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Liquidity Synchronization, its Determinants and Outcomes for Valuation: Evidence from Selected Emerging Asian Economies

by

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To Allah Almighty (SWT) Who has been there right from the beginning to this very point.

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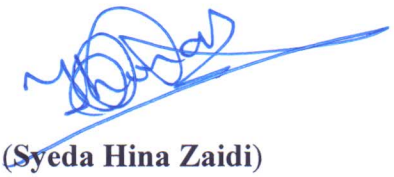

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List of Publications

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Abstract

This study investigates the presence of liquidity synchronization and its firm-level and country-level determinants in selected emerging Asian economies. Moreover, the results of this study provide insights into the degree of liquidity synchronization during economic growth volatility and its impact on stock valuation. As a non-diversifiable risk factor, liquidity co-movement shock spreads market-wide and thus disrupts the overall functioning of the financial market. Firms in Asian markets operate in legal and regulatory environments distinct from those of firms analyzed in the previous literature. A major knowledge gap pertaining to Asian emerging markets serves as the primary motivation for this study. Four emerging Asian economies are selected from the MSCI emerging market index: Bangladesh, China, India, and Pakistan for analysis from 2010 to 2019. Liquidity is estimated using transaction cost measures. Four different measures: quoted spread, proportional quoted spread, effective spread and proportional effective spread are applied for liquidity computation. The fixed effect panel data technique is employed on secondary data for estimation of determinants and pricing of liquidity synchronization. The empirical findings reveal high levels of liquidity synchronicity in weaker economic and financial environments with low GDP growth, high inflation, interest rates and underdeveloped financial systems taking the form of low levels of private credit. Liquidity synchronization is also affected by poor investor protection, political instability and weak rule of law. Moreover, liquidity synchronization is higher in period of economic growth volatility. The implied cost of equity pricing model and realized returns pricing model are employed to study the impact of liquidity synchronization on asset valuation. Liquidity synchronization is found to have a significant impact on asset valuation in emerging Asian economies.

Keywords: Liquidity synchronization, Economic growth volatility, Cost of equity, Asset valuation, Emerging Asian economies.

JEL Classification: F43, G11, G12, G15

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Abbreviations

AMEX	American Stock Exchange
APT	Arbitrage Pricing Theory
ASX	Australian Securities Exchange
CAPM	Capital Asset Pricing Model
CDS	Credit Default Swap
FTSE	Financial Times Stock Exchange
GDP	Gross Domestic Product
GMM	Generalized Method of Moment
ICOC	Implied Cost of Capital
IPO	Initial Public Offering
LCAPM	Liquidity Adjusted Capital Asset Pricing Model
MPEG	Market Price Earning to Growth
MSCI	Morgan Stanley Capital International
NASDAQ	National Association of Securities Dealers Automated Quotations
NYSE	New York Stock Exchange
OLS	Ordinary Least Square
OPEC	Organization of the Petroleum Exporting Countries
RRet	Realized Returns
VAR	Vector Autoregressive Model

Chapter 1

Introduction

Liquidity is a broad, yet elusive concept. Liquidity is the price for immediacy (Stoll, 2000), and plays a pivotal role in financial markets due to its facilitation of trading efficiency and better risk sharing. Liquidity is the cost incurred while trading an asset, such as the capacity to trade large volumes, the time required to execute a transaction, and the price impact (Vu et al., 2015). Liquidity is important for asset managers and active investors involved in portfolio management, who need to change their positions on a frequent basis to earn a profit from trading activities. It is generally believed that the measurement of liquidity should be executed across multiple assets at the portfolio level rather than at a single stock level. First, portfolio transactions involve the trading of multiple assets. Second, asset returns are correlated. Thus, liquidity has many dimensions through which it can affect stock returns. Market liquidity is not constant and is subject to unexpected changes which may affect investors' decisions. Liquidity affects asset returns through two channels, level and risk. Investors use liquidity levels to trade relatively large quantities at a low cost in a short period of time (Saad and Samet, 2017). In general, the investment regulations require investors to participate during market declines. This exposes investors to liquidity risk and the inability to trade at desirable times and market prices (Vaihekoski, 2009).

While liquidity is not an independent attribute of a specific security, the two share common components (Chordia et al., 2000; Hasbrouck and Seppi, 2001; Huberman

and Halka, 2001). Liquidity is not just the trading cost of an asset but is also a systematic risk factor due to synchronicity (Acharya and Pedersen, 2005; Kamara et al., 2008; Lee, 2011; Moshirian et al., 2017). Liquidity has a spillover effect that spreads across the market. The liquidity of an individual stock co-moves with market wide liquidity. In other words, covariance exists between market and stock liquidity. This covariance plays a significant role in portfolio selection, resource allocation and asset pricing. Stock liquidity sensitivity to market liquidity is a serious concern when illiquidity arises at an inopportune time (Shyu, 2017). When market liquidity declines, there is different downside pressure on different stocks. In particular, downside liquidity pressure is more intense for stocks, for which there is a strong correlation between market and stock liquidity. Liquidity synchronicity is stronger during periods of market volatility and low when the market is tranquil (Bedowska-Sójka and Echaust, 2019). Under normal circumstances, the investors concern little regarding illiquidity risk; however, it might become a matter of serious concern during liquidity crisis (Ang et al., 2014; Wu, 2019). If liquidity shocks are non-diversifiable with varying impact on individual stocks, the greater sensitivity of a stock return to such shocks, the higher will be the expected returns (Chen, 2005; Chordia et al., 2000).

Recent studies using datasets from international markets has evidenced that liquidity synchronicity is a persistent global phenomenon (Brockman et al., 2009; Dang et al., 2015; Karolyi et al., 2012; Moshirian et al., 2017; Wang, 2013; Zhang et al., 2009). In periods of market turmoil, there is an increase in liquidity demand because traders are focused on liquidating their positions across various securities, and the supply of liquidity decreases due to funding constraints imposed by liquidity suppliers (Karolyi et al., 2009). It is generally observed that stock market liquidity dries up during an economic downturn. Under difficult economic conditions, investors either shift their investments away from equity markets completely or allocate equity to safer securities that guarantee wealth safety (Switzer and Picard, 2016). The presence of liquidity synchronicity along with its determinants, has important inference on portfolio diversification. How liquidity impacts investors and the underlying forces that drive liquidity synchronicity under different

financial environments are major concerns of the finance literature. Researchers have offered several other propositions regarding co-movement in liquidity. Such propositions focus on effects of noise trading (Huberman and Halka, 2001), asymmetric information and weak governance practices (Karolyi et al., 2012), market volatility (Hameed et al., 2010), macroeconomic announcements (Brockman et al., 2009), institutional investors (Chen et al., 2013), the role of financial intermediaries (Sójka and Echaust, 2019), and foreign institutional ownership (Deng et al., 2018). Due to the unique characteristics of each market, the relevance of each factor involved differs for different markets.

Market microstructure literature ascertains the role of liquidity in price formation mechanisms of stock, and several empirical studies have revealed that liquidity risk is a priced factor (Anthonisz and Putniņš, 2017; Chen, 2005; Lee, 2011; Pástor and Stambaugh, 2003). Although the empirical evidence regarding the association of liquidity risk and stock returns are compelling, there has been limited focus on the effect of liquidity risk on the cost of equity. Furthermore, the focus of most of these studies is on developed markets, whereas, the liquidity spirals seem more disruptive and prevalent in emerging markets (Karolyi, et al., 2009).

Given the catalytic role of liquidity synchronicity, this study aims to investigate the firm and country-specific determinants and degrees of liquidity synchronization under economic growth volatility in four emerging Asian stock markets, including those in Bangladesh, China, India, and Pakistan. Furthermore, we have developed a linkage between liquidity synchronicity and asset valuation and examine whether liquidity synchronicity is reflected in asset valuation. A comprehensive analysis of the role of liquidity synchronicity in asset valuation would transform trading strategies and portfolio formation.

1.1 Theoretical Background

Under Arrow Debreu Paradigm, there are no frictions while trading in the financial markets and thus liquidity is perfect. Efficient market hypothesis states that asset prices immediately capture new information. The decision of an investor is

determined only by risk and return. However, the financial markets in real world are far more complex than predicted by traditional finance theory. Markets are characterized by frictions and there is information asymmetry. Based on these frictions, there are certain rules that govern the underlying mechanism of trading and define the structure of the market. These rules determine the behavior of traders regarding how, when and where they can trade. This organizational structure is the foundation of price formation and stock market liquidity (O'Hara, 1995).

Market microstructure has occupied the attention globally due to rapid transformation of financial markets driven by globalization, technology and regulations. Over the past two decades, no other finance field has captured as much interest of academics as market microstructure. Market microstructure is mainly concerned with trading, market rules, market structures and how different designs of markets affect the asset exchange. Capital market theory is one of the main stream in finance research. It provides the basic framework of how different types of risk are priced.

Present study primarily relates to asset pricing models and market microstructure theory. The focus of current study is to identify the sensitivity of stock liquidity to overall market liquidity and to find the impact of systematic liquidity risk on valuation of asset; one of the implications of theory of market microstructure on asset pricing. Theories of behavioral finance and signaling theory are incorporated in supportive theoretical context.

1.1.1 Theories of Asset Pricing

The theories of asset pricing are based on the fact that systematic risk is always priced in financial markets and the investors demand compensation for this risk. In this vein, The Capital Asset Pricing Model (CAPM) by Sharpe (1964) described the association between expected returns and systematic market risk. CAPM is used over a longer span of time however, empirical evidence has proved that the

conventional Capital Asset Pricing Model has limited ability in explaining security returns. CAPM is criticized for aggregating all risk into a single market risk. Arbitrage Pricing Theory (APT) was developed by Stephen Ross (1976) as an alternative to CAPM for explaining asset returns. APT aims to address the limitations of CAPM with the idea that different stocks have different sensitivities for different macroeconomic factors. In order to explain stock returns a wide range of variables have been discovered. Fama and French (1996) incorporated two risk factors in CAPM i.e., size and value (book to market value) to describe stock returns. Fama and French three-factor model brought significant development in traditional CAPM, but it enabled to describe some anomalies. Fama and French (2015) added two additional factors i.e., investment and profitability. The idea behind Fama and French five factor model was based on the fact that the three-factor model overlooks the variation in returns related to investment and profitability.

Acharya and Pedersen (2005) incorporated liquidity risk in the asset pricing model. They state that higher compensation is required by investors to hold a security which is difficult to trade when there is general illiquidity in the market. In other words, a stock having a low level of liquidity covariance with market liquidity is preferred by the investor. Their work is based on the proposition that liquidity adjusted CAPM is a more appropriate asset pricing model as compared to standard CAPM. The reason behind is that standard CAPM states that asset price fluctuations can be captured by market risk, whereas LCAPM is based on three forms of liquidity risks i.e., covariance between asset's liquidity and market liquidity (liquidity synchronicity), covariance between asset's liquidity and market returns and covariance between asset's return and market liquidity.

It is generally assumed in asset pricing theories that all the assets can be quickly traded because of their liquidity characteristic. However, in the real world the frequently traded asset classes are not perfectly liquid. The investors bear transaction costs and most probably experience a reduction in future prices if they decide to quickly liquidate their position. Thus, future cash flows are affected by liquidity due to its influence on asset prices. The ease of stock trading is extremely important to financial markets and especially to investors. Stock market

participants while making their investment portfolios deem liquidity as one of the major determinants of stock price. But there is an association between stock liquidity and overall market liquidity. When the liquidity of market declines, there is different downside pressure on different stocks. In particular, this downside liquidity pressure is comparatively more intense for the stocks, where there is a high correlation between market liquidity and stock liquidity.

1.1.2 Theories of Market Microstructure

The theory of market microstructure has played an important role in clarifying the relationship between stock return and liquidity. In microstructure literature, market liquidity has price dimension and quantity dimension. Price dimension is represented in terms of bid-ask spread whereas market depth is used to represent quantity dimension. The intuitions behind bid-ask spread are an important subject in the literature of market microstructure. The bid-ask spread works as a barometer to reflect the current situation of market liquidity. Theoretically, the bid-ask spread is the economic compensation provided to market makers to ensure the provision of continuous liquidity in stock market. The markets are mostly organized by the traditional specialists or market makers who constantly play their part in providing liquidity in the market and setting spread. In general, the spread is to be reasonably enough for covering the potential costs of these liquidity providers.

The investors depend on information for their decision making. However, the variance in access to information may have adverse effects on stock liquidity and pricing. The price movement is based on trading volumes. For instance, a large buy order can put an upward pressure on prices which makes subsequent purchases relatively more expensive. In the time of market distress, the liquidation cost of large positions can be result in financial instability. Early literature into liquidity provision focused on the transaction costs of processing the orders of buy and sell (Demsetz, 1968). These opportunity costs are only one part of quoted spread and known as order processing cost. Some researchers compared the total spreads in different markets without decomposing these spreads into component

part. The full-scale model of bid ask spread was developed in 1980s. T. Ho & Stoll, (1981 and 1983) identified the inventory control element of bid ask spread. Their study revealed that inventory positions are adjusted by the market makers through quoted bid-ask spread, lowering bid-ask prices when the level of inventory is high and raising the prices when inventory levels are low. Copeland and Galai (1983) stated that adverse selection element of bid-ask spread provide compensation to market makers for bearing risk involved in trading with better informed traders. Since there is a chance that any transaction can have an informed counterpart, the market maker will increase the ask price after each sale and decrease the bid price after each purchase. Grossman and Miller (1988) stated that liquidity events along with the risk of delay in trade give rise to immediate demand. The continuous presence of market makers and their willingness of risk bearing before arrival of final buyer and seller provide supply immediacy.

Traditionally the market microstructure literature focused on the characteristics of a single security. The concept of common component of liquidity was highlighted by Chordia et al. (2000). Since dealer inventory is primarily determined by the volume of trading, the variation in volume may results in co-movement in the optimal levels of inventory which in turn leads to co-movement in bid-ask spread and quoted depth. Trading of large orders simultaneously may exert joint pressure on dealer inventories. Correlated trading behavior of institutional investors induces changes in inventory level across wide market sectors. Thus, liquidity of individual stocks co-moves with the market wide liquidity. Asymmetric information is also a source of liquidity synchronicity. The study evidenced that liquidity synchronicity is higher for portfolios as compared to individual stock.

The trading cost theory was presented by Amihud and Mendelson (1986). The trading costs such as order processing costs, brokerage fees and taxes on transactions are the sources of illiquidity. The buyer and seller bear a transaction cost during trading; this process continues throughout the life of an asset. These costs affect security prices if investors entail higher returns for bearing them (Amihud and Mendelson, 2006). This theory proposes that expected returns of an asset are

increasing function of its trading costs and there exists a positive association between the two. The stocks with higher bid ask spread have higher returns, because investors demand compensation for higher trading costs. Transaction cost results in market segmentation, as more liquid stocks are held by short term investors as compared to long term investors. The short-term investors are more prone to trading costs due to frequent transactions. Conversely, for long term investors, the transaction costs diminish over the holding period. Moreover, the large investors holding better information are able to influence stock prices. These costs represent market frictions and are a source of market illiquidity, since these affects the trading price of the investors. Markets with higher trading costs are less liquid in comparison to the markets with low trading costs (Atkins and Dyl, 1997).

1.1.3 Theories of Behavioral Finance

The traditional finance theories explain that investors are rational and take their investment decisions on sound logic. However, this notion deviates from reality. Investors are normal human beings and are influenced by emotions which can drive them to make irrational decisions. The financial meltdown of 2008 had captured the attention of theorists worldwide. Despite serious efforts in exploring the root cause, classical theories of finance are not considered as success stories regarding the issue. To find alternative explanations several studies are based on the perceptions of behavior finance.

In financial markets, the investors are confronted with two choices that are mutually exclusive: they can rely on their conviction that is based on their private information or follow the market trend. If the investor is following others, then there is the presence of herding behavior. Herding is defined as "everybody doing what everyone else is doing even when their private information suggests doing something else" (Banerjee, 1992). In herding behavior, market participants imitate the trading activities of other investors, whereas their private information pursues them to take some different action. This type of conduct can be considered as normal because it is a common human behavior to be influenced by other's action.

Thus, investors are also impacted by external factors while taking investment decisions. However, the consequences of this mimicking can be positive or negative. The associated behavior may adversely affect the risk and return component of assets and thus have implication for asset pricing. The market faces liquidity dry ups when the investors engage in panic selling or financial intermediaries withdraw their liquidity provision or both. Liquidity movements have important implications in forecasting aggregate returns. Liquidity is also considered as an indicator of market sentiments (Baker and Stein, 2004). The market with high liquidity level reflects positive investor sentiments that intensify the trading volumes. On the other hand, market with low liquidity level denotes the negative investor sentiments that reduce the trading volumes. Pessimistic sentiments induce investors to withdraw their position and create joint outflows. Thus, pessimistic investor sentiment can adversely affect market liquidity. Prevalent investor sentiment persuades the investors to move together causing liquidity synchronicity.

1.1.4 Signaling Theory

The common variation in the trading behaviour of institutional investors is considered as one of the major causes of liquidity synchronicity. The market participants look for performance signals. Due to asymmetric information people know that large investors sell share when they are overvalued with very low prospect for future and buy share when they are confident about bright prospect for future.

Some institutional investors change their portfolio balances when they receive private information containing some adverse news about a particular industry. As a result, they try to sell the securities of relevant firms before the news become publicly available and start purchasing other stocks to hold their investment position. This change in portfolio mix creates a signal in the market. Other institutional investors follow the trading strategies of their competitors. Such behaviour leads to co-movement in liquidity and cause liquidity synchronization in market.

1.2 Problem Statement

Liquidity synchronization was not a common subject before global financial crisis. Systematic liquidity risk was omitted in most of the financial models. The illiquidity experience during crisis has highlighted the role of liquidity risk in global financial instability. It was revealed that illiquidity risk can play a horrible role in transmitting contagion through regional, national and global financial systems. The market stakeholders recognize that a decline or disappearance of liquidity has a direct effect on asset prices which cannot be predicted by the traditional fundamentals of assets (Bradrania and Peat, 2014). The risk of illiquidity influences asset prices and any hike in this risk would result in stock market crash (Nneji, 2015). In worst cases the liquidity decline may result in systemic consequences or market freeze and loss of investors' trust in the price discovery mechanism of the market. Hence the market players prefer stability in market liquidity because it translates to lower transaction cost.

The existing literature is concentrated towards the developed markets of the world, where the effects of illiquidity can be mitigated by large trading volumes, diversification of ownership structure, and balance of short-term and long-term investors. The market structures of most of the Asian emerging markets are significantly different from those studied in the developed markets. The firms in Asian markets operate in a distinctive legal and regulatory environment as compared to the firms which are analyzed in the previous literature. Market illiquidity is one of the biggest hurdles to foreign investment in the emerging economies of Asia. Due to the importance of liquidity synchronization, the research gap on various dimensions of liquidity synchronization, the conflicting conclusions on its role in asset valuation and unique market structure of emerging economies, a comprehensive analysis of the subject is much needed. Keeping in view the above stated facts, the study attempts to investigate the presence of market wide liquidity synchronicity in emerging markets.

1.3 Research Questions

This study is an attempt to answer the following questions:

1. Is there market wide liquidity synchronization in the stocks of selected economies?
2. What are the major determinants of liquidity synchronization?
3. What is the impact of economic growth volatility on liquidity synchronization?
4. Does liquidity synchronicity affect stocks valuation?

1.4 Research Objectives

This study has following specific objectives:

1. To investigate the presence of market wide liquidity synchronization.
2. To identify the major sources of liquidity synchronization.
3. To examine the impact of economic growth volatility on liquidity synchronization.
4. To study the role of liquidity synchronization in stocks valuation.

1.5 Significance of the Study

The concept of liquidity synchronicity has provided entirely new prospects for discovering various aspects of liquidity, through shifting the focus from liquidity of a single asset to market wide liquidity. Liquidity synchronicity has important implications for portfolio managers. From a practical investment perspective, a better understanding of the phenomenon both within and across markets not only enables investors to design unconventional trading strategies but also helps them decide the compensation they would require for holding an exposure. Advanced

knowledge of sources of liquidity synchronicity and its role in asset valuation will increase investors' confidence in financial markets and will thereby, increase the efficiency of corporate resource allocation.

This study is differentiated from the earlier studies in its attempt to extend the scope of liquidity synchronization literature to Asian economies. The study contributes to the growing literature of liquidity synchronicity in the following ways. First, the bid-ask liquidity measures are employed following (Chordia et al., 2000), which captures transaction cost more accurately than conventional liquidity proxies (Moshirian et al., 2017). Bid-ask spread has the ability to measure the aggregate transaction cost more precisely than other liquidity measures. Second, the driving factors of liquidity synchronization are identified at the country level. Specifically, the study focuses on the financial environment and investor protection within the economy. Unlike previous literature, the new dimensions of investor protection, including regulatory quality, political stability and the rule of law are introduced. The presence of strong governance and rule of law, government effectiveness and political stability ensures strong investor protection in a country. Third, the impact of economic growth volatility on liquidity synchronicity is investigated. Fourth, the evidence of valuation effect of liquidity risk arising from liquidity synchronicity are provided.

As a risk factor, the pricing of liquidity synchronicity has substantial inferences on stock returns. Most of the previous studies have employed liquidity adjusted CAPM to examine the pricing effect of liquidity risks and found little evidence on the effect of liquidity synchronicity on stock returns (Acharya and Pedersen, 2005; Lee, 2011). The current study examines pricing of liquidity synchronicity in a different setting and find that it is priced in stock markets of the selected countries. Following (Hail and Leuz, 2006; Moshirian et al., 2017; Saad and Samet, 2017), the cost of capital is computed which is a more suitable estimate of expected returns. Cross market analyses have proposed several determinants of implied cost of capital. For example, Francis et al. (2005) studied the impact of voluntary disclosure incentives on cost of capital. Hail and Leuz (2009) investigated the association of legal institution, security regulations and cross-listings in financial

markets with cost of equity capital. Chen et al., (2011) investigated the impact of corporate governance practices on implied cost of equity. Lang et al., (2012) employed stock liquidity as a mediating channel through which cost of equity is affected by firm level transparency. Ortiz-Molina and Phillips (2014) found high cost of equity for firms with more illiquid real assets. To our knowledge, the existing literature on the predictive ability of liquidity synchronicity in explaining cost of capital is rare. The study enhances the existing body of knowledge by discovering a higher cost of capital for stocks having high liquidity synchronicity.

The findings of this study will offer several valuable insights. As a non-diversifiable risk factor, liquidity co-movement shock spreads market-wide and thus disrupts the overall functioning of the financial market. Firms in Asian markets operate in legal and regulatory environments distinct from those of firms analyzed in the previous literature. The globalization of financial markets and major risks and uncertainties associated with developed markets have driven fund managers to expand their portfolios into emerging markets. As the liquidity of a single security is sensitive to market liquidity, an analysis of factors that affect the sensitivity of stock liquidity to overall market liquidity is much needed.

Comprehensive analyses of liquidity synchronicity in emerging markets are limited primarily due to data availability constraints and the small market sizes of emerging markets relative to developed equity markets. The market models used in most developed countries differ from emerging economies. Therefore, it is much needed to investigate the prevalence, determinants and pricing of liquidity synchronicity in emerging economies of Asia. The study of firm specific and country specific factors that contribute to the variation in liquidity co-movement will help in identifying the reason of varying levels of synchronicity across firms and countries. The impact of economic growth volatility on liquidity synchronicity and the role of liquidity synchronicity in asset valuation will give investors a better understanding for devising trading strategies.

1.6 Organization of the Study

The rest of the study is organized as follows: a brief review of the existing literature is provided in the next section. Section three describes our data and variables. Our empirical findings are provided in section four. Section five concludes.

Chapter 2

Literature Review

This chapter presents a review of existing literature on liquidity synchronization.

2.1 Liquidity

Liquidity of financial markets is one of the most significant subjects in modern finance. It is an important factor of market quality due to its role in portfolio allocation, asset pricing and risk management (Chakravarty & Holden, 1995). Despite crucial nature of the matter, there is no single definition of liquidity in existing literature. Liquidity is a vague concept because it covers several transaction properties experiences in the market (Kyle, 1985). The market microstructure literature supports that liquidity is the ability and ease of buying and selling assets and this capacity enables the traders to trade into and out of positions swiftly without much effect on prices.

Liquidity reflects nearly all characteristics of the working of capital markets. It allows individual buyers and sellers to satisfy the unanticipated financial requirements without facing huge monetary losses. From institutional investors' perspective, illiquidity suffices irregular returns on assets, high risk and low levels of trade volume (Instefjord, 1999). Liquidity is also a significant element of firms' cost of capital, because it is closely related to transaction costs. Low transaction cost means high liquidity and vice versa (Zheng, 2008). Wurgler (2000) found

that large markets contain more price information, perhaps because low transaction costs followed by high liquidity led to effective arbitrage, which allows fund managers to differentiate between good and bad transaction.

According to Sarr and Lybek (2002), five complementary and distinct features are displayed by the liquid markets; depth, breath, immediacy, tightness and resiliency. Market depth denotes the presence of abundant orders below the stock price. It is the ability to trade without effecting the quoted price (Chollete et al. 2007) and can be stated in terms of trade or order volumes. The more units of a security could be bought or sold at a given price, the deeper the limit order book. For a market to be deeper, it must have large number of buy and sell trading orders. Breath means that numerous and large volumes of orders are available, with minimum influence on prices. Breadth represents the percentage of stocks participating in a specific direction in comparison to the total number of stocks. It depicts market strength by comparing the number of stocks with increasing price with number of stocks with decreasing price. If stocks with increasing prices are higher than the number of stocks with decreasing prices then there is a positive market depth with bullish trend. Conversely, if stocks with decreasing prices are higher than the number of stocks with increasing prices then there is a negative market depth with bearish trend.

Immediacy refers to the speed of order execution supported by efficacy of trading and settlement systems. It defines the time required to complete a transaction of a certain size in a particular market at prevailing price. It means that an order can be executed without spending time in lining up the buyer and seller in advance. Immediacy is an integral part of trading systems that provide continuous trading and market makers are the major source of immediacy in financial markets. Market tightness denotes the total cost of revolving a specific amount of stocks within a shortest span of time. A tight market is a market where there is intense competition, active trading, high volumes and narrow bid-ask spread. In tight markets, dealers make profits in volumes and lose in narrow spread.

Market resilience describes how quickly a new order flow return to normal in a large order. It is termed as the speed at which stock price return to its fundamental

after execution of a large transaction. Resilience is based on the supposition that when a huge transaction results in a price change without effecting the underlying value of an asset, the price of that asset should move to its equilibrium (Hasbrouck, 1988). Resilience considers the demand and supply state of a market.

The concept of liquidity is extensively used in research and practice; however, there is no consensus on its measurement (Kempf and Korn, 1999). There are several measures of liquidity, which can be estimated either from order data or trade data, and cover different aspects of liquidity. While there are various dimensions of liquidity/illiquidity, there are also various sources of it. The major source of illiquidity is transaction cost, which comprises of commission cost, order processing cost or searching cost etc. The second source of illiquidity is asymmetric information. The third source is the transactions by large traders which is a source of imperfect competition. Another source is uncertainty which results in widening of bid ask spread by traders to protect themselves against unanticipated and potential losses (Altay and Çalgıcı, 2019).

There is an extensive range of liquidity measures due to different sources and aspects of liquidity. Hui and Heubel (1984) introduced Hui Heubel Liquidity Ratio (HHL) for measuring liquidity of an asset. The lower the ratio, the more liquid the asset and vice versa. Roll (1984) designed a liquidity measure based on covariance of price changes using effective bid ask spread. Cooper et al. (1985) developed Amivest measure which compares the daily returns with volume calculate in number of shares. Amihud and Mendelson (1986) designed a proxy to estimate the cost of trade based on bid ask spread. A high bid ask spread depicts high trading cost which reflects a decrease in liquidity. Thus, the investment in assets having high trading cost needs higher return.

Lesmond et al. (1999) introduced LOT measure to capture the occurrence of zero return days. For each give period, this proxy requires estimation of maximum likelihood which makes its measurement time intensive. It is the ratio of days with zero returns and the total number of observed days. Zero return means when informed traders do not enter into a trade because they find transaction cost higher than the benefits of trade and value of information. Brennan and

Subramanyam (1996), Amihud (2002) and Acharya and Pedersen (2005) generate price impact measures, which are designed to measure the impact of trading of one dollar on prices. Amihud (2002) is one of the most popular proxies of illiquidity as the information required for its computation is readily available. Amihud and Amivest measures are designed in somewhat similar manner, yet differ in certain aspects. For instance, one applies the dollar volume whereas; the other employs the share volume. Amivest measure captures liquidity, while Amihud measure covers illiquidity. Pástor and Stambaugh (2003) developed return reversal liquidity measure based on price impact.

Eckbo and Norli (2005) and used stock turnover to measure the number of trades as liquidity proxy. It depicts the holding period of a representative investment and is measured by the ratio of trading volume and number of outstanding shares. Higher stock turnover is interpreted as shorter holding period of stock. Florackis et al. (2011) introduced a novel price impact ratio as substitute of Amihud (2002) illiquidity ratio by identifying limitations of the Amihud (2002) measure. It is argued that the denominator of Amihud illiquidity ratio, trading volume has high correlation with market value of the asset. Furthermore, the return to volume ratio does not account for the frequency of security trading. In order to overcome the identified shortfalls of Amihud (2002) measure, Florackis et al. (2011) generate a new proxy, absolute returns managed by the turnover ratio. Corwin and Schultz (2012) introduced a new estimator called High-Low Spread, which employs the daily low and high prices only. This measure is based on the argument that the daily lower prices are mostly seller-originated trades and the daily higher prices are mostly buyer-initiated trades. Corwin and Lipson (2011) claimed that the high-low spread captures both transaction costs and volatility. The estimate is not only easy to estimate, but is also believed to outperform the low frequency estimates in American stock exchange (Corwin and Schultz, 2012). Likewise, Chung and Zhang (2014) presented a closing percent quoted spread, using daily closing bid-ask prices. The proxy is considered as good measure of effective spread.

The conclusions from different estimators of liquidity can direct to different outcomes (Benić and Franić, 2008). Different measures are calculated at different

intervals viz. low frequency data is captured daily and high frequency data is captured in minutes and seconds. The market microstructure literature recommends liquidity to be measured at high frequency to cover maximum variations in a day. Bernstein (1987) analysed different liquidity measures and concluded that there is no compatibility between stock liquidity and efficiency. On arrival of new information, a liquid market keeps noise and rapid price changes at minimum. Conversely, there are sudden changes in prices in efficient market as new information arrives. Thus, high levels of liquidity lead to less market efficiency (Bernstein, 1987).

Goyenko et al. (2009) argued that Amihud illiquidity measure is better in capturing liquidity as it is robust to fluctuations in minimum tick size. They compared cost per volume and percent cost liquidity proxies from daily stock data and found that FHT measure is highly correlated with spread related measures. Mianbi and Langnan (2007) examined and compared various high frequency and low frequency liquidity measures using Spearman, Pearson's and Partial Pearson's correlation and found Hui-Heubel ratio as the best measure of liquidity.

2.2 Liquidity Risk

Liquidity risk arises due to lack of marketability of an asset, which is difficult to be traded quickly enough to avoid loss. Liquidity risk can be classified in two categories: liquidity risk in funding and liquidity risk in trading. Liquidity risk in funding is associated with the balance sheet management framework of financial institutions. It relates to the likelihood that the financial institutions drain out their liquidity for repayment of debt (Marrison 2002). Trading liquidity risk, which is also called market liquidity risk arises from different market features, such as availability of information, number of market participants, and zero cost entry and exit (Bervas 2006). The focus of this study is on trading liquidity risk. Acharya and Pedersen (2005) introduced four major sources of trading liquidity risk. Level of liquidity: The risk of liquidity is connected with the additional cost of illiquidity that effects stock returns. Commonality in liquidity: The covariance between individual stock liquidity and market liquidity. Flight to liquidity: When

investors shift their portfolio from illiquid assets to liquid assets. Depressed wealth effect: Co-variation between market returns and stock illiquidity.

Wagner (2011) described that when large number of investors tend to sell their securities at the same time, there is downward pressure on prices. In such condition the investors are inclined to dispose of their holdings at lower prices and are ready to pay premium. He called this phenomenon the risk of liquidation. Similarly, Bradrania and Peat (2014) revealed market liquidity risk affects returns. There is presence of liquidity premium in expected returns, which increases during high illiquidity risk. In the same vein, Nneji (2015) found that risk of illiquidity influences asset prices and any hike in this risk would result in stock market crash. Chiang and Zheng (2015) conducted a study on G7 countries and found that illiquidity risk has a positive association with excess stock returns. Furthermore, the effects are more distinct in large sized, low risk, growing and liquid stocks.

Liang and Wei (2012) found high premium in prices of developed countries. The results also revealed higher liquidity risk in countries where there is more insider trading practices and larger governing boards. Lin et al. (2014) presented evidence that when there is slow reaction of prices in response to market information, the investors abstain from such stocks trading and thus the returns of these stocks increase on account of market liquidity risk. Cao and Petrasek (2014) found a massive selling pressures by risk averse investors during low levels of liquidity, which leads to a negative relation between stock returns and liquidity risk. The authors also found that concentrated ownership helps in reducing liquidity risk because large investors do not involve in panic selling during market crisis. On the contrary, Sensoy (2017) found a positive association between ownership concentration and liquidity risk. The study revealed that institutional investors contribute to higher level of liquidity risk.

2.3 Liquidity Synchronization

Liquidity synchronization refers to the impact of market wide liquidity changes on individual stock liquidity. This phenomenon has captured the interest of academicians over the last two decades, who have covered an extensive range of related issues. Although researchers have long been interested in investigating the significant role of liquidity in stock markets, most studies on market microstructures have focused on a single security. Researchers have recently argued that liquidity is not merely an attribute of a single security and it encompasses the entire market, which has been coined systematic or liquidity synchronicity (Chordia et al., 2000; Huberman and Halka, 2001; Hasbrouck and Seppi, 2001; Choe and Yang, 2010). It is not worthwhile to study individual securities, because investors trade in portfolio of assets (Domowitz et al., 2005).

Several studies have documented the presence and dynamics of liquidity synchronicity. Within this context, Chordia et al. (2000) conducted the first study on liquidity synchronicity. Their analysis focuses on impacts of daily fluctuations in industry and market liquidity on the liquidity of a single stock. The results reveal a notable impact of industry and market wide liquidity on a single firm's liquidity. Similarly, Hasbrouck and Seppi (2001) investigated Dow 30 stock and found a single common component that drives liquidity. In same vein, Huberman and Halka (2001) selected 240 stocks of the NYSE at random from 254 observations to identify the presence of liquidity synchronicity. The author further investigated the role of asymmetric information and inventory risk in liquidity synchronicity. However, no evidence was provided on impacts of the selected variables on liquidity synchronicity.

Johann et al. (2019) provided a comprehensive analysis of liquidity, its determinants and liquidity synchronization in the German stock market. The results revealed lower levels of liquidity and higher liquidity synchronization during crisis. Wang (2010) analyzed developed and emerging economies and found that a group of global and regional factors have more significant impacts on liquidity synchronicity than a single factor. The study shows that global factors affect liquidity

synchronicity through shocks in volatility and returns while regional factors affect liquidity synchronicity through shocks in volatility and liquidity. De Nicolò and Ivaschenko (2009) conducted a study on 18 emerging and 12 developed economies and found evidence of liquidity co-movement. It is concluded that equity markets are more vulnerable to this form of liquidity risk. Tripathi et al. (2021) examined liquidity synchronization in Indian stock exchange using market model. The study revealed that liquidity synchronization is heterogenous and time-varying in conditional quantiles.

To gain insight into liquidity co-movement, Galariotis and Giouvris (2007) studied the co-movement of liquidity in the United Kingdom during different trade regimes. The London Stock Exchange changed its trade regime for FTSE250 stocks from a quote driven regime to a hybrid regime and that for FTSE100 stocks from a quote driven regime to an order driven regime in the period studied. The study shows that for FTSE250 stocks, liquidity synchronicity is strong for the portfolio level while for FTSE100 stocks, phenomena are strong not only at the portfolio level, but for individual stocks as well. However, overall synchronicity remained similar on average across different trading regimes irrespective of the type of liquidity provision involved. Similarly, Huberman and Halka (2001) identified liquidity synchronicity in NYSE quote driven markets. The authors conclude that liquidity emerges due to existence of noise traders in the market.

Kempf and Mayston (2008) analyzed liquidity synchronicity in the Frankfurt Stock Exchange. Since for medium and small trades, the inside spread shows only the systematic risk of liquidity, the authors expanded their study of liquidity synchronicity beyond best prices to identify high levels of trade systematic liquidity risk. They found large stocks portfolios to carry much higher levels of systematic liquidity risk than small stock portfolios. Further, systematic liquidity risk is high when markets are falling and in the morning. Similarly, Fabre and Frino (2004) studied the presence of liquidity synchronicity in the Australian Stock Exchange (ASX), which is a purely order driven market.

In contrast to earlier research, some evidence of market wide liquidity synchronicity is found in ASX stock, though with less pervasiveness and significance as that

found in other markets. These results conform to the fact that the ASX and other markets of the developed world have different structures. Likewise, Fernando and Herring (2003) showed that common shocks of liquidity caused by the recent financial crisis are long lasting and cannot be diversified. This is the case because for an order driven market, negative shocks render liquidity a scarce commodity, as more market players withdraw from the security market due to considerable order imbalances. Tayeh (2016), in investigating the Amman Stock Exchange, argued that due to differences in market structures, impacts of market wide liquidity on individual stock liquidity differ during the pre- and post-automation of a trading system. Generally, the results show varied levels of liquidity commonality on manual and automated trading platforms. Pukthuanthong-Le and Visaltanachoti (2009) examined liquidity synchronicity in Thailand stock exchange using various liquidity measures. The authors found existence of both industry wide and market wide liquidity synchronicity. Tayeh (2016) studied Amman stock exchange and argued that intraday data is not available for most of the emerging economies. The study employed different liquidity proxies and found evidence of liquidity synchronicity for all measures except price impact. Furthermore, in contrast to previous studies, weak evidence of industry wide liquidity synchronicity is found in Amman stock market. Olbrys (2020) investigated intra-market liquidity synchronization in six emerging Central and Eastern European equity markets. The analysis provided no significance evidence of liquidity co-movement in selected markets.

While the focus of the synchronicity literature has been on the equity market, empirical studies have also explored liquidity synchronicity in various other markets. For example, Friewald et al. (2013) explored synchronicity in liquidity in the bond market. Marshall et al. (2013) studied synchronicity in commodity markets. Corò et al. (2013) examined the synchronicity of liquidity in credit swap markets. (Anthony et al. (2017) studied liquidity synchronicity in secondary corporate markets and found that liquidity synchronicity increases in varied ways during a global financial crisis. Anciaux et al. (2021) found evidence of liquidity synchronization in crypto currencies. Mancini et al. (2013) conducted a first systematic study on liquidity synchronicity in foreign exchange markets. Li et al. (2020) developed

a new methodology for measuring liquidity synchronization in foreign exchange markets, termed as beta index and claimed its enhanced accuracy in estimation.

After reviewing literature, the following research hypothesis is formed to test the prevalence of liquidity synchronization in selected emerging economies.

H_1: There is market wide liquidity synchronicity in the selected emerging economies of Asia.

2.4 Determinants of Liquidity Synchronization

Several empirical studies have been conducted across the globe to identify possible causes of liquidity synchronicity. For instance, Chordia et al. (2000) identified the cost of inventory and asymmetric information as possible causes of liquidity synchronicity. Coughenour and Saad (2004) studied co-variation in liquidity among securities traded by a single firm in the quote driven market. The authors found that shared information and capital among specialists within a firm result in co-movement in their liquidity provisions. Hameed et al. (2010) found that market fluctuations affect capacities to fund financial intermediaries and result in covariation in their liquidity provisions. Domowitz et al. (2005) found that in an order driven market, order type correlations act as an economic force that causes liquidity synchronicity.

To investigate which factors drive liquidity co-movement, Choe and Yang (2010) investigated the Korean Stock Exchange to determine causes of liquidity synchronicity. Inventory costs, investor sentiment, information asymmetry and volatility are studied as potential causes. The empirical analysis shows that higher levels of liquidity synchronicity are caused by information asymmetry, investor sentiments, volatility and style-based trading. However, inventory costs do not have significant effects on liquidity synchronicity. Further, more individual trading is related to more synchronicity in liquidity, which is a sign of strong investor sentiment in the Korean Stock Exchange. Hillier et al. (2007) similarly studied the relationship between firm size and liquidity synchronicity. The authors developed a model of spreads and information to provide insight into these factors. Their

empirical evidence shows that the interval over which liquidity movements are measured has significant impacts on the presence and magnitude of common variability in liquidity. Such intervals form due to delays in information incorporation into bid and ask spreads. Hadhri and Ftiti (2019) investigated liquidity synchronization and its regional, local and global determinants in emerging economies from the North Africa and Middle East. Regional and local factors are found to have no impact on markets with low sensitivity to exogenous factors.

Hameed et al. (2010) found that asset market values have an asymmetric impact on liquidity. In line with theoretical models, negative returns reduce liquidity much more than increases in liquidity due to positive returns. Thus, liquidity synchronicity and levels of liquidity are affected by market declines. It has also been found that within an industry, liquidity synchronicity increases to a formidable level when returns on other industries are negative and significant. Likewise, Brockman et al. (2009) studied liquidity synchronicity using data from 47 stock exchanges and intraday spreads. The authors found that exchange level changes across world stock exchanges greatly influence firm level changes in liquidity. The stock exchanges of emerging Asian economies exhibit more synchronicity than stock exchanges in Latin America. After exploring the role of liquidity synchronicity in individual stock exchanges, the researchers examined the phenomenon across exchanges and found that bid-ask depths and spreads affect global sources. Local sources contribute almost 39% of an individual firm's liquidity synchronicity while global sources contribute 19% to the overall synchronicity of the same firm. Sources of global synchronicity and exchange levels are also considered by the researchers. It is found that both U.S. macro-economic and domestic statements affect synchronicity.

Brockman and Chung (2002) studied the Hong Kong Stock Exchange, which is one the world's largest order driven markets. They found that liquidity synchronicity includes components from both industries and markets. As opposed to what is found for quote driven markets, no positive relationship is found between a firm's size and its sensitivity to variations in market wide bid ask spreads. However,

market stress has a stronger effect on the synchronicity of large firms than on that of smaller firms.

Liquidity synchronicity can be a result of both demand and supply side variables. Various explanations and models on supply side liquidity synchronicity have some commonality by describing that during high volatility and large market decline, the specialists' ability of liquidity supply decreases and demand of liquidation increases (Karolyi et al. 2012). Institutional investors generally involve in large scale trading. Thus, institutional investors' trading has large impact on equity market. Several studies have documented the trading behavior of institutional investors with one interesting finding that such trading is not independent. Institutional investors are informed traders and their trading is always based on some market wide information (Barclay and Warner 1993). Most of the times they carry similar information, employ same analytic models and tools and apply similar trading strategy and as a result process the new information in a similar manner. For example, the institutional investors tend to involve in trading on positive feedback (Sias and Starks, 1997). Therefore, they decrease their stock holdings during bearish market and increase their stock holdings during bullish market. Herding behavior is also found in institutional investors. Lakonishok et al. (1992) argued that institutional investors follow the trading behavior of other informed and experienced institutional investors in order to manage the performance pressure by sponsors. The correlated trading behavior of institutional investors has been discussed in previous literature in order to explain its impact on market volatility, volumes and daily returns (Gabaix et al. 2006). However, the recent literature has identified its role in covariance in liquidity in equity markets. The portfolio trading by institutional investors affects several stocks simultaneously, which causes a sync in liquidity of many stocks.

The first demand side explanation stating the correlated trading behavior of institutional investors was presented by Kamara et al. (2008). They investigated the common shares of US firms to study liquidity synchronicity for 1963 through 2005. Their findings show that synchronicity increased for larger firms while for

small firms the authors found a significant decline in liquidity synchronicity. Considering developments that affected US equity markets in the sampled period, the authors further studied data on the institutional ownership of common equity and found that an increase in institutional ownership is related to an increase in the sensitivity of stocks to systematic liquidity shocks. Index trading and institutional investing are more prevalent among large stocks than small stocks. It is also found that percentage differences in institutional ownership between large and small stocks can better explain variances in their respective liquidity betas. These results suggest that changes in the structures of stock markets cause an increase in large stocks' exposure to liquidity synchronicity.

Koch et al. (2016) found that high ownership of mutual funds particularly the funds facing liquidity constraints or high turnovers exhibit high liquidity synchronicity. The possible reason is that institutional investors generally place large and continuous orders, which causes liquidity synchronization (Chordia et al. 2000). It is postulated that interrelated trading done by investors for a single stock explains liquidity synchronicity across stocks. From data on stock liquidity and mutual fund ownership in AMEX and NYSE stocks for 1980 to 2008, the authors concluded that mutual funds play an important role in liquidity synchronicity. The results show a correlation between stocks owned by mutual funds experiencing liquidity shocks and stocks with high turnover. Both types of stocks exhibit higher levels of liquidity synchronicity. Campbell et al. (2001) suggested that private information, persistent trading, herding behavior by institutional investors results in simultaneous and large-scale trading which causes increase in liquidity synchronicity. Vo et al. (2021) investigated the association between liquidity synchronization and institutional ownership across 40 countries to test the impact of different information environments. A negative relation is found between liquidity synchronization and institutional ownership. In addition, information environment played a strong moderating role. Negative association was higher for information environments with less transparency.

Zhang et al. (2021) studied the association between liquidity synchronization and ownership concentration for foreign firms listed in China over a period of 10 years

to test the impact of cultural diversity. It is found that cultural diversity has a negative relation with liquidity synchronization. Bradrania and Wo (2021) investigated the impact of firm size and foreign and local institutional investors on liquidity synchronization in Australian stock market. The study revealed high liquidity synchronization for large firms compared to small firms. The findings suggested that during unanticipated illiquidity events, foreign institutional ownership increase the exposure on large stocks. A positive association is found between liquidity synchronization and foreign institutional ownership, particularly for mid-cap and large firms. However, local institutional investment is positively associated for large-cap firms only. The study by Wang (2021) revealed that correlation between institutional herding and disputes among shareholder is the cause of liquidity synchronization in China. Furthermore, it is found that shareholders dispute has a negative association with liquidity synchronization and this relation is more distinct in stocks having higher control rights.

Wang (2013) examined the effect of volatility and market returns on liquidity variations in 12 equity markets. The sample used includes both emerging and developed markets. The study shows that common factors have significant impact on liquidity variations in equity markets. Furthermore, volatility is found to be the least important factor in determining cross market average liquidity. Regional factors are found to have effects through volatility and liquidity shocks, whereas the markets dynamics of United Kingdom and United States are found to have few effects on emerging markets. Similarly, Sensoy (2016) studied Turkey's stock market to investigate the effects of macroeconomic and monetary policy statements on liquidity synchronicity. The study interestingly finds that only shifts in U.S. macroeconomic and monetary policy cause liquidity synchronicity in the market. Furthermore, there is a significant upward surge in liquidity synchronicity beyond best price quotes, showing that incorrect results on liquidity synchronicity can be obtained when researchers consider spreads at best prices. Corwin and Lipson (2011) studied the NYSE and found that liquidity synchronicity levels are relatively lower in large firms than in smaller firms. Kuo et al. (2017) explored the Taiwan Stock Exchange to study the tick size impact on liquidity synchronicity.

Their results reveal that a small tick size can have a significant impact on market quality and liquidity risk.

Morris and Shin (2004) and Bernardo and Welch (2004) proposed the concept of "liquidity black holes" which describes that liquidation of one security causes further price drop and triggers liquidation of another. Vayanos (2004) argued that during period of high volatility, investors demand more for holding liquid assets. Garleanu and Pedersen (2007) suggested that high volatility results in low level of market liquidity due to tight risk management by institutions. Another explanation about volatility and liquidity synchronicity relationship is the flight to quality phenomenon.

Chen et al. (2013) empirically evaluated the Chinese Stock Market to identify sources of synchronicity that result in liquidity change. The authors studied the interdependence of changes in liquidity synchronicity and the involuntary trading behaviors of institutional investors. Their results show that the involuntary trading behaviors of investors of an open end fund have reasonable impacts on the liquidity synchronicity of China's Stock Exchange. Deng et al. (2018) also studied 39 stock markets of different countries for 2000 - 2014 to analyze the relationship between liquidity synchronicity and the institutional ownership of foreign investors. The results reveal an inverse relationship between global foreign institution ownership and the liquidity synchronicity of stocks. Foreign investors are in a better position to decrease liquidity synchronicity through corporate transparency. US based and independent foreign investors can exercise greater control over the liquidity synchronicity of a stock. Furthermore, there is a U-shaped relationship between the liquidity synchronicity of a stock and foreign institutional relationship. Thus, a foreign institutional investor can substitute a country's corporate governance level, minimize effects of local culture, and manage uncertainties of economic policy. The study also shows that liquidity synchronicity bridges the relationship between firm valuation and foreign institutional ownership. This ownership can increase firm valuation through stock liquidity and its liquidity synchronicity.

Gold et al. (2017) examined liquidity synchronicity in the Canadian Stock Market from 2008 to 2015. It is found that changes in liquidity are common across the

market and more significant in specific industries. They found that industry and market specific liquidity factors have major effects on individual asset liquidity. Thus, the liquidity of an individual asset is predominantly affected by industry and market-wide liquidity. Narayan et al. (2015) evaluated four hypotheses on liquidity synchronicity in Chinese Stock Markets. The authors hypothesize that liquidity changes with firm size, that market-wide liquidity directly affects individual stock liquidity, that there is an asymmetric effect on liquidity synchronicity and that individual stock liquidity is affected by related sector liquidity. Data on 48 million and 34 million transactions pertaining to the Shenzhen and Shanghai stock exchanges are analyzed. The results show that among the three key sectors studied, the liquidity of the industrial sector provides important evidence for explaining individual stock liquidity. The study also found the prevalence of liquidity synchronicity and strong impact of industry wide liquidity on an individual stock's liquidity. The empirical evidence found does not support size or asymmetric effects of market liquidity on the liquidity of an individual stock. In a similar work by Barberis et al. (2005), it is shown that most investors categorize firms into different groups while trading resources are allocated among groups of firms rather than to individual firms. The correlated trading behaviors of investors induce the liquidity and return co-movement of stocks. Pirinsky and Wang (2006) found a common tendency for investors to assign more weight to local firms while forming portfolios. Correlated trading resulting from this local bias induces liquidity co-movement in the same region.

Green and Hwang (2009) reported that stock categorization by investors is based on security returns and price-based preferences encourage price-based synchronicity. Strong patterns of co-movement in stocks are found with similar prices. Similarly, Greenwood (2008) found that stocks newly added to the index co-vary with increasing intensity relative to existing member stocks. Karolyi et al. (2012) studied behaviors of liquidity synchronicity across countries over time while considering demand determinants such as correlated the trading behaviors of institutional and international investors, investor sentiment, incentives available for investment in

stocks and supply determinants such as liquidity available to financial intermediaries for funding. The study found higher levels of liquidity synchronicity in countries with more market volatility, significant proportions of foreign investors and higher levels of correlated trading. In same vein, Brunnermeier and Pedersen (2009) found that high levels of market volatility and sharp declines in the market significantly impact liquidity available to financial intermediaries. As a result, liquidity in the market is reduced and synchronicity in liquidity is increased. Kamara et al. (2008) and Koch et al. (2016) found that the correlated trading behaviors of investors from institutions can increase liquidity synchronicity. Furthermore, liquidity synchronicity can arise when demand for liquidity across stocks is correlated. This happens when individual investors cannot identify better incentives to trade in individual stocks. Morck et al. (2000) found a correlation between such incentives and regulations on transparency and investor protection and showed that investor sentiment also affects liquidity synchronicity. Similarly, Bouchaddekh and Bouri (2015) studied the Tunisian financial market from 2011 to 2013. Variables empirically studied include the number of transactions, volatility, access to new information, trading volumes, etc. The researchers found that the return, volume and arrival of new information have strong effects on liquidity synchronicity.

Another group of investors-the foreign investors could be a major determinant of liquidity synchronicity. Foreign investors have almost the same rationale as institutional investors. Ferreira and Matos (2008) found that U.S. investors hold around 75% of non-U.S. firms through institutions. Therefore, they might exhibit the same trading strategies with same explanation as of institutional investors. The study also revealed some other factors associated to foreign investors' trading like capital inflows and outflows, order imbalance and exchange rate fluctuations. Barber et al. (2009) conducted a study with main focus on individual investors. It is revealed that individual investors avoid changing their portfolio mix and usually keep buying similar stock. Further, the overconfidence of individual buyers during an upward market leads them to buy more and more. Anginer (2010) reported that flight to liquidity is higher in household investors; during market downturn they demand more liquidity. In this way, the individual investors drive liquidity

synchronicity during down-market conditions.

Watanabe and Watanabe (2008) found that macroeconomic factors affect the liquidity of the stock market in times of volatility. Chordia et al. (2008) explained that in response to expansionary monetary policy, the liquidity of the stock market increases. It is further elaborated that macroeconomic shocks indirectly affect market returns, liquidity and turnover. Jensen and Moorman (2010) and Lu-Andrews and Glascock (2010) analyzed the causes of time variations in liquidity premiums in the United States Stock Exchange. These studies reveal that expansionary monetary policy reduces the price of liquidity and that during an economic recession, investors demand a better return for holding illiquid stocks. Shyu (2017) examined whether marking to market disclosure affects synchronicity in liquidity in the Chinese Stock Market. The study explored the effect of fair value disclosure on the stock market and its relation to a financial crisis. The relationship between liquidity synchronicity and fair value disclosure is studied by examining how fair value measurement contributes to liquidity synchronicity in the Chinese stock market. Synchronicity in liquidity is a form of systematic risk for individual stocks. Therefore, unexpected liquidity demand will cause stock prices to drop rapidly while investors holding the same stocks must dispose of their security due to the same liquidity problem. As a result, there is a cyclical drop in market price and an overall decline in systematic liquidity in the financial system. Lin (2010) examined the impact of financial market liberalization on liquidity synchronicity in emerging economies. For a sample of 20 emerging economies covering a period of 20 years, it is found that opening local markets to foreign investors increases the liquidity of local markets by limiting asymmetric information. However, financial liberalization also introduces more liquidity risk in the form of liquidity synchronicity. A further investigation shows that higher levels of liquidity synchronicity arise from an increase in inventory risk due to financial liberalization.

Alhassan and Naka (2017), using daily and annual data for 1995 to 2015 for 50 countries in East Asia and the Pacific region, investigated how oil markets impact liquidity synchronicity. Two transmitting channels are found: oil price returns and volatility effects on liquidity synchronicity. The study reveals that oil volatility

and returns explain liquidity synchronicity in countries where there is more integration with oil markets. The authors also found that the effect of oil volatility is more evident in oil-exporting countries than in oil-importing countries. Their findings suggest that oil price volatility in liquidity synchronicity is more substantial for oil sensitive countries than oil price returns except for five OPEC members, where synchronicity in liquidity is heavily affected by oil volatility along with returns. Similarly, Tissaoui et al. (2017) explored synchronicity in liquidity using data from 105 stocks for 2008 to 2014 for the Saudi stock market. The analysis showed strong liquidity synchronicity in the Tadawul stock market and significant synchronicity in liquidity under normal conditions. The study documented that liquidity synchronicity in the Saudi stock market is stronger under different stock market conditions than under different oil market conditions. In exploring the magnitude of impact, a time series analysis revealed that liquidity synchronicity is vital across all size-based quartiles, though the magnitude of corresponding impacts varies. Firms with less market capitalization are more vulnerable to synchronicity in liquidity, while those with the considerable market capitalization are the least susceptible to synchronicity in liquidity. However, under boom-and-bust conditions of the oil market, the results are different, where the quartile of small market capitalization is generally the least sensitive to market wide liquidity while the second quartile is more susceptible to synchronicity in liquidity.

Pan et al. (2015) studied the Shanghai Stock Exchange to measure impacts of investors' trading activities on liquidity co-movements and common returns. They divided their population into retail and institutional investors and found that retail traders contribute much less to synchronicity in liquidity than institutional traders. However, retail investors make more substantial contributions to return co-movements. Such contributions are more visible in firms with high levels of information asymmetry. Dang et al. (2015) explored the impact of international cross listing on liquidity synchronicity using large dataset covering more than 20,000 firms and 39 markets for 1996 to 2007. Their results suggest that the impact of aggregate liquidity shocks is reduced for stocks that have been cross listed. It is also found that for countries with poor institutional infrastructure,

opaque information conditions and high levels of market segmentation, cross listing has a negative effect on home liquidity synchronicity. Isshaq and Faff (2016) investigated the relationship between liquidity synchronicity and uncertainty in firm fundamentals. Volatility in operating profits is used to measure fundamental uncertainty. They argued that liquidity synchronicity is stronger for firms with less volatility in profitability; supporting the prediction that liquidity synchronicity is negatively associated with operating profitability volatility.

After reviewing literature, the following research hypotheses are formed to identify the determinants of liquidity synchronization.

H_{2i}: There is a negative relationship between GDP growth and liquidity synchronicity.

H_{2ii}: There is a negative relationship between banking sector development and liquidity synchronicity.

H_{2iii}: There is a positive relationship between interest rate and liquidity synchronicity.

H_{2iv}: There is a positive relationship between exchange rate and liquidity synchronicity.

H_{2v}: There is a positive relationship between inflation rate and liquidity synchronicity.

H_{2vi}: There is a negative relationship between level of investors' protection in the country and liquidity synchronicity.

H_{3i}: There is a positive relationship between stock return volatility and liquidity synchronicity.

H_{3ii}: There is a positive relationship between debt-to-equity ratio of the firm and liquidity synchronicity.

H_{3iii}: There is a positive relationship between firm size and liquidity synchronicity.

H_{3iv}: There is a negative relationship between book to market ratio and liquidity synchronicity.

H_{3v}: There is a negative relationship between return on equity and liquidity synchronicity.

H_{3vi}: There is a positive relationship between institutional investment and liquidity synchronization.

2.5 Liquidity Synchronization and Economic Growth

Several researchers have attempted to investigate the link between the real economy and financial markets. It is generally believed that stock markets affect economy through liquidity. Highly liquid stock markets facilitate investment in the long run, thus support capital allocation and long-term growth expectations (Levine and Zervos, 1999). Naik and Padhi (2015) found evidence of positive long-term impact of stock market liquidity on economic growth. Christiano and Eichenbaum (1995) argued that illiquidity phases occur due to panic selling by the market participants (demand effect), withdrawal of liquidity supply by the market makers (supply effect) or combination of both. Similarly, Hameed et al. (2010) found that negative market returns reduce liquidity of stock, particularly when there is tightness in the funding market. Nazir et al. (2010) studied the impact of market size and liquidity on economic growth. It is found that market size has a stronger impact on economic growth relative to market liquidity. The significance of financial market development in the course of real economic growth is also endorsed by Beck and Levine (2001).

To gain insight into the empirical relation between stock market liquidity and economic cycle, Rösch and Kaserer (2014) explored the drivers of stock market liquidity during global financial crisis and sovereign debt crisis. The empirical evidence revealed fluctuations in liquidity commonality having peaks during crisis period. The results were in line with theory that supports for spiral linkage between funding and market liquidity. In the same vein, Brunnermeier and Pedersen (2009) found that tightness in funding liquidity leads to an increase in liquidity

commonality which in turn induces overall market dry-ups. Hoque and Yakob (2017) examined the moderating role of exchange rate and foreign capital inflow in stock market development and economic growth nexus. The results suggested a positive moderating role of foreign capital inflow and negative moderating role of exchange rate, whereas an interaction of both moderators had a positive impact on stock market development and economic growth relationship. Gibson and Mougeot (2004) found that liquidity risk premium in U.S. stock market has a linear relationship with the Recession Index. Eisfeldt (2004) suggested a setting where stock market liquidity varies with economic fundamentals i.e., investment and economic productivity. The study conducted by Ake (2010) empirically examined the relationship between stock market development and economic growth in Eurozone. They found a positive association between the stock market and real economy for active and liquid stock markets, whereas a negative relationship for less liquid and small markets.

Næs et al. (2011) conducted a study on stock markets of the US and Norway. The authors found that stock market liquidity is a predictor of the future and current state of different macroeconomic indicators related to economic growth (GDP, investment, consumption and unemployment). It is further revealed that the liquidity of small firms decreases faster than that of large firms under poor economic conditions, which is consistent with the general belief that the liquidity of small firms is more reflective of economic conditions. Beudeker (2015) analyzed the association between stock markets and real economic cycle in Eurozone. The results revealed that market liquidity is not a strong predictor of GDP and unemployment growth. However, liquidity commonality explained GDP growth. After the out-burst of a financial crisis, the commonality trend of liquidity changes. Zhou et al. (2018) made static and dynamic analysis to describe liquidity synchronization effect in Chinese equity market. It is found that the relation between industry and business cycle has an impact on liquidity synchronization.

Switzer and Picard (2016) studied the association between market wide liquidity and economic cycle in the NYSE. Weak evidence is found regarding the relationship between liquidity fundamentals and economic conditions. Carp (2012) provided

empirical evidence that stock liquidity and market capitalization do not have any impact on economic growth. Similarly, Kamran et al. (2018) investigated the impact of stock market liquidity on economic growth and found no significant relationship. Conversely, Pan and Mishra (2018) attempted to apprehend the interplay between the real economy and stock market. They found a negative impact of stock market indicators on economy in long-run; however, no evident relationship was found in the short run. Similarly, Arestis et al. (2001) conceded that high market liquidity negatively affects economic growth. One possible reason is that increased liquidity increases return on investment resulted in reduced saving rates and thereby hampers economic growth.

After reviewing literature, the following research hypothesis is formed to test the impact of economic growth volatility on liquidity synchronization.

H_4: Economic growth volatility positively affects the sensitivity of stock liquidity to market liquidity.

2.6 Liquidity Synchronization and Asset Valuation

The existing literature demonstrates the significance of liquidity in determining stock returns. The financial surveys have mostly discussed the pricing of liquidity risk; however, the area of pricing of liquidity synchronization is less explored. While the covariance of individual stock returns and systematic liquidity is termed as liquidity risk, liquidity synchronization risk is defined as the covariance between individual stock liquidity and systematic liquidity (Anderson et al., 2016). Liquidity synchronicity is a form of non-diversifiable risk. Arguments related to the covariance between aggregate liquidity and stock returns have been forwarded by Renault and Ericsson (2000); Domowitz and Wang (2002); Acharya and Pedersen (2005) and Sadka (2006). These studies attempted to rationalize the significance of systematic liquidity and provided a foundation for empirical research to study the role of illiquidity shocks on asset returns.

Researchers have found mixed evidence regarding liquidity pricing. For instance, Pástor and Stambaugh (2003) found that average returns of the stocks with high sensitivities to liquidity surpass the average returns of the stocks with low sensitivities to liquidity. Martınez et al. (2005) found the relevance of liquidity risk factors in explaining average returns in Spain. Similarly, Chen (2005) investigated liquidity risk in stock and bond markets and suggested that liquidity risk is a pervasive risk factor, which is priced in both markets. Korajczyk and Sadka (2008) employed principal component analysis with eight measures of liquidity and found a common systematic component with significant liquidity premia. However, the focus of the study was limited to the covariance of market liquidity and stock returns. Lou and Sadka (2011) studied the stock return sensitivity to market illiquidity and found liquidity risk a better predictor of returns. In the same vein, Foran et al. (2015) investigated the pricing of liquidity risk by applying principal component analysis. The results indicated that systematic liquidity risk is positively whereas individual stock liquidity risk is negatively priced.

Liang and Wei (2012) investigated the relationship between stocks returns and liquidity risk for 21 developed markets of the world. They argued that selection of developed markets mitigates the effects of currency constraints. The study revealed systematic pricing of liquidity risk locally in 11 developed economies. They also found evidence of low premium of liquidity risk for markets with efficient corporate governance practices. Lasfer et al. (2003) examined the association of market liquidity and momentum phenomenon on a sample of 39 stock indices. Positive abnormal returns are found following positive price shocks and negative abnormal returns are found following negative price shocks. Furthermore, such post shock momentum is found to be greater in illiquid markets. Asness et al. (2013) investigated momentum and value returns globally. Using stock market indices, individual stocks, government bonds, currencies and futures data of commodity, they documented momentum and value premiums and highly associated momentum and value returns across asset classes and markets. With the same focus, Cakici and Tan (2014) studied value and momentum effects particularly the size effect using data from 23 developed markets. While examining how market

liquidity and funding liquidity impact the momentum and value effects, they found value returns are more affected by liquidity changes.

Jun et al. (2003) using data from 27 emerging markets reported a positive association between stock returns and overall market liquidity. However, the causality analysis revealed no significant causality between the two variables. The study highlighted the value of understanding the two different concepts, i.e. individual stock liquidity and aggregate market liquidity. The study supported the idea that there is low market integration in emerging markets; thus, low market liquidity does not essentially lead to higher expected returns. Bekaert et al. (2007) employed panel VAR to measure the predictive ability of liquidity shocks in 18 emerging economies. A negative association of previous liquidity with excess return was found. Furthermore, unanticipated positive shocks drive high concurrent excess returns in segmented markets. Hearn (2010) investigated liquidity and size effects using a liquidity and size augmented CAPM for emerging markets of South Asia. The findings showed that both liquidity and size are priced in emerging Asian economies. Donadelli and Prosperi (2012) documented significant time-varying systematic risk and risk adjusted returns in 19 emerging markets. The findings of the study revealed that excess returns might not be justified by the volume-based liquidity. It was also found that risk adjusted returns are explained by additional costs in addition to illiquidity. They argued that their documented puzzles encounter the conventional asset pricing models. Koech (2012) conducted a study on companies listed in Nairobi stock exchange. Simple OLS technique was employed to determine the association between stock returns and liquidity. A weak correlation between the variables of interest is found. The results were contradictory to existing evidence from developed markets due to inefficient market conditions of the sample stock market.

Chang et al. (2010) examined the connection between stock returns and liquidity for Tokyo stock exchange. They found a negative association between liquidity and expected stock returns even after risk adjustment. Furthermore, liquidity was found to be priced during the boom phase of the economy but there was no

significant impact during the contraction phase. The results were in contradiction of the notion that liquidity is priced in inopportune times. In a related study, Narayan and Zheng (2011) examined the liquidity and stock returns nexus for Chinese stock market and inferred that liquidity has a strong impact in the Shanghai stock market than the Shenzhen stock market. Similarly, Uddin (2009) studied the relationship between stock returns and liquidity in NYSE and AMEX. Relative measures of liquidity were applied rather than absolute measures to closely capture the systematic liquidity risk. The author argued that if the market on average is suffering from low liquidity, then it is not feasible to categorize a single stock as illiquid only because of its low trading.

Hubers (2012) examined the pricing of liquidity using CAPM, LCAPM and CAPM with liquidity and Fama and French factors. The returns were regressed for each model on portfolios sorted for size and liquidity levels. The results showed a positive association between asset prices and liquidity. Likewise, Angelidis and Andrikopoulos (2010) examined London stock exchange. They provided evidence that systematic liquidity risk is an important determinant of expected returns. Additionally, it was concluded that new information is initially incorporated in the trading behavior of large investors and then processed by the small investors. Similarly, Cotter et al. (2015) studied the conditional pricing of idiosyncratic risk and systematic risk for the UK security market. The study found evidence of pricing of idiosyncratic volatility during a market downturn. Conversely, Martınez et al. (2005) investigated the predictive power of liquidity in explaining stock returns in Spanish stock market and found that liquidity is not priced in Spanish market. Jensen and Moorman (2010) and Lu-Andrews and Glascock (2010) analyzed US stock market to study the sources of time variation in liquidity premium. The results provide evidence that reduction in liquidity prices is induced by expansionary monetary policy and that investors demand higher compensation for holding illiquid securities during an economic recession.

The existence of liquidity premium raised new queries regarding the role of liquidity in the conventional settings of the Capital Asset Pricing Model. Theoretically,

if the risk of illiquidity is systematic and explains stock returns, it should be considered in CAPM. The pricing effect of systematic liquidity risk leads researchers to test liquidity-adjusted CAPM. In this regard, Amihud and Mendelson (1986); Holmström and Tirole (2001); Gibson and Mougeot (2004) and Chan and Faff (2005) incorporated liquidity in CAPM in order to analyze the impact of liquidity on stock returns and found that the cross-sectional returns are better explained by the models with liquidity effects in comparison with traditional CAPM. Liquidity adjusted capital asset pricing model has been employed by various researchers to investigate the price implications of liquidity risk. LCAPM revisited the frictionless market assumptions and considered capital markets with trading cost. LCAPM provided a unified framework to investigate the impact of liquidity risk on returns by adding different liquidity risk channels to a single asset pricing model. In this regard, Acharya and Pedersen (2005) proposed three kinds of liquidity risk: the covariance of market return and stock liquidity, the covariance of market liquidity and stock return and the covariance of stock liquidity and market liquidity. It was found that the sensitivity of stock liquidity and market liquidity has no pricing effect whereas the covariance of stock liquidity and market returns have significant impact on asset pricing. Lee (2011) extended the scope of liquidity adjusted CAPM on a global level. The study revealed that stock's required rate of return is dependent, not only on the covariance of its liquidity with overall local market liquidity but also on the covariance of its liquidity with local and global market returns. Hagströmer et al. (2013) estimated three liquidity risks in US stock and found liquidity as a systematic risk factor. Vu et al. (2015) examined the impact of systematic liquidity risk on Australian market and found support for the significance of liquidity risk in stock returns particularly during market declines.

Anthonisz and Putniņš (2017) developed a capital asset pricing model with downside liquidity risk i.e., the sensitivity of asset liquidity to negative market returns. The authors found strong empirical support for pricing of downside liquidity risk. Kim and Lee (2014) investigated the price implications of liquidity risk using

liquidity adjusted CAPM with multiple liquidity measures and found that systematic liquidity shocks are undiversified source of risk. In the same vein, Stahel (2005) investigated asset pricing implications of liquidity synchronization in developed countries and found that global liquidity is more important than local market liquidity in asset pricing. Ho and Chang (2015) considered three models i.e. the CAPM, Fama and French three factor model and Fama and French model augmented by momentum to study the pricing of liquidity risk in an order driven market. The results revealed that the returns sensitivities to aggregate market liquidity fluctuations are related to cross-sectional expected stock returns. Vaihekoski (2009) employed conditional asset pricing models to investigate the pricing of liquidity risk using the Generalized Method of Moment (GMM) framework. The study was conducted to examine the pricing of liquidity both as an asset-specific feature and as a systematic risk factor. They found that liquidity is priced as a market wide risk and not as an asset specific characteristic. Hasbrouck and Seppi (2001); Chen (2005); Chollete et al. (2008) employed factor analysis by adding common factors to the CAPM. Hasbrouck and Seppi (2001) found that the liquidity adjusted model outperformed the conventional CAPM. The studies revealed that liquidity risk is priced and liquidity adjustment to asset pricing models enhances their ability to explain returns.

Moshirian et al. (2017) provided evidence regarding pricing of liquidity risk arising from liquidity synchronicity. Implied cost of capital pricing method and realized returns pricing method are applied to investigate the pricing effect of systematic liquidity. Liquidity synchronicity is found as a priced factor in realized returns model; however, the results were insignificant for the implied cost of capital models. In the same vein, Saad and Samet (2017) investigated the impact of liquidity risk on stock's implied cost of capital (ICOC) and found that ICOC increases with increase in liquidity synchronicity but decreases with an increasing covariance of market returns and stock liquidity and covariance of market liquidity and stock returns. After reviewing literature, the following research hypothesis is formed to test the impact of liquidity synchronization on stocks valuation.

H_5: Liquidity synchronicity has an impact on stock valuation.

2.7 Gaps in Literature

A comprehensive review of existing literature has revealed that the prime concern of most of the studies is liquid markets of the world. In such markets the adverse effects of illiquidity can be mitigated by large number of traded securities, diversified ownership structures and combinations of long term and short-term investors. Emerging markets represents an ideal setting for the study, where illiquidity is one of the biggest hurdles to foreign investment. Firms in Asian markets operate in legal and regulatory environments distinct from those of firms analyzed in the previous literature. There are only a few studies on the liquidity synchronization phenomenon in emerging economies, especially in the Asian region. Further the pricing of liquidity synchronization differs across markets and is thus not appropriate for generalization. A major knowledge gap pertaining to Asian emerging markets serves as the primary motivation for this study.

Chapter 3

Research Methodology

The current study aims to identify the presence of liquidity synchronization in selected emerging Asian economies along with its significant determinants. Secondly, the study explores the impact of economic growth volatility on liquidity synchronization. Thirdly, role of liquidity synchronization on asset valuation is also discussed in this study.

This chapter includes details regarding population, sample, and objectives-based models and techniques. Section 3.1 presents population of study. Section 3.2 deliberates sample selection and sample period. Section 3.3 provides detail of research models based on specific objectives.

3.1 Population

Today the world is a global village. There are plenty of opportunities for investments outside the developed economies. The emerging economies of Asia offers such opportunities. Considering the fact, the sample for this study is defined as the four emerging economies of Asia including Pakistan, China, Bangladesh and India. The main reason for selecting these economies is their prominence in Asian emerging region. Pakistan, India, China and Bangladesh are neighboring nations and are among the top five most populated countries of Asia. China is the largest economy among the selected countries followed by India, Pakistan and Bangladesh.

Over the past two decades, the economy of Bangladesh has shown remarkable progress by sustainable economic growth. Bangladesh is the fastest growing economy of Asia and has achieved the status of middle-income country in 2015 due to rapid growth. The economy is now moving towards the status of least developed countries by qualifying the eligibility criteria of United Nations. India is at second place of growth rate in Asian countries as per report of International Monetary Fund World Economic Outlook in April 2019. The economy of China is enjoying extensive growth over the past three decades. The success is based on a mixed economic system that is comprised of restricted capitalism within a command economy. Pakistan's economic growth is slowed in FY 2020 year due to tighten government policies, however, recovery is anticipated from the current year onwards. The projections for poverty are showing a declining trend in the coming years. With different starting points and different speeds and approaches, the emerging Asian economies displays different development levels of stock markets. Irrespective of the stage of growth, illiquidity is a common problem and one of the biggest hurdles to foreign investment in these economies.

3.2 Sample

Four representative stock exchanges i.e., Pakistan Stock Exchange, Shanghai Stock Exchange, Dhaka Stock Exchange and Bombay Stock Exchange are selected for the study. We use the following criteria for selecting firms for the study:

1. Non-financial companies listed in the representative stock exchanges. The financial companies are not included because they have different capital and profit structures. The financial firms normally have very high leverage, which does not have the same meanings as for non-financial firms. For non-financial firms, high leverage indicates financial distress. The combined analysis of both financial and non-financial firms can influence the generalization of results.

2. For the purpose of this study the sample period covers 10 years i.e., 2010-2019.

3. The data is available on all variables for each year of sample period.

Table 3.1: List of Stock Exchanges.

Country	Stock Exchange	Number of Firms
Bangladesh	Dhaka Stock Exchange	50
China	Shanghai Stock Exchange	100
India	Bombay Stock Exchange	100
Pakistan	Pakistan Stock Exchange	100

3.3 Research Models

The following research models are used to investigate the specific objectives:

3.3.1 Presence of Liquidity Synchronization

The concept of common component of liquidity was highlighted by Chordia et al. (2000). Since dealer inventory is primarily determined by the volume of trading, the variation in volume may results in co-movement in the optimal levels of inventory which in turn leads to co-movement in bid-ask spread and quoted depth. Trading of large orders simultaneously may exert joint pressure on dealer inventories. Correlated trading behavior of institutional investors induces changes in inventory level across wide market sectors. Thus, liquidity of individual stocks co-moves with the market wide liquidity.

The presence of liquidity synchronization in stock markets of selected countries is measured following Chordia et al. (2000); Fabre and Frino (2004); Zhang et al. (2009); Dang et al. (2015); Anthony et al. (2017); Moshirian et al. (2017) and Tissaoui et al. (2018). The market model is used by applying time series regression to investigate the liquidity synchronicity for each stock for each year:

$$\Delta L_{i,t} = \beta_0 + \beta_1 \Delta L_{M,t} + \beta_2 \Delta L_{M,t+1} + \beta_3 \Delta L_{M,t-1} + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 R_{Vi,t} + \epsilon_{i,t} \tag{3.1}$$

Here $\Delta L_{i,t}$ is the percentage change in the liquidity of stock i from day $t-1$ to day t, and $\Delta L_{M,t}$ is the percentage change in the market liquidity from day $t-1$ to day t. The study defines the market liquidity as equally-weighted average of the daily liquidity of all the stocks in the market (excluding stock i) for day t. $R_{M,t}$, $R_{M,t+1}$ and $R_{M,t-1}$ is the concurrent, one-day lead and one-day lag equally weighted market returns respectively. The market return variables are included to apprehend any spurious dependence arising due to the relationship between returns and liquidity. $R_{Vi,t}$ is percentage change in the stock's squared return, the measure of stock return volatility which influence the stock liquidity (Tissaoui et al., 2018; Galariotis and Giouvris, 2007). One-day lead ($\Delta L_{M,t+1}$) and one-day lag ($\Delta L_{M,t-1}$) is included to capture the market movement adjustments. The liquidity of stock is broadly defined as the capacity to trade heavy stock quantities quickly, with low cost and little price impact (Karolyi et al. 2009). The literature in market microstructure has provided a variety of measures for the individual stock liquidity. In our analysis, liquidity is estimated using transaction cost measures. Four different measures: quoted spread, proportional quoted spread, effective spread and proportional effective spread are employed for liquidity computation. Chung and Zhang (2014) suggested bid ask proxies using closing bid-ask prices. To address the problem of data constraint daily closing data is used to measure the liquidity of stock i.

Table 3.2: Definition of Liquidity Measures.

Liquidity Measure	Acronym	Definition
Quoted spread	QS	$P_A - P_B$
Proportional quoted spread	PQS	$(P_A - P_B)/P_M$
Effective spread	ES	$2\lvert P_t - P_M \rvert$
Proportional effective spread	PES	$2\lvert P_t - P_M \rvert / P_t$

P_A, P_B and P_M denotes ask price, bid price and mid-point of ask and bid prices, respectively. P_t indicates the actual price of the day.

Equation (1) is estimated for each stock i for each year to get R^2 statistic. R^2 measure for regression is used to explain the percentage change in the daily variation in liquidity of stocks i due to daily variation in the market liquidity. Higher R^2 value reveals the higher variation in the liquidity of individual stock due to liquidity of market. Gamma (γ) the logarithmic transformation of R^2 is used to measure liquidity synchronization. The arrangement is done for the dependent variable to be used in the subsequent analysis.

$$\gamma = \log\left(\frac{R_i^2}{1 - R_i^2}\right)$$

The logarithmic transformation is the ratio of explained versus unexplained variance. Since R^2 is bound to have a value between zero and one, the liquidity synchronization is thus obtained by taking log of transformed R^2. Gamma (γ) is a monotonically increasing function of R^2. It has a more normal distribution relative to R^2 due to transformation. Therefore, it is preferred over R^2 in empirical studies by Chordia et al. (2000), Fabre and Frino (2004), Zhang et al. (2009), Dang et al. (2015), Anthony et al. (2017), Moshirian et al. (2017) and Tissaoui et al. (2018). A higher value of γ indicates higher sensitivity of stock liquidity to market liquidity.

3.3.2 Country Specific Determinants of Liquidity Synchronization

In this section, the country-specific factors are identified, which can contribute to the variation in liquidity synchronicity of stock. Stocks are one of the most associated assets to the economic environment. Since the equity market reflects the economic conditions, the macroeconomic variables could be employed as the leading indicators of stock market efficiency. Economic performance can be assessed by real GDP growth, monetary policies, debt availability to the private sector,

government stability, pervasiveness of law and governance and other related variables.

As liquidity is one of the major indicators of stock market efficiency and it is not an independent attribute of a single security, it is worthwhile to study the relationship between liquidity synchronization and major macroeconomic variables. Panel data analysis is used to examine the country-level factors that affect liquidity synchronization. Gamma (γ) is our dependent variable regressed on country-specific variables to identify the determinants of liquidity synchronicity.

$$\begin{aligned}\gamma_{i,t} = \beta_0 + \beta_1 GDP_{i,t} + \beta_2 PCG_{i,t} + \beta_3 I_{i,t} + \beta_4 EX_{i,t} + \beta_5 INF_{i,t} + \beta_6 PS_{i,t} \\ + \beta_7 RQ_{i,t} + \beta_8 RL_{i,t} + \epsilon_{i,t}\end{aligned} \tag{3.2}$$

Where

γ = Liquidity Synchronization of firm i in year t

GDP = Annual GDP growth of country i in year t

PCG = Private Credit to GDP of country i in year t

I = Interest Rate of country i in year t

EX = Exchange Rate of country i in year t

INF = Inflation Rate of country i in year t

PS = Political Stability of country i in year t

RQ = Regulatory Quality of country i in year t

RL = Rule of Law of country i in year t

3.3.2.1 Definition of Variables

Liquidity Synchronization: Liquidity synchronization is the dependent variable denoted by Gamma (γ) which is the logarithmic transformation of R2 used to

measure liquidity co-movement.

$$\gamma = \log\left(\frac{R_i^2}{1 - R_i^2}\right)$$

Annual GDP Growth: GDP growth rate is measured by annual GDP growth in year t. The variable is expected to have a negative association with liquidity synchronization. More growing and stable economies have low level of liquidity synchronicity (Moshirian et al., 2017).

Private Credit to GDP: Private credit to GDP is the measure of banking sector development of the country. There is low level of investment and efficiency of capital allocation in less developed banking industry, which may result in less developed capital markets (Levine, 2002). Investors follow market trends in such markets to mitigate the risk of inefficiencies in capital allocation. Thus, banking sector development is expected to have a negative impact on liquidity synchronicity. Private credit to GDP is measured by the ratio of private sector credit to GDP in year t.

Interest Rate: Interest rate is the real interest rate (%) in year t. Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.

Exchange Rate: Exchange rate is the period average of the official exchange rate in year t. Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages.

Inflation Rate: Inflation rate is the inflation in consumer prices (annual %). Inflation is measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

Investor Protection: High liquidity synchronization is found in the countries with weak transparency and poor level of investor protection (Karolyi et al., 2012). Greater investor protection can play a significant role in investors' liquidity demand. Conversely, poor investor protection results in a low quality of available

public information which increase asymmetric information. The presence of strong governance, steady rule of law, government effectiveness and political stability ensures strong investor protection in the country. The following variables are studied to capture the impact of investor protection on the liquidity synchronization. The secondary data on all the variables are collected from Worldwide Governance Indicators, World Bank website.

Political Stability: Political stability measures the perception of the level of political stability in the country.

Regulatory Quality: It captures the ability of government to form sound regulations and policies and to implement those regulation to promote the development of private sector.

Rule of Law: The rule of law reflects the extent to which the masses have confidence in rules and laws in society and how much they abide by those rules and laws. These rules include property rights, enforcement of contracts, law enforcing authorities and the likelihood of violence and crime.

3.3.3 Firm Specific Determinants of Liquidity Synchronization

In this section, the firm-specific factors are identified, which can contribute to the variation in liquidity synchronization of stock. Panel data analysis is applied on annual data to study the impact of firm specific variables on liquidity synchronization.

$$\gamma_{i,t} = \beta_0 + \beta_1 Vol_{i,t} + \beta_2 DER_{i,t} + \beta_3 Size_{i,t} + \beta_4 BM_{i,t} + \beta_5 ROE_{i,t} + \beta_6 IO_{i,t} + \epsilon_{i,t} \tag{3.3}$$

Where

Vol = Stock Return Volatility of firm i in year t

DER = Debt to Equity Ratio of firm i in year t

Size = Firm Size of firm i in year t

BM = Book to Market Ratio of firm i in year t

ROE = Return on Equity of firm i in year t

IO = Institutional ownership of firm i in year t

3.3.3.1 Definition of Variables

Stock Return Volatility: The stock return volatility is the variations in the price of stock over a specific time period. Different stocks have different tendencies of price variations. Stock return volatility is expected to have positive association with liquidity synchronicity. Annualized stock return volatility is measured by multiplying the standard deviation of daily stock volatility by the square root of 252.

Debt to Equity Ratio: Debt to equity ratio is used to measure the financial health of a company. It is the proportion of debt and equity used by the company to finance the business assets. The ratio reflects the level by which shareholder's equity can meet the liabilities of creditors. High debt to equity ratio shows that the company is depending on the borrowed funds. The ratio is expected to have a positive relation with liquidity synchronization. Debt to equity ratio is measured as proportion of long-term debt to common equity.

Institutional Ownership: The studies conducted by Chen et al. (2013), Kamara et al. (2008) and Pan et al. (2015) have evidenced that the trading behavior of institutional investors is one of the major factors behind liquidity synchronization. When institutional investors experience capital inflows and outflows, they respond immediately by changing their trading strategies. The involuntary trading behavior of investors results in a significant correlation of institutional investors' trading demand, which leads to synchronization in liquidity and fragility of stock prices (Chen et al. 2013). The institutional investors have diversified portfolio, thus correlated trading behavior causes liquidity synchronicity. The variable is expected to have a positive association with liquidity synchronization. Institutional

ownership is measured by the ratio of the total number of shares owned by the institutional investors to total number of outstanding shares.

Firm Size: Firm size plays a significant role in sensitivity level of stock liquidity to market liquidity. Large firms are more prone to liquidity synchronicity as compared to small firms (Syamala and Reddy, 2013). The larger firms have more institutional investment, thus correlated trading behavior by institutional investors causes high synchronization. There is an expected positive association between firm size and liquidity synchronicity. Firm Size is measured by the log of market capitalization.

Book to Market Ratio: The book to market ratio is used to assess company's current market value in comparison to its book value. Moshirian et al. (2017) find a negative relationship between book to market ratio and liquidity synchronization. Book to market ratio is measured by the log of book value to market value of the firm.

Return on Equity: Return on equity is the measure of profitability of the firm. The existing literature has evidenced that more profitable firms are less susceptible to liquidity synchronization. Return on equity is measured by the ratio of net income to shareholders' equity.

3.3.4 Impact of Economic Growth Volatility on Liquidity Synchronization

Economic cycle is the overall economic state divided into different phases. All countries experience variations in the growth levels of output, income and consumption. Gross domestic product, employment, interest rate and spending patterns are the main sources of economic growth volatility. Economic growth volatility refers to the economic fluctuations that occur between stages of expansion and contraction. The investors continuously process information about the current state of the economy, which subsequently affects their trading activities. During an economic downturn, the investors either allocate their funds to safer stocks or shift their portfolio away from equity markets. Thus, economic growth volatility affects the overall stock market liquidity. The incremental effect of the economic

growth volatility on liquidity synchronicity is tested by introducing GDP growth volatility as an interaction term of variation in market liquidity in annualized Equation (1). The economic growth volatility is measured by the standard deviation of the annual percentage of GDP growth.

$$\begin{aligned}\Delta L_{i,t} = \beta_0 + \beta_1 \Delta L_{M,t} + \beta_2 \Delta L_{M,t+1} + \beta_3 \Delta L_{M,t-1} + \beta_4 (\Delta L_{M,t} \times \sigma GDP) \\ + \beta_5 (\Delta L_{M,t+1} \times \sigma GDP) + \beta_6 (\Delta L_{M,t-1} \times \sigma GDP) + \beta_7 R_{M,t} + \beta_8 R_{M,t+1} \\ + \beta_9 R_{M,t-1} + \beta_{10} R_{Vi,t} + \epsilon_{i,t}\end{aligned} \tag{3.4}$$

3.3.5 Liquidity Synchronization and its Outcomes for Valuation

The theories of asset pricing are based on the fact that systematic risk is always priced in financial markets and the investors demand compensation for this risk. It is generally believed in asset pricing theories that all assets can be quickly traded because of their liquidity characteristic. However, in the real world the frequently traded asset classes are not perfectly liquid. The investors bear transaction costs and most probably experience a reduction in future prices if they decide to quickly liquidate their position. Thus, future cash flows are affected by liquidity due to its influence on asset prices. The ease of stock trading is extremely important to financial markets and especially to investors. Stock market participants while making their investment portfolios deem liquidity as one of the major determinants of stock price. But there is an association between stock liquidity and overall market liquidity. When the liquidity of market declines, there is different downside pressure on different stocks. In particular, this downside liquidity pressure is comparatively more intense for the stocks, where there is a high correlation between market liquidity and stock liquidity.

Chordia et al. (2000) argued that there is a positive relationship between asset's sensitivity to liquidity shocks and its expected returns, if these shocks are unanticipated and their effect on asset returns is inevitable. Considering the importance of

liquidity synchronization on asset pricing this study investigates whether liquidity synchronicity has impact on the valuation of assets in selected emerging economies of Asia. The panel data technique is applied on annual data of the firms.

Following Hail and Leuz (2009) and Moshirian et al. (2017) two methods are used to investigate the stock valuation:

(i) The implied cost of capital method (ICOC)

(ii) The realized returns method (RRet)

The following four cost of capital models are widely used in literature for valuation of stock:

1. Claus and Thomas (2001) model of residual income valuation
2. Gebhardt et al. (2001) model of residual income valuation
3. Ohlson and Juettner-Nauroth (2005) model of abnormal earning growth valuation
4. Easton (2004) model of MPEG ratio

The Claus and Thomas (2001) model of residual income valuation is as follows:

$$p_t = bv_t + \sum_{\tau=1}^{T} \frac{(e\hat{p}s_{t+\tau} - r_{CT}.bv_{t+\tau-1})}{(1+r_{CT})\tau} \frac{(e\hat{p}s_{t+T} - r_{CT}.bv_{t+T-1})(1+g)}{(r_{CT}-g)(1+r_{CT})^T} \tag{3.5}$$

The Clause and Thomas (2001) model calculates the expected future residual income using the book value per share and future forecasted earnings per share for the next five years. The nominal residual income after five years is expected to grow at the predicted inflation rate.

The Gebhardt et al. (2001) model of residual income valuation is as follows:

$$p_t = bv_t + \sum_{\tau=1}^{T} \frac{(e\hat{p}s_{t+\tau} - r_{GLS}.bv_{t+\tau-1})}{(1+r_{GLS})\tau} \frac{(e\hat{p}s_{t+T+1} - r_{GLS}.bv_{t+T})}{r_{GLS}(1+r_{GLS})^T} \tag{3.6}$$

The Gebhardt et al. (2001) model calculates the future expected residual income using the book value per share and future forecasted earnings per share for the first three years. After three years, the expected residual income is derived by the linear reduction of the future return on equity to the industry-specific return median. Future book values are estimated assuming clean surplus.

The Ohlson and Juettner-Nauroth (2005) model of abnormal earning growth valuation is as follows:

$$p_t = \frac{e\hat{p}s_{t+1}}{r_{OJ}}.\frac{\left(g_{st} + r_{OJ}.\frac{\hat{d}_{t+1}}{e\hat{p}s_{t+1}} - g_{It}\right)}{(r_{OJ} - g_{It})} \tag{3.7}$$

The Ohlson and Juettner-Nauroth (2005) model is estimated using one year ahead forecasted earnings, future dividend per share and forecast of long-term and short-term growth rates of abnormal earnings.

The Easton (2004) model of MPEG ratio is as follows:

$$p_t = \frac{(e\hat{p}s_{t+2} - r_{MPEG}.a\hat{d}_{t+1} - e\hat{p}s_{t+1})}{r^2_{MPEG}} \tag{3.8}$$

The Easton (2004) model obtains abnormal earnings growth using one year and two years ahead earnings per share and one year ahead expected dividend per share. Abnormal earning with perpetual growth is assumed after the initial period.

Where

p_t = Market price of a firm's stock j at time t

bv_t = Book value per share at time t

$bv_{t+\tau}$ = Expected book value per share at time $t+\tau$, where $bv_{t+\tau} = bv_{t+\tau-1} + e\hat{p}s_{t+\tau} - \hat{d}_{t+\tau}$

$\hat{d}_{t+\tau}$ = Expected future net dividends per share for period $(t+\tau-1, t+\tau)$

$e\hat{p}s_{t+\tau}$ = Expected future earnings per share at time $(t+\tau-1, t+\tau)$

g_{st} = Short-term growth rate

g_{It} = Long-term growth rate

r_{GLS} = ICOC for Gebhart, Lee, and Swaminathan's (2001) model

r_{CT} = ICOC for Claus and Thomas' (2001) model

r_{MPEG} = ICOC for Easton's (2004) MPEG model

r_{OJ} = ICOC for Ohlson and Juettner-Nauroth's (2005) model

For the purpose of this study, average of the above four implied cost of capital models is used to compute the implied cost of capital variable. The impact of liquidity synchronization on valuation is studied by the following two models:

$$ICOC_{i,t} = \alpha_0 + \alpha_1\gamma_{i,t} + \alpha_2\beta_{i,t} + \alpha_3 MV_{i,t} + \alpha_4 BM_{i,t} + \alpha_5 DE_{i,t} + \alpha_6 SV_{i,t} + \mu_{i,t} \quad (3.9)$$

$$RRet_{i,t} = \alpha_0 + \alpha_1\gamma_{i,t} + \alpha_2\beta_{i,t} + \alpha_3 MV_{i,t} + \alpha_4 BM_{i,t} + \alpha_5 DE_{i,t} + \alpha_6 SV_{i,t} + \mu_{i,t} \quad (3.10)$$

Where

ICOC = Implied Cost of Capital

RRet = Realized Returns

γ = Liquidity Synchronization

β = Market Beta

MV = Market Value

BM = Book to Market Ratio

DE = Debt to Equity Ratio

SV = Stock Return Volatility

3.3.5.1 Definition of Variables

Implied Cost of Capital: The implied cost of capital is the internal rate of return that equates the current price of stock to the present value of expected

future residual income. The average of four implied cost of capital estimates is used for computation of variable.

Realized Returns: The realized returns is computed for each stock by getting stock returns in excess of T-bill monthly returns.

Liquidity Synchronization: Liquidity synchronization is measured by γ which is the logarithmic transformation of R^2 from regression equation.

Market Beta: Beta is the measure of stock volatility in relation to market. Market beta is measured by dividing the covariance of stock return and benchmark return by the variance of benchmark return.

$$\beta = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

Market Value: The market value of the firm is measured by the log of market capitalization of the firm.

Book to Market Ratio: Book to market ratio is measured by the log of book value to market value of the firm.

Debt to Equity Ratio: Debt to equity ratio is used to measure the financial health of a company. It is the proportion of debt and equity used by the company to finance the business assets. The ratio reflects the level by which shareholder's equity can meet the liabilities of creditors. High debt to equity ratio shows that the company is depending on the borrowed funds. Debt to equity ratio is measured as proportion of long-term debt to common equity.

Stock Return Volatility: The stock return volatility is the variations in the price of stock over a specific time period. Different stocks have different tendencies of price variations. Annualized stock return volatility is measured by multiplying the standard deviation of daily stock volatility by the square root of 252.

Chapter 4

Data Analysis and Discussion

This chapter starts with illustrating the descriptive statistics of liquidity measures for each selected country followed by the evidence of presence of liquidity synchronicity, its firm and country specific determinants, the impact of economic growth volatility and outcomes for asset valuation.

4.1 Empirical Analysis for Pakistan Stock Exchange

4.1.1 Descriptive Statistics for Liquidity Measures

Descriptive statistics of different liquidity proxies computed for Pakistan Stock Exchange are exhibited in Table 4.1. Descriptive statistics illustrate the statistical behavior of the variables and include mean, median and standard deviation of four transaction cost-based liquidity measures. Mean and median depicts the average and central value of data while volatility is shown by standard deviation. The average quoted spread is 35.6% while the central value of quoted spread is 23.1%. A high volatility is found revealing dispersion of quoted spread across firms.

Percentage quoted spread has a mean value of 1% while the data has a central value of 0.5%. The percentage quoted spread is less volatile as compared to quoted

spread with standard deviation of 1.4%. Effective spread has a mean value of 47.9% which is somewhat higher than the quoted spread. The effective spread is generally considered to be a relatively realistic measure of market liquidity than quoted spread (Guloglu and Ekinci 2016). The standard deviation is 1.965, which means that there is variance between data and its average. Percentage effective spread has an average value of 1.1% and central value of 0.6%. Like percentage quoted spread, percentage effective spread has low value of standard deviation.

Table 4.1: Descriptive Statistics of Liquidity Measures.

	Mean	Median	Standard Deviation
QS	0.356	0.231	2.125
PQS	0.010	0.005	0.014
ES	0.479	0.231	1.965
PES	0.011	0.006	0.015

4.1.2 Presence of Market Wide Liquidity Synchronization in Pakistan Stock Exchange

The presence of liquidity synchronization in Pakistan Stock Market is reported in Table 4.2. Equation 1 is regressed for each stock in each year using four different liquidity measures. The daily percentage change in the liquidity of an individual stock is regressed on daily percentage change in average equally weighted liquidity of all other stocks in the sample. The market average liquidity is computed excluding the dependent variable security. QS is the quoted spread, PQS is the proportional quoted spread, EF is the effective spread and PES is the proportional effective spread. Δ denotes the percentage change in liquidity between two successive trading days. Concurrent, lag and lead denote the same day, previous day and next day changes in market liquidity. The sum shows the mean of concurrent, lag and lead. % Positive indicates the percentage of coefficient with positive slopes while % positive significant reports the percentage of coefficients with positive slopes and significance at 5% level of significance.

The results for quoted spread depict an average of 31% for concurrent coefficient with an associated t-statistics of 2.03%. Quoted spread provides the highest average among all liquidity variables. 74% of the coefficients are positive among which around 24% are significant at 5% level. An average of 14% is found for concurrent coefficient using effective spread liquidity measure with a t-statistics of 2.18%. Nearly 64% of the coefficients are positive and 34.27% concurrent coefficients are positive and significant at 5% level. The measure of proportional quoted spread provided the highest number of positive coefficients i.e., 82% followed by proportional effective spread i.e., 80.40%.

The average impact of percentage change in the previous day market liquidity on the percentage change of individual stock liquidity is highest using quoted spread i.e., 20%. 66.84% of the coefficients are positive while around 15% coefficients are positive and significant. The results of effective spread measure provide an average lag coefficient of 3% with t-statistics of 2.39%. 51.5% coefficients are found positive whereas 21.36% coefficients are positive and significant. Proportional effective spread provides the lowest percentage of positive and significant coefficients i.e., 8.92% followed by proportional quoted spread i.e., 13.25%.

The average impact of percentage change in the next day market liquidity on the percentage change of individual stock liquidity is highest using quoted spread i.e., 13% with an associated t-statistics of 4.26%. The highest number of positive and significant coefficients are found using quoted spread (11.21%) followed by effective spread (9.66%) and proportional effective spread (5.74%). The mean of adjusted R^2 for quoted spread is 19% while for effective spread measure the value is 10%. The return and squared return variables are included in analysis to apprehend any spurious dependence arising due to the relationship between returns and liquidity, thus their coefficients are not reported. The results of control variables are depicted in Table 4.3.

The market liquidity coefficient is lower as compared to the reported coefficient in the studies of developed markets conducted by Chordia (2000), Galariotis and Giouvris, (2007), Brockman et al. (2009). However, the sensitivity of individual

stock liquidity to market wide liquidity confirms the presence of liquidity synchronization in Pakistan stock market and supports our hypothesis. The results are consistent with Hasbrouk and Seppi (2001); Huberman and Halka (2001); Coughenour and Saad (2004); Kamara et al. (2008); Kempf and Mayston (2008).

TABLE 4.2: Market Wide Liquidity Synchronization

	ΔQS	ΔPQS	ΔES	ΔPES
Concurrent	0.31	0.25	0.14	0.16
t-stat	2.03	1.49	2.18	0.73
% positive	74.00	82.00	63.60	80.40
% positive significant	23.96	34.27	17.80	22.08
Lag	0.20	0.12	0.03	0.11
t-stat	3.14	1.83	2.39	2.19
% positive	66.84	69.55	51.49	42.17
% positive significant	14.89	13.25	21.36	08.92
Lead	0.13	0.04	0.02	0.22
t-stat	4.26	2.47	1.28	1.12
% positive	62.58	66.19	65.32	48.56
% positive significant	11.21	03.58	09.66	05.76
Sum	0.21	0.14	0.06	0.16
t-stat	3.14	1.93	1.95	1.35
Adjusted R^2	0.19	0.17	0.10	0.13

TABLE 4.3: Control Variables of Market Model

	ΔQS	ΔPQS	ΔES	ΔPES
$R_{M,t}$	0.15	0.26	0.18	0.23
t-stat	7.13	2.51	1.58	1.21
$R_{M,t-1}$	0.37	0.09	0.13	0.08
t-stat	9.12	1.48	2.93	0.25
$R_{M,t+1}$	0.08	0.12	0.03	0.04
t-stat	3.58	1.82	0.28	0.68
$R_{Vi,t}$	0.29	0.02	0.19	0.01
t-stat	2.86	3.54	2.18	2.66

4.1.3 Country Specific Determinants of Liquidity Synchronization

4.1.3.1 Unit Root Test

The stationarity of the financial time series is the necessary condition for empirical analysis. We start our analysis by testing the stationarity status of country specific variables. The Phillip Parren test is applied on time series because it assumes non independence of error term and allows heterogeneous distribution of data. The results of unit root test are presented in table 4.4. The results confirmed that all the variables are stationary at level.

Table 4.4: Unit Root Test

Variable	Phillips-Perron Test
γ	-17.977
GDP	-6.328
PC	-19.468
IR	-72.224
INF	-9.93
EX	-57.593
PS	-36.501
RQ	-13.698
RL	-14.742

4.1.3.2 Descriptive Statistics of Country Specific Determinants

Table 4.5 reports descriptive statistics of the country specific variables for a sample of 100 Pakistani firms. Descriptive statistics is used to study the behavior of data. The average liquidity synchronicity is -0.632 with a maximum value of -0.069 and minimum value of -1.826. The standard deviation is 24.3% which depicts a relatively low volatility in liquidity synchronicity for the sample firms. On average

the annual GDP growth remain 3.96%. However, there is high deviation ranging from 0.99% to 5.84%. The domestic credit to private sector as a percentage of GDP shows a mean of 17.41% with a standard deviation of 1.71.

The real interest rate of the country reports an average of 4.18% with a minimum of -4.37% and maximum of 8.32%. On average inflation remains at 7.55% with a volatility of 3.46. Exchange rate of local currency per unit of USD ranges from PKR 85.19 to PKR 150.04 with a huge volatility of 17.95. The variables of investors' protection including political stability, regulatory quality and rule of law exhibits small deviation ranging from 3% to 5% reflecting no big change over the years.

TABLE 4.5: Descriptive Statistics of Country Specific Determinants

	γ	GDP	PC	IR	INF	EX	PS	RQ	RL
Mean	-0.632	3.957	17.408	4.177	7.546	105.252	0.453	0.589	0.532
Median	-0.609	4.536	16.998	4.364	7.441	102.199	0.46	0.59	0.5
Maximum	-0.069	5.836	21.413	8.321	12.939	150.036	0.5	0.64	0.58
Minimum	-1.826	0.989	15.386	-4.368	2.529	85.194	0.41	0.500	0.500
Std. Dev.	0.243	1.609	1.711	3.277	3.46	17.946	0.026	0.048	0.039
Skewness	-0.99	-0.613	1.011	-1.479	0.1	1.347	-0.059	-0.322	0.408
Kurtosis	7.731	2.035	3.428	4.967	1.631	4.258	2.167	1.846	1.167

4.1.3.3 Pearson's Correlation Analysis of Country Specific Determinants

Table 4.6 demonstrates the Pearson's correlation analysis. The correlation analysis is performed to identify the degree of association between liquidity synchronicity and country specific variables. Liquidity synchronicity is found to have positive association with GDP growth and exchange rate, while negative association with domestic credit to private sector, inflation rate, interest rate. As expected, we find negative correlation between liquidity synchronization and indicators of investors'

protection. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

TABLE 4.6: Pearson's Correlation Matrix of Country Specific Determinants.

	γ	GDP	PC	INF	IR	EX	PS	RL	RQ
γ	1								
GDP	0.162	1							
PC	-0.082	-0.539	1						
INF	-0.119	-0.365	0.234	1					
IR	-0.050	0.484	-0.323	-0.602	1				
EX	0.069	-0.116	-0.054	-0.172	0.232	1			
PS	-0.171	-0.167	-0.111	0.302	-0.365	-0.439	1		
RL	-0.097	0.264	0.104	-0.394	0.305	0.395	0.641	1	
RQ	-0.092	-0.439	-0.064	0.651	-0.351	-0.290	0.499	0.108	1

4.1.3.4 Coefficient Estimates of the Country Specific Determinants of Liquidity Synchronization

To investigate our objective of identification of the country specific determinant, various regression models are used to study the impact of each country-specific determinant on liquidity synchronization. The results are reported in Table 4.7. Most of the variables have significant impacts on liquidity synchronicity, though the findings offer only partial support to the predicted signs. Liquidity synchronicity is found to be stronger under high country GDP growth, low interest rates, low inflation rates, low ratios of the private credit to GDP, high levels of political instability, poor rule of law and regulatory quality.

To analyze the incremental contributions of each determinant, panel data technique is used. The results are reported in Table 4.8. Model (1) includes financial and economic environment determinants. High levels of liquidity synchronicity are found for economies exhibiting high GDP growth, high inflation rates and low

TABLE 4.7: Coefficient Estimates of Individual Country Specific Determinants.

Country specific variables	predicted sign	Coefficient	t-stat	R^2(%)	Adj. R^2(%)
Economic and Financial Environment					
GDP Growth	-	0.063	5.192	2.6	2.5
Private Credit to GDP	-	-0.030	-2.604	0.6	0.5
Interest Rate	+	-0.009	-1.587	0.2	0.2
Inflation Rate	+	-0.021	-3.777	1.4	1.3
Exchange Rate	+	0.002	2.183	0.4	0.3
Government Stability and Investor Protection					
Political Stability	-	-4.104	-5.498	2.9	2.8
Regulatory Quality	-	1.546	3.080	0.9	0.8
Rule of Law	-	-1.195	-2.905	0.8	0.7

interest rates with underdeveloped financial systems taking the form of low levels of private credit. The results are consistent with Levine (2002), who reports that in markets with less developed banking system, the investors follow market trends hoping to tackle the risk arising from the inefficiency of capital allocation, hence increasing liquidity synchronicity. Determinants related to investor protection are included in Model (2). Political stability, the rule of law and regulatory quality are found to show significant inverse relationships to liquidity synchronicity. Model (3) includes all of the variables of interest. The idea of trying different combinations is to test whether the results of some variables are driven by other variables, which can be depicted in t-stats. A continuous significant t-statistics in all models validates the impact of variable on liquidity synchronicity. The inflation rate is found to have a significant positive effect, whereas GDP growth, financial system development, political stability, the rule of law and regulatory quality is significant and negatively related to liquidity synchronicity. The findings are consistent with those of Koch et al. (2016), Næs et al. (2011) and Karolyi et al. (2012). It is found that in markets with limited investor protection, levels of liquidity synchronicity are higher.

TABLE 4.8: Coefficient Estimates of Country Specific Determinants of Liquidity Synchronization.

Country specific variables	predicted sign	Model 1	Model 2	Model 3
GDP Growth	-	0.157		0.318
		(5.611)		(3.475)
Private Credit to GDP	-	-0.055		-0.144
		(-0.379)		(-4.165)
Interest Rate	+	-0.389		-0.0264
		(-5.253)		(-2.599)
Inflation Rate	+	0.027		0.202
		(1.824)		(3.154)
Exchange Rate	+	0.006		0.011
		(5.062)		(1.675)
Political Stability	-		-4.388	-3.435
			(-4.492)	(-1.437)
Regulatory Quality	-		-0.383	-8.019
			(-0.662)	(-2.800)
Rule of Law	-		-0.658	-5.518
			(-0.825)	(-2.105)
Geographical Size		0.011	0.006	0.012
		(0.130)	(0.570)	(1.258)
Per Capita GDP		-0.003	-0.052	-0.127
		(-2.350)	(-1.236)	(-0.908)
Number of Stocks		-0.016	-0.003	-0.128
		(-0.861)	(-0.368)	(-1.993)
Adj. R^2 (%)		8.2	4.1	11
F-Stat		15.49	10.31	15.15
Durbin-Watson Stat		2.03	2.21	1.93

4.1.4 Firm Specific Determinants of Liquidity Synchronization

4.1.4.1 Unit Root Test

The stationarity status of firm level variables is tested. The findings of the augmented Dickey–Fuller and Phillip-Parren tests are presented in Table 4.9. The augmented Dickey–Fuller test requires the independent and identical distribution of time-series, which may not be applicable to whole data, so the Phillip-Parren test is also applied, which allows heterogeneous distribution of data. The results confirmed that all the variables are stationary at level.

TABLE 4.9: Unit Root Test.

Variable	Augmented Dickey-Fuller Test	Phillips-Perron Test
γ	-18.021***	-17.977***
SV	-6.992***	-6.984***
DE	-5.600***	-15.937***
BM	-8.711***	-8.500***
ROE	-16.784***	-16.776***
IO	-4.431***	-5.761***
SZ	-5.011***	-5.145***

*Note: *** is $p < 0.001$ level of significance.*

4.1.4.2 Descriptive Statistics of Firm Specific Determinants

Table 4.10 reports descriptive statistics of the firm specific variables. The average liquidity synchronicity is -0.632 with a maximum value of -0.069 and minimum value of -1.826. The standard deviation is 24.3% which depicts low volatility in liquidity synchronicity for sample firms. On average the stock return volatility remains 36.4% with a standard deviation of 11.6%. The book to market ratio shows a mean of 54.5% with a deviation ranging from -3.944 to 3.877.

The debt-to-equity ratio reports an average of 1.708. On average return on equity remain at 21.7% with a volatility of 68.6%. Institutional ownership ranges from 0.00 to 70.184% with a huge volatility of 15.928. The firm size depicts an average of 4.028.

TABLE 4.10: Descriptive Statistics of Firm-Specific Determinants

	γ	SV	BM	DE	ROE	IO	SZ
Mean	-0.632	0.364	0.545	1.708	0.217	17.088	4.028
Median	-0.609	0.339	0.455	1.305	0.167	12.375	4.06
Maximum	-0.069	0.812	3.877	45.4	6.001	70.184	5.87
Minimum	-1.826	0.18	-3.944	-18.9	-6.186	0.000	1.981
Std. Dev.	0.243	0.116	0.923	3.488	0.686	15.928	0.883
Skewness	-0.99	3.9	0.501	4.373	0.564	1.641	0.037
Kurtosis	7.703	37.045	8.236	41.412	47.396	5.276	2.546

4.1.4.3 Pearson's Correlation Analysis of Firm Specific Determinants

Table 4.11 demonstrates the correlation analysis of liquidity synchronicity and firm specific determinants. Liquidity synchronicity is found to have positive association with stock return volatility, debt to equity, institutional ownership and firm size, while negative association with book to market and return on equity. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

TABLE 4.11: Pearson's Correlation Matrix of Firm Specific Determinants.

	γ	SV	DE	BM	ROE	IO	SZ
γ	1						
SV	0.033	1					
DE	0.032	0.075	1				
BM	-0.035	-0.172	-0.011	1			
ROE	-0.149	-0.084	-0.001	0.111	1		
IO	0.069	0.228	0.025	-0.020	-0.003	1	
SZ	0.103	0.513	0.062	-0.055	-0.213	0.116	1

4.1.4.4 Coefficient Estimates of the Firm Specific Determinants on Liquidity Synchronization

Liquidity synchronization is initially regressed on individual firm level determinants to test the incremental effect of each variable. The results are presented

in Table 4.12. The overall impact of firm specific variables is presented in Table 4.13. A negative and significant association between liquidity synchronization and return on equity is found, which confirms our hypothesis of an expected negative relation between liquidity synchronization and return on equity. On the other hand, in support of our hypothesis regarding impact of firm size on liquidity synchronization, a positive and significant relationship is found between firm size and liquidity synchronization. Therefore, higher liquidity synchronicity is found in large firms with low return on equity. The results support the earlier evidence that when firms have low productivity, the cost of liquidity provision increases (Bernado and Welch, 2004), liquidity decreases (Griffin 2010) and consequently there is an increase in liquidity synchronicity (Naes et al, 2011).

TABLE 4.12: Coefficient Estimates of Individual Firm Specific Determinants.

Firm specific variables	Predicted sign	Coefficient	t-stat	Adj. R^2(%)
Debt to Equity	+	-0.006	-0.520	0.10
Stock Return Volatility	+	-2.803	-0.543	0.10
Book to Market	-	-0.023	-0.561	0.12
Return on Equity	-	-0.157	-2.418	2.21
Institutional Ownership	+	0.032	1.118	0.52
Size	+	-0.085	1.668	1.13

TABLE 4.13: Coefficient Estimates of Firm-Specific Determinants of Liquidity Synchronization.

Firm Specific Variables	Coefficients	t-stat
Debt to Equity	-0.051	-0.401
Stock Return Volatility	0.231	0.493
Book to Market	-0.033	-0.661
Return on Equity	-0.193	-2.891
Institutional Ownership	0.025	0.971
Size	0.123	2.036
Adj. R^2	4.8%	
F-stat	2.125	
Durbin-Watson stat	2.214	

4.1.5 Economic Growth Volatility and Liquidity Synchronization

Liquidity synchronicity under economic growth volatility is presented in Table 4.14. The mean coefficient of concurrent market liquidity is positive and statistically significant. This coefficient is positive and significant for 41.11% of firms and negative and significant for 11.89% of firms. The findings reveal that, on average, the liquidity of an individual stock is positively associated with market liquidity. In analyzing the impact of the economic growth volatility, it is found that mean of estimated coefficient increases from 0.208 to 0.315 with the interaction of growth volatility. Further, this coefficient is positive and significant for 45.08% of firms and negative and significant for 9.5% of firms. Thus, the sensitivity of individual stock liquidity to market liquidity increases in times of economic volatility. There is an increase in liquidity demand because traders are focused on liquidating their positions across various securities and on decreasing the supply of liquidity due to the funding constraints of liquidity suppliers. The results are consistent with Zhou et al. (2018) and Beudeker (2015) and supports our hypothesis that economic growth volatility positively affects the sensitivity of stock liquidity to market liquidity.

Table 4.14: Impact of Economic Growth Volatility on Liquidity Synchronization.

	Normal Market								Economic Growth Volatility							
	Concurrent		Lead		Lag		Sum		Concurrent		Lead		Lag		Sum	
	β_1	t-stats	β_2	t-stats	β_3	t-stats	$\beta_1+\beta_2+\beta_3$	t-stats	β_4	t-stats	β_5	t-stats	β_6	t-stats	$\beta_4+\beta_5+\beta_6$	t-stats
Mean of estimated coefficient	0.208	1.982	0.152	2.015	0.148	1.251	0.508	5.248	0.315	2.035	0.138	0.116	0.098	1.481	0.551	3.632
% Firms with a positive coefficient	76.53		58.25		71.39				81.78		53.84		68.91			
% Firms with a positive coefficient and insignificant t-stats	35.42		21.28		36.26				36.17		19.69		34.82			
% Firms with a positive coefficient and significant t-stats	41.11		36.97		34.99				45.08		33.56		33.43			
% Firms with a negative coefficient	23.47		41.75		28.61				18.22		46.16		31.09			
% Firms with a negative coefficient and insignificant t-stats	11.58		23.25		09.65				09.25		27.58		14.85			
% Firms with a negative coefficient and significant t-stats	11.89		18.50		19.10				09.50		19.17		16.90			
Adj-R^2 (%)	22.5															

4.1.6 Liquidity Synchronization and its Outcomes for Valuation

4.1.6.1 Descriptive Statistics of Determinants of Cost of Capital

Table 4.15 reports descriptive statistics of the firm specific variables. The average implied cost of capital is 11.32 with standard deviation of 13.56. The average liquidity synchronicity is -0.632 with a maximum value of -0.069 and minimum value of -1.826. The standard deviation is 24.3%. On average the stock return volatility remains 36.4% with a standard deviation of 11.6%. The book to market ratio shows a mean of 54.5% with a deviation ranging from -3.944 to 3.877. The debt-to-equity ratio reports an average of 1.708. On average market beta remain at 1.031 with a volatility of 41.6%. The firm size depicts an average of 0.364.

Table 4.15: Descriptive Statistics of Determinants of Cost of Capital

	ICOC	γ	BT	BM	DE	SZ	SV
Mean	11.32	-0.632	1.031	0.545	1.708	4.028	0.364
Median	11.66	-0.609	1.095	0.455	1.305	4.06	0.339
Maximum	21.32	-0.069	1.89	3.877	45.4	5.87	0.812
Minimum	5.92	-1.826	0.1	-3.944	-18.9	1.981	0.18
Std. Dev.	13.56	0.243	0.416	0.923	3.488	0.883	0.116
Skewness	1.713	-0.99	-0.072	0.501	4.373	0.037	3.9
Kurtosis	8.606	7.703	2.13	8.236	41.412	2.546	37.045

4.1.6.2 Pearson's Correlation Analysis of Determinants of Cost of Capital

The Pearson's Correlation analysis is performed to find the degree of association between variables. The findings are presented in Table 4.16. Liquidity synchronization is found to have positive association with implied cost of capital and realized returns. This implies that stock's realized returns and cost of equity are

higher with high sensitivity of stock liquidity to market liquidity, which confirms the notion that investors demand high compensation for holding a security with high levels of liquidity synchronicity. A positive relation of cost of capital and realized returns is found with market beta and stocks' book to market value. This suggests that more volatile and overvalued stocks have higher returns. A negative association between valuation variables and measures of debt-to-equity firms' size and market volatility is found.

Table 4.16: Pearson's Correlation Matrix of Determinants of Cost of Capital.

	ICOC	RRet	γ	β	BM	DE	MV	SV
ICOC	1							
RRet	0.456	1						
γ	0.142	0.263	1					
β	0.112	0.109	0.028	1				
BM	0.031	0.095	0.032	-0.083	1			
DE	-0.125	-0.325	-0.032	0.113	-0.015	1		
MV	-0.226	-0.149	0.072	-0.225	0.019	-0.047	1	
SV	-0.325	-0.086	-0.023	0.498	-0.217	0.067	-0.502	1

4.1.6.3 Liquidity Synchronization and Asset Valuation

The asset valuation effect of liquidity synchronization is examined using panel regression. The results are presented in Table 4.17. The implied cost of capital pricing method is applied to measure the pricing of liquidity synchronization in Models 1 and 2 and realized returns pricing method is used in Models 3 and 4. Models 1 and 3 examine the impact of control variables on the stock pricing under both methods. Model 2 and 4 test the effect of liquidity synchronization and control variables on valuation models. The results reveal that liquidity synchronization is priced in the selected emerging economies of Asia. The results supports our hypothesis that liquidity synchronization is priced and has an impact on stock

valuation. The coefficient of liquidity synchronization is positive and significant in ICOC pricing model. However, the results are not significant for the realized returns pricing method. These results are in contrast with the earlier study by Moshirian et al. (2017), who found pricing of liquidity synchronization for realized returns model. The market beta and book to market ratio is found to have a positive and significant impact on asset valuation. On the contrary, market value and stock return volatility of the firm is found to have an inverse and significant impact on stock valuation.

TABLE 4.17: Liquidity Synchronization and Asset Valuation

Variables	ICOC		RRet	
	Model 1	Model 2	Model 3	Model 4
γ		0.023		0.036
		(1.906)		(1.169)
β	0.016	0.026	0.023	0.009
	(2.035)	(1.995)	(1.259)	(1.351)
MV	-0.022	-0.026	-0.046	-0.052
	(-2.129)	(-2.027)	(-2.228)	(-1.983)
BM	0.010	0.008	0.006	0.007
	(3.159)	(3.259)	(2.589)	(2.096)
DE	-0.011	-0.025	-0.009	-0.013
	(-0.156)	(-0.896)	(-1.256)	(-1.758)
SV	-0.256	-0.315	-0.153	-0.069
	(-2.354)	(-2.226)	(-3.580)	(-2.066)
Adj.R^2 (%)	9.61	11.25	18.25	19.63
F-Stat	3.22	3.65	5.69	5.91
Durbin-Watson Stat	1.905	2.359	1.829	1.963

4.2 Empirical Analysis for Shanghai Stock Exchange

4.2.1 Descriptive Statistics for Liquidity Measures

Descriptive statistics of different liquidity proxies computed for Shanghai Stock Exchange are exhibited in Table 4.18. The average quoted spread is 6.2% while the central value of quoted spread is 5.1%. The standard deviation is found to be 17.6%.

Percentage quoted spread has a mean value of 1% while the data has a central value of 0.2%. The percentage quoted spread is more volatile as compared to quoted spread with standard deviation of 6.5%. Effective spread has a mean value of 7.5% which is somewhat higher than the quoted spread. The standard deviation is 45.1, which means that there is variance between data and its average. Percentage effective spread has an average value of 1.5% and central value of 0.3%. Like percentage quoted spread, percentage effective spread has high value of standard deviation.

Table 4.18: Descriptive Statistics of Liquidity Measures.

	Mean	Median	Standard deviation
QS	0.062	0.051	0.176
PQS	0.010	0.002	0.651
ES	0.075	0.059	0.451
PES	0.015	0.003	0.532

4.2.2 Presence of Market Wide Liquidity Synchronicity in Shanghai Stock Exchange

The results of liquidity synchronization in China are presented in Table 4.19. The results provide evidence that liquidity synchronicity is a persistent phenomenon that prevails in almost all markets of the world including China. On average

the quoted spread for concurrent coefficient is 64% with an associated t-statistics of 4.57%. 91.25% of the coefficients are positive among which around 73.56 are significant at 5% level. An average of 71% is found for concurrent coefficient using proportional quoted spread liquidity measure with a t-statistics of 3.51%. 85.63% of the coefficients are positive and 81.25% concurrent coefficients are positive and significant at 5% level. The measure of effective spread provided the highest number of positive coefficients i.e., 94.25% followed by proportional effective spread i.e., 90.24%. Furthermore, effective spread measure shows 91.27% positive and significant coefficients, which is the highest percentage among the four liquidity measures.

While analyzing the impact of lag market liquidity, an average coefficient value of 40% is found. 31.48% of the coefficients are positive while around 6.31% coefficients are positive and significant. The results of effective spread measure provide an average lag coefficient of 10% with t-statistics of 0.14%. 14.28% coefficients are found positive whereas 9.37% coefficients are positive and significant. Proportional quotes spread provides the highest percentage of positive and significant coefficients i.e., 14.09% followed by proportional effective spread i.e., 11.28%.

The average impact of percentage change in the lead market liquidity on the percentage change of individual stock liquidity is highest using proportional quoted spread i.e., 19%. The highest number of positive and significant coefficients are found using quoted spread (12.08%) followed by proportional effective spread (10.29%). The mean of adjusted R^2 for quoted spread is 37% while for effective spread measure the value is 31%. The results of control variables are presented in Table 4.20. The results are consistent with earlier studies on Chinese stock market including Narayan et al. (2015); Zhou et al. (2018) and Zhang et al. (2021).

TABLE 4.19: Market Wide Liquidity Synchronization.

	ΔQS	ΔPQS	ΔES	ΔPES
Concurrent	0.64	0.71	0.50	0.55
t-stat	4.57	3.51	4.70	2.64
% positive	91.25	85.63	94.25	90.24
% positive significant	73.56	81.25	91.27	43.21
Lag	0.40	0.42	0.10	0.14
t-stat	0.15	0.47	0.14	0.02
% positive	31.48	23.01	14.28	22.86
% positive significant	6.31	14.09	09.37	11.28
Lead	0.10	0.19	0.16	0.02
t-stat	2.12	0.64	1.29	0.03
% positive	48.63	33.25	15.29	26.39
% positive significant	12.08	05.63	09.88	10.29
Sum	0.38	0.44	0.25	0.23
t-stat	2.28	1.54	2.04	0.90
Adjusted R^2	0.37	0.29	0.31	0.14

TABLE 4.20: Control Variables of Market Model.

	ΔQS	ΔPQS	ΔES	ΔPES
$R_{M,t}$	0.22	0.13	0.31	0.24
t-stat	9.58	5.63	2.19	4.28
$R_{M,t-1}$	0.41	0.11	0.27	0.16
t-stat	11.05	3.55	0.96	1.84
$R_{M,t+1}$	0.13	0.08	0.12	0.01
t-stat	4.27	4.11	2.13	0.35
$R_{vi,t}$	0.36	0.20	0.19	0.05
t-stat	5.28	1.85	2.06	1.20

4.2.3 Country Specific Determinants of Liquidity Synchronization

4.2.3.1 Unit Root Test

We start our analysis by testing the stationarity status of country specific variables. The Phillip Parren test is applied on time series because it assumes non independence of error term and allows heterogeneous distribution of data. The results of unit root test are presented in table 4.21. The results confirmed that all the variables are stationary at level.

Table 4.21: Unit Root Test

Variable	Phillips-Perron Test
γ	-7.951
GDP	-62.454
PC	-13.866
IR	-30.875
INF	-29.663
EX	-19.591
PS	-12.314
RQ	-35.014
RL	-15.364

4.2.3.2 Descriptive Statistics of Country Specific Determinants

Table 4.22 reports descriptive statistics of the country specific variables for a sample of 100 listed firms of China. The average liquidity synchronicity is -0.549 with a maximum value of -0.07 and minimum value of -1.195. The standard deviation is 23.3% which depicts average volatility in liquidity synchronicity for sample firms. On average the annual GDP growth remain 7.678% with a deviation ranging from 5.95% to 10.636%. The domestic credit to private sector as a percentage of GDP shows a mean of 50.804% with a standard deviation of 1.123.

The real interest rate of the country reports an average of 2.067% with a minimum of -1.402% and maximum of 4.522%. On average inflation remain at 2.590% with a volatility of 1.123. Exchange rate of local currency per unit of USD ranges from RMB 6.196 to RMB 6.966 with a low volatility of 0.282. The variables of investors' protection including political stability, regulatory quality and rule of law exhibits small deviation ranging from 3.3% to 6.6% reflecting no big change over the years.

TABLE 4.22: Descriptive Statistics of Country Specific Determinants.

	γ	GDP	PC	INF	IR	EX	PS	RQ	RL
Mean	-0.549	7.678	50.804	2.59	2.067	6.571	0.647	0.541	0.573
Median	-0.54	7.234	50.922	2.347	2.963	6.493	0.646	0.568	0.583
Maximum	-0.07	10.636	52.386	5.554	4.522	6.966	0.691	0.636	0.667
Minimum	-1.195	5.95	48.77	1.437	-1.402	6.196	0.589	0.455	0.51
Std. Dev.	0.233	1.336	1.19	1.123	2.119	0.282	0.033	0.066	0.041
Skewness	-0.28	1.06	-0.364	1.633	-0.459	0.114	-0.126	-0.223	0.592
Kurtosis	2.36	3.125	1.807	5.063	1.636	1.535	1.93	1.49	3.638

4.2.3.3 Pearson's Correlation Analysis of Country Specific Determinants

Table 4.23 demonstrates the correlation analysis. Liquidity synchronicity is found to have negative association with GDP growth, domestic credit to private sector, inflation rate, interest rate, exchange rate, regulatory quality and rule of law. The positive association is found only with political stability. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

4.2.3.4 Coefficient Estimates of the Country Specific Determinants of Liquidity Synchronization

For a preliminary investigation, we use various regression models to study the impact of each country-specific determinant on liquidity synchronicity. The results

TABLE 4.23: Pearson's Correlation Matrix of Country Specific Determinants.

	γ	GDP	PC	INF	IR	EX	PS	RL	RQ
γ	1								
GDP	-0.107	1							
PC	-0.070	0.264	1						
INF	-0.038	-0.600	0.445	1					
IR	-0.089	0.624	0.194	-0.583	1				
EX	-0.099	-0.204	-0.725	-0.324	-0.020	1			
PS	0.049	-0.285	-0.861	-0.466	-0.097	0.780	1		
RL	-0.097	0.361	-0.472	-0.602	0.326	0.285	0.459	1	
RQ	-0.079	-0.174	-0.114	-0.023	0.271	0.605	0.247	-0.356	1

are reported in Table 4.24. Most of the variables have significant impacts on the predicted signs. Liquidity synchronicity is found to be stronger under low country GDP growth, low ratios of the private credit to GDP, low interest rates, low inflation rates, low exchange rate, high levels of political stability, poor rule of law and regulatory quality.

TABLE 4.24: Coefficient Estimates of Individual Country Specific Determinants.

Country specific variables	predicted sign	Coefficient	t-stat	R^2(%)	Adj. R^2(%)
Economic and Financial Environment					
GDP Growth	-	-0.051	-3.405	1.1	1.0
Private Credit to GDP	-	-0.036	-2.223	0.4	0.3
Interest Rate	+	-0.011	-1.204	0.1	0.1
Inflation Rate	+	-0.049	-2.827	0.7	0.6
Exchange Rate	+	-0.219	-3.144	0.1	0.1
Government Stability and Investor Protection					
Political Stability	-	0.927	1.543	0.2	0.1
Regulatory Quality	-	-0.917	-3.077	0.9	0.8
Rule of Law	-	-1.207	-2.508	0.6	0.5

To analyze the incremental contributions of each determinant, we use pooled regression. The results are reported in Table 4.25. We find high levels of liquidity synchronicity for economies exhibiting low GDP growth. The finding confirms our hypothesis of negative association between liquidity synchronization and economic growth and is consistent with results of Karolyi et al. (2012). Furthermore, high liquidity synchronization is found with low inflation rates, low exchange rate and low interest rates with under developed financial systems taking the form of low levels of private credit. The rule of law and regulatory quality are found to show significant inverse relationships to liquidity synchronicity, whereas political stability is significantly positively related to liquidity synchronicity.

TABLE 4.25: Coefficient Estimates of Country Specific Determinants of Liquidity Synchronization.

Country specific variables	predicted sign	Model 1	Model 2	Model 3
GDP Growth	-	-0.166		-0.112
		(-6.301)		(-2.923)
Private Credit to GDP	-	0.0197		-0.065
		(0.529)		(-1.538)
Interest Rate	+	-0.130		-0.113
		(-5.865)		(-3.236)
Inflation Rate	+	-0.076		-0.052
		(-2.796)		(-0.766)
Exchange Rate	+	-0.642		-0.819
		(-6.373)		(-3.304)
Political Stability	-		4.685	0.834
			(6.193)	(0.447)
Regulatory Quality	-		-2.189	-1.635
			(-7.218)	(-1.403)
Rule of Law	-		-3.756	-0.513
			(-6.508)	(-0.227)
Geographical Size		0.136	0.025	0.374
		(1.691)	(0.530)	(2.030)

Per Capita GDP	-0.033	-0.015	-0.009
	(-1.003)	(-0.831)	(-1.982)
Number of Stocks	-0.009	-0.018	-0.106
	(-0.639)	(-0.964)	(-1.115)
Adj. R^2 (%)	9.8	5.3	23
F-Stat	18.39	12.19	19.86
Durbin-Watson Stat	1.905	1.825	2.315

4.2.4 Firm Specific Determinants of Liquidity Synchronization

4.2.4.1 Unit Root Test

The analysis is started by testing the stationarity status of firm level variables. The findings of the augmented Dickey–Fuller and Phillip Parren test are presented in Table 4.26. The augmented Dickey–Fuller test requires the independent and identical distribution of time-series, which may not be applicable to whole data, so the Phillip Parren test is also applied, which allows heterogeneous distribution of data. The results confirmed that all the variables are stationary at level.

Table 4.26: Unit Root Test.

Variable	Augmented Dickey-Fuller Test	Phillips-Perron Test
γ	-7.969***	-7.951***
SV	-10.484***	-10.546***
DE	-15.485***	-15.485***
BM	-8.300***	-8.323***
ROE	-13.753***	-13.748***
IO	-3.410***	-6.118***
SZ	-6.114***	-6.204***

*Note: *** is $p < 0.001$ level of significance.*

4.2.4.2 Descriptive Statistics of Firm Specific Determinants

Table 4.27 reports descriptive statistics of the firm specific variables. The average liquidity synchronicity is -0.549 with a maximum value of -0.07 and minimum value of -1.195. The standard deviation is 23.3%. On average the stock return volatility remains 41% with a standard deviation of 9.9%. The book to market ratio shows a mean of 54.1% with a deviation ranging from 0.031 to 2.714.

The debt-to-equity ratio reports an average of 1.841. On average return on equity remain at 0.008% with a volatility of 79.4%. Institutional ownership ranges from 0.04% to 42.97% with a volatility of 10.791. The firm size depicts an average of 3.873.

TABLE 4.27: Descriptive Statistics of Firm-Specific Determinants

	γ	SV	DE	BM	ROE	IO	SZ
Mean	-0.549	0.41	1.841	0.541	0.008	9.664	3.873
Median	-0.54	0.399	0.996	0.468	0.07	4.845	3.829
Maximum	-0.07	0.765	50.92	2.714	0.514	42.97	5.463
Minimum	-1.195	0.208	0.068	0.031	-12.046	0.04	2.961
Std. Dev.	0.233	0.099	3.882	0.399	0.794	10.791	0.425
Skewness	-0.28	0.771	9.127	1.442	-14.244	1.257	1.134
Kurtosis	2.36	3.832	107.416	6.581	215.002	3.862	5.131

4.2.4.3 Pearson's Correlation Analysis of Firm Specific Determinants

Table 4.28 demonstrates the correlation analysis of liquidity synchronicity and firm specific determinants. Liquidity synchronicity is found to have positive association with stock return volatility, debt to equity, institutional ownership, return on equity and firm size, while negative association with book to market. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

TABLE 4.28: Pearson's Correlation Matrix of Firm Specific Determinants.

	γ	SV	DE	BM	ROE	IO	SZ
γ	1						
SV	0.130	1					
DE	0.014	0.000	1				
BM	-0.103	-0.283	-0.034	1			
ROE	0.018	-0.023	-0.799	0.074	1		
IO	0.145	0.039	-0.116	-0.119	0.114	1	
SZ	0.029	-0.166	-0.039	0.098	0.137	0.332	1

4.2.4.4 Coefficient Estimates of the Firm Specific Determinants of Liquidity Synchronization

Liquidity synchronization is initially regressed on individual firm level determinants to test the incremental effect of each variable. The results are presented in Table 4.29. The overall impact of firm specific variables is presented in Table 4.30. The signs of most of the variables are as per prediction. A positive and significant association of liquidity synchronization with stock return volatility, institutional ownership and firms' debt to equity ratio is found. Thus, liquidity synchronicity is found to be higher for highly levered firms with high financial risk and correlated trading behavior. The results supports our hypothesis and are consistent with the studies of Campbell et al. (2001) and Chen et al. (2013).

TABLE 4.29: Coefficient Estimates of Individual Firm Specific Determinants.

Firm specific variables	Predicted sign	Coefficient	t-stat	Adj. R^2(%)
Debt to Equity	+	-0.004	-0.927	0.3
Stock Return Volatility	+	0.242	1.887	1.4
Book to Market	-	-0.026	-0.844	0.2
Return on Equity	+	0.012	1.211	0.5
Institutional Ownership	+	0.032	3.211	3.8
Size	+	0.038	1.302	0.6

TABLE 4.30: Coefficient Estimates of Firm-Specific Determinants of Liquidity Synchronization.

Firm Specific Variables	Coefficients	t-stat
Debt to Equity	0.012	2.119
Stock Return Volatility	0.244	1.981
Book to Market	-0.034	-0.156
Return on Equity	0.038	1.459
Institutional Ownership	0.031	2.457
Size	0.018	0.526
Adj. R^2	6.3%	
F-stat	2.731	
Durbin-Watson stat	1.910	

4.2.5 Economic Growth Volatility and Liquidity Synchronization

Liquidity synchronicity under economic growth volatility is presented in Table 4.31. The mean coefficient of concurrent market liquidity is positive and statistically significant. This coefficient is positive and significant for 62.27% of firms and negative and significant for 13.42% of firms. The findings reveal that the liquidity of most of the stocks is positively associated with market liquidity. In analyzing the impact of the economic growth volatility, It is found that the concurrent coefficient is positive and significant for 71.63% of firms and negative and significant for 8.53% of firms. Thus, the sensitivity of individual stock liquidity to market liquidity increases in times of economic volatility. There is an increase in liquidity demand because traders are focused on liquidating their positions across various securities and on decreasing the supply of liquidity due to the funding constraints of liquidity suppliers.

Table 4.31: Impact of Economic Growth Volatility on Liquidity Synchronization.

	Normal Market								Economic Growth Volatility							
	Concurrent		Lead		Lag		Sum		Concurrent		Lead		Lag		Sum	
	β_1	t-stats	β_2	t-stats	β_3	t-stats	$\beta_1+\beta_2+\beta_3$	t-stats	β_4	t-stats	β_5	t-stats	β_6	t-stats	$\beta_4+\beta_5+\beta_6$	t-stats
Mean of estimated coefficient	0.589	4.652	0.141	1.625	0.259	1.128	0.989	7.405	0.428	3.548	0.251	2.143	0.124	1.985	0.803	7.676
% Firms with a positive coefficient	86.58		52.68		41.25				91.47		46.25		53.25			
% Firms with a positive coefficient and insignificant t-stats	24.31		25.70		29.51				19.84		22.98		30.06			
% Firms with a positive coefficient and significant t-stats	62.27		26.98		11.74				71.63		23.27		23.19			
% Firms with a negative coefficient	13.42		47.32		58.75				08.53		53.75		46.75			
% Firms with a negative coefficient and insignificant t-stats	09.65		29.66		31.46				05.02		36.82		22.09			
% Firms with a negative coefficient and significant t-stats	03.77		17.66		27.29				03.51		16.93		24.66			
Adj-R^2 (%)	41.06															

4.2.6 Liquidity Synchronization and its Outcomes for Valuation

4.2.6.1 Descriptive Statistics of Determinants of Cost of Capital

Table 4.32 reports descriptive statistics of the firm specific variables. The average implied cost of capital is 6.341 with standard deviation of 4.96. The average liquidity synchronicity is -0.549 with a maximum value of -0.070 and minimum value of -1.195. The standard deviation is 23.3%. On average the stock return volatility remains 41% with a standard deviation of 9.9%. The book to market ratio shows a mean of 54.1%. The debt-to-equity ratio reports an average of 1.841. On average market beta remain at 1.004 with a volatility of 35.4%. The firm size depicts an average of 3.873.

Table 4.32: Descriptive Statistics of Determinants of Cost of Capital

	ICOC	γ	BT	BM	DE	SV	SZ
Mean	6.341	-0.549	1.004	0.541	1.841	0.41	3.873
Median	6.953	-0.54	0.98	0.468	0.996	0.399	3.829
Maximum	7.219	-0.07	1.998	2.714	50.92	0.765	5.463
Minimum	2.423	-1.195	0.05	0.031	0.068	0.208	2.961
Std. Dev.	4.96	0.233	0.354	0.399	3.882	0.099	0.425
Skewness	1.49	-0.28	0.008	1.442	9.127	0.771	1.134
Kurtosis	5.527	2.36	3.533	6.581	107.416	3.832	5.131

4.2.6.2 Pearson's Correlation Analysis of Determinants of Cost of Capital

The Pearson's Correlation analysis is performed to find the degree of association between variables. The findings are presented in Table 4.33. Liquidity synchronization is found to have positive association with implied cost of capital and realized returns. This implies that stock's realized returns and cost of equity are higher with high sensitivity of stock liquidity to market liquidity, which confirms

the notion that investors demand high compensation for holding a security with high levels of liquidity synchronicity. A positive relation of cost of capital and realized returns is found with market beta and stocks' book to market value. A negative association between valuation variables and measures of debt-to-equity, firms' size and market volatility is found.

Table 4.33: Pearson's Correlation Matrix of Determinants of Cost of Capital.

	ICOC	RRet	γ	BT	BM	DE	SV	SZ
ICOC	1							
RRet	0.635	1						
γ	0.335	0.369	1					
BT	0.256	0.358	-0.057	1				
BM	0.159	0.196	-0.053	-0.015	1			
DE	-0.245	-0.196	0.079	0.117	-0.034	1		
SV	-0.339	-0.249	0.119	0.151	-0.283	0.000	1	
SZ	-0.106	-0.097	0.082	-0.122	0.098	-0.039	-0.166	1

4.2.6.3 Liquidity Synchronization and Asset Valuation

The asset valuation effect of liquidity synchronization is examined using panel regression. The results are presented in Table 4.34. The implied cost of capital pricing method is applied to measure the pricing of liquidity synchronization in Models 1 and 2 and realized returns pricing method is used in Models 3 and 4. Models 1 and 3 examine the impact of control variables on the stock pricing under both methods. Model 2 and 4 test the effect of liquidity synchronization and control variables on valuation models. The results reveal that liquidity synchronization is priced in the Chinese stock market The coefficient of liquidity synchronization is positive and significant in both pricing models. The results supports the study by Saad and Samet (2017). Book to market ratio is found to have a positive and significant, whereas, debt to equity is found to have a negative and significant impact on stock valuation is Chinese stock market.

TABLE 4.34: Liquidity Synchronization and Asset Valuation.

Variables	ICOC		RRet	
	Model 1	Model 2	Model 3	Model 4
γ		0.018		0.025
		(2.156)		(2.325)
β	0.006	0.009	0.008	0.011
	(1.356)	(2.516)	(0.965)	(1.362)
MV	-0.048	-0.021	-0.003	-0.014
	(-1.227)	(-1.028)	(-1.147)	(-1.325)
BM	0.021	0.023	0.013	0.006
	(3.049)	(3.318)	(2.549)	(3.492)
DE	-0.016	-0.046	-0.003	-0.067
	(-2.219)	(-2.337)	(-3.163)	(-2.354)
SV	-0.056	-0.009	-0.084	-0.159
	(-0.259)	(-0.369)	(-1.135)	(-1.027)
Adj.R^2 (%)	21.6	24.86	19.69	20.81
F-Stat	2.96	2.99	3.28	5.67
Durbin-Watson Stat	2.319	2.085	2.008	1.829

4.3 Empirical Analysis of Bombay Stock Exchange

4.3.1 Descriptive Statistics of Liquidity Measures

Descriptive statistics of different liquidity proxies computed for Bombay Stock Exchange are exhibited in Table 4.35. The average quoted spread is 22.7% while the central value of quoted spread is 19.5%. The standard deviation is found to be very high at 557.1%.

Percentage quoted spread has a mean value of 2.8% while the data has a central value of 1.1%. The percentage quoted spread is less volatile as compared to quoted spread with standard deviation of only 1.5%. Effective spread has a mean value

of 52.1% which is higher than the quoted spread. The standard deviation is 435.8%, which means that there is very high variance between data and its average. Percentage effective spread has an average value of 2.6% and central value of 1.4%. Like percentage quoted spread, percentage effective spread has low value of standard deviation at 2.6%.

Table 4.35: Descriptive Statistics of Liquidity Measures.

	Mean	Median	Standard deviation
QS	0.227	0.195	5.571
PQS	0.028	0.011	0.015
ES	0.521	0.301	4.358
PES	0.026	0.014	0.026

4.3.2 Presence of Market Wide Liquidity Synchronization in Bombay Stock Exchange

The presence of liquidity synchronicity is Bombay Stock Exchange is exhibited in Table 4.36. The average of concurrent coefficient using quoted spread and proportional quoted spread is 56% and 61% respectively. The percentage of significant and positive coefficients is 84.28% and 77.19% using same measures respectively. Proportional effective spread is found to have the highest number of positive coefficients i.e., 90.18%. The average coefficients of lead and lag variables are small as compared to the concurrent variables depicting the fact that individual stock liquidity is more responsive to current market liquidity rather than lead and lag market liquidity. Likewise, the percentage of coefficients with positive and significant values is also lower in lead and lag analysis as compared to current analysis. The maximum mean value of adjusted R^2 is 32% using proportional quoted spread. Table 4.37 depicts the coefficients of control variables. The results are consistent with studies of Kumar and Misra (2018) and Tripathi et al. (2021) conducted on Indian stock market.

TABLE 4.36: Market Wide Liquidity Synchronization.

	ΔQS	ΔPQS	ΔES	ΔPES
Concurrent	0.56	0.61	0.51	0.14
t-stat	2.60	3.11	4.19	1.25
% positive	86.32	85.14	78.25	90.18
% positive significant	84.28	77.19	68.69	51.10
Lag	0.01	0.01	0.08	0.03
t-stat	1.64	0.94	2.03	1.19
% positive	41.12	42.36	36.89	32.28
% positive significant	3.60	16.25	17.21	04.96
Lead	0.03	0.01	0.13	0.05
t-stat	1.99	2.15	0.37	0.92
% positive	71.26	58.36	51.28	63.28
% positive significant	22.24	14.28	08.65	46.39
Sum	0.20	0.21	0.24	0.073
t-stat	2.07	2.06	2.19	1.12
Adjusted R^2	0.30	0.32	0.06	0.15

TABLE 4.37: Control Variables of Market Model.

	ΔQS	ΔPQS	ΔES	ΔPES
$R_{M,t}$	0.24	0.14	0.20	0.16
t-stat	4.28	2.55	2.09	2.21
$R_{M,t-1}$	0.18	0.09	0.08	0.10
t-stat	3.50	3.06	2.18	0.43
$R_{M,t+1}$	0.16	0.18	0.36	0.12
t-stat	1.28	1.17	0.29	1.11
$R_{Vi,t}$	0.46	0.18	0.02	0.01
t-stat	3.20	3.33	3.14	1.83

4.3.3 Country Specific Determinants of Liquidity Synchronization

4.3.3.1 Unit Root Test

We start our analysis by testing the stationarity status of country specific variables. The Phillip Parren test is applied on time series because it assumes non independence of error term and allows heterogeneous distribution of data. The results of unit root test are presented in table 4.38. The results confirmed that all the variables are stationary at level.

Table 4.38: Unit Root Test

Variable	Phillips-Perron Test
γ	-16.744
GDP	-92.938
PC	-13.866
IR	-27.688
INF	-18.985
EX	-33.149
PS	-53.048
RQ	-65.309
RL	-38.991

4.3.3.2 Descriptive Statistics of Country Specific Determinants

Table 4.39 reports descriptive statistics of the country specific variables for a sample of 100 listed firms of India. The average liquidity synchronicity is -0.501 with a maximum value of -0.105 and minimum value of -1.005. The standard deviation is 23.2% which depicts average volatility in liquidity synchronicity for sample firms. On average the annual GDP growth remain 6.659% with a deviation ranging from 4.181% to 8.498%. The domestic credit to private sector as a percentage of GDP shows a mean of 50.804% with a standard deviation of 1.190.

The real interest rate of the country reports an average of 4.273% with a minimum of -1.984% and maximum of 7.556%. On average inflation remain at 7.325% with a volatility of 2.815. Exchange rate of local currency per unit of USD ranges from

INR45.726 to INR 70.420 with a volatility of 8.381. The variables of investors' protection including political stability, regulatory quality and rule of law exhibits small deviation ranging from 2.00% to 4.7% reflecting no big change over the years.

TABLE 4.39: Descriptive Statistics of Country Specific Determinants

	γ	GDP	PC	IR	EX	INF	PS	RQ	RL
Mean	-0.501	6.659	50.804	4.273	60.074	7.325	0.551	0.654	0.708
Median	-0.477	6.715	50.922	5.103	62.591	7.006	0.553	0.68	0.715
Maximum	-0.105	8.498	52.386	7.556	70.42	11.989	0.581	0.73	0.75
Minimum	-1.005	4.181	48.77	-1.984	45.726	2.491	0.525	0.59	0.66
Std. Dev.	0.232	1.357	1.19	2.792	8.381	2.815	0.02	0.047	0.029
Skewness	-0.367	-0.273	-0.363	-0.958	-0.581	0.061	0.223	-0.261	-0.287
Kurtosis	2.164	1.933	1.807	2.978	1.957	2.041	1.862	1.837	1.87

4.3.3.3 Pearson's Correlation Analysis of Country Specific Determinants

Table 4.40 demonstrates the Pearson's correlation analysis. Liquidity synchronicity is found to have negative association with GDP growth, domestic credit to private sector, inflation rate, political stability and regulatory quality. The positive association is found with interest rate, exchange rate and rule of law. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

TABLE 4.40: Pearson's Correlation Matrix of Country Specific Determinants.

	γ	GDP	PC	IR	EX	INF	PS	RQ	RL
γ	1								
GDP	-0.037	1							
PC	-0.059	-0.135	1						
IR	0.119	-0.017	-0.117	1					
EX	0.119	-0.085	-0.418	0.868	1				
INF	-0.178	-0.126	0.600	-0.724	-0.726	1			
PS	-0.045	0.485	-0.390	0.576	0.494	-0.528	1		
RQ	-0.062	-0.059	-0.620	0.053	0.213	-0.228	0.208	1	
RL	0.146	0.293	-0.053	0.685	0.645	-0.443	0.234	-0.039	1

4.3.3.4 Coefficient Estimates of the Country Specific Determinants on Liquidity Synchronization

For a preliminary investigation, various regression models are used to study the impact of each country-specific determinant on liquidity synchronicity. The results are reported in Table 4.41. Most of the variables have significant impacts on the predicted signs. Liquidity synchronicity is found to be stronger under low country GDP growth, low ratios of the private credit to GDP, high interest rates, low inflation rates, high exchange rate, high levels of political instability, poor regulatory quality.

TABLE 4.41: Coefficient Estimates of Individual Country Specific Determinants.

Country Specific Variables	Predicted Sign	Coefficient	t-stat	R^2 (%)	Adj. R^2 (%)
Economic and Financial Environment					
GDP Growth	-	-0.0179	-1.165	0.3	0.1
Private Credit to GDP	-	-0.031	-1.862	0.3	0.2
Interest Rate	+	0.026	3.790	1.4	1.3
Inflation Rate	+	-0.039	-5.705	3.1	3.0
Exchange Rate	+	0.008	3.794	1.4	1.3
Government Stability and Investor Protection					
Political Stability	-	-0.006	-0.061	0.01	0.01
Regulatory Quality	-	-0.836	-1.972	0.3	0.2
Rule of Law	-	3.196	4.669	2.1	2.0

To analyze the incremental contributions of each determinant, panel data technique is used. The results are reported in Table 4.42. High levels of liquidity synchronicity are found for economies exhibiting low GDP growth, low inflation rates, low interest rates with under developed financial systems taking the form of low levels of private credit. The political instability and regulatory quality are found to show inverse relationship to liquidity synchronicity. When there is an increase in financial and economic risk, market players might substitute the high-risk securities with safe options to mitigate risk, hence results in liquidity synchronicity (Brunnermeier and Pedersen, 2009).

TABLE 4.42: Coefficient Estimates of Country Specific Determinants of Liquidity Synchronization.

Country Specific Variables	Predicted Sign	Model 1	Model 2	Model 3
GDP Growth	-	-0.232		-0.276
		(-1.535)		(-6.321)
Private Credit to GDP	-	0.108		0.296
		(3.154)		(3.966)
Interest Rate	+	-0.063		-0.322
		(-2.588)		(-5.275)
Inflation Rate	+	-0.088		-0.195
		(-5.361)		(-6.455)
Exchange Rate	+	0.011		0.011
		(1.717)		(1.321)
Political Stability	-		-0.781	2.299
			(-0.746)	(5.002)
Regulatory Quality	-		-0.689	-0.131
			(-1.597)	(-0.199)
Rule of Law	-		3.279	5.327
			(4.641)	(6.715)
Geographical Size		-0.128	-0.032	-0.043
		(-0.315)	(-0.139)	(-0.884)
Per Capita GDP		0.009	0.003	0.069
		(1.595)	(0.624)	(2.029)
Number of Stocks		-0.011	-0.006	-0.107
		(-0.221)	(-0.113)	(-1.098)
Adj.R^2 (%)		4.8	2.5	9.4
F-Stat		9.51	8.55	15.38
Durbin-Watson		1.981	1.973	1.971

4.3.4 Firm Specific Determinants of Liquidity Synchronization

4.3.4.1 Unit Root Test

We start our analysis by testing the stationarity status of firm level variables. The findings of the augmented Dickey–Fuller and Phillip Parren test are presented in Table 4.43. The augmented Dickey–Fuller test requires the independent and identical distribution of time-series, which may not be applicable to whole data, so the Phillip Parren test is also applied, which allows heterogeneous distribution of data. The results confirmed that all the variables are stationary at level.

Table 4.43: Unit Root Test.

Variable	Augmented Dickey-Fuller Test	Phillips-Perron Test
γ	-16.766***	-16.744***
SV	-6.410***	-11.516***
DE	-16.167***	-16.181***
BM	-7.477***	-7.500***
ROE	-8.735***	-8.268***
IO	-5.243***	-5.460***
SZ	-4.302***	-4.127***

*Note: *** is $p < 0.001$ level of significance.*

4.3.4.2 Descriptive Statistics of Firm Specific Determinants

Table 4.44 reports descriptive statistics of the firm specific variables. The average liquidity synchronicity is -0.501 with a maximum value of -105 and minimum value of -1.005. The standard deviation is 23.2%. On average the stock return volatility remains 32.6% with a standard deviation of 10.5%. The book to market ratio shows a mean of 33% with a deviation ranging from -0.102 to 2.079.

The debt-to-equity ratio reports an average of 0.592. On average return on equity remain at 23.4% with a volatility of 49.3%. Institutional ownership ranges from 0.5% to 66.5% with a volatility of 14.5%. The firm size depicts an average of 5.523.

TABLE 4.44: Descriptive Statistics of Firm Specific Determinants

	γ	SV	DE	IO	BM	ROE	SZ
Mean	-0.501	0.326	0.592	0.286	0.33	0.234	5.523
Median	-0.477	0.294	0.166	0.27	0.235	0.164	5.563
Maximum	-0.105	0.667	47.463	0.665	2.079	5.941	7.1
Minimum	-1.005	0.155	-20.189	0.005	-0.102	-0.417	3.99
Std. Dev.	0.232	0.105	3.518	0.145	0.327	0.493	0.698
Skewness	-0.367	0.998	7.142	0.47	2.262	8.448	-0.038
Kurtosis	2.164	3.558	112.715	2.628	9.792	86.512	2.053

4.3.4.3 Pearson's Correlation Analysis of Firm Specific Determinant

Table 4.45 demonstrates the correlation analysis of liquidity synchronicity and firm specific determinants. Liquidity synchronicity is found to have positive association with institutional ownership and firm size while negative association with stock return volatility, debt to equity, book to market and return on equity. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

TABLE 4.45: Pearson's Correlation Matrix of Firm Specific Determinants.

	γ	SV	DE	IO	BM	ROE	SZ
γ	1						
SV	-0.086	1					
DE	-0.011	0.107	1				
IO	0.182	-0.245	-0.073	1			
BM	-0.378	0.348	0.016	-0.002	1		
ROE	-0.146	0.140	0.449	-0.159	-0.219	1	
SZ	0.243	-0.439	-0.085	0.451	-0.231	-0.112	1

4.3.4.4 Coefficient Estimates of the Firm Specific Determinants of Liquidity Synchronization

Liquidity synchronicity is initially regressed on individual firm level determinants to test the incremental effect of each variable. The results are presented in Table

4.46. The overall impact of firm specific variables is presented in Table 4.47. A positive and significant association of liquidity synchronization with institutional ownership and firms' size is found. Similar results are reported by Gaurav and Kumar (2018). A negative and significant relationship is found between liquidity synchronization and book to market ratio. Thus, liquidity synchronicity is found to be higher for firms with high institutional ownership and low book to market ratio.

TABLE 4.46: Coefficient Estimates of Individual Firm Specific Determinants.

Firm Specific Variables	Predicted Sign	Coefficient	t-stat	Adj. R^2 (%)
Debt to Equity	+	-0.006	-0.176	0.2
Stock Return Volatility	+	-0.191	-1.363	0.7
Book to Market	-	-0.268	-6.432	14.3
Return on Equity	+	0.690	2.334	2.1
Institutional Ownership	+	0.291	2.921	3.3
Size	+	0.082	3.961	5.9

TABLE 4.47: Coefficient Estimates of Firm Specific Determinants of Liquidity Synchronization.

Firm Specific Variables	Coefficients	t-stat
Debt to Equity	-0.028	-1.067
Stock Return Volatility	0.218	1.519
Book to Market	-0.222	-4.997
Return on Equity	0.346	1.124
Institutional Ownership	0.501	5.006
Size	0.120	5.385
Adj. R^2	26.6%	
F-stat	14.679	
Durbin Watson	1.963	

4.3.5 Economic Growth Volatility and Liquidity Synchronization

Liquidity synchronicity under economic growth volatility is presented in Table 4.48. The mean coefficient of concurrent market liquidity is positive and statistically significant. This coefficient is positive and significant for 53.68% of firms and negative and significant for 4.52% of firms. The findings reveal that, on average, the liquidity of an individual stock is positively associated with market liquidity. In analyzing the impact of the economic growth volatility, it is found that the mean of the estimated coefficient increases from 0.253 to 0.321 with the interaction of growth volatility. Further, this coefficient is positive and significant for 49.52% of firms and negative and significant for 7.38% of firms. Thus, the sensitivity of individual stock liquidity to market liquidity increases in times of economic volatility. There is an increase in liquidity demand because traders are focused on liquidating their positions across various securities and on decreasing the supply of liquidity due to the funding constraints of liquidity suppliers.

Table 4.48: Impact of Economic Growth Volatility on Liquidity Synchronization.

	Normal Market								Economic Growth Volatility							
	Concurrent		Lead		Lag		Sum		Concurrent		Lead		Lag		Sum	
	β_1	t-stats	β_2	t-stats	β_3	t-stats	$\beta_1+\beta_2+\beta_3$	t-stats	β_4	t-stats	β_5	t-stats	β_6	t-stats	$\beta_4+\beta_5+\beta_6$	t-stats
Mean of estimated coefficient	0.253	2.113	0.059	1.249	0.112	1.993	0.424	5.355	0.321	2.069	0.025	1.468	0.049	2.193	0.395	5.73
% Firms with a positive coefficient	76.25		42.58		45.09				78.29		40.21		43.49			
% Firms with a positive coefficient and insignificant t-stats	22.57		10.3		28.21				28.77		10.53		12.4			
% Firms with a positive coefficient and significant t-stats	53.68		22.28		16.88				49.52		19.68		21.09			
% Firms with a negative coefficient	23.75		57.42		54.91				21.71		59.79		56.51			
% Firms with a negative coefficient and insignificant t-stats	19.23		36.25		29.08				14.33		36.28		41.2			
% Firms with a negative coefficient and significant t-stats	4.52		21.17		25.83				7.38		23.51		15.31			
Adj-R2 (%)	23.26															

4.3.6 Liquidity Synchronization and its Outcomes for Valuation

4.3.6.1 Descriptive Statistics of Determinants of Cost of Capital

Table 4.49 reports descriptive statistics of the firm specific variables. The average implied cost of capital is 14.237 with standard deviation of 11.282. The average liquidity synchronicity is -0.501 with a maximum value of -0.105 and minimum value of -1.005. The standard deviation is 23.2%. On average the stock return volatility remains 0.326 with a standard deviation of 10.5%. The book to market ratio shows a mean of 33% with a deviation ranging from -0.102 to 2.079.

The debt-to-equity ratio reports an average of 0.592. On average market beta remain at 0.731with a volatility of 25.1%. The firm size depicts an average of 5.523.

TABLE 4.49: Descriptive Statistics of Determinants of Cost of Capital

	ICOC	γ	BT	BM	DE	SV	SZ
Mean	14.237	-0.501	0.731	0.33	0.592	0.326	5.523
Median	13.825	-0.477	0.72	0.235	0.166	0.294	5.563
Maximum	23.358	-0.105	1.53	2.079	47.463	0.667	7.100
Minimum	11.204	-1.005	0.14	-0.102	-20.189	0.155	3.99
Std. Dev.	11.282	0.232	0.251	0.327	3.518	0.105	0.698
Skewness	0.659	-0.367	0.561	2.262	7.142	0.998	-0.038
Kurtosis	3.22	2.164	3.669	9.792	112.715	3.558	2.053

4.3.6.2 Pearson's Correlation Analysis of Determinants of Cost of Capital

The Pearson's Correlation analysis is performed to find the degree of association between variables. The findings are presented in Table 4.50. Liquidity synchronization is found to have positive association with implied cost of capital and realized returns. This implies that stock's realized returns and cost of equity

are higher with high sensitivity of stock liquidity to market liquidity. A positive relation of cost of capital and realized returns is found with market beta and debt-to-equity. A negative association between valuation variables and book to market value, stock return volatility and firm size is found.

Table 4.50: Pearson's Correlation Matrix of Determinants of Cost of Capital.

	ICOC	RRet	γ	BT	BM	DE	SV	SZ
ICOC	1							
RRet	0.409	1						
γ	0.025	0.113	1					
BT	0.259	0.321	-0.143	1				
BM	-0.095	-0.129	-0.378	0.440	1			
DE	0.365	0.396	-0.002	0.056	0.003	1		
SV	-0.338	-0.259	-0.086	0.235	0.349	0.128	1	
SZ	-0.159	-0.086	0.244	-0.132	-0.232	-0.105	-0.439	1

4.3.6.3 Liquidity Synchronization and Asset Valuation

The asset valuation effect of liquidity synchronization is examined using panel regression. The results are presented in Table 4.51. The implied cost of capital pricing method is applied to measure the pricing of liquidity synchronization in Models 1 and 2 and realized returns pricing method is used in Models 3 and 4. Models 1 and 3 examine the impact of control variables on the stock pricing under both methods. Model 2 and 4 test the effect of liquidity synchronization and control variables on valuation models. The results reveal that liquidity synchronization is priced in the Indian stock market. The coefficient of liquidity synchronization is positive and significant in both pricing model i.e. ICOC pricing model and RRet pricing model. The results are consistent with Saad and Samet (2017). Market beta is found to have a positive and significant impact on stock value. Conversely, market value, book to market ratio and stock return volatility is found to have an inverse and significant impact on stock valuation in Indian market.

TABLE 4.51: Liquidity Synchronization and Asset Valuation.

	ICOC		RRet	
Variables	Model 1	Model 2	Model 3	Model 4
γ		0.128		0.203
		(2.315)		(2.137)
β	0.063	0.078	0.083	0.046
	(3.826)	(3.625)	(2.237)	(2.518)
MV	-0.023	-0.009	-0.013	-0.051
	(-1.689)	(-1.869)	(-1.259)	(-2.082)
BM	-0.035	-0.044	-0.027	-0.018
	(-3.249)	(-3.158)	(-2.318)	(-2.315)
DE	0.001	0.007	0.025	0.045
	(1.114)	(1.157)	(1.234)	(1.854)
SV	-0.052	-0.150	-0.082	-0.046
	(-2.628)	(-2.085)	(-1.928)	(-2.009)
Adj.R^2 (%)	17.68	18.29	21.34	24.37
F-Stat	4.86	6.58	6.99	8.57
Durbin-Watson Stat	1.886	1.825	2.148	1.962

4.4 Empirical Analysis of Dhaka Stock Exchange

4.4.1 Descriptive Statistics of Liquidity Measures

Descriptive statistics of different liquidity proxies computed for Dhaka Stock Exchange are exhibited in Table 4.52. The average quoted spread is 63.8% while the central value of quoted spread is 35.0%. The standard deviation is found to be high at 89.9%.

Percentage quoted spread has a mean value of 3.5% while the data has a central value of 2.4%. The percentage quoted spread is less volatile as compared to quoted spread with standard deviation of only 2.6%. Effective spread has a mean value of 71.2% which is higher than the quoted spread. The standard deviation is 156.3%, which means that there is very high variance between data and its average. Percentage effective spread has an average value of 2.9% and central value of

2.1%. Like percentage quoted spread, percentage effective spread has low value of standard deviation at 1.9%.

TABLE 4.52: Descriptive Statistics of Liquidity Measures.

	Mean	Median	Standard deviation
QS	0.638	0.350	0.899
PQS	0.035	0.024	0.026
ES	0.712	0.425	1.563
PES	0.029	0.021	0.019

4.4.2 Presence of Market Wide Liquidity Synchronization in Dhaka Stock Exchange

Table 4.53 presents the prevalence of liquidity synchronicity in Dhaka Stock Exchange. The results for quoted spread depict an average of 15% for concurrent coefficient. 88.13% of the coefficients are positive among which 11.25 are significant at 5% level. An average of 3% is found for concurrent coefficient using proportional quoted spread liquidity measure. 63.12% of the coefficients are positive and 9.63% concurrent coefficients are positive and significant at 5% level. The measure of effective spread provided an average of 9% followed by proportional effective spread at 10%.

For lag market liquidity, a highest average coefficient value of 45% is found using proportional quoted spread. 82.36% of the coefficients are positive while around 25.36% coefficients are positive and significant. The average impact of percentage change in the lead market liquidity on the percentage change of individual stock liquidity is highest using proportional effective spread i.e., 12%. The highest number of positive and significant coefficients are found using quoted spread (75.11%) followed by proportional quoted spread (21.58%). The results of control variables are presented in Table 4.54.

TABLE 4.53: Market Wide Liquidity Synchronization.

	ΔQS	ΔPQS	ΔES	ΔPES
Concurrent	0.15	0.03	0.09	0.10
t-stat	1.08	1.39	0.24	0.69
% positive	88.13	63.12	74.25	69.32
% positive significant	11.25	9.63	4.65	7.74
Lag	0.21	0.45	0.10	0.14
t-stat	2.96	0.51	1.94	0.36
% positive	65.74	82.36	84.27	79.65
% positive significant	56.32	25.36	18.27	12.25
Lead	0.03	0.05	0.02	0.12
t-stat	0.61	1.07	1.83	0.39
% positive	72.39	81.56	48.65	52.31
% positive significant	75.11	21.58	11.47	52.31
Sum	0.13	0.17	0.07	0.12
t-stat	1.55	0.99	1.34	0.48
Adjusted R^2	0.09	0.14	0.05	0.09

TABLE 4.54: Control Variables of Market Model.

	ΔQS	ΔPQS	ΔES	ΔPES
$R_{M,t}$	0.21	0.13	0.03	0.01
t-stat	2.13	2.01	0.55	1.08
$R_{M,t-1}$	0.06	0.16	0.04	0.01
t-stat	1.58	2.11	0.23	1.44
$R_{M,t+1}$	0.13	0.24	0.12	0.04
t-stat	3.08	2.20	1.33	0.91
$R_{Vi,t}$	0.35	0.22	0.16	0.05
t-stat	0.66	1.21	0.37	0.82

4.4.3 Country Specific Determinants of Liquidity Synchronization

4.4.3.1 Unit Root Test

We start our analysis by testing the stationarity status of country specific variables. The Phillip Parren test is applied on time series because it assumes non independence of error term and allows heterogeneous distribution of data. The results of unit root test are presented in table 4.55. The results confirmed that all the variables are stationary at level.

Table 4.55: Unit Root Test

Variable	Phillips-Perron Test
γ	-8.009
GDP	-48.92
PC	-12.881
IR	-17.925
INF	-67.655
EX	-60.169
PS	-21.418
RQ	-21.457
RL	-31.477

4.4.3.2 Descriptive Statistics of Country Specific Determinants

Table 4.56 reports descriptive statistics of the country specific variables for a sample of 50 listed firms of Bangladesh. The average liquidity synchronicity is -0.732 with a maximum value of -0.454 and minimum value of -1.123. The standard deviation is 17.9% which depicts an average volatility in liquidity synchronicity for sample firms. On average the annual GDP growth remain 6.760% with a deviation ranging from 5.572% to 8.153%. The domestic credit to private sector as a percentage of GDP shows a mean of 44.149% with a standard deviation of 2.058.

The real interest rate of the country reports an average of 4.877% with a minimum of 3.069% and maximum of 6.886%. On average inflation remain at 6.881% with

a volatility of 1.733. Exchange rate of local currency per unit of USD ranges from BDT69.649 to BDT84.454 with a volatility of 4.169. The variables of investors' protection including political stability, regulatory quality and rule of law exhibits small deviation ranging from 2.1% to 4.9% reflecting no big change over the years.

TABLE 4.56: Descriptive Statistics of Country Specific Determinants

	γ	GDP	PC	IR	EX	INF	PS	RQ	RL
Mean	-0.732	6.76	44.149	4.877	78.618	6.881	0.563	0.514	0.327
Median	-0.689	6.537	44.072	4.972	78.286	6.206	0.56	0.525	0.33
Maximum	-0.454	8.153	47.583	6.886	84.454	11.395	0.6	0.59	0.36
Minimum	-1.123	5.572	40.961	3.069	69.649	5.514	0.52	0.45	0.3
Std. Dev.	0.179	0.788	2.058	1.112	4.169	1.733	0.021	0.049	0.016
Skewness	-0.443	0.36	0.156	-0.006	-0.635	1.635	-0.21	-0.145	0.346
Kurtosis	2.15	2.052	1.94	2.237	2.892	4.78	2.649	1.619	3.159

4.4.3.3 Pearson's Correlation Analysis of Country Specific Determinants

Table 4.57 demonstrates the correlation analysis. Liquidity synchronicity is found to have negative association with GDP growth, domestic credit to private sector, exchange rate, political stability and regulatory quality. The positive association is found with interest rate, inflation rate and rule of law. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

TABLE 4.57: Pearson's Correlation Matrix of Country Specific Determinants.

	γ	GDP	PC	IR	EX	INF	PS	RQ	RL
γ	1								
GDP	-0.082	1							
PC	-0.054	0.830	1						
IR	0.129	-0.567	-0.631	1					
EX	-0.017	0.817	0.703	-0.197	1				
INF	0.042	-0.546	-0.656	0.329	-0.685	1			
PS	-0.084	0.349	0.238	-0.248	0.025	-0.320	1		
RQ	-0.069	0.358	0.492	-0.334	0.100	-0.493	0.659	1	
RL	0.114	-0.741	-0.447	0.558	-0.613	0.492	-0.273	-0.342	1

4.4.3.4 Coefficient Estimates of the Country Specific Determinants of Liquidity Synchronization

For a preliminary investigation, various regression models are employed to study the impact of each country-specific determinant on liquidity synchronicity. The results are reported in Table 4.58. Most of the variables have significant impacts on the predicted signs. Liquidity synchronicity is found to be stronger under low country GDP growth, low ratios of the private credit to GDP, high interest rates, low inflation rates, low exchange rate, high levels of political instability and poor regulatory quality.

TABLE 4.58: Coefficient Estimates of Individual Country Specific Determinants.

Country Specific Variables	Predicted Sign	Coefficient	t-stat	R^2 (%)	Adj. R^2 (%)
Economic and Financial Environment					
GDP Growth	-	-0.075	-1.963	0.6	0.5
Private Credit to GDP	-	-0.02	-1.264	0.3	0.2
Interest Rate	+	0.084	3.037	1.6	1.5
Inflation Rate	+	0.017	0.982	0.2	0.1
Exchange Rate	+	-0.030	-0.404	0.2	0.1
Government Stability and Investor Protection					
Political Stability	-	-2.864	-1.984	0.7	0.5
Regulatory Quality	-	-1.031	-1.615	0.5	0.3
Rule of Law	-	5.366	2.695	1.3	1.1

To analyze the incremental contributions of each determinant, panel data technique is employed. The results are reported in Table 4.59. The high levels of liquidity synchronicity for economies exhibiting low GDP growth, high inflation rates, high interest rates are found. The political stability, rule of law and regulatory quality are found to show inverse relationship with liquidity synchronicity. The results are non-significant for macroeconomic variables.

TABLE 4.59: Coefficient Estimates of Country Specific Determinants of Liquidity Synchronization.

Country Specific Variables	Predicted Sign	Model 1	Model 2	Model 3
GDP Growth	-	-0.159		-0.025
		(-1.446)		(-0.117)
Private Credit to GDP	-	0.055		0.109
		(1.528)		(0.535)
Interest Rate	+	0.076		0.185
		(1.587)		(0.693)
Inflation Rate	+	0.0271		-0.0425
		(0.951)		(-0.315)
Exchange Rate	+	0.016		-0.042
		(0.816)		(-0.376)
Political Stability	-		-2.058	-0.948
			(-1.072)	(-0.306)
Regulatory Quality	-		0.077	-2.047
			(0.099)	(-0.443)
Rule of Law	-		4.671	-4.758
			(2.199)	(-0.266)
Geographical Size		0.023	0.060	-0.126
		(0.250)	(0.391)	(0.220)
Per Capita GDP		-0.102	-0.160	-0.108
		(-0.154)	(-0.483)	(-0.325)
Number of Stocks		-0.027	-0.073	-0.042
		(-0.621)	(-1.117)	(-1.737)
Adj.R^2 (%)		2.2	1.6	2.4
F-Stat		2.518	2.989	1.662
Durbin-Watson Stat		1.815	1.996	1.928

4.4.4 Firm Specific Determinants of Liquidity Synchronization

4.4.4.1 Unit Root Test

The stationarity status of firm level variables is tested using augmented Dickey–Fuller and Phillip Parren test. The findings of the augmented Dickey–Fuller and Phillip Parren test are presented in Table 4.60. The augmented Dickey–Fuller test requires the independent and identical distribution of time-series, which may not be applicable to whole data, so the Phillip Parren test is also applied, which allows heterogeneous distribution of data. The results confirmed that all the variables are stationary at level.

Table 4.60: Unit Root Test.

Variable	Augmented Dickey-Fuller Test	Phillips-Perron Test
γ	-7.958***	-8.009***
SV	-8.245***	-8.224***
DE	-7.497***	-8.005***
BM	-6.494***	-6.136***
ROE	-11.682***	-11.66***
IO	-4.755***	-7.002***
SZ	-2.943***	-3.512***

*Note: *** is $p < 0.001$ level of significance.*

4.4.4.2 Descriptive Statistics of Firm Specific Determinants

Table 4.61 reports descriptive statistics of the firm specific variables. The average liquidity synchronicity is -0.732 with a maximum value of -0.454 and minimum value of -1.123. The standard deviation is 17.9%. On average the stock return volatility remains 35.9% with a standard deviation of 13.6%. The book to market ratio shows a mean of 68.8% with a deviation ranging from 0.014 to 3.761.

The debt-to-equity ratio reports an average of 1.576. On average return on equity remain at 8.9% with a volatility of 90.6%. Institutional ownership ranges from

1.9% to 70.9% with a volatility of 11.5%. The firm size depicts an average of 3.840.

TABLE 4.61: Descriptive Statistics of Firm Specific Determinants

	γ	SV	DE	BM	ROE	IO	SZ
Mean	-0.732	0.359	1.576	0.688	0.089	0.24	3.84
Median	-0.689	0.348	0.915	0.52	0.099	0.223	3.677
Maximum	-0.454	0.831	46.698	3.761	1.907	0.709	6.127
Minimum	-1.123	0.086	0.058	0.014	-12.83	0.019	2.34
Std. Dev.	0.179	0.136	4.313	0.614	0.906	0.115	0.586
Skewness	-0.443	0.58	9.814	1.553	-12.422	0.482	1.612
Kurtosis	2.15	3.365	102.863	5.991	177.665	3.052	5.956

4.4.4.3 Pearson's Correlation Analysis of Firm Specific Determinants

Table 4.62 demonstrates the correlation analysis of liquidity synchronicity and firm specific determinants. Liquidity synchronicity is found to have positive association with debt to equity, return on equity, institutional ownership and firm size while negative association with stock return volatility and book to market. The results of correlation analysis provide evidence of non-existence of multicollinearity between the explanatory variables.

TABLE 4.62: Pearson's Correlation Matrix of Firm Specific Determinants.

	γ	SV	DE	BM	ROE	IO	SZ
γ	1.000						
SV	-0.117	1.000					
DE	0.084	-0.028	1.000				
BM	-0.003	0.149	-0.121	1.000			
ROE	0.151	-0.216	0.025	-0.065	1.000		
IO	0.032	-0.056	0.034	0.120	-0.017	1.000	
SZ	0.074	-0.457	-0.023	-0.398	0.247	-0.017	1.000

4.4.4.4 Coefficient Estimates of the Firm Specific Determinants of Liquidity Synchronization

Liquidity commonality is initially regressed on individual firm level determinants to test the incremental effect of each variable. The results are presented in Table 4.63. The overall impact of firm specific variables is presented in Table 4.64. A positive and significant association of liquidity synchronization with stock return volatility, debt to equity ratio and book to market ratio is found. Therefore, liquidity synchronicity is found to be higher for highly levered firms with high financial risk and high book to market value. The results of Moshirian et al. (2017) support our findings.

TABLE 4.63: Coefficient Estimates of Individual Firm Specific Determinants.

Firm Specific Variables	Predicted Sign	Coefficient	t-stat	Adj. R^2 (%)
Debt to Equity	+	0.054	1.357	0.7
Stock Return Volatility	+	0.315	2.495	2.6
Book to Market	-	0.062	2.212	2.1
Return on Equity	+	-0.013	-0.157	0.01
Institutional Ownership	+	-0.137	-0.911	0.3
Size	+	0.0296	1.006	0.4

TABLE 4.64: Coefficient Estimates of Firm Specific Determinants of Liquidity Synchronization.

Firm Specific Variables	Coefficients	t-stat
Debt to Equity	0.007	1.845
Stock Return Volatility	0.326	2.313
Book to Market	0.098	3.245
Return on Equity	-0.017	-0.902
Institutional Ownership	-0.229	-1.557
Size	0.043	1.221
Adj. R^2	8.3%	
F-stat	3.443	
Durbin-Watson stat	2.092	

4.4.5 Economic Growth Volatility and Liquidity Synchronization

Liquidity synchronicity under economic growth volatility is presented in Table 4.65. The mean coefficient of concurrent market liquidity is positive and statistically significant. This coefficient is positive and significant for 33.25% of firms and negative and significant for 3.22% of firms. The findings reveal that, on average, the liquidity of an individual stock is positively associated with market liquidity. In analyzing the impact of the economic growth volatility, it is found that the mean of the estimated coefficient increases from 0.096 to 0.223 with the interaction of growth volatility. Further, this coefficient is positive and significant for 39.55% of firms and negative and significant for 25.52% of firms. Thus, the sensitivity of individual stock liquidity to market liquidity increases in times of economic volatility.

Table 4.65: Impact of Economic Growth Volatility on Liquidity Synchronization.

	Normal Market								Economic Growth Volatility							
	Concurrent		Lead		Lag		Sum		Concurrent		Lead		Lag		Sum	
	β_1	t-stats	β_2	t-stats	β_3	t-stats	$\beta_1+\beta_2+\beta_3$	t-stats	β_4	t-stats	β_5	t-stats	β_6	t-stats	$\beta_4+\beta_5+\beta_6$	t-stats
Mean of estimated coefficient	0.096	1.259	0.001	0.635	0.14	1.066	0.237	2.96	0.223	1.046	0.029	1.214	0.025	0.541	0.277	2.801
% Firms with a positive coefficient	65.22		63.29		71.22				56.22		69.35		52.22			
% Firms with a positive coefficient and insignificant t-stats	31.97		37.6		21.97				16.67		48.26		5.94			
% Firms with a positive coefficient and significant t-stats	33.25		25.69		49.25				39.55		21.09		46.28			
% Firms with a negative coefficient	34.78		36.71		28.78				43.78		30.65		47.78			
% Firms with a negative coefficient and insignificant t-stats	31.56		12.58		19.39				18.26		6.85		22.33			
% Firms with a negative coefficient and significant t-stats	3.22		24.13		9.39				25.52		23.8		25.45			
Adj-R^2 (%)	9.6															

4.4.6 Liquidity Synchronization and its Outcomes for Valuation

4.4.6.1 Descriptive Statistics of Determinants of Cost of Capital

Table 4.66 reports descriptive statistics of the firm specific variables. The average implied cost of capital is 10.361 with standard deviation of 6.541. The average liquidity synchronicity is -0.382 with a maximum value of -0.176 and minimum value of -1.123. The standard deviation is 26.5%. On average the stock return volatility remains 0.359 with a standard deviation of 13.6%. The book to market ratio shows a mean of 68.8%. The debt-to-equity ratio reports an average of 1.576. On average market beta remain at 0.838 with a volatility of 36.5%. The firm size depicts an average of 3.840.

Table 4.66: Descriptive Statistics of Determinants of Cost of Capital

	ICOC	γ	BT	BM	DE	SV	MV
Mean	10.361	-0.732	0.838	0.688	1.576	0.359	3.84
Median	10.068	-0.689	0.83	0.52	0.915	0.348	3.677
Maximum	12.135	-0.454	1.86	3.761	46.698	0.831	6.127
Minimum	6.213	-1.123	0.06	0.014	0.058	0.086	2.34
Std. Dev.	6.541	0.179	0.365	0.614	4.313	0.136	0.586
Skewness	1.15	-0.443	0.219	1.553	9.814	0.58	1.612
Kurtosis	4.826	2.15	2.487	5.991	102.863	3.365	5.956

4.4.6.2 Pearson's Correlation Analysis of Determinants of Cost of Capital

The Pearson's Correlation analysis is performed to find the degree of association between variables. The findings are presented in Table 4.67. Liquidity synchronization is found to have positive association with implied cost of capital and realized returns. This implies that stock's realized returns and cost of equity are

higher with high sensitivity of stock liquidity to market liquidity, which confirms the notion that investors demand high compensation for holding a security with high levels of liquidity synchronicity. A positive relation of cost of capital and realized returns is found with stocks' book to market value and debt-to-equity. A negative association between valuation variables and measures of firms' size, market beta and market volatility is found.

TABLE 4.67: Pearson's Correlation Matrix of Determinants of Cost of Capital.

	ICOC	RRet	γ	BT	BM	DE	SV	MV
ICOC	1							
RRet	0.325	1						
γ	0.156	0.086	1					
BT	-0.058	-0.068	-0.115	1				
BM	0.229	0.159	0.143	0.292	1			
DE	0.046	0.125	0.089	-0.063	-0.121	1		
SV	-0.218	-0.129	-0.161	0.264	0.149	-0.028	1	
MV	-0.025	-0.019	0.065	-0.138	-0.398	-0.023	-0.457	1

4.4.6.3 Liquidity Synchronization and Asset Valuation

The asset valuation effect of liquidity synchronization is examined using panel regression. The results are presented in Table 4.68. The implied cost of capital pricing method is applied to measure the pricing of liquidity synchronization in Models 1 and 2 and realized returns pricing method is used in Models 3 and 4. Models 1 and 3 examine the impact of control variables on the stock pricing under both methods. Model 2 and 4 test the effect of liquidity synchronization and control variables on valuation models. The results reveal that liquidity synchronization has no impact on cost of equity in Bangladesh market. However, market value and stock return volatility of the firm has significant and inverse relationship, whereas, debt-to-equity has significant and positive association with asset valuation.

TABLE 4.68: Liquidity Synchronization and Asset Valuation.

	ICOC		RRet	
Variables	Model 1	Model 2	Model 3	Model 4
γ		0.008		0.006
		(0.359)		(0.258)
β	-0.005	-0.008	-0.006	-0.004
	(-0.529)	(-1.676)	(-0.227)	(-1.538)
MV	-0.113	-0.834	-0.638	-0.389
	(-1.403)	(-3.323)	(-3.284)	(-3.354)
BM	1.635	0.258	0.984	0.885
	(0.765)	(1.406)	(1.369)	(0.693)
DE	0.112	0.065	0.052	0.065
	(1.557)	(1.855)	(1.993)	(1.827)
SV	-0.454	-0.326	-0.098	-0.368
	(-2.573)	(-2.213)	(-1.836)	(-1.989)
Adj.R^2 (%)	6.51	8.85	8.12	11.28
F-Stat	3.44	5.64	4.31	5.28
Durbin-Watson Stat	1.875	1.965	1.859	1.883

Chapter 5

Conclusion

5.1 Conclusion

This study investigates the firm-level and country-level determinants of liquidity synchronization, the degrees of liquidity synchronization during economic growth volatility and the impact of liquidity synchronization on stock valuation for four emerging Asian economies including Bangladesh, China, India and Pakistan. Strong evidence of liquidity synchronization is found for these economies. Among the selected economies, China shows the highest, and Bangladesh shows the lowest levels of liquidity synchronization. The study finds varied evidence of the impact of economic and financial environment of a country on liquidity synchronization. For instance, we found significant impact of economic growth, financial sector development, inflation rate, interest rate and investors protection on liquidity synchronization in Pakistan. For China, investor protection is not evidenced as determining factor of liquidity synchronization. However, the macroeconomic factors including economic growth, exchange rate and interest rate established impact on liquidity synchronization. While analyzing the relationship between country specific factors and liquidity synchronization for India, we found economic growth, developed financial system, interest rate, inflation rate, political stability as determining factors of liquidity synchronization. For Bangladesh; despite economy's large financing needs, the capital market is not effective for generating investment

and growth. The financial intermediation role played by domestic capital market is not significant, where the capital raised by banks is multiple times larger than the investments in equity and bond markets. Due to less developed capital market, the impact of all economic indicators on liquidity synchronization is found to be non-significant. In general, it is revealed that levels of liquidity synchronization are higher under weak economic and financial conditions, political instability and poor rule of law. When financial and economic risk increases, market players trade their high-risk securities for safe assets in order to abate risk, hence increasing liquidity synchronicity. In markets with less developed banking system, the investors follow market trends hoping to tackle the risk arising from the inefficiency of capital allocation.

Similarly, the contribution of firm specific factors in liquidity synchronization is diverse for selected economies. Firms' capital structure is found significant only in case of China. Stock return volatility, which is the measure of firms' financial health is significant for both China and Bangladesh. Firms' profitability is found significant only in case of Pakistan. Institutional ownership provides evidence of its impact in India and China. Firms' size is significant for almost all countries except for Bangladesh. While analyzing the impact of economic growth volatility, we find that mean of the estimated coefficient of interaction term of economic growth volatility and liquidity synchronization has been increased for all countries except China. The possible reason could be the size of market which is not much affected by regular fluctuations in economic growth. Moreover, the explanatory power of economic growth volatility augmented model has been increased in almost all cases when we compare it with the original market model. Thus, the sensitivity of individual stock liquidity to market liquidity increases in times of economic volatility. There is an increase in liquidity demand because traders are focusing on liquidating their positions across various securities and on decreasing the supply of liquidity due to the funding constraints of liquidity suppliers. Overall, we found the liquidity synchronization is priced in almost all countries except for Bangladesh, which confirms the notion that investors demand a premium for holding a security with a high level of liquidity synchronization. Findings of current study commend

the role of liquidity synchronization in asset valuation and complement the existing literature on liquidity premiums. Liquidity synchronization is a non-diversifiable risk which affects the implied cost of capital.

The current study has several important implications. The existence of liquidity synchronization and the dynamics of liquidity in emerging markets of Asia are important, not only for academicians, but also for regulators, policymakers, portfolio managers, investors and other decision makers. Liquidity synchronization is a systematic risk factor and have impact on stock prices. As financial theory states that markets are efficient. The term market efficiency suggests that stock prices reflect the relevant information in a timely manner and thus, risk should be correctly priced. However, in presence of liquidity synchronization, the idea of market efficiency takes a stern hit that why stocks' prices are enabled to convey the early signs of illiquidity risk. High levels of liquidity synchronization in economy reveals inefficiency of market. Investors demand high compensation for stocks with high levels of liquidity sensitivity and market liquidity. The results of the present study can assist investors with appropriate portfolio formation by managing risks of liquidity synchronization.

Synchronicity in liquidity represents a source of systematic risk, which is a non-diversifiable and inherent to the entire market. If covariation in trading costs is unanticipated and has varying effects across the market, the investors trying to mitigate the impact must have information of the common sources that simultaneously influence the liquidity of stocks. Investors can make more informed decisions when they are aware of the degree of association between macroeconomic variables and liquidity synchronicity. Understanding liquidity synchronicity is essential for asset managers, who use different trading strategies to diversify their investments. Better understanding of the level of sensitivity of individual stock's liquidity to market liquidity is important for their marketing efforts to attract prospective participants. For regulators and policymakers, and particularly for those in emerging economies, understanding liquidity and recognizing the dynamics and magnitude of liquidity synchronicity are important for policy coordination and market development. The regulator should devise macroeconomic policies by focusing on the

factors responsible for liquidity synchronization. Reforms in investor protection rules can play a pivotal role in building investors' confidence in emerging markets. Further understanding of such phenomena can facilitate the formation of policies for preventing market turmoil due to liquidity shocks. Future models must consider common determinants of liquidity.

5.2 Limitations of the Study and Future Research Directions

This study has confirmed and broadened the scope of existing research in the area of liquidity synchronization. However, this study was carried out with certain limitations, and hence provides opportunities for future research.

1. The empirical analysis is based on selected emerging economies of Asia for a limited time period due to constraints with respect to data availability during the sample period. In an attempt to reduce the inference of biased conclusions, the time-series observations have been increased. However, the findings may not be generalized for other markets with different institutional structures and for different time periods. The impact of macroeconomic predictors could vary from one economy to another. This proposed an in-depth analysis of the degree of association between stock liquidity synchronicity and macroeconomic variables, particularly after major macroeconomic fluctuations. Thus, an empirical analysis could be extended across different economies and across various asset markets like the bond market, commodity market and foreign exchange market.

2. The present study focuses only on the liquidity of non-financial firms in the equity markets. The scope of the study can be extended to financial firms of the economy.

3. There is no such universal measure that best captures liquidity across the world economies. Considering data availability, the transaction cost proxy

is used in this study to measure stock liquidity. There are several other liquidity measures that may construct different conclusions. Furthermore, the liquidity measures used in this study are the bid and ask prices at the end of the days. The findings may have been different if the measures are generated using the intraday data.

4. The study is conducted without any classification between state-owned enterprises and private firms. It would be worthwhile investigating whether government-owned firms have greater pricing effects due to state dependence being a common factor.

5. An interesting extension of the current study would be to investigate the pricing of liquidity synchronization during market crashes. Since low liquidity levels often bring market crises, it would be worthwhile exploring whether there is any difference in the pricing of liquidity synchronization before, during and after a market crash.

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