# Determinant Factors of Market Liquidity in the Indonesian Equity Market

by

**Ihda Muktiyanto**

Bachelor of Accounting,
University of Satya Negara Indonesia, Indonesia

Master of Science in Finance,
University of Illinois at Urbana Champaign, USA

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# Abstract

Liquidity refers to the ability of a financial market to trade large volumes of assets quickly at low cost, and it covers a wide range of market dimensions including size, time and cost. Prior studies have found that liquidity is one of the most significant of an efficient financial market and that it affects costs of equity, returns and valuations, market stability, and economic growth. Although studies and discussions on various aspects and dimensions of liquidity have been well documented, the sources of liquidity variation vary greatly across markets. The main research question of this thesis is: What are the determinant factors of liquidity at market and at firm levels in Indonesia?

A set of regression models were employed to test a range of hypotheses developed to determine the factors influencing liquidity. The models distinctively address the analysis at market level and individual stock level. Following the initial tests, this thesis employed ARCH regression to identify and analyse the key determinants of liquidity at the market level. GARCH (1,1) regression was used to examine the influence of market level liquidity on the individual stock level liquidity. Two regression models were applied to test the determinant factors of liquidity at the individual stock levels: foreign investor and market power. Lastly, parametric and non-parametric tests were conducted to test the impact of economic policies and regulatory changes.

The findings suggest that market liquidity had declined during periods of high market volatility in Indonesia during the period of analysis. Announcements on macroeconomic indicators had little influence on market liquidity. Market liquidity was found to increase during periods of positive market return and to be negatively related to interest rates. There was strong evidence of seasonal regularities related to the days of the week, days around holidays and during Ramadan.

At the individual stock level, the results suggest the presence of commonality in liquidity where individual stock liquidity collectively moved in response to the changes of market level liquidity. The degree of this commonality is between that of developed markets and its emerging market counterparts. The results further show that foreign ownerships did not significantly affect the liquidity variation for the majority of the firms. Market power has a positive impact on liquidity, regulatory factors affected market liquidity in a significant way.

# Student Declaration

I, Ihda Muktiyanto, declare that the DBA thesis entitled 'Determinant Factors of Market Liquidity in the Indonesian Equity Market' is no more than 65,000 words in length, including quotations and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Ihda Muktiyanto

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This thesis has been edited by Peter Symons. Editor intervention was restricted to Standards D and E of the Australian Standards for Editing Practice.

# List of Publications

## Conference Papers

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# List of Abbreviations

| | |
|---|---|
| AMEX | American Stock Exchange (former name of NYSE MKT LLC) |
| ARCH | Autoregressive Conditional Heteroskedasticity |
| ASEAN-5 | Association of South East Asian Nations-5 (five major southeast Asian economies: Malaysia, Thailand, Indonesia, the Philippines and Singapore) |
| ASX | Australian Securities Exchange |
| Bapepam | Badan Pengawas Pasar Modal (Indonesian Capital Market Supervisory Agency) |
| BPI | Bursa Parallel Indonesia (Parallel Stock Exchange of Indonesia) |
| BRICS | Brazil, Russia, India, China and South Africa (five major emerging national economies) |
| CPI | Consumer Price Index |
| DJIA | Dow Jones Industrial Average |
| FWB | Frankfurter Wertpapierbörse (Frankfurt Stock Exchange) |
| GDP | Gross Domestic Product |
| IBPA | Indonesia Bond Pricing Agency |
| IDX | Indonesian Stock Exchange |
| IOSCO | International Organization of Securities Commissions |
| JATS | Jakarta Automated Trading System |
| JSX | Jakarta Stock Exchange |
| KLSE | Kuala Lumpur Stock Exchange |
| KPEI | Kliring Penjaminan Efek Indonesia (Indonesian Clearing Guarantee Corporation) |
| KSE | Korea Stock Exchange |
| KSEI | Kustodian Sentral Efek Indonesia (Indonesian Central Securities Depository) |
| LSE | London Stock Exchange |
| MSCI | Morgan Stanley Capital International |
| NYSE | New York Stock Exchange |

| | |
|---|---|
| OECD | Organisation for Economic Co-operation and Development |
| OJK | Otoritas Jasa Keuangan (Indonesian Financial Service Authority) |
| OLS | Ordinary Least Squares (regression) |
| OTC | Over the Counter (market) |
| PQSPR | Proportional Quoted Spread (a liquidity proxy) |
| QDEP | Quantity Depth (a liquidity proxy) |
| QSPR | Quoted Spread (a liquidity proxy) |
| Rp | Rupiah (Indonesian currency unit) |
| SCP | Structure-Conduct-Performance (paradigm) |
| SEAQ | Stock Exchange Automated Quotation system of the London Stock Exchange |
| SEB | Stock Exchange of Bombay |
| SEHK | Stock Exchange of Hong Kong |
| SES | Stock Exchange of Singapore |
| SET | Stock Exchange of Thailand |
| SETS | Stock Exchange Electronic Trading Service of the London Stock Exchange |
| SMARTS | Securities Markets Automated Research Training and Surveillance |
| SSX | Surabaya Stock Exchange |
| TOREX | Toronto Stock Exchange |
| TVAL | Trading Value (a liquidity proxy) |
| TVOL | Trading Volume (a liquidity proxy) |
| UMA | Unusual Market Activity |
| VDEP | Value Depth (a liquidity proxy) |
| XETRA | Exchange Electronic Trading of the Frankfurt Stock Exchange |

# Chapter 1
# Introduction

## 1.1 Background

Liquidity has been recognised as one of the most instrumental properties of an efficient financial market. Referred to as the ability to trade large volumes of assets quickly at low cost as and when required, liquidity covers a wide range of market dimensions including quantity, cost and time (Harris 2003). Studies have documented abundant evidence that liquidity affects costs of equity, returns and valuations, trading activities, investment strategies, risk management, market stability and economic growth (Pástor & Stambaugh 2003; O'Hara 2004; Acharya and Pedersen 2005; Butler, Grullon & Weston 2005; Chordia, Roll and Subrahmanyam 2008). Although studies and discussions on various aspects and dimensions of liquidity have been well documented, the precise sources of variation in market liquidity have not been fully understood.

Various studies have identified the dominant determinants of liquidity. These include the notable ones of Goldstein and A. Kavajecz (2000), Chordia, Roll and Subrahmanyam (2001), Rhee and Wang (2009) and Kale and Loon (2011). Goldstein and A. Kavajecz (2000) found that the bid-ask spreads and market depths declined following the implementation of new tick size that changed from eighths to sixteenths in the New York Stock Exchange (NYSE). Chordia, Roll, and Subrahmanyam (2001) found that NYSE liquidity is generally induced by variables such as interest rates, market performance, investor sentiment and announcements of indicators about the state of the economy. Rhee and Wang (2009) examined the role of foreign investors on market liquidity in the Indonesian stock market and found that foreign ownership is negatively related to liquidity. Kale and Loon (2011) reported a positive association between the ability to control the product market and stock liquidity, based on data from the United States between 1984 and 2003 and argue that higher market power leads to a more stable cash flow thereby dampening stock price volatility and improving liquidity.

In addition, studies have also examined the relationship between firm-level liquidity and market-level liquidity. That is, the liquidity of a single firm tends to move collectively with others in response to the liquidity of the entire market average, implying commonality in the individual stock liquidity. The commonality in liquidity was documented, for example, by

Chordia, Roll and Subrahmanyam (2000), Huberman and Halka (2001), Fabre and Frino (2004), Pukthuanthong-Le and Visaltanachoti (2009) and Choe and Yang (2010).

## 1.2 Research Problem

Despite the significant progress made towards understanding market liquidity, the determinants of liquidity variation remain elusive. The studies have not produced a comprehensive set of factors that affect liquidity at both market as well as at firm levels. Previous studies have only focused on the impact of the individual factors in a narrower perspective. Moreover, no one has studied the commonality in the individual stock liquidity in the Indonesian equity market.

Comprehensive studies of stock market liquidity in the context of emerging markets are also limited, primarily due to the insignificant size of the markets compared to global equity markets. However, current economic uncertainty in developed markets has motivated global funds to increase portfolio share in the emerging markets. These markets are important for the countries concerned because of the role they play in their respective economies.

## 1.3 Research Questions

As discussed above, understanding the sources of variation of market liquidity is particularly important, given its effect on many aspects of financial variables. However, no studies have focused on examining a range of factors affecting the liquidity simultaneously at the market level and at the firm level in the Indonesian market. Motivated by these observations, the research question addressed in this study is: What are the determinant factors of liquidity at market and at firm levels in Indonesia?

## 1.4 Objectives of the Study

Following the above research question, the specific aims of the thesis are to:

1. Identify the patterns of the aggregate market liquidity in the Indonesian equity market over time and across firms.
2. Identify the major influential factors of aggregate market liquidity.
3. Determine whether individual stock liquidity in the Indonesian equity market possess the property of commonality.
4. Determine the major influential factors of individual stock liquidity.

## 1.5 Research Scope

Following are the motivations for selecting the Indonesian equity market for the study:

First, prior studies on market liquidity have mostly focused on the countries with developed financial markets such as the United States, Europe and Japan. Given the level of maturity, the complexity and size of these markets, the results might not be applicable to the Indonesian market. For instance, studies in dealer-driven markets in developed economies have identified inventory cost as a dominant factor affecting commonality in liquidity. However, in an order-driven market, such as the Indonesian Stock Exchange (IDX), inventory cost may be less relevant (Fabre & Frino 2004).

Second, a comprehensive study of liquidity behaviour in the Indonesian equity market has not been undertaken. The studies to date have taken a narrow view of liquidity behaviour. For example, Allen and Sudiman (2009), Ekaputra and Ahmad (2007) and Purwoto and Tandelilin (2004) focused on the impact of implementation of finer tick size on liquidity. Rhee and Wang (2009) studied the influence of market liberalisation on liquidity, and Aitken and Comerton-Forde (2003) examined the impact of the 1998 Asian Crisis on liquidity. In contrast to those studies, the present study aims to address the deficiency in the literature by including a wider range of variables such as foreign ownership, market power, share tick size, margin eligibility and unusual market activity.

Third, detailed knowledge of market liquidity in the Indonesian equity market is scarce. Providing a comprehensive analysis will enrich the literature, and inform the development of trading strategies of market participants and inform the articulation of policies of regulators to improve market efficiency. This, in turn, has implications for greater market stability resulting in increasing market size. Continued implementation of such policies would contribute to economic efficiencies and growth in the longer term.

Finally, given the recent surge in the growth rate of the Indonesian economy, the equity market has considerable potential for growth and in order to sustain the growth rates and maintain competitiveness its performance must be improved. It is the home of some of the largest resources and commodity companies in the Asian region. With a population of more than 250 million, the fourth largest population in the world, Indonesia has the capacity to provide a wide range of investment opportunities for global investors.

## 1.6 Methodology

The thesis will employ econometric methods to test a set of hypotheses in order to achieve the research objectives. The study will begin with the discussion on the descriptive statistics of market liquidity, followed by the estimation of regression functions to specify the relationships between the determinant factors and liquidity.

This study uses a number of widely accepted liquidity measures to address the above research questions. The liquidity measures include value depth (VDEP), quantity depth (QDEP), proportional bid–ask spread (PQSPR), quoted bid-ask spread (QSPR), trading value (TVAL) and trading volume (TVOL). These proxies are chosen because they conform very well to the data, covering both single and multiple dimensions of market liquidity and both positive and negative perspectives of liquidity. The independent variables were selected in the context of the theory underlying the study framework. The observations include all listed companies in the IDX from January 2005 to December 2011, based on the selection criteria.

The following section provides a brief description of how each objective will be achieved.

**Objective One**

The first objective is to estimate the aggregate market liquidity over time and across firms. The study will aggregate the individual firm liquidity to construct market level liquidity measures as a time series data set. The variability of cross invariant liquidity is analysed from the average variations of observations of five firm sizes. Additionally, the analysis of correlations between liquidity measures is discussed. Finally, the findings will be compared to those of the previous studies.

**Objective Two**

The second objective is to identify major influential factors of aggregate market liquidity. Here, the study will be guided by a number of prominent research which provides significant evidence of the variables that affect the market level liquidity. The determinant variables summarised from the related literature are categorised into four groups: international market indicators, macroeconomic factors, market performance measures, and seasonal regularities. Initially, the Ordinary Least Squares (OLS) regressions will be used to estimate the relationships between six market level liquidity measures and the potential determinant variables selected. OLS assumes the existence of a constant variance while the time series

data naturally has non-stationary variance that may result in inefficient estimates. Engle (1982) suggests a model that allows the forecast variance of the time series data to vary systematically. Therefore, it will incorporate a modelling of conditional variance using autoregressive conditional heteroskedasticity (ARCH) model. The OLS and ARCH estimates will be subject to appropriate statistical tests to form conclusions about the associated hypotheses.

**Objective Three**

The third objective is to determine whether the individual stock liquidity is correlated with market level liquidity. From this point forward, the analysis will focus on the liquidity of the individual firms. ARCH models will be developed to determine the link between firm liquidity and market liquidity, or commonality in liquidity. The model will assess the common movement of each of the six liquidity measures for the selected sample observations with the corresponding market level liquidity including the lag and lead market liquidity. Additionally, following the empirical studies that have examined commonality in firm liquidity, this thesis will also include market return and individual stock volatility as control variables. Commonality is high when a substantial number of firms have liquidity with positive and statistically significant relationship to market liquidity. Commonality across firm sizes and industry sectors will be examined as well.

**Objective Four**

The fourth objective is to determine the factors that potentially affect individual stock liquidity. The thesis will test the relationship between individual firm liquidity and selected independent variables that include foreign ownership, market power, and regulatory variables. This objective will determine the proportion of firms that have negative or positive and statistically significant coefficients of the respective independent variables. A higher proportion of significant coefficients indicate that the variables are more influential to the individual firm liquidity. Statistical tests will be used to examine whether liquidity differences between pre and post-regulatory events are significant.

## 1.7 Contributions of the Research

The proposed research will expand the body of knowledge related to stock market liquidity. In particular, the study will make three contributions. First, it provides an analytical

framework of liquidity determinants at market level and at firm level using the ARCH model. Second, it contributes to the literature by providing empirical evidence on: the patterns of liquidity variations, factors affecting liquidity at market level, commonality in firm liquidity, and factors affecting liquidity at firm level. Third, it will broaden the knowledge on the equity market liquidity in emerging markets.

## 1.8 Significance of the Study

Given the important role played by market liquidity to determine market efficiency and its importance to national economic development, the regulators, market participants, and academics need to understand factors that influence market liquidity and their implications for policy development. The results of this study are expected to assist regulators and market participants to improve the development of capital markets.

The current study is also expected to improve trading strategies to maximise return. These strategies will contribute to the development of better market structures that result in a greater level of liquidity. Furthermore, a liquid market will promote market efficiency and improve its contribution to national economic development. Thus, the results of this study will be beneficial for investors, policy makers, and regulators.

## 1.9 Organisation of the Thesis

The introduction develops the motivation of the proposed study and provides an overview of the entire thesis. This will be followed by the review of the literature incorporating theoretical and empirical evidence. This is followed by proposed research framework and hypotheses, which provides explanation of the selected variables. The systematic implementation of the research methodology is then presented. After analysing the statistical results to test the hypotheses, the thesis will provide research findings and recommendations. The content of each chapter is briefly described below.

**Chapter One** provides the background of the thesis together with the research problem and the research questions. This chapter also outlines the objectives of the study, the methodology, the contributions of the research, the significance of the study and the organisation of the study.

**Chapter Two** outlines the context of the Indonesian equity market and describes the market structure, trading mechanisms and trading regulations. It will also provide a literature review

on market liquidity and the market structure together with the liquidity properties in an order-driven market structure. This is followed by a review of determinants of liquidity that provide significant impact on its variability.

**Chapter Three** proposes the conceptual framework and the hypotheses to guide the analysis for answering the research questions in this thesis, as well as the research methodology and variable operationalisation. The conceptual framework will cover the determinant factors of the market and individual firm liquidity, and the commonality of individual stock liquidity.

**Chapter Four** will outline the statistical analysis. Descriptive statistics and different set of regression analysis for identifying determinant factors of liquidity at the market level will be developed and interpreted.

**Chapter Five** will outline the descriptive statistics and regression analysis for identifying the commonality and the determinant factors of liquidity at the individual stock level.

**Chapter Six** presents summary of the empirical results. This chapter will also discuss the research implications of policy recommendations. As a final point, it concludes with the potential agenda for further research deriving from the results of this thesis.

# Chapter 2
# Literature Review

## 2.1 Introduction

This chapter has two main purposes: to discuss the institutional setting of the Indonesian equity market, and to outline the theories underpinning this research. First, it introduces the Indonesian equity market. This section begins with an overview of Indonesia macroeconomics followed by an overview of the development of the equity market. Because the market structure has an important impact on market liquidity, a detailed specification of trading mechanisms is presented. Second, it provides an overview of empirical and theoretical literature related to market liquidity and the determinant factors of its variations. This section will discuss the definition of the term liquidity together with the most frequently used liquidity measures. This will also identify and classify the potential determinant factors of the liquidity variation.

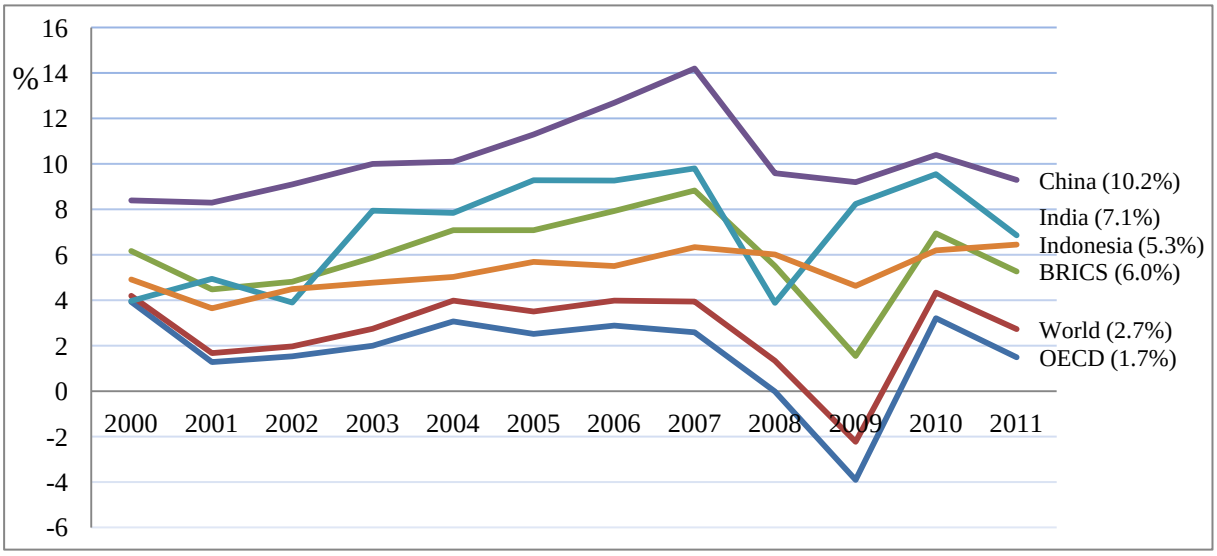
## 2.2 Institutional Setting

### 2.2.1 Brief Overview of Indonesia's Economy

Indonesia's economy has been growing substantially during the past decade. As indicated in Figure 2.1, the annual GDP growth between 2000 and 2011 averaged 5.3%. During the same period, only China and India achieved higher average growth rates of 10.2% and 7.1% respectively. The Indonesian annual GDP growth is also consistently higher than the average of those of the global economy (2.7%) and the Organisation for Economic Co-operation and Development (OECD) countries (1.7%). However, the growth rates of the BRICS countries (Brazil, Russia, India, China and South Africa) outperformed Indonesia by around 0.7%. It is worth noting that, even after the Global Financial Crisis, the Indonesian economy in 2009 was still growing at a rate of 4.6%, while the growth rates of the global economy, OECD and BRICS countries, except China and India, were negative.

Moreover, according to a report by consultants McKinsey & Co. (Oberman et al. 2012), Indonesia is currently the 16$^{th}$ largest economy in the world with the lowest economic volatility compared to OECD and BRICS countries. The report further predicts that Indonesia will become the seventh largest economy in the world by 2030 after China, United States, India, Japan, Brazil and Russia. This stability of economic growth, as well as the promising

economic outlook, shows the important role of Indonesia in the global economic landscape in general, and in the Asian region in particular.




Source: World Bank's World Development Indicators (WDI) database; average growth in parentheses

Figure 2.1 GDP Growth (annual %) 2000 – 2011

The improvement of macroeconomic fundamentals has motivated international rating agencies to upgrade the Indonesian sovereign rating recently. As illustrated in Table 2.1, the majority of global credit rating agencies have reinstated the Indonesian sovereign rating to investment grade. An investment grade indicates that the particular nation suggests a promising economic outlook, with declining country risk, which, in combination, enhances global investment confidence.

Table 2.1 Indonesia's Sovereign Credit Rating

| Rating Agency | Rating | Outlook | As of |
|---|---|---|---|
| Moody's Investor Service | Baa3 | Stable | 18 January 2012 |
| Standard & Poor's | BB+ | Stable | 8 April 2011 |
| Fitch Ratings | BBB- | Stable | 15 December 2011 |
| Japan Credit Rating Agency | BBB- | Stable | 24 August 2011 |
| Rating &Information, Inc. | BBB- | Stable | 18 October 2012 |

Data Source: Bank Indonesia, 2012

Sustainability of economic growth cannot be separated from a sound and well-diversified financial system of a country. In Indonesia, the roles of banks and the stock market, the two

main institutions that channel savings to investments in a financial system, have significantly changed, mostly because of the Asian financial crisis in the 1990s. Before the crisis, the Indonesian economic growth was largely supported by financing from the banks. But, when the non-performing loan portfolio rapidly expanded resulting in default, the banking system collapsed and so did the economy. The government of Indonesia responded with a number of fundamental deregulations to strengthen the Indonesian stock market and the financial system. The combined effect of a strong banking system and a functioning stock market have a significant impact on the development of numerous large companies as well as on the rapid improvement of economic growth (Kung, Carverhill & McLeod 2010).

The following section discusses the establishment and the development of the Indonesian stock market.

### 2.2.2 Background of the Indonesian Equity Market

#### 2.2.2.1 Institutional Evolution

The stock market in Indonesia started as a branch of the Amsterdam Stock Exchange (Amsterdamse Effectenbeurs) in Jakarta on December 14 1912, when Indonesia was a Dutch colony. It aimed at to facilitate the transactions of stocks and bonds issued by Dutch companies operating in Indonesia, the government securities and the municipalities. The exchange comprised thirteen members and 250 listed securities (Noerhadi 1994). However, all activities were suspended and eventually closed in 1940 due to World War II. After gaining independence, the Indonesian government re-opened the stock market in Jakarta on 31 June 1952. At that time, the stock market traded the securities issued before World War II; and investors from Netherland were still the dominant market players. However, due to a series of conflicts between Indonesia and Dutch, including the nationalisation of Dutch companies in 1958, most of the Dutch investors left Indonesia and the resulting economic instability resulted in an inflation rate of 650% which led to the closure of the stock market (Noerhadi 1994; Bapepam LK 2005).

The government re-activated the stock market in 1977 through the establishment of Capital Market Executing Agency (Bapepam), a unit within the Ministry of Finance. Bapepam played a dual role of regulator and operator of the stock market. The Parallel Stock Exchange of Indonesia (BPI) and Surabaya Stock Exchange (SSX) were incorporated in 1988 and 1989, respectively. BPI is an over-the-counter market organised by the stockbroking association;

established as an exchange to raise capital for new firms with no profit history, whereas SSX is a private stock exchange established in response to 1988 government regulation to allow the private sector to operate stock exchanges. These exchanges were merged in 1994. Following a series of substantial financial reforms, the Jakarta Stock Exchange (JSX), a private entity under corporate law and owned by its members, was launched in 1992 (Noerhadi 1994). The Indonesian Stock Exchange (IDX) was established in 2007 following a merger between JSX and SSX[1].

Following daily trading operations being mandated to JSX in 1992, Bapepam became the sole securities market regulator and was renamed as *Capital Market Supervisory Agency*. The name was changed again in 2006 to Capital Market and Financial Institution Supervisory Agency, following its consolidation with the Directorate General of the Financial Institutions (Bapepam LK 2006). The capital market regulator is now a part of the integrated financial authority under the Financial Service Authority (OJK), commencing in 2013.

The Indonesian equity market follows a rule-based regulatory system; a system that is similar to that of the United States which relies on stating specific requirements via a comprehensive and efficient administrative system. As opposed to the principle-based regulatory system, the rule-based approach has the advantage of specifically regulating what the market participants can do and what they cannot do, making it fairly predictable. The disadvantage of this system is that it may accept questionable conduct as justified because of the confusion surrounding the different interpretations of the rules. The following section outlines the development of stock market activity in Indonesia from 1977 to 2012, with emphasis on the study period of 2005 to 2011.

#### 2.2.2.2 Overview of the Stock Market Activity

During the first decade since the inception of the Indonesian stock market in the late 1970s, the Indonesian stock market did not experience any significant development. By the end of 1984, fewer than twenty-four firms raised capital; which remained constant until 1988. That is, there were no new public offers from 1984 to 1988, and during which period, annual trading volumes and values indicate that the stock market was significantly illiquid (see Table 2.2).

[1]If not stated otherwise, the indicators before December 2007 presented throughout this thesis are mainly those of the JSX.

Table 2.2 IDX Market Activity 1977–2012

| Year | Annual Trading | | Market Capitalization | | Listed Firms | Market Index |
|---|---|---|---|---|---|---|
| | Volume (million shares) | Value (Rp bil) | Amount (million shares) | Value (Rp bil) | | |
| 1977 | 0 | 0 | 0 | 3 | 1 | 98.00 |
| 1978 | 0 | 0 | 0 | 4 | 1 | 114.99 |
| 1979 | 0 | 1 | 7 | 24 | 4 | 110.03 |
| 1980 | 2 | 6 | 15 | 41 | 6 | 103.54 |
| 1981 | 5 | 8 | 20 | 49 | 8 | 100.26 |
| 1982 | 4 | 13 | 40 | 99 | 13 | 95.00 |
| 1983 | 3 | 10 | 48 | 103 | 23 | 85.62 |
| 1984 | 1 | 2 | 57 | 91 | 24 | 67.68 |
| 1985 | 2 | 3 | 58 | 89 | 24 | 66.53 |
| 1986 | 1 | 2 | 58 | 94 | 24 | 69.69 |
| 1987 | 3 | 5 | 59 | 100 | 24 | 82.58 |
| 1988 | 7 | 31 | 73 | 449 | 24 | 305.12 |
| 1989 | 96 | 964 | 433 | 4,309 | 56 | 399.69 |
| 1990 | 703 | 7,311 | 1,780 | 14,187 | 122 | 417.79 |
| 1991 | 1,008 | 5,778 | 3,729 | 16,436 | 139 | 247.39 |
| 1992 | 1,706 | 7,953 | 6,254 | 24,840 | 153 | 274.33 |
| 1993 | 3,844 | 19,086 | 9,787 | 69,300 | 172 | 588.76 |
| 1994 | 5,293 | 25,483 | 23,854 | 103,835 | 217 | 469.64 |
| 1995 | 10,646 | 32,358 | 45,795 | 152,247 | 238 | 513.84 |
| 1996 | 29,528 | 75,730 | 77,241 | 215,026 | 253 | 637.43 |
| 1997 | 76,599 | 120,385 | 135,669 | 159,930 | 282 | 401.71 |
| 1998 | 90,621 | 99,685 | 170,549 | 175,729 | 288 | 398.03 |
| 1999 | 178,487 | 147,881 | 846,131 | 451,815 | 277 | 676.91 |
| 2000 | 134,531 | 122,775 | 1,186,307 | 259,621 | 287 | 416.32 |
| 2001 | 148,381 | 97,523 | 885,241 | 239,259 | 316 | 392.03 |
| 2002 | 171,207 | 120,763 | 939,545 | 268,423 | 331 | 424.94 |
| 2003 | 234,031 | 125,438 | 829,360 | 460,366 | 333 | 691.89 |
| 2004 | 411,768 | 247,007 | 656,447 | 679,949 | 331 | 1,000.23 |
| 2005 | 401,868 | 406,006 | 712,985 | 801,253 | 336 | 1,162.64 |
| 2006 | 436,936 | 445,708 | 924,489 | 1,249,074 | 344 | 1,805.52 |
| 2007 | 1,039,542 | 1,050,154 | 1,128,174 | 1,988,326 | 383 | 2,745.83 |
| 2008 | 787,846 | 1,064,528 | 1,374,412 | 1,076,491 | 396 | 1,355.41 |
| 2009 | 1,467,659 | 975,135 | 1,465,655 | 2,019,375 | 398 | 2,534.36 |
| 2010 | 1,330,865 | 1,176,237 | 1,894,828 | 3,247,097 | 420 | 3,703.51 |
| 2011 | 1,203,550 | 1,223,441 | 2,198,133 | 3,537,294 | 440 | 3,821.99 |
| 2012 | 1,053,762 | 1,116,113 | 2,438,408 | 4,126,994 | 459 | 4,316.69 |

Data Source: Bapepam Annual Reports and IDX Fact Books

During the late 1980s, the government initiated extensive regulatory reforms in the stock market, banking, and taxation (Noerhadi 1994). The first important reform package aimed at fostering stock market growth, known as the December Package 1987, was implemented in December 1987. The new policy simplified the process of issuing stocks and listing the stocks on the exchange, removed restrictions on foreign investors to purchase stock of listed firms, and eliminated the previously imposed 4% daily stock price variation.

Another influential reform package, known as the October Package 1988, was released in October 1988.. Although the deregulation centred on restructuring the banking industry, the indirect implications for the stock market development were substantial. For instance, the new regulations imposed a 15% withholding tax on the interest earned from bank deposits. This policy consequently removed the disparity between taxation of returns on the equity market and taxation of interest on bank deposits. That is, the income received from stock market products such as dividends or capital gains has a similar tax treatment to earnings from banking products. Additionally, October Package 1988 also introduced a limit on bank lending, known as "legal lending limit". This rule restricts banks from providing credits greater than 20% of capital base to a single borrower and more than 50% of capital base to affiliated companies or borrowers including banks and non-bank financial institutions. Consequently, banks had to find alternative instruments to invest in and to save their money; and, firms had to find alternative sources of financing. In that situation, the stock market became an attractive avenue to facilitate the allocation of capital.

These reforms had an immediate impact of increasing the number of new listed firms and stimulating higher trading activity. Table 2.2 clearly showed that as the number of listed firms increased from twenty-four in 1988 to fifty-six in 1989, the value of market capitalisation climbed from Rp449 billion at the end of 1988 to Rp4,309 billion by 1989. This growth continued until 1990 reaching 122 firms and a market capitalisation of Rp14,309 billion. More importantly, the annual trading value increased impressively from around Rp31 billion at the end of 1988 to Rp964 billion by the end of 1989 and to Rp7,311 billion in 1990.

During the 1990s, as can be seen in Table 2.2, the trading activity and the market capitalisation had grown consistently. In particular, when IDX introduced an electronic trading system in 1995, there were substantial increases in the values of all the indicators. For example, the trading value more than doubled from around Rp32 trillion to Rp76 trillion, whilst market capitalisation increased from around Rp150 trillion to Rp215 trillion. However,

a significant downturn occurred when the Indonesian economy was affected by the Asian Crisis in 1998, which caused the composite index to fall to 398. The recovery began in 1999 and the composite index gradually increased thereafter.

However, as shown in Table 2.2, the composite index fell again in the early 2000s. Until 2003, the index fluctuated between 400 and 600 and there was no significant growth. The Indonesian Government decided to merge JSX and SSX at the end of 2007 in response to the needs for higher efficiency and competitiveness of stock exchange operations, which was expected to improve market activity. Unfortunately, the Global Financial Crisis in 2008 gradually weakened the Indonesian economy and led to a significant decrease in the composite index. The recovery, however, was much faster compared to the market downturn due to the Asian crisis in 1998. The index consistently increased and reached the highest level of 3,822 on 31 December 2011. This positive growth provide a strong indication of the increasing role of the equity market in allocating capital in the Indonesian economy as well as positioning itself as an attractive alternative for global investors.

#### 2.2.2.3 IDX Trading Mechanism

Introduced by IDX in 1995, the Jakarta Automated Trading System (JATS) is a fully computerised trading system that is an order-driven system. Trading takes place in three trading windows consisting of a regular market, a cash market and a negotiated market (IDX 2013). The descriptions presented in this thesis focuses on the regular market, which is the main trading venue for public investors to trade; and this market accounts for 98% of all trades (Dvořák 2005). The following discussion on trading mechanisms elaborates only the elements of the mechanisms that have direct links to the variations of liquidity, including price formations, market continuity, tick sizes and price ranges, trading transparency and transaction costs.

The process of price formation in a stock exchange is determined under two alternative trading mechanisms: an order-driven system and a quote-driven system (Madhavan 1992). In an order-driven system a trade is made through an auction and occurs whenever the buying and selling prices are matched. The order-driven system operates in a continues-auction, providing immediate executions, or in a periodic call market auction, where orders are accumulated during a pre-specified period and a clearing price is set for the execution. Market intermediaries have no obligation to supply and maintain liquidity in an order-driven market.

Under the current regulatory framework, JATS is an order-driven system, a system that also exists in other major financial markets such as Euronext, the London Stock Exchange (SETS), Borsa Italiana, the Swiss Exchange and the Tokyo Stock Exchange (de Jong & Rindi 2009).

In contrast, under a quote-driven system, investors can trade immediately with market makers who post quotation prices for buying and selling. Market makers are responsible for supplying the liquidity by entering quotations and standing ready to buy or sell securities. The quote-driven market is adopted by the NYSE (Floor) and London Stock Exchange (SEAQ-International). Some stock markets, including the Frankfurt Stock Exchange (XETRA/Floor), the Toronto Stock Exchange (TOREX) and the NYSE Hybrid Market (Superdot), provide a hybrid system in which order-driven and quote-driven mechanisms co-exist (De Jong & Rindi 2009).

Under the order-driven system, JATS arranges trades by matching buying orders and selling orders using continuous market and call market systems. The continuous market system allows trades to occur at any time during the trading session whenever the prices of buying and selling orders are matched. In contrast, the call market system accumulates all orders throughout a given period; and a clearing price is defined at the end of the period to settle buying and selling orders. Continuous markets are organised during main trading sessions and the post-closing session whilst call markets are operated during pre-opening and pre-closing sessions.

During continuous market sessions, buying and selling orders are matched based on the price priority and time priority rules, called the "order precedence rules" (IDX 2013). The price priority rule is set first, which gives priority to buyers who post a higher bid price, or to sellers who input a lower ask price to match first. If more than one order is posted at a given price, the time priority rule is applied; the order placed at an earlier time will be given a priority to trade. Orders submitted to JATS may be executed fully or in part depending on the volume available on the order book at the given price.

Table 2.3 illustrates the trading schedule set out in the IDX equity-trading rule. A pre-opening session is carried out during the first 15-minute session, during which period, the stockbrokers can post buying and selling orders to JATS at any price. The trading system accumulates the incoming orders in an order book. At the end of the session, the selling and buying orders are matched at an opening price that is computed based on an algorithm that allows maximum

shares for each stock to be traded. The remaining unexecuted orders from the pre-opening session remain in the order book and are processed during the regular market sessions on the day.

Following this, two main regular market sessions are organised under the continuous market system, separated by an afternoon break. These morning and afternoon sessions are the main trading sessions for the whole market activity. It should be noted that the break on Fridays is longer than that of the other days to allow for the midday prayers. This rule leads to a shorter trading time, which can directly affect the number of trades on Fridays.

Table 2.3 Trading Schedules in the Regular Market

| Trading Session | Continuity of Trades | Time | Description |
|---|---|---|---|
| Pre-Opening | Call market: One single auction | 08:45:00 – 08:55:00 | Posting bids and asks |
| | | 08:55:01 – 08:59:59 | Setting a market clearing price; Orders are matched based on the precedence rules accordingly |
| Session I | Continuous auctions | M–Th: 09:00:00 –12:00:00 | Matching orders based on the precedence rules in continuous basis |
| | | F: 09:00:00 –11:30:00 | |
| Break Time | | | |
| Session II | Continuous auctions | M–Th: 13:30:00 –15:49:59 | Matching orders based on the precedence rules in continuous basis |
| | | F: 14:00:00 –15:49:59 | |
| Pre-Closing | Call market: One single auction | 15:50:00 – 16:00:00 | Posting bids and asks |
| | | 16:00:01 – 16:04:59 | Setting a market clearing price; Orders are matched based on the precedence rules accordingly |
| Post-Closing | Continuous auctions based on the closing price | 16:05:00 – 16:15:00 | No price formation; Orders are matched based on time priority. |

Source: IDX Equity Trading Rule

At the end of the day, JATS arranges pre-closing and post-closing sessions. The pre-closing session is organised based on the call market system to generate a closing price. The closing price is key information for market participants, through which the portfolio valuations and performance are measured. The unexecuted orders will be automatically withdrawn at the end of each trading day so that the following trading day begins with a fresh set of orders.

In addition to the trading schedule, IDX trading regulations provide specific arrangements about the trading unit, tick size and price limit. Trading takes place in units of a pre-specified number of shares (lot). One round lot of five hundred shares represents one trading unit.[2] However, this could have implications on liquidity as prior studies have shown that a reduction of minimum shares in a trading unit increases the firm's base of individual investors. In turn, a higher number of small investors improves trading activity and thereby increasing liquidity (Amihud, Mendelson & Uno 1999).

Furthermore, the bid and ask orders may be posted in the JATS according to a set of five tick size increments as shown in Table 2.4.[3] Prior studies have found that tick size is an important element of liquidity; however, studies on the Jakarta Stock Exchange show mixed results. Purwoto and Tandelilin (2004) found that the adoption of a single tick size policy in 2000 significantly improved liquidity. Consistent with this finding, Ekaputra and Ahmad (2007) confirmed that stock liquidity is enhanced when tick size was reduced in 2005. In contrast, Allen and Sudiman (2009), documented that a further reduction on the smallest tick size cluster in 2007 did not improve liquidity.

Table 2.4 Tick Size Increment

| Stock Price Range | Minimum Tick Size | Maximum Price Step |
|---|---|---|
| <Rp200 | Rp1 | Rp10 |
| Rp200 to <Rp500 | Rp5 | Rp50 |
| Rp500 to <Rp2,000 | Rp10 | Rp100 |
| Rp2,000 to <Rp5,000 | Rp25 | Rp250 |
| >Rp5,000 | Rp50 | Rp500 |

Source: IDX Equity Trading Rule

IDX also requires orders to be posted within certain price bands. JATS will automatically reject the orders if they are submitted beyond the price limit at which:

1. the order prices are smaller than Rp50;
2. the order prices are more than 35% above or below the reference price for stock prices from Rp50 to Rp200;
3. the order prices are more than 25% above or below the reference price for stock prices from above Rp200 to Rp5,000;

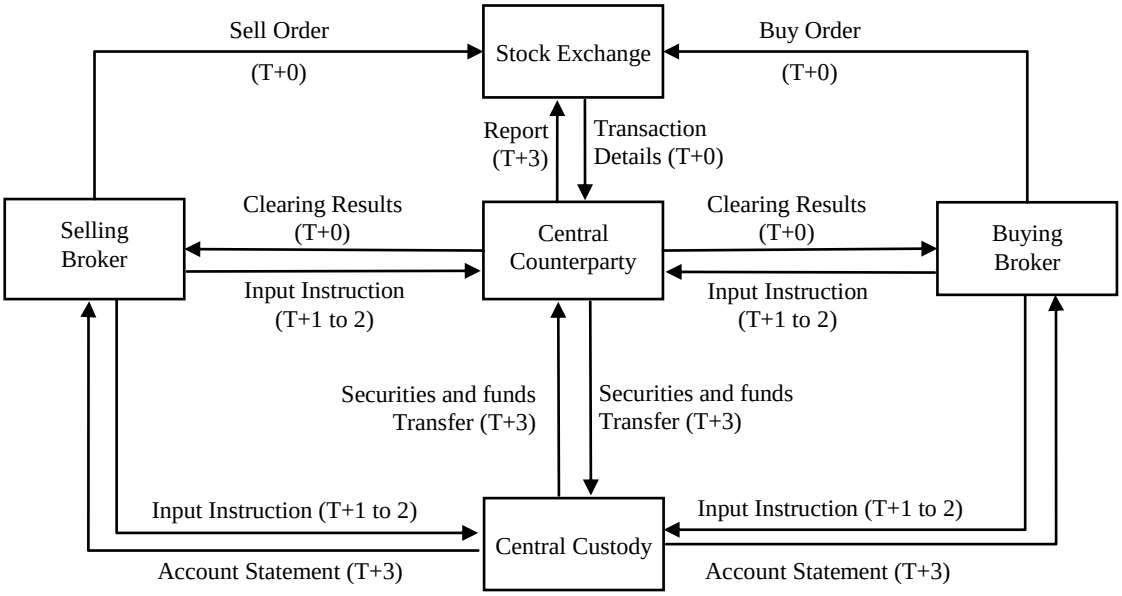
[2] The trading unit has been changed to one hundred shares per lot since 3 January 2014.
[3]The tick size has been amended since 6 January 2014.

4. the order prices are more than 20% above or below the reference price for stock prices that higher than Rp5,000;
5. the auto rejection level of new listed stocks is two times of those stated above.

The reference price is generated from the pre-opening session or based on the previous closing price if the session does not result in an opening price. The maximum of the daily price step is ten times the minimum tick size. However, the order price cannot exceed the daily auto rejection level. In terms of the order quantity, the maximum number of one order is 10,000 lots or 10% of the total outstanding stock, whichever is lower (IDX 2013). These limits have an important effect on the price fluctuations and therefore the liquidity.

After the trading is completed, the settlement process takes place within a three-day period. Figure 2.2 illustrates the trading process, clearance and settlement in the Indonesian stock market system. The settlement process begins at T+1 and finishes at T+3. Within T+1 to T+2 stockbrokers send settlement instructions to the central counterparty (KPEI) and the central custodian (KSEI). Subsequently, KPEI and KSEI perform the brokers' instructions by transferring the funds from the buyers' accounts into the sellers' accounts, and the shares from the sellers' accounts into the buyers' accounts. The clearance and settlement arrangements are important policy decisions to improve market performance: increasing liquidity, improving efficiency and decreasing transaction costs (De la Torre, Gozzi & Schmukler 2007).

In terms of trading transparency, JATS distributes extensive pre-trade and post-trade information in real time through data vendors and exchange members. Pre-trade information contains the available bids and offers information so that investors may observe their ability to trade at a desired price and volume. Post-trade information provides trading information of individual securities, including prices and volumes of the transactions as well as the identity of the selling brokers and the buying brokers. The distribution of information on a real time basis is necessary, as it improves transparency or, expressed differently, the degree of transparency of a market is measured as a deviation from a real-time standard. Ideally, real-time information reflects the highest level of transparency. The trading information is important to enable investors to observe their execution quality. An efficient execution promotes investor confidence, enhances investor protection and encourages investor participation in trading activity, and therefore improves market liquidity.




Source: IDX

Figure 2.2 Trading Flow and Settlement

It should be noted that the post trade information contains the identity of the brokers, in that the information provided by JATS is not completely anonymous. Anonymity is an important feature of the trading system that may affect liquidity because this feature affects how investors submit their orders. Comerton-Forde, Putniņš and Tang (2011) documented that in a market where anonymity is a choice, traders tend to submit orders anonymously when they are relatively well informed and need to post large orders.

Apart from trading transparency, liquidity is highly associated with transaction costs; higher transaction costs negatively affect liquidity. That is, when trading costs are too high, investors will trade less frequently and a buy-and-hold strategy may be the only feasible alternative. The transaction costs include all relevant costs of trade and may be classified into implicit cost, explicit cost and opportunity cost (Harris 2003). Implicit cost occurs when investor positions are negatively influenced by price changes. These price changes are also referred to as price impacts. The implicit costs of trades are estimated using liquidity measures such as bid ask price spread and price impact. The explicit costs principally include levies, taxes and brokerage commissions (Oberman et al. 2012), which are more easily identified compared to implicit costs (Harris 2003). Meanwhile, the opportunity cost rises when investors fail to take opportunities for making profit on price movements.

In IDX, investors have to pay levy, selling tax and value added tax as well as brokerage commissions. The levy is set at 4 basis points and selling tax is set at 10 basis points of the transaction values; the value added tax is 10% of the brokerage commission. The brokerage commissions, however, vary across stockbrokers; IDX does not regulate the commission rates that brokers may apply. Normally, the entire one side transaction cost (for buyer or seller) is around 15 to 25 basis points of the transaction value. To illustrate, an investor who purchases or sells Rp2 million stocks has to settle transaction costs as depicted in Table 2.5 below.

Table 2.5 Transaction Cost

| Item | Buying | Selling |
|---|---|---|
| Transaction Value | 2,000,000 | 2,000,000 |
| Brokerage Commission e.g. 0.10% | 2,000 | 2,000 |
| VAT 10% of the Commission | 200 | 200 |
| Levy 0.04% | 800 | 800 |
| Selling Tax 0.10% | | 2,000 |
| Total Transaction Fee | 3,000 | 5,000 |
| | (0.15%) | (0.25%) |

Source: Author's estimation

#### 2.2.2.4 Foreign Ownership

Foreign ownership is another important element of market liquidity. The participation of foreign investors can affect demand and supply in a domestic market and therefore enhance market liquidity (Rhee & Wang 2009). When the Indonesian stock market was reactivated in 1977, participation of foreigners was restricted. The policy was amended in 1987 when foreigners were allowed to purchase up to 49% of the listed shares, except for banking institutions. Further liberalisation took place after the Asian Crisis and eventually the restriction on foreign ownership on non-bank listed companies was removed in 1997 which was followed by the lifting of the restriction on listed banks in 1998 (Kung, Carverhill & McLeod 2010).

The significant role of foreign presence in the Indonesian stock market can be observed from the percentage of their ownership and the trading activities. Between January 2002 and August 2007, foreign investors held around 70% of the total free-float shares; this portion is equal to 41% of market capitalisation (Rhee & Wang 2009). By the end of 2011, the percentage declined to 42.9% of the total shares in IDX, which accounted for around 27% of

the average selling value and 30% of buying value (IDX 2012). As foreign investors play a crucial role in the trading activity and corporate monitoring of the listed companies in the IDX, regulators need to closely monitor the level of foreign investor ownership in order to effectively manage the impact of cross border liquidity.

#### 2.2.2.5 Market Monitoring

The IDX trading regulations ensure that markets are fair, efficient and transparent, in order to protect investors and to reduce systemic risk. Market monitoring is an important tool of trading regulation to detect, and deter if present, any prohibited fraudulent, deceptive conduct or market abuse. IDX conducts market monitoring which includes a combination of direct surveillance, inspection, investigation and market halts. A Securities Markets Automated Research Training and Surveillance (SMARTS) system is operated to provide alerts which can detect market irregularities on a real-time basis. Based on the continuous surveillance system, IDX releases alerts of the trading activity of selected stocks that behave unusually over a certain period. It is expected that these alerts would make public investors aware of the risk of aberrant stocks. While the motivation is to maintain a transparent and fair trading system, those actions may contribute to the fluctuation of market liquidity.

## 2.3 Market Liquidity

Liquidity has been universally perceived as a significant attribute of a well-organized financial market (Harris 2003). Given that all market participants prefer liquid markets, market liquidity is an important attribute for minimising the cost of trading (Demsetz 1968), and therefore provides a higher investment return. From the stock exchange point of view, a liquid market attracts more investors to trade and allows the issuers to raise more capital at a lower cost (Butler, Grullon & Weston 2005) with the resulting improvement of stock exchange revenue. Similarly, regulators are concerned about the liquid market as it is crucial in developing an efficient market (Chordia, Roll & Subrahmanyam 2008) and maintaining market stability (O'Hara 2004).

The purpose of this section is to provide a description of market liquidity, and to discuss the empirical evidence of the factors that have been found to affect liquidity variations over time. In the first part, the definition of market liquidity along with the dimensions and measures will be discussed. The second part presents how international factors, macroeconomic factors, market performance factors, and seasonal regularities affect market liquidity.

### 2.3.1 Definition

The term "liquidity" is widely used in various settings in financial literature, specifically in two contexts: solvency and marketability (Frank, Hermosillo & Hesse 2008). Solvency indicates the ability of companies to settle their liabilities in a timely manner. This is the liability side of the balance sheet and known as "funding liquidity" (Drehmann & Nikolaou 2013). Marketability refers to the ease of converting less liquid assets such as property or securities into cash, or of trading the assets in the marketplace. Firms consider marketability as the liquidity of the asset side of the balance sheet; investors call this characteristic "market liquidity".

Following Harris (2003), this study defines liquidity as the ability to trade large volumes of assets quickly, at low cost, as and when required.[4] This definition contains three substantial aspects: quantity, cost and time, and, as such, leads to multi-dimensional measures of liquidity. The following sections provide the descriptions of liquidity dimensions and their measures.

### 2.3.2 Dimension

This first dimension, quantity, is also known as the market "depth". Essentially, market depth demonstrates the level of supply and demand of the securities traded in a financial market. As a primary measure, this dimension is indicated by the number of stocks readily available for instantaneous trading at a given buying or selling price. Hence, a higher volume of stocks indicates deeper market liquidity. This liquidity measure is especially important for large orders because market depth is an indicator of the market's ability to absorb those orders. Black (1971) argues that it is unlikely that investors can buy or sell a large size of shares quickly without affecting prices. That is, large orders may need to search liquidity beyond the best bid or ask price (Harris 2003). Consequently, investors may expect a certain price concession for the immediate trading of a large volume of shares. To minimise the unexpected price impact, large orders may be executed over a longer period. If the market is liquid, the orders can be executed at prices that do not significantly differ from the current market price. This means that a liquid market has a low price impact.

Second dimension is "value" which is also known as market "width" or "tightness". This dimension is defined at a minimum conversion cost. The primary method to measure the cost

[4]If not specifically stated, the terms *liquidity* and *market liquidity* are used interchangeably throughout the thesis.

of trading is by identifying commissions, taxes, and bid-ask spread (Aitken & Comerton-Forde 2003; Francioni et al. 2008). While commissions and taxes explicitly reflect the cost of trading, bid-ask spread represents implicit costs of engaging simultaneous buying and selling of a stock. Normally, researchers do not use explicit cost as a proxy of trading costs because of lack of data (Huang & Stoll 1996; Bonser-Neal, Linnan & Neal 1999) or because of the inability of the stock exchange to control the costs (Aitken & Comerton-Forde 2003). Bid-ask spread is therefore widely used to measure an execution cost, especially for small orders (Aitken & Comerton-Forde 2003; Harris 2003). This dimension specifies that the market is liquid if the outstanding bid and ask orders are always available at all times, and when the bid- ask spread is narrow (Black 1971).

Third dimension is "immediacy". This indicates the speed of transaction of a given size at a given time (Kyle 1985; Harris 2003; Amihud & Mendelson 2006). The turnover and trading activity within a specified period can be used to measure this dimension. From this perspective, higher number, value, and volume of trading reflect better market liquidity.

The liquidity dimensions discussed above are separate but related. Intuitively, deep markets will provide lower costs of transactions and offer immediacy, while shallow markets require higher transaction costs and have less immediacy. However, depending on the liquidity proxies used, the relationships are not consistently correlated, suggesting that liquidity is an elusive multi-dimensional concept (Stoll 2000; Chai, Faff & Gharghori 2010).

### 2.3.3 Measure

Although theoretically straightforward, liquidity is a multidimensional concept and is difficult to measure (Amihud & Mendelson 1991; Amihud 2002). Therefore, different liquidity measures must be estimated to address the range of liquidity dimensions. Aitken and Comerton-Forde (2003) documented at least sixty-eight different liquidity measurements. Accordingly, a rigorous analysis must incorporate different liquidity measures to capture those diverse dimensions. This thesis employs three categories of market liquidity measures that capture the aspects of market depth, transaction costs and trading activity, which are: market depth measures, transaction cost measures, and trading activity. They are discussed below.

**Market Depth Measures**

Market depth estimates the positive liquidity measure that is expected to capture the liquidity itself, meaning that a higher value indicates better liquidity. This classification consists of quantity depth (QDEP) and value depth (VDEP). QDEP is the number of shares available at the best bid and the best ask prices. The best bid price is the highest price, by which sellers can sell without decreasing the price; and the best ask price is the lowest price where buyers can buy without increasing the price. By calculating market depth as a value of shares (value depth), liquidity may be compared across stocks with different prices. VDEP is the sum of the product of number of shares at the best bid and s the bid price, and the product of number of shares offered at the best ask and the ask price (Huberman & Halka 2001).

**Transaction Cost Measures**

Transaction cost represents a negative liquidity proxy, which reflects inverse measures of liquidity or simply illiquidity: that is, a higher value means a lower liquidity. In practice, the precise costs of the individual transactions vary and are determined by many factors, depending on the time and the size of the transactions, and the negotiation between investors and brokers. This implies that the actual costs of trading should be collected from investors. For that reason, accurate information on the actual trading cost is not accessible and is expensive to obtain (Roll 1984). Prior studies have estimated the trading cost from the spread between the best bid price and the best ask price (Smidt 1971). The best bid price is the highest price at which limit order traders wish to buy, whereas the best ask price is the lowest price at which limit order traders want to sell (Rosu 2012). As the spreads reflect the costs of transaction, a market is considered liquid if the spreads are minimised. Furthermore, the bid-ask spread is a reliable proxy of liquidity to indicate the implicit cost of trades which can be divided into the order processing cost component and the adverse selection component (Brockman & Chung 1999).

Chordia, Roll and Subrahmanyam (2001) extend the quoted bid-ask spread (QSPR) into more relative liquidity measurements by creating a ratio, namely proportional quoted spread (PQSPR). PQSPR is useful when comparing the spreads of stocks with different price levels.

Market depth and bid-ask spread are estimated using the quantities and prices of open positions available in the order book. This information represents the cost of trading and the size of supply from interested buyers and sellers who have placed buying and selling orders in

a queue. In other words, market depth and bid-ask spread contain pre-trade information about the market's ability to absorb demands. The market depth and bid-ask spread can, therefore, be used to estimate future liquidity (Aitken & Comerton-Forde, 2003) whereas liquidity may be estimated using historical information from trading activity.

**Trading Activity**

Trading activity incorporates shares traded during a particular period, represented by trading value and trading volume. This indicator is simple, and the data is readily available. Blume, Easley and O'Hara (1994) suggest that trading volume generates distinct information from that provided by stock prices. If the stock price reflects the average level of trader's private information, trading volume provides the quality of the traders' information signals. This is ultimately applicable for small, less followed stocks where private information, generally has a greater impact than that of public information.

Unlike the first two categories, which measure the market's ability to absorb incoming orders (that is, pre-trade information), the trading activity is an indicator of the actual trade that has been completed in the market (that is, post-trade information). Thus, it should be noted that this proxy provides ex-post measures, reflecting the information on the number of shares participants traded in the past. It may not reflect the market's ability to absorb demand and supply in the future (Aitken & Comerton-Forde 2003).

### 2.3.4 Data Frequency

In the past, estimating liquidity was a tedious task. For example, Roll (1984) contends that bid-ask spread data is costly, scarcely available, and when available was difficult to access in many stock markets and Amihud (2002) argues that estimating liquidity using bid-ask spread requires a large amount of data.

In recent years, however, technology has allowed easy access to an enormous database both at low frequency and high frequency levels. On one hand, the low frequency data provides trading information on a daily, weekly or monthly basis. This type of data is less complicated, and in most cases, can be easily obtained over a long period and across different stocks. On the other hand, the high frequency data provide information on tick-by-tick intraday transactions, which offer more accurate estimates of liquidity proxies (Hasbrouck 2009).

Although high frequency data give more precise estimates of liquidity, low frequency data is still widely used because the results of the liquidity proxies from low frequency data are comparable with those from high frequency data. Goyenko, Holden and Trzcinka (2009) tested the reliability of low frequency liquidity measures both at monthly and annual levels. They compared nine low frequency spread measures against three high frequency spread measures, and twelve low frequency price impact measures against three high frequency benchmarks. The study found that low frequency measures do very well in estimating liquidity, with a strong correlation and low mean squared error.

### 2.3.5 Two Sides of Liquidity

It has been suggested that market liquidity has negative and positive implications for the financial market. From the negative side of the argument, liquidity motivates investors to trade speculatively (Summers & Summers, 1989). That is, in a liquid market, investors can trade large volumes at low cost and with small price impact.. In such a case, the efficiency generated from the speculative trading outweighs the trading cost. Furthermore, in a liquid market, investors prefer to actively trade and may not be interested in monitoring the governance of the firms (Coffee 1991). These negative impacts of liquidity motivate governments to impose taxes on financial transactions (Summers & Summers, 1989).

However, others contend that a liquid market is very important for market players. Investors are more willing to hold assets and require a lower risk premium if they can easily and quickly buy and sell the assets (Amihud & Mendelson 1991). Amihud and Mendelson (1986) suggest that if policymakers can develop a strategy to improve market liquidity, the costs of raising capital can be reduced. Furthermore, lack of liquidity is known to result in high volatility which then can hinder financial market development (Rhee & Wang 2009). These positive aspects of liquidity has the potential to motivate policymakers to formulate policy for improving liquidity by encouraging investments, minimising risk, developing efficient equity market, and enhancing market stability (O'Hara 2004; Huang & Wang 2010).

### 2.3.6 Liquidity in Order-driven Market

In an order-driven market, the ultimate sources of liquidity are provided by public sellers and buyers (Handa & Schwartz 1996). That is, the liquidity suppliers and demanders are open to

everyone who posts limit orders or market orders.[5] The limit order providers are liquidity suppliers who submit buy or sell orders that queue in a limit order book. They stand ready as buyers or sellers for the incoming market orders. In contrast, the market order providers are the liquidity demanders, as they will submit orders at a market price and hit the open limit orders that are waiting in the order book. Therefore, the determinants of supply and demand in an order-driven market are the number of limit orders and market orders (not the number of buying orders and selling orders).

The decision to select a limit order or a market order is made based on a careful examination of the trade-off between trading for better price and trading for faster execution (Amihud & Mendelson 1986). Investors will submit limit orders for a better price execution since this type of orders are submitted at better prices: higher than the market price for selling and lower than the market price for buying. When the price fluctuation is reasonably high, the limit order would be traded at a better execution price. In contrast, investors will submit a market order to instantly match with the existing limit order in the order book. However, they have no ability to select a better execution price. A market order results in faster execution time, and therefore incurs less waiting costs.

The likelihood of limit order being executed by an incoming market order will increase if the price fluctuation is relatively high. However, it should be noted that the execution would generate profits only if the price changes are temporary. For example, if the current market price is Rp1,000, a limit buy order at Rp900 can be executed if the price moves from Rp1,000 to Rp900. However, the profit can be generated only if the price reverses back to the one that is higher than Rp900. The price changes are temporary if they are motivated by factors other than information, such as liquidity needs or inventory rebalancing (Handa & Schwartz 1996). The non-informational motives lead to temporary short run price fluctuations, which then trigger the execution of the limit orders. Hence, temporary price changes are good for limit orders only if the volatility is temporary which is influenced by non-information factors.

Although limit orders may generate higher profits, they expose investors to the risk of time delay. The limit orders have to stay in the order book waiting for incoming market orders that will hit the orders at the given price without certainty. The closer a limit order price is to a market price, the faster the execution time, but the lower the profit. When the market price

[5] A limit order is an instruction to buy or sell a stock at a better price, which is lower than the available market price for buying or higher than the available market price for selling. A market order is an instruction to buy or sell a given quantity of shares at the available market price and consequently, will enjoy an immediate execution.

deviates from the price of a limit order, the limit order faces risks of not being executed, where the order will remain unexecuted until the market closes. Therefore, a limit order is preferable for patient traders willing to spend more time for a better execution price. Patient traders are normally those who manage a relatively balanced portfolio and are reluctant to add more positions (Handa, Schwartz & Tiwari 1998).

Limit orders also expose investors to the risk of adverse selection (Handa & Schwartz 1996) by which a limit order may be picked off by an arriving market order that has updated new private and public information (Copeland & Galai 1983). This occurs when the limit order providers can neither withdraw nor modify the price, while the others react quickly in response to the new information. In that situation, limit-buy orders will be executed at prices lower than the current market price, but will suffer losses as the price drops permanently. Conversely, if the stock price goes up and becomes much higher than the price limit, a limit buy order will not be executed (Handa & Schwartz 1996). The price changes could be permanent in the presence of asymmetric information. Therefore, limit orders are more attractive for informed traders (Kaniel & Liu 2006), especially if the information decays slowly (Keim & Madhavan 1995). If the information is short-lived, informed traders will respond quickly by submitting market orders for immediate execution (Harris 1998).

From the discussion above, it is clear that liquidity in an order-driven market is a function of a complex set of interactions between limit orders (liquidity suppliers) and market orders (liquidity demanders). Traders will post limit orders in response to a higher price fluctuation, as it will increase the likelihood of the order being executed. Whenever new information arrives, a limit order may deal with the dilemma of adverse selection and the risk of un-execution. However, traders still prefer to place limit orders, as they believe that there should be other traders trading on non-informational motives, such as liquidity-motivated transactions. A limit order is also preferable when the price volatility is high, the bid-ask spread is wide and the order size is large (Bae, Jang & Park 2003). Thus, the liquidity level in an order-driven market that is negatively related to the price volatility and the number of limit order traders. That is, the higher the liquidity, the lower the volatility and the lower the number of limit orders.

## 2.4 Determinants of Equity Market Liquidity

A range of empirical evidence has identified important sources of liquidity variations at the level of aggregate market and individual firm. At the level of aggregate market, Chordia, Roll and Subrahmanyam (2001) have identified significant determinant factors of market liquidity, including macroeconomic indicators, interest rates, market return and volatility as well as seasonality. At the individual firm level, previous studies show that individual stock liquidity has a tendency to move together with the fluctuations of market-wide liquidity. Commonality has been found to show positive association with systemic risk (Huberman & Halka 2001). The plausible determinant factors at the individual stock level include foreign ownership (Rhee & Wang 2009), tick size changes (Aitken & Comerton-Forde 2005) and market power in the product market (Kale & Loon 2011). The literature has two clearly distinguishable research strands and the following discussion outlines them. First, it discusses the possible sources of liquidity variations at the market level; and second, it presents a discussion on commonality in individual stock liquidity and is followed by a discussion on the empirical results on the sources of commonality.

### 2.4.1 Determinants of Market-wide Liquidity

Given the importance of the overall market risk and return, regulators and market players mostly focus on information at a market level rather than at an individual firm level. Policy decisions are often made on market level information; securities regulators look into the entire market to monitor market instability. Global investors consider market level liquidity in making a better-diversified investment portfolio consisting of financial assets across different markets.

Based on the existing empirical literature, the possible factors affecting market liquidity discussed in the following section are categorised into international factors, macroeconomic factors, market performance factors, and seasonal regularities.

#### 2.4.1.1 International Market Factors

The literature strongly suggests that the stock markets are interdependent. According to Karolyi and Stulz (2003), lower restrictions on international investment have increased the capital flow across countries, which then increases cross-country correlations and consequently increases global influences on asset prices. Additionally, Ibrahim (2005)

suggests that stock markets in the two countries will be likely to move together if those countries have a strong economic relationship and similarities in macroeconomic policy implementations.

Abd, Meera and Omar (2008) argue that a greater degree of foreign ownership seems to have improved the integration among stock markets, both regionally and internationally. They found that the ASEAN-5 markets are influenced by both the US market and the Japanese market, with the latter exerting a greater influence. Likewise, Trang Nha and Kakinaka (2010) suggests that financial liberalisation and increasing technology on the networking system have increased the dependency and integration among stock markets. In their study, Trang Nha and Kakinaka (2010) found evidence of the mean return and volatility spill over effects from developed markets (that is, US, Japan and China) to emerging markets (that is, Malaysia and Indonesia). In a more recent study, Wang (2013) found that the liquidity of the domestic Asian markets is affected by regional markets and global markets, with a stronger regional effect, suggesting that the Asian market is more integrated within the region than with global markets.

The literature has also reported the evidence related to the dependency of Indonesian market to the developed markets. For example, Ghosh, Saidi and Johnson (1999) reported that the Japanese stock market appeared to have greater influence on the Indonesian stock market than did the US market. He argues that this is likely due to the close economic relationship and the similarities of the regulatory structure between Indonesia and Japan. During the period of financial crisis, however, Ibrahim (2005) found that the Indonesian stock market was becoming more responsive to the changes of both the US and the Japanese markets. Similar evidence is reported by Majid and Kassim (2009); the Indonesian stock market experienced average daily losses during the US sub-prime mortgage crisis in 2007. They argue that during the crisis, common international variables have a stronger impact on the market performance compared to the impact of domestic country variables.

From the discussion above, it can be discerned that the shocks of international stock markets have a negative impact on the emerging markets, including the Indonesian stock market. Those studies, however, focus their interest on the international influence on the domestic stock index fluctuation. None of the existing studies examines the impact of volatility in developed markets on the aggregate market liquidity in emerging markets.

#### 2.4.1.2 Macroeconomic Factors

Macroeconomic variables have most often been suggested to affect market liquidity. Chordia, Roll and Subrahmanyam (2001) suggest that macroeconomic indicators provide important information for decision makers engaged in trading on the stock market for two reasons. First, macroeconomic information not only affect a single stock but the entire market. Second, macroeconomic indicators are released as a single event while announcements of firm-specific information, such as earnings announcements, are not well coordinated across stocks. The following discussions provide empirical evidence of the macroeconomic conditions that have significant influence on market liquidity: financial crisis, releases of the macroeconomic indicators and interest rates.

In their study on the US stock and bond markets, Chordia, Sarkar and Subrahmanyam (2005) found that market depth decreases during the financial crisis; implying a negative impact on liquidity. Similarly, Yeyati, Schmukler and Van Horen (2008), in their study of seven emerging countries, and Chordia, Roll and Subrahmanyam (2011), in their study of the NYSE, found that bid-ask spreads widen during a crisis. The negative impact of financial crisis on market liquidity may be because of the increasing credit constraints imposed by liquidity suppliers, including intermediaries and speculators (Choi & Cook 2006; Chiu et al. 2012). In contrast, Aitken and Comerton-Forde (2003) documented an increase in market liquidity following a financial crisis. Based on the sample data from 1 June 1996 to 28 August 1998 on the Jakarta Stock Exchange, they found that trade-based liquidity proxies (that is, volume, value, frequency and relative volume) improved following the Asian Crisis in 1998. Increasing liquidity during the 1998 crisis arose because of investors choosing quality during the period of crisis. That is, during this period investors sold stocks with low liquidity and bought those with higher liquidity a practice referred to as “flight to quality”.

The evidence on the impact of the announcements of the macroeconomic indicators on liquidity is not conclusive. Chordia, Roll and Subrahmanyam (2001) found a statistically significant improvement of market depth and trading activity during the two days prior to the announcements of economic indicators (gross domestic product and unemployment rate) in NYSE listed stocks. Their finding suggests that dealers responded to differences of opinion by uninformed investors prior to macroeconomic events by providing a better depth. Evidence to the contrary was documented by Van Ness BF, Van Ness RA and Warr (2005) who found no relation between any of the variables included in macroeconomic announcements and

liquidity or trading activity for Nasdaq listed stocks. They explained that the distinctions compared to prior studies are likely due to the different period of the study. This argument is in line with the results of Fujimoto (2004). Using monthly data of NYSE and American Stock Exchange (AMEX) from August 1962 to December 2001, the study found that the impact of macroeconomic factors on liquidity is time dependent; it was significant before the mid-1980s and became less important afterwards. Kim, McKenzie and Faff (2004) found little evidence of the effect of the announcement of six macroeconomic indicators on risk and return of three US financial markets: the bond, stock and foreign exchange markets. They suggest, instead, that the content of the news has a greater impact on risk and return rather than the announcement itself. For equity markets, the study revealed that consumer and producer price information is the news that seems to affect risk and return.

Chordia, Roll and Subrahmanyam (2001) reported statistically significant relationship between interest rates and market liquidity. They argue that an increase in interest rates raises the costs of margin trading and short selling and thereby reduces market depth and trading activity but widens quoted spreads. Their study found that the short-term interest rate is negatively related to trading activity and depth measures, but positively related to the quoted spread. Furthermore, an increase in the spread between long-term and short-term interest rates is negatively associated with trading activity and market depth, but positively associated with quoted spreads. Fujimoto (2004) found that liquidity in NYSE and AMEX decreased in response to a higher short-term interest rate. Using a vector autoregression approach, he further documented that the positive shocks of short-term interest rates decrease liquidity indirectly through market return, volatility and share turnover. Consistent to prior findings, Van Ness BF, Van Ness RA and Warr (2005) documented that short-term rates and term spreads are negatively related to trading volume in Nasdaq from 1993 to 2002. A plausible reason is that higher interest rates encouraged investors to shift their investment from equity to debt instruments that provided higher returns, which then reduced liquidity in the equity markets.

Overall, empirical studies have examined the significant impact of financial crisis, macroeconomic events and key interest rates on the variation of market liquidity. These studies documented that liquidity has a tendency to decrease during the period of the financial crisis. It was further found that, prior to the macroeconomic events, uninformed investors

seem to have different opinions on the market direction, which increases trading activity. The evidence also shows that a higher interest rate will reduce market liquidity.

#### 2.4.1.3 Market Performance Factors

Chordia, Roll and Subrahmanyam (2001) provide evidence that liquidity is strongly related to up and down markets, recent falling and rising markets and recent market volatility. Liquidity levels have an asymmetric response to up and down markets: weak increases in up markets and strong decreases in down markets. This asymmetric response of spread measures was confirmed by Van Ness BF, Van Ness RA and Warr (2005) who found that liquidity decreases during the period of down markets, suggesting that market makers tend to suspend trading activity. Additionally, Chordia, Roll and Subrahmanyam (2001) found that depth strongly increases during up markets, implying that during the period of positive market returns, market makers raise their bid quantity which then increases the average depth. However, unlike depth and spread measures that have asymmetric response to the market directions, Chordia, Roll and Subrahmanyam (2001) and Van Ness BF, Van Ness RA and Warr (2005) found similar results where trading volume increased in both market directions which indicates that any uncertainty in the market is responded to by increased trading activity. Consistent with the previous findings, Hameed, Kang and Viswanathan (2010) found that liquidity decreased during down markets. They suggest that when funding sources are limited in a negative market return, market intermediaries are likely to experience difficulty in providing liquidity. Consequently, market liquidity may evaporate after a negative market return, especially during times of capital constraints. From the perspective of collateral argument, negative market return reduces the value of intermediaries' aggregate collateral and forces asset holders to liquidate the collateral.

Another area of significance is the days immediately following the periods of falling or rising markets. A recent market history is an important variable for momentum and contrarian trading strategies and therefore will have an impact on liquidity. To create a proxy to show this market trend, Chordia, Roll and Subrahmanyam (2001) used a five day moving average of past returns. They found that positive market returns seems to cause a decrease in market depth but has insignificant impact on spreads and trading activity. In contrast, Van Ness BF, Van Ness RA and Warr (2005) found no significant relationships between market trend variables and liquidity.

Finally, in regards to recent market volatility, Chordia, Roll and Subrahmanyam (2001) provide evidence that trading activity decreases with recent market-wide volatility; and, surprisingly, the spread measures also decrease with recent market volatility. This suggests that the lower trading activity has allowed market makers to reduce their inventory imbalances, and thereby reduce the spreads. These findings are confirmed by recent studies including Wang (2013) and Yeyati, Schmukler and Van Horen (2008) who found that domestic market volatility has a strong negative impact on liquidity. However, Van Ness BF, Van Ness RA and Warr (2005) found somewhat surprising result that liquidity is uncorrelated with volatility.

Overall, the above studies clearly documented that liquidity increases during periods of up markets and decreases during periods of down markets, which was also observed to continue over the days immediately following the rising markets and falling markets. Lastly, liquidity tends to be negatively related to market volatility.

#### 2.4.1.4 Seasonal Regularities

A large number of studies have documented the existence of return anomalies around specific calendar events and around cultural festivities. For example, using data from NYSE and AMEX from 1963 to 1979, Keim (1983) found higher abnormal returns in January particularly during the initial weeks than the rest of the year, where small firms generated higher abnormal returns relative to the large firms and the size effect was stronger in January. He argued that the findings appeared to be unrelated with tax loss selling hypothesis, financial information event hypothesis or spurious causality caused by outliers. A study of Reinganum (1983) on NYSE and AMEX from 1962 to 1979 found that small firms outperformed the larger firms, especially in the first few trading days in January and the evidence show that tax selling hypothesis was found to be the main reason for the anomaly. Based on the data from NYSE and AMEX between 1963 to 1980, Roll (1983) also found evidence of January effect and size effect. Roll (1983) suggests that phenomena relate to the significant losses at the end of the previous year due to the selling pressure from investors who want to realise losses for income tax purposes. However, recent studies show that the January effect is not as significant as it was in the past (Booth & Keim 2000; Marshall & Visaltanachoti 2010). Similarly, French (1980) and Keim and Stambaugh (1984) observed that the average returns over weekends are lower than those during the weekdays. Schwert (2003) found that the

phenomena of the weekend effect significantly declines due to the development of market microstructures through which the cost of trading decreases and the market is more liquid.

Other studies have documented the return anomaly related to cultural festivities. For example, Chan, Khanthavit and Thomas (1996) found that in addition to days-of-the-week effect and months of the year effect, the cultural holiday effects exist, in particular the Chinese New Year effect on SES and KLSE, Islamic New Year and Vesak effect in KLSE, Hindu holidays of Diwali and Dessura in SEB and Chakri holiday in SET. Oguzsoy and Güven (2004) reported that from 1988 to 1999 the ISE National 100 Composite Index of the Istanbul Stock Exchange generated an eightfold higher average return on the two days before the Eid holiday than during the rest of the year.

Another cultural effect relevant to countries with a majority Muslim population is related to the month of Ramadan. There is no general agreement about the return regularities during the month of Ramadan. Based on sample data from February 1985 through to April 2000, Seyyed, Abraham and Al-Hajji (2005) found that returns during Ramadan in the Saudi stock market were not significantly different to that in the other months of the year. In contrast, Białkowski, Etebari and Wisniewski (2012) reported that eleven Islamic countries (that is, Egypt, Jordan, Kuwait, Malaysia, Morocco, Oman, Pakistan, Qatar, Tunisia, Turkey and United Arab Emirates) provided higher average return during Ramadan than the rest of the year between 1989 to 2007. Using the Morgan Stanley Capital International (MSCI) index, the study found that investors were able to realise on average 38.09% annualised return in dollar value, compared to 4.32% for the rest of the year. The results using the S&P index produces consistent results, with average annualised returns of 40.77% during Ramadan and 11.87% during the other months. Further, Al-Hajieh, Redhead and Rodgers (2011) found statistically significant higher daily stock return during Ramadan compared to the rest of the year between 1992 to 2007 in six Middle-East countries, namely Egypt, Jordan, Kuwait, Qatar, Turkey and United Arab Emirates. Contrary to the findings above, Al-Deehani (2006) reported significant negative returns in the Kuwait stock market during the month of November in the seven years between January 1996 and December 2004, six of which overlapped with the month of Ramadan.

However, few studies address the seasonal regularities in the context of market liquidity both around specific calendar events and around the cultural festivities. For example, Chordia, Roll and Subrahmanyam (2001) found that liquidity varies over the days of the week and around

the major holidays, and days before the announcement of selected macroeconomic indicators. Specifically, liquidity and trading activities significantly increase on Tuesdays and decline on Fridays. Around holidays, the trading volume, trading value and market depth decline while quoted spread increases, implying that liquidity is decreasing. Van Ness BF, Van Ness RA and Warr (2005) found consistent results where liquidity has persistent patterns related to the days-of-the-week effects, with Tuesdays having the highest liquidity and Fridays having the lowest liquidity during the weeks. This days-of-the-week effect and the holiday effect have also been observed in the bond market (Chordia, Sarkar & Subrahmanyam 2005) implying a similar pattern of behaviour in the equity market as well as the debt market.

With regard to cultural seasonality of liquidity, Białkowski, Etebari and Wisniewski (2012) reported that the liquidity does not significantly change during Ramadan in Saudi stock market. Hence, as prior studies show, the presence and the magnitude of the seasonal regularities are not consistent across markets. This evidence provides strong support for seasonality as a determinant factor of market liquidity in the Indonesian stock market.

### 2.4.2 Commonality in Individual Stock Liquidity

There is evidence for significantly strong correlation between firm level liquidity and market level liquidity. The co-movement of individual stock variations due to market level liquidity is known as commonality in liquidity. The identification of the commonality in liquidity along with the potential determinants of the individual stock liquidity will be the focus of the following discussion.[6]

According to Brockman and Chung (2008), a commonality refers to a situation where the liquidity of a single stock tends to move together with the average market liquidity. Many studies have reported commonality in liquidity across different markets, for example, developed and emerging markets, order-driven and dealer driven markets, and across various assets, for example, stock, bond, real estate and derivative. As found by many studies, commonality can exist at varying degrees. Strong commonalities were documented by Chordia, Roll and Subrahmanyam (2000) and Huberman and Halka (2001) in NYSE, Brockman and Chung (2002) in SEHK, Galariotis and Giouvris (2007) in LSE, Pukthuanthong-Le and Visaltanachoti (2009) in SET Thailand and Choe and Yang (2010) in

[6]The summary of previous studies on the commonality in liquidity is provided in Appendix 1.

KSE Korea. In contrast, weak commonalities were found by others including Hasbrouck and Seppi (2001) in DJIA, and Fabre and Frino (2004) in ASX.

The presence of commonality in liquidity was initially documented by Chordia, Roll and Subrahmanyam (2000), Hasbrouck and Seppi (2001) and Huberman and Halka (2001). Chordia, Roll and Subrahmanyam (2000) investigated commonality in the liquidity of NYSE stocks by regressing various proxies for individual stock liquidity against market-wide averages, on a stock-by-stock basis. The study reported a positive and highly significant association between daily changes in stock liquidity and market-wide average liquidity across different liquidity measures. Hasbrouck and Seppi (2001) addressed the importance of cross-stock common factors for pricing and liquidity. Using principal component analysis, the study provided evidence for the existence of common factors in the thirty DJIA stocks. Huberman and Halka (2001) found significant autocorrelation among liquidity data. Using four proxies of liquidity: spread, spread/price ratio, quantity depth and dollar depth on 240 NYSE stocks, they found systematic components on the temporal variation of liquidity, indicating the presence of commonality in liquidity.

Commonality in liquidity has important implications for market stability and investment management. A higher commonality means that liquidity of the individual stock tends to move together with market-wide liquidity and leads to higher non-diversifiable systemic risk factors (Pástor & Stambaugh 2003; Acharya & Pedersen 2005; Korajczyk & Sadka 2008). This conclusion suggests that stock markets would be more vulnerable if commonality is stronger, implying that liquidity may evaporate more quickly during periods of financial crises. This presents a significant challenge to regulators and policy makers who, in the presence of strong commonality, should maintain a constant watch on the market parameters to prevent serious damage to the financial market during financial crises (Fernando, Herring & Subrahmanyam 2008).

In addition, investors will require a higher return of a stock that is exposed to the higher systemic risk component (Chordia, Roll & Subrahmanyam 2000). That is, firms with higher liquidity risk (liquidity beta) are more sensitive to the market-wide liquidity and earn higher expected returns than those that exhibit a lower sensitivity (Pástor & Stambaugh 2003; Coughenour & Saad 2004; Acharya & Pedersen 2005). Thus, investors should consider the risks of co-movement of individual liquidity when implementing portfolio diversification strategies.

Unlike prior studies on commonality in liquidity that primarily focus on dealer driven in developed markets, there are a growing number of investigations in the context of order-driven in emerging markets, including Bauer (2004), Fabre and Frino (2004), Lee et al. (2006), Galariotis and Giouvris (2007) and Pukthuanthong-Le and Visaltanachoti (2009). Bauer (2004) documented the presence of liquidity commonality in the Swiss Stock Exchange, an order-driven market. Fabre and Frino (2004) found that co-movements of individual stocks in ASX are less persistent than in other markets. Using daily interval data, Lee et al. (2006) documented the existence of significant liquidity commonality in the Taiwan OTC stock market. Galariotis and Giouvris (2007) reported strong evidence of commonality of FTSE100 stocks traded in an order-driven market. Pukthuanthong-Le and Visaltanachoti (2009) documented plausible evidence of commonality across different sizes of firms and over different times of market fluctuation using different liquidity proxies in the Stock Exchange of Thailand.

In addition to the findings on the commonality in stock liquidity, prior studies have identified the potential factors that may explain the presence of the commonality. For example, Coughenour and Saad (2004) claimed that commonality exists in NYSE because of the specialist effect: specialists trade using a pool of capital and share profit and inventory information within their portfolio. If a single specialist is responsible for providing liquidity for more than one stock, the liquidity of a stock has a tendency to co-move with liquidity of other stocks traded by the same specialist. Their study shows evidence that the commonality in firm liquidity is stronger for stocks handled by the same NYSE specialist firm than for other stocks and that the commonality is higher for specialists that face funding constraint.

Brockman and Chung (2006) found that including a stock in an index improves the commonality. They found that in the Hong Kong Stock Exchange the commonality in liquidity was stronger for the 132 stocks which were members of equity indices than the 551 stocks which were not members of any index. The index inclusion increases the co-variation of the stocks because of their common base of the trading activities of arbitrageurs and portfolio managers. Arbitrageurs trade in a block of stocks as part of their trading on the index derivative, while portfolio managers trade the stocks in the index to track the performance of a particular index. As a result, the commonality in liquidity exists in the stocks participating in an equity index.

Karolyi, Lee and van Dijk (2012) examined the variations of commonality in liquidity related to the supply side (funding capital of market intermediaries) and the demand side (investor participations and investor sentiment) of liquidity. Using data from twenty-one developed economies and nineteen emerging economies covering the period 1995 to 2009, the findings show that commonality in liquidity is stronger in markets during the period of high market volatility and with larger international participation. This study also found evidence that commonality in liquidity is weaker in the developed markets than in the emerging markets.

The discussion above illustrates that the presence and the degree of commonality vary amongst markets and over time. This study is expected to extend the current evidence by examining Indonesia as an emerging market.

### 2.4.3 Determinants of Individual Stock Liquidity

The factors affecting liquidity at the level of aggregate market is different to those at the level of individual stocks. At the market level, liquidity is a function of factors that is systemic to the overall economy (Jun, Marathe & Shawky 2003). In contrast, the variations of the individual stock liquidity are also a manifestation of specific characteristics of the individual stock. The following discussion will elaborate on the potential determinant factors in the individual stock level: foreign ownership, market power, and regulatory factors.

#### 2.4.3.1 Foreign Ownership

Following market liberalisation, previous studies often suggest that higher foreign investor participation will foster the development of domestic markets. The empirical studies regarding the impact of foreign investors on domestic market liquidity, however, resulted in mixed findings. Levine and Zervos (1998) found that market liquidity increases after foreign investors were allowed to purchase local stocks in sixteen emerging markets. They claimed that, following the liberalisation of capital control, stock markets would be larger, more liquid, more integrated but more volatile. Dvořák (2005) supports the finding with the evidence that foreign investors tend to initiate more trades in the Indonesian stock market than do their domestic counterparts. Consistent with the experience of emerging markets, Sun, Tong and Yan (2009) also documented an increasing liquidity in Shanghai Stock Exchange and the Shenzhen Stock Exchange after market liberalisation within the country in 2001 when the B-share market that used to be traded only for foreign investors was opened for domestic investors.

Others found negative relationships between foreign presence and liquidity. De la Torre, Gozzi and Schmukler (2007) hypothesised that stock market liberalisation will attract foreign investors to purchase local stocks and increase the pool of capital available to domestic firms and develop the investor base, thereby improving the liquidity in the domestic markets. The evidence from 117 countries between 1975 and 2004, however, showed otherwise: liquidity decreased after market liberalisation. Instead of local markets having more trading activities from foreign investors, financial globalisation attracts domestic investors to trade stocks and use financial services abroad. This phenomenon tends to be stronger, in particular, if the domestic environment is weak.

Rhee and Wang (2009) also found a negative relationship between foreign presence and stock market liquidity in the Indonesian market. There are four main reasons for this finding. First, under conditions where the interaction between foreign and domestic trading is primarily at the institutional level, the presence of foreign participants tends to increase information asymmetry, mainly because foreigners often works strategically and possess better experience. Second, when the percentage of foreign ownership is very large, foreign shareholders may have sufficient voting power to appoint corporate boards, which may also lead to a higher information asymmetry. Third, if the majority ownership is transferred to foreign investors, the strong connection with local industry and government to access informal information may be diminished; as a result, the company is perceived as "foreign" to domestic investors, and therefore decreasing liquidity. Fourth, a greater foreign ownership increases the concentration of corporate ownership and promotes buy and hold strategy which in turn reduces liquidity.

Likewise, Ng et al. (2011) reported that the trading activity in twenty-eight out of a sample of forty countries had decreased from 2002 to 2007 following the presence of foreign ownership. There are two economic reasons for this negative impact. First, foreign holders had reduced free-float stocks in the market, which increase the number of inactive stocks. Second, the foreign large holders caused the information asymmetry effect by exploiting their superior information advantage that translates into higher transactions costs in compensation for the expected loss by liquidity traders.

#### 2.4.3.2 Market Power

There are growing number of studies to link product and financial markets by providing evidence on how the competition in the product markets affects stock performance in the financial markets. Hou and Robinson (2006) argue that a manager's decision related to the product market will subsequently affect stock returns. The causal relationship can be explained based on the expectation that the operational decision, which is the result of the strategic competition among market players in the product market, seems to affect the firms' cash flow, which in turn dictates the stock return. The study found that firms, which operate in a competitive environment, provide about 4% higher stock return compared to those that operate in a concentrated product market. This is because firms operating in a competitive market are forced to be more innovative than are those in a concentrated industry.

Based on a conceptual model, Peress (2010) predicted that a market structure in the product markets has significant influence on the liquidity of stocks in the financial markets. Firms in a highly competitive market do not have a strong ability to control the market and therefore have lower market power. Firms with lower market power are exposed to higher earnings volatility. The diverse earning forecast leads to a higher variation of opinion among investors or analysts, which then induces a higher stock trading activity. Peress' empirical results are, however, contradictory: a lower market power leads to a lower liquidity. That is, the stocks of firms with lower market power are less frequently traded, whereas the stocks of firms with higher market power are more actively traded. This suggests that the higher market power is more likely to generate higher profit, lower risk, and lower variance in forecasts. The findings imply that only informed traders are aware of and are able to accurately forecast earnings. This model incorporated the fundamental premise that market power implies an ability of a firm to control the price of a product that is not associated with a loss of demand for the product.

Kale and Loon (2011) conducted a study to test the model developed by Peress (2010) which used market share and product differentiation as proxies for market power. Market share indicates market domination of a firm over the competitors in the industry, which is measured by the proportion of the firm's sales over the sales of all firms in the industry. Product differentiation refers to the uniqueness of a product compared to its competitor in the industry. A higher product differentiation leads to higher abnormal rents and generate a higher operating profit margin. Firms with higher market power are able to influence the industry by

setting a higher product price. This will increase the profit margin. This market power will affect firm value through the expectation of firm cash flow (Merton 1987). Based on the data from the United States between 1984 and 2003, Kale and Loon (2011) confirmed Peress' empirical finding: there is a positive association between the ability to control the market and stock liquidity. The resulting cash flow stability of firms with high market share results in stable stock prices reducing the sensitivity of the firms to order flow. Dampened stock price volatility has a positive impact on liquidity.

#### 2.4.3.3 Regulatory Factors

Previous studies suggest that stock exchanges have the ability to influence the cost of transactions, and thus liquidity, by transforming its market structure through regulations, technology and product development (Aitken & Comerton-Forde 2003). More specifically, stock exchanges may influence liquidity through trading mechanisms (Amihud, Mendelson & Lauterbach 1997; Brown & Zhang 1997; Jain 2003; Chung, Kang & Kim 2011), tick price (Bessembinder 2000; Chung, Kang & Kim 2011) and margin trading eligibility (Alexander et al. 2004).

The following discussion explores the structure and regulatory factors that affect liquidity, including tick size, margin trading, and market surveillance.

**Tick Size**

A tick size rule is an important element of trading protocols that prohibits discrete grid of price increments, which in turn forces investors to place orders at a minimum allowable price interval. A stock exchange typically regulates a stepwise tick size system in which the minimum tick size increases with stock prices. The IDX adopted this model, in which five clusters of tick sizes increase with price (Allen & Sudiman 2009). Others may set a single uniform minimum tick size applicable for all price levels, such as one-cent-dollar increments in the New York Stock Exchange (Van Ness BF, Van Ness RA & Warr 2005). The tick size is recognised as the cost of transactions: a larger tick size is an attribute of higher trading costs (Bessembinder 2000; Chung, Kang & Kim 2011). Lowering tick size, however, is not necessarily more advantageous; too low tick price may deter the willingness of liquidity supplier to absorb demands. This is because a lower tick size may encourage "front running", whereby professional traders may take advantage by stepping in front of public limit orders at a slightly better price and have a better chance to trade. In addition, if a lower tick size causes

the quoted depth to decline, large orders will be exposed to a higher cost of trading. Hence, if the tick price is too low, investors can place a relatively indifferent price and this may result in a higher cost of negotiation and cost of delay.

In their study of tick size, spreads and liquidity, Bessembinder (2000) documented that a smaller tick size significantly reduces both quoted and effective spreads; that is, better liquidity. Specifically, tick size reduction has a greater liquidity impact for low-priced stocks. In the context of the Korean Stock Exchange, Chung, Kang and Kim (2011) found that the bid-ask spreads of the majority of high-priced stocks are equal to their tick size. This finding indicates that the tick size rule restricts bid-ask spreads from decreasing further. The study also reveals that the probability of information-driven trades is positively related to the tick size, implying that higher tick size does not prevent informed-motivated investors from trading. However, a direct relationship between informed trades and tick size does not necessarily reflect the relationship between informed trades and spreads or cost of trading. The higher-priced stocks with a larger tick size may have lower effective bid-ask spreads, and thus higher liquidity.

**Margin Trading**

Margin trading enables investors to buy more stocks than they normally could, using money borrowed from their financial intermediaries. Optimistic investors who buy on margin may enjoy profit from excessive leverage by borrowing a large amount of money when the price increases (Hardouvelis 1988). As their wealth increases, those investors could borrow more money and buy more stocks, which increase the stock price even higher. This is called the "pyramiding process". However, when the market collapses, the pessimistic investors begin to sell their stocks and drive the prices downwards. Consequently, the financial intermediaries might require additional collateral if the value of the stocks is not sufficient to cover the value of the financing. At a certain point, the financial intermediaries will liquidate the collateral, forcing further declines in price. This is known as the "de-pyramiding process". Thus, margin trading entails higher risk that may cause excessive volatility.

Normally, regulators set margin requirements by limiting the proportion of money investors can borrow from financial intermediaries. This regulation will deter unnecessary volatility in securities prices resulting from pyramiding and de-pyramiding. Margin requirement also discourages investors from borrowing more money from banks which otherwise, should be

available in alternative sectors such as agriculture to prevent depression (Schwert 1989). For example, the current initial margin requirement set by the US Federal Reserve is 50%, meaning that investors have to provide, at minimum, 50% of the buying cost from their own money. If the stock price increases, investors may withdraw the differential; if the stock price decreases, up to a pre-determined level (at the maintenance margin), they are required to provide additional collaterals to the creditors.

In addition, regulators often limit the number of stocks eligible for margin trading to control the pyramiding and de-pyramiding effects. Recent studies have examined the correlation between margin trading and market quality. Alexander et al. (2004) investigated whether liquidity of a stock would change following its inclusion in the margin eligible list. The study found that when stocks become qualified for margin trading, market liquidity of those stocks does not change even though trading volume increases. They suggest that following margin-eligibility of a stock, the adverse selection component increases, but the order-processing costs decrease.

**Market Surveillance**

Stock market authorities conduct surveillance with the objectives of maintaining fair and orderly trading activities, organising trading interventions, detecting market violations, ensuring timely disclosure of price sensitive information and maintaining compliance with market rules (IOSCO 2012). Market surveillance mechanisms may include: trading halts or suspensions, incidental disclosures of price sensitive information and daily price limit fluctuations. These regulatory policies normally become tighter during a crisis; regulators may interrupt the trading activity to reduce instability. During the Global Financial Crisis in 2008, the Indonesian stock market authority closed its entire equity market for three consecutive trading days following the drastic drop of the composite index at the end of October 2008.

The unusual market activity (UMA) report is one of surveillance mechanisms by which IDX requires listed firms to disclose their critical information that may contribute to the unusual stock trading activity. In point II.11.3. of the current version of IDX trading regulation (IDX 2013), UMA is defined as:

> trading activity and or unusual price movement of securities during a certain period of time, which according to the exchange potentially disturbs the functioning of orderly, fair and efficient securities trading

This definition implies that UMA is an exchange intervention in order to provide sufficient opportunity for information to be disseminated more completely and symmetrically, and for market participants to rationally reconsider their investment decisions based on new information.

Faten (2008) suggests that asymmetric information can be reduced with high quality of public disclosures, such as financial reporting disclosures, news releases and mandatory reporting. In such instances, when the activity is very unusual, IDX mandates the firms to disclose relevant information or may even suspend the trading of the stocks during a session or a day until the firms disclose sufficient information (IDX 2004). Thus, the release of UMA should have effects on trading activity. In general, Welker (1995) argues that information disclosure reduces the information asymmetry and therefore improves liquidity. In a study on the implications of UMA for trading activities in IDX, Hanafi (2011) reports that positive UMA information increases trading activities while negative UMA decreases trading activities. The implications of UMA for a greater dimension of market liquidity, however, have not been observed in the current literature.

## 2.5 Theoretical Aspects

This section outlines the theoretical motivations through which the determinant factors, as discussed earlier in the Section 2.4, may motivate liquidity variations. There is compelling evidence that different types of liquidity behaviour across stocks and across markets are associated with different trading regulations (Cumming, Johan & Li 2011), trading systems (Madhavan 2000) as well as macroeconomic and market indicators (Chordia, Roll & Subrahmanyam 2001; Fujimoto 2004). Theoretically, those factors could affect liquidity through different channels. This thesis provides three hypotheses that guide those associations, namely market microstructure, structure conduct performance and seasonal regularities.

As the primary motivation of this review is to present a theoretical foundation to frame the hypotheses, it is not its focus to elaborate a comprehensive assessment of the theoretical propositions. In general, those concepts share a similar notion in the sense of extending the classic finance theory which assumes that the market is perfect and frictionless. Their main

characteristics rely on the equivalent understanding that the market is not frictionless and that market structure affects the interactions of various market elements. As such, the different market structures have an effect on equilibrium outcomes, such as asset price, market efficiency or performance.

However, these theoretical models are derived on different tenets and multiple sets of parameters, assumptions and space states. Drawing a line through those concepts may lead to overgeneralisation. The objective of considering those concepts is to enrich and expand the theoretical contributions of a dynamic equilibrium concept within the landscape of financial literature. Thus, it is important to develop a comprehensive and meaningful understanding so that the remedies are comprehensive and effective.

### 2.5.1 Market Microstructure Theory

The traditional Walrasian literature on economic theory assumes that the market is frictionless and free to enter (Madhavan 2000). Frictionless means that buyers and sellers can trade an infinite amount of assets without making a price impact; the transactions are cost free, and, assets can be traded without restrictions, such as the short sale constraint (Çetin, Jarrow & Protter 2004). The traditional theory, however, is silent about the implications of frictions on the market equilibrium and market efficiency (Goldman & Beja 1979). In fact, the frictions exist in various market settings. In the real world, investors define their expectation of the value of assets after considering market frictions such as investment barriers, regulatory friction, foreign capital control, asymmetric information and the costs of trading.

Market microstructure theory relaxes the assumptions that the market is frictionless and free to enter by addressing the frictions in the models. The central idea of market microstructure theory is to examine the process of transforming demands into the price (Madhavan 2000). The process involves investigating the interactions between market players, organisation of a trading system and price formation (Goldman & Beja 1979; Cohen et al. 1980). In the well-known paper entitled “Market Microstructure” which gave the name to this field of financial economics, Garman (1976) describes microstructure as the detail tick by tick transaction events in asset trading. Specifically, each step made toward a trade is influenced by various market frictions, including the organisation and the functions of markets (Lipson 2003), trading rules (O’Hara 1995), conventions (Mahoney 2003), market structure and individual

behaviour (Calamia 1999). These market frictions impede the trading process and affect price discovery (Biais, Glosten & Spatt 2005).

Madhavan (2000) asserts that market microstructure theory has made important contributions in explaining how various rules affect market structure ('black box') and how the 'black box' affects price formation and, hence the liquidity and market quality. It is the central role of the black box to organise, process and subsequently transform the orders to transactions according to selected rules and regulations. The selection of market structure also has a significant consequence on the cost of transactions (Chung & Hrazdil 2010). Consequently, investors have to manage trading strategies that efficiently manage the cost of trading. For that reason, modern trading systems employ complicated algorithms to incorporate a number of factors such as order type, execution time and liquidity searching to minimise costs rather than to exploit profitable trading (Francioni et al. 2008).

Lipson (2003) noted that the market microstructure theory has great merit in developing corporate finance and international finance research. For instance, in their study of corporate finance in an asset pricing model, Acharya and Pedersen (2005) and Amihud and Mendelson (1986) incorporated liquidity risk to estimate the impact of liquidity and volatility on price and required return. In international finance, market microstructure literature investigates issues such as the impact of liberalisation on market volatility (James & Karoglou 2010) and liquidity commonality across markets (Jun, Marathe & Shawky 2003; Zheng, Jun & Yan Leung 2009).

The market microstructure theory provides a useful theoretical framework to investigate market liquidity and the associated determinant factors. The following section reviews two fundamental paradigms that explain how market frictions influence liquidity. The first paradigm is the inventory model, which focuses on the stochastic nature of supply and demand. The second paradigm is the asymmetric information model.

#### 2.5.1.1 Inventory Model

The inventory model is built upon the fundamental assumption that dealers play a central role in providing liquidity to public investors. Often there are situations where buyers' needs and sellers' needs do not match. In such situations, dealers enter the market and serve as intermediaries by buying securities from the sellers, and by selling them to the buyers later on. Conversely, dealers might sell their own inventory and buy later on. Thus, the dealers

facilitate the bridging of the time gap between transactions. To perform this function effectively, dealers have to maintain a certain level of inventory, which incurs opportunity costs.

Like any other retailer or wholesaler, dealers have to set a certain level of margins that is sufficient to cover cost of carrying inventory, to cover the risk of unwanted inventory and to generate profits. Dealers set margins from the difference (spread) between buying and selling price. Thus, there cannot be a single market price to settle trades (Demsetz 1968). Dealers will dynamically adjust the bid and ask prices to serve the immediate supply. There should be an asking price and a bid price in which the asking price is higher than the bid price for a positive margin. Demsetz (1968) argues that in such circumstances, dealers will adjust bid-ask spread in order to serve the markets to complete the transaction in a timely manner.

Smidt (1971) suggests that dealers have to actively adjust the stock price in response to the variations of the inventory level. When the inventory position is too high, dealers are exposed to a higher risk of holding the inventory and are reluctant to accumulate more inventories. To liquidate the position, dealers have to attract more buyers by posting lower ask prices. This decision leads to the reduction of their unwanted position and revert to the optimum level. In contrast, if the dealers hold lower than the optimum inventory level, they will post higher bid prices, which invites more sellers and revert their positions back to the optimum level. Hence, by setting the right price, dealers can avoid accumulating unwanted positions on one side of the market while increasing the inventory turnover.

Building on the idea of Smidt (1971), Garman (1976) provides a model to examine the relationship between the dealers' quoted price and inventory level. He incorporates the capital limitation as an exogenous factor that affect dealers' ability to stand ready as sellers or buyers. The model thus addresses the temporary imbalances due to stochastic order arrivals and the way the market clears the stochastic flows. Based on the Garman's model, the price will deviate from the existing price following a large trading and will reverse to the equilibrium thereafter. The resulting capital increase will reduce transitory price fluctuations.

Stoll (1978) developed a model by which dealers adjust the bid-ask spread, as a holding cost, in response to the deviation of optimum level of inventory. The model suggests the inclusion of optimisation problems on the assumption that dealers set an optimal inventory level based on their risk return preference. The risk return preference in this situation is a function of the

fundamental characteristics of the stocks. Thus, the estimated optimum level varies for each dealer and for each stock. This explains why bid-ask spread varies across stocks quoted by different dealers. Following a transaction, dealer's optimum inventory level could deviate and shift to a sub-optimum level. The dealer then posts quotations based on the adjusted bid-ask spread to rebalance its position back to its optimum level. Under more complex assumptions, Ho and Stoll (1983) suggest a more advanced model that can accommodate bid and ask price quotes of multiple dealers over multiple stocks.

In short, the main issue of the inventory model is how dealers manage their bid-ask spreads in response of inventory fluctuation. The inventory fluctuation increases the risks of holding inventory as the prices may deviate from the expected value of the asset. For that reason, dealers adjust bid-ask spread that will affect liquidity in the market.

#### 2.5.1.2 Information-Based Model

The information-based model was first discussed in a paper by Bagehot (1971) and later developed by Glosten and Milgrom (1985), Kyle (1985), Easley and O'Hara (1992) and Parlour (1998). According to Bagehot (1971), market makers always make losses when trading with traders who have access to special information and generate profits when trading with traders having no special information. Informed traders are assumed to possess private information about the fundamental value of the asset traded. In contrast, uninformed traders trade for other motives such as liquidity needs. In order to avoid lose money consistently, market makers have to set a higher ask price than bid price. The spread will be applied to all traders, as market makers are unable to distinguish between the two. Thus, bid-ask spread would exist even in competitive markets without explicit transaction costs, instead, the bid-ask spread is set in response to asymmetric information.

Glosten and Milgrom (1985) formulated a model of price formation based on asymmetric information. The model assumes that traders can be classified into market specialists, informed traders and uninformed traders. The proportion of informed traders is given and order flow is sequential: that is, buying orders will be followed by selling orders and vice versa. Dealers are uninformed traders and rely on the observation of past trading activities to develop their trading strategy, by which bid-ask spread is determined. They have no access to any observable variables in order to distinguish between informed and uninformed traders. Dealers will set bid and ask quotes that are sufficient to cover any loss from the trading with

informed traders. Dealers will update these quotes continuously, given their new information, from trade to trade. As the price becomes more informed, the bid-ask spread would diminish over time. Hence, dealers would have more certainty in setting sufficient spreads; as a result, public traders will be exposed to price impact. In contrast, dealers will set a wider bid-ask spread when the probability of trading with informed traders is high.

The information model discussed above assumes that traders can only trade once. Thus, there is no subsequent trade that may cause price impact which encourages investors to trade in large volumes. In view of this, Kyle (1985) proposed a model in which traders may participate frequently, requiring them to employ effective and efficient trading strategies. The model assumes that the informed traders have detailed knowledge on the volatility of the stocks, whereas the uninformed traders post their orders independent of the true value of the stocks. Market makers trade with both informed and uninformed traders and set prices to clear the market. In anticipation of the aggressive trading behaviour of informed traders, market makers set prices as a linear function of net order flow and combine order accumulation of the informed and uninformed traders. Under such a condition, market makers have to choose the optimal quantity to trade based on the rational conjectures about market liquidity variables which are measured by tightness, depth, and resiliency.

Easley and O'Hara (1992) introduce random arrivals of new information. When an information event occurs, informed traders will either buy or sell depending on the information signal. Uninformed traders, however, may choose to refrain from trading irrespective of new information events. When uninformed traders choose not to trade, the trading process will slow down. Therefore, if a trading does occur, the time between trades should contain informative events. Easley, Hvidkjaer and O'Hara (2002) introduce Poisson distributions by which information is assumed to arrive at randomly continuous, not discrete, time intervals. This model estimates the probability of whether a trade is informed by measuring the intensity of information arrivals.

Parlour (1998) asserts a model of dynamic price in a limit order market. The model assumes that no dealers provide liquidity in the market. In the model, informed traders have to determine whether they place limit orders or market orders or even refrain from trading. If a limit order is selected, informed traders have to deal with risks of un-execution or time delay. In contrast, when they choose to submit a market order, informed traders have to accept the available market price.

In summary, the interactions of the informed and uninformed traders will stimulate the price changes which determine the bid-ask spread and enables new information to be incorporated into the price. The information-based model suggests that bid-ask spread is a function of the information on order arrival, the supply and demand elasticity and the information quality of insiders (Glosten & Milgrom 1985). Unlike the inventory model that has a temporary effect on price changes, the information is impounded into share prices permanently (Biais, Glosten & Spatt 2005).

### 2.5.2 Structure-Conduct-Performance (SCP) Paradigm

The SCP provides theoretical basis for implementing the economic theory of market models in the practical world. The SCP paradigm dates back to Mason (1939) and Bain (1951) who have been regarded as the primary sources in public policy on industry structure and firms' behaviour. They argue that firms' price policy and their market control are substantially influenced by the structure of the industry, such as the firms' relative and absolute size over their competitors (that is, industry concentration). The general view of the SCP paradigm suggests that firm performance and market efficiency are influenced to some degree by the market structure and conduct (Caves et al. 1987). As opposed to the traditional view of industrial organisation, SCP takes real world frictions, such as trading cost, limited information and barrier to entry, into consideration.

There are two channels supporting the notion that industry concentration leads to a higher economic profitability (Molyneux & Forbes 1995). First, the market concentration hypothesis argues that a higher market concentration will result in a greater market power and generate a better performance, regardless of the efficiency of the firm. Second, the efficient structure hypothesis contends that the performance of a firm depends on its efficiency. That is, a leading firm can earn higher profit because it is more efficient and more competitive and therefore is able to dominate the market. Thus, the performance is achieved not because of its collusive conduct that causes market concentration, but because of its cost advantages allowing it to sell its products at a lower price and acquire even larger market shares.

Early literature about the SCP paradigm attempted to uncover the importance of market structure on economic performance. Bain (1951) argues that sellers would generate higher profits in a more concentrated market. His study on American manufacturing industry covering 1936-1940, however, found mixed results; for large firms the association between

firms' profit and industry concentration is significant, but for those that have net worth less than five million US dollars, the association tends to be insignificant. In a review of forty-six published sources from 1936 to 1970, Weiss (1979) reported a strong positive association between industry concentration and profits in the US, UK, Canada and Japan.

Studies in SCP paradigm have mainly focused on the implications of market structure on the profit levels of firms or the welfare of a society. Recently, there has been growing interest to examine the economic link between industrial organisation theory and the financial economics attributes. The studies covering this area attempt to see the impact of firms' product market characteristics, such as market power, on the stock market performance.

Theoretically, the level of firms' competitiveness in the product markets will affect the stock price in the stock markets. Firms will determine their decision to set a price or to spend a certain advertisement cost based on their competitiveness. This decision, in turn, will affect the firms' cash flow in the future. That is, firms with stronger market power would be able to generate a more stable future cash flow. As a result, the stock price would be less volatile and consequently the stock return tends to be lower (Hou & Robinson 2006). A higher cash flow stability, together with a lower return volatility, allow a lower market impact and a higher market liquidity (Kale & Loon 2011). Larger trading volume of stocks whose firms enjoy market monopoly can accelerate the incorporation of private information into stock price with which the liquidity of the stocks is improved (Peress 2010).

In short, industry concentration allows the leading firms to generate a better future cash flow. With a monopoly that derives a higher market power, firms will enjoy a higher stock trading volume, which then speeds up the incorporation of private information on stock prices and results in higher market liquidity.

### 2.5.3 Seasonal Regularities

A large body of evidence has documented persistent regularities of securities return both in cross section and in time series observations. Interestingly, these findings are frequently not consistent with any existing central theory or paradigms. That is, the underlying paradigms that explain many of the phenomena remain unclear. Financial economic literature often classified these findings as an anomaly to show empirical results that deviate from the traditional theory, such as capital asset pricing model (Schwert 2003). For example, return anomaly involve the predictability of return that is inconsistent with the classical finance

theories. The findings stimulated the development of a new theory in finance that is called behavioural finance (Frankfurter & McGoun 2001).

Michaud (1999) provides two sets of fundamental reasons behind the existence of market anomalies. The first set is associated with market inefficiency and economic significance, which are temporary inefficiencies and are due to irrational investor behaviour. The second set includes inaccurate estimation of risk, methodological errors, data snooping, misinterpretations of the size factor, attribute-sorted portfolio implications, econometric limitations, and magnified returns.

However, the study in market anomalies is not without its critiques. Many opponents are less sympathetic to the arguments that market anomaly is not consistent with the traditional finance theory, for example Fama (1998) and Frankfurter and McGoun (2001). Fama (1998) argues that market anomaly is consistent with the market efficiency and is not an outcome of market inefficiency for two reasons. First, anomaly is an implication of time lag adjustment to new information, and has been supported by long-term observations. The anomalies reflect the under-reactions or over-reactions in response to information released, and market efficiency is indicated if under-reaction and over-reaction are roughly even. Second, if in an extreme situation the existence of anomaly is not consistent with the under-reaction and over-reaction hypothesis, there might be method sensitive bias. That is, using different methods, the magnitude of the market anomaly may be reduced or even reversed. In this sense, the anomaly is simply an attribute of chance. Frankfurter and McGoun (2001) underline the misconception of the term “anomalies” which then emerged in the behavioural finance topic. They argue that what most studies referred as anomalies has been recognised by prior finance literature from the very beginning. For example, when testing efficient market hypothesis or capital asset pricing model, the issues have been taken into account to confirm the evidence.

Schwert (2003) in his survey on anomalies and market efficiency, notes the temporary nature of market anomalies as found in many studies. That is, once a type of anomaly is published, the magnitude of the anomaly will weaken, reverse or fade over time. Later studies, however, have failed to confirm the existence of the phenomena in either out of sample analysis of time series data or in cross sectional observations. These findings lead to two possible explanations to rationalize the anomalies. First is that the anomaly existed in the past but investors had successfully exploited the pattern and exited upon profit taking, implying that anomaly

reflects market inefficiency. Second, the anomaly is simply statistical abnormalities during the study periods.

From the very extensive literature on this topic, however, one can argue that market anomalies are important elements of financial market attributes, regardless of the capacity of the current theories to provide satisfactory explanation. There is sufficient evidence supporting the notion that market anomaly is a reflection of market inefficiency, a result of irrational trading behaviour or a consequence of statistical and methodological bias. In light of these interpretations, it is important to note that market anomaly is an observable phenomenon that influences not only on the return patterns, but also on the trading activities and therefore market liquidity. Its presence over time and across different stocks and markets, even though is short-lived, implies that market anomaly such as calendar and cultural anomalies may have an important role to affect stock market liquidity.

## 2.6 Summary

The Indonesian stock market has undergone significant regulatory and institutional reforms since its inception in 1977. The reform packages in the 1980s involving stock market, banking and taxation provided an influential foundation for the stock market development as an alternative source of financing and investment. The institutional changes during 1990s, including the establishment of JSX, the introduction of electronic trading system and the removal of the 49% foreign ownership cap, further increased the number of listed companies and stock trading activities. Stronger institutional reforms were implemented in the 2000s when the two national exchanges were merged and a national financial authority was established as an integrated regulator of all financial institutions in the country. These policy reforms, in combination with the economic recovery after the 2008 Global Financial Crisis, have contributed to the improvement of market liquidity during the late 2000s.

This chapter reviewed the concept of liquidity and the common underlying factors that determine liquidity at the market level and at the individual stock level. The current study focused on three liquidity measures: market depth, trading cost and trading activity and the literature has identified the dominant determinants of market liquidity. At the market level, the variables that potentially affect liquidity are international factors, macroeconomic factors, market performance factors and seasonal regularities. At the individual level, liquidity is affected by factors such as foreign ownership, market power, structure and regulatory factors.

Empirical studies have also established that stock level liquidity to some extents is affected by the market level liquidity, also known as commonality in liquidity. However, studies have reported conflicting results depending on the maturity of the markets, the efficiency of the structures and the effectiveness of the regulations.

There are three conceptual and theoretical frameworks guiding the choice of the determinant variables: market microstructure theory, structure-conduct-performance paradigm and seasonal regularities. Market microstructure theory suggests that liquidity varies in response to inventory fluctuation and to information asymmetry. The structure conduct performance paradigm suggests that liquidity is driven by the firms' market power that allows them to generate a better future cash flow which, in turn, will result in more stable stock price and higher liquidity. The evidence showed that seasonal regularities exist over time and across different markets, even though they are short-lived. This may also be an important variable to affect liquidity.

Based on the empirical and theoretical evidence discussed in this chapter, the theoretical framework most appropriate for the current study will be developed in the next chapter. Along with this, the research hypotheses, the model and the methodology of the research will also be discussed.

# Chapter 3
# Research Design and Method

## 3.1 Introduction

The previous chapter presented an overview of the institutional setting of the Indonesian equity market, and a review of the empirical and theoretical literature relating to market liquidity and its determinants. The purpose of this chapter is to present a discussion on the ways the potential determinant variables systematically affect the time-series variation of market liquidity. This will be achieved by constructing a conceptual framework and developing research hypotheses, as well as selecting the research methodology and method. The conceptual framework is constructed to substantiate the potential links between market liquidity and its determinants, and the potential links between individual stock liquidity and market level liquidity. The testable hypotheses are developed to examine the validity of the relationships in accordance with the conceptual framework. Moreover, the research methodology provides the philosophical foundation of the research design, whereas the research method is selected to accurately measure the relative significance of the relationships. The chapter ends with a detailed discussion on the selection of key variables.

## 3.2 Research Framework

The empirical and theoretical review presented in Chapter Two demonstrated that the determinant factors at the market level are broadly different to those at the individual stock level. Generally, the state of economic variables will determine market-wide stock prices (Chen, Roll & Ross 1986) while the firm unique variables tend to affect properties at individual stock level.

In the light of the literature, the research framework presented in Figure 3.1 incorporates the liquidity determinants that encompass two dimensions: market level and firm level variations. At the market level, the determinant factors include international market indicators, macroeconomic events, interest rates, market performance and seasonal regularities (Chordia, Roll & Subrahmanyam 2001; Korajczyk & Sadka 2008; Al-Hajieh, Redhead & Rodgers 2011). At the individual stock level, this study predicts that firm liquidity is, to some extent, driven by liquidity at the market level (Chordia, Roll & Subrahmanyam 2000; Hasbrouck & Seppi 2001; Huberman & Halka 2001). In addition, the study will examine a set of common

determinants of liquidity at the firm level based on previous empirical evidence, namely: participation of foreign ownerships (Rhee & Wang 2009), market power in the product markets (Kale & Loon 2011) and regulatory forces.

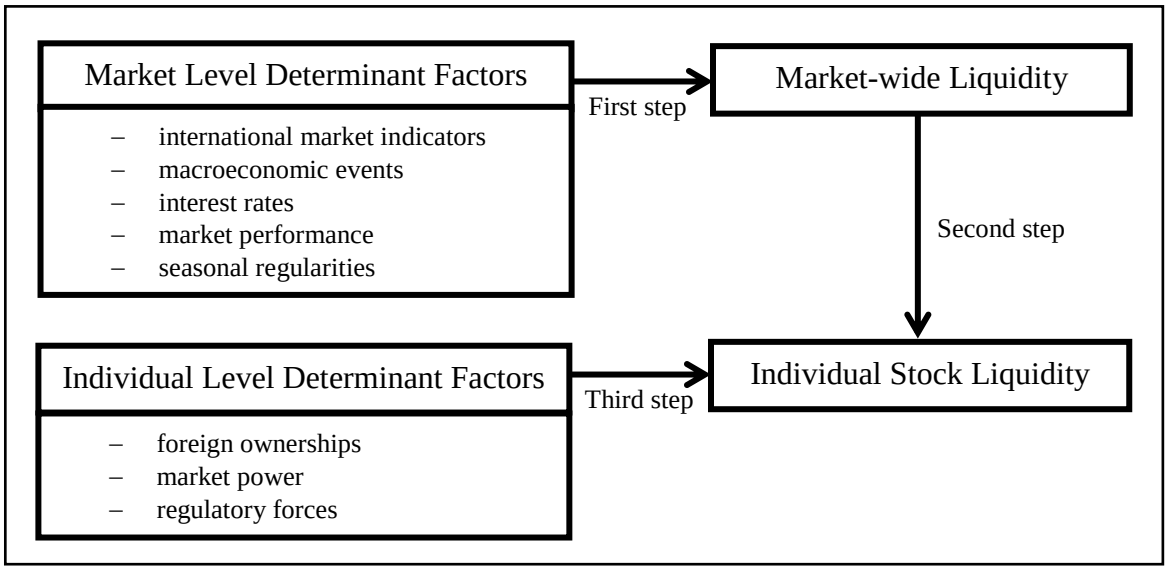



Figure 3.1 Conceptual Framework

## 3.3 Hypothesis Development

Guided by the literature review and the proposed research framework, the following discussion formulates the study hypotheses.

### 3.3.1 Determinants of Market-wide Liquidity

#### 3.3.1.1 International Market Factors

The global interdependence among countries has been increasing significantly due to lower investment barriers (Karolyi & Stulz 2003), similarities in macroeconomic policies and improved economic relationships (Ibrahim 2005) as well as developing networking technology (Trang Nha & Kakinaka 2010). As a consequence, foreign markets have affected local stock markets. Many studies have reported that Indonesian stock market exhibits some levels of dependency on the US and the Japanese stock markets (Abd, Meera & Omar 2008; Majid & Kassim 2009; Trang Nha & Kakinaka 2010; Wang 2013). These studies have

documented that the Indonesian stock returns were influenced by the US and the Japanese stock returns. Yet, none of the studies examine the effect of foreign market volatility on the market liquidity in emerging markets.

The present study will test the hypothesis that the liquidity of the Indonesian equity market is dependent upon return variation of foreign markets, focusing mainly on the US and Japanese markets. The relevant hypothesis is:

**H1**: Market liquidity is negatively related to the US and Japanese market volatility.

#### 3.3.1.2 Financial Crisis

Chordia, Sarkar and Subrahmanyam (2005) in their study on the US stock and bond markets, found that market depth decrease during the financial crisis. Likewise, Yeyati, Schmukler and Van Horen (2008) and Chordia, Roll and Subrahmanyam (2011) found that bid-ask spreads widen during a crisis. Those results strongly indicate that liquidity decreases during a financial crisis. The relevant hypothesis to test this is:

**H2:** The financial crisis is negatively related to market liquidity.

#### 3.3.1.3 Macroeconomic Events

Chordia, Roll and Subrahmanyam (2001) found statistically significant improvement in market depth and trading activity during the two days prior to the announcements of economic indicators (gross domestic product and unemployment rate). However, the majority of findings show that the announcements of macroeconomic indicators have no significant influence on the liquidity patterns (Fujimoto 2004; Kim, McKenzie & Faff 2004; Van Ness BF, Van Ness RA & Warr 2005). Despite differences in findings, the latter studies suggest that the inconsistency is likely due to the temporal properties of the relationship, which could change over time.

Given these findings, it is reasonable to argue that the announcements of the macroeconomic indicators may have a significant impact on the liquidity in Indonesian stock exchange. This hypothesis is particularly relevant due to the 2008 Global Financial Crisis which caused the macroeconomic developments were less predictable. The relevant hypothesis is:

**H3**: Liquidity decreases prior to the announcements of macroeconomic indicators due to the greater market uncertainty.

#### 3.3.1.4 Interest Rates

Studies have shown that interest rates affect the changes in liquidity b through various channels. Chordia, Roll and Subrahmanyam (2001) suggest that an interest rate increase raises the costs of margin trading and short selling, which in turn reduces liquidity. Alternatively, higher interest rates cause investors to sell their equity investment and buy debt instruments that provide higher returns, and thereby reduces liquidity in the equity markets (Van Ness BF, Van Ness RA & Warr 2005). Fujimoto (2004) suggests that interest rate shock improved liquidity indirectly through market return, volatility and share turnover. Given these findings, the present study argues that the interest rates will negatively affect liquidity. The relevant hypotheses for these are:

**H4a:** The short-term interest rates have negative correlation with liquidity

**H4b:** The term spread between long term government bonds and short-term interest rate has negative correlation with liquidity.

#### 3.3.1.5 Market Performance Factors

The literature has ample evidence supporting the impact of market performance, as measured by market returns and volatility, on liquidity. It has been suggested that market makers tend to temporarily step back from trading during the period of negative market returns, which causes liquidity to decrease (Van Ness BF, Van Ness RA & Warr 2005); and they tend to raise bid quantity during the period of positive market returns, which then increases the average depth and increases liquidity (Chordia, Roll & Subrahmanyam 2001). Consistent with these findings, Hameed, Kang and Viswanathan (2010) also reported that bid-ask spreads are likely to decrease when the market is bullish and tend to increase when the market is bearish.

Various technical trading strategies rely on historical market movements, and therefore will have an impact on liquidity (Chordia, Roll & Subrahmanyam 2001; Van Ness BF, Van Ness RA & Warr 2005). The current study expects that recent market history would affect liquidity in a significant way.

In addition to the historical market movements, a majority of studies have found that recent market volatility is negatively related to liquidity (Chordia, Roll & Subrahmanyam 2001;

Yeyati, Schmukler & Van Horen 2008; Wang 2013). In such situations, Chordia, Roll and Subrahmanyam (2001) suggest that trading activity decreases during a highly volatile market as market makers attempt to decrease their inventory imbalances.

The relevant hypotheses to test these relationships are:

**H5a:** The equity market return has a positive impact on liquidity

**H5b:** The recent market return has a positive impact on liquidity

**H5c:** The recent market volatility has a negative impact on liquidity

#### 3.3.1.6 Seasonal Regularities

Many studies have confirmed the existence of seasonal regularities in which stock market return displays a persistent pattern on particular days of the week, days around holidays and days during periods of cultural significance. In their studies on the US markets, Chordia, Roll and Subrahmanyam (2001) and Van Ness BF, Van Ness RA and Warr (2005) found a slowing down of liquidity on Fridays with the highest liquidity mostly occurring on Tuesdays.

Furthermore, a number of studies have identified the presence of calendar anomalies on liquidity variations around major holidays. For example, Hameed, Kang and Viswanathan (2010) and Chordia, Roll and Subrahmanyam (2001) found that liquidity in the NYSE tends to decrease before major holidays such as Independence Day, Christmas, or New Year's Day.

Studies in Muslim countries conducted by Seyyed, Abraham and Al-Hajji (2005), Al-Hajieh, Redhead and Rodgers (2011) and Białkowski, Etebari and Wisniewski (2012) found that Ramadan has negative impact on return volatility. With the exception of the work done by Białkowski, Etebari and Wisniewski (2012), who reported that the liquidity has no significant patterns during Ramadan in Saudi stock market, there are not any studies that have examined the impact of the month of Ramadan on liquidity. However, given the negative relationship between volatility and liquidity, the impact of Ramadan on liquidity is expected to be positive.

The relevant hypotheses to test the presence of these seasonal regularities are:

**H6a:** Liquidity has persistent days-of-the-week effects

**H6b:** Liquidity decreases before a major holiday

**H6c:** Liquidity increases during the month of Ramadan

### 3.3.2 Commonality in Individual Stock Liquidity

The next research hypothesis relates to the well-documented phenomenon of firm level liquidity following the movement of market level liquidity, referred to as commonality in liquidity. The degree of this association, however, varies across markets and over time. Fundamentally, a higher commonality implies that the individual stock is exposed to a higher systemic market liquidity risk (Pástor & Stambaugh 2003; Acharya & Pedersen 2005; Korajczyk & Sadka 2008). Karolyi, Lee and van Dijk (2012) found that commonality is higher in a country with less investor protection and higher capital inflow. As the study suggested, this thesis predicts a significant individual stock commonality in the Indonesia stock market. The following hypothesis is proposed to test this:

**H7:** Individual stock liquidity significantly moves together in response to the market-wide liquidity.

### 3.3.3 Determinants of Individual Stock Liquidity

The following section presents a discussion on the research hypotheses relevant to liquidity at the firm level.

#### 3.3.3.1 Foreign Ownership

Previous research on the impact of foreign investors on market liquidity has produced mixed results. A study on 117 countries found that foreign institutional ownership has a negative impact on liquidity (De la Torre, Gozzi & Schmukler 2007). A similar result was produced by Rhee and Wang (2009), who found a negative relationship between a foreign presence and liquidity in the Indonesian market. However, a study of sixteen emerging markets by Levine and Zervos (1998), showed that when foreigners are allowed to freely trade in the domestic market, the market liquidity will likely increase. Consistent with the experience of the emerging markets, Sun, Tong and Yan (2009) also reported that the liquidity in Shanghai Stock Exchange and the Shenzhen Stock Exchange increased following market liberalisation. Thus it appears that there is no conclusive evidence on the impact of foreign presence on market liquidity. This variable is included in the present study, motivated by the inconclusive findings. The proposed hypothesis, therefore, does not specify a negative or positive change of liquidity. The relevant hypothesis for these relationships is:

**H8:** Foreign investor participations significantly influence liquidity.

#### 3.3.3.2 Market Power

Market power in the product market is an important factor affecting the individual stock liquidity, the prediction being that as the market power grows, the future cash flow improves, the stock price becomes more stable, and the liquidity increases (Peress 2010). Thus, the higher the market power, the better the market liquidity. Consistently, the results of Kale and Loon (2011) demonstrated that stronger market power decreases stock volatility and increases liquidity. The relevant hypothesis for the argument is:

**H9:** Market power has a positive relationship with the individual stock liquidity.

#### 3.3.3.3 Minimum Tick Price

Previous studies have found that a finer minimum tick price will narrow down the bid-ask price spread (Goldstein & A. Kavajecz 2000; Chordia, Roll & Subrahmanyam 2008). Motivated by the tick size construction used by Bessembinder (2000), the present study proposes the following hypothesis:

**H10a:** Change to smaller tick price has a positive impact on liquidity.

#### 3.3.3.4 Margin Eligibility

As Seguin (1990) and Alexander et al. (2004) demonstrated, the trading volume of OTC securities and Nasdaq Small Cap stocks increased following the announcement margin eligibility. Alexander et al. (2004) reported that liquidity of a stock, in terms of spreads and depths, does not significantly change after gaining eligibility for margin trading. There are, however, some principle differences between margin regulations in the US markets and those in the Indonesian market. The margin-trading regime in the US market was set by the Federal Reserve Board in 1934, providing longer history of margin trading activities compared to the Indonesian market that has had that regulation from 1997. Additionally, the US Federal Reserve allows commercial banks to provide loans for purchasing stocks while Bank Indonesia forbids the commercial banks from lending funds for securities trading except for very strict conditions and at a limited amount. This has caused funding sources for margin trading in the Indonesian market to be restricted to stockbrokers. The current study tests for a positive correlation between gaining margin eligibility and individual stock liquidity. The relevant hypothesis for this argument is:

**H10b:** Gaining margin eligibility has a positive impact on individual stock liquidity.

#### 3.3.3.5 Unusual Market Activity

Faten (2008) suggests that asymmetric information can be reduced with high level public disclosures of information such as financial reports, periodical news releases, and meeting other mandatory reporting obligations. In accordance with the proposition, an announcement of unusually high trading activity by IDX might be perceived as an indication of the existence of asymmetric information between the corporate insiders and the market outsiders. This in turn could deter market liquidity. The relevant hypothesis to test this is:

**H10c:** The announcement of unusual market activity will have a negative impact on liquidity.

Table 3.1 presents the summary of the hypotheses discussed above.

Table 3.1 Research Hypotheses

| Variable | Proxy | Expectation |
|---|---|---|
| Determinant factors of market level liquidity | | |
| International factors | S&P 500 volatility | Negative relationship |
| | Nikkei volatility | Negative relationship |
| Financial Crisis | Crisis period | Negative relationship |
| Macroeconomic release factors | GDP data release | Significant pattern |
| | CPI data release | Significant pattern |
| | Unemployment data release | Significant pattern |
| Interest rates | Short-term rates | Negative relationship |
| | Term spread | Negative relationship |
| Market performance factors | Market returns | Positive relationship |
| | Market volatility | Negative relationship |
| Seasonal regularities | Days of the week | Significant pattern |
| | Days around holidays | Significant pattern |
| | Ramadan effect | Significant pattern |
| Commonality in individual stock liquidity | | |
| Market level liquidity | Equally weighted average of six liquidity measures | Significant commonality |
| Determinant factors of individual stock liquidity | | |
| Foreign ownership | Foreign ownership | Significant pattern |
| Market power | Operating income | Positive relationship |
| Regulatory factors | Tick price | Negative relationship |
| | Margin-eligible stocks | Positive relationship |
| | Unusual market activity | Negative relationship |

## 3.4 Empirical Model

Before analysing the ultimate empirical results, a description of overall statistical trends and the characteristics of liquidity and market activity will be presented. This section describes six measures of liquidity and their properties, as well as their measurements transformations required for the estimations.

The main part of the empirical analysis aims to answer three major research questions: 1) what factors determine the variation of aggregate market-wide liquidity, 2) whether the co-movement of the individual stock liquidity exists, and 3) what factors determine the variation of the individual stock liquidity. Accordingly, three steps of empirical models are developed. The first step comprises of empirical analysis of the determinant factors of liquidity variation at the market level. The second step conducts an analysis on the common relationships between individual stock liquidity and market-wide liquidity or the commonality of liquidity. The third step is the identification of the determinants of liquidity at the individual stock level. The sections immediately following discuss the models and the discussion on the estimation techniques.

### 3.4.1 Determinants of Market-wide Liquidity

The proposed research model is motivated by Chordia, Roll and Subrahmanyam (2001) which used the regressions between aggregate market-wide liquidity and a series of potential explanatory variables to analyse the determinant factors of market-wide liquidity. The present study will measure the impact of international factors, macroeconomic events, interest rates, market performance factors and seasonal regularities on market-wide liquidity. Additionally, to address the impact of the 2008 financial crisis, the model will also incorporate dummy variables to represent the periods of during and the period after the Financial Crisis.

Following Rhee and Wang (2009), the logarithmic transformed values of the variables is used to estimate the relationships between the determinant factors and the liquidity variations. The transformation is used in order to improve the properties of the data set in terms of skewness and kurtosis and to dampen the impact of outliers. This transformation also corrects situations of non-constant error variance, and provide a useful interpretation the estimated coefficients as elasticity (Albright et al. 2011).

The first model is as follows:

$$\begin{aligned}\text{LN\_LIQ}_{m,t} = {} & \alpha_{m,t} + \beta_1 \text{Crs} + \beta_2 \text{PostCrs} + \beta_3 \text{Ln\_Vol\_SnP}_{t-1} + \beta_4 \text{Ln\_Vol\_Nikkei} + \beta_5 \text{CPI}_0 \\ & + \beta_6 \text{CPI}_{12} + \beta_7 \text{GDP}_0 + \beta_8 \text{GDP}_{12} + \beta_9 \text{UNP}_0 + \beta_{10} \text{UNP}_{12} + \beta_{11} \text{DLn\_Shortrate} \\ & + \beta_{12} \text{Ln\_Tspread} + \beta_{13} \text{Mkt}_t^+ + \beta_{14} \text{MA5Mkt}_t^+ + \beta_{15} \text{Ln\_MA5}|\text{Mkt}_t| \\ & + \beta_{16} \text{Mon} + \beta_{17} \text{Tue} + \beta_{18} \text{Wed} + \beta_{19} \text{Thu} + \beta_{20} \text{Hol} + \beta_{21} \text{Ramadan} + \varepsilon_{m,t}\end{aligned}$$

Where:

LN_LIQ is the natural logarithm of market-wide daily average liquidity.

Crs is equal to 1 if the trading days are between 1 October 2008 and 31 March 2009 and 0 otherwise.

PostCrs is equal to 1 if the trading days are from 1 April 2009 to 31 December 2011 and 0 otherwise.

Ln_Vol_Nikkei is the natural logarithm of daily volatility of the Nikkei 225 Index.

Ln_Vol_SnP is the the natural logarithmic of daily volatility of the Standard and Poor's 500 Index.

CPI0 is equal to 1 if a trading day falls in the day of the CPI announcements and 0 otherwise.

CPI12 is equal to 1 if a trading day falls in the two trading days prior to the CPI announcements and 0 otherwise.

GDP0, GDP12, UNP0 and UNP12 are defined as for CPI for GDP and unemployment announcements.

DLn_Shortrate is the first difference of natural logarithm of short-term interest rate.

Ln_TSpread is natural logarithmic of the term spread between short-term interest rate and 10 year government bond.

MKT+ is equal to 1 if a trading day has positive daily market return and 0 otherwise.

MA5MKT+ is equal to 1 if a trading day has positive moving average of the 5 day index returns and 0 otherwise.

Ln_MA5|MKT| is the natural logarithm of the past five trading-day average of daily absolute market return.

MON is equal to 1 if a trading day falls on Monday and 0 otherwise.

TUE is equal to 1 if a trading day falls on Tuesday and 0 otherwise.

WED is equal to 1 if a trading day falls on Wednesday and 0 otherwise.

THU is equal to 1 if a trading day falls on Thursday and 0 otherwise.

HOL is equal to 1 if the trading days follow these conditions: 1) if the holiday is on a Friday, then the preceding Thursday, 2) if the holiday is on a Monday, then the following Tuesday, 3) if the holiday is on another weekday, then the preceding and following days, and 0 otherwise.

Ramadan is equal to 1 if a trading day falls on the months of Ramadan and 0 otherwise.

$\alpha$ is the intercept, $\beta_i$ are the regression coefficient, and, $\varepsilon$ refers to unobserved random error component.

### 3.4.2 Commonality in Individual Stock Liquidity

Based on the theoretical framework and hypothesis developments discussed earlier, the present study will follow Chordia, Roll and Subrahmanyam (2000) to examine the commonality of individual stock liquidity. The main function to determine the presence of, and if so to measure the degree of, commonality is:

$$DL_{i,t} = \alpha_i + \beta_i DL_{M,t} + \varepsilon_{i,t}$$

Where, $DL_{i,t}$ is the daily percentage change of liquidity in stock *i* at time *t;* $DL_{m,t}$ is the daily percentage change in the market-wide liquidity at time *t;* $\alpha_i$ and $\beta_i$ are estimated coefficients, where $\beta_i$ is a measure of the degree of co-movement between the individual liquidity and aggregate market-wide liquidity; and $\varepsilon_{i,t}$ is random error. The equations are estimated following appropriate transformations needed to make the data stationary (Chordia, Roll & Subrahmanyam 2000).

The equation includes as determinant variables the concurrent, lead and lag of the liquidity changes ($DL_{M,t}$; $DL_{M,t+1}$; $DL_{M,t-1}$), the market returns ($R_M$; $R_{M,t+1}$; $R_{M,t-1}$), and volatility of the individual stock ($D(R_{i,t}^2)$). The inclusion of lead and lag terms is to address the liquidity adjustment in the commonality function. In addition, market returns and volatility are included to serve as control variables in order to isolate the effect of market level liquidity on the stock level liquidity. Market return could have particular relevance for spread measures since market return and spread are the functions of transaction price, while volatility is a common factor that possibly influences liquidity (Chordia, Roll & Subrahmanyam 2000). The inclusion of these variables follows previous work by researchers such as Chordia, Roll and Subrahmanyam (2000) and Huberman and Halka (2001) in the USA, Brockman and Chung

(2002) in Hong Kong, Galariotis and Giouvris (2007) in England, Kempf and Mayston (2008) in Germany and Pukthuanthong-Le and Visaltanachoti (2009) in Thailand.

After including all relevant variables above, the commonality is modelled as follows:

$$DL_{i,t} = \alpha_i + \beta_1 DL_{M,t} + \beta_2 DL_{M,t+1} + \beta_3 DL_{M,t-1} + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 D(R_{i,t}^2) + \varepsilon_{i,t}$$

Where, $DL_{i,t}$ is the daily liquidity of individual stock *i* at time t, $DL_{M,t}$ is the daily market level liquidity at time t, $R_{M,t}$ is market returns, and $D(R_{i,t}^2)$ is market volatility.

For the model on commonality in liquidity across the different industry sectors, this study includes sector level liquidity in the equations, a similar approach used in the previous studies such as Chordia, Roll and Subrahmanyam (2000), Galariotis and Giouvris (2007) and Narayan, Zhang and Zheng (2010). Thus, the commonality by industry sector is estimated with the following model:

$$DL_{i,t} = \alpha_i + \beta_1 DL_{M,t} + \beta_2 DL_{M,t+1} + \beta_3 DL_{M,t-1} + \beta_4 DL_{I,t} + \beta_5 DL_{I,t+1} + \beta_6 DL_{I,t-1} + \beta_7 R_{M,t} + \beta_8 R_{M,t+1} + \beta_9 R_{M,t-1} + \beta_{10} D(R_{i,t}^2) + \varepsilon_{i,t}$$

Where, $DL_{M,t}, DL_{M,t+1}$ and $DL_{M,t-1}$ refer to the concurrent, lead and lag of the liquidity changes at market level. $DL_{I,t}, DL_{I,t+1}$, and $DL_{I,t-1}$ are the concurrent, lead and lag of the liquidity changes at industry level. $R_{M,t}, R_{M,t+1}$ and $R_{M,t-1}$ are the concurrent, lead and lag of the market returns, and, $D(R_{i,t}^2)$ refers to the volatility of stock *i*.

### 3.4.3 Determinants of Individual Stock Liquidity

The third analysis involves three models that are designed to capture the effect of the three explanatory variables individually: foreign presence, market power and regulatory factors. They are as follows:

1) The following model tests the impact of foreign presence on the daily changes of individual liquidity:

$$DL_{i,t} = \alpha_i + \beta_1 DForeign_{i,t} + \beta_2 Crs_t + \beta_3 PostCrs_t + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 D(R_{i,t}^2) + \varepsilon_{i,t}$$

Where DL refers to the daily changes (delta) of liquidity measures. DForeign is the daily changes of the percentage of foreign ownership. $R_{M,t}$ is market returns, and $D(R_{i,t}^2)$ is market volatility. Crs and PostCrs are as defined earlier, and $\varepsilon_{i,t}$ is a random disturbance.

2) To test the impact of market power factors on the daily changes of individual liquidity, a regression model is developed as follows:

$$LIQ_{i,t} = \alpha_i + \beta_1 MP_{i,t-1} + \beta_2 R_{M,t} + \beta_3 R_{i,t}^2 + \varepsilon_{i,t}$$

Where, LIQ denotes the quarterly average of liquidity measures. MP refers to market power. $R_{M,t}$ is the quarterly market return at time t. $R_{i,t}^2$ is the firm squared return to represent volatility of stock *i* at time t.

3) To test the impact of the regulatory factors (that is, tick size changes, inclusion and exclusion on the margin eligible list and the unusual market activity) on the individual stock liquidity, two statistical tests will be employed to examine the significant difference between pre- and post-regulatory events: a paired t-test and a Wilcoxon signed-rank test.

### 3.4.4 ARCH Model

The most widely used regression model in earlier studies of market liquidity is the ordinary least squares (OLS) estimator. For instance, Chordia, Roll and Subrahmanyam (2000) used OLS to analyse the co-movement of the individual stock liquidity by regressing the individual stock liquidity to market-wide liquidity and the control variables. Chordia, Roll and Subrahmanyam (2001) applied OLS on a time series regression to estimate the autocorrelations of both non-scaled and scaled liquidity and trading activity measures. Poon, Rockinger and Stathopoulos (2011) ran an OLS regression between daily market liquidity and level of the institutional holdings.

An OLS regression assumes the existence of a constant variance or homoscedastic error terms. If the series does not have the property of constant variance over time, the OLS regression may result in inefficient estimates. Tests were carried out for the assumptions of the OLS model and corrective procedures were taken to remedy the impacts of violations of the assumptions. Engle (1982) proposed a model that allows the variance to vary systematically over time. Here the assumption is that the conditional variance depends upon the past squared residuals, which is known as autoregressive conditional heteroskedastic models (ARCH). Bollerslev (1986) suggests the ARCH model to also include the lag values

of error terms which are known as generalised ARCH (GARCH) model, a model that is widely used particularly in financial time series analysis (Bollerslev, Engle & Nelson 1994). Therefore, to ensure that the heteroskedasticity in the errors is handled properly, this study primarily uses ARCH and GARCH models in the analysis.

Time series data is normally trended, by which its variance and mean change systematically from time to time. This attribute of data is known as non-stationary. A regression between two non-stationary variables often generates statistically significant results despites its meaningless associations. This study takes the natural logarithmic form of the variables since in the logarithmic form the variables are most likely stationary. To ensure the stationarity of the variables, the augmented Dickey-Fuller (ADF) unit root test is employed prior to running the regressions, which is as given below:

$$\Delta Y_t = \alpha + \lambda_t + \gamma Y_{t-1} + \sum_{s=1}^{m} a_s \Delta Y_{t-s} + v_t$$

where $Y_t$ is the variable under investigation, $\alpha$ is constant term, $\lambda_t$ is time trend, $\Delta Y_{t-1} = Y_{t-1} - Y_{t-2}, \Delta Y_{t-s} = Y_{t-s} - Y_{t-s-1}$, and $v_t$ is residuals. The inclusion of *s* lagged first differences of the dependent variables can be used to eliminate autocorrelation of the residuals.

The ADF method tests the null hypothesis that the coefficient of first lag variable ($\gamma$) is equal to zero, and if the test rejects the null ($\gamma = 0$) the time series variable does not have a unit root, meaning it is stationary. There are three variations of an ADF test equation: 1) no constant term and no time trend, 2) with constant term but no time trend or 3) with constant term and with time trend. To select which one of the three is the most appropriate model for a particular data, Hill, Griffiths and Lim (2011) suggests observing the visual appearance of the series plot. If the series is concentrated around zero sample average, the suitable equation is the one without constant term and trend. For a series that fluctuates around non-zero sample average, use the test equation with constant and without trend. The equation containing time trend and constant term is suitable for series that fluctuates around a linear trend.

A more comprehensive method of unit root test has been developed by Phillips and Perron (1988). The model incorporates additional elements of automatic correction that allows for autocorrelated residuals. The PP test uses the standard Dickey Fuller method and modifies the

t-ratio of the α coefficient, and as a result, the serial correlation does not affect the asymptotic distribution of the test statistic. In general, the results of ADF and PP tests are similar.

There are instances where the residuals from regressions involving two non-stationary variables may be stationary. In this case, the relationships between the variables are said to be cointegrated. Cointegration suggests that the variables share similar stochastic trends implying long-run equilibrium. Tests can be performed to check if the residuals of regressions between two non-stationary variables are stationary (Hill, Griffiths & Lim, 2011). This test is necessary only if the variables are non-stationary.

The residuals generated from the ARCH and GARCH estimations may be auto correlated. Ignoring this residual autocorrelation effects can reduce the efficiency of the estimates. To test the residual whether they are auto correlated, this study uses the Lagrange multiplier (LM) test. The LM statistic is computed from a regression of the squared residuals on constant and lagged squared residuals. The null hypothesis is that there is no serial correlation or no ARCH effect in the residuals. Therefore, if the p-value is statistically significant, reject the null hypothesis that there is no serial correlation or ARCH effect in the residuals.

## 3.5 Operationalisation of the Key Variables

This section provides the descriptions of the key variables used in the models. It is a step that is referred as the operationalisation of the concepts by Sekaran and Bougie (2009) and Veal and Ticehurst (2005). Operationalisation is the process by which the research articulates methods to measure the concepts. The following sections justify the selection of the variables, the choice of proxies, where direct observation is not available, and their measurements.

### 3.5.1 Dependent Variables

It should be emphasised here that market liquidity is a multi-dimensional concept, and therefore relying on a single method in measuring liquidity may result in biased estimation. Following the suggestion in the literature, this thesis uses three groups of measures each comprising two variables. The three groups represent market depth, transaction cost and trading activity. The following sections provide the details.

#### 3.5.1.1 Market Depth Measures

Market depth indicates the sizes of buying and selling orders available in the order book. A deeper market means that a higher number of buyers or sellers willing to trade at their respective bid and ask price. The thesis will select two depth measures as follows:

1. Quantity depth (QDEP) is included to measure the number of stocks available and are ready to be traded at the best bid and ask positions.

$$\mathrm{QDEP}_{i,t} = (\mathrm{Q}_{\mathrm{A}_{i,t}} + \mathrm{Q}_{\mathrm{B}_{i,t}})/2$$

   Where $\mathrm{Q}_{\mathrm{A}_{i,t}}$,$\mathrm{Q}_{\mathrm{B}_{i,t}}$are the quantity of ask and bid at the best ask and bid prices of stock *i* at time *t*, respectively.

2. Dollar depth (VDEP) is the monetary value of the quantity depth.

$$\mathrm{VDEP}_{i,t} = (\mathrm{P}_{\mathrm{A}_{i,t}}\mathrm{Q}_{\mathrm{A}_{i,t}} + \mathrm{P}_{\mathrm{B}_{i,t}}\mathrm{Q}_{\mathrm{B}_{i,t}})/2$$

   Where, $\mathrm{P}_{\mathrm{A}_{i,t}}$and $\mathrm{P}_{\mathrm{B}_{i,t}}$ are the best ask and bid prices, respectively; and the other variables are as defined earlier.

Based on the depth measures at the individual stock level above, the daily value of the market level liquidity is computed as an average of liquidity series as follows:

$$\mathrm{QDEP}_{m,t} = \frac{1}{\mathrm{N}}\sum_{i}^{j}\mathrm{QDEP}_{i,t}$$

$$\mathrm{VDEP}_{m,t} = \frac{1}{\mathrm{N}}\sum_{i}^{j}\mathrm{VDEP}_{i,t}$$

Where N is the number of stocks included in day t.

#### 3.5.1.2 Trading Cost Measures

The most widely used proxy for market liquidity in the previous studies is the spread between the best bid price and best ask price. The bid-ask spread can be regarded as the dimension of costs of transaction, the costs of holding inventories and risks of adverse selections. Under this view, the spreads serve as an inverse proxy for stock liquidity. A higher spread indicates

higher transaction costs and risks; and therefore, refers to lower liquidity. Recent studies that have used these measures include Rhee and Wang (2009), Poon, Rockinger and Stathopoulos (2011), Næs, Skjeltorp and Ødegaard (2011), Cumming, Johan and Li (2011) and Jiang, Kim and Zhou (2011). The thesis will estimate the spread using two spread measures as follows:

1. Quoted spread (QSPR)

   The QSPR is the nominal difference between best ask price and best bid price.

$$\mathrm{QSPR}_{i,t} = \mathrm{P}_{A_{i,t}} - \mathrm{P}_{B_{i,t}}$$

   The variables are as defined earlier.

2. Proportional quoted spread (PQSPR)

   The PQSPR is the proportion of the bid-ask spread to the mid point of the bid and ask prices, given by:

$$\mathrm{PQSPR}_{i,t} = (\mathrm{P}_{A_{i,t}} - \mathrm{P}_{B_{i,t}}) / \left(\frac{\mathrm{P}_{A_{i,t}} + \mathrm{P}_{B_{i,t}}}{2}\right)$$

   The variables are as defined earlier. Dividing the spread by the mid price makes this relative ratio a better measurement of spread, as stocks with different prices can be compared.

To construct a market-wide liquidity series, the average of individual stocks' quoted spreads and proportional quoted spreads is computed each day. The market level liquidity series are computed as follows:

$$\mathrm{QSPR}_{m,t} = \frac{1}{N}\sum_{i}^{j} \mathrm{QSPR}_{i,t}$$

$$\mathrm{PQSPR}_{m,t} = \frac{1}{N}\sum_{i}^{j} \mathrm{PQSPR}_{i,t}$$

Where the variables are as defined earlier.

Previous studies have estimated market depth and bid-ask spread from either high frequency or low frequency data. High frequency data refers to tick by tick data that is normally generated from an intraday intervals, such as thirty seconds (Brockman & Chung 2006), one minute (Alzahrani 2011) or thirty minutes (Aitken & Comerton-Forde 2003). In contrast, low frequency data denotes the end of the day closing prices (Galariotis & Giouvris 2007) or monthly observations (Korajczyk & Sadka 2008). Although many previous studies have used the intraday data, Lesmond (2005) found that the liquidity measures using low frequency data are highly correlated with a number of liquidity measures using high frequency intraday data. Following this, the present research will use the closing prices and quantities of best bid and best ask orders at the end of days to estimate the daily spread and depth.

#### 3.5.1.3 Trading Activity Measures

A liquid market allows participants to rapidly trade large volume of transactions with low price impact, which supports the use of trading volume as a reliable proxy for market liquidity. This study defines this indicator as the quantity of shares traded during a trading day. In addition, the trading value indicates the number of shares traded during the day multiplied by the stock price. Trading activity measures have been used in previous studies, including those of Chordia, Roll and Subrahmanyam (2000), Chordia, Roll and Subrahmanyam (2001), Aitken and Comerton-Forde (2003) and Yeyati, Schmukler and Van Horen (2008).

The aggregate market liquidity series is computed as the equal weighted average of individual stocks' trading volume and trading value. The market-wide series of trading volume and trading value are constructed as follows:

$$\mathrm{TVOL}_{\mathrm{m,t}} = \frac{1}{\mathrm{N}} \sum_{\mathrm{i}}^{\mathrm{j}} \mathrm{TVOL}_{\mathrm{i,t}}$$

$$\mathrm{TVAL}_{\mathrm{m,t}} = \frac{1}{\mathrm{N}} \sum_{\mathrm{i}}^{\mathrm{j}} \mathrm{TVAL}_{\mathrm{i,t}}$$

Where, $\mathrm{TVOL}_{\mathrm{i,t}}$ is the trading volume for stock *i*, $\mathrm{TVAL}_{\mathrm{i,t}}$ is the trading value for stock *i*, and N is the number of stocks included in the day *t*.

### 3.5.2 Determinants of Market-wide Liquidity

The identified determinant factors of market level liquidity are classified into four categories, namely international market factors, macroeconomic factors, market performance factors and seasonal regularities.

#### 3.5.2.1 International Market Factors

To determine the impact of foreign markets on the liquidity of the domestic market, the Nikkei index and S&P 500 index. These two indices were included as the regressors based on two reasons. First, prior studies have shown that the US and Japanese markets have a strong impact on the Indonesian market (Ghosh, Saidi & Johnson 1999; Ibrahim 2005; Majid & Kassim 2009). Second, the US stock market is regarded as a global benchmark for international markets. Trends of markets such the US market cannot be ignored by other markets in the world because of its significance (Ghosh, Saidi & Johnson 1999). As the trading in the NYSE closes at 4.00am Jakarta time, the volatility of the NYSE market refers to that of the preceding day (lag 1). In contrast, the same day volatility is used for Tokyo Stock Exchange as it closes at 1.00pm Jakarta time. To measure return volatility, this study follows Chordia, Roll and Subrahmanyam (2001) and uses a moving average of five day absolute market return.

#### 3.5.2.2 Macroeconomic Factors

In order to capture the potential impact of the 2008 Global Financial Crisis on liquidity variation, this study will include dummy variables to represent the relevant periods: during the Crisis (Crs) and after the Crisis (PostCrs). However, determining a crisis period is to some extent arbitrary. This study determines the crisis period from 1 October 2008 to 31 March 2009, as this period was marked by significant falls in the composite market index and followed by its recovery. Two dummy variables are used in the model, as follows:

1. Crs is equal to 1 if the observations are from 1 October 2008 to 31 March 2009 and 0 otherwise;
2. PostCrs is equal to 1 if the observations are from 1 April 2009 to 31 December 2011 and 0 otherwise.

In order to isolate the impact of the announcement of macroeconomic indicators, the present study follows Chordia, Roll and Subrahmanyam (2001) and uses two dummy variables. The

first dummy corresponds to one to two days prior to the macroeconomic information released and the second dummy represents the day the macroeconomic information released. Overall, the three macroeconomic events have six dummy variables in total. The dummy variables are as follows:

1. CPI0 is equal to 1 if a trading day falls on the day of an announcement of CPI and 0 otherwise;
2. CPI12 is equal to 1 if a trading day falls within two trading days prior to an announcement of CPI, and 0 otherwise;
3. GDP0 is equal to 1 if a trading day falls on the day of an announcement of GDP, and 0 otherwise;
4. GDP12 is equal to 1 if a trading day falls within two trading days prior to an announcement of GDP, and 0 otherwise;
5. UNP0 is equal to 1 if a trading day falls on the day of an announcement of unemployment rate, and 0 otherwise;
6. UNP12 is equal to 1 if a trading day falls within two trading days prior to an announcement of unemployment rate, and 0 otherwise.

The interest rate variables in this study also refers to the work by Chordia, Roll and Subrahmanyam (2001), which includes short-term interest rates and term spreads. The term spreads are computed as the difference between the daily yield of ten-year local currency government bond and the two-year government bond. The interest rate variables are as follows:

1. Shortrate is the short-term interest rate;
2. Tspread is the term spread between the short-term interest rate and 10 year government bonds.

#### 3.5.2.3 Market Performance Factors

Motivated by previous studies, including Chordia, Roll and Subrahmanyam (2001) and Pukthuanthong-Le and Visaltanachoti (2009), this study uses MKT+ as a dummy variable which refers to 1 for days when the market return is positive, or 0 otherwise. The operationalisation of the variable is designed differently to that of previous studies, given that the regressions in this study are estimated with logarithmic transformation of the variables. The use of dummy variables will avoid the problems associated with logarithmic

transformation on non-positive values. Likewise, MA5MKT+ is obtained when the recent five-day market return is positive.

The following dummy variables are determined by the signs of the daily market return on the respective days.

1. MKT+ is 1 if the daily market return at the time t is positive and 0 otherwise;
2. MA5MKT+ is 1 if the recent five day market return is positive and 0 otherwise.

Additionally, MA5|MKT| is the moving average of five-day absolute market return that represents volatility.

#### 3.5.2.4 Seasonal Regularities

The seasonal regularities of time series liquidity are examined in this paper to serve two purposes. First, the financial time series data follow not only the fundamental development of the variables of interest, but also trend cycle attributable to seasonal influences. As such, seasonal factors should be included in the model in order to control the trend variations. Second, the regularities have been identified as a type of market anomaly. The anomaly is crucial, as its existence might be associated with a particular episode or events. This study tests the regularities during the days of the week, days prior to the holidays and days in the period of a cultural festival.

A set of four dummy variables is constructed to capture the day-of-the-week effect on the regularities of liquidity, as given below:

1. Mon is equal to 1 if a trading day is on Mondays and 0 otherwise;
2. Tue is equal to 1 if a trading day is on Tuesdays and 0 otherwise;
3. Wed is equal to 1 if a trading day is on Wednesdays and 0 otherwise;
4. Thu is equal to 1 if a trading day is on Thursdays and 0 otherwise.

Days around holidays are represented by dummy variables based on the approach of Chordia, Roll and Subrahmanyam (2001), as follows:

Hol is equal to 1 if a trading day follows these conditions: 1) if the holiday falls on a Friday, then the preceding Thursday, 2) if the holiday falls on a Monday, then the

following Tuesday, 3) if the holiday is on another weekday, then the preceding and following days, and 0 otherwise.

Previous studies such as Al-Hajieh, Redhead and Rodgers (2011) and Białkowski, Etebari and Wisniewski (2012) have analysed the impact of the month of Ramadan with the use of dummy variables. The present study follows the previous research and includes a dummy variable which assumes a value of 1 if the trading day falls in the month of Ramadan and 0 otherwise.

### 3.5.3 Commonality in Individual Stock Liquidity

The commonality is estimated from the regressions between liquidity at stock level as dependent variables and liquidity at market level as independent variables. To estimate the aggregate liquidity at the market level, previous research, including Chordia, Roll and Subrahmanyam (2000), has excluded the stock under examination. The objective here is to minimise the impact of misleading constraint in the average coefficient of the time series regression (Chordia, Roll & Subrahmanyam 2000). This will produce slightly different market liquidity values for each individual stock. This thesis will apply the same procedure to generate market level liquidity and return in the regression under the commonality model.

### 3.5.4 Determinants of Individual Stock Liquidity

There are some individual characteristics which have been found to affect liquidity. They are foreign ownerships of stocks, market power and regulatory factors.

#### 3.5.4.1 Foreign Ownership

A number of studies have investigated the influence of the presence of foreign investors on market liquidity including Karolyi, Lee and van Dijk (2012); Rhee and Wang (2009); and Choe and Yang (2010). This finding is the motivation for including this variable as one of the determinants of market liquidity in the present study. Previous studies, notably Rhee and Wang (2009), used monthly observations. This thesis uses daily data from KSEI for the period from 2005 to 2011 to estimate foreign presence using the percentage size of foreign ownership relative to the total outstanding shares.

#### 3.5.4.2 Market Power

The current study uses the quarterly data of operating profit margin as a proxy for market power. This follows Kale and Loon (2011) which measured price-cost margin using the ratio of operating income to sales, or operating profit margin. The data is obtained from Bloomberg as the ratio between IS_OPER_INC and SALES_REV_TURN. The first variable is the operating income, while the latter is the total of operating revenues less various adjustments to gross sale.

#### 3.5.4.3 Regulatory Factors

The role of structural and regulatory factors in moderating market liquidity was discussed earlier. At the empirical level the main problem with these variables is to isolate the effect of the individual variables. One approach to overcome this problem was suggested by Bessembinder (2000), who compared the changes in liquidity variables before and after stock price changes from one category of tick size to another tick size. Motivated by this approach, the current study estimates the liquidity changes associated with the regulatory events: tick size changes, inclusion on margin-eligibility list and unusual market activity. This empirical analysis will employ two statistical tests to examine whether or not the post-event liquidity levels are significant compared to the pre-event liquidity for each of the regulatory event. Firstly, a paired-sample parametric t-test will be used to check if the differences between the mean liquidity before and after the regulatory events are statistically significant. Secondly, a Wilcoxon signed-rank test will be used to test the significant differences on the median liquidity. Although similar to t-test, this non-parametric test does not require the assumption of normal distribution. This test is therefore more appropriate for the liquidity variable considering that the distribution of liquidity data is right-skewed.

For tick size analysis, following Bessembinder (2000), the tick size event occurs when the closing prices pass through to a higher or a lower tick size level. For example, a minimum tick size of Rp5 is required for stocks whose prices range between Rp200 and Rp500 and tick size of Rp10 is applicable for those whose prices range between Rp500 and Rp2,000. The day when the closing prices increase from Rp495 to Rp510 is determined as a tick size increasing event for the corresponding stocks. In contrast, a tick size decreasing event is defined when the closing prices decrease from Rp510 to Rp495.

For margin eligibility analysis, motivated by Alexander et al. (2004), the present study defines an event triggering the inclusion on margin eligibility list as the first day when the stocks become margin eligible according to the IDX monthly lists. Likewise, an event of the exclusion from margin eligibility list occurs when the stocks are deleted from the lists.

For unusual market activity analysis, the UMA event is defined as the date when IDX publishes information about stocks which, according to their assessment, might have unusual trading activity or unusual price movements. IDX expects investors to be more aware of the unusual trading behaviour in order to closely monitor information related to the firms and to anticipate any further possibilities before making investment decision.

Table 3.2 summarises the determinant variables of the market level and individual level liquidity discussed earlier.

Table 3.2 Independent Variables of Liquidity at the Market and Individual Stock Level

| Variable | Operationalisation |
|---|---|
| Vol_Nikkei | Daily volatility of the Nikkei 225 Index |
| Vol_SnP | Daily volatility of the Standard and Poors 500 Index |
| $GDP_0$ | 1 if a trading day is on the day of announcement of Gross Domestic Product and 0 otherwise |
| $GDP_{12}$ | 1 if a trading day is on the one to two trading days prior to the announcement of Gross Domestic Product and 0 otherwise |
| $UNP_0$, $UNP_{12}$, $CPI_0$, $CPI_{12}$ | Defined as for GDP for unemployment rate and consumer price index |
| Shortrate | Short-term interest rate |
| TSpread | The term spread between ten year government bonds and short-term interest rates |
| MKT+ | 1 if a trading day has positive daily market return and 0 otherwise |
| MA5MKT+ | 1 if a trading day has positive moving average of the 5 day index returns and 0 otherwise |
| MA5\|MKT\| | The moving average of the 5 days absolute return (proxy of market volatility) |
| Mon | 1 if a trading day is on Monday, and 0 otherwise |
| Tue | 1 if a trading day is on Tuesday, and 0 otherwise |
| Wed | 1 if a trading day is on Wednesday, and 0 otherwise |
| Thu | 1 if a trading day is on Thursday, and 0 otherwise |
| Hol | 1 if the trading days satisfy this following conditions: if the holiday is on Friday, then preceding Thursday; or if the holiday is on Monday, then the following Thursday; or if the holiday is on another weekday, then the preceding and following days; and 0 otherwise |
| Ramadan | 1 if a trading day is during the month of Ramadan |
| Foreign | The percentage size of foreign ownership relative to the total outstanding shares |
| MP | Quarterly operating margin of firm *i* (proxy of market power) |

## 3.6 Data Analysis

This section provides a detail description of the data used in this thesis and its sources. What follows is a description of data related issues such as sample selection and data properties. This is followed by a description of the methods of estimation and analysis.

### 3.6.1 Overview of the Data

The estimation procedures employed in this thesis primarily use end of day trading data provided by the research division of the IDX. For the type of analysis performed in the thesis, the closing prices are very important compared to the other transaction prices during a trading day. Closing prices are used as they are convenient and assumed to be a fair value for a specific trading day (Harris 1989).

The data from IDX contains information that is accessible to investors; hence it is used to inform their decisions. The specification of this data is similar to the one that investors are able to observe from the brokers or trading data providers such as Reuters or Bloomberg. The trading data captured from a stock broker trading screen includes information about trading activity of a stock on a given day, consisting of data such as previous price, highest price, lowest price, opening price, closing price, trading volume, trading value, trading frequency, best bid price, bid volume, best offering price and offering volume. In addition, other data was collected from IDX and KSEI, including the number of scriptless shares and listed shares.

The dataset containing daily share ownership of each individual stock is provided by the Indonesian central securities depository (KSEI). Bond market activity report is provided by Indonesian bond-pricing agency (IBPA). The current study also uses relevant data from various sources, including: Statistics Indonesia (macroeconomic data announcements), IDX (schedule of exchange holidays, lists of margin eligible stocks and lists of unusual market activity), Bank Indonesia (interest rates), Asian Development Bank (bond yields) World Bank Database (macroeconomic data, including GDP and unemployment rate), Datastream (international market index) and Bloomberg (operating profit margin). For the purpose of this thesis, the Ramadan period is assumed to start from every thirty days before the first Eid holidays, as indicated in the schedule of the exchange holidays. Finally, to minimise the impact of trading unit bias on the liquidity measures, this study use the information about merger, reverse stock, stock bonus, stock dividend, stock split, and right issues from the KSEI.

In order to improve the reliability of the results, it is necessary to select observations that satisfy three conditions, as suggested by Chordia, Roll and Subrahmanyam (2000). These conditions are:

1. It has to be listed on the IDX in each given year during the sample period from 3 January 2005 to 31 December 2011, which covers 1,704 trading days.
2. Each selected stock must have been traded at least once a month during a given year.
3. The selected stock must have at minimum changes of outstanding shares; thus firms engaged in corporate actions namely: merger, reverse stock, stock bonus, stock dividend and stock split were excluded during the year the corporate actions occurred.

Table 3.3 displays the main variables of the trading data to estimate six liquidity measures and returns along with their descriptions.

Table 3.3 Daily Trading Data Description

| Variable | Type | Description |
|---|---|---|
| Trade Date | Date | Trading dates |
| Sec Code | Text | Stock initials |
| Open | Numeric | Open price of the stock |
| High | Numeric | Highest price of the stock |
| Low | Numeric | Lowest price of the stock |
| Close | Numeric | Close price of the stock |
| Day's Volume | Numeric | Trading quantity of the stock |
| Day's Value | Numeric | Trading volume of the stock |
| Num Trades | Numeric | Trading frequency of the stock |
| Close Offer | Numeric | The lowest ask price |
| Close Offer Depth | Numeric | Offer volume at the lowest ask price |
| Close Bid | Numeric | The highest bid price |
| Close Bid Depth | Numeric | Bid volume at the highest bid price |
| Listed Qty | Numeric | Number of shares outstanding |

### 3.6.2 Period of Study

The sample observation covers a seven-year period from 1 January 2005 to 31 December 2011, which included two aberrant periods. First is the Global Financial Crisis of 2008 which resulted in dynamic market fluctuations and a fall of about 40% in the market index. In order

to properly account for this aberration, dummy variables were included in the estimation model. One dummy variable was included to represent the period of the crisis and another to represent the post-crisis period that will enable the model to isolate the impact of the crisis. Specifically, the period of crisis covers the fourth quarter of 2008, which was characterized by increasing liquidity pressure (Santoso et al. 2010). Second is a period of major infrastructure changes during the merger of Jakarta Stock Exchange and Surabaya Stock Exchange to form the Indonesia Stock Exchange in 2007, including an upgrade of the automated trading system from JATS to JATS-NextG in 2009.

## 3.7 Summary

This chapter guides the research with development of the research framework, hypotheses and the methods of analyses. The developed framework provides justification of the theoretical link between liquidity at the firm level and at the market level and their determinant factors enabling the analyses of the impact of variations. This is followed by the development of a set of hypotheses to aid with achieving the objectives of the research and consequently the research question. The hypotheses are classified into three groups, namely: the determinant factors of market-wide liquidity, the commonality in individual stock liquidity and the determinant factors of individual stock liquidity. The chapter then provided a detailed exposition of the variables and the factors, their measurements and the data sources. The following two chapters present the results of the research: market level analysis in Chapter Four and the firm level analysis in Chapter Five.

# Chapter 4
# Determinants of Market-wide Liquidity

## 4.1 Introduction

The previous chapter detailed the theoretical framework and the research methods, along with the justification of the research hypotheses. This chapter reports on the empirical outcomes of the analysis to answer the research questions about the potential determinants of market-wide liquidity. It initially presents the summary statistics of the data set used in the estimation of the models in order to provide an understanding of the time-series and cross-sectional properties of the data set. This is followed by the presentation of the model estimates and the testing of the relevant hypotheses.

## 4.2 Sample Characteristics

The selection of sample observations follows Chordia, Roll and Subrahmanyam (2001), taking into considerations the trading mechanisms in the Indonesian stock market and its characteristics, as set out in Section 3.6.1. However, unlike the study done by Chordia, Roll and Subrahmanyam (2001), this study included stocks with right issues considering the high number of firms engaged in right issues during the period of the study, as shown in Table 4.1.

Table 4.1 Types of Corporate Actions 2005-2011

| Corporate Action | Number of events | Number of firms |
|---|---|---|
| Merger | 13 | 12 |
| Stock Split | 76 | 71 |
| Reverse Split | 20 | 19 |
| Stock Bonus | 11 | 10 |
| Stock Dividend | 44 | 34 |
| Right Issue | 173 | 152 |

Source: KSEI Data, 2012

A total of 336 companies were listed in the IDX on 2 January 2005, increasing to 440 by 31 December 2011. Following the application of the selection criteria, outlined in the previous

chapter, the sample reduced to 347 stocks with 299,620 stock-day observations. The sample selection criteria produced a sample with a relatively constant number of stocks per day within each calendar year. Figure 4.1 illustrates the trend of the number of selected stocks per day over the sample period from 2 January 2005 to 31 December 2011. This sample represents 89% of the total value of transactions and 85% of the total volume of shares traded. This provides excellent representation of the population. For each stock, the liquidity measures were estimated from the daily trading data that involves stock prices (high, low and close), the best bid prices and the best ask prices as well as the quantity offered at the best bid prices and at the best ask prices at the end of the day.

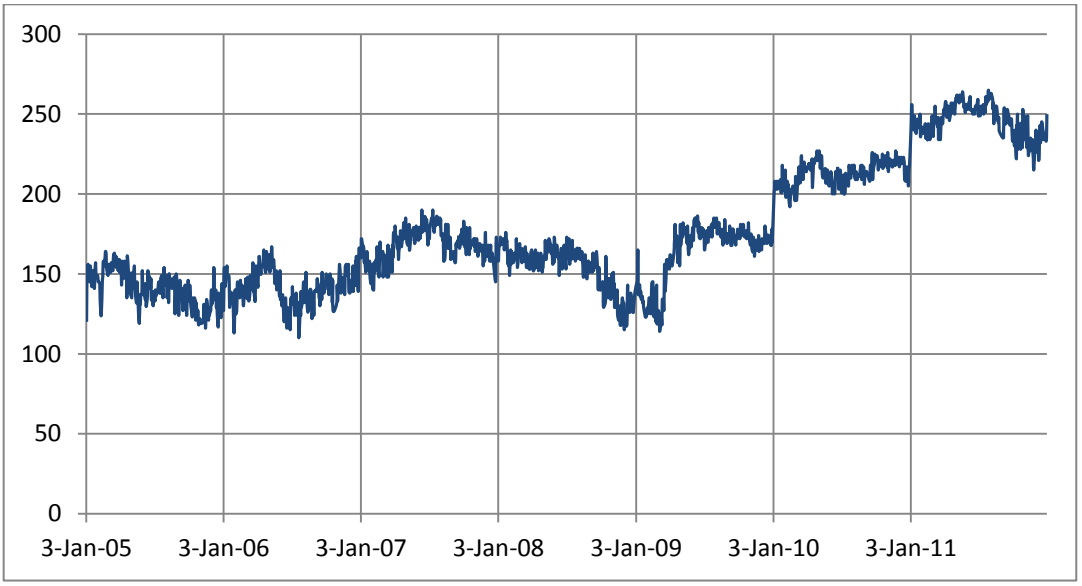



Figure 4.1 Number of Stocks in the Daily Sample

Table 4.2 provides descriptive statistics of the sample observations. Overall, the selected stocks are traded an average of 309 times a day, with a minimum of 1, maximum of 56,658 and a median of 53 times per day. The mean, minimum, maximum and median of trading days for each selected individual stocks are 863, 34, 1704 and 861 days respectively, whereas the mean, minimum, maximum and median of the number of stocks per day are 176, 110, 265 and 166 stocks respectively. These figures corroborate the findings of Rhee and Wang (2009) who found that the percentage of stocks not traded on an average trading day in IDX between 2002 and 2007 is relatively high, ranging between 34.7% and 41.9%.

Table 4.2 Descriptive Statistics of Sample Observations

| | Sum | Mean | Median | Minimum | Maximum | Std.Dev |
|---|---|---|---|---|---|---|
| Trading frequency (trades) | 92,613,961 | 309 | 53 | 1 | 56,658 | 867 |
| Trading day | 1,704 | 863 | 861 | 34 | 1,704 | 529 |
| Number of stocks per day | 347 | 176 | 166 | 110 | 265 | 39 |

Notes: These statistics are calculated from the selected sample observations from 2005 to 2011.

## 4.3 Empirical Attributes of Market-wide Liquidity

This section aims to describe time series trends and cross sectional patterns of market-wide liquidity. This is expected to answer the first research questions in respect to the liquidity behaviour over time and across different groups of stocks. For the purpose of the time series analysis, yearly liquidity measures were constructed by first calculating the daily cross sectional average of the individual stock liquidity and then, calculating the annual average of cross sectional market liquidity within the corresponding year. This provides six series of annual market level liquidity measures from 2005 to 2011. In addition, to evaluate cross sectional properties of market liquidity, the time series stock liquidity is classified into five groups based on the firm's size (market capitalisation) at the end of the preceding year. This classification gives five cross sectional clusters of market liquidity, from small to large firms.

Following the classification of liquidity measures presented in Chapter Three, the attributes of market-wide liquidity are divided into three groups: market depth, trading costs and trading activity. Market liquidity increases with market depth (that is, value depth (VDEP) and quantity depth (QDEP)) and decreases with trading costs (that is, proportional quoted spread (PQSPR) and quoted spread (QSPR)). As such, the higher the depths (spreads), the higher (lower) the liquidity. Furthermore, the trading activities are estimated by the daily trading value (TVAL) and trading quantity (TVOL) of the individual stocks, where a higher trading activity indicates a higher liquidity.

The following sections will discuss the characteristics of the market liquidity from three viewpoints: overall descriptive statistics, time series trends and cross sectional variations.

### 4.3.1 Overall Statistics of Market Liquidity

Table 4.3 presents a summary of statistics of the daily liquidity measures in the Indonesian equity market. The statistics were calculated for each stock in the time series and then averaged across stocks.

As can be seen from the table, the mean value depth is Rp0.826 billion per day, the mean quantity depth is 1.358 million shares per day, the mean proportional quoted spread is 4.7%, the mean quoted spread is Rp35.6, the mean of daily trading value per stock is Rp12.454 billion and the mean daily trading value per stock is 12.772 million shares. Compared to the corresponding values from previous studies, the evidence from the present study shows that liquidity in the IDX has improved, but is still much lower than those of other economies in the region. For instance, the value depth was Rp0.826 billion, which is about 4 times the value depth of Rp0.208 billion observed by Rhee and Wang (2009) in their study on IDX from January 2002 to August 2007. Furthermore, the mean and median of PQSPR is 0.047 and 0.046 respectively which are comparable to the findings of Rhee and Wang (2009) which reported mean and median value of 0.041 and 0.027, respectively. By comparison, the corresponding values are 0.01497 and 0.01490 in the US market (Chordia, Roll & Subrahmanyam 2001), and 0.0391 and 0.0381 in Australia market (Fabre & Frino 2004).

The statistics shows that the means are much higher than the medians, suggesting positive skewness, implying that a small number of market liquidity have extreme positive values. The positive skewness of liquidity was also found in previous studies, such as Roll and Subrahmanyam (2010) for the US market and Rhee and Wang (2009) for the Indonesian market.

Further evidence shows that the volatility of liquidity, as indicated by the coefficient of variation,[7] is generally higher than those documented in previous studies. The variation of the time series mean in IDX ranges between 0.248 (QSPR) and 1.169 (TVOL). In contrast, Chordia, Roll and Subrahmanyam (2001) reported that the lowest and the highest liquidity variations in the US market were 0.125 (QSPR) and 0.525 (TVAL) respectively, approximately half of the values observed in the present study.

[7]Black (2012) suggest to use the coefficient of variation, the standard deviation relative to the corresponding mean, to measure the relative dispersion of series in different unit.

Table 4.3 Summary Statistics of Liquidity Measures

**Panel A:** Definitions

| Liquidity Measures | Definitions | Unit |
|---|---|---|
| Market Depth: | | |
| Value Depth | $VDEP = (P_A Q_A + P_B Q_B)/2$ | Billion Rupiah |
| Quantity Depth | $QDEP = (Q_A + Q_B)/2$ | Million Shares |
| Trading Cost: | | |
| Quoted Spread | $QSPR = P_A - P_B$ | Hundred Rupiah |
| Proportional Quoted Spread | $PQSPR = (P_A - P_B)/\left(\frac{P_A + P_B}{2}\right)$ | None (ratio) |
| Trading Activity: | | |
| Trading Value | TVAL = Trading value of individual stock per day | Billion Rupiah |
| Trading Volume | TVOL = Trading quantity of individual stock per day | Million shares |

**Panel B**: Cross Sectional Statistics for Time Series Mean

| | Mean | Median | Std. Dev | CoV | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| VDEP | 0.826 | 0.804 | 0.328 | 0.408 | 0.368 | 0.399 |
| QDEP | 1.358 | 1.227 | 0.727 | 0.593 | 1.168 | 1.656 |
| PQSPR | 0.047 | 0.046 | 0.015 | 0.329 | 0.557 | 0.067 |
| QSPR | 0.356 | 0.341 | 0.085 | 0.248 | 0.863 | 1.308 |
| TVAL | 12.454 | 11.329 | 6.804 | 0.601 | 1.123 | 1.852 |
| TVOL | 12.772 | 9.995 | 11.680 | 1.169 | 4.336 | 29.703 |

**Panel C:** Cross Sectional Means of Time Series Correlations between Liquidity Variable Pairs for Individual Stock

| | VDEP | QDEP | PQSPR | QSPR | TVAL |
|---|---|---|---|---|---|
| QDEP | 0.657*** | | | | |
| PQSPR | -0.562*** | -0.173*** | | | |
| QSPR | -0.277*** | -0.225*** | 0.295*** | | |
| TVAL | 0.251*** | -0.122*** | -0.413*** | -0.152*** | |
| TVOL | 0.107*** | -0.027 | -0.309*** | -0.317*** | 0.708*** |

Notes: This table provides definitions and summary statistics of liquidity measures for the stocks listed in the IDX. Panel A presents the definitions of the liquidity proxies. $P_A$ is asking price, $P_B$ denotes bid price, $P_H$ is the highest price, $P_L$ being lowest price, $Q_A$ denotes ask quantity, $Q_B$ is bid quantity and Val is total daily trading value in Rupiah. Panel B provides the cross sectional summary for the means of liquidity proxy on a time series basis. Panel C shows the cross-sectional means of correlations between liquidity variable pairs in the time series. Each liquidity measure presented here is estimated based on the daily averages for the entire period from 3 January 2005 to 30 December 2011 of all stocks listed in IDX with at least traded once on at least a calendar month and without corporate actions during the year. There are 177, 179, 205, 189, 196, 244 and 275 stocks selected in 2005, 2006, 2007, 2008, 2009, 2010 and 2011 respectively. The CV or coefficient of variation is the standard deviation divided by the mean. *** Correlation is significant at the 0.01 level (2-tailed).

Most of the pair-wise correlations are weak, except for the pairs (QDEP, VDEP) and (TVOL, TVAL) at 0.657 and 0.708, respectively, while all of the estimates are significant, bar one. The correlations among liquidity measures or among illiquidity measures are positive, which is 0.657 (VDEP, QDEP) and 0.295 (PQSPR, QSPR). In contrast, negative correlations are found between liquidity (illiquidity) measures and illiquidity (liquidity) measures, which are between –0.173 and –0.562. Concurring with the findings of Van Ness BF, Van Ness RA and Warr (2005), trading activities and spread measures in the present data are negatively correlated as well, which are between –0.152 and –0.413. However, the correlations of the liquidity proxies were not consistent with the previous findings, such as Stoll (2000). For example, while trading activity is expected to be positively correlated with depth measures, the results show that the correlations between trading activity and quantity depth are negative (–0.122 and –0.027). Overall, the strongest negative correlation was between value depth and proportional spread at –0.562 while the highest positive correlation was that between quantity depth and value depth at 0.657. These results are moderately consistent with the previous findings, such as in Lee et al. (2006), where the correlations between liquidity proxies in the Taiwan OTC stock market were between –0.169 and 0.999, and in Fabre and Frino (2004) where the correlations between liquidity measures in the Australian Stock Exchange ranged from –0.095 to 0.895.

In sum, IDX experienced a steady increase of liquidity compared to the findings of previous studies on the Indonesian market. The potential explanations for this include an increase in the number of listed firms (see Table 2.2), the merger of JSX and SSX in 2007 and the economic recovery following the Global Financial Crisis of 2008. However, the statistics indicate that the liquidity of the Indonesian equity market is quite low with a reasonably high variability. This is broadly consistent with the results of Jain (2003), in his study on fifty-one stock exchanges, who found that emerging markets are characterised by a lower liquidity and higher volatility compared to developed markets. One plausible reason for this is likely to be that of the dominant role of foreign investors in the Indonesian stock market, which can quickly invest and withdraw their money for short-term profits. As reported by Rhee and Wang (2009), a significant participation of foreign investors in the Indonesian stock market had a negative impact on liquidity. Another possible reason is the different settings of institutional arrangements and trading rules as well as the size of the Indonesian stock market.

### 4.3.2 Time Series Properties of Market Liquidity

Figure 4.2 shows the plots of the mean annual liquidity and trading activity, incorporating six measures. It is clear that market liquidity has been quite volatile over the study period. In general, all of the measures increased in the beginning followed by a sharp decline during the Global Financial Crisis in 2008, and gradually increasing afterwards.

More specifically, the two depth measures show rapid increases during the early periods reaching a high in 2006 and 2007 and subsequently declining to a low level in 2008 during the Global Financial Crisis. By the end of 2011, VDEP had grown by 29%, while QDEP had decreased by 5%. In contrast, the trading cost measures show a different pattern. The yearly mean of PQSPR declined about a half (47%) from 5.7% in 2005 to 3.0% in 2011. The mean QSPR remained relatively stable at around Rp40 between 2005 and 2011. The daily trading value (quantity) of an individual stock increased from Rp5.96 billion (5.65 million shares) in 2005 to Rp16.81 billion (25.91 million shares) in 2009, subsequently decreasing to Rp12.64 billion (12.50 million shares) in 2011; this increases trading value and trading quantity to 112% and 120% respectively.

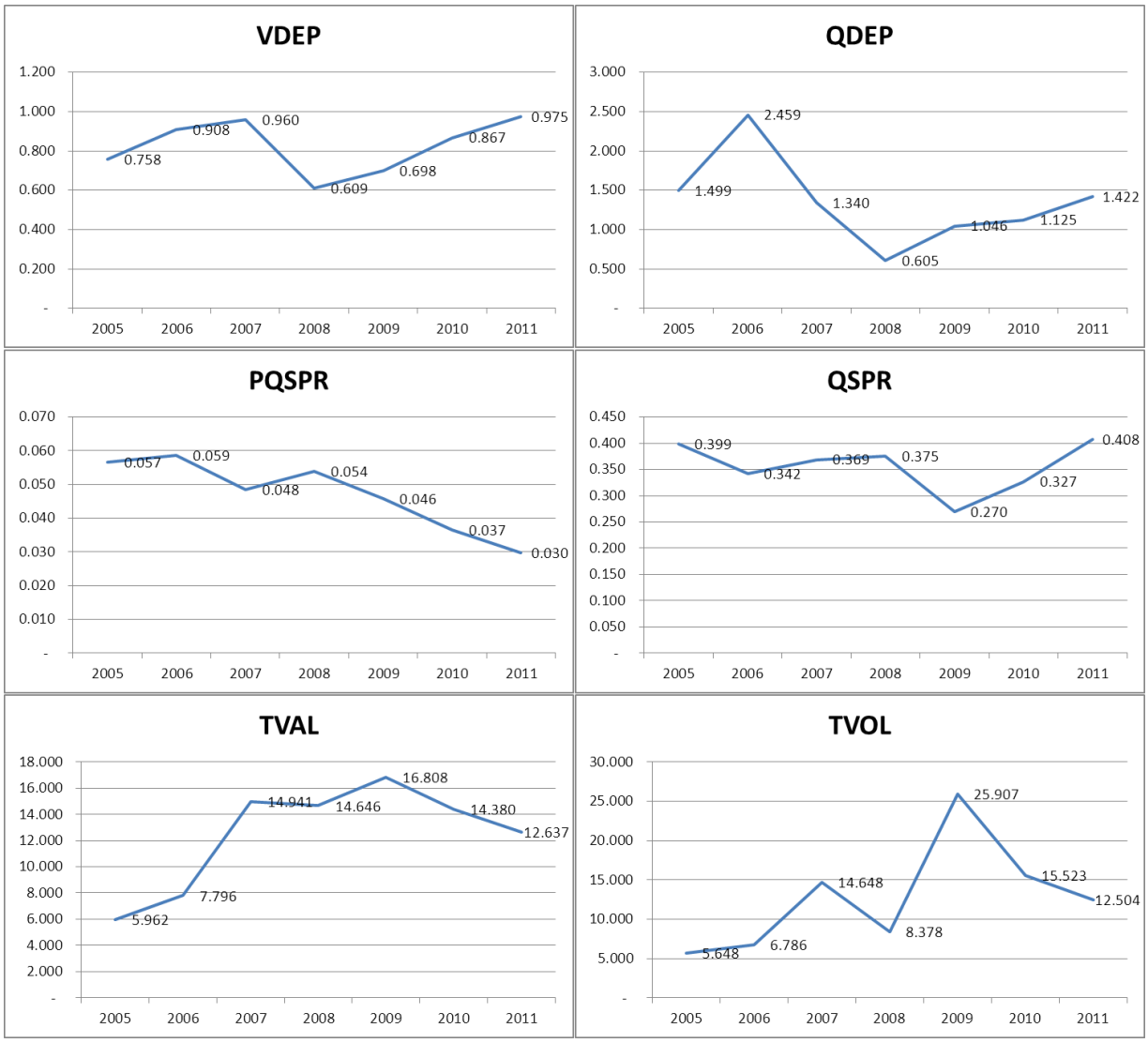
### 4.3.3 Cross Sectional Properties of Market Liquidity

For the purpose of the cross section analysis, the liquidity measures are categorised into five groups on the basis of the firm size (see Table 4.4). The firm size is estimated from a time series mean of market capitalisations at the end of the previous year; where market capitalisation is the product of stock prices and the outstanding shares.

Table 4.4 Cross Sectional Clusters based on Market Capitalisation

| Quintile | Market Capitalisation Range (Rupiah) | Number of Firms |
|---|---|---|
| Quintile 1 (Small firms) | <= 133.9 billion | 70 |
| Quintile 2 | 133.9 billion – 419.1 billion | 70 |
| Quintile 3 | 419.1 billion – 1,183.9 billion | 69 |
| Quintile 4 | 1,183.9 billion – 4,548.5 billion | 69 |
| Quintile 5 (Large firms) | > 4,548.5 billion | 69 |

Note: Market capitalization is the product of the number of outstanding stocks and the closing price for each stock. The ranges are calculated according the value of market capitalisation at the end of the previous year and averaged out over the seven year period. Each quintile represents 20% of the sample observations.




Note: The values are calculated for each stock per year and then averaged across stock. The unit measurements are as follows: VDEP in billion Rupiah, QDEP in million shares, PQSPR in ratio, QSPR in hundred Rupiah, TVAL in billion Rupiah and TVOL in million shares.

Figure 4.2 Annual Time Series Mean of Daily Liquidity and Trading Activity (2005–2011)

The cross sectional statistics in Table 4.5 show that the mean of the daily value depth and quantity depth improves with market capitalisation. The mean of value depth increases from Rp28 million in small firms to over Rp2.8 billion in large firms, indicating that large firms have more liquidity, as expected. However, small firms are exposed to a higher variation of value depth as indicated by a higher coefficient of variation, suggesting a higher liquidity risk. Likewise, the daily quantity depth is substantially higher for large firms, with a sharp rise from 0.199 million shares in small firms to 3.426 million shares in large firms (about eighteen times). In contrast, the small firms are exposed to a lower volatility of quantity depth. The table also illustrates that both depth measures have a much lower median than the mean,

implying that the daily market depths are strongly right-skewed, where most of the observations are positive values concentrated close to zero. Overall, this result suggests a generally positive correlation between market capitalisation and liquidity.

Table 4.5 Summary Statistics of Liquidity based on Market Capitalisation from 2005 to 2011

| Liquidity | Quintiles | N | Mean | Median | Std. Deviation | CV |
|---|---|---|---|---|---|---|
| VDEP | Quintile 1 (Small firms) | 70 | 0.028 | 0.015 | 0.042 | 1.502 |
| | Quintile 2 | 70 | 0.072 | 0.039 | 0.127 | 1.772 |
| | Quintile 3 | 69 | 0.165 | 0.081 | 0.223 | 1.351 |
| | Quintile 4 | 69 | 0.618 | 0.297 | 0.759 | 1.229 |
| | Quintile 5 (Large firms) | 69 | 2.812 | 1.748 | 3.641 | 1.295 |
| QDEP | Quintile 1 (Small firms) | 70 | 0.199 | 0.100 | 0.255 | 1.284 |
| | Quintile 2 | 70 | 0.284 | 0.114 | 0.598 | 2.105 |
| | Quintile 3 | 69 | 0.569 | 0.235 | 0.823 | 1.445 |
| | Quintile 4 | 69 | 1.710 | 0.434 | 2.996 | 1.752 |
| | Quintile 5 (Large firms) | 69 | 3.426 | 0.882 | 9.622 | 2.808 |
| PQSPR | Quintile 1 (Small firms) | 70 | 0.109 | 0.097 | 0.066 | 0.604 |
| | Quintile 2 | 70 | 0.057 | 0.045 | 0.040 | 0.695 |
| | Quintile 3 | 69 | 0.057 | 0.039 | 0.058 | 1.019 |
| | Quintile 4 | 69 | 0.035 | 0.021 | 0.034 | 0.964 |
| | Quintile 5 (Large firms) | 69 | 0.015 | 0.010 | 0.015 | 0.941 |
| QSPR | Quintile 1 (Small firms) | 70 | 0.331 | 0.137 | 0.654 | 1.978 |
| | Quintile 2 | 70 | 0.486 | 0.116 | 1.580 | 3.252 |
| | Quintile 3 | 69 | 0.556 | 0.116 | 1.222 | 2.197 |
| | Quintile 4 | 69 | 0.437 | 0.143 | 0.958 | 2.191 |
| | Quintile 5 (Large firms) | 69 | 0.485 | 0.235 | 0.984 | 2.028 |
| TVAL | Quintile 1 (Small firms) | 70 | 1.317 | 0.520 | 1.970 | 1.496 |
| | Quintile 2 | 70 | 2.721 | 0.829 | 4.819 | 1.771 |
| | Quintile 3 | 69 | 5.162 | 2.186 | 7.716 | 1.495 |
| | Quintile 4 | 69 | 17.223 | 3.723 | 33.755 | 1.960 |
| | Quintile 5 (Large firms) | 69 | 29.566 | 12.608 | 66.287 | 2.242 |
| TVOL | Quintile 1 (Small firms) | 70 | 0.235 | 0.110 | 0.365 | 1.556 |
| | Quintile 2 | 70 | 0.822 | 0.324 | 1.209 | 1.471 |
| | Quintile 3 | 69 | 1.519 | 0.846 | 2.001 | 1.317 |
| | Quintile 4 | 69 | 6.257 | 3.634 | 8.718 | 1.393 |
| | Quintile 5 (Large firms) | 69 | 40.029 | 24.990 | 55.670 | 1.391 |

Note: This table displays descriptive statistics for cross sectional liquidity of individual stock time series mean described in Panel A. Table 4.3. The figures are calculatedfrom thetime series mean of daily liquidity on each stock and then averaged to 5 clusters according to its market capitalisation group in Table 4.4. Each quintile represents 20% of the sample observations.

The mean value for proportional quoted spreads decreased with firm sizes. The mean value for the proportional spread of small firms is 10.9%, while that of large firms is only 1.5%. In contrast, the mean value for the quoted spread increased with firm sizes. The mean value for quoted spread is lower for small firms, with a significant jump from Rp33.1 in small firms to Rp48.5 in large firms. Since the proportional quoted spread is parameterised as the quoted spread over the mid price, relative to their prices, the results suggest that, holding the price constant, large firms have relatively lower spread and therefore higher liquidity.

The table further indicates that trading activity, as measured by trading value and trading volume, increases with firm size. Particularly, the average of daily trading value increased from about Rp234 million in small firms to about Rp40 billion in large firms, a sharp increase of more than 170 times. Likewise, the average of daily trading volume of small firms and large firms increased considerably from a low of 1.32 million shares to a high of 29.57 million shares, meaning that the trading quantity of large firms is about twenty-two times that of small firms. However, the variability of trading activities, as measured by the coefficient of variance, does not differ significantly between the groups implying that the variability shown by standard deviation is affected by the large differences in the means of the groups and, once this is factored in, the relative variation is fairly uniform.

From the above discussion of the descriptive statistics, it can be concluded that there is a positive relationship between firm size and liquidity as indicated by higher market depths, lower proportional quoted spread, and higher trading activity. These findings suggest a size effect where the level of firm size as measured by market capitalisation is an important determinant of liquidity variations.

### 4.4 Determinants of Market-wide Liquidity

Prior to the estimation of the regression, all time-series included in the regressions (including all market-wide liquidity proxies, market volatility, and interest rate variables) were tested for stationarity by performing an Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The results in Table 4.6 indicate that the null hypothesis of a unit root (that is, non-stationary) can be rejected at the 1% significance level. These findings indicate that the liquidity series and the explanatory variables are all stationary in the natural logarithmic transforms.

Table 4.6 Results for Unit Root Test of the Variables

| Variables | ADF test statistic | | PP test statistic | |
|---|---|---|---|---|
| | t-Stat | P-Val | Adjusted t-Stat | P-Val |
| Liquidity: | | | | |
| Ln_VDEP | -4.7374 | 0.0001 | -10.6649 | 0.0000 |
| Ln_QDEP | -4.6032 | 0.0001 | -8.0365 | 0.0000 |
| Ln_PQSPR | -3.7505 | 0.0035 | -4.1271 | 0.0009 |
| Ln_QSPR | -6.0186 | 0.0000 | -12.9336 | 0.0000 |
| Ln_TVAL | -3.7857 | 0.0031 | -12.7657 | 0.0000 |
| Ln_TVOL | -5.8633 | 0.0000 | -10.7151 | 0.0000 |
| Explanatory Variables: | | | | |
| Ln1_Vol_SnP | -3.9563 | 0.0017 | -8.2748 | 0.0000 |
| Ln_Vol_Nikkei | -5.7396 | 0.0000 | -9.7088 | 0.0000 |
| Ln_MA5\|MKT\| | -5.8504 | 0.0000 | -10.1836 | 0.0000 |
| Ln_TSpread | -3.8292 | 0.0027 | -4.5748 | 0.0001 |
| DLn_Shortrate | -51.3096 | 0.0001 | -51.8290 | 0.0001 |

Note: This table displays the results of unit root tests based on ADF Augmented Dickey Fuller and Phillips Perron models with Null Hypothesis: liquidity series has a unit root.

Initial results indicated the presence of serial correlations as measured by Durbin-Watson statistics (see Appendix Two), which is to be expected given the nature of the variable. The estimation procedure corrected for this serial correlation by incorporating an AR (1) process in the model (Asteriou & Hall 2007). This procedure is theoretically appropriate given that, under the inventory paradigm and asymmetric information theory, investors or market makers will start their trading day by looking at their inventory position and asymmetric information from the previous day. The perceptions about the portfolio position and information from the previous day are expected to drive their trading behaviour and, hence, the liquidity during the day. The results in Appendix Three show that AR (1) is statistically significant, indicating that the natural logarithmic level of market-wide liquidity is strongly affected by the autoregressive components.

Results in Appendix Three show that the adjusted $R^2$ estimates fall between 0.75 (QSPR) and 0.94 (PQSPR), indicating that the joint effects of independent variables can substantially explain a significant amount of the variations in the dependent variables. However, further statistical tests demonstrated that the null hypotheses of the ARCH LM test for all OLS regressions are rejected at the 1% significance level. This indicates that the residuals of the

OLS estimates have ARCH effects. After employing the GARCH (1,0) or simply ARCH model, the residual test based on ARCH LM cannot be rejected, suggesting that the ARCH estimates for all liquidity measures have no ARCH effect. In addition, the ARCH model has lower Akaike info criterion compared to the OLS model, which further supports the selection of the ARCH model as a better estimator than the OLS model.

The following sections discuss the estimates of the ARCH model presented in Table 4.7. As a comparison, it can be seen from Table 4.7 and Appendix Three that the estimates of the OLS and ARCH models are qualitatively similar.

### 4.4.1 International Market Factors

Globalisation has resulted in integrating global financial markets, which has many benefits but also creates challenges for contagion effects where financial instability is transmitted between the financial markets. Based on this argument, it is expected that the volatility in the US and Japanese markets will negatively affect liquidity in the Indonesian market. The empirical results strongly support the argument.

Indonesian market liquidity is significantly and negatively related to the foreign market volatility. The coefficients of one-period lagged market volatility of S&P 500 on value depth and trading value regressors are negative and statistically significant at 5% significance level. Furthermore, one-period lagged S&P 500 volatility has a significant and positive impact on the proportional quoted spread at the 5% level, implying that an increase in the volatility of S&P 500 would reduce liquidity and trading activity in the following period. Nikkei volatility has a negative impact on trading value and trading volume, significant at 5% and 1%, respectively. The evidence supports for the hypothesis H1 that market liquidity is negatively related to foreign market volatility.

### 4.4.2 Macroeconomic Factors

This section provides analysis of the results relating to the impact of macroeconomic factors (Global Financial Crisis, announcement of macroeconomic indicators, and interest rates) on the variations of market-wide liquidity and trading activity.

Table 4.7 Determinants of aggregate market liquidity, equally weighted time series regressions estimated by GARCH (1,0)

| Explanatory Variable | LN_VDEP | | LN_QDEP | | LN_PQSPR | | LN_QSPR | | LN_TVAL | | LN_TVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat |
| Constant | -0.7834*** | (-5.6200) | 0.0594 | (0.3798) | -2.8910*** | (-37.0466) | -0.7524*** | (-9.0183) | 1.3926*** | (7.0025) | 1.5233*** | (6.7542) |
| CRS | -0.7665*** | (-15.5124) | -0.6317*** | (-6.4668) | -0.1106 * | (-1.9391) | -0.1358 ** | (-2.0927) | -0.0499 | (-0.3374) | -0.0253 | (-0.1668) |
| POSTCRS | 0.0642 | (1.1991) | -0.0807 | (-0.8103) | -0.2529*** | (-4.1284) | -0.1258*** | (-3.0721) | 0.4536*** | (4.0866) | 0.7014*** | (5.8438) |
| LN_VOL_SNP(-1) | -0.0559*** | (-2.6165) | -0.0277 | (-1.3355) | 0.0190 ** | (2.3999) | 0.0109 | (1.0699) | -0.0700 ** | (-2.4990) | -0.0404 | (-1.3666) |
| LN_VOL_NIKKEI | 0.0051 | (0.2413) | 0.0162 | (0.7910) | -0.0030 | (-0.3825) | -0.0017 | (-0.1642) | -0.0577 ** | (-2.1624) | -0.0867*** | (-3.0308) |
| $CPI_{12}$ | -0.0222 | (-1.0660) | -0.0087 | (-0.4103) | -0.0059 | (-0.7479) | 0.0082 | (0.8211) | 0.0067 | (0.2216) | -0.0172 | (-0.5163) |
| $CPI_0$ | -0.0037 | (-0.1684) | -0.0060 | (-0.2911) | 0.0040 | (0.4918) | 0.0000 | (-0.0031) | -0.0206 | (-0.6953) | -0.0093 | (-0.2566) |
| $GDP_{12}$ | -0.0077 | (-0.2436) | -0.0019 | (-0.0572) | -0.0086 | (-0.6494) | -0.0176 | (-0.6955) | 0.0758 | (1.4018) | 0.0817 | (1.2439) |
| $GDP_0$ | -0.0074 | (-0.2178) | 0.0121 | (0.3917) | 0.0093 | (0.7011) | 0.0012 | (0.0495) | 0.1190*** | (2.5973) | 0.1026 * | (1.7633) |
| $UNP_{12}$ | 0.0062 | (0.1204) | -0.0054 | (-0.0868) | 0.0208 | (0.8750) | 0.0524 * | (1.7417) | 0.0233 | (0.2979) | -0.0500 | (-0.5802) |
| $UNP_0$ | -0.0256 | (-0.4969) | -0.0857 | (-1.3648) | -0.0084 | (-0.3973) | 0.0081 | (0.3187) | -0.0902 | (-0.9531) | -0.1246 | (-1.2972) |
| DLN_SHORTRATE | -0.1056 | (-0.8152) | -0.0958 | (-0.7694) | 0.1644*** | (3.1081) | 0.3180*** | (3.8043) | -0.2174 | (-1.0527) | -0.1946 | (-0.7948) |
| LN_TSPREAD | -0.2659 | (-1.5645) | -0.2954 | (-1.4702) | 0.1871 ** | (2.2485) | 0.2418 ** | (2.3450) | -0.1655 | (-0.5938) | -0.1766 | (-0.6090) |
| MKT+ | 0.1235*** | (14.0911) | 0.0851*** | (10.4864) | -0.0192*** | (-6.3720) | -0.0271*** | (-6.1095) | 0.0730*** | (6.2160) | 0.0604*** | (4.6047) |
| MA5MKT+ | 0.0354 ** | (2.5055) | 0.0350 ** | (2.5633) | -0.0183*** | (-3.7075) | -0.0268*** | (-3.7241) | 0.0359 * | (1.9392) | 0.0477 ** | (2.4062) |
| LN_MA5\|MKT\| | -0.0595*** | (-2.6902) | -0.0348 | (-1.5770) | 0.0088 | (1.1140) | 0.0442*** | (4.0338) | -0.0355 | (-1.4535) | 0.0354 | (1.3794) |
| MON | -0.0882*** | (-7.7577) | -0.0812*** | (-7.1867) | 0.0155*** | (3.9324) | 0.0043 | (0.7443) | -0.0847*** | (-5.8053) | -0.0668*** | (-3.9903) |
| TUE | -0.0327 ** | (-2.4658) | -0.0253 ** | (-2.0154) | -0.0087 * | (-1.8642) | -0.0094 | (-1.3488) | 0.0202 | (1.1323) | 0.0622*** | (3.1191) |
| WED | 0.0023 | (0.1663) | 0.0004 | (0.0317) | -0.0190*** | (-4.0582) | -0.0229*** | (-3.2550) | 0.0759*** | (4.2483) | 0.1181*** | (6.0289) |
| THU | 0.0063 | (0.5596) | 0.0159 | (1.4276) | -0.0259*** | (-6.5414) | -0.0343*** | (-5.5900) | 0.0844*** | (5.6515) | 0.1369*** | (8.1576) |
| HOL | -0.0328 * | (-1.8348) | -0.0348 * | (-1.9329) | 0.0258*** | (4.2554) | 0.0431*** | (4.4639) | -0.0919*** | (-4.1793) | -0.1448*** | (-5.9477) |
| RAMADAN | 0.1286 ** | (2.4020) | 0.1471 ** | (2.4883) | -0.0882*** | (-4.5406) | -0.0786 ** | (-2.4845) | -0.2214*** | (-3.8336) | -0.0415 | (-0.5035) |
| AR(1) | 0.8204*** | (52.5964) | 0.9099*** | (83.6406) | 0.9620*** | (134.6823) | 0.8657*** | (77.0964) | 0.8638*** | (64.7625) | 0.8564*** | (62.8494) |
| Akaike info criterion | -0.3126 | | -0.2222 | | -2.2695 | | -1.4746 | | 0.3212 | | 0.5681 | |
| Durbin-Watson stat | 2.5281 | | 2.6447 | | 2.4108 | | 2.5204 | | 2.4245 | | 2.4469 | |
| ARCH-LM test: | | | | | | | | | | | | |
| Obs*R-squared | 0.0613 | | 1.0764 | | 0.0024 | | 0.6921 | | 0.0046 | | 0.0623 | |
| Prob. Chi-Square | 0.8044 | | 0.2995 | | 0.9610 | | 0.4055 | | 0.9457 | | 0.8028 | |

***, **, * Coefficients significant at 1%, 5%, 10% level respectively.

#### 4.4.2.1 Financial Crisis

The hypothesis contends that the financial crisis is negatively related to market liquidity, which is tested by estimating the impact of the 2008 Global Financial Crisis on aggregate market liquidity using two dummy variables representing the period of during a crisis (Crs) and the period of after crisis (PostCrs). The results show strong evidence that the financial crisis influences market liquidity, at 1% significance level.

The evidence shows that the impact of crisis on market liquidity is rather contradictory. The first evidence shows that market liquidity decreases during financial crisis, as indicated by the significant and negative coefficients of Crs on the market depth regressions at 1% level. This suggests that market depth decreased during the crisis. A possible explanation for this is that investors try to minimise posting limit orders during the financial crisis to reduce the risk of adverse selection. This risk increased during the crisis due to higher asymmetric information and information uncertainties that are normally stronger during the financial crisis (Nagel 2012). Alternatively, a crisis triggered by international financial shocks have a negative effect on market liquidity because of the increasing credit constraints imposed by liquidity suppliers, including intermediaries and speculators (Choi & Cook 2006; Chiu et al. 2012). Overall, the results, that market depth decreases during the financial crisis, are consistent with the findings of Chordia, Sarkar and Subrahmanyam (2005) in their study on the US stock and bond markets.

The second piece of evidence, however, shows that the liquidity improves during the crisis period. The coefficients of Crs on the regressions of proportional quoted spread and on quoted spread are negative and statistically significant at the 10% and 5% level. This indicates that the bid-ask spreads narrowed during the crisis period. This finding differs from the evidence from previous research, such as Yeyati, Schmukler and Van Horen (2008) in their study of seven emerging countries and Chordia, Roll and Subrahmanyam (2011) in their study of the NYSE, which found that bid-ask spreads widen during a crisis. This result was unexpected and suggests that during the crisis investors wish to reduce their inventory position to minimise a potentially higher risk of holding inventory, and in order to liquidate the position, they have to attract more buyers by posting lower ask prices, which then narrows the spread.

The results further indicate that liquidity improved after the crisis. The coefficient of PostCrs on PQSPR and QSPR were negative and significant at the 1% level. The declining spread

following the financial crisis may be associated with the higher trading activity as the markets rebound. As the results show, the coefficients of PostCrs on both trading activity are positive and significant at the 1% level. This evidence indicates an improvement in market liquidity and trading activity following the crisis.

Overall, the results' support for the hypothesis H2 suggest that the financial crisis had a strong negative impact on aggregate market liquidity, further justifying the inclusion of dummy variables to represent relevant periods of the financial crisis.

#### 4.4.2.2 Macroeconomic Events

The market-wide liquidity is expected to exhibit signs of regularities during the days prior to the announcement, and on the days of the announcement of macroeconomic indicators (that is, CPI, GDP and unemployment). The regularities are estimated by two dummy variables i.e. two days prior to the release and the day of release for each macroeconomic indicator included in the announcement.

As can be seen from the table, in most cases, the results do not provide support for the significant impact of macroeconomic announcement on liquidity. Out of the thirty-six coefficients estimated in this category, thirty-three coefficients were not significant. For example, the results show that the coefficients of the CPI dummy variables were not statistically significant for all liquidity and trading activity measures. This supports the findings of Chordia, Roll and Subrahmanyam (2001) who found that the announcement of CPI did not appear to affect market liquidity and suggest that this is because CPI in the USA was fairly easy to predict. The finding of the present research seems to indicate that this could be the case in Indonesia as well. Further investigations are required to identify possible reasons for this behaviour in the Indonesian context.

Three coefficients were statistically significant: $GDP_0$ on trading value and trading volume regressions and $UNP_{12}$ on the quoted spread regressions. The coefficients of $GDP_0$ on trading value and trading volume regression are positive and significant at 1% and 10% levels, respectively. The fact that the trading activity increased indicates that during the announcement of GDP values, investors might be engaging in attempts to accumulate inventories, given that the Indonesian GDP growth was consistency higher than the growth rates of developed countries and global economy, in general. The coefficient of $UNP_{12}$ on the quoted spread regression is positive and significant at the 10% level. This implies that within

two days prior to the announcements of unemployment rate, investors were less certain about the level of unemployment rate, which leads to higher bid-ask spreads. As a result of this added uncertainty on price determination, investors respond by setting a wider spread. The findings related to the announcements of gross domestic product and unemployment rate are in line with those of Chordia, Roll and Subrahmanyam (2001), who found statistically significant improvement in market depth and trading activity during the two-days prior to the announcements.

The fact that the macroeconomic events have little impact on the financial market attributes is consistent with the findings of prior studies, including Kim, McKenzie and Faff (2004), Van Ness BF, Van Ness RA and Warr (2005) and Chordia, Sarkar and Subrahmanyam (2005). Hence, these findings provide little support on the presence of the regularities of liquidity around the announcements of macroeconomic indicators as suggested by hypothesis H3.

#### 4.4.2.3 Interest Rates

The impact of interest rates on aggregate market liquidity were estimated by the coefficients on the short-term interest rate at the first difference level and the coefficients on term spread. The evidence shows that interest rate variables have a significant implication on market-wide liquidity. In particular, the first difference of the short-term interest rate has a positive and significant influence on proportional spread and quoted spread at a 1% significance level. These results concur with Chordia, Sarkar and Subrahmanyam (2005) who found that aggregate market liquidity decrease with short-term interest rate. This suggests that as interest rate increases, investors are exposed to a higher cost of margin trading and an increase in the cost of financing inventory (Chordia, Roll & Subrahmanyam 2001). Alternatively, an increase of interest rate is an indicator of potential worsening of economic growth in the future, which may raise the risk of holding inventory (Fujimoto 2004) which, in turn, decreases market liquidity. The negative relationship between aggregate market liquidity and short-term interest rate provides support for hypothesis H4a.

The results also show that an increase in term spread will decrease market-wide liquidity as demonstrated by a higher spread measure. Specifically, term spread has significant positive effects on proportional quoted spread and quoted spread, implying that an increase in long-term interest rates relative to short-term interest rates will drive the market-wide liquidity to decrease. These results are consistent with those of Fujimoto (2004) who finds that market

liquidity substantially declines with term spread. These findings provide support for the hypothesis H4b.

### 4.4.3 Market Performance Factors

This following section provides a detailed discussion on the influence of market performance indicators (that is, market return, recent market return and market volatility) on aggregate market liquidity.

#### 4.4.3.1 Market Return

The regularities of market liquidity following an up and a down market are estimated from the coefficients of dummy variables of positive market return (MKT+). The empirical evidence shows that market depths and trading activity are higher and bid-ask spread is lower during the days of positive market returns. The coefficients of MKT+ on all liquidity regressions are significant at 1% level. This indicates that during the positive returns, increasing eagerness of the investors to trade results in a higher trading activity. This positive sentiment intensifies market depth that, in turn, increases the ability of the markets to absorb incoming orders at lower spreads.

The evidence supports the findings of previous studies, including Chordia, Roll and Subrahmanyam (2002), who found that after a negative (positive) market return, liquidity tends to be lower (higher); and also Hameed, Kang and Viswanathan (2010) who reported that bid-ask spreads tend to increase when the market is negative and to decrease when the market is positive. Thus, the results provide support for the hypothesis H5a that the equity market return has a positive impact on aggregate market liquidity.

#### 4.4.3.2 Recent Market Return

Practically, various trading strategies, such as momentum and contrarian strategies, use technical analysis that relies on historical market movements. Based on this argument, it is expected that a recent increase in market returns will be positively related to liquidity. The results show that the coefficients of MA5MKT+ are positive and significant at least at the 10% level. This indicates that market depths and trading activity increased, while trading costs decreased during the days immediately following rising markets; suggesting that market liquidity is responsive to changes in recent market returns. As hypothesised, a recently up

market (MA5MKT+) positively affects liquidity. The results confirm hypothesis H5b that the recent market return has a positive influence on liquidity.

#### 4.4.3.3 Market Volatility

The relationship between market liquidity and market volatility, as measured by a five day moving average of absolute return (MK5|MKT|), is expected to be negative. That is, market liquidity will decrease following higher market volatility. The empirical results support the exposition that volatility is negatively related with value depth and is positively related with quoted spread, at 1% significance. These results imply that, to avoid additional inventory risks following a large price fluctuation, investors tend to reduce their order submissions, as demonstrated by negative market depth (Chordia, Roll & Subrahmanyam 2002) which leads to larger bid-ask spreads. These findings are consistent with the results of Chordia, Roll and Subrahmanyam (2001), Yeyati, Schmukler and Van Horen (2008) and Wang (2013) who found that market volatility has a strong negative impact on liquidity. Hence, the results support for the hypothesis H5c that market volatility has negative impact on market liquidity.

### 4.4.4 Seasonal Regularities

This section provides a discussion of the regularity pattern of market-wide liquidity during the days of the week, the days around holidays and the days during the month of Ramadan.

#### 4.4.4.1 Day of the Week Effect

In terms of variations during the days of the week, the results show that the regularities are, in most cases, statistically significant. Specifically, market depth is lower on Mondays than on Fridays, and is significant at 1% level. The results further demonstrate that the coefficients for Tuesdays are negative and significant at the 5% level in depth regressions. The liquidity, in turn, gradually improves on Wednesdays and reaches the highest positive level on Thursdays, although the coefficients of Wednesday and Thursday dummy variables on both market depth regressions are not statistically significant, probably due to greater variations.

A similar pattern was found for the spread measures. For instance, compared to the proportional quoted spreads on Fridays, those for Mondays are positive and significant at 1% level. The evidence further shows that the proportional quoted bid-ask spreads are at the largest, or, the liquidity is at the lowest level, on Mondays. Following this, liquidity improves on Tuesdays and steadily increases on Wednesdays (significant at the 1% level) for both

spread measure regressions. Finally, the highest negative coefficients are found on Thursdays, where the coefficients of both spread regressions are negative and significant at the 1% level. Overall, the results on spread measures suggest that liquidity improves from Monday to Thursday and support the hypothesis of the day-of-the-week effect.

Likewise, all coefficients of the day-of-week on the trading value and trading volume regressions, except for that of Tuesday on trading value regression, are significant at 1% level of significance. The results show that the lowest trading activity occurs on Mondays, as indicated by the negative and significant coefficient of the dummy variables representing Mondays. It then, increased on Tuesdays, as indicated by the increasing positive coefficients on both trading activity measures. The liquidity kept increasing through Wednesdays and reached the highest level on Thursdays.

Overall, the evidence supports the existence of the day-of-the-week effect. The results indicate that market liquidity on Mondays was lower than that on Fridays and kept increasing during the following day of the week reaching the highest level on Thursdays. The weekly regularities of liquidity are consistent with the results of previous studies, such as Chordia, Roll and Subrahmanyam (2001) and Chordia, Sarkar and Subrahmanyam (2005). The finding suggests that anomaly is an implication of lagged adjustment to new information (Fama 1998). That is, investors tend to reduce trading activity on Mondays due to higher risk as a result of a higher degree of asymmetric information during the weekend. As the information asymmetry gradually diminishes during the week, investors are keen to engage in trading, improving market liquidity as the week progresses. These findings are consistent with hypothesis H6a that daily liquidity follows a general weekly pattern.

#### 4.4.4.2 Holiday Effect

The holiday effect was estimated by the coefficients of dummy variables that represent holidays. The hypothesis states that liquidity and trading activity will decrease during the days around holidays. The empirical evidence shows that all coefficients of the dummy variables on the market liquidity proxy and trading activity regressions are statistically significant and the signs provide support to the hypothesis. Specifically, the coefficients of dummy variables on market depth and trading activity are negative and those of spread measures are positive, which are significant at least at the 10% level. These results imply that market-wide liquidity

and trading activity declined during the days around holidays, which provides strong support for hypothesis H6b.

These findings suggest that during the days around the holidays, which is often followed by reduced information disclosures from firms and government sources, investors tend to trade less frequently. The finding that market liquidity declines around holidays is consistent with the findings of earlier studies such as Chordia, Roll and Subrahmanyam (2001), Van Ness BF, Van Ness RA and Warr (2005), Hameed, Kang and Viswanathan (2010) and Chordia, Sarkar and Subrahmanyam (2011).

#### 4.4.4.3 Ramadan Effect

The empirical evidence provides supports to the hypothesis H6c that market liquidity increases during the month of Ramadan. The results show that the coefficients of Ramadan on market depth are positive and those on spreads are negative; the coefficients, except one, are significant at least at the 5% level. This rising market liquidity is consistent with the notion that Ramadan positively affects investor sentiment and decisions (Białkowski, Etebari & Wisniewski 2012). However, the coefficient of Ramadan on trading value is negative and significant at the 1% level, suggesting that investors trade less frequently during the month of Ramadan.

### 4.5 Summary

This chapter provided detailed analysis of the time series and cross sectional properties of market-wide liquidity and its determinants. Focusing on the period from January 2005 to December 2011, this study found that most of the market liquidity indicators in the Indonesian Stock Exchange showed an increasing trend. Value depth increased by approximately 29%; trading value rose by 112%; trading volume increased by 120%, and proportional spread dropped by about 47%. From a cross sectional point of view, on average, market-wide liquidity increases with firm size. Value depth of large firms is about 100 times larger than in small firms, while proportional spreads for large firms is approximately 86% lower than those of small firms. Additionally, large firms experienced a daily trading value of around 170 times, and daily trading volume about 22 times of the small firms.

The study produced statistically significant evidence of the determinants of aggregate market liquidity in the Indonesian equity market as follows:

1. Market liquidity decreases with the volatility of Standard and Poor's, and the volatility of Nikkei;
2. Financial crisis had a strong negative impact on aggregate market liquidity;
3. The announcements of macroeconomic indicators marginally influence market liquidity and trading activity;
4. Short-term interest rates and term spreads have a negative effect on market liquidity;
5. Market returns are positively related to liquidity;
6. Historical market trends have a positive impact on liquidity;
7. Market volatility has negative impact on market liquidity;
8. There is strong evidence of seasonal regularities within a week. Liquidity decreases on Mondays and gradually increases during the week reaching the highest level on Thursdays. Additionally, market-wide liquidity decreases around holidays but increases during the month of Ramadan.

# Chapter 5
# Commonality and Determinant Factors of Individual Stock Liquidity

## 5.1 Introduction

Chapter Four focused on the underlying factors contributing to the variation of liquidity at the market level. The current chapter will present the results of commonality in liquidity and the analysis of the influential factors at the individual stock level. The chapter begins with an analysis on the commonality in liquidity across different firm sizes and firm sectors. This will be followed by identifying what factors determine the variation of the liquidity at the firm level.

## 5.2 Commonality in Individual Stock Liquidity

Commonality in liquidity has been documented in many previous studies, including Chordia, Roll and Subrahmanyam (2000), Hasbrouck and Seppi (2001), Huberman and Halka (2001), Brockman and Chung (2008) and Chai, Faff and Gharghori (2010). Those studies have reported that the liquidity of a single stock tends to move together with the liquidity of the market. Commonality in liquidity prevails across different markets and various assets at varying degrees.

The commonality in this study is estimated according to the simple "market model" time series regression from the study of Chordia, Roll and Subrahmanyam (2000), which was followed by other studies including Brockman and Chung (2008) and Pukthuanthong-Le and Visaltanachoti (2009). Previous studies used OLS regressions to estimate the relationships between liquidity of individual security and liquidity of the market. Unlike those studies, this current thesis estimates the parameters under a GARCH (1,1) model to address the time varying component of autoregressive conditional heteroscedastic, which was chosen following the initial analyses.

As discussed in Chapter Three, the study uses the following market model function to analyse the commonality in liquidity:

$$DL_{i,t} = \alpha_i + \beta_i DL_{M,t} + \varepsilon_{i,t},$$

Where DL refers to percentage change (D) of the daily liquidity (L) measures.

Market level liquidity is calculated as an equal weighted average of individual stock liquidity in the sample, as previously described in Section 3.5.1. There is, however, a slightly different aggregate value of market level liquidity for each individual stock regression. When calculating the market level liquidity of stock A, for example, the averaging process excludes the observations for stock A. This is expected to minimise the misleading constraint, especially when the market liquidity is measured as an equal weighted average, where each stock is constrained to exactly unity. Although the differences are generally small for each individual stock, it can be substantial when aggregated across many equations (Chordia, Roll & Subrahmanyam 2000).

In examining the commonality, additional regressors are included. First, besides the contemporaneous changes in market level liquidity, the regression will include one lead and one lag of the daily changes of the market level liquidity. These lead and lag variables are expected to capture any lagged adjustment in commonality. Second, market return will be included in the regression to control for possible spurious dependence between returns and spread measures. Similarly, market return variables are also being led and lagged for one period. Lastly, the regression will include the individual stock's squared return as a proxy of return volatility, a nuisance element which may affect liquidity (Chordia, Roll & Subrahmanyam 2000; Galariotis & Giouvris 2007). The inclusion of market return and volatility as control variable will allow the isolation of the impact of market-wide liquidity on individual stock liquidity (Brockman & Chung 2002). Following Chordia, Roll and Subrahmanyam (2000), the present study does not report the coefficients of nuisance variables.

The sample observations follow the criteria set out in Chapter Four. For the individual regressions at the firm level, it is necessary for the samples to have sufficient observations for the entire period of study. This criterion is included to ensure data continuity at the individual stock level for ARCH analysis. As such, the sample observations need to satisfy the following conditions: 1) traded at least once in a calendar month over the seven-year period of 1704

trading days, 2) without corporate actions that affect the possibility of trading unit bias and 3) with data available over the period of the study. The selected samples are 75 stocks, with mean 1,555 trading days, minimum 821 trading days, maximum 1,704 trading days, and the median of 1,669 trading days.

In an attempt to make the results comparable with the previous studies, the data will be categorised according to the firm sizes and industry groups. Some previous studies partitioned samples into five firm size quintiles (Chordia, Roll & Subrahmanyam 2000; Fabre & Frino 2004; Lee et al. 2006; Brockman & Chung 2008) while others divided sample observations into three different firm sizes (that is, small, medium and large), such as in the study of Pukthuanthong-Le and Visaltanachoti (2009). This current study divides the sample into three categories on market capitalisation; an approach that will minimise the magnifying effect of the limited sample.

Furthermore, the selected sample observations are classified into nine industry sectors based on the Jakarta Stock Industrial Classification. One of the methodological issues with respect to clustering the limited sample was the strongly skewed distribution and the impact of the outliers. This issue was partially resolved by grouping the industries into three main categories: primary, manufacturing and services. Given the selection criteria was dictated by the data availability, as shown in Table 5.1, the observations are not equally distributed among the categories. The largest group of samples (thirty-six firms or 49%) are the service industry. This is followed by thirty-two samples (42%) in the manufacturing industry. The smallest group of samples are in the primary industry (seven firms or 9%).

Prior to the estimation of the GARCH (1,1) regressions, all time-series liquidity at stock level and at market level were tested for stationarity by performing an Augmented Dickey-Fuller (ADF) test with the Schwartz Information Criterion (SIC) to obtain the optimal lag length. Appendices four and five reports the results of ADF test for the six liquidity proxies at the individual stock and at the market level. The results indicate that data series of liquidity for all seventy-five firms are stationary. The similar test on market returns also found that all market return variables for the corresponding individual stock are stationary (see Appendix Six).

Table 5.1 Sample Classification by Industry Sector

| Sector (Sub-Sector) | Number of Firms | % |
|---|---|---|
| Primary Industry | 7 | 9 |
| 1. Agriculture | 3 | 4 |
| 2. Mining | 4 | 5 |
| Manufacturing Industry | 32 | 42 |
| 3. Basic Industry and Chemicals | 15 | 20 |
| 4. Miscellaneous Industry | 4 | 5 |
| 5. Consumer Goods Industry | 13 | 17 |
| Services Industry | 36 | 49 |
| 6. Property, Real Estate and Building Construction | 6 | 8 |
| 7. Infrastructure, Utilities & Transportation | 5 | 7 |
| 8. Finance | 12 | 16 |
| 9. Trade, Services & Investment | 13 | 17 |
| Total Sample | 75 | 100 |

The following sections will discuss the results of the commonality in liquidity.

### 5.2.1 Market-wide Commonality in Liquidity

Table 5.2 shows the results pertaining to the commonality in liquidity for six liquidity proxies. The table provides the summary of the seventy-five regressions, including the mean of concurrent, lead and lag market liquidity coefficients and the number and the percentage of firms with positive and negative slope coefficients that have t-statistics greater and lower than the 5% critical level in a one-tailed test (1.645).

The summary indicates the level of commonality in liquidity. The commonality in liquidity is specified by the number and the percentage of firms with positive and statistically significant coefficients of concurrent market-wide liquidity. The degree of the commonality is identified from the mean coefficients of market level liquidity. That is, the liquidity of individual stock will be more sensitive to market liquidity variation given the higher value of the coefficient.

For the regressions covering value depth (VDEP), approximately 37% of firms have positive and significant coefficients of concurrent market liquidity ($\beta_1$). This is higher than the 4.24% observed in Australia by Fabre and Frino (2004). Further 7% of the firms have negative and significant coefficients. For the rest of the firms (56%), the coefficients are not significant.

For the regressions on quantity depth (QDEP), about 28% of the coefficients were positive and significant. This is smaller than the 31% observed in the US market by Chordia, Roll and

Subrahmanyam (2000), but much higher than the 3.18% found in the Australian market by Fabre and Frino (2004). Studies in emerging markets also found higher level of commonality, such as 37.8% in Hong Kong market (Brockman & Chung 2002) and 46% in Thailand market (Pukthuanthong-Le & Visaltanachoti 2009).

For the proportional quoted spread (PQSPR), around 41% of firms had experienced positive and significant association between firm liquidity and concurrent market liquidity. This is higher than the 33% documented in the US market by Chordia, Roll and Subrahmanyam (2000) and much higher than the 3% observed in the Australian market by Fabre and Frino (2004). But the percentage is substantially lower compared to that of the emerging markets, such as 72% reported by Pukthuanthong-Le and Visaltanachoti (2009) in Thailand.

For the regressions covering quoted spread (QSPR), approximately 41% of firms have positive and significant concurrent coefficients. This percentage is higher than the 35% reported in the US market by Chordia, Roll and Subrahmanyam (2000) and considerably higher than the 2% observed in Australia by Fabre and Frino (2004), as well as the 25% observed in Thailand, an emerging market, by Pukthuanthong-Le and Visaltanachoti (2009).

For trading value (TVAL), approximately 32% of firms experienced positive and statistically significant coefficients and 3% of firms have negative and significant coefficients. For the rest of the sample, 65% of firms the coefficients were not significant. Lastly, in terms of trading volume (TVOL), around 33% firms displayed positive and significant coefficients. Further, 5% firms had negative and significant coefficients while that of 61% firms were insignificant. The results suggest that the levels of commonality of trading activities are reasonably high.

Turning our attention into the lead and lagged effects, as shown in the table, 8 to 32% of the firms had positive impact of leading or lagged terms. This observation is substantially higher than those of Chordia, Roll and Subrahmanyam (2000) in the US, with 4 to 9%, and those of Brockman and Chung (2002) in Hong Kong, with 6 to 13%. This higher commonality of lead and lag variables is an indication that historical information seems to play a bigger role in the Indonesian market, compared to other markets.

Table 5.2 Market-wide Commonality in Liquidity

| Liquidity Proxy | Independent Variable | Mean of Estimated Coefficients | Number (per cent) of Firms with coefficient > 0 | | Number (per cent) of Firms with coefficient < 0 | |
|---|---|---|---|---|---|---|
| | | | Significant | Not Significant | Significant | Not Significant |
| VDEP | $DL_{M,t}$ | 0.510 | 28 (37) | 26 (35) | 5 (7) | 16 (21) |
| | $DL_{M,t+1}$ | -0.014 | 17 (23) | 28 (37) | 8 (11) | 22 (29) |
| | $DL_{M,t-1}$ | 0.391 | 22 (29) | 13 (17) | 5 (7) | 35 (47) |
| QDEP | $DL_{M,t}$ | 0.215 | 21 (28) | 18 (24) | 10 (13) | 26 (35) |
| | $DL_{M,t+1}$ | 0.211 | 23 (31) | 25 (33) | 6 (8) | 21 (28) |
| | $DL_{M,t-1}$ | 0.010 | 19 (25) | 24 (32) | 11 (15) | 21 (28) |
| PQSPR | $DL_{M,t}$ | 0.128 | 31 (41) | 17 (23) | 7 (9) | 20 (27) |
| | $DL_{M,t+1}$ | 0.091 | 24 (32) | 18 (24) | 4 (5) | 29 (39) |
| | $DL_{M,t-1}$ | 0.069 | 19 (25) | 28 (37) | 8 (11) | 20 (27) |
| QSPR | $DL_{M,t}$ | 0.065 | 31 (41) | 24 (32) | 8 (11) | 12 (16) |
| | $DL_{M,t+1}$ | 0.031 | 15 (20) | 36 (48) | 7 (9) | 17 (23) |
| | $DL_{M,t-1}$ | 0.035 | 16 (21) | 34 (45) | 8 (11) | 17 (23) |
| TVAL | $DL_{M,t}$ | 2.750 | 24 (32) | 28 (37) | 2 (3) | 21 (28) |
| | $DL_{M,t+1}$ | -1.642 | 14 (19) | 27 (36) | 5 (7) | 29 (39) |
| | $DL_{M,t-1}$ | -2.593 | 6 (8) | 36 (48) | 10 (13) | 23 (31) |
| TVOL | $DL_{M,t}$ | 1.423 | 25 (33) | 36 (48) | 4 (5) | 10 (13) |
| | $DL_{M,t+1}$ | -0.971 | 13 (17) | 29 (39) | 3 (4) | 30 (40) |
| | $DL_{M,t-1}$ | -2.117 | 6 (8) | 26 (35) | 8 (11) | 35 (47) |

Notes:

1. This table presents the estimation results of the commonality in liquidity for 75 firms listed on the IDX from 3 January 2005 to 30 December 2011.
2. The results are based on a GARCH (1,1) model which regresses each of the daily percentage changes of individual stock's liquidityon percentage changes in the equal-weighted average liquidity for all stocks in the sample ('market'), excluding the stock under examination. That is, this table presents the commonality based on the following multiple regressions:

$$DL_{i,t} = \alpha_i + \beta_1 DL_{M,t} + \beta_2 DL_{M,t+1} + \beta_3 DL_{M,t-1} + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 D(R^2_{i,t}) + \varepsilon_{i,t}$$

Where, $DL_{M,t}$; $DL_{M,t+1}$; $DL_{M,t-1}$ refer to the concurrent, lead and lag of liquidity changes, $R_M$, $R_{M,t+1}$, $R_{M,t-1}$ are the concurrent, lead and lag of the market returns. $D(R^2_{i,t})$ refers to the volatility of stock i. PQSPR is the proportional quoted spread, QSPR is the quoted spread, VDEP is the Rupiah value of market depth, QDEP is the number of shares for market depth, TVAL is the daily trading value, and TVOL is the daily trading quantity (shares).

A further observation is that for the positive coefficients more of the current (t) effects are significant compared to leading values (t+1) and lagged (t-1). In contrast, for the negative coefficients, more of the lagged values (t-1) are significant compared to lead value (t+1), the current values falling in between. For example, in the case of VDEP, the positive and significant current (t) effect coefficient is 37%, which is higher than the lead (23%) and the lag (29%). In contrast, the negative and significant lagged (t-1) effect coefficients is 47% and

higher than the current (21%) and lead (29%). This suggests that the stock level liquidity of the majority firms are positively related to current effect and negatively related to the lagged effect.

The evidence further shows that the mean of estimated coefficients ranges between 0.065 and 2.750 for concurrent liquidity, between –1.642 and 0.211 for lead values, and between –2.593 and 0.391 for lagged values. These intervals compare reasonably well with the observations in the US markets at 0.691 to 1.373, –0.156 to 0.336, and –0.047 to 0.169, respectively. This provides evidence that the commonality and the degree of commonality are persistent across stocks and are about as high as the level of its counterparts.

Overall, the findings support the hypothesis H7 that the individual stock liquidity significantly moves together in response to the market-wide liquidity. Specifically, the commonality in Indonesian equity market is generally stronger than that of the US and Australian markets but is weaker than the markets in Hong Kong and Thailand, suggesting that the commonality in the Indonesian equity market is stronger than that of developed market and weaker than those of other emerging markets. Additionally, the evidence shows that the lagged and led components strongly affect the daily changes of individual stock liquidity; a finding that is not common in the literature. These suggests that the Indonesian market is exposed to a higher non-diversifiable or systemic risk (Pástor & Stambaugh 2003; Acharya & Pedersen 2005; Korajczyk & Sadka 2008), which may contribute the Indonesian equity market to be riskier, especially during periods of financial crisis (Fernando, Herring & Subrahmanyam 2008).

### 5.2.2 Commonality in Liquidity by Firm Size

Table 5.3 reports the findings on the commonality of liquidity by firm size. The results shown provide little support for the existence of commonality across firm sizes. For small and medium firms, the percentage of firms with positive and significant coefficients is reasonably low, ranging between 1% and 16% for small firms, and ranging between 11% and 25% for large firms. Although the percentage seems to increase with firm sizes, the comparable results from other emerging markets show a higher percentage of commonality, such as about 10% to 17% of smaller firms, and 47% to 74% of largest group firms reported in the Hong Kong (Brockman & Chung 2002); and 11% to 64% of smallest group firms and 25% to 72% of largest group firms documented in Thailand (Pukthuanthong-Le & Visaltanachoti 2009).

These findings provide evidence that firm sizes in the Indonesian equity market have a smaller impact on the commonality in liquidity than in other emerging markets.

Table 5.3 Market-wide Commonality in Liquidity by Firm Size

| Liquidity proxy | Firm Size | Mean of Estimated Coefficient | Number (per cent) of Firms with coefficient > 0 | | Number (per cent) of Firms with coefficient < 0 | |
|---|---|---|---|---|---|---|
| | | | Significant | Not Significant | Significant | Not Significant |
| VDEP | Small | 1.028 | 10 (13) | 4 (5) | 2 (3) | 9 (12) |
| | Medium | 0.348 | 10 (13) | 7 (9) | 1 (1) | 7 (9) |
| | Large | 0.154 | 8 (11) | 9 (12) | 2 (3) | 6 (8) |
| QDEP | Small | 0.121 | 5 (7) | 7 (9) | 3 (4) | 10 (13) |
| | Medium | 0.188 | 8 (11) | 4 (5) | 5 (7) | 8 (11) |
| | Large | 0.336 | 8 (11) | 7 (9) | 2 (3) | 8 (11) |
| PQSR | Small | 0.136 | 12 (16) | 4 (5) | 3 (4) | 6 (8) |
| | Medium | 0.115 | 8 (11) | 11 (15) | 3 (4) | 3 (4) |
| | Large | 0.135 | 11 (15) | 9 (12) | 1 (1) | 4 (5) |
| QSPR | Small | –0.003 | 6 (8) | 8 (11) | 5 (7) | 6 (8) |
| | Medium | 0.098 | 12 (16) | 8 (11) | 1 (1) | 4 (5) |
| | Large | 0.099 | 13 (17) | 5 (7) | 2 (3) | 5 (7) |
| TVAL | Small | 2.178 | 1 (1) | 16 (21) | 1 (1) | 7 (9) |
| | Medium | 4.409 | 4 (5) | 16 (21) | 1 (1) | 4 (5) |
| | Large | 1.663 | 19 (25) | 5 (7) | 0 (0) | 1 (1) |
| TVOL | Small | –0.218 | 1 (1) | 12 (16) | 2 (3) | 10 (13) |
| | Medium | 3.401 | 6 (8) | 12 (16) | 1 (1) | 6 (8) |
| | Large | 1.087 | 18 (24) | 5 (7) | 1 (1) | 1 (1) |

Notes:

1. Sample size is 25 for each group
2. This table presents the estimation results of the commonality in liquidity for 75 firms listed on the IDX over the period from 3 January 2005 to 30 December 2011.

$$DL_{i,t} = \alpha_i + \beta_1 DL_{M,t} + \beta_2 DL_{M,t+1} + \beta_3 DL_{M,t-1} + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 D(R_{i,t}^2) + \varepsilon_{i,t}$$

   Where, $DL_{M,t}$; $DL_{M,t+1}$; $DL_{M,t-1}$ refer to the concurrent, lead and lag of the liquidity changes, $R_M$, $R_{M,t+1}$, $R_{M,t-1}$ are the concurrent, lead and lag of the market returns. $D(R_{i,t}^2)$ refers to the volatility of stock i. VDEP, QDEP, PQSPR, QSPR, TVAL and TVOL are as defined earlier. This table presents the coefficients of concurrent market level liquidity variables; estimated coefficients for nuisance variables are not reported.
3. The results are based on a GARCH (1,1) model for each of the daily percentage changes of individual stock's liquidity proxies. The proxies are regressed in time series on percentage changes in the equal-weighted average liquidity for all stocks in the sample, excluding the stock under examination.

The mean of estimated coefficients further support the little size effect on the commonality in liquidity. That is, the slope coefficients are not consistent with respect to their size, although generally seem to be positive. For example, in the case of value depth, the beta coefficients

tend to decrease with size, for quantity depth and quoted spread measures, the beta coefficients increase with size, and for proportional quoted spreads they tend to follow a U-shaped pattern. For the trading activity measures, the middle group has a higher beta coefficient than the small and large firms. This result is partially consistent with the literature where Chordia, Roll and Subrahmanyam (2000) found liquidity to generally increase with firm size; and Brockman and Chung (2002) found liquidity to be high for small and large firms and to be low for medium firms. Further confirmatory studies are required for a firm conclusion on this aspect of liquidity.

### 5.2.3 Commonality in Liquidity by Industry Sector

Liquidity of a firm is influenced not only by market level liquidity but also by industry specific component. More specifically, firms within a similar industry could have stronger co-variation in liquidity as a result of the occasional occurrences of asymmetric information (Chordia, Roll & Subrahmanyam 2000).

The commonality at the industry level is observed by clustering the sample firms into the corresponding industry categories and then summarising the regression results, similar to the earlier analysis of the firm size effect. The results are shown for each of the three industries. In each category, the mean of the coefficients, and the number and percentage of statistically significant positive and negative coefficients, as well as the insignificant coefficients, are reported.

Table 5.4 shows that 14% to 44% of the firms appear to have commonality on concurrent market liquidity variables. The commonality for manufacturing industry varies from 34% firms in terms of market depth measure and trading activities to 44% in terms of proportional quoted spread. Of the firms belonging to primary industry, the positive and significant coefficients range from 14% in term of proportional quoted spread and 43% in terms of market depth measure and trading activities. For the services industry, the commonality exists from as low as 19% of firms in the case of quantity depth to as high as 44% in the case of both spread measures. The results are consistent with the notion that liquidity of firms within the same industry-specific is likely to have higher co-variation.

Further analysis was carried out to examine whether industry or market effect had a greater influence on the individual firm liquidity. Following previous studies, such as Chordia, Roll

and Subrahmanyam (2000), Galariotis and Giouvris (2007) and Narayan, Zhang and Zheng (2010), this study examined the influence of the industry-specific average liquidity measures on firm liquidity by including the industry-specific measures as additional regressors. For each industry sector, the liquidity measures at industry level were computed as an equal weighted average of individual stock liquidity. As for market level liquidity, to obtain industry specific liquidity, the liquidity of a firm under examination was excluded from the computation.

Table 5.4 Commonality in Liquidity by Industry Clusters

| Liquidity Proxy | Industry Category | Number of Firms | Mean of Estimated Coefficient | Number (per cent) of Firms with coefficient > 0 | | Number (per cent) of Firms with coefficient < 0 | |
|---|---|---|---|---|---|---|---|
| | | | | Significant | Not Significant | Significant | Not Significant |
| VDEP | Manufacturing | 32 | 0.610 | 11 (34) | 8 (25) | 3 (9) | 10 (31) |
| | Primary | 7 | 0.558 | 3 (43) | 3 (43) | 0 (0) | 1 (14) |
| | Services | 36 | 0.411 | 14 (39) | 9 (25) | 2 (6) | 11 (31) |
| QDEP | Manufacturing | 32 | 0.133 | 11 (34) | 7 (22) | 4 (13) | 10 (31) |
| | Primary | 7 | 0.470 | 3 (43) | 2 (29) | 0 (0) | 2 (29) |
| | Services | 36 | 0.238 | 7 (19) | 9 (25) | 6 (17) | 14 (39) |
| PQSPR | Manufacturing | 32 | 0.162 | 14 (44) | 11 (34) | 3 (9) | 4 (13) |
| | Primary | 7 | 0.046 | 1 (14) | 3 (43) | 1 (14) | 2 (29) |
| | Services | 36 | 0.114 | 16 (44) | 10 (28) | 3 (8) | 7 (19) |
| QSPR | Manufacturing | 32 | 0.079 | 13 (41) | 11 (34) | 2 (6) | 6 (19) |
| | Primary | 7 | 0.024 | 2 (29) | 1 (14) | 1 (14) | 3 (43) |
| | Services | 36 | 0.060 | 16 (44) | 9 (25) | 5 (14) | 6 (17) |
| TVAL | Manufacturing | 32 | 3.728 | 11 (34) | 16 (50) | 1 (3) | 4 (13) |
| | Primary | 7 | 0.683 | 3 (43) | 2 (29) | 0 (0) | 2 (29) |
| | Services | 36 | 2.283 | 10 (28) | 19 (53) | 1 (3) | 6 (17) |
| TVOL | Manufacturing | 32 | 1.381 | 11 (34) | 11 (34) | 2 (6) | 8 (25) |
| | Primary | 7 | -0.197 | 3 (43) | 2 (29) | 0 (0) | 2 (29) |
| | Services | 36 | 1.776 | 11 (31) | 16 (44) | 2 (6) | 7 (19) |

Notes:

1. This table presents the estimation results of the commonality in liquidity for 75 firms listed on the IDX over the period from 3 January 2005 to 30 December 2011.

$$DL_{i,t} = \alpha_i + \beta_1 DL_{M,t} + \beta_2 DL_{M,t+1} + \beta_3 DL_{M,t-1} + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 D(R_{i,t}^2) + \varepsilon_{i,t}$$

   Where, $DL_{M,t}$; $DL_{M,t+1}$; $DL_{M,t-1}$ refer to the concurrent, lead and lag of the liquidity changes, $R_M$, $R_{M,t+1}$, $R_{M,t-1}$ are the concurrent, lead and lag of the market returns. $D(R_{i,t}^2)$ refers to the volatility of stock i. VDEP, QDEP, PQSPR, QSPR, TVAL and TVOL are as defined earlier. This table presents the coefficients of concurrent market level liquidity variables; estimated coefficients for nuisance variables are not reported.

2. The results are based on a GARCH (1,1) model for each of the daily percentage changes of individual stock's liquidity proxies. The proxies are regressed in time series on percentage changes in the equal-weighted average liquidity for all stocks in the sample, excluding the stock under examination.

Table 5.5 provides evidence pertaining to the commonality in liquidity after the inclusion of industry level liquidity average. The results show that market liquidity continues to exert a strong influence on firm liquidity. This is indicated by the fact that about 23% to 28% of the firms had positive and significant impacts of market level liquidity. At the industry level, the table shows for 17% to 35% of the correlation between industry liquidity and firm liquidity were positive.

Table 5.5 Market and Industry Commonality in Liquidity

| Liquidity Proxy | Independent Variable | Mean of Estimated Coefficients | Number (per cent) of Firms with coefficient > 0 | | Number (per cent) of Firms with coefficient < 0 | |
|---|---|---|---|---|---|---|
| | | | Significant | Not Significant | Significant | Not Significant |
| VDEP | Market | 0.208 | 19 (25) | 23 (31) | 13 (17) | 20 (27) |
| | Industry | 0.247 | 15 (20) | 30 (40) | 12 (16) | 18 (24) |
| QDEP | Market | 0.028 | 19 (25) | 19 (25) | 15 (20) | 22 (29) |
| | Industry | 0.026 | 26 (35) | 18 (24) | 6 (8) | 25 (33) |
| PQSPR | Market | 0.107 | 21 (28) | 30 (40) | 11 (15) | 13 (17) |
| | Industry | 0.016 | 12 (16) | 31 (41) | 12 (16) | 20 (27) |
| QSPR | Market | 0.070 | 17 (23) | 31 (41) | 8 (11) | 19 (25) |
| | Industry | –0.002 | 13 (17) | 24 (32) | 13 (17) | 25 (33) |
| TVAL | Market | 0.653 | 21 (28) | 31 (41) | 2 (3) | 21 (28) |
| | Industry | 2.805 | 18 (24) | 31 (41) | 6 (8) | 20 (27) |
| TVOL | Market | –1.208 | 17 (23) | 36 (48) | 3 (4) | 19 (25) |
| | Industry | 2.835 | 18 (24) | 35 (47) | 3 (4) | 19 (25) |

Notes:

1. This table presents the estimation results of the commonality in liquidity by industry for 75 firms listed on the IDX over the period from 3 January 2005 to 30 December 2011.

$$DL_{i,t} = \alpha_i + \beta_1 DL_{M,t} + \beta_2 DL_{M,t+1} + \beta_3 DL_{M,t-1} + \beta_4 DL_{I,t} + \beta_5 DL_{I,t+1} + \beta_6 DL_{I,t-1} + \beta_7 R_{M,t} + \beta_8 R_{M,t+1} + \beta_9 R_{M,t-1} + \beta_{10} D(R^2_{i,t}) + \varepsilon_{i,t}$$

Where, $DL_{M,t}$; $DL_{M,t+1}$; $DL_{M,t-1}$ refer to the concurrent, lead and lag of the liquidity changes at market level, $DL_{I,t}$; $DL_{I,t+1}$; $DL_{I,t-1}$ are the concurrent, lead and lag of the liquidity changes at industry level, $R_{M,t}$; $R_{M,t+1}$; $R_{M,t-1}$ are the concurrent, lead and lag of the market returns, and $D(R^2_{i,t})$ refers to the volatility of stock i. VDEP, QDEP, PQSPR, QSPR, TVAL and TVOL are as defined earlier. This table presents the coefficients of concurrent market level liquidity variables; estimated coefficients for nuisance variables are not reported.

2. The results are based on a GARCH (1,1) model for each of the daily percentage changes of individual stock's liquidity proxies. The proxies are regressed in time series on percentage changes in the equal-weighted average liquidity for all stocks in the sample for each market-wide and industry level liquidity, excluding the stock under examination.

The industry effect, however, is generally weaker than the market effect. The regression results show that industry-specific liquidity is less influential than market-wide liquidity for

four out of six liquidity measures, viz VDEP, PQSPR, QSPR and TVAL. For example, in terms of VDEP, only 20% of the significant coefficients at the industry level and 25% at the market level, respectively. This finding of weak industry effect over aggregate market effect on commonality is contrary to Chordia, Roll and Subrahmanyam (2000) for US market but consistent with that of Brockman and Chung (2002) for Hong Kong market and Fabre and Frino (2004) for Australian market.

## 5.3 Determinants of Individual Stock Liquidity

As stated earlier, the present study will analyse the potential determinants of individual stock liquidity using individual regressions of the firm level. Narayan and Zheng (2010) argue that the approach using individual stock estimation provides more reliable results because: 1) it avoids data snooping biases of a portfolio approach which normally occur in assets pricing tests, 2) it will minimise missing information due to the aggregation from portfolio formation, and 3) it allows individual regressions to vary with size, book to market parameters and macroeconomic indicators.

The regressions will estimate the potential factors that may have significant impact on the liquidity changes of the individual stock. The potential factors examined in this study include changes of foreign ownerships, market power in the product market and regulatory factors. They will be discussed in the following sections.

### 5.3.1 Foreign Ownership

Previous research has investigated the direct impact of foreign ownership on liquidity of individual firms. The results are, however, inconclusive. Some studies have concluded that the presence of foreign investors has a negative impact on liquidity, while other studies have found a positive impact. For example, Rhee and Wang (2009) found a negative relationship between liquidity and foreign presence in the Indonesian market, arguing that foreign ownerships would increase information asymmetry between foreign and local investors and that foreign investors prefer a buy-and-hold strategy, both of which reduce the level of trading activities. Similarly, Ng et al. (2011) found that the presence of foreign ownership in twenty-eight out of a sample of forty countries had reduced free-float stocks in the markets, which then negatively affected trading activities. In contrast, Dvořák (2005) found that foreign

investors in the Indonesian stock market initiated more trades than did their local counterparts, leading to an increase in liquidity.

The impact of foreign presence on liquidity in this study is examined based on a regression analysis between the concurrent changes of foreign ownerships and changes of liquidity measures. The participation of foreign investors is estimated from the daily ratio of foreigner-owned shares to the total free-float shares for each individual stock. In order to evaluate the impact of foreign participation on the stock liquidity, it is necessary to account for the fact that liquidity has strong relationship to returns, volatility and financial crises. Hence, additional regressors (that is, market return and volatility) were used as control variables; and dummy variables were employed to represent the relevant periods of the financial crisis of 2008. The coefficients of the control variables and the dummy variables, however, are not reported in the analysis, as the focus is only on the ownership variable.

Table 5.6 provides a description of percentage foreigner-owned shares for 347 active firms from 2005 to 2011, based on the selection criteria specified in Chapter Four. The percentages are clustered according to their market capitalisations. The table shows that about 59% of the outstanding shares are in electronic form (scriptless or free-float[8]) and about 40.3% of the free-float shares are held by foreign investors. The table further shows that foreign ownership increased steadily with market capitalisation, from 23.8% in small firms to 63.9% in large firms; implying that foreign investors focus mostly on large stocks. The average foreign holding moderately conforms to the previous studies which reported that foreigners were accountable for about 42% trading activity during 1995 to 2003 (Agarwal et al. 2009), and that foreigners held about 69.4% total value of free-float shares, mainly on large firms, from 2002 to 2007 (Rhee & Wang 2009).

In order to use GARCH (1,1) model, an additional filtering criteria was applied on the 347 firms following the one used in Section 5.2 and obtained 75 sample observations. Prior to the regression estimation, the daily changes of foreign ownerships were checked for the stationarity using ADF test statistics. The results in Appendix Seven show that the null hypothesis of a non-stationarity for all sample time series observation can be rejected at the 1% significance level, implying that the changes of foreign ownerships are all stationary at the first level difference. The unit root tests for market returns were carried out in Section 5.2 and also show that all the sample series are stationary.

[8] The scriptess or free-float is the portion of shares that is tradable in the electronic trading system of IDX.

Table 5.6 Foreign Ownership in Indonesia

| Year | Bottom quintile | Quintile 2 | Quintile 3 | Quintile 4 | Top quintile | Total |
|---|---|---|---|---|---|---|
| The average of scriptless shares as percentage of outstanding shares from 2005 to 2011 (%) | | | | | | |
| | 64.6 | 54.3 | 59.8 | 56.1 | 60.3 | 59.0 |
| Foreign owned shares as percentage of scriptless shares (%) | | | | | | |
| 2005 | 19.4 | 24.8 | 33.3 | 46.9 | 68.5 | 37.1 |
| 2006 | 19.9 | 30.1 | 37.3 | 47.7 | 69.4 | 39.7 |
| 2007 | 21.7 | 31.6 | 36.4 | 48.7 | 66.0 | 40.2 |
| 2008 | 23.2 | 33.1 | 37.3 | 46.7 | 61.9 | 39.9 |
| 2009 | 25.2 | 34.8 | 37.1 | 44.3 | 61.7 | 40.2 |
| 2010 | 26.0 | 34.5 | 38.2 | 44.8 | 62.0 | 41.3 |
| 2011 | 30.3 | 35.2 | 39.9 | 47.7 | 60.7 | 42.9 |
| Average | 23.8 | 32.3 | 37.2 | 46.6 | 63.9 | 40.3 |

Notes: This table reports the percentage of scriptless shares as the free-float portion of total shares outstanding, and the foreign holding shares as percentage of outstanding scriptless shares. The quintiles are categorised based on the firm size, bottom quintile is for small firms and top quintiles are for large firms. The percentages are obtained by first calculating the annual average of daily foreign ownership for each stock, and then, calculating the cross sectional foreign ownership within the corresponding year. Following Rhee and Wang (2009), this study concentrates only on the scriptless or the tradable portion.

Table 5.7 reports the output of the regression for the impact of foreign ownership changes on liquidity after controlling for the market returns, volatility and financial crisis. It was found that, depending on the liquidity measures used, only 3% to 20% of 75 stocks exhibit positive effect of foreign presence while 5% to 13% of the stocks have negative effect, leaving the majority of the stocks with no significant effect of foreign presence.

Table 5.7 Impact of Foreign Presence on Liquidity

| Liquidity Proxy | Mean of Estimated Coefficient ($\beta_1$) | Number (per cent) of Firms with coefficient > 0 | | Number (per cent) of Firms with coefficient < 0 | |
|---|---|---|---|---|---|
| | | Significant | Not Significant | Significant | Not Significant |
| DVDEP | 3.096 | 14 (19) | 27 (36) | 4 (5) | 30 (40) |
| DQDEP | 6.215 | 15 (20) | 27 (36) | 8 (11) | 25 (33) |
| DPQSPR | -0.601 | 10 (13) | 28 (37) | 10 (13) | 27 (36) |
| DQSPR | -0.684 | 11 (15) | 25 (33) | 10 (13) | 29 (39) |
| DTVAL | -4.692 | 6 (8) | 16 (21) | 7 (9) | 46 (61) |
| DTVOL | -1.768 | 2 (3) | 24 (32) | 8 (11) | 41 (55) |

Notes:

1. The results are based on a GARCH (1,1) model for each of the daily percentage changes of individual stock's liquidity proxies and changes of foreign ownership percentages.

$$DL_{i,t} = \alpha_i + \beta_1 DForeign_{i,t} + \beta_2 Crs + \beta_3 PostCrs + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 D(R^2_{i,t}) + \varepsilon_{i,t}$$

Where, DL refers to the daily changes of liquidity measures. DForeign is the daily changes of the percentage of foreign ownership. Crs refers to the dummy variables represent the period during the 2008 financial crisis. PostCrs is the dummy variable representing the period after the 2008 financial crisis. $R_M$, $R_{M,t+1}$, $R_{M,t-1}$ are the concurrent, lead and lag of the market returns. $D(R^2_{i,t})$ refers to the volatility of stock i. VDEP, QDEP, PQSPR, QSPR, TVAL and TVOL is as defined earlier.

Thus, the results of the research did not support hypothesis H8 which states that foreign investor participations have strong influence on liquidity. This finding is not consistent with those of Levine and Zervos (1998), Dvořák (2005) and Sun, Tong and Yan (2009) who documented positive associations, and with the findings of De la Torre, Gozzi and Schmukler (2007) and Rhee and Wang (2009) who found negative correlations. One possible explanation for this observation could be the herding effect hypothesis, which is defined by Bowe and Domuta (2004) as a situation where all investors make the same set of choices. In their study of herding behaviour of local and foreign investors in the Indonesian market during the 1997 Financial Crisis, Bowe and Domuta (2004) found that both foreign and local investors have a strong behaviour of herding. The foreign investors, however, had a stronger tendency to exhibit herding compared to the domestic investors. As a result, foreign investors may have no dominant influence on the liquidity variations.

### 5.3.2 Market Power

Kale and Loon (2011) found that the level of market power acts as a strong driver of liquidity. Using price cost margin and market share as proxies for market power, their finding supports the earlier theoretical model developed by Peress (2010) who argued that liquidity will improve with market power by lowering volatility.

Motivated by Kale and Loon (2011), the present study examined the impact of market power on market liquidity using the quarterly observations of price cost margin. The data set employed for market power estimations was obtained from the Bloomberg database covering unbalanced quarterly observations of 139 firms from the first quarter of 2005 to fourth quarter of 2011 consisting a total of 3,482 firm quarters. The selected sample observations included at least twenty quarters, to a maximum of twenty-eight quarters, with a mean and median number of quarters of twenty-five and twenty-four, respectively.

This thesis first applied a univariate technique to examine the relationship between liquidity and market power. Table 5.8 shows the univariate analysis where quartile one is for the liquidity of firms with the lowest market power and quartile four is for those with the highest market power. Where liquidity is positively related to market power, market depth and trading activity (spread) are expected to increase (decrease) when market power increases. The results show that for all liquidity measures, there is a statistically significant increase in liquidity moving from quartile one to quartile four. For example, proportional quoted spread decreased

from 0.055 in quartile one to 0.025 in quartile four. These results are consistent with the findings of Kale and Loon (2011).

Table 5.8 Univariate Analysis of Market Power

| Liquidity | Market Power Quartiles | | | | Sig-Difference 1–4 |
|---|---|---|---|---|---|
| | 1 (Lowest) | 2 | 3 | 4 (Highest) | |
| VDEP | 0.262 | 0.409 | 0.837 | 1.901 | 0.000*** |
| QDEP | 0.846 | 0.988 | 1.362 | 1.190 | 0.087* |
| PQSPR | 0.055 | 0.039 | 0.028 | 0.025 | 0.000*** |
| QSPR | 0.223 | 0.323 | 0.361 | 0.423 | 0.001*** |
| TVAL | 2.855 | 4.782 | 15.431 | 31.098 | 0.000*** |
| TVOL | 7.227 | 7.560 | 13.092 | 12.704 | 0.013** |

Notes: This table reports liquidity for four groups of market power levels. The sample was sorted from a panel dataset of 3,482 firm-quarter observations from 2005 to 2011. VDEP, QDEP, PQSPR, QSPR, TVAL and TVOL are as defined earlier. Sig-Difference 1-4 is the difference between liquidity in quartiles 1 and 4 assuming unequal variance. ***, **, * denotes significance at 1%, 5%, 10% levels, respectively.

Further analyses were carried out on the results presented in the previous table. The first estimated the number of firms that exerted market power on stock liquidity and the second estimated the aggregate beta coefficients of the regressions using the modified Fama and MacBeth (1973) procedure.

The analysis of the market power involved the estimation of 139 individual time series regressions with firm liquidity as the dependent variable and lagged market power as the independent variable. Market power variable was lagged in order to capture the delayed effect of the information content of financial statements on liquidity. Departing from the previous models estimated in the thesis, these regressions did not include lag and lead returns as control variables; the delayed effect of information on market returns is assumed to be less apparent in the quarterly observations. If market power is positively related to liquidity, there should be a substantial number of firms with positive coefficients for market depth measures, and negative coefficients for trading cost measures.

Table 5.9 reports the summary of the estimation output of the OLS regressions. The table shows that value depth has the highest percentage (20%) of firms with significantly positive coefficients while proportional quoted spread has the highest percentage (20%) of firms with

significantly negative coefficients. The second largest percentage (17%) of firms with significantly negative coefficients is TVAL. Overall, except for QSPR, the results suggest that market power has positive impact on market depth and trading activity, and negative impact on trading costs. That is consistent with the expectation based on literature.

Table 5.9 Impact of Market Power on Liquidity

| Liquidity Proxy | Number (per cent) of Firms with coefficient > 0 | | Number (per cent) of Firms with coefficient < 0 | |
|---|---|---|---|---|
| | Significant | Not Significant | Significant | Not Significant |
| VDEP | 28 (20) | 63 (45) | 7 (5) | 41 (29) |
| QDEP | 22 (16) | 56 (40) | 17 (12) | 44 (32) |
| PQSPR | 5 (4) | 36 (26) | 28 (20) | 70 (50) |
| QSPR | 19 (14) | 57 (41) | 9 (6) | 54 (39) |
| TVAL | 24 (17) | 76 (55) | 5 (4) | 34 (24) |
| TVOL | 19 (14) | 69 (50) | 8 (6) | 43 (31) |

Notes:

1. This table presents the estimation results of the impact of market power on liquidity for 139 firms listed on the IDX over the period from 1st quarter 2005 to 4th quarter 2011.

$$LIQ_{i,t} = \alpha_i + \beta_1 MP_{i,t-1} + \beta_2 R_{M,t} + \beta_3 R_{i,t}^2 + \varepsilon_{i,t}$$

   Where, LIQ denotes the quarterly average of liquidity measures. MP refers to market power. $R_{M,t}$ is the quarterly market return at time t. $R_{i,t}^2$ is the firm squared return to represent volatility of stock *i* at time t. VDEP, QDEP, PQSPR, QSPR, TVAL and TVOL is as defined earlier.

2. The results are based on an OLS model for each of the quarterly average of individual stock's liquidity proxies. The proxy of market power (MP) is the price cost margin measured by the operating profit margin.

The second analysis involved the computation of the aggregate beta estimates, the t-statistics, and the respective adjusted $R^2$ across the firm level regressions employing the modified Fama-MacBeth approach. Following the estimation of the time series regressions, cross sectional regressions were computed between stock liquidity and the betas obtained from the original regressions. The relevant model is presented below:

$$LIQ_{i,T} = \gamma_{T,0} + \gamma_{T,1}\beta_{i,MP} + \gamma_{T,2}\beta_{i,R_M} + \gamma_{T,3}\beta_{i,R_i^2} + \varepsilon_{i,T}$$

Where: $LIQ_{i,T}$ is the liquidity proxies of stock *i* at time T, $\beta_{i,MP}$ are the beta coefficients of market power for stock *i*, $\beta_{i,R_M}$ are the beta coefficients of market return for stock *i*, $\beta_{i,R_i^2}$ are the beta coefficients of squared return of stock *i*, $\gamma$ is the estimated coefficient of the second step and $\varepsilon_{i,T}$ is the random error. *T* ranges from first quarter 2005 to fourth quarter 2011 while *i* consists of 139 firms.

The final step involves the averaging of $\gamma_T$ over *T* quarters to obtain the coefficients of market power, market return and individual stock volatility. Following Jun, Marathe and Shawky (2003), the adjusted t-statistics is calculated as:

$$t = \frac{\bar{\beta}}{\sigma/\sqrt{T-1}}$$

were $\bar{\beta}$ is the mean estimated beta coefficients over *T* quarters from the second step regressions and σ refers to the standard deviation of the estimated beta coefficient across *T* quarters.

The results of Fama-MacBeth regressions are reported in Table 5.10. The findings are consistent with the results reported in the first step. Specifically, the coefficients on the lagged market power for the three liquidity measures are significant at the 1% level. The positive sign on value depth and trading values and the negative sign on proportional quoted spread suggest that lagged market power has positive impact on market liquidity.

Table 5.10 Fama-MacBeth Regressions of Market Power on Liquidity

| | VDEP | QDEP | PQSPR | QSPR | TVAL | TVOL |
|---|---|---|---|---|---|---|
| Intercept | 0.435*** | 0.865*** | 0.021*** | 0.167*** | 2.228*** | 4.635*** |
| | (14.069) | (14.892) | (17.669) | (23.262) | (8.944) | (12.186) |
| Lagged Market Power ($\bar{\gamma}_1$) | 0.104*** | 0.009 | –0.026*** | –0.012 | 0.057*** | –0.070 |
| | (7.867) | (0.821) | (-6.238) | (–0.735) | (5.875) | (-1.487) |
| Market Return($\bar{\gamma}_2$) | 0.517*** | –0.198 | –0.710*** | 1.046*** | 1.009*** | 0.528*** |
| | (5.333) | (–1.508) | (–6.244) | (5.861) | (11.07) | (5.248) |
| Stock Volatility ($\bar{\gamma}_3$) | –0.002*** | 0.002*** | 0.001*** | 0.002*** | 0.001*** | 0.002*** |
| | (–15.382) | (5.012) | (5.093) | (8.647) | (4.108) | (3.877) |
| Average $R^2$ | 0.558 | 0.336 | 0.299 | 0.680 | 0.698 | 0.470 |

Notes: This table presents two-step Fama-MacBeth regressions of the impact of market power on liquidity. The sample is 139 firms with 28 quarters from 1st quarter 2005 to 4th quarter 2011.

First step: $LIQ_{i,t} = \alpha_i + \beta_1 MP_{i,t-1} + \beta_2 R_{M,t} + \beta_3 R_{i,t}^2 + \varepsilon_{i,t}$

Second step: $LIQ_{i,T} = \gamma_{T,0} + \gamma_{T,1}\beta_{i,MP} + \gamma_{T,2}\beta_{i,R_M} + \gamma_{T,3}\beta_{i,R_i^2} + \varepsilon_{i,T}$

Where, LIQ denotes the quarterly average of liquidity measures. MP refers to market power which is measured as the operating profit margin. $R_{M,t}$ is the quarterly market return at time t. $R_{i,t}^2$ is the firm squared return to represent volatility of stock *i* at time t. The coefficients are the average from the quarterly cross sectional regressions. VDEP, QDEP, PQSPR, QSPR, TVAL and TVOL are as defined earlier. Numbers in parenthesis are Fama-MacBeth t-statistics adjusted for first-order autocorrelation. Average $R^2$ is the average from the quarterly cross sectional regressions. ***, **, * denotes significance at 1%, 5%, 10% levels, respectively.

To summarise, the univariate analysis and the two-step regression analysis provide ample evidence to support for the hypothesis H9 that expects positive relationship between market power and liquidity. This suggests that the market power in the Indonesian market seems to behave consistent to those studied by Peress (2010) and Kale and Loon (2011).

### 5.3.3 Regulatory Factors

Three regulatory events: changes to tick size clusters, changes to margin trading eligibility and announcement of unusual market activity were deployed to examine the impact of regulatory events on liquidity. As main references, this thesis used two notable studies on the tick size impact by Bessembinder (2000) and Aitken and Comerton-Forde (2005), and a study on the inclusion impact of the margin eligibility list by Alexander et al. (2004). Following the methodology used by Bessembinder (2000) and Alexander et al. (2004), rather than investigating differences in market liquidity surrounding changes in market-wide events, this study investigates the differences in market liquidity surrounds the associated firm-by-firm events.

The study will first calculate the average pre- and post-events liquidity for each firm across the included regulatory events. In the following section, five pairs of pre- and post-event average liquidity will be contrasted, from one day before and one day after to five days before and five days after the regulatory events. Paired-sample t-test and Wilcoxon signed-rank tests were conducted to test whether the pre- and post- event liquidity were statistically significant. The outputs of those two tests, however, are largely comparable with a stronger level of significance generated from the non-parametric test as shown in Tables 15.12 to 15.16. The next section provides the descriptions of the regulatory events along with the output of statistical tests for the mean and median before and after the regulatory events.

#### Events of Tick Size Changes

As shown in Table 5.11, during the period from 2005 to 2011, the study sample experienced 3,123 events of tick size changes.[9] Of the 139 stocks in the sample, 130 experienced 1,601 events of a tick size increase and 132 stocks faced 1,522 events of tick size decrease. There were 1,420 cases of tick size increasing following a tick size decrease and 102 cases of

[9] The tick size increment is presented in Table 2.4 and identified based on the changes of closing price.

consecutive tick size increases. There were 1,415 cases of tick size decreasing following tick size increase and 54 cases of consecutive tick size deceases. A total of 79 events of tick size increase and 53 events of tick size decrease were observed for the first time where the changes prior to the beginning of the sample period were not identified.

Table 5.11 Events of Tick Size Changes

| Events | Number of Events |
|---|---|
| Tick_Up | 1,601 |
| The stock price reversed to a higher tick size | 1,420 |
| The stock price increased further to a higher tick size | 102 |
| The first observation of tick increases with unidentified previous changes | 79 |
| Tick_Down | 1,522 |
| The stock price reversed to a lower tick size | 1,415 |
| The stock price decreased further to a lower tick size | 54 |
| The first observation of tick decreases with unidentified previous changes | 53 |
| Total | 3,123 |

Notes: The events of tick size changes were identified from the changes of the individual stocks' closing prices. A closing price that passed a higher tick size group is categorised as a Tick_Up event. In contrast, lower closing price compared to the previous days that passed over a lower tick size group is classified as a Tick_Down event.

Table 5.12 provides measures of the differences in liquidity for each pair of average liquidity before and after the tick-increasing events. In general, there is a significant increase of mean and median of average liquidity following a tick-increasing event across all pairs of time windows. The mean differences seem to be get gradually smaller when moving from the shortest to the longest event windows. For example, for value depth the one-day window surrounding a tick-increasing event had a difference at Rp0.433 billion, which is greater than that of the five-day window at Rp0.284 billion.

A similar pattern is found for all other measures. An increase in spread measures is consistent with predictions. The positive changes observed for quoted spreads following a higher tick size is an indication that tick size has a direct impact of restricting the spreads from decreasing further. This behaviour was documented by Chung, Kang and Kim (2011). A prediction of such a relationship is that a higher tick size leads to a higher quoted spread. But, given the increasing spreads, an increase in market depth and trading activity is unexpected. This finding may suggest that the expected profits generated from higher price increments due

to a higher tick sizes outweighs the trading costs. Hence, the results of the present sample do not strongly support the proposition that higher tick sizes would subsequently reduce liquidity.

Table 5.12 Liquidity Comparison of Pre- and Post-Tick Size Increasing Events

| Liquidity | Mean | | | | Median | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Difference | | Pre | Post | Difference | |
| VDEP | | | | | | | | |
| Pair_1 | 0.825 | 1.258 | 0.433 | *** | 0.0484 | 0.1048 | 0.0564 | *** |
| Pair_2 | 0.855 | 1.247 | 0.392 | *** | 0.0582 | 0.1237 | 0.0655 | *** |
| Pair_3 | 0.862 | 1.211 | 0.349 | *** | 0.0584 | 0.1265 | 0.0681 | *** |
| Pair_4 | 0.883 | 1.188 | 0.305 | *** | 0.0603 | 0.1254 | 0.0651 | *** |
| Pair_5 | 0.899 | 1.183 | 0.284 | *** | 0.0643 | 0.1255 | 0.0612 | *** |
| QDEP | | | | | | | | |
| Pair_1 | 1.476 | 2.202 | 0.726 | *** | 0.1023 | 0.1900 | 0.0877 | *** |
| Pair_2 | 1.522 | 2.180 | 0.658 | *** | 0.1290 | 0.2173 | 0.0883 | *** |
| Pair_3 | 1.543 | 2.108 | 0.565 | ** | 0.1370 | 0.0822 | 0.0822 | *** |
| Pair_4 | 1.611 | 2.054 | 0.443 | * | 0.1390 | 0.0909 | 0.0909 | *** |
| Pair_5 | 1.664 | 2.029 | 0.365 | | 0.1415 | 0.094 | 0.0940 | *** |
| PQSPR | | | | | | | | |
| Pair_1 | 0.028 | 0.031 | 0.003 | *** | 0.0108 | 0.0202 | 0.0094 | *** |
| Pair_2 | 0.028 | 0.031 | 0.003 | *** | 0.0149 | 0.0198 | 0.0049 | *** |
| Pair_3 | 0.029 | 0.031 | 0.002 | ** | 0.0146 | 0.0052 | 0.0052 | *** |
| Pair_4 | 0.029 | 0.031 | 0.002 | ** | 0.0154 | 0.0044 | 0.0044 | *** |
| Pair_5 | 0.030 | 0.031 | 0.001 | ** | 0.0162 | 0.0038 | 0.0038 | *** |
| QSPR | | | | | | | | |
| Pair_1 | 0.198 | 0.256 | 0.058 | *** | 0.1000 | 0.1000 | 0.0000 | *** |
| Pair_2 | 0.202 | 0.254 | 0.052 | *** | 0.0850 | 0.1000 | 0.0150 | *** |
| Pair_3 | 0.209 | 0.251 | 0.042 | *** | 0.0967 | 0.1000 | 0.0033 | *** |
| Pair_4 | 0.211 | 0.248 | 0.037 | *** | 0.0875 | 0.1000 | 0.0125 | *** |
| Pair_5 | 0.213 | 0.247 | 0.034 | *** | 0.0900 | 0.1000 | 0.0100 | *** |
| TVAL | | | | | | | | |
| Pair_1 | 14.191 | 18.523 | 4.332 | *** | 0.5037 | 1.4178 | 0.9141 | *** |
| Pair_2 | 13.810 | 16.888 | 3.078 | *** | 0.6323 | 1.3897 | 0.7574 | *** |
| Pair_3 | 13.630 | 15.997 | 2.367 | *** | 0.5922 | 1.3406 | 0.7484 | *** |
| Pair_4 | 13.475 | 15.584 | 2.109 | *** | 0.6005 | 1.3173 | 0.7168 | *** |
| Pair_5 | 13.206 | 15.250 | 2.044 | *** | 0.6092 | 1.3691 | 0.7599 | *** |
| TVOL | | | | | | | | |
| Pair_1 | 15.240 | 21.041 | 5.801 | *** | 1.2805 | 2.5275 | 1.2470 | *** |
| Pair_2 | 14.814 | 19.095 | 4.281 | *** | 1.3970 | 2.5853 | 1.1883 | *** |
| Pair_3 | 14.144 | 18.034 | 3.890 | *** | 1.3600 | 2.6102 | 1.2502 | *** |
| Pair_4 | 13.901 | 17.228 | 3.327 | *** | 1.4121 | 2.6445 | 1.2324 | *** |
| Pair_5 | 13.658 | 16.760 | 3.102 | *** | 1.4505 | 2.5587 | 1.1082 | *** |

Table 5.12 Continued

Notes: This table reports mean and median liquidity based on 1,601 events where a share price passed to a higher tick size using five event windows. These five pair event windows compare the average liquidity up to five trading days prior to the events (–5 to –1) and five trading days post the events (+1 to +5). Value Depth is in billion rupiah, Quantity Depth is in million shares, Quoted Spread is in hundred rupiah, Trading Value is in billion rupiah per day, and Trading Volume is in million shares per day. Mean (median) difference is tested by using a paired t test (Wilcoxon signed-rank test). ***, **, * the differences are significant at 1%, 5% and 10% respectively.

Table 5.13 reports the average liquidity changes during the periods surrounding tick-decreasing events. The results show significant reduction of mean and median levels for all pairs. Consistent with prior research in the IDX by Allen and Sudiman (2009), trading activity experienced significant declines following a tick size decrease. A significant decline of the average quoted spread was also found following a lowering of tick size, which is consistent with the finding of Aitken and Comerton-Forde (2005) for the Australian market.

It is also important to note that the reduction in the mean difference of market depth and spreads is consistently lower as the time horizon in the comparison interval is lengthened. For value depth, the reductions declined from Rp0.40 billion per day in a one-day interval to Rp0.29 billion per day in a five-day interval. Different patterns were found for trading value and trading volume. The decline in trading value tends to increase over a longer horizon, and that of trading volume seems to decrease over a longer horizon suggesting that tick size reductions may have a greater impact on the low priced stocks, as indicated by increasing trading volume. As such, when the trading volume gradually reversed, trading value did not follow the reversal.

The above findings agreed with by Chung, Kang and Kim (2011) who suggest that lowering tick sizes would reduce liquidity as the liquidity providers are less willing to supply liquidity due to higher risk of front running. This occurs when the decrease in tick size follows a decrease in quoted depth that may result in increasing trading costs, particularly for traders with large volume orders.

Table 5.13 Liquidity Comparison of Pre- and Post-Tick Size Decreasing Events

| Liquidity | Mean | | | | Median | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Difference | | Pre | Post | Difference | |
| VDEP | | | | | | | | |
| Pair_1 | 1.127 | 0.727 | –0.400 | *** | 0.0732 | 0.0398 | –0.0334 | *** |
| Pair_2 | 1.100 | 0.742 | –0.358 | *** | 0.0829 | 0.0523 | –0.0306 | *** |
| Pair_3 | 1.086 | 0.773 | –0.313 | *** | 0.0892 | 0.0563 | –0.0329 | *** |
| Pair_4 | 1.088 | 0.785 | –0.303 | *** | 0.0916 | 0.0600 | –0.0316 | *** |
| Pair_5 | 1.081 | 0.791 | –0.290 | *** | 0.0941 | 0.0634 | –0.0307 | *** |
| QDEP | | | | | | | | |
| Pair_1 | 1.936 | 1.233 | –0.703 | *** | 0.1429 | 0.0935 | –0.0494 | *** |
| Pair_2 | 1.946 | 1.279 | –0.667 | *** | 0.1730 | 0.1189 | –0.0541 | *** |
| Pair_3 | 1.845 | 1.328 | –0.517 | *** | 0.1880 | 0.1299 | –0.0581 | *** |
| Pair_4 | 1.794 | 1.345 | –0.449 | *** | 0.1888 | 0.1419 | –0.0469 | *** |
| Pair_5 | 1.787 | 1.322 | –0.465 | *** | 0.1853 | 0.1458 | –0.0395 | *** |
| PQSPR | | | | | | | | |
| Pair_1 | 0.034 | 0.032 | –0.002 | ** | 0.0202 | –0.0052 | –0.0052 | *** |
| Pair_2 | 0.034 | 0.032 | –0.002 | | 0.0201 | –0.0042 | –0.0042 | *** |
| Pair_3 | 0.034 | 0.033 | –0.001 | | 0.0201 | –0.0031 | –0.0031 | *** |
| Pair_4 | 0.034 | 0.033 | –0.001 | | 0.0202 | –0.0029 | –0.0029 | *** |
| Pair_5 | 0.034 | 0.033 | –0.001 | | 0.0206 | –0.0029 | –0.0029 | *** |
| QSPR | | | | | | | | |
| Pair_1 | 0.245 | 0.210 | –0.035 | *** | 0.1000 | 0.1000 | 0.0000 | *** |
| Pair_2 | 0.243 | 0.215 | –0.028 | *** | 0.1000 | 0.1000 | 0.0000 | *** |
| Pair_3 | 0.243 | 0.216 | –0.027 | *** | 0.1000 | 0.1000 | 0.0000 | *** |
| Pair_4 | 0.242 | 0.220 | –0.022 | *** | 0.1000 | 0.1000 | 0.0000 | *** |
| Pair_5 | 0.242 | 0.222 | –0.020 | *** | 0.1060 | 0.1000 | –0.0060 | *** |
| TVAL | | | | | | | | |
| Pair_1 | 13.466 | 12.370 | –1.096 | | 0.5483 | –0.1285 | –0.1285 | *** |
| Pair_2 | 13.740 | 12.204 | –1.536 | *** | 0.6177 | 0.4579 | –0.1598 | *** |
| Pair_3 | 13.372 | 11.970 | –1.402 | *** | 0.5946 | 0.4899 | –0.1047 | *** |
| Pair_4 | 13.584 | 11.883 | –1.701 | *** | 0.6238 | 0.5200 | –0.1038 | *** |
| Pair_5 | 13.580 | 11.823 | –1.757 | *** | 0.6485 | 0.5144 | –0.1341 | *** |
| TVOL | | | | | | | | |
| Pair_1 | 14.294 | 11.831 | –2.463 | ** | 1.1923 | –0.1535 | –0.1535 | *** |
| Pair_2 | 15.050 | 11.644 | –3.406 | *** | 1.3200 | 1.1218 | –0.1982 | *** |
| Pair_3 | 14.250 | 11.548 | –2.702 | *** | 1.5188 | 1.2171 | –0.3017 | *** |
| Pair_4 | 14.305 | 11.604 | –2.701 | *** | 1.5504 | 1.3866 | –0.1638 | *** |
| Pair_5 | 14.144 | 11.652 | –2.492 | *** | 1.5895 | 1.3858 | –0.2037 | *** |

Notes: This table reports mean and median liquidity based on 1,522 events where a share price passed to a lower tick size using five event windows. These five pair event windows compare the average liquidity up to five trading days prior to the events (–5 to –1) and five trading days post the events (+1 to +5). Value Depth is in billion rupiah, Quantity Depth is in million shares, Quoted Spread is in hundred rupiah, Trading Value is in billion rupiah per day, and Trading Volume is in million shares per day. Mean (median) difference is tested by using a paired t test (Wilcoxon signed-rank test). ***, **, * the differences are significant at 1%, 5% and 10% respectively.

**Events of Margin-Eligibility Changes**

IDX limits the number of stocks eligible for margin trading to control the risk of pyramiding and de-pyramiding, as discussed in Chapter Two. The changes in margin-eligibility affect are only a small portion of stocks at a specific period as noted by Seguin (1990) and Alexander et al. (2004). That is, when a stock gains eligibility for margin trading, it is likely that the stock will remain on the list for the subsequent periods. Among the 139 stocks in the sample observations, seventy-one stocks experienced 112 events of inclusion on the list of margin eligible stocks, and seventy-five stocks faced 125 events where they were excluded from the list.

Table 5.14 shows the average liquidity before and after the inclusion on margin-eligibility list. The results generally show that the inclusion of margin-eligibility tends to increase market depth and trading activity but leads to a higher quoted spread. In addition, the impact of stocks gaining margin eligibility status seems to get weaker with the lengthening time horizon. For example, the post-event average value depth increased by 0.282 billion shares in one-day intervals but the increase was only about a half of that of the five-day interval. This indicates that the magnitude of the impact tends to decrease over a longer time horizon. This finding suggests that investors may replace their margin-trading portfolio with the margin eligible stocks; a trading strategy which increases the liquidity of the respective stocks. Once the portfolio reposition has taken place, the trading activity of such a stock would gradually decrease. Thus, the output provides evidence that inclusion of a stock on a margin eligible list had positive impact on liquidity but at a decreasing rate with the longer time horizon.

Table 5.14 Liquidity Comparison of Pre- and Post-Inclusion of Margin-Eligibility

| Liquidity | Mean | | | | Median | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Difference | | Pre | Post | Difference | |
| VDEP | | | | | | | | |
| Pair_1 | 0.832 | 1.115 | 0.283 | ** | 0.3252 | 0.5420 | 0.2168 | * |
| Pair_2 | 0.878 | 1.150 | 0.272 | ** | 0.4540 | 0.6119 | 0.1579 | *** |
| Pair_3 | 0.901 | 1.099 | 0.198 | ** | 0.5397 | 0.6294 | 0.0897 | *** |
| Pair_4 | 0.923 | 1.101 | 0.178 | ** | 0.5228 | 0.6725 | 0.1497 | *** |
| Pair_5 | 0.968 | 1.116 | 0.148 | ** | 0.5775 | 0.6663 | 0.0888 | *** |
| QDEP | | | | | | | | |
| Pair_1 | 2.322 | 2.538 | 0.216 | | 0.4168 | 0.5948 | 0.1780 | |
| Pair_2 | 2.383 | 2.813 | 0.430 | | 0.4885 | 0.6313 | 0.1428 | *** |
| Pair_3 | 2.393 | 2.782 | 0.389 | | 0.5410 | 0.6444 | 0.1034 | ** |
| Pair_4 | 2.460 | 2.810 | 0.350 | | 0.6215 | 0.5984 | –0.0231 | ** |
| Pair_5 | 2.506 | 2.851 | 0.345 | | 0.6320 | 0.6196 | –0.0124 | ** |
| PQSPR | | | | | | | | |
| Pair_1 | 0.013 | 0.015 | 0.002 | | 0.0118 | 0.0121 | 0.0003 | |
| Pair_2 | 0.013 | 0.014 | 0.001 | | 0.0119 | 0.0124 | 0.0005 | |
| Pair_3 | 0.013 | 0.014 | 0.001 | | 0.0120 | 0.0123 | 0.0003 | |
| Pair_4 | 0.013 | 0.014 | 0.001 | | 0.0118 | 0.0126 | 0.0008 | |
| Pair_5 | 0.013 | 0.014 | 0.001 | | 0.0117 | 0.0125 | 0.0008 | |
| QSPR | | | | | | | | |
| Pair_1 | 0.139 | 0.262 | 0.123 | * | 0.1000 | 0.1000 | 0.0000 | *** |
| Pair_2 | 0.143 | 0.233 | 0.090 | * | 0.1000 | 0.1000 | 0.0000 | ** |
| Pair_3 | 0.149 | 0.224 | 0.075 | * | 0.1000 | 0.1000 | 0.0000 | |
| Pair_4 | 0.147 | 0.217 | 0.070 | * | 0.1000 | 0.1000 | 0.0000 | ** |
| Pair_5 | 0.147 | 0.212 | 0.065 | * | 0.1000 | 0.1000 | 0.0000 | ** |
| TVAL | | | | | | | | |
| Pair_1 | 12.561 | 20.069 | 7.508 | *** | 4.9291 | 7.6235 | 2.6944 | *** |
| Pair_2 | 12.427 | 18.006 | 5.579 | *** | 4.6133 | 8.8508 | 4.2375 | *** |
| Pair_3 | 12.173 | 16.635 | 4.462 | ** | 5.7625 | 2.4103 | 2.4104 | *** |
| Pair_4 | 12.825 | 16.434 | 3.609 | ** | 5.7566 | 1.5455 | 1.5455 | ** |
| Pair_5 | 13.013 | 16.886 | 3.873 | ** | 5.9386 | 0.7238 | 0.7237 | *** |
| TVOL | | | | | | | | |
| Pair_1 | 31.419 | 46.329 | 14.910 | ** | 4.9135 | 3.1733 | 3.1733 | *** |
| Pair_2 | 34.862 | 43.106 | 8.244 | | 5.7006 | 1.6917 | 1.6916 | *** |
| Pair_3 | 34.811 | 38.326 | 3.515 | | 6.7243 | 0.8340 | 0.8341 | ** |
| Pair_4 | 37.577 | 38.150 | 0.573 | | 7.4021 | 6.7522 | –0.6499 | |
| Pair_5 | 38.004 | 37.838 | –0.166 | | 7.6900 | 1.0610 | 1.0610 | * |

Notes: This table reports mean and median liquidity based on 112 events where a stock is included in a margin eligible list using five event windows. These 5 pair event windows compare the average liquidity up to 5 trading days prior to the events (-5 to -1) and 5 trading days post the events (+1 to +5). Value Depth is in billion rupiah, Quantity Depth is in million shares, Quoted Spread is in hundred rupiah, Trading Value is in billion rupiah per day, and Trading Volume is in million shares per day. Mean (median) difference is tested by using a paired t test (Wilcoxon signed-rank test). ***, **, * the differences are significant at 1%, 5% and 10% respectively.

In contrast, as shown in Table 5.15, the exclusion of a stock from margin eligibility list did not affect its liquidity in significant way.

Table 5.15 Liquidity Comparison of Pre- and Post-Exclusion of Margin-Eligibility

| Liquidity | Mean | | | | Median | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Difference | | Pre | Post | Difference | |
| VDEP | | | | | | | | |
| Pair_1 | 0.595 | 0.643 | 0.048 | | 0.1895 | 0.2060 | 0.0165 | |
| Pair_2 | 0.558 | 0.548 | –0.010 | | 0.2751 | 0.2412 | –0.0339 | |
| Pair_3 | 0.575 | 0.563 | –0.012 | | 0.2716 | 0.2214 | –0.0502 | |
| Pair_4 | 0.567 | 0.571 | 0.004 | | 0.2796 | 0.2403 | –0.0393 | |
| Pair_5 | 0.569 | 0.578 | 0.009 | | 0.3235 | 0.2374 | –0.0861 | |
| QDEP | | | | | | | | |
| Pair_1 | 1.509 | 1.501 | –0.008 | | 0.3250 | 0.3015 | –0.0235 | |
| Pair_2 | 1.382 | 1.270 | –0.112 | | 0.3659 | 0.3084 | –0.0575 | |
| Pair_3 | 1.386 | 1.229 | –0.157 | | 0.3317 | 0.2896 | –0.0421 | |
| Pair_4 | 1.367 | 1.255 | –0.112 | | 0.3731 | 0.3219 | –0.0512 | |
| Pair_5 | 1.605 | 1.285 | –0.320 | | 0.3996 | 0.3350 | –0.0646 | |
| PQSPR | | | | | | | | |
| Pair_1 | 0.018 | 0.017 | –0.001 | | 0.0153 | 0.0136 | –0.0017 | |
| Pair_2 | 0.017 | 0.017 | 0.000 | | 0.0158 | 0.0153 | –0.0005 | |
| Pair_3 | 0.017 | 0.017 | 0.000 | | 0.0156 | 0.0152 | –0.0004 | |
| Pair_4 | 0.017 | 0.017 | 0.000 | | 0.0160 | 0.0159 | –0.0001 | |
| Pair_5 | 0.017 | 0.017 | 0.000 | | 0.0153 | 0.0158 | 0.0005 | |
| QSPR | | | | | | | | |
| Pair_1 | 0.237 | 0.148 | –0.089 | * | 0.1000 | 0.1000 | 0.0000 | ** |
| Pair_2 | 0.198 | 0.161 | –0.037 | ** | 0.1000 | 0.1000 | 0.0000 | |
| Pair_3 | 0.179 | 0.167 | –0.012 | | 0.1000 | 0.1000 | 0.0000 | |
| Pair_4 | 0.177 | 0.167 | –0.010 | | 0.1000 | 0.1000 | 0.0000 | |
| Pair_5 | 0.174 | 0.167 | –0.007 | | 0.1000 | 0.1000 | 0.0000 | |
| TVAL | | | | | | | | |
| Pair_1 | 10.682 | 12.933 | 2.251 | | 1.5197 | 1.3644 | –0.1553 | |
| Pair_2 | 10.033 | 13.290 | 3.257 | | 1.5481 | 1.5792 | 0.0311 | |
| Pair_3 | 10.618 | 13.113 | 2.495 | | 1.9941 | 1.6527 | –0.3414 | |
| Pair_4 | 9.613 | 13.850 | 4.237 | | 1.9731 | 1.8162 | –0.1569 | |
| Pair_5 | 8.945 | 13.251 | 4.306 | | 2.0764 | 1.6828 | –0.3936 | |
| TVOL | | | | | | | | |
| Pair_1 | 22.333 | 29.117 | 6.784 | | 2.6605 | 1.8885 | –0.7720 | |
| Pair_2 | 21.919 | 25.709 | 3.790 | | 2.7670 | 2.4825 | –0.2845 | |
| Pair_3 | 20.437 | 24.210 | 3.773 | | 3.0710 | 2.8468 | –0.2242 | |
| Pair_4 | 19.819 | 26.884 | 7.065 | | 2.9716 | 2.6029 | –0.3687 | |
| Pair_5 | 19.483 | 25.047 | 5.564 | | 2.9176 | 2.4636 | –0.4540 | |

Notes: This table reports mean and median liquidity based on 125 events where a stock is excluded from a margin eligible list using five event windows. These five pair event windows compare the average liquidity up to five trading days prior to the events (–5 to –1) and five trading days post the events (+1 to +5). Value Depth is in billion rupiah, Quantity Depth is in million shares, Quoted Spread is in hundred rupiah, Trading Value is in billion rupiah per day, and Trading Volume is in million shares per day. Mean (median) difference is tested by using a paired t test (Wilcoxon signed-rank test). ***, **, * the differences are significant at 1%, 5% and 10% respectively.

Differences of only two pairs of mean were significantly different. These findings suggest that the exclusion of a stock from margin-eligibility list does not restrain investors from trading the stocks. The insignificant changes may be related to the fact that during the first few days of the exclusions, investors need time to adjust their portfolio by selling the stocks that have lost their eligibility for margin trading and replacing them with those that have been newly listed for margin eligibility. This repositioning is necessary to allow investors to continue to utilise financing received from their stockbrokers to benefit from margin trading.

**Events of Unusual Market Activity**

The events of unusual market activity (UMA) were determined on the basis of the date when the IDX published the UMA announcement in its website. Sixty-nine of the 139 stocks in the sample had experienced a total of 114 events of unusual market activity over the study period.

Table 5.16 shows the mean and median of average liquidity before and after UMA announcements. Following the announcement of the unusual market activities, the mean average liquidity did not significantly change except for trading activity measures in the first two pairs of intervals. The table shows that there were significant increases on quoted spread and significant reductions on trading activity, based on the medians. While it is apparent that the increase on median quoted spread seems to be higher over a longer time intervals, the decline on both trading activity measures get smaller over similar time horizons. For example, the increase in quoted spread rose from zero in one-day interval to Rp2.5 in five-day interval. In contrast, the reduction of trading value was 8.28 million shares in one-day interval and 1.51 million shares in five-day interval.

The above results suggest that following UMA announcements, the wider quoted spread had motivated investors to reduce trading activities due to increased uncertainty. The reduction of the median trading activity seems to decline over a longer time horizon, indicating that following the release of additional information by related listed firms, reducing information asymmetry, trading activity of the corresponding stocks gradually improves.

Table 5.16 Liquidity Comparison of Pre- and Post-UMA Announcements

| Liquidity | Mean | | | | Median | | | |
|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Difference | | Pre | Post | Difference | |
| VDEP | | | | | | | | |
| Pair_1 | 0.388 | 0.301 | –0.087 | | 0.0596 | 0.0984 | 0.0388 | |
| Pair_2 | 0.325 | 0.315 | –0.010 | | 0.0576 | 0.0886 | 0.0310 | |
| Pair_3 | 0.330 | 0.314 | –0.016 | | 0.0737 | 0.0966 | 0.0229 | |
| Pair_4 | 0.314 | 0.304 | –0.010 | | 0.0693 | 0.0953 | 0.0260 | |
| Pair_5 | 0.304 | 0.303 | –0.001 | | 0.0695 | 0.1117 | 0.0422 | |
| QDEP | | | | | | | | |
| Pair_1 | 1.014 | 1.099 | 0.085 | | 0.1689 | 0.1225 | –0.0464 | |
| Pair_2 | 0.964 | 1.013 | 0.049 | | 0.1617 | 0.1508 | –0.0109 | |
| Pair_3 | 1.037 | 1.040 | 0.003 | | 0.1653 | 0.1664 | 0.0011 | |
| Pair_4 | 1.083 | 1.041 | –0.042 | | 0.1838 | 0.1772 | –0.0066 | |
| Pair_5 | 1.139 | 1.053 | –0.086 | | 0.1717 | 0.2258 | 0.0541 | |
| PQSPR | | | | | | | | |
| Pair_1 | 0.019 | 0.021 | 0.002 | | 0.0141 | 0.0157 | 0.0016 | |
| Pair_2 | 0.022 | 0.022 | 0.000 | | 0.0158 | 0.0160 | 0.0002 | |
| Pair_3 | 0.023 | 0.024 | 0.001 | | 0.0157 | 0.0171 | 0.0014 | |
| Pair_4 | 0.023 | 0.026 | 0.003 | | 0.0168 | 0.0180 | 0.0012 | |
| Pair_5 | 0.024 | 0.026 | 0.002 | | 0.0170 | 0.0179 | 0.0009 | |
| QSPR | | | | | | | | |
| Pair_1 | 0.181 | 0.163 | –0.018 | | 0.0500 | 0.0500 | 0.0000 | ** |
| Pair_2 | 0.175 | 0.165 | –0.010 | | 0.0500 | 0.0500 | 0.0000 | ** |
| Pair_3 | 0.217 | 0.209 | –0.008 | | 0.0633 | 0.0667 | 0.0034 | *** |
| Pair_4 | 0.206 | 0.229 | 0.023 | | 0.0538 | 0.0750 | 0.0212 | *** |
| Pair_5 | 0.201 | 0.238 | 0.037 | * | 0.0600 | 0.0850 | 0.0250 | *** |
| TVAL | | | | | | | | |
| Pair_1 | 31.529 | 22.332 | –9.197 | ** | 11.2884 | 3.0113 | –8.2771 | *** |
| Pair_2 | 25.354 | 20.326 | –5.028 | * | 7.7868 | 3.4982 | –4.2886 | *** |
| Pair_3 | 21.260 | 19.756 | –1.504 | | 6.3025 | 3.1759 | –3.1266 | ** |
| Pair_4 | 19.226 | 18.478 | –0.748 | | 5.5037 | 3.0078 | –2.4959 | *** |
| Pair_5 | 17.005 | 18.095 | 1.090 | | 5.0355 | 3.5267 | –1.5088 | ** |
| TVOL | | | | | | | | |
| Pair_1 | 143.100 | 106.201 | –36.899 | *** | 24.5248 | 8.1798 | –16.3450 | *** |
| Pair_2 | 120.645 | 99.000 | –21.645 | * | 17.4453 | 8.0885 | –9.3568 | *** |
| Pair_3 | 102.009 | 96.896 | –5.113 | | 16.0943 | 7.9315 | –8.1628 | *** |
| Pair_4 | 91.345 | 87.861 | –3.484 | | 14.7973 | 6.9318 | –7.8655 | *** |
| Pair_5 | 80.758 | 81.007 | 0.249 | | 14.7273 | 7.1275 | –7.5998 | *** |

Notes: This table reports mean and median liquidity based on 114 events where a stock is reported to have an unusual market activity using five event windows. These five pair event windows compare the average liquidity up to 5 trading days prior to the events (-5 to -1) and 5 trading days post the events (+1 to +5). Value Depth is in billion rupiah, Quantity Depth is in million shares, Quoted Spread is in hundred rupiah, Trading Value is in billion rupiah per day, and Trading Volume is in million shares per day. Mean (median) difference is tested by using a paired t test (Wilcoxon signed-rank test). ***, **, * the differences are significant at 1%, 5% and 10% respectively.

The results obtained related to the regulatory events are summarised as follows. For tick size impact, the finding shows that liquidity has a positive relationship with tick size. The evidence does not support hypothesis H10a; that changes to smaller tick price has a positive impact on liquidity. For margin-eligibility events, the finding shows that the liquidity

increased when stocks gained margin-eligibility status, providing support for Hypothesis H10b. On the impact of unusual market activity, the evidence indicates that UMA announcement had significant impact only on the quoted spread and trading activity measures, which provides partial support for Hypothesis H10c.

## 5.4 Summary

This chapter tested the presence of commonality in liquidity and the major determinant factors of individual stock liquidity. There is strong evidence for the presence of commonality in liquidity in the Indonesian market and the strength appears to be higher than that in other developed markets and lower than the emerging markets. The commonality in liquidity appears to vary among the industries where the manufacturing sector had a greater commonality than the other industry sectors. However, compared to the effect of the aggregate market liquidity, the effect of industry liquidity was less significant. There is little evidence that commonality in the Indonesian equity market varies with firm sizes.

The determinant factors observed in the previous studies have significant impact on liquidity of individual stocks in the Indonesian market. The regression results showed that foreign ownerships did not significantly affect liquidity for the majority of firms. The evidence further showed that the impact of market power as measured by quarterly operating profit margins seem to be significant. Regulatory factors had some impact on liquidity.

# Chapter 6
# Summary, Conclusion and Recommendation

## 6.1 Introduction

This final chapter has four purposes. The first is to summarise the study and its key findings, the second is to assess the implications of the study for both practitioners and academics, the third is to outline the limitations of the research and last, to provide some suggestions for future studies in the area.

Given that liquidity is a vital element of efficient financial markets, the main research question of this thesis was: What are the determinant factors of liquidity at the market and at the firm levels in Indonesia. The thesis identified the determinant factors found to be significant in the previous studies in other markets and in different situations and the hypotheses for the current study were articulated around the previous findings.

## 6.2 Summary

The current study used data mainly provided by the research division of the IDX and covered 2005 to 2011. To minimise the number of infrequently trading stocks in the sample observations, the stocks must have been traded at least once in a calendar month and had no major corporate actions that affect the number of outstanding shares during the given year. Six liquidity proxies were estimated for each individual stock; and the market-wide variable is then calculated as the equally weighted average of the individual stock liquidity for each trading day.

Following statistical tests, the logarithmic transforms of the variables were employed due to the presence of co-integration. Furthermore, due to the presence of serial correlations and time-varying volatility, an ARCH process was employed to estimate the model coefficients.

To test for commonality, daily changes of liquidity measures for individual stock were regressed on market liquidity. The regressions also included the following variables: a lead and a lag of the market liquidity, current value, a lead and a lag of the market returns, and market volatility. The size effect was analysed by clustering the regression results into three

quintiles of the firm sizes, and the industry effect was analysed by comparing three groups of the industrial sectors and employing regressions on the industry level liquidity as independent variables, following standard practice in the literature.

The determinant factors of liquidity at stock level were tested using three models. For the impact of foreign presence, the daily changes of percentage foreign ownership were regressed on the daily changes of stock liquidity. For market power, the lagged values of quarterly operating margin were regressed on the quarterly values of stock liquidity. Different time series frequencies were employed for the different models in order to match the impacts: daily for foreign ownerships and quarterly for operating margin. Lastly, paired-sample t-tests and Wilcoxon signed-rank tests were employed to estimate the impact of regulatory events.

## 6.3 Conclusions

Following the main purpose of the study of identifying the determinant factors of market liquidity, the four specific objectives were: 1) to identify the liquidity patterns over time and across firms, 2) to identify the influential factors of time series variation at the market level, 3) to investigate the presence of commonality in liquidity, and 4) to identify the determinant factors of liquidity at the firm level. Following is a summary of the findings.

### 6.3.1 Liquidity Properties

The first research objective was to identify the patterns of market liquidity in the Indonesian equity market over time and across firms.

#### 6.3.1.1 Liquidity over Time

The data shows that market-wide liquidity generally fluctuates around a positive trend. Over the sample period, the value depth and quantity depth grew by 29% and 5%, respectively. The trading cost declined by 47% when liquidity is estimated in terms of proportional quoted spread. Trading value and trading volume more than doubled. A significant decrease in liquidity occurred over the period of the 2008 financial crisis and was followed by a sizeable rebound. This finding is most likely to relate to the developments of the Indonesian equity market during the period of the study, namely the increasing number of the listed firms, the merger between the two national stock markets, and the recovery from the Global Financial Crisis.

However, consistent with the previous findings, liquidity in the Indonesian market, as an emerging market, is relatively low and is highly volatile. One possible explanation may be related to the financial liberalisation which allows foreign investors to easily trade for short-term profits. The liquidity levels were further influenced by the different institutional settings of market microstructure as well as the different rules and regulations.

#### 6.3.1.2 Liquidity across Firms

The findings show that market liquidity generally increased with size; implying a size effect in liquidity. The large firms had value depth of about one hundred times that of the small firms. The trading costs, in terms of proportional quoted spreads, decreased with firm sizes, where the trading costs of the group of the large firms were only about 14% of those of the small firms. The trading value of firms in the large size groups was 170 times that of the ones in the small firms.

### 6.3.2 Key Findings on the Determinants of Market-wide Liquidity

The second objective was to identify the determinant factors of time series variation of liquidity in market-wide level. The results found the evidence as follows.

1. The international market volatility was apparently transmitted as a negative factor for domestic liquidity. The volatility of the Standard and Poor's and Nikkei indices significantly reduced value depth and trading value while increased trading costs. This suggests that financial liberalisation and technology developments have caused the dependency of the Indonesian market on the developed markets, which triggered volatility spill over effects;

2. Financial crisis is negatively related to market liquidity. Investors posted lower bid and ask quantity at the best prices during the 2008 financial crisis. This is likely because investors tried to avoid the higher adverse selection risks due to higher asymmetric information and information uncertainties (Aitken and Comerton-Forde 2003; Nagel 2012);

3. Liquidity did not significantly change during the period surrounding the announcements of macroeconomic indicators. These results are not consistent with Chordia, Roll and Subrahmanyam (2001), who found a statistically significant improvement of market depth and trading activity during the two days prior to the announcements of

macroeconomic indicators (gross domestic product and unemployment rate) in NYSE listed stocks. Importantly for this study, however, is that the findings are consistent with previous research (Kim, McKenzie & Faff 2004; Van Ness BF, Van Ness RA and Warr 2005; Chordia, Sarkar and Subrahmanyam 2005) that found a little impact of macroeconomic events on market liquidity;

4. Liquidity decreased with a higher interest rate, which is in line with the prediction that a higher interest rate leads to a higher cost of trading (Chordia, Roll & Subrahmanyam 2001). This finding also corroborates the argument that if interest rates are higher, investors are encouraged to buy portfolios toward interest-paying instruments (Van Ness BF, Van Ness RA & Warr 2005). The other explanation of this result is probably due to an increasing risk of holding inventory, considering that investors perceived a higher interest rate as a signal of the probability of worsening economy (Fujimoto 2004);

5. Market depths and trading activity increased, and trading costs decreased during the days of positive market returns (MKT+) and during the days immediately following rising markets (MA5MKT+). The evidence is consistent with that of previous studies, including Hameed, Kang and Viswanathan (2010), who reported that trading costs tend to increase when the market is negative and to decrease when the market is positive; and also Chordia, Roll and Subrahmanyam (2002), who found that liquidity tends to be lower (higher) after a negative (positive) market return;

6. Market depths and trading costs were negatively related to market volatility. These results suggest that investors tend to step back from trading to avoid additional inventory risks following a large price fluctuation (Chordia, Roll & Subrahmanyam 2002). These findings are consistent with the results of Chordia, Roll and Subrahmanyam (2001), Yeyati, Schmukler and Van Horen (2008) and Wang (2013), who found that liquidity is negatively influenced by domestic market volatility;

7. In terms of the days-of-the-week effect, market depths and trading activities touched the lowest level on Mondays, gradually improved and reached the highest level on Thursdays. Similarly, trading costs are at the highest on Mondays, and steadily decreased and achieved the lowest level on Thursdays. This finding supports the hypothesis of the day-of-the-week effect on liquidity. These weekly regularities are consistent with the results of previous studies, such as Chordia, Roll and Subrahmanyam (2001) and

Chordia, Sarkar and Subrahmanyam (2005). An increasing pattern of liquidity during the weeks indicates that the regularities are likely related to the time-lag adjustment on new information (Fama 1998); investors tend to avoid trading on Mondays because of higher risks due to higher asymmetric information over the weekends. Investors, then, trade more as the information asymmetry gradually diminishes during the weeks;

8. The results also provide strong evidence of the holiday effect: market depths and trading activities (trading costs) were lower (higher) during the days around the holidays than the rest of the year. It seems that investors trade less frequently in response to reduced information disclosures from firms and government sources during the holidays. The finding that market liquidity declined during the days around the holidays is broadly consistent with those of earlier studies such as Chordia, Roll and Subrahmanyam (2001), Van Ness BF, Van Ness RA and Warr (2005), Hameed, Kang and Viswanathan (2010) and Chordia, Sarkar and Subrahmanyam (2011);

9. In the case of Ramadan effect, there is ample evidence that market depth improved and trading costs decreased during the month of Ramadan. This confirms the prediction that Ramadan has positive impacts on the investor sentiment and decisions (Białkowski, Etebari & Wisniewski 2012) which then increase market liquidity. However, the results showed that investors trade less frequently during the month of Ramadan.

### 6.3.3 Key Findings on the Commonality in Individual Stock Liquidity

The third objective was to investigate the presence of commonality in liquidity. The findings are summarised below.

1. The commonality in liquidity was present in the Indonesian equity market. The proportions of stocks with positive and significant liquidity beta for market depth and trading cost measures were between 28 and 41%. These proportions are generally greater than those documented in developed markets, such as in the US market (Chordia, Roll & Subrahmanyam 2000) and in the Australian market (Fabre & Frino 2004); but, it is much smaller than that of emerging markets such Hong Kong (Brockman & Chung 2002) and the Thailand market (Pukthuanthong-Le & Visaltanachoti 2009). Moreover, the proportion of stocks with positive and significant liquidity beta for the trading activity measures were about 32% for trading value and 33% for trading volume. Overall, the

results suggest that the commonality in liquidity in the Indonesian equity market is more significant than the commonality in developed markets, but less pervasive than those of its counterparts in emerging markets. A higher commonality in the Indonesian market suggests that Indonesia market is potentially exposed to a higher non-diversifiable systemic risk factors (Pástor & Stambaugh 2003; Acharya & Pedersen 2005; Korajczyk & Sadka 2008), especially during the financial crisis (Fernando, Herring & Subrahmanyam 2008);

2. The evidence further showed that, depending on the liquidity measures used, between 8 and 32% of the stocks had positive and significant coefficients of leading or lagging terms. This is relatively higher than the 4 to 9% range in the US (Chordia, Roll & Subrahmanyam 2000) and in Hong Kong market with 6 to 13% (Brockman & Chung 2002). This observation is an indication that historical information seems to play a bigger role in the Indonesian market, compared to other markets. A further observation is that the concurrent market-wide liquidity beta coefficients were statistically significant, with the exception of that of trading value;

3. Across firm sizes, the percentage of stocks with positive beta coefficients was less than 25%. This is much lower than in Hong Kong at 7% to 74.3% (Brockman & Chung 2002) and in Thailand at 14% to 75% (Pukthuanthong-Le & Visaltanachoti 2009). However, there is not sufficient evidence to conclude that the commonality of small firms is significantly different from that of the large firms. The beta coefficients has a positive association with firm size for quantity depth and quoted spread measures, had a U-shaped pattern for proportional quoted spread where the coefficient was smallest in the middle quintile, and it had an inverted U-shaped pattern for trading activities where the coefficients were highest in the middle group. In contrast, previous studies found consistent patterns across liquidity measures, such as monotonically increasing with firm size as found by Chordia, Roll and Subrahmanyam (2000) or an inversed U-shaped as documented by Brockman and Chung (2002);

4. In the case of commonality across industries, depending on the liquidity proxies, the manufacturing industry had the largest proportion of stocks with positive and significant beta coefficients varying from 34 to 44%. This was followed by the proportion of stocks in the primary industry, varying from 14 to 43% and then in the services industry varying from 19 to 44%. This implies that the manufacturing industry is, on average, more

sensitive to variations in market liquidity. The industry liquidity effect, however, is weaker compared to the aggregate market effect, suggesting that in the case of Indonesian market, industry level liquidity is less important than market level liquidity.

### 6.3.4 Key Findings on the Determinants of Individual Stock Liquidity

The fourth objective was to identify the determinant factors at the firm level. The results are described below.

1. After controlling for market returns, volatility and financial crisis, only 3 to 20% of seventy-five stocks exhibit positive effect of foreign presence and 5 to 13% of the stocks have a negative effect, leaving the majority of the stocks with no significant effect of foreign presence. This suggests that for a majority of the stocks, foreign presence has no significant impact on liquidity changes;

2. Market power has a positive impact on market depth and trading activity and has a negative impact on trading costs. The output of modified Fama MacBeth regressions shows that the coefficients on the lagged market power for the three liquidity measures are significant at the 1% level. The positive sign on value depth and trading values and the negative sign on proportional quoted spread suggest that lagged market power has positive impact on market liquidity. Following this, these findings suggest that the impact of market power on the individual stock liquidity was significant in the present population;

3. In terms of the regulatory effect, there is a significant increase (reduction) of mean and median of average liquidity following a tick increasing (decreasing) event, suggesting that the impact of tick size changes is contrary to expectation. The inclusion of a stock in margin-eligibility list tends to increase market depth and trading activity, while the exclusion from the list did not affect its liquidity significantly. Finally, the evidence shows that only the quoted spread and trading activity measures were significantly influenced by UMA announcements, which partially support the expectation.

### 6.3.5 Hypothesis Testing

The results of the present study can be summarised as follows:

**H1**: *Supported*. International market volatility negatively influences the Indonesian market liquidity.

**H2**: S*upported*. The financial crisis is negatively related to market liquidity.

**H3**: *Not supported*. The releases of macroeconomic indicators do not significantly affect the Indonesian market liquidity.

**H4a**: *Supported*. Short-term interest rates are negatively related to the Indonesian market liquidity.

**H4b**: *Supported*. Term spreads are negatively related to the Indonesian market liquidity.

**H5a**: *Supported*. Market return positively affects the Indonesian market liquidity.

**H5b**: *Supported*. Recent market trend positively affects the Indonesian market liquidity.

**H5c**: *Supported*. Market volatility negatively affects the Indonesian market liquidity.

**H6a**: *Supported*. Market liquidity has strong seasonal regularities on the days of the weeks.

**H6b**: *Supported*. Market liquidity has strong seasonal regularities on the days around the holidays.

**H6c**: *Supported*. Market liquidity has strong seasonal regularities on the days during the month of Ramadan.

**H7**: *Supported*. Liquidity in the Indonesian equity market shows moderate commonality, between the developed markets and the other emerging markets.

**H8**: *Not supported*. Foreign ownership has little influence on the individual liquidity.

**H9**: S*upported*. Market power has a positive impact on the market liquidity.

**H10a**: *Not supported*. Tick size changes affect market liquidity in different direction.

**H10b**: *Supported*. Margin eligibility changes affect market liquidity in a significant way.

**H10c**: *Partly supported*. Announcements of unusual market activity affect market liquidity in a significant way using some liquidity measures.

## 6.4 Recommendations

The current study has several key findings that will be of particular interest not only to market practitioners, including investors, market operators and regulators, but also to academics. In particular, the results have implications as follows.

1. Investors or portfolio managers who are involved in developing trading strategies should take the key determinants of liquidity variations into account to achieve maximum profits. The trading strategy should also address various momentums that coincide with the best timing for buying and selling the stocks. Moreover, an investment strategy should involve stock selection criteria to create a well-diversified portfolio across different sizes and industries. By selecting the stocks and the time at which the liquidity is expected at the highest, an efficient strategy would be able to minimise the costs of transactions and maximise profits. This knowledge is particularly important since the stocks that are traded infrequently, or the period when the markets have liquidity problem has a significant effect in increasing the risks and therefore reducing the profit. Specifically, the evidence in Chapter Four demonstrates that market-wide liquidity is determined by numerous key factors, including international market volatility, financial crisis, market performance and interest rate factors. The evidence also shows that the market-wide liquidity has days of the week, days around the holidays and days during the month of Ramadan regularities. Investors or portfolio managers should also have their attention to the commonality of the individual liquidity as well as the determinant factors affecting liquidity at the stock level as discussed in Chapter Five. The findings of this research should help to guide the development of such trading strategies;

2. Market operators (that is, the stock exchange and their back office institutions, namely clearing corporations and securities custodians) are also expected to benefit from the findings of this research. The findings suggest that stock exchanges may control liquidity by regulating tick sizes, where a lower tick size tend to increase the trading activities, which, in turn, improves their revenue. Better understanding of factors that determine a stock exchange's liquidity is important to focus the developments of their trading system as well as their marketing efforts to attract potential participants for investing and companies for listing in the stock markets;

3. The findings should help regulators and policy makers to identify the potential factors, time and group of stocks that are associated with liquidity risks. For example, the results in Chapter Four show that the liquidity of small firms tends to be more volatile than that of large firms. Thus, in the case of a financial crisis occurring, regulators should develop strategies to maintain liquidity, for example, by limiting the fluctuation of stock prices differently on the basis of the firm sizes. This is expected to effectively minimise the magnitude of the negative market returns during the crisis that adversely affects liquidity;

4. The findings are also expected to provide new insight into the literature on the patterns and determinants of liquidity variations in emerging markets. Furthermore, unlike previous research that have used the OLS regression model to identify the determinant factors and commonality in liquidity, this research provides a methodological implication by using an ARCH model, a model that has been widely used for analysing financial time series data.

## 6.5 Limitations of the Study

The present research is carried out based on the limited sample observation during the limited period of study. Therefore, there are some potential limitations that should be taken into account. The limitations of this current research include the following aspects.

1. The sample observations were selected from a seven-year period. The findings may not be generalisable with different selection criteria and to a longer period. Therefore, the results obtained from this study should be treated with caution;

2. The sample observation used in this current study was selected based on sample criteria. There are limitations associated with the stock selection method. Although a thorough literature review and careful judgement have been carried out to minimise the limitation of the method, the selected sample may still potentially be biased;

3. The current study used the best bid and best ask prices at the end of the day to estimate the liquidity. The relationships may have been different if the liquidity is estimated by the number of orders at all price levels and generated from the intraday data;

4. The present study focused only on the liquidity of equity market in an emerging market. Many studies have reported significant findings on liquidity across different markets, for

example, developed and emerging markets, and across various assets, for example, stock, bond, real estate and derivative.

## 6.6 Suggestions for Further Research

This thesis has documented findings in relation to the determinant factors that significantly affect liquidity. The section below presents some suggestions for future research.

The empirical analysis of this thesis could be extended to a longer sample period. This may provide additional verification of the influential factors that may affect time series variation of market liquidity. Alternatively, the selected seven-year sample could be divided along important structural changes. Further, the intertemporal relationship between the determinant factors and liquidity may change over time. The changes could be captured and analysed through a dynamic approach.

The sample observations in the present study were selected following a set of criteria. As the criteria was greatly influenced by the methodology, which then affects the research outcomes, it is recommended to formulate different sets of selection criteria for different methodology. For example, further research could be undertaken to analyze a dataset which has more exposure to the alternative methodology, such as vector auto regression used by Fujimoto (2003) and Chordia, Sarkar and Subrahmanyam (2005) in their analysis on the factors affecting market liquidity in the US market. This could provide further confirmation as to whether the determinant factors in this thesis still have significant influence on liquidity and whether the commonality in liquidity increases with firm size.

Although previous studies confirmed that liquidity estimated using low frequency data is comparable with the liquidity estimated from high frequency data, the latter gives more precise liquidity estimations. Referring to the limitation where the current study used the end of day data, future studies could utilise intraday observations to estimate liquidity.

Finally, there is potential extension of the research to cover other domestic asset classes such as debt instruments. This will provide new insights into the liquidity determinants in the context of debt securities markets in emerging markets. However, given the nature of dealer-driven bond markets, trading information is not published. Here, the lack of sufficient and reliable data for Indonesian bond markets that spans a long-time period could be a challenge.

## Bibliography


Abd, MS, Meera, AKM & Omar, MA, 2008, "Interdependence of ASEAN–5 stock markets from the US and Japan", *Global Economic Review*, vol. 37, no. 2, pp. 201–225.

Acharya, VV & Pedersen, LH, 2005, 'Asset pricing with liquidity risk', *Journal of Financial Economics*, vol. 77, no. 2, pp. 375–410.

Agarwal, S, Faircloth, S, Liuc, C & Rhee, SG, 2009, 'Why do foreign investors underperform domestic investors in trading activities? Evidence from Indonesia', *Journal of Financial Markets*, vol. 12, no. 1, pp. 32–53.

Aitken, M & Comerton-Forde, C, 2003, 'How should liquidity be measured?', *Pacific-Basin Finance Journal*, vol. 11, no. 1, pp. 45–59.

——, 2005, 'Do reductions in tick sizes influence liquidity?', *Accounting and Finance*, vol. 45 no. 2, pp. 171–184.

Al-Deehani, TM, 2006, 'Seasonality as an unobservable component: The case of Kuwait stock market', *Applied Financial Economics*, vol. 16, no. 6, pp. 471–478.

Al-Hajieh, H, Redhead, K & Rodgers, T, 2011, 'Investor sentiment and calendar anomaly effects: A case study of the impact of Ramadan on Islamic Middle Eastern markets', *Research in International Business and Finance*, vol. 25, no. 3, pp. 345-356.

Albright, SC, Winston, WL, Zappe, CJ, Broadie, MN & Kolesar, P, 2011, *Data Analysis and Decision Making with Microsoft® Excel*, South-Western/Cengage Learning, Mason, Ohio.

Alexander, GJ, Ors, E, Peterson, MA & Seguin, PJ, 2004, 'Margin regulation and market quality: a microstructure analysis', *Journal of Corporate Finance*, vol. 10, no. 4, pp. 549–574.

Allen, DE & Sudiman, J, 2009, '*Does tick size change improve liquidity provision: Evidence from the Indonesia Stock Exchange'*, School of Accounting, Finance and Economics & FEMARC Working Paper Series 0906, Edith Cowan University.

Alzahrani, A, 2011, 'Liquidity determinants in an order-driven market: Using high frequency data from the Saudi market', paper presented to International Conference on Economics, Trade and Development, Bali, Indonesia 1–3 April 2011

Amihud, Y, 2002, 'Illiquidity and stock returns: Cross-section and time-series effects', *Journal of Financial Markets*, vol. 5, no. 1, pp. 31–56.

Amihud, Y & Mendelson, H, 1986, 'Asset pricing and the bid-ask spread', *Journal of Financial Economics*, vol. 17, no. 2, pp. 223–249.

——, 1991, ‘Liquidity, asset prices and financial policy’, *Financial Analysts Journal*, vol. 47, no. 6, pp. 56–66.

——, 2006, ‘Stock and bond liquidity and its effect on prices and financial policies’, *Financial Markets Portfolio Management* vol. 20, no. 1, pp. 19–32.

Amihud, Y, Mendelson, H & Lauterbach, B, 1997, ‘Market microstructure and securities values: Evidence from the Tel Aviv Stock Exchange’, *Journal of Financial Economics*, vol. 45 no. 3, pp. 365–390.

Amihud, Y, Mendelson, H & Uno, J, 1999, ‘Number of shareholders and stock prices: Evidence from Japan’, *The Journal of Finance*, vol. 54, no. 3, pp. 1,169–1,184.

Asteriou, D & Hall, SG, 2007, *Applied Econometrics: A Modern Approach Using Eviews and Microfit Revised Edition*, Palgrave New York.

Bae, K-H, Jang, H & Park, KS, 2003, ‘Traders’ choice between limit and market orders: Evidence from NYSE stocks’, *Journal of Financial Markets*, vol. 6, no. 4, pp. 517–538.

Bagehot, W, 1971, ‘The only game in town’, *Financial Analysts Journal*, vol. 27, no. 2, pp. 12–22.

Bain, JS, 1951, ‘Relation of profit rate to industry concentration: American manufacturing, 1936–1940’, *The Quarterly Journal of Economics*, vol. 65, no. 3, pp. 293–324.

Bapepam LK, 2005, *The History of Stock Market in Indonesia*, viewed 5 March 2013, <http://www.bapepam.go.id/old/profil/sejarah.htm>.

——, 2006, *Annual Report 2006: Synergy, Integrity, Trustworthy, Respectable, Transparency, Accountability*, Jakarta.

Bauer, W, 2004, ‘*Commonality in liquidity in pure order-driven markets’*, Working Paper, Swiss National Centre of Competence in Research.

Bessembinder, H, 2000, ‘Tick size, spreads, and liquidity: An analysis of Nasdaq securities trading near ten dollars’, *Journal of Financial Intermediation*, vol. 9, no. 3, pp. 213–239.

Biais, B, Glosten, L & Spatt, C, 2005, ‘Market microstructure: A survey of microfoundations, empirical results, and policy implications’, *Journal of Financial Markets*, vol. 8, no. 2, pp. 217–264.

Białkowski, J, Etebari, A & Wisniewski, TP, 2012, ‘Fast profits: Investor sentiment and stock returns during Ramadan’, *Journal of Banking and Finance*, vol. 36, no. 3, pp. 835–845.

Black, F, 1971, ‘Toward a fully automated stock exchange’, *Financial Analysts Journal*, vol. 27, no. 4, pp. 28–44.

Black, K, 2012, '*Business Statistics: For Contemporary Decision Making'*, Wiley, Hoboken, New Jersey.

Blume, L, Easley, D & O'Hara, M, 1994, 'Market statistics and technical analysis: The role of volume', *The Journal of Finance*, vol. 49, no. 1, pp. 153–181.

Bollerslev, T, 1986, 'Generalized autoregressive conditional heteroskedasticity', *Journal of Econometrics*, vol. 31, no. 3, pp. 307–327.

Bollerslev, T, Engle, RF & Nelson, DB, 1994, 'ARCH models', in RF Engle & DL McFadden (eds), *Handbook of econometrics*, Elsevier, North Holland, vol. 4, pp. 2,959–3,038.

Bonser-Neal, C, Linnan, D & Neal, R, 1999, 'Emerging market transaction costs: Evidence from Indonesia', *Pacific-Basin Finance Journal*, vol. 7, no. 2, pp. 103–127.

Booth, DG & Keim, DB, 2000, 'Is there still a January effect? ', in DB Keim & WT Ziemba (eds), *Security Market Imperfections in Worldwide Equity Markets*, Cambridge University Press, New York.

Bowe, M & Domuta, D, 2004, 'Investor herding during financial crisis: A clinical study of the Jakarta Stock Exchange', *Pacific-Basin Finance Journal*, vol. 12, no. 4, pp. 387–418.

Brockman, P & Chung, DY, 1999, 'Bid-ask spread components in an order-driven environment', *Journal of Financial Research*, vol. 22, no. 2, p. 227.

——, 2002, 'Commonality in liquidity: Evidence from an order-driven market structure', *Journal of Financial Research*, vol. 25, no. 4, pp. 521–539.

——, 2006, 'Index inclusion and commonality in liquidity: Evidence from the Stock Exchange of Hong Kong', *International Review of Financial Analysis*, vol. 15, no. 4–5, pp. 291–305.

——, 2008, 'Commonality under market stress: Evidence from an order-driven market', *International Review of Economics and Finance*, vol. 17 no. 2, pp. 179–196.

Brockman, P, Chung, DY & Pérignon, C, 2009, 'Commonality in liquidity: A global perspective', *Journal of Financial and Quantitative Analysis*, vol. 44, no. 04, pp. 851–882.

Brown, DP & Zhang, ZM, 1997, 'Market orders and market efficiency', *The Journal of Finance*, vol. 52, no. 1, pp. 277–308.

Butler, AW, Grullon, G & Weston, JP, 2005, 'Stock market liquidity and the cost of issuing equity', *Journal of Financial & Quantitative Analysis*, vol. 40, no. 2, pp. 331–348.

Calamia, A, 1999, *Market microstructure: Theory and empirics*, Laboratory of Economics and Management, Papers Series 19, Sant'Anna School of Advanced Studies of Pisa, Italy.

Caves, R, Ward, I, Williams, P & Wright, C, 1987, '*Australian Industry: Structure, Conduct, Performance'*, 2 edn, Prentice-Hall, New York ; Sydney.

Çetin, U, Jarrow, R & Protter, P, 2004, 'Liquidity risk and arbitrage pricing theory', *Finance and Stochastics*, vol. 8, no. 3, pp. 311–341.

Chai, D, Faff, R & Gharghori, P, 2010, 'New evidence on the relation between stock liquidity and measures of trading activity', *International Review of Financial Analysis*, vol. 19, no. 3, pp. 181–192.

Chan, MWL, Khanthavit, A & Thomas, H, 1996, 'Seasonality and cultural influences on four Asian stock markets', *Asia Pacific Journal of Management*, vol. 13, no. 2, pp. 1–24.

Chen, N-F, Roll, R & Ross, SA, 1986, 'Economic forces and the stock market', *Journal of Business*, vol. 59, no. 3, pp. 383–403.

Chiu, J, Chung, H, Ho, K-Y & Wang, GHK, 2012, 'Funding liquidity and equity liquidity in the subprime crisis period: Evidence from the ETF market', *Journal of Banking & Finance*, vol. 36, no. 9, pp. 2,660–2,671.

Choe, H & Yang, C-W, 2010, 'Liquidity commonality and its causes: Evidence from the Korean stock market', *Asia-Pacific Journal of Financial Studies*, vol. 39, no. 5, pp. 626–658.

Choi, WG & Cook, D, 2006, *Stock market liquidity and the macroeconomy: Evidence from Japan*, Working Paper WP/05/6, International Monetary Fund.

Chordia, T, Roll, R & Subrahmanyam, A, 2000, 'Commonality in liquidity', *Journal of Financial Economics*, vol. 56, no. 1, pp. 3–28.

——, 2001, 'Market liquidity and trading activity', *Journal of Finance*, vol. 56, no. 2, pp. 501–530.

——, 2002, 'Order imbalance, liquidity, and market returns', *Journal of Financial Economics*, vol. 65, no. 1, pp. 111–130.

——, 2008, 'Liquidity and market efficiency', *Journal of Financial Economics*, vol. 87, no. 2, pp. 249–268.

——, 2011, "Recent trends in trading activity and market quality", *Journal of Financial Economics*, vol. 101, no. 2, pp. 243–263.

Chordia, T, Sarkar, A & Subrahmanyam, A, 2005, "An empirical analysis of stock and bond market liquidity", *Review of Financial Studies*, vol. 18, no. 1, pp. 85–129.

Chordia, T, Sarkar, A & Subrahmanyam, A, 2011, "Liquidity dynamics and cross-autocorrelations", *Journal of Financial & Quantitative Analysis*, vol. 46, no. 3, pp. 709–736.

Chung, D & Hrazdil, K, 2010, ‘Liquidity and market efficiency: A large sample study’, *Journal of Banking and Finance*, vol. 34, no. 10, pp. 2,346–2,357.

Chung, KH, Kang, J & Kim, JS, 2011, ‘Tick size, market structure, and market quality’, *Review of Quantitative Finance and Accounting*, vol. 36, no. 1, pp. 57–81.

Coffee, JCJ, 1991, ‘Liquidity versus control: The institutional investor as corporate monitor’, *Columbia Law Review*, vol. 91, no. 6, pp. 1,278–1,358.

Cohen, KJ, Hawawini, GA, Maier, SF, Schwartz, RA & Whitcomb, DK, 1980, ‘Implications of microstructure theory for empirical research on stock price behavior’, *The Journal of Finance*, vol. 35, no. 2, pp. 249–257.

Comerton-Forde, C, Putniņš, TJ & Tang, KM, 2011, ‘Why do traders choose to trade anonymously?’, *Journal of Financial & Quantitative Analysis*, vol. 46, no. 4, pp. 1,025–1,049.

Copeland, TE & Galai, D, 1983, ‘Information effects on the bid-ask spread’, *The Journal of Finance*, vol. 38, no. 5, pp. 1,457–1,469.

Coughenour, JF & Saad, MM, 2004, ‘Common market makers and commonality in liquidity’, *Journal of Financial Economics*, vol. 73, no. 1, pp. 37–69.

Cumming, D, Johan, S & Li, D, 2011, ‘Exchange trading rules and stock market liquidity’, *Journal of Financial Economics*, vol. 99, no. 3, pp. 651–671.

De Jong, F & Rindi, B, 2009, ‘*The Microstructure of Financial Markets’*, Cambridge University Press, Cambridge.

De la Torre, A, Gozzi, JC & Schmukler, SL, 2007, ‘Stock market development under globalization: Whither the gains from reforms?’, *Journal of Banking and Finance*, vol. 31, no. 6, pp. 1731–1754.

Demsetz, H, 1968, ‘The cost of transacting’, *Quarterly Journal of Economics*, vol. 82, no. 1, pp. 33–53.

Domowitz, I, Hansch, O & Wang, X, 2005, 'Liquidity commonality and return co-movement’, *Journal of Financial Markets*, vol. 8, no. 4, pp. 351–376.

Drehmann, M & Nikolaou, K, 2013, 'Funding liquidity risk: Definition and measurement’, *Journal of Banking Finance*, vol. 37, no. 7, pp. 2173–2182.

Dvořák, T, 2005, ‘Do domestic investors have an information advantage? Evidence from Indonesia’, *The Journal of Finance*, vol. 60, no. 2, pp. 817–839.

Easley, D, Hvidkjaer, S & O'Hara, M, 2002, ‘Is information risk a determinant of asset returns?', *Journal of Finance*, vol. 57, no. 5, pp. 2185–2221.

Easley, D & O'Hara, M, 1992, 'Time and the process of security price adjustment', *The Journal of Finance*, vol. 47, no. 2, pp. 577–605.

Ekaputra, I & Ahmad, B, 2007, 'The impact of tick size reduction on liquidity and order strategy: Evidence from the Jakarta stock exchange (JSX)', *Journal of Economics and Finance in Indonesia*, vol. 55, pp. 89–104

Engle, RF, 1982, 'Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation', *Econometrica*, vol. 50, no. 4, pp. 987–1007.

Fabre, J & Frino, A, 2004, 'Commonality in liquidity: Evidence from the Australian Stock Exchange', *Accounting & Finance*, vol. 44, no. 3, pp. 357–368.

Fama, EF, 1998, 'Market efficiency, long-term returns, and behavioral finance', *Journal of Financial Economics*, vol. 49, no. 3, pp. 283–306.

Fama, EF & MacBeth, JD, 1973, 'Risk, return, and equilibrium: Empirical tests', *The Journal of Political Economy*, vol. 81, no. 3, pp. 607-636

Faten, L, 2008, 'Stock market liquidity and information asymmetry around voluntary earnings disclosures: New evidence from France', *International Journal of Managerial Finance*, vol. 4, no. 1, pp. 60–75.

Fernando, CS, 2003, 'Commonality in liquidity: transmission of liquidity shocks across investors and securities', *Journal of Financial Intermediation*, vol. 12, no. 3, pp. 233–254.

Fernando, CS, Herring, RJ & Subrahmanyam, A, 2008, 'Common liquidity shocks and market collapse: Lessons from the market for perps', *Journal of Banking Finance*, vol. 32, no. 8, pp. 1,625–1,635.

Francioni, R, Hazarika, S, Reck, M & Schwartz, RA, 2008, 'Equity market microstructure: Taking stock of what we know', *Journal of Portfolio Management*, vol. 35, no. 1, pp. 57–71.

Frank, N, Hermosillo, BG & Hesse, H, 2008, '*Transmission of Liquidity Shocks: Evidence from the 2007 Subprime Crisis'*, Working Paper WP/08/200, International Monetary Fund.

Frankfurter, GM & McGoun, EG, 2001, 'Anomalies in finance: What are they and what are they good for?', *International Review of Financial Analysis*, vol. 10, no. 4, pp. 407–429.

French, KR, 1980, 'Stock returns and the weekend effect', *Journal of Financial Economics*, vol. 8, no. 1, pp. 55–69.

Fujimoto, A, 2004, *Macroeconomic sources of systematic liquidity*, Working paper University of Alberta, Canada.

Galariotis, EC & Giouvris, E, 2007, 'Liquidity commonality in the London Stock Exchange', *Journal of Business Finance & Accounting*, vol. 34, no. 1–2, pp. 374–388.

Garman, MB, 1976, 'Market microstructure', *Journal of Financial Economics*, vol. 3, no. 3, pp. 257–275.

Ghosh, A, Saidi, R & Johnson, KH, 1999, 'Who moves the Asia-Pacific stock markets—US or Japan? Empirical evidence based on the theory of cointegration', *Financial Review*, vol. 34, no. 1, pp. 159–169.

Glosten, LR & Milgrom, PR, 1985, 'Bid, ask and transaction prices in a specialist market with heterogeneously informed traders', *Journal of Financial Economics*, vol. 14, no. 1, pp. 71–100.

Goldman, MB & Beja, A, 1979, 'Market prices vs equilibrium prices: Returns' variance, serial correlation, and the role of the specialist', *The Journal of Finance*, vol. 34, no. 3, pp. 595–607.

Goldstein, MA & A. Kavajecz, K, 2000, 'Eighths, sixteenths, and market depth: changes in tick size and liquidity provision on the NYSE', *Journal of Financial Economics*, vol. 56, no. 1, pp. 125–149.

Goyenko, RY, Holden, CW & Trzcinka, CA, 2009, 'Do liquidity measures measure liquidity?', *Journal of Financial Economics*, vol. 92, no. 2, pp. 153–181.

Hameed, A, Kang, W & Viswanathan, S, 2010, 'Stock market declines and liquidity', *The Journal of Finance*, vol. 65, no. 1, pp. 257–293.

Hanafi, MM, 2011, 'Unusual market activity announcements', *Gadjah Mada International Journal of Business*, vol. 12, no. 2, pp. 159–187.

Handa, P & Schwartz, RA, 1996, 'How best to supply liquidity to a securities market', *Journal of Portfolio Management*, vol. 22, no. 2, pp. 44–51.

Handa, P, Schwartz, RA & Tiwari, A, 1998, 'The ecology of an order-driven market', *The Journal Of Portfolio Management*, vol. 24, no. 2, pp. 47–55.

Hardouvelis, GA, 1988, 'Margin requirements and stock market volatility', *Quarterly Review, Federal Reserve Bank of New York*, vol. Summer, pp. 80–89.

Harris, L, 1989, 'A day-end transaction price anomaly', *The Journal of Financial and Quantitative Analysis*, vol. 24, no. 1, pp. 29–45.

——, 2003, '*Trading and Exchange Market Microstructure for Practitioners'*, Oxford University Press, Inc., New York.

Hasbrouck, J, 2009, 'Trading costs and returns for U.S. equities: Estimating effective costs from daily data', *The Journal of Finance*, vol. 64, no. 3, pp. 1445–1477.

Hasbrouck, J & Seppi, DJ, 2001, ‘Common factors in prices, order flows, and liquidity’, *Journal of Financial Economics*, vol. 59, no. 3, pp. 383–411.

Hill, RC, Griffiths, WE & Lim, GC, 2011, *Principles of Econometrics*, 4 edn, Wiley, Hoboken, New Jersey.

Hillier, D, Hillier, J & Kyaw, K, 2007, 'Liquidity commonality and the intervalling effect', *Accounting & Finance*, vol. 47, no. 3, pp. 495–512.

Ho, TSY & Stoll, HR, 1983, 'The dynamics of dealer markets under competition', *The Journal of Finance*, vol. 38, no. 4, pp. 1053–1074.

Hou, K & Robinson, DT, 2006, 'Industry concentration and average stock returns', *Journal of Finance*, vol. 61, no. 4, pp. 1927–1956.

Huang, J & Wang, J, 2010, 'Market liquidity, asset prices, and welfare', *Journal of Financial Economics*, vol. 95, no. 1, pp. 107–127.

Huang, RD & Stoll, HR, 1996, 'Dealer versus auction markets: A paired comparison of execution costs on NASDAQ and the NYSE', *Journal of Financial Economics*, vol. 41, no. 3, pp. 313–357.

Huberman, G & Halka, D, 2001, 'Systematic liquidity', *Journal of Financial Research*, vol. 24, no. 2, p. 161.

Ibrahim, MH, 2005, 'International linkage of stock prices: The case of Indonesia', *Management Research News*, vol. 28 no. 4, pp. 93–115.

IDX, 2004, *Rule Number I-H: Sanction*, Jakarta.

——, 2012, *IDX Fact Book 2012*, Jakarta.

——, 2013, *Rule Number II-A: Equity-Type Securities Trading*, Jakarta.

IOSCO, 2012, *Technological Challenges to Effective Market Surveillance Issues and Regulatory Tools*, Consultation Report CR12/2012, International Organization of Securities Commissions, Madrid, Spain.

Jain, P, 2003, *Institutional Design and Liquidity at Stock Exchanges around the World*, Working Paper Indiana University.

James, GA & Karoglou, M, 2010, 'Financial liberalization and stock market volatility: the case of Indonesia', *Applied Financial Economics*, vol. 20, no. 6, pp. 477–486.

Jiang, CX, Kim, J-C & Zhou, D, 2011, 'Liquidity, analysts, and institutional ownership', *International Review of Financial Analysis*, vol. 20, no. 5, pp. 335–344.

Jun, S-G, Marathe, A & Shawky, HA, 2003, 'Liquidity and stock returns in emerging equity markets', *Emerging Markets Review*, vol. 4, no. 1, pp. 1–24.

Kale, JR & Loon, YC, 2011, 'Product market power and stock market liquidity', *Journal of Financial Markets*, vol. 14, no. 2, pp. 376–410.

Kaniel, R & Liu, H, 2006, 'So what orders do informed traders use?', *Journal of Business*, vol. 79, no. 4, pp. 1867–1914.

Karolyi, GA, Lee, K & van Dijk, MA, 2012, 'Understanding commonality in liquidity around the world', *Journal of Financial Economics*, vol. 105, no. 1, pp. 82–112.

Karolyi, GA & Stulz, RM, 2003, 'Are financial assets priced locally or globally?', in MH G.M. Constantinides & RM Stulz (eds), *Handbook of the Economics of Finance*, Elsevier, North Holland, vol. 1, Part B, pp. 975–1020.

Keim, DB, 1983, 'Size-related anomalies and stock return seasonality: Further empirical evidence', *Journal of Financial Economics*, vol. 12, no. 1, pp. 13–32.

Keim, DB & Madhavan, A, 1995, 'Anatomy of the trading process empirical evidence on the behavior of institutional traders', *Journal of Financial Economics*, vol. 37, no. 3, pp. 371–398.

Keim, DB & Stambaugh, RF, 1984, 'A further investigation of the weekend effect in stock returns', *Journal of Finance*, vol. 39, no. 3, pp. 819–835.

Kempf, A & Mayston, D, 2008, 'Liquidity commonality beyond best prices', *Journal of Financial Research*, vol. 31, no. 1, pp. 25–40.

Kim, S-J, McKenzie, MD & Faff, RW, 2004, 'Macroeconomic news announcements and the role of expectations: evidence for US bond, stock and foreign exchange markets', *Journal of Multinational Financial Management*, vol. 14, no. 3, pp. 217–232.

Korajczyk, RA & Sadka, R, 2008, 'Pricing the commonality across alternative measures of liquidity', *Journal of Financial Economics*, vol. 87, no. 1, pp. 45–72.

Kung, JJ, Carverhill, AP & McLeod, RH, 2010, 'Indonesia's stock market: evolving role, growing efficiency', *Bulletin of Indonesian Economic Studies*, vol. 46, no. 3, pp. 329–346.

Kyle, AS, 1985, 'Continuous auctions and insider trading', *Econometrica*, vol. 53, no. 6, pp. 1315–1335.

Lee, J-H, Lin, S-Y, Lee, W-C & Tsao, C-Y, 2006, 'Common factors in liquidity: Evidence from Taiwan's OTC stock market', *International Review of Financial Analysis*, vol. 15, no. 4–5, pp. 306–327.

Lesmond, DA, 2005, 'Liquidity of emerging markets', *Journal of Financial Economics*, vol. 77, no. 2, pp. 411–452.

Levine, R & Zervos, S, 1998, 'Capital control liberalization and stock market development', *World Development*, vol. 26, no. 7, pp. 1169–1183.

Lipson, ML, 2003, 'Market microstructure and corporate finance', *Journal of Corporate Finance*, vol. 9, no. 4, pp. 377–384.

Madhavan, A, 1992, 'Trading mechanisms in securities markets', *The Journal of Finance*, vol. 47, no. 2, pp. 607–641.

——, 2000, 'Market microstructure: A survey',*Journal of Financial Markets*, vol. 3, no. 3, pp. 205–258.

Mahoney, PG, 2003, 'Market microstructure and market efficiency', *The Journal of Corporate Law*, no. 28, pp. 541–549.

Majid, MSA & Kassim, SH, 2009, 'Impact of the 2007 US financial crisis on the emerging equity markets', *International Journal of Emerging Markets*, vol. 4, no. 4, pp. 341–357.

Marshall, BR & Visaltanachoti, N, 2010, 'The other January effect: Evidence against market efficiency?', *Journal of Banking & Finance*, vol. 34, no. 10, pp. 2413–2424.

Mason, ES, 1939, 'Price and production policies of large-scale enterprise', *The American Economic Review*, vol. 29, no. 1, pp. 61–74.

Merton, RC, 1987, 'A simple model of capital market equilibrium with incomplete information', *The Journal of Finance*, vol. 42, no. 3, pp. 483–510.

Michaud, R, 1999, *Investment Styles, Market Anomalies, and Global Stock Selection*, Research Foundation Publications of The Institute of Chartered Financial Analysts, Charlottesville, Virginia.

Molyneux, P & Forbes, W, 1995, 'Market structure and performance in European banking', *Applied Economics*, vol. 27, no. 2, p. 155.

Næs, R, Skjeltorp, JA & Ødegaard, BA, 2011, 'Stock market liquidity and the business cycle', *The Journal of Finance*, vol. 66, no. 1, pp. 139–176.

Nagel, S, 2012, 'Evaporating liquidity', *Review of Financial Studies*, vol. 25, no. 7, pp. 2,005–2,039.

Narayan, PK, Zhang, Z & Zheng, X, 2010, *Some Hypotheses on Commonality in Liquidity: New Evidence from the Chinese Stock Market*, School Working Paper 2010/10, Deakin University, Melbourne.

Narayan, PK & Zheng, X, 2010, 'Market liquidity risk factor and financial market anomalies: Evidence from the Chinese stock market', *Pacific-Basin Finance Journal*, vol. 18, no. 5, pp. 509–520.

Ng, L, Wu, F, Yu, J & Zhang, B, 2011, *The role of foreign blockholders in stock liquidity: A cross-country analysis*, Working Paper, University of Queensland Business School.

Noerhadi, D, 1994, 'The role of the Indonesian capital market', in RH McLeod (ed.), *Indonesia Assessment 1994: Finance As a Key Sector in Indonesia's Development*, Research School of Pacific and Asian Studies, Australian National University.

O'hara, M, 1995, *Market Microstructure Theory*, Basil Blackwell Inc., Cambridge, Massachusetts.

——, 2004, *Liquidity and Financial Market Stability*, Working Papers Research Series 55, National Bank Of Belgium

Oberman, R, Dobbs, R, Budiman, A, Thomson, F & Rosse, M, 2012, *The Archipelago Economy: Unleashing Indonesia's Potential*, McKinsey Global Institute, McKinsey & Company.

Oguzsoy, CB & Güven, S, 2004, 'Holy days effect on Istanbul stock exchange', *Journal of Emerging Market Finance* vol. 3, no. 1, pp. 63–75.

Parlour, CA, 1998, 'Price dynamics in limit order markets', *The Review of Financial Studies*, vol. 11, no. 4, pp. 789–816.

Pástor, Ľ & Stambaugh, RF, 2003, 'Liquidity risk and expected stock returns', *Journal of Political Economy*, vol. 111, no. 3, pp. 642–685.

Peress, J, 2010, 'Product market competition, insider trading, and stock market efficiency', *The Journal of Finance*, vol. 65, no. 1, pp. 1–43.

Phillips, PCB & Perron, P, 1988, 'Testing for a unit root in time series regression', *Biometrika*, vol. 75, no. 2, pp. 335–346.

Poon, S-H, Rockinger, M & Stathopoulos, K, 2011, *Market Liquidity and Institutional Trading during the 2007–8 Financial Crisis*, Working Paper 623, Manchester Business School

Pukthuanthong-Le, K & Visaltanachoti, N, 2009, 'Commonality in liquidity: Evidence from the stock exchange of Thailand', *Pacific-Basin Finance Journal*, vol. 17, no. 1, pp. 80–99.

Purwoto, L & Tandelilin, E, 2004, 'The impact of the tick size reduction on liquidity: Empirical evidence from the Jakarta stock exchange', *Gadjah Mada International Journal of Business*, vol. 6, no. 2, pp. 225–249.

Reinganum, MR, 1983, 'The anomalous stock market behavior of small firms in January: Empirical tests for tax-loss selling effects', *Journal of Financial Economics*, vol. 12, no. 1, pp. 89–104.

Rhee, SG & Wang, J, 2009, 'Foreign institutional ownership and stock market liquidity: Evidence from Indonesia', *Journal of Banking & Finance*, vol. 33, no. 7, pp. 1,312–1,324.

Roll, R, 1983, 'Vas ist das?', *The Journal Of Portfolio Management*, vol. 9, no. 2, pp. 18–28.

——, 1984, 'A simple implicit measure of the effective bid-ask spread in an efficient market', *Journal of Finance*, vol. 39, no. 4, pp. 1,127–1,139.

Roll, R & Subrahmanyam, A, 2010, 'Liquidity skewness', *Journal of Banking & Finance*, vol. 34, no. 10, pp. 2,562–2,571.

Rosu, I, 2012, 'Order choice and information in limit order markets', in F Abergel, JP Bouchaud, T Foucault, CA Lehalle & M Rosenbaum (eds), *Market Microstructure: Confronting Many Viewpoints*, John Wiley & Sons, West Sussex.

Santoso, W, Harun, CA, Hidayat, T & Wonida, H, 2010, *Market liquidity risk as an indicator of financial stability: The case of Indonesia*, Working Paper, Bank Indonesia.

Schwert, GW, 1989, 'Margin requirements and stock volatility', *Journal of Financial Services Research*, vol. 3, no. 2–3, pp. 153–164.

——, 2003, 'Anomalies and Market Efficiency', in MH G.M. Constantinides & RM Stulz (eds), *Handbook of the Economics of Finance*, Elsevier, North Holland, vol. 1, Part B, pp. 939–974.

Seguin, PJ, 1990, 'Stock volatility and margin trading', *Journal of Monetary Economics*, vol. 26, no. 1, pp. 101–121.

Sekaran, U & Bougie, J, 2009, *Research Methods for Business: A Skill Building Approach*, John Wiley & Sons, West Sussex.

Seyyed, FJ, Abraham, A & Al-Hajji, M, 2005, 'Seasonality in stock returns and volatility: The Ramadan effect', *Research in International Business and Finance*, vol. 19, no. 3, pp. 374–383.

Smidt, S, 1971, 'Which road to an efficient stock market: Free competition or regulated monopoly?', *Financial Analysts Journal*, vol. 27, no. 5, pp. 18–69.

Stoll, HR, 1978, 'The supply of dealer services in securities markets', *The Journal of Finance*, vol. 33, no. 4, pp. 1,133–1,151.

——, 2000, 'Presidential address: Friction', *The Journal of Finance*, vol. 55, no. 4, pp. 1,479–1,514.

Summers LH & Summers VP, 1989, 'When financial markets work too well: A cautious case for a securities transactions tax', *Journal of Financial Services Research*, vol. 3, no. 2, pp. 261–286.

Sun, Q, Tong, WHS & Yan, Y, 2009, 'Market liberalization within a country', *Journal of Empirical Finance*, vol. 16, no. 1, pp. 18–41.

Trang Nha, L & Kakinaka, M, 2010, 'International transmission of stock returns: Mean and volatility spillover effects in Indonesia and Malaysia', *International Journal of Business & Finance Research*, vol. 4, no. 1, pp. 115–131.

Van Ness BF, Van Ness RA & Warr, RS, 2005, 'Nasdaq trading and trading costs: 1993–2002', *Financial Review*, vol. 40, no. 3, pp. 281–304.

Veal, AJ & Ticehurst, GW, 2005, *Business Research Methods: A Managerial Approach*, Pearson Addison Wesley, South Melbourne.

Wang, J, 2013, 'Liquidity commonality among Asian equity markets', *Pacific-Basin Finance Journal*, vol. 21, no. 1, pp. 1,209–1,231.

Weiss, LW, 1979, 'The structure-conduct-performance paradigm and antitrust', *University of Pennsylvania Law Review*, vol. 127, no. 4, pp. 1,104–1,140.

Welker, M, 1995, 'Disclosure policy, information asymmetry, and liquidity in equity markets', *Contemporary Accounting Research*, vol. 11, no. 2, pp. 801–827.

Yeyati, EL, Schmukler, SL & Van Horen, N, 2008, 'Emerging market liquidity and crises', *Journal of the European Economic Association*, vol. 6, no. 2–3, pp. 668–682.

Zheng, Z, Jun, C & Yan Leung, C, 2009, 'Explaining country and cross-border liquidity commonality in international equity markets', *Journal of Futures Markets*, vol. 29, no. 7, pp. 630–652.

Appendix 1 Research in Commonality in Liquidity

| No | Author | Objective | Market | Results |
|---|---|---|---|---|
| 1. | Chordia, Roll and Subrahmanyam (2000) | Investigate common determinants of liquidity (quote-driven) | NYSE | Commonality exists |
| 2. | Hasbrouck and Seppi (2001) | Investigate the important of cross-stock common factors | DJIA and NYSE | Commonality exists, but is weak |
| 3. | Huberman and Halka (2001) | Investigate systematic time-varying component of liquidity. | 60 Stocks NYSE | Commonality exists |
| 4. | Brockman and Chung (2002) | Investigate commonality in order-driven market | SEHK | Commonality exists |
| 5. | Fernando (2003) | Develop a theoretical model | | Common factors of liquidity co-movements have common (systematic) components and idiosyncratic components. |
| 6. | Fujimoto (2004) | Examine the macroeconomic sources of time variation in liquidity | NYSE and AMEX | Macroeconomic factors become less important for monthly aggregate liquidity. |
| 7. | Coughenour and Saad (2004) | Investigate the importance of supply-generated liquidity co-variation | NYSE | Shared capital and information among specialist cause commonality |
| 8. | Bauer (2004) | Investigate commonality in order-driven market | SWX, Swiss | Commonality exists |
| 9. | Fabre and Frino (2004) | Commonality Chordia 2000 | ASX | Commonality exists, but is weak |
| 10. | Domowitz, Hansch and Wang (2005) | Develop a theory | ASX | Commonality is affected by order type factor |
| 11. | Brockman and Chung (2006) | Study the equity index inclusion as source of commonality | SEHK | Equity indices have a greater exposure to commonality |
| 12. | Lee et al. (2006) | Investigate commonality in liquidity | Taiwan OTC stock market | Commonality exists |
| 13. | Hillier, Hillier and Kyaw (2007) | Investigate the firm size–liquidity relationship | LSE | Commonality exists, wider market liquidity changes become more influential on individual large stock liquidities |
| 14. | Galariotis and Giouvris (2007) | Investigate the existence of commonality in order-driven | LSE | Strong commonality exists for FTSE100 stocks both at individual and portfolio level, for FTSE250 only at portfolio level |

| No | Author | Objective | Market | Results |
|---|---|---|---|---|
| 15. | Fernando, Herring and Subrahmanyam (2008) | Develop a model for commonality in perpetual floating-rate notes | | Concentrated ownership is negative for stability |
| 16. | Brockman and Chung (2008) | Investigate the existence of commonality in order-driven | SEHK | Commonality increases during periods of market stress. Larger firms have more commonality. |
| 17. | Kempf and Mayston (2008) | Investigate the commonality in displayed liquidity beyond best prices. | Frankfurt Stock Exchange | Liquidity commonality beyond the inside spread is much larger than it is at the inside spread |
| 18. | Korajczyk and Sadka (2008) | Develop latent factor models of liquidity, aggregated across various liquidity measures | NYSE, AMEX, and NASDAQ | Commonality exists across assets for each individual measure. Return shocks correlated with liquidity shocks. |
| 19. | Brockman, Chung and Pérignon (2009) | Investigate commonality global versus local market | 47 countries, including Indonesia | Exchange-level sources of commonality represent roughly 39% of the firm's total commonality in liquidity, while global sources contribute an additional 19%. |
| 20. | Pukthuanthong-Le and Visaltanachoti (2009) | Investigate the existence of commonality in order-driven | SET, Thailand | Strong evidence of commonality across liquidity measures. |
| 21. | Zheng, Jun and Yan Leung (2009) | Investigate the co-movement of international liquidity | 25 developed countries | Within-country and cross-border liquidity commonalities are found to be significant |
| 22. | Choe and Yang (2010) | Investigate the causes of the commonality | KSE, Korea | Strong liquidity commonality, positive factors: information<br>Asymmetry, order imbalance<br>Program trading & dummy index as well as individual investors' trading |
| 23. | Hameed, Kang and Viswanathan (2010) | Investigate the causes of the commonality | NYSE | Market liquidity drops after large negative market returns because aggregate collateral of financial intermediaries falls and many asset holders are forced to liquidate |
| 24. | Karolyi, Lee and van Dijk (2012) | Investigate the commonality in liquidity across countries over time | 40 countries, including Indonesia | Commonality is greater in volatile market, more international participation, more correlated trading activity. |
| 25. | Wang (2013) | Investigate the cross-market liquidity commonality | 12 stock markets in Asia including Indonesia | Liquidity of individual stock has greater influence from liquidity of Asian developed markets than factors from Asian emerging markets. The global factors have the smallest impact. |

Appendix 2 Determinants of aggregate market liquidity estimated by OLS (without autoregression components (AR(1))

| Explanatory Variable | LN_VDEP | | LN_QDEP | | LN_PQSPR | | LN_QSPR | | LN_TVAL | | LN_TVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat | Coefficient | t-Stat |
| Constant | -1.998 *** | (-21.6288) | -1.908 *** | (-16.4644) | -2.194 *** | (-34.9204) | -0.303 *** | (-4.8969) | 3.718 *** | (25.4150) | 3.209 *** | (19.4307) |
| CRS | -0.819 *** | (-24.4440) | -0.777 *** | (-18.4927) | 0.090 *** | (3.9317) | -0.243 *** | (-10.8207) | -0.493 *** | (-9.3041) | -0.224 *** | (-3.7368) |
| POSTCRS | 0.069 *** | (3.7026) | 0.016 | (0.6714) | -0.446 *** | (-35.2488) | -0.141 *** | (-11.2926) | 0.356 *** | (12.1043) | 0.689 *** | (20.7065) |
| LN_VOL_SNP(-1) | -0.098 *** | (-6.0121) | -0.195 *** | (-9.5518) | -0.008 | (-0.6996) | 0.057 *** | (5.1822) | 0.077 *** | (2.9838) | 0.109 *** | (3.7532) |
| LN_VOL_NIKKEI | -0.036 ** | (-2.1543) | -0.065 *** | (-3.1014) | 0.047 *** | (4.1127) | -0.005 | (-0.4381) | 0.009 | (0.3331) | -0.094 *** | (-3.1321) |
| $CPI_{12}$ | -0.031 | (-1.1158) | -0.035 | (-0.9998) | -0.006 | (-0.3214) | 0.005 | (0.2884) | 0.044 | (1.0111) | 0.022 | (0.4446) |
| $CPI_0$ | -0.034 | (-0.9083) | -0.036 | (-0.7778) | 0.009 | (0.3460) | 0.017 | (0.6979) | 0.058 | (0.9793) | 0.019 | (0.2921) |
| $GDP_{12}$ | 0.087 * | (1.8781) | 0.087 | (1.4994) | -0.030 | (-0.9477) | -0.030 | (-0.9809) | 0.143 * | (1.9517) | 0.171 ** | (2.0728) |
| $GDP_0$ | 0.086 | (1.3404) | 0.076 | (0.9531) | -0.026 | (-0.6015) | -0.025 | (-0.5903) | 0.172 * | (1.7049) | 0.150 | (1.3169) |
| $UNP_{12}$ | -0.076 | (-1.0703) | -0.038 | (-0.4244) | 0.034 | (0.6980) | -0.048 | (-1.0057) | 0.013 | (0.1151) | 0.084 | (0.6635) |
| $UNP_0$ | -0.025 | (-0.2528) | -0.088 | (-0.7125) | 0.001 | (0.0168) | -0.070 | (-1.0608) | -0.096 | (-0.6161) | 0.013 | (0.0759) |
| DL_SHORTRATE | -0.132 | (-0.5284) | -0.423 | (-1.3525) | 0.078 | (0.4622) | 0.527 *** | (3.1476) | -0.217 | (-0.5497) | -0.602 | (-1.3495) |
| LN_TSPREAD | -0.040 | (-0.5194) | -0.815 *** | (-8.4124) | -0.058 | (-1.1035) | 0.097 * | (1.8646) | 0.181 | (1.4768) | 0.008 | (0.0589) |
| MKT+ | 0.153 *** | (10.0702) | 0.122 *** | (6.4095) | -0.028 *** | (-2.6892) | -0.045 *** | (-4.4632) | 0.064 *** | (2.6506) | 0.067 ** | (2.4682) |
| MA5MKT+ | 0.146 *** | (9.3175) | 0.182 *** | (9.2524) | -0.072 *** | (-6.7387) | -0.105 *** | (-9.9957) | 0.159 *** | (6.3946) | 0.270 *** | (9.6149) |
| LN_MA5\|MKT\| | -0.206 *** | (-12.6296) | -0.193 *** | (-9.4286) | 0.104 *** | (9.3765) | 0.075 *** | (6.8473) | 0.263 *** | (10.2038) | 0.283 *** | (9.7145) |
| MON | -0.087 *** | (-3.5879) | -0.087 *** | (-2.8686) | 0.015 | (0.9194) | 0.002 | (0.1049) | -0.070 * | (-1.8205) | -0.047 | (-1.0841) |
| TUE | -0.038 | (-1.5835) | -0.034 | (-1.1395) | -0.010 | (-0.6107) | -0.010 | (-0.6358) | 0.029 | (0.7557) | 0.076 * | (1.7807) |
| WED | 0.003 | (0.1126) | -0.006 | (-0.2041) | -0.014 | (-0.8627) | -0.017 | (-1.0573) | 0.088 ** | (2.3106) | 0.128 *** | (3.0001) |
| THU | -0.003 | (-0.1220) | 0.010 | (0.3156) | -0.024 | (-1.4506) | -0.029 * | (-1.7991) | 0.090 ** | (2.3726) | 0.138 *** | (3.2101) |
| HOL | -0.026 | (-0.8068) | -0.013 | (-0.3371) | 0.022 | (1.0323) | 0.031 | (1.4572) | -0.102 ** | (-2.0452) | -0.197 *** | (-3.4938) |
| RAMADAN | 0.151 *** | (5.4873) | 0.153 *** | (4.4455) | -0.001 | (-0.0546) | 0.026 | (1.4296) | 0.036 | (0.8372) | -0.019 | (-0.3782) |
| Observations: | 1690 | | 1690 | | 1690 | | 1690 | | 1690 | | 1690 | |
| R-squared | 0.615 | | 0.553 | | 0.594 | | 0.213 | | 0.282 | | 0.374 | |
| Adjusted R-squared | 0.610 | | 0.548 | | 0.589 | | 0.203 | | 0.273 | | 0.367 | |
| Akaike info criterion | 0.491 | | 0.944 | | -0.280 | | -0.308 | | 1.410 | | 1.653 | |
| Durbin-Watson stat | 0.577 | | 0.442 | | 0.180 | | 0.390 | | 0.433 | | 0.437 | |

Appendix 3 Determinants of aggregate market liquidity estimated by OLS (with autoregression components (AR(1))

| Explanatory Variable | LN_VDEP | | | LN_QDEP | | | LN_PQSPR | | | LN_QSPR | | | LN_TVAL | | | LN_TVOL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Coefficient | | t-Stat | Coefficient | | t-Stat | Coefficient | | t-Stat | Coefficient | | t-Stat | Coefficient | | t-Stat | Coefficient | | t-Stat |
| Constant | -0.847 | *** | (-5.9649) | -0.081 | | (-0.4932) | -2.880 | *** | (-37.6206) | -0.689 | *** | (-8.3101) | 1.389 | *** | (6.7042) | 1.552 | *** | (6.7457) |
| CRS | -0.815 | *** | (-10.0666) | -0.732 | *** | (-5.9795) | -0.109 | * | (-1.7136) | -0.150 | *** | (-2.7080) | -0.037 | | (-0.2617) | 0.023 | | (0.1524) |
| POSTCRS | 0.053 | | (0.9988) | -0.150 | * | (-1.6613) | -0.275 | *** | (-3.7467) | -0.141 | *** | (-3.6191) | 0.455 | *** | (4.5171) | 0.752 | *** | (7.3128) |
| LN_VOL_SNP(-1) | -0.060 | *** | (-2.9756) | -0.035 | | (-1.5967) | 0.018 | ** | (2.4157) | 0.023 | ** | (2.0297) | -0.067 | ** | (-2.4063) | -0.048 | | (-1.4973) |
| LN_VOL_NIKKEI | 0.007 | | (0.3446) | 0.023 | | (1.0928) | -0.003 | | (-0.4234) | -0.001 | | (-0.0648) | -0.060 | ** | (-2.2606) | -0.080 | *** | (-2.6331) |
| $CPI_{12}$ | -0.021 | | (-0.9997) | -0.008 | | (-0.3381) | -0.006 | | (-0.7982) | 0.008 | | (0.6907) | 0.004 | | (0.1483) | -0.005 | | (-0.1520) |
| $CPI_0$ | 0.000 | | (0.0050) | 0.002 | | (0.0751) | 0.003 | | (0.3814) | 0.000 | | (0.0152) | -0.020 | | (-0.6789) | -0.006 | | (-0.1731) |
| $GDP_{12}$ | -0.026 | | (-0.6873) | -0.012 | | (-0.2971) | -0.007 | | (-0.4998) | -0.020 | | (-0.9530) | 0.074 | | (1.4598) | 0.095 | | (1.6295) |
| $GDP_0$ | -0.031 | | (-0.7998) | -0.006 | | (-0.1592) | 0.008 | | (0.6184) | 0.000 | | (-0.0146) | 0.111 | ** | (2.1809) | 0.106 | * | (1.8050) |
| $UNP_{12}$ | 0.013 | | (0.2216) | -0.011 | | (-0.1838) | 0.022 | | (1.0869) | 0.045 | | (1.3721) | 0.042 | | (0.5315) | -0.009 | | (-0.0990) |
| $UNP_0$ | -0.016 | | (-0.2762) | -0.104 | * | (-1.6721) | -0.005 | | (-0.2334) | 0.003 | | (0.0827) | -0.077 | | (-0.9763) | -0.097 | | (-1.0671) |
| DL_SHORTRATE | -0.072 | | (-0.4974) | 0.032 | | (0.1980) | 0.167 | *** | (2.8821) | 0.309 | *** | (3.7083) | -0.143 | | (-0.7057) | -0.155 | | (-0.6765) |
| LN_TSPREAD | -0.233 | | (-1.3280) | -0.089 | | (-0.3916) | 0.197 | ** | (2.2607) | 0.222 | ** | (1.9926) | -0.141 | | (-0.5104) | -0.205 | | (-0.6780) |
| MKT+ | 0.126 | *** | (15.0999) | 0.091 | *** | (10.4680) | -0.020 | *** | (-6.7404) | -0.031 | *** | (-6.6631) | 0.073 | *** | (6.5530) | 0.059 | *** | (4.6120) |
| MA5MKT+ | 0.038 | *** | (2.8244) | 0.024 | * | (1.6643) | -0.019 | *** | (-3.9390) | -0.026 | *** | (-3.5333) | 0.035 | ** | (1.9632) | 0.045 | ** | (2.1799) |
| LN_MA5\|MKT\| | -0.070 | *** | (-3.3027) | -0.057 | ** | (-2.4759) | 0.010 | | (1.2478) | 0.041 | *** | (3.4180) | -0.035 | | (-1.1781) | 0.047 | | (1.3871) |
| MON | -0.088 | *** | (-7.6988) | -0.078 | *** | (-6.6063) | 0.016 | *** | (3.9414) | 0.003 | | (0.4389) | -0.084 | *** | (-5.5449) | -0.065 | *** | (-3.7296) |
| TUE | -0.034 | ** | (-2.4726) | -0.026 | * | (-1.8689) | -0.009 | * | (-1.8781) | -0.008 | | (-1.0337) | 0.021 | | (1.1830) | 0.063 | *** | (3.0337) |
| WED | 0.008 | | (0.5555) | 0.008 | | (0.5537) | -0.019 | *** | (-3.9766) | -0.021 | *** | (-2.7560) | 0.075 | *** | (4.1736) | 0.114 | *** | (5.4872) |
| THU | 0.005 | | (0.4208) | 0.020 | * | (1.6753) | -0.026 | *** | (-6.5686) | -0.035 | *** | (-5.6702) | 0.086 | *** | (5.6863) | 0.131 | *** | (7.5623) |
| HOL | -0.036 | * | (-1.8601) | -0.028 | | (-1.3902) | 0.024 | *** | (3.5210) | 0.046 | *** | (4.2621) | -0.098 | *** | (-3.7941) | -0.139 | *** | (-4.6713) |
| RAMADAN | 0.126 | ** | (2.4865) | 0.114 | * | (1.9151) | -0.095 | *** | (-4.4755) | -0.075 | ** | (-2.4654) | -0.212 | *** | (-2.8558) | -0.033 | | (-0.3942) |
| AR(1) | 0.787 | *** | (49.9950) | 0.872 | *** | (69.5164) | 0.956 | *** | (127.2128) | 0.842 | *** | (62.8139) | 0.853 | *** | (63.8645) | 0.833 | *** | (59.9576) |
| Observations: | 1690 | | | 1690 | | | 1690 | | | 1690 | | | 1690 | | | 1690 | | |
| R-squared: | 0.825 | | | 0.850 | | | 0.944 | | | 0.748 | | | 0.758 | | | 0.785 | | |
| Adjusted R-squared | 0.823 | | | 0.848 | | | 0.944 | | | 0.745 | | | 0.755 | | | 0.782 | | |
| Akaike info criterion | -0.299 | | | -0.147 | | | -2.265 | | | -1.447 | | | 0.323 | | | 0.588 | | |
| ARCH-LM Test(1): | | | | | | | | | | | | | | | | | | |
| Obs*R-squared | 180.656 | | | 182.695 | | | 91.567 | | | 176.343 | | | 127.363 | | | 138.954 | | |
| Prob. Chi-Square | 0.000 | | | 0.000 | | | 0.000 | | | 0.000 | | | 0.000 | | | 0.000 | | |

(1) Breusch-Godfrey Serial Correlation LM Test

Appendix 4 Unit Root Test Results for Individual Stock Liquidity Measures

| No | Code | D_PQSPR | | D_QSPR | | D_VDEP | | D_QDEP | | D_TVAL | | D_TVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val |
| 1 | AALI | -5.363 | 0.000 | -5.421 | 0.000 | -44.431 | 0.000 | -44.433 | 0.000 | -42.003 | 0.000 | -42.064 | 0.000 |
| 2 | ADES | -16.379 | 0.000 | -16.378 | 0.000 | -15.269 | 0.000 | -42.897 | 0.000 | -42.683 | 0.000 | -42.636 | 0.000 |
| 3 | ADHI | -6.331 | 0.000 | -6.791 | 0.000 | -11.487 | 0.000 | -10.717 | 0.000 | -31.322 | 0.000 | -31.528 | 0.000 |
| 4 | ADMF | -26.983 | 0.000 | -27.202 | 0.000 | -44.083 | 0.000 | -44.104 | 0.000 | -6.370 | 0.000 | -6.286 | 0.000 |
| 5 | ADMG | -9.198 | 0.000 | -9.137 | 0.000 | -10.924 | 0.000 | -10.898 | 0.000 | -41.871 | 0.000 | -41.817 | 0.000 |
| 6 | AMFG | -14.022 | 0.000 | -14.109 | 0.000 | -44.018 | 0.000 | -44.120 | 0.000 | -8.329 | 0.000 | -8.326 | 0.000 |
| 7 | APLI | -5.896 | 0.000 | -5.731 | 0.000 | -43.196 | 0.000 | -8.919 | 0.000 | -6.978 | 0.000 | -6.936 | 0.000 |
| 8 | ASGR | -5.200 | 0.000 | -5.398 | 0.000 | -6.485 | 0.000 | -8.705 | 0.000 | -41.772 | 0.000 | -41.752 | 0.000 |
| 9 | ASII | -7.585 | 0.000 | -7.665 | 0.000 | -42.923 | 0.000 | -42.789 | 0.000 | -27.230 | 0.000 | -27.290 | 0.000 |
| 10 | BAYU | -46.043 | 0.000 | -46.378 | 0.000 | -8.746 | 0.000 | -8.889 | 0.000 | -41.637 | 0.000 | -41.668 | 0.000 |
| 11 | BBNI | -5.847 | 0.000 | -5.808 | 0.000 | -7.654 | 0.000 | -7.677 | 0.000 | -6.124 | 0.000 | -6.053 | 0.000 |
| 12 | BDMN | -15.473 | 0.000 | -15.534 | 0.000 | -8.415 | 0.000 | -8.638 | 0.000 | -41.174 | 0.000 | -41.193 | 0.000 |
| 13 | BLTA | -6.267 | 0.000 | -9.688 | 0.000 | -7.402 | 0.000 | -6.697 | 0.000 | -47.009 | 0.000 | -47.593 | 0.000 |
| 14 | BMRI | -8.197 | 0.000 | -8.436 | 0.000 | -41.619 | 0.000 | -41.644 | 0.000 | -28.624 | 0.000 | -28.681 | 0.000 |
| 15 | BNGA | -11.953 | 0.000 | -11.901 | 0.000 | -44.537 | 0.000 | -44.523 | 0.000 | -6.868 | 0.000 | -6.838 | 0.000 |
| 16 | BNLI | -7.145 | 0.000 | -7.085 | 0.000 | -42.523 | 0.000 | -42.472 | 0.000 | -41.751 | 0.000 | -41.761 | 0.000 |
| 17 | BRPT | -34.561 | 0.000 | -36.151 | 0.000 | -48.486 | 0.000 | -47.743 | 0.000 | -9.670 | 0.000 | -9.667 | 0.000 |
| 18 | BUDI | -6.178 | 0.000 | -6.044 | 0.000 | -20.233 | 0.000 | -7.081 | 0.000 | -41.554 | 0.000 | -41.557 | 0.000 |
| 19 | BUMI | -10.210 | 0.000 | -10.025 | 0.000 | -32.758 | 0.000 | -32.185 | 0.000 | -41.303 | 0.000 | -41.300 | 0.000 |
| 20 | BVIC | -11.219 | 0.000 | -10.351 | 0.000 | -44.091 | 0.000 | -44.007 | 0.000 | -9.488 | 0.000 | -9.362 | 0.000 |
| 21 | CMNP | -4.771 | 0.000 | -4.782 | 0.000 | -19.624 | 0.000 | -19.567 | 0.000 | -9.370 | 0.000 | -9.352 | 0.000 |
| 22 | ELTY | -8.932 | 0.000 | -8.647 | 0.000 | -15.223 | 0.000 | -41.418 | 0.000 | -4.578 | 0.000 | -4.574 | 0.000 |
| 23 | ENRG | -5.363 | 0.000 | -5.393 | 0.000 | -8.881 | 0.000 | -8.845 | 0.000 | -9.785 | 0.000 | -9.408 | 0.000 |
| 24 | EPMT | -5.429 | 0.000 | -5.460 | 0.000 | -11.733 | 0.000 | -11.923 | 0.000 | -41.365 | 0.000 | -41.365 | 0.000 |
| 25 | ETWA | -12.464 | 0.000 | -12.311 | 0.000 | -42.484 | 0.000 | -42.758 | 0.000 | -27.671 | 0.000 | -27.514 | 0.000 |
| 26 | GGRM | -8.411 | 0.000 | -5.678 | 0.000 | -44.919 | 0.000 | -45.031 | 0.000 | -41.378 | 0.000 | -41.379 | 0.000 |
| 27 | GJTL | -5.853 | 0.000 | -5.964 | 0.000 | -29.277 | 0.000 | -29.300 | 0.000 | -43.842 | 0.000 | -43.921 | 0.000 |
| 28 | INAF | -6.937 | 0.000 | -6.971 | 0.000 | -41.605 | 0.000 | -41.646 | 0.000 | -41.773 | 0.000 | -41.766 | 0.000 |
| 29 | INCI | -11.793 | 0.000 | -11.800 | 0.000 | -15.076 | 0.000 | -42.484 | 0.000 | -41.260 | 0.000 | -41.262 | 0.000 |
| 30 | INDF | -7.240 | 0.000 | -7.484 | 0.000 | -43.037 | 0.000 | -43.004 | 0.000 | -7.023 | 0.000 | -7.080 | 0.000 |
| 31 | INDR | -33.720 | 0.000 | -25.110 | 0.000 | -8.668 | 0.000 | -5.848 | 0.000 | -42.013 | 0.000 | -42.006 | 0.000 |
| 32 | INKP | -7.369 | 0.000 | -8.243 | 0.000 | -48.424 | 0.000 | -6.127 | 0.000 | -45.882 | 0.000 | -45.931 | 0.000 |
| 33 | INTP | -34.766 | 0.000 | -20.913 | 0.000 | -42.330 | 0.000 | -42.406 | 0.000 | -41.463 | 0.000 | -41.463 | 0.000 |
| 34 | ISAT | -30.726 | 0.000 | -30.639 | 0.000 | -45.902 | 0.000 | -45.833 | 0.000 | -27.038 | 0.000 | -27.095 | 0.000 |

| No | Code | D_PQSPR | | D_QSPR | | D_VDEP | | D_QDEP | | D_TVAL | | D_TVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val |
| 35 | JIHD | -5.442 | 0.000 | -5.387 | 0.000 | -42.720 | 0.000 | -42.913 | 0.000 | -41.563 | 0.000 | -41.560 | 0.000 |
| 36 | JPFA | -5.166 | 0.000 | -5.217 | 0.000 | -45.271 | 0.000 | -42.831 | 0.000 | -41.624 | 0.000 | -41.697 | 0.000 |
| 37 | KAEF | -5.522 | 0.000 | -5.512 | 0.000 | -43.039 | 0.000 | -43.030 | 0.000 | -7.775 | 0.000 | -7.699 | 0.000 |
| 38 | KIJA | -11.732 | 0.000 | -11.753 | 0.000 | -15.520 | 0.000 | -8.197 | 0.000 | -41.311 | 0.000 | -41.309 | 0.000 |
| 39 | KLBF | -12.056 | 0.000 | -12.260 | 0.000 | -27.884 | 0.000 | -27.894 | 0.000 | -23.725 | 0.000 | -23.585 | 0.000 |
| 40 | KPIG | -8.111 | 0.000 | -7.522 | 0.000 | -42.416 | 0.000 | -41.421 | 0.000 | -41.312 | 0.000 | -41.326 | 0.000 |
| 41 | LMAS | -3.825 | 0.003 | -3.669 | 0.005 | -12.076 | 0.000 | -41.964 | 0.000 | -41.408 | 0.000 | -41.410 | 0.000 |
| 42 | LTLS | -7.436 | 0.000 | -7.471 | 0.000 | -8.803 | 0.000 | -8.845 | 0.000 | -10.310 | 0.000 | -10.284 | 0.000 |
| 43 | MAPI | -7.252 | 0.000 | -7.209 | 0.000 | -7.281 | 0.000 | -7.217 | 0.000 | -8.804 | 0.000 | -8.424 | 0.000 |
| 44 | MDLN | -6.891 | 0.000 | -5.580 | 0.000 | -6.589 | 0.000 | -6.536 | 0.000 | -10.593 | 0.000 | -10.492 | 0.000 |
| 45 | MEDC | -37.383 | 0.000 | -37.769 | 0.000 | -43.633 | 0.000 | -28.353 | 0.000 | -33.171 | 0.000 | -33.092 | 0.000 |
| 46 | MPPA | -6.314 | 0.000 | -6.251 | 0.000 | -7.077 | 0.000 | -7.183 | 0.000 | -41.498 | 0.000 | -41.491 | 0.000 |
| 47 | MRAT | -9.550 | 0.000 | -9.539 | 0.000 | -44.535 | 0.000 | -44.626 | 0.000 | -41.361 | 0.000 | -41.372 | 0.000 |
| 48 | MTDL | -8.995 | 0.000 | -9.064 | 0.000 | -41.851 | 0.000 | -41.843 | 0.000 | -41.437 | 0.000 | -41.428 | 0.000 |
| 49 | MYOR | -33.909 | 0.000 | -34.203 | 0.000 | -9.356 | 0.000 | -41.386 | 0.000 | -7.766 | 0.000 | -7.777 | 0.000 |
| 50 | PLAS | -17.456 | 0.000 | -42.957 | 0.000 | -41.881 | 0.000 | -42.063 | 0.000 | -6.554 | 0.000 | -6.557 | 0.000 |
| 51 | PNBN | -30.198 | 0.000 | -25.231 | 0.000 | -15.048 | 0.000 | -15.039 | 0.000 | -41.425 | 0.000 | -41.426 | 0.000 |
| 52 | PNIN | -7.631 | 0.000 | -7.597 | 0.000 | -10.787 | 0.000 | -11.175 | 0.000 | -41.539 | 0.000 | -41.546 | 0.000 |
| 53 | PNLF | -5.651 | 0.000 | -5.569 | 0.000 | -44.085 | 0.000 | -44.183 | 0.000 | -41.307 | 0.000 | -41.311 | 0.000 |
| 54 | PTBA | -4.882 | 0.000 | -4.969 | 0.000 | -44.708 | 0.000 | -44.771 | 0.000 | -10.737 | 0.000 | -10.700 | 0.000 |
| 55 | PYFA | -13.129 | 0.000 | -6.422 | 0.000 | -41.291 | 0.000 | -41.302 | 0.000 | -43.216 | 0.000 | -43.693 | 0.000 |
| 56 | RALS | -6.958 | 0.000 | -5.588 | 0.000 | -41.510 | 0.000 | -41.520 | 0.000 | -8.995 | 0.000 | -8.953 | 0.000 |
| 57 | RMBA | -5.206 | 0.000 | -5.063 | 0.000 | -9.358 | 0.000 | -42.414 | 0.000 | -7.170 | 0.000 | -7.143 | 0.000 |
| 58 | SCMA | -33.625 | 0.000 | -33.924 | 0.000 | -28.394 | 0.000 | -41.518 | 0.000 | -41.930 | 0.000 | -41.938 | 0.000 |
| 59 | SMCB | -57.275 | 0.000 | -57.183 | 0.000 | -10.072 | 0.000 | -9.912 | 0.000 | -11.578 | 0.000 | -14.364 | 0.000 |
| 60 | SMDR | -13.814 | 0.000 | -13.630 | 0.000 | -44.990 | 0.000 | -45.238 | 0.000 | -23.024 | 0.000 | -23.053 | 0.000 |
| 61 | SMMA | -51.210 | 0.000 | -7.197 | 0.000 | -5.850 | 0.000 | -6.061 | 0.000 | -41.473 | 0.000 | -41.470 | 0.000 |
| 62 | SPMA | -4.447 | 0.000 | -4.360 | 0.000 | -6.663 | 0.000 | -6.662 | 0.000 | -41.844 | 0.000 | -41.878 | 0.000 |
| 63 | SULI | -15.472 | 0.000 | -15.664 | 0.000 | -11.253 | 0.000 | -12.026 | 0.000 | -41.767 | 0.000 | -41.719 | 0.000 |
| 64 | TBLA | -7.084 | 0.000 | -7.457 | 0.000 | -6.321 | 0.000 | -6.371 | 0.000 | -42.113 | 0.000 | -42.082 | 0.000 |
| 65 | TCID | -16.551 | 0.000 | -34.116 | 0.000 | -8.549 | 0.000 | -5.588 | 0.000 | -41.442 | 0.000 | -41.443 | 0.000 |
| 66 | TIRT | -11.458 | 0.000 | -6.720 | 0.000 | -42.131 | 0.000 | -42.232 | 0.000 | -18.152 | 0.000 | -18.311 | 0.000 |
| 67 | TKIM | -5.647 | 0.000 | -5.585 | 0.000 | -31.262 | 0.000 | -8.227 | 0.000 | -42.086 | 0.000 | -42.138 | 0.000 |
| 68 | TLKM | -25.549 | 0.000 | -30.559 | 0.000 | -22.880 | 0.000 | -22.975 | 0.000 | -17.604 | 0.000 | -17.596 | 0.000 |
| 69 | TMPO | -50.524 | 0.000 | -51.555 | 0.000 | -6.105 | 0.000 | -19.058 | 0.000 | -41.329 | 0.000 | -41.333 | 0.000 |
| 70 | TRST | -9.137 | 0.000 | -9.224 | 0.000 | -42.003 | 0.000 | -42.010 | 0.000 | -41.326 | 0.000 | -41.322 | 0.000 |

| No | Code | D_PQSPR | | D_QSPR | | D_VDEP | | D_QDEP | | D_TVAL | | D_TVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val |
| 71 | ULTJ | -33.303 | 0.000 | -33.879 | 0.000 | -13.083 | 0.000 | -23.696 | 0.000 | -41.888 | 0.000 | -41.978 | 0.000 |
| 72 | UNSP | -8.698 | 0.000 | -8.557 | 0.000 | -51.536 | 0.000 | -48.117 | 0.000 | -41.273 | 0.000 | -41.273 | 0.000 |
| 73 | UNTR | -5.505 | 0.000 | -5.512 | 0.000 | -42.658 | 0.000 | -42.609 | 0.000 | -8.346 | 0.000 | -8.174 | 0.000 |
| 74 | UNVR | -5.721 | 0.000 | -6.800 | 0.000 | -43.035 | 0.000 | -43.019 | 0.000 | -43.030 | 0.000 | -43.009 | 0.000 |
| 75 | WOMF | -7.706 | 0.000 | -7.579 | 0.000 | -41.651 | 0.000 | -41.744 | 0.000 | -41.570 | 0.000 | -41.588 | 0.000 |

Notes:This table presents unit root test results of the daily percentage changes in individual stocks' liquidity proxies from 3 January 2005 to 30 December 2011. PQSPR refers toproportional quoted spread, QSPR is the quoted spread, VDEP is theRupiah value of market depth, QDEP is thenumber of shares for market depth, TVAL is the daily trading value, and TVOL refers to daily trading quantity (shares) . D denotes the daily percentage changes in that variable for each liquidity variable. The unit root test isbased on the Augmented Dickey-Fuller (ADF) test with the Schwartz Information Criterion (SIC) to obtain the optimal lag length.

Appendix 5 Unit Root Test Results for Market Liquidity Measures

| No | Code | D_MPQSPR | | D_MQSPR | | D_MVDEP | | D_MQDEP | | D_MTVAL | | D_MTVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val |
| 1 | AALI | -14.290 | 0.000 | -25.658 | 0.000 | -26.328 | 0.000 | -8.398 | 0.000 | -13.211 | 0.000 | -8.560 | 0.000 |
| 2 | ADES | -22.859 | 0.000 | -25.637 | 0.000 | -26.384 | 0.000 | -8.384 | 0.000 | -13.223 | 0.000 | -8.560 | 0.000 |
| 3 | ADHI | -26.143 | 0.000 | -25.664 | 0.000 | -26.419 | 0.000 | -8.315 | 0.000 | -15.713 | 0.000 | -8.501 | 0.000 |
| 4 | ADMF | -26.430 | 0.000 | -15.724 | 0.000 | -26.375 | 0.000 | -8.400 | 0.000 | -13.220 | 0.000 | -8.566 | 0.000 |
| 5 | ADMG | -22.900 | 0.000 | -25.676 | 0.000 | -26.381 | 0.000 | -8.376 | 0.000 | -13.246 | 0.000 | -8.635 | 0.000 |
| 6 | AMFG | -26.104 | 0.000 | -25.748 | 0.000 | -26.385 | 0.000 | -8.396 | 0.000 | -15.647 | 0.000 | -8.568 | 0.000 |
| 7 | APLI | -26.215 | 0.000 | -25.674 | 0.000 | -26.380 | 0.000 | -8.377 | 0.000 | -13.223 | 0.000 | -8.583 | 0.000 |
| 8 | ASGR | -14.322 | 0.000 | -25.666 | 0.000 | -26.374 | 0.000 | -8.367 | 0.000 | -13.235 | 0.000 | -8.548 | 0.000 |
| 9 | ASII | -26.166 | 0.000 | -25.071 | 0.000 | -26.472 | 0.000 | -8.399 | 0.000 | -15.380 | 0.000 | -8.541 | 0.000 |
| 10 | BAYU | -13.943 | 0.000 | -25.632 | 0.000 | -26.380 | 0.000 | -8.374 | 0.000 | -13.221 | 0.000 | -8.533 | 0.000 |
| 11 | BBNI | -26.155 | 0.000 | -25.665 | 0.000 | -26.282 | 0.000 | -8.347 | 0.000 | -13.325 | 0.000 | -8.523 | 0.000 |
| 12 | BDMN | -14.286 | 0.000 | -25.626 | 0.000 | -26.367 | 0.000 | -8.372 | 0.000 | -13.200 | 0.000 | -8.529 | 0.000 |
| 13 | BLTA | -26.150 | 0.000 | -25.677 | 0.000 | -26.357 | 0.000 | -8.297 | 0.000 | -15.607 | 0.000 | -8.492 | 0.000 |
| 14 | BMRI | -26.153 | 0.000 | -25.620 | 0.000 | -26.843 | 0.000 | -8.420 | 0.000 | -12.021 | 0.000 | -8.366 | 0.000 |
| 15 | BNGA | -26.152 | 0.000 | -25.670 | 0.000 | -26.625 | 0.000 | -8.241 | 0.000 | -15.673 | 0.000 | -12.945 | 0.000 |
| 16 | BNLI | -26.155 | 0.000 | -25.731 | 0.000 | -26.385 | 0.000 | -8.398 | 0.000 | -15.671 | 0.000 | -8.551 | 0.000 |
| 17 | BRPT | -26.119 | 0.000 | -25.659 | 0.000 | -26.344 | 0.000 | -8.403 | 0.000 | -15.610 | 0.000 | -8.535 | 0.000 |
| 18 | BUDI | -26.196 | 0.000 | -25.667 | 0.000 | -26.371 | 0.000 | -8.374 | 0.000 | -13.230 | 0.000 | -8.600 | 0.000 |
| 19 | BUMI | -26.144 | 0.000 | -25.655 | 0.000 | -15.224 | 0.000 | -7.792 | 0.000 | -15.383 | 0.000 | -18.479 | 0.000 |
| 20 | BVIC | -26.065 | 0.000 | -25.666 | 0.000 | -26.379 | 0.000 | -8.406 | 0.000 | -13.221 | 0.000 | -8.566 | 0.000 |
| 21 | CMNP | -26.192 | 0.000 | -25.651 | 0.000 | -26.407 | 0.000 | -8.395 | 0.000 | -15.652 | 0.000 | -8.537 | 0.000 |
| 22 | ELTY | -26.163 | 0.000 | -25.672 | 0.000 | -26.474 | 0.000 | -11.175 | 0.000 | -15.634 | 0.000 | -8.196 | 0.000 |
| 23 | ENRG | -26.179 | 0.000 | -25.661 | 0.000 | -26.358 | 0.000 | -18.439 | 0.000 | -13.256 | 0.000 | -15.052 | 0.000 |
| 24 | EPMT | -13.985 | 0.000 | -25.539 | 0.000 | -26.381 | 0.000 | -8.343 | 0.000 | -15.652 | 0.000 | -8.559 | 0.000 |
| 25 | ETWA | -14.298 | 0.000 | -25.663 | 0.000 | -26.380 | 0.000 | -8.369 | 0.000 | -13.219 | 0.000 | -12.886 | 0.000 |
| 26 | GGRM | -26.158 | 0.000 | -25.250 | 0.000 | -26.288 | 0.000 | -8.398 | 0.000 | -13.205 | 0.000 | -8.566 | 0.000 |
| 27 | GJTL | -26.181 | 0.000 | -25.660 | 0.000 | -26.411 | 0.000 | -8.395 | 0.000 | -13.233 | 0.000 | -8.554 | 0.000 |
| 28 | INAF | -26.073 | 0.000 | -25.677 | 0.000 | -26.379 | 0.000 | -8.372 | 0.000 | -13.211 | 0.000 | -8.530 | 0.000 |
| 29 | INCI | -26.209 | 0.000 | -25.710 | 0.000 | -26.374 | 0.000 | -8.317 | 0.000 | -13.220 | 0.000 | -8.565 | 0.000 |
| 30 | INDF | -26.136 | 0.000 | -25.647 | 0.000 | -26.416 | 0.000 | -8.427 | 0.000 | -13.306 | 0.000 | -8.528 | 0.000 |
| 31 | INDR | -14.525 | 0.000 | -25.767 | 0.000 | -26.381 | 0.000 | -8.398 | 0.000 | -13.221 | 0.000 | -8.564 | 0.000 |
| 32 | INKP | -26.148 | 0.000 | -25.678 | 0.000 | -26.388 | 0.000 | -8.394 | 0.000 | -15.668 | 0.000 | -12.822 | 0.000 |
| 33 | INTP | -14.289 | 0.000 | -25.456 | 0.000 | -26.354 | 0.000 | -8.396 | 0.000 | -13.175 | 0.000 | -8.558 | 0.000 |
| 34 | ISAT | -26.166 | 0.000 | -25.607 | 0.000 | -26.475 | 0.000 | -8.422 | 0.000 | -15.534 | 0.000 | -8.474 | 0.000 |

| No | Code | D_MPQSPR | | D_MQSPR | | D_MVDEP | | D_MQDEP | | D_MTVAL | | D_MTVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val |
| 35 | JIHD | -26.175 | 0.000 | -25.631 | 0.000 | -26.381 | 0.000 | -8.405 | 0.000 | -13.227 | 0.000 | -8.566 | 0.000 |
| 36 | JPFA | -14.381 | 0.000 | -25.684 | 0.000 | -26.370 | 0.000 | -8.391 | 0.000 | -13.236 | 0.000 | -8.573 | 0.000 |
| 37 | KAEF | -26.265 | 0.000 | -25.676 | 0.000 | -26.376 | 0.000 | -8.373 | 0.000 | -15.654 | 0.000 | -8.573 | 0.000 |
| 38 | KIJA | -26.170 | 0.000 | -25.667 | 0.000 | -26.429 | 0.000 | -8.492 | 0.000 | -15.630 | 0.000 | -15.162 | 0.000 |
| 39 | KLBF | -14.299 | 0.000 | -25.671 | 0.000 | -31.849 | 0.000 | -8.432 | 0.000 | -13.218 | 0.000 | -8.401 | 0.000 |
| 40 | KPIG | -14.411 | 0.000 | -25.714 | 0.000 | -26.385 | 0.000 | -8.386 | 0.000 | -13.220 | 0.000 | -8.566 | 0.000 |
| 41 | LMAS | -14.267 | 0.000 | -25.666 | 0.000 | -26.379 | 0.000 | -8.378 | 0.000 | -13.217 | 0.000 | -8.571 | 0.000 |
| 42 | LTLS | -22.887 | 0.000 | -25.680 | 0.000 | -26.386 | 0.000 | -8.382 | 0.000 | -13.208 | 0.000 | -8.574 | 0.000 |
| 43 | MAPI | -14.316 | 0.000 | -25.702 | 0.000 | -26.369 | 0.000 | -8.393 | 0.000 | -13.223 | 0.000 | -8.568 | 0.000 |
| 44 | MDLN | -14.302 | 0.000 | -25.674 | 0.000 | -26.392 | 0.000 | -8.381 | 0.000 | -13.226 | 0.000 | -8.602 | 0.000 |
| 45 | MEDC | -26.163 | 0.000 | -25.673 | 0.000 | -26.416 | 0.000 | -8.396 | 0.000 | -15.587 | 0.000 | -8.527 | 0.000 |
| 46 | MPPA | -26.133 | 0.000 | -25.683 | 0.000 | -26.376 | 0.000 | -8.383 | 0.000 | -13.217 | 0.000 | -8.572 | 0.000 |
| 47 | MRAT | -14.356 | 0.000 | -25.669 | 0.000 | -26.379 | 0.000 | -8.368 | 0.000 | -15.668 | 0.000 | -8.559 | 0.000 |
| 48 | MTDL | -26.197 | 0.000 | -25.669 | 0.000 | -26.386 | 0.000 | -8.434 | 0.000 | -13.215 | 0.000 | -8.510 | 0.000 |
| 49 | MYOR | -14.306 | 0.000 | -25.803 | 0.000 | -26.357 | 0.000 | -8.397 | 0.000 | -13.222 | 0.000 | -8.572 | 0.000 |
| 50 | PLAS | -26.101 | 0.000 | -25.611 | 0.000 | -26.386 | 0.000 | -8.466 | 0.000 | -13.198 | 0.000 | -12.889 | 0.000 |
| 51 | PNBN | -26.125 | 0.000 | -25.661 | 0.000 | -26.337 | 0.000 | -8.370 | 0.000 | -15.663 | 0.000 | -8.559 | 0.000 |
| 52 | PNIN | -14.344 | 0.000 | -25.658 | 0.000 | -26.384 | 0.000 | -8.382 | 0.000 | -13.223 | 0.000 | -8.566 | 0.000 |
| 53 | PNLF | -14.306 | 0.000 | -25.665 | 0.000 | -26.452 | 0.000 | -11.324 | 0.000 | -13.201 | 0.000 | -8.661 | 0.000 |
| 54 | PTBA | -26.150 | 0.000 | -25.692 | 0.000 | -26.459 | 0.000 | -8.404 | 0.000 | -13.219 | 0.000 | -8.568 | 0.000 |
| 55 | PYFA | -14.313 | 0.000 | -25.677 | 0.000 | -26.383 | 0.000 | -8.389 | 0.000 | -13.224 | 0.000 | -8.612 | 0.000 |
| 56 | RALS | -26.158 | 0.000 | -25.663 | 0.000 | -26.365 | 0.000 | -8.411 | 0.000 | -13.243 | 0.000 | -8.569 | 0.000 |
| 57 | RMBA | -22.940 | 0.000 | -25.738 | 0.000 | -32.138 | 0.000 | -8.357 | 0.000 | -15.672 | 0.000 | -8.621 | 0.000 |
| 58 | SCMA | -14.356 | 0.000 | -25.725 | 0.000 | -26.368 | 0.000 | -8.397 | 0.000 | -13.221 | 0.000 | -8.564 | 0.000 |
| 59 | SMCB | -26.166 | 0.000 | -25.661 | 0.000 | -26.345 | 0.000 | -8.402 | 0.000 | -15.617 | 0.000 | -8.460 | 0.000 |
| 60 | SMDR | -14.319 | 0.000 | -25.829 | 0.000 | -26.378 | 0.000 | -8.397 | 0.000 | -13.219 | 0.000 | -8.566 | 0.000 |
| 61 | SMMA | -22.922 | 0.000 | -25.706 | 0.000 | -26.364 | 0.000 | -8.397 | 0.000 | -13.218 | 0.000 | -8.572 | 0.000 |
| 62 | SPMA | -14.316 | 0.000 | -25.691 | 0.000 | -26.357 | 0.000 | -8.378 | 0.000 | -15.653 | 0.000 | -12.911 | 0.000 |
| 63 | SULI | -26.152 | 0.000 | -25.612 | 0.000 | -26.368 | 0.000 | -8.399 | 0.000 | -15.641 | 0.000 | -8.513 | 0.000 |
| 64 | TBLA | -26.127 | 0.000 | -25.678 | 0.000 | -26.397 | 0.000 | -8.352 | 0.000 | -13.245 | 0.000 | -8.564 | 0.000 |
| 65 | TCID | -26.151 | 0.000 | -17.837 | 0.000 | -26.381 | 0.000 | -8.396 | 0.000 | -13.220 | 0.000 | -8.566 | 0.000 |
| 66 | TIRT | -26.177 | 0.000 | -25.678 | 0.000 | -26.380 | 0.000 | -8.399 | 0.000 | -13.225 | 0.000 | -8.570 | 0.000 |
| 67 | TKIM | -22.910 | 0.000 | -25.643 | 0.000 | -26.378 | 0.000 | -8.396 | 0.000 | -15.640 | 0.000 | -8.556 | 0.000 |
| 68 | TLKM | -26.145 | 0.000 | -25.589 | 0.000 | -26.053 | 0.000 | -8.346 | 0.000 | -15.287 | 0.000 | -8.511 | 0.000 |
| 69 | TMPO | -25.711 | 0.000 | -25.677 | 0.000 | -26.375 | 0.000 | -8.375 | 0.000 | -15.661 | 0.000 | -8.567 | 0.000 |
| 70 | TRST | -26.195 | 0.000 | -25.682 | 0.000 | -26.380 | 0.000 | -8.411 | 0.000 | -13.229 | 0.000 | -8.588 | 0.000 |

| No | Code | D_MPQSPR | | D_MQSPR | | D_MVDEP | | D_MQDEP | | D_MTVAL | | D_MTVOL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val | t-Stat | P-Val |
| 71 | ULTJ | -26.472 | 0.000 | -25.714 | 0.000 | -26.383 | 0.000 | -8.394 | 0.000 | -13.231 | 0.000 | -8.558 | 0.000 |
| 72 | UNSP | -26.162 | 0.000 | -25.673 | 0.000 | -26.499 | 0.000 | -8.198 | 0.000 | -13.272 | 0.000 | -8.521 | 0.000 |
| 73 | UNTR | -26.128 | 0.000 | -25.575 | 0.000 | -26.342 | 0.000 | -8.389 | 0.000 | -15.760 | 0.000 | -8.530 | 0.000 |
| 74 | UNVR | -26.156 | 0.000 | -25.694 | 0.000 | -26.294 | 0.000 | -8.388 | 0.000 | -13.179 | 0.000 | -8.559 | 0.000 |
| 75 | WOMF | -23.110 | 0.000 | -25.720 | 0.000 | -26.389 | 0.000 | -8.398 | 0.000 | -15.658 | 0.000 | -8.559 | 0.000 |

Notes: This table presents unit root test results of the daily percentage changes in market-wide liquidity for individual stocks from 3 January 2005 to 30 December 2011. The corresponding individual stock is not included in the market average liquidity variables. PQSPR refers toproportional quoted spread, QSPR is the quoted spread, VDEP is theRupiah value of market depth, QDEP is the number of shares for the market depth, TVAL is the daily trading value, and TVOL refers to daily trading quantity (shares) . D denotes the daily percentage changes in that variable for each liquidity variable. M refers to market level liquidity. The unit root test is based on the Augmented Dickey-Fuller (ADF) test with the Schwartz Information Criterion (SIC) to obtain the optimal lag length.

Appendix 6 Unit Root Test Results for Individual Stock Returns and the Corresponding Market Returns

| No | Code | RET | | MRET | |
|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val |
| 1 | AALI | –16.495 | 0.000 | –25.456 | 0.000 |
| 2 | ADES | –24.254 | 0.000 | –25.589 | 0.000 |
| 3 | ADHI | –12.192 | 0.000 | –25.447 | 0.000 |
| 4 | ADMF | –41.665 | 0.000 | –25.430 | 0.000 |
| 5 | ADMG | –28.625 | 0.000 | –25.494 | 0.000 |
| 6 | AMFG | –6.465 | 0.000 | –25.436 | 0.000 |
| 7 | APLI | –17.248 | 0.000 | –25.426 | 0.000 |
| 8 | ASGR | –17.648 | 0.000 | –25.421 | 0.000 |
| 9 | ASII | –9.082 | 0.000 | –25.442 | 0.000 |
| 10 | BAYU | –20.112 | 0.000 | –25.368 | 0.000 |
| 11 | BBNI | –8.574 | 0.000 | –25.453 | 0.000 |
| 12 | BDMN | –17.457 | 0.000 | –25.421 | 0.000 |
| 13 | BLTA | –23.436 | 0.000 | –25.414 | 0.000 |
| 14 | BMRI | –38.508 | 0.000 | –25.402 | 0.000 |
| 15 | BNGA | –17.513 | 0.000 | –25.437 | 0.000 |
| 16 | BNLI | –27.392 | 0.000 | –25.470 | 0.000 |
| 17 | BRPT | –17.867 | 0.000 | –25.441 | 0.000 |
| 18 | BUDI | –16.687 | 0.000 | –25.364 | 0.000 |
| 19 | BUMI | –8.959 | 0.000 | –25.375 | 0.000 |
| 20 | BVIC | –10.645 | 0.000 | –25.387 | 0.000 |
| 21 | CMNP | –7.287 | 0.000 | –25.376 | 0.000 |
| 22 | ELTY | –40.838 | 0.000 | –25.417 | 0.000 |
| 23 | ENRG | –7.731 | 0.000 | –25.399 | 0.000 |
| 24 | EPMT | –7.465 | 0.000 | –25.442 | 0.000 |
| 25 | ETWA | –43.729 | 0.000 | –25.441 | 0.000 |
| 26 | GGRM | –17.208 | 0.000 | –25.405 | 0.000 |
| 27 | GJTL | –42.357 | 0.000 | –25.431 | 0.000 |
| 28 | INAF | –26.173 | 0.000 | –25.409 | 0.000 |
| 29 | INCI | –33.217 | 0.000 | –25.479 | 0.000 |
| 30 | INDF | –40.766 | 0.000 | –25.373 | 0.000 |
| 31 | INDR | –13.968 | 0.000 | –25.445 | 0.000 |
| 32 | INKP | –8.833 | 0.000 | –25.423 | 0.000 |
| 33 | INTP | –16.625 | 0.000 | –25.414 | 0.000 |
| 34 | ISAT | –14.063 | 0.000 | –25.403 | 0.000 |
| 35 | JIHD | –45.371 | 0.000 | –25.403 | 0.000 |
| 36 | JPFA | –44.296 | 0.000 | –25.457 | 0.000 |
| 37 | KAEF | –10.087 | 0.000 | –25.411 | 0.000 |
| 38 | KIJA | –29.048 | 0.000 | –25.429 | 0.000 |
| 39 | KLBF | –12.181 | 0.000 | –25.436 | 0.000 |
| 40 | KPIG | –25.749 | 0.000 | –25.437 | 0.000 |
| 41 | LMAS | –7.122 | 0.000 | –25.381 | 0.000 |
| 42 | LTLS | –14.992 | 0.000 | –25.414 | 0.000 |

| No | Code | RET | | MRET | |
|---|---|---|---|---|---|
| | | t-Stat | P-Val | t-Stat | P-Val |
| 43 | MAPI | –8.843 | 0.000 | –25.442 | 0.000 |
| 44 | MDLN | –41.380 | 0.000 | –25.421 | 0.000 |
| 45 | MEDC | –17.017 | 0.000 | –25.410 | 0.000 |
| 46 | MPPA | –14.305 | 0.000 | –25.407 | 0.000 |
| 47 | MRAT | –8.180 | 0.000 | –25.421 | 0.000 |
| 48 | MTDL | –22.505 | 0.000 | –25.462 | 0.000 |
| 49 | MYOR | –13.299 | 0.000 | –25.437 | 0.000 |
| 50 | PLAS | –9.928 | 0.000 | –25.395 | 0.000 |
| 51 | PNBN | –17.923 | 0.000 | –25.407 | 0.000 |
| 52 | PNIN | –11.473 | 0.000 | –25.384 | 0.000 |
| 53 | PNLF | –28.142 | 0.000 | –25.441 | 0.000 |
| 54 | PTBA | –8.143 | 0.000 | –25.374 | 0.000 |
| 55 | PYFA | –24.489 | 0.000 | –25.367 | 0.000 |
| 56 | RALS | –11.019 | 0.000 | –25.409 | 0.000 |
| 57 | RMBA | –10.810 | 0.000 | –25.445 | 0.000 |
| 58 | SCMA | –16.089 | 0.000 | –25.357 | 0.000 |
| 59 | SMCB | –40.777 | 0.000 | –25.423 | 0.000 |
| 60 | SMDR | –43.002 | 0.000 | –25.449 | 0.000 |
| 61 | SMMA | –15.695 | 0.000 | –25.453 | 0.000 |
| 62 | SPMA | –32.306 | 0.000 | –25.433 | 0.000 |
| 63 | SULI | –11.346 | 0.000 | –25.529 | 0.000 |
| 64 | TBLA | –40.331 | 0.000 | –25.426 | 0.000 |
| 65 | TCID | –12.147 | 0.000 | –25.439 | 0.000 |
| 66 | TIRT | –20.829 | 0.000 | –25.282 | 0.000 |
| 67 | TKIM | –39.506 | 0.000 | –25.412 | 0.000 |
| 68 | TLKM | –16.299 | 0.000 | –25.367 | 0.000 |
| 69 | TMPO | –15.975 | 0.000 | –25.402 | 0.000 |
| 70 | TRST | –48.397 | 0.000 | –25.442 | 0.000 |
| 71 | ULTJ | –21.244 | 0.000 | –25.395 | 0.000 |
| 72 | UNSP | –39.296 | 0.000 | –25.431 | 0.000 |
| 73 | UNTR | –21.554 | 0.000 | –25.427 | 0.000 |
| 74 | UNVR | –9.503 | 0.000 | –25.380 | 0.000 |
| 75 | WOMF | –20.551 | 0.000 | –25.441 | 0.000 |

Notes: This table presents unit root test results of the individual stock returnsand the corresponding market returns from 3 January 2005 to 30 December 2011. The corresponding individual stock return is not included in the market average returns. RET is individual stock returns. MRET refers to market return for the corresponding stock. The unit root test isbased on the Augmented Dickey-Fuller (ADF) test with the Schwartz Information Criterion (SIC) to obtain the optimal lag length.

Appendix 7 Unit Root Test Results for Daily Changes of Foreign Ownership

| No | Code | t-Stat | P-Val |
|---|---|---|---|
| 1 | AALI | –32.000 | 0.0000 |
| 2 | ADES | –45.250 | 0.0001 |
| 3 | ADHI | –35.641 | 0.0000 |
| 4 | ADMF | –17.164 | 0.0000 |
| 5 | ADMG | –48.404 | 0.0001 |
| 6 | AMFG | –31.182 | 0.0000 |
| 7 | APLI | –41.195 | 0.0000 |
| 8 | ASGR | –15.820 | 0.0000 |
| 9 | ASII | –37.120 | 0.0000 |
| 10 | BAYU | –35.298 | 0.0000 |
| 11 | BBNI | –33.407 | 0.0000 |
| 12 | BDMN | –32.220 | 0.0000 |
| 13 | BLTA | –31.981 | 0.0000 |
| 14 | BMRI | –33.125 | 0.0000 |
| 15 | BNGA | –16.955 | 0.0000 |
| 16 | BNLI | –51.619 | 0.0001 |
| 17 | BRPT | –23.985 | 0.0000 |
| 18 | BUDI | –26.600 | 0.0000 |
| 19 | BUMI | –39.239 | 0.0000 |
| 20 | BVIC | –31.623 | 0.0000 |
| 21 | CMNP | –31.810 | 0.0000 |
| 22 | ELTY | –16.289 | 0.0000 |
| 23 | ENRG | –31.553 | 0.0000 |
| 24 | EPMT | –16.881 | 0.0000 |
| 25 | ETWA | –29.334 | 0.0000 |
| 26 | GGRM | –37.513 | 0.0000 |
| 27 | GJTL | –26.839 | 0.0000 |
| 28 | INAF | –23.728 | 0.0000 |
| 29 | INCI | –36.418 | 0.0000 |
| 30 | INDF | –38.710 | 0.0000 |
| 31 | INDR | –20.554 | 0.0000 |
| 32 | INKP | –34.055 | 0.0000 |
| 33 | INTP | –37.308 | 0.0000 |
| 34 | ISAT | –36.154 | 0.0000 |
| 35 | JIHD | –26.926 | 0.0000 |
| 36 | JPFA | –15.427 | 0.0000 |
| 37 | KAEF | –23.617 | 0.0000 |

| No | Code | t-Stat | P-Val |
|---|---|---|---|
| 38 | KIJA | –25.645 | 0.0000 |
| 39 | KLBF | –29.851 | 0.0000 |
| 40 | KPIG | –7.897 | 0.0000 |
| 41 | LMAS | –41.320 | 0.0000 |
| 42 | LTLS | –33.482 | 0.0000 |
| 43 | MAPI | –31.613 | 0.0000 |
| 44 | MDLN | –41.300 | 0.0000 |
| 45 | MEDC | –38.392 | 0.0000 |
| 46 | MPPA | –33.574 | 0.0000 |
| 47 | MRAT | –27.974 | 0.0000 |
| 48 | MTDL | –37.555 | 0.0000 |
| 49 | MYOR | –43.113 | 0.0000 |
| 50 | PLAS | –41.257 | 0.0000 |
| 51 | PNBN | –29.189 | 0.0000 |
| 52 | PNIN | –20.620 | 0.0000 |
| 53 | PNLF | –29.315 | 0.0000 |
| 54 | PTBA | –17.655 | 0.0000 |
| 55 | PYFA | –41.258 | 0.0000 |
| 56 | RALS | –27.145 | 0.0000 |
| 57 | RMBA | –32.209 | 0.0000 |
| 58 | SCMA | –26.356 | 0.0000 |
| 59 | SMCB | –32.523 | 0.0000 |
| 60 | SMDR | –32.940 | 0.0000 |
| 61 | SMMA | –13.355 | 0.0000 |
| 62 | SPMA | –37.985 | 0.0000 |
| 63 | SULI | –45.559 | 0.0001 |
| 64 | TBLA | –25.187 | 0.0000 |
| 65 | TCID | –27.366 | 0.0000 |
| 66 | TIRT | –35.268 | 0.0000 |
| 67 | TKIM | –18.449 | 0.0000 |
| 68 | TLKM | –20.506 | 0.0000 |
| 69 | TMPO | –33.487 | 0.0000 |
| 70 | TRST | –41.382 | 0.0000 |
| 71 | ULTJ | –44.706 | 0.0001 |
| 72 | UNSP | –41.485 | 0.0000 |
| 73 | UNTR | –41.375 | 0.0000 |
| 74 | UNVR | –27.880 | 0.0000 |
| 75 | WOMF | –42.163 | 0.0000 |