity is generally deemed to be one of main factor determining stock returns. However, the number of studies examining this topic in Taiwan market is limited though Taiwan is one of the most actively operating market in Asia. Simultaneously, Taiwan economy is relatively dynamic and globally integrated, and hence attracting a huge amount of foreign funds flowing into. This thesis not only test the significance of liquidity effect on stock market return but also studying the dynamics of this impact during period that is coincident to calendar effects.

In order to scrutinize these issues, robust OLS method is employed to deal with heteroskedasticity problem, in which excess returns of selected stocks are independent variable and illiquidity factor as well as market risk factor are independent variable, along with size and book – to – market variable in Fama – French model and co-skewness variable in CAPM three moment model. 18 portfolios are formed based on joint criteria including size, book – to – market value and illiquidity ratio to study this relationship. Illiquidity ratio as presented in the research of Amihud (2002) is utilized to represent liquidity measure. Besides, subsamples of January months and one – week – periods before and after New Lunar Year holiday is extracted to further examine how the liquidity impact does change in some special cases that prevalently considered as typical anomalies in stock market. New – Lunar – Year is observed to having effect similar to “turn – of – year – end effect”.

With regards to the first hypothesis of the existence of relationship between liquidity and stock excess returns, a significantly positive relation is recorded between illiquidity factor and stock excess returns in both tests on Fama – French model and CAPM three moment model. However, unlike conventional cases in mature market, size effect and book – to – market value effect prove little evidence of affecting stock excess returns. Similarly, there is

no evidence about systematic co-skewness's impact. Comparing R^2 of these models help to figure out that Fama – French model is not superior to traditional CAPM. Furthermore, Time series analysis is also conducted on each portfolio to study how liquidity affect varies according to firm characteristics. Results are not surprising as liquidity impact is highly significant with illiquid stocks while insignificant in case of very liquid stocks. In addition, intercepts of all time – series regressions, in support of explanatory power of factors included in models.

However, this impact is less noticeable though still statistically significant in January and post NLY holiday, as opposed to stronger impact in pre – holiday period. Therefore, hypothesis 2 is not rejected. This outcome suggests other elements out of the scope of this thesis dominating stock excess return during studied period.

On the whole, though some phenomena in Taiwan market are not the same as those happen in developed market due to different market's characteristics, for example, size effect and book – to – market value effect, liquidity effect is verified throughout the market, which reflects that liquidity is properly priced.

6.2. Limitations

In some part of this analysis, the findings are not totally consistent and mixed results suggest that further investigation should be conducted to clarify phenomena in this market. Also, as pointed out in the paper of Lee and Swminathan (2000) that liquidity and momentum are potentially confounding. In further research, we would orthogonalized IMV factor to momentum factor to check this proposition.

LIST OF REFERENCES

Abadir & Spiedridijk (2005). Liquidity Constraints and the Demand for Assets: An Application to the Festivity Effect. Available at http://dx.doi.org/10.2139/ssrn.829484

Acharya & Pedersen (2005). Asset Pricing with Liquidity Risk. *Journal of Financial Economics.* Vol. 77, pp. 375-410.

Akbar & Nguyen (2016). The Explanatory Power of Higher Moment Capital Asset Pricing Model in the Karachi Stock Exchange. *Research in International Business and Finance.* Vol. 36, pp. 241-253.

Akhtaruzzaman et al. (2014). Interest rate, Size and Book – to – market Effects in Australia Financial Firms. ISSN: 0003-6846, retrieving http://www.tandfonline.com/loi/raec20.

Amihud & Mendelson (1986). Asset pricing and the bid-ask spread. *Journal of Financial Economics*. Vol. 17, no. 2, pp. 223-249.

Amihud & Mendelson (1989). The Effects of Beta, Bid-Ask Spread, Residual Risk, and Size on Stock Returns. *The Journal of Finance*, vol. 44, no. 2, pp. 479-486.

Amihud & Yakov (2002). Illiquidity and stock returns: Cross-section and time series effects. *Journal of Financial Markets*. Vol. 5, 31–56.

Armitage, Brzeszczynski & Serdyuk (2014). Liquidity Measures and Cost of Trading in an Illiquid Market. *Jouranl of Emerging Market Finance.* Vol 13(2), pp. 155-196.

Assefa & Mollick (2014). African Stock Market Returns and Liquidity Premia. *International Financial Market, Inst. and Money.* Vol. 32, pp. 325-342.

Baekaert, Harvey and Lundblad (2007). Liquidity and Expected Returns: Lessons From Emerging Markets. *Review of Financial Studies, Oxford University Press for Society for Financial Studies*. Vol. 20(6), pp. 1783-1831.

Bekaert, Harvey & Lundblad (2007). Liquidity and Expected Returns: Lessons from Emerging Market. *The Review of Financial Studies.* Vol. 20, No. 6, pp. 1783-1831.

Bradrania & Peat (2006). Characteristic Liquidity, Systematic Liquidity and Expected Returns. *International Financial Market, Inst. And Money.* Vol. 33, pp. 78-98.

Brennan & Subrahmanyam (1993). Market microstructure and asset pricing: On the compensation for illiquidity in stock return. *Journal of Financial Economics.* Vol. 41, pp. 441-464.

Brennan, Chordia & Subrahmanyam (1998). Alternative factor specifications, security characteristics, and the cross-section of expected stock returns. *Journal of Financial Economics*. Vol. 49, no. 3, pp. 345-373.

Chalmers & Kadlec (1998). An empirical examination of the amortized spread. *Journal of Financial Economics.* Vol. 48, pp. 159-188

Chalmers & Kadlec (1998). An Empirical Examination of the Amortized Spread. *Journal of Financial Economics.* Vol. 48, pp. 159-188.

Chan & Faff (2005). Asset pricing and the Illiquidity Premium. *The Financial Review.* Vol. 40, pp. 429-458.

Chan, Khanthavit & Thomas (1996). Seasonality and Cultural Influences on Four Asian Stock Markets. *Asia Pacific J Manage*. Vol. 13, No. 1. doi:10.1007/BF01733814.

Chen & Kan (1996) Expected return and the bid-ask spread, in S. Saitou, K. Sawaki, and K. Kubota, ed.: *Modern Portfolio Theory and Applications* (Gakujutsu Shuppan Center, Osaka).

Chen et al. (2010). Investigating Seasonal Anomalies in Asian Stock Market Prices: A Stochastic Dominance Approach. *International Journal of Management.* Vol. 27, No.1.

Chiang & Zheng (2015). Liquidity and Stock Returns: Evidence from international markets. *Global Finance Journal.* Vol. 27, pp. 73-97.

Chuhan (1992). Are institutional investors an important source of portfolio investment in emerging markets? *World Bank Policy Research Working Paper 1243*. Washington D.C.: World Bank.

Chui & Wei (1998). Book – to – market, Firm size, and the Turn – o f – the -year effect: Evidence from Pacific – Basin Emerging Market. *Pacific – Basin Finance Journal.* Vol 6, pp. 275-293.

Chung, Darrat & Li (2014). Superstition and Stock Trading: some new Evidence. *Journal of the Asia Pacific Economy,* 19:4, 527-538.

Congsheng Wu (2013). The Chinese New Year Holiday Effect: Evidence from Chinese ADRs. *Investment Management and Financial Innovation.* Vol. 10, Issue 2.

Darrat, Li & Chung (2013). Seasonal Anomalies: A Closer Look at the Johannesburg Stock Exchange. *Contemporary Management Research.* Vol. 9, No. 2, pp. 155-168.

Datar, V.T., Y. Naik, N. & Radcliffe, R (1998). Liquidity and stock returns: An alternative test. *Journal of Financial Markets*. Vol. 1, no. 2, pp. 203-219.

Dimson & Mussavian (1999). Three Centuries of Asset Pricing. *Journal of Banking and Finance.* Vol. 23, pp. 1745-1769.

Eleswarapu & Reinganum (1993). The seasonal behavior of the liquidity premium in asset pricing. *Journal of Financial Economics*. Vol. 34, no. 3, pp. 373-386.

Fama & French (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance*. Vol. 47, no. 2, pp. 427-465.

Fama & French (1992). The Cross-Section of Expected Stock Returns. *The Journal of Finance.* Vol. 47, Issue. 2.

Fama & French (1995). Size and Book – to – Market Factor in Earnings and Returns. *Journal of Finance.* Vol. 1, No. 1.

Ftiti & Tissaoui (2015). Liquidity, Liquidity Risk and Information Flow: Lessons from an Emerging Market. *Research in International Business and Finance. Retrieving at* http://dx.doi.org/10.1016/j.ribaf.2015.09.028

Gibson & Mougeot (2004). The Pricing of Systematic Liquidity Risk: Empirical Evidence from the US Stock Market. *Journal of Banking and Finance.* Vol. 28, pp. 157-178.

Hopenhayn & Werner (1996). Information, Liquidity and Asset Trading in a Random Matching Game. *Journal of Economic Theory.* Vol. 64, Issue. 2, pp. 349-379. Retrieving at http://dx.doi.org/10.1006/jeth.1996.0021

Hopenhayn & Werner (1996). Information, Liquidity, and Asset Trading in a Random Matching Game. *Journal of Economic Theory.* Vol. 68, pp. 349-379

Jun, Marathe & Shawky (2003). Liquidity and Stock Return in Emerging Equity Markets. *Emerging Market Review.* Vol. 4, pp. 1-24.

Jun, Marathe and Shawky (2003). Liquidity and Stock Returns in Emerging Equity Markets. Emerging Markets Review. Vol. 4(1), pp. 1–24.

Keim (1983), Size – Related Anomalies and Stock Return Seasonality: Further Empirical Evidence. *Journal of Financial Economics*. Vol. 12, pp. 13-32.

Kraus & Litzenberger (1976). Skewness Preference and the Valuation of Risk Assets. *The Journal of Finance.* Vol. XXXI, No. 4.

Kyle (1985). Continuous Auction and Insider Trading. *Econometrica.* Vol.53, No. 6.

Lam & Tam (2011). Liquidity and Asset Pricing: Evidence from the Hong Kong Stock Market. *Journal of Banking and Finance.* Vol 35, pp. 2217-2230.

Lhabitant & Grogoriou (2008). Stock Market Liquidity: Implication for Market Microstructure and Asset Pricing. *John Wiley & Sons.*

Lin et al. (2016). Price Limits and the Value Premium in the Taiwan Stock Market. *Pacific – Basin Finance Journal.* Vol. 41, pp. 26-45.

Lischewski & Voronkova (2012). Size, Value and Liquidity. Do They Really Matter on an Emerging Stock Market? *Emerging Markets Review.* Vol 13, pp. 8-25.

Liu (2006). A liquidity-augmented capital asset pricing model. *Journal of Financial Economics.* Vol 82, 631 – 671.

Luo Dengyue (2010). Liquidity Risk and Asset Pricing: The Multivariate GARCH – in – Mean Application. *International Conference on E-Business and E-Government.* Vol. 00, pp. 5203-5206, 2010, doi:10.1109/ICEE.2010.1304

Marrett & Worthington (2009). An Empirical Note on the Holiday Effect in the Australian stock market, 1996 – 2006. *Applied Economics Letters.* Vol 16, pp. 1796-1772.

Marshall, Nguyen & Visalanachoti (2014). Transaction Costs in an Illiquid Order – Driven Market. *Available at* http://dx.doi.org/10.2139/ssm/2512924.

Narayan & Zheng (2011). The Relationship between Liquidity and Returns on the Chinese Stock Market. *Journal of Asian Economics.* Vol 22, pp. 259-266.

Pastor & Stamburgh (2003). Liquidity and Expected Stock Returns. *The Journal of Political Economy;*111,3; pp. 642

Su et al. (2011). Financial Anomalies: Evidence from Chinese A – share Markets. *International Journal of Economics and Finance.* Vol. 3, No.2.

Sukor & Edil (2012). Stock Retruns, Firm Size, Liquidity and the Festivities Effect: Asian Evidence. Available at SSRN: https://ssrn.com/abstract=2155462.

Thomas & Dahzi (2015). Liquidity and Stock Returns: Evidence from International Markets. *Global Finance Journal.* Vol. 26, No. 2.

Vo and Batten (2010). An Empirical Investigation of Liquidity and Stock Returns Relationship in Vietnam Stock Markts during Financial Crisis. *Munich Personal RePEc Archive. Retrieving at* https://mpra.ub.unimuenchen.de/29862/1/MPRA_paper_29862.pdf&embedded=true

Wang et al. (2012). The Liquidity Effect in Stock Markets Evidence from Taiwan. *International Journal of Mathematical Models and Methods in Applied Sciences.* Issue 6, Vol. 6.

Weimin Liu (2006). A Liquidity – Augmented Capital Asset Pricing Model. *Journal of Financial Economics.* Vol. 82, No. 3, pp. 631-671.

Yuan & Gupta (2014). Chinese Lunar New Year effect in Asian Stock Markets, 1999 – 2012. *The Quarterly Review of Economics and Finance.* Vol 54, pp. 529-537.

Official website of Taiwan Government: http://statdb.dgbas.gov.tw/pxweb/Dialog/Saveshow.asp

Taiwan Stock Exchange Website: http://twse.com.tw/en/

The World Bank Website: http://www.worldbank.org/