



LIQUIDITY SYNCHRONIZATION AND ASSET VALUATION IN SELECTED EMERGING ASIAN ECONOMIES



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ABSTRACT

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This study examined the impact of liquidity synchronization on stock valuation in selected emerging economies in Asia. Empirical testing was motivated by the relevance of liquidity synchronization in asset pricing. Liquidity synchronicity is a non-diversifiable risk, which can affect the overall functioning of a market. The regulatory environments of Asian firms are different from those investigated in previous studies. Comprehensive analysis of the subject is limited in emerging economies mainly due to the small size of the markets and the constraint of data availability. A substantial knowledge gap provides the underlying foundation of this study. Three emerging economies of Asia – China, Pakistan and India – were selected for analysis using data from 2010 to 2019. The implied cost of equity pricing model and realized returns pricing model were employed to study the impact of liquidity synchronicity on asset valuation. Liquidity synchronization was found to have a significant impact on asset valuation in emerging Asian economies and the effect is stronger during market volatility.

Contribution/Originality: This study is one of very few studies which have extended the scope of liquidity synchronicity literature to Asian economies. We provide evidence of the valuation effect of liquidity risk arising from liquidity synchronicity. This study documents a higher cost of equity for assets having high liquidity synchronicity during market volatility.

1. INTRODUCTION

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 that is 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, Chai, & Do, 2015). 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 & 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). The market players recognize that a decline or evaporation of liquidity has a direct effect on asset prices, which cannot be predicted by the traditional fundamentals of assets. In worst

cases, a liquidity decline may result in systemic consequences or market freezes and a 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 costs (Zaidi & Rupeika-Apoga, 2021). Liquidity is not just the trading cost of an asset but is also a systematic risk factor due to synchronicity (Acharya & Pedersen, 2005; Kamara, Lou, & Sadka, 2008; Lee, 2011; Moshirian, Qian, Wee, & Zhang, 2017). There is a co-movement between individual stock liquidity and market-wide liquidity (Chordia, Roll, & Subrahmanyam, 2000; Huberman & Halka, 2001). Under normal circumstances, investors are less concerned about illiquidity risk; however, it might become a matter of grave concern during liquidity crises (Ang, Papanikolaou, & Westerfield, 2014; Wu, 2019). If liquidity shocks are non-diversifiable with varying impact on individual stocks, the more sensitive a stock return is to such shocks, the expected returns will be higher (Chen, 2005; Chordia et al., 2000). Recent studies using datasets from international markets have evidenced that liquidity synchronicity is a persistent global phenomenon (Brockman, Chung, & Pérignon, 2009; Dang, Moshirian, Wee, & Zhang, 2015; Karolyi, Lee, & Van Dijk, 2012; Moshirian et al., 2017; Wang, 2013; Zhang, Cai, & Cheung, 2009).

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 & Putniņš, 2017; Chen, 2005; Lee, 2011; Pástor & Stambaugh, 2003). Although the empirical evidence regarding the association of liquidity risk and stock returns is 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, Lee, & Van Dijk, 2009). There is good reason to develop a linkage between liquidity synchronicity and asset valuation and examine whether liquidity synchronicity is reflected in asset valuation. Answering this question is the basic objective of the current study. A comprehensive analysis of the role of liquidity synchronicity in asset valuation would transform trading strategies and portfolio formation. Using data from China, Pakistan and India over a period of ten years, we examined the role of liquidity synchronicity in stock valuation.

This paper is differentiated from the earlier studies in its attempt to extend the scope of liquidity synchronicity literature to Asian economies. Our study contributes to the growing literature of liquidity synchronicity in the following ways: first, we employed bid-ask liquidity measure following (Chordia et al., 2000), which captures transaction cost more accurately than low frequency proxies (Moshirian et al., 2017). Bid-ask spread has the ability to measure the aggregate transaction cost more precisely than other liquidity measures. Second, we provide evidence of the valuation effect of liquidity risk arising from liquidity synchronicity. As a risk factor, the pricing of liquidity synchronicity has substantial inferences on stock returns. Most of the previous studies have employed the liquidity adjusted capital asset pricing model (LCAPM) to examine the pricing effect of liquidity risks and found little evidence on the effect of liquidity synchronicity on stock returns (Acharya & Pedersen, 2005; Lee, 2011). In our study, we examined pricing of liquidity synchronicity in a different setting and found that it is priced in the stock markets of the selected countries. Following Hail and Leuz (2006); Moshirian et al. (2017) and Saad and Samet (2017), we estimated the cost of capital, which is a more suitable estimate of expected returns. In addition, we investigated the impact of market volatility on the price discovery of liquidity synchronicity. Third, cross-market analyses have proposed several determinants of the implied cost of capital. For example, Francis, Khurana, and Pereira (2005) studied the impact of voluntary disclosure incentives on the 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, Chen, and Wei (2011) investigated the impact of corporate governance practices on the implied cost of equity; Lang, Lins, and Maffett (2012) employed stock liquidity as a mediating channel through which cost of equity is affected by firm-level transparency; and Ortiz-Molina and Phillips (2014) found a 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 scarce. We enhanced the existing body of knowledge by discovering a higher cost of capital for stocks that have high liquidity synchronicity during market volatility.

The remainder of this paper is organized as follows. The review of literature and hypothesis are presented in next section. In section 3, data and empirical methodology is described. Section 4 presents the results of the studies. Section 5 concludes.

2. LITERATURE REVIEW

With the globalization of financial markets, focus on the role of liquidity in market stability has increased considerably. While the conventional literature focuses on the liquidity of individual stock, recent studies have argued that liquidity is not merely an attribute of single security and it encompasses the entire market, which has been coined systematic or liquidity synchronicity (Chordia et al., 2000; Hasbrouck & Seppi, 2001; Huberman & Halka, 2001). Liquidity synchronization refers to the impact of a common liquidity factor on individual stock (Brockman et al., 2009). This phenomenon has captured the interest of researchers during the past two decades and has covered a series of related issues. The presence and dynamics of liquidity synchronicity have been documented in several studies. Within this context, the first study on liquidity synchronicity was conducted by Chordia et al. (2000). The findings of the study revealed a considerable impact of market-wide liquidity on individual stock's liquidity. The pioneer study of Chordia et al. (2000) was followed by Hasbrouck and Seppi (2001) and Huberman and Halka (2001). These initial studies on liquidity synchronicity employed different empirical techniques and arrived at similar conclusions - that liquidity synchronization exists in the US market. Fabre and Frino (2004); Galariotis and Giouvriss (2007); Kempf and Mayston (2008); Brockman et al. (2009); Zhang et al. (2009); Karolyi et al. (2012); Wang (2013); Moshirian et al. (2017); and Zaidi and Rupeika-Apoga (2021) extended the scope of study to international markets.

A growing body of literature demonstrates the significance of liquidity in determining stock returns. The financial surveys have mostly discussed the pricing of liquidity risk in markets; however, the area of liquidity synchronization pricing remains 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, Binner, Hagströmer, & Nilsson, 2016). Liquidity synchronicity is a form of non-diversifiable risk. Arguments related to 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 liquidity shocks on asset returns.

Researchers have found mixed evidence regarding the pricing of systematic liquidity. For instance, Pástor and Stambaugh (2003) found that the average returns of the stocks with high sensitivities to liquidity surpassed the average returns of the stocks with low sensitivities to liquidity. In a related study, Martinez, Nieto, Rubio, and Tapia (2005) found 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 a 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 to be a better predictor of returns. In the same vein, Foran, Hutchinson, and O'Sullivan (2015) investigated the pricing of liquidity risk by applying a principal component analysis. The results indicated that systematic liquidity risk is positively priced, whereas individual stock liquidity risk is negatively priced.

The existence of liquidity premium raised new queries regarding the role of liquidity in the conventional settings of capital asset pricing model (CAPM). Theoretically, if the risk of illiquidity is systematic and explains

stock returns, it should be considered in the CAPM. The pricing effect of systematic liquidity risk led researchers to test liquidity using the 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 the 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 the traditional CAPM. The liquidity adjusted capital asset pricing model (LCAPM) has been employed by various researchers to investigate the price implications of liquidity risk. The LCAPM revisited the frictionless market assumptions and considered capital markets with trading cost. It 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 has a significant impact on asset pricing. Lee (2011) extended the scope of the liquidity adjusted CAPM to a global level. The study revealed that stock's required rate of return is dependent not only on the covariance of its liquidity with the overall local market liquidity but also on the covariance of its liquidity with local and global market returns. Hagströmer, Hansson, and Nilsson (2013) estimated three liquidity risks in US stocks and found liquidity to be a systematic risk factor. Vu et al. (2015) examined the impact of systematic liquidity risk on the 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 evidence for pricing of downside liquidity risk. Kim and Lee (2014) investigated the price implications of liquidity risk using the liquidity adjusted CAPM with multiple liquidity measures and found that systematic liquidity shocks are an 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, the Fama & French three-factor model, and the Fama & 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 expected cross-sectional expected stock returns. Vaihekoski (2009) employed conditional asset pricing models to investigate the pricing of liquidity risk using the generalized method of movements (GMM) framework. The study was conducted to examine the pricing of liquidity both as an asset specific feature and as a systematic risk factor, and the researchers found that liquidity is priced as a market-wide risk and not as an asset specific characteristic. Hasbrouck and Seppi (2001); Chen (2005); and Chollete, Næs, and Skjeltorp (2008) employed a factor analysis by adding common factors to 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. The implied cost of capital and realized returns pricing methods were applied to investigate the pricing effect of systematic liquidity. Liquidity synchronicity was found as a priced factor in the realized returns model; however, the results were insignificant for the implied cost of capital models. Similarly, Saad and Samet (2017) investigated the impact of liquidity risk on stock's implied cost of capital (ICOC) and found that ICOC increases with an increase in liquidity synchronicity but decreases with increasing covariance of market returns and stock liquidity and covariance of market liquidity and stock returns.

A brief review of literature has revealed that the main focus of most of the studies is on developed markets. There are only a few studies on the liquidity synchronization phenomenon in emerging economies, especially in the Asian region. Furthermore, the pricing of liquidity synchronicity differs across markets and thus is not appropriate

for generalization. There is a considerable knowledge gap which has provided a foundation for this study. Is liquidity synchronicity a predictor of asset valuation in emerging Asian economies? Does market volatility play a moderating role in the valuation of liquidity synchronicity? These questions are addressed in this study.

This study seeks to test the following hypotheses:

- **H1.** Liquidity synchronicity has an impact on asset valuation in the selected emerging economies of Asia.
- **H2.** The effect of liquidity synchronicity on asset valuation is higher during market volatility.

3. DATA AND METHODOLOGY

3.1. Data Description

To investigate the pricing and valuation effect of liquidity synchronization, financial time series data for three emerging Asian economies were extracted from various sources. The liquidity synchronicity measure was developed using a dataset covering a ten-year period running from January 4, 2010 to December 31, 2019. The three emerging economies (China, Pakistan and India) were selected from the MSCI emerging market index and the main stock exchanges were selected for the study (see Appendix A for the list of stock exchange). Companies' accounting data and stock prices were collected from Datastream. The implied cost of capital models are provided in Appendix B.

3.2. Methodology

Data stationarity was checked by applying the augmented Dickey-Fuller test and the Philips-Perron test. All variables were found stationary at level confirming no pattern in the data series. The Pearson correlation test was applied in order to analyze the degree of association between variables. The ordinary least squares (OLS) technique was applied to construct the liquidity synchronization variable. Using panel regression, we regressed the implied cost of capital and realized returns on liquidity synchronization and control variables.

3.2.1. Liquidity Synchronization

To construct the liquidity synchronization measure, a market model was employed following existing empirical literature (Anthony, Docherty, Lee, & Shamsuddin, 2017; Chordia et al., 2000; Coughenour & Saad, 2004; Dang et al., 2015; Fabre & Frino, 2004; Kamara et al., 2008; Karolyi et al., 2012; Moshirian et al., 2017; Zhang et al., 2009). The ordinary least squares technique was used on the time series data to measure liquidity synchronicity for each stock in each year:

$$\Delta L_{i,t} = \beta_0 + \beta_1 \Delta L_{M,t} + \beta_2 \Delta L_{M,t+1} + \beta_3 \Delta L_{M,t-1} + \beta_4 R_{M,t} + \beta_5 R_{M,t+1} + \beta_6 R_{M,t-1} + \beta_7 RV_{i,t} + \varepsilon_{i,t} \quad (1)$$

Definition of Variables

- i. **Liquidity:** liquidity is the key determinant of market quality and a significant pre-requisite for development and growth of financial markets (Wang, 2013). Liquidity has multiple dimensions and thus various liquidity measures are presented in existing literature. In our analysis, liquidity is measured using transaction cost-based measures, i.e., proportional quoted spread $(P_A - P_B) / P_M$, where P_A is the ask price, P_B is the bid price and P_M is the bid-ask midpoint. Chordia et al. (2000) documented the co-movement of the bid-ask spread of individual stocks with market wide liquidity.
- ii. $\Delta L_{i,t}$: the percentage change in the liquidity of stock i from day $t-1$ to day t .
- iii. $\Delta L_{M,t}$: the percentage change in market liquidity from day $t-1$ to day t . Market liquidity is the equally weighted average of the daily liquidity of all stocks in the market (excluding stock i) on day t . Market movement adjustments are captured using one day lead ($\Delta L_{M,t+1}$) and one day lag ($\Delta L_{M,t-1}$).
- iv. R_M : the equally weighted market returns. $R_{M,t+1}$ and $R_{M,t-1}$ are one day lead and one day lag, respectively.
- v. $RV_{i,t}$: stock return volatility is the percentage change in a stock's squared return.

Equation 1 is estimated to obtain the R^2 statistics for each stock for each year. The R^2 estimate is used to measure the percentage changes in the liquidity of stock i due to variations in market liquidity. Liquidity synchronicity is measured using Gamma (γ), which is the logarithmic transformation of the R^2 estimate.

$$\gamma = \log(R_i^2 / (1 - R_i^2)) \quad (2)$$

Equation 2 is the logarithmic transformation of the explained versus unexplained variance. Since R^2 is a bound range between zero and one, liquidity synchronicity is obtained from the log of the transformed R^2 . Gamma (γ) is a monotonically increasing function of R^2 . It has a more normal distribution than R^2 due to transformation, and is therefore, preferred over R^2 in empirical studies. A higher γ value indicates greater stock liquidity sensitivity to market liquidity. The coefficients of Gamma (γ) are multiplied by 100 for subsequent analysis.

3.2.2. Liquidity Synchronization and Asset Valuation

Following Hail and Leuz (2006); Li, Ng, and Swaminathan (2013); Moshirian et al. (2017) and Saad and Samet (2017), two asset pricing methods were used: the realized returns (RR) pricing method and the implied cost of capital (ICOC) pricing method. The implied cost of capital is defined as the internal rate that equates the current price of stock to the present value of its expected future cash flows. ICOC is computed using the average of four ICOC models: the Gebhardt, Lee, and Swaminathan (2001) model of residual income valuation; the (Claus & Thomas, 2001) model of residual income valuation; the (Easton, 2004) model of MPEP ratio; and the (Ohlson & Juettner-Nauroth, 2005) model of abnormal earning growth valuation. The average of the our models was used to apprehend any spurious conclusion arising from the use of a single model (Dhaliwal, Heitzman, & Zhen, 2006). The realized returns pricing method was computed for each stock by obtaining stock returns in excess of the Treasury Bill monthly returns.

The impact of liquidity synchronization on stock valuation was calculated by applying the following two models:

$$ICOC_{it} = \alpha_0 + \alpha_1 \gamma_{i,t} + \alpha_2 \beta_{i,t} + \alpha_3 MV_{it} + \alpha_4 BM_{it} + \alpha_5 RS_{it} + \mu_{it} \quad (3)$$

$$RRet_{it} = \alpha_0 + \alpha_1 \gamma_{i,t} + \alpha_2 \beta_{i,t} + \alpha_3 MV_{it} + \alpha_4 BM_{it} + \alpha_5 RS_{it} + \mu_{it} \quad (4)$$

Equation 3 tests the impact of liquidity synchronization on the implied cost of capital, and Equation 4 tests the impact of liquidity synchronization on realized returns of stocks.

ICOC = Implied Cost of Capital.

RRet = Realized Returns.

γ = Liquidity Synchronization.

β = Market Beta.

MV = Market Value.

BM = Book to Market Ratio.

RS = Relative Spread.

3.2.3. Liquidity Synchronization and Asset Valuation Under Market Volatility

The impact of market volatility on the pricing of liquidity synchronization was studied using market volatility as the variable. The interaction term is included in Equations 3 and 4 to test the incremental effects of market volatility on the pricing of liquidity synchronization. Equations 5 and 6 study the incremental effects on the implied cost of capital and realized returns, respectively.

$$ICOC_{it} = \alpha_0 + \alpha_1 (\gamma_{i,t} * V) + \alpha_2 \gamma_{i,t} + \alpha_3 \beta_{i,t} + \alpha_4 MV_{it} + \alpha_5 BM_{it} + \alpha_6 RS_{it} + \alpha_7 V_{it} + \mu_{it} \quad (5)$$

$$RRet_{it} = \alpha_0 + \alpha_1 (\gamma_{i,t} * V) + \alpha_2 \gamma_{i,t} + \alpha_3 \beta_{i,t} + \alpha_4 MV_{it} + \alpha_5 BM_{it} + \alpha_6 RS_{it} + \alpha_7 V_{it} + \mu_{it} \quad (6)$$

Definition of Variables

- i. 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 was used to compute the variable.
- ii. Realized Returns: the realized returns were computed for each stock by getting stock returns in excess of the Treasury Bill monthly returns.
- iii. Liquidity Synchronization: liquidity synchronization was measured using the logarithmic transformation of R^2 from the regression equation.
- iv. Market Beta: beta measures stock volatility in relation to market. Market beta was measured by dividing the covariance of stock return and benchmark return by the variance of the benchmark return.
- v. Market Value: the market value of a firm was measured by the log of its market capitalization.
- vi. Book-to-Market Ratio: the book-to-market ratio of a firm was measured by its log of book value to market value.
- vii. Relative Spread: relative spread was measured by $[(P_A - P_B)/P_t]$, where P_A and P_B are the ask and bid prices respectively and P_t is the closing price of stock. The variable was incorporated to capture the impact of the transaction cost.
- viii. Market Volatility: market volatility was computed by the standard deviation of the market returns.

4. RESULTS AND DISCUSSION*4.1. Unit Root Test*

The augmented Dickey-Fuller and Phillips-Perron tests were applied to test the stationarity status of variables. All variables were found to be stationary at level and the results are presented in [Table 1](#).

Table-1. Panel unit root tests.

Variable	ADF Level	PP Level
ICOC	14.1057***	16.2219***
RRet	7.9808***	8.0365***
γ	68.7806***	60.2489***
β	11.4182***	10.2541***
MV	46.2581***	61.0473***
BM	74.1821***	68.2147***
RS	25.4526***	21.7512***
V	51.9589***	39.4082***

4.2. Pearson's Correlation Analysis

The Pearson's correlation analysis was performed to find the degree of association between variables; the findings are presented in [Table 2](#).

Table-2. Pearson's correlation matrix.

Variable	ICOC	RRet	γ	β	MV	BM	RS	V
ICOC	1							
RRet	0.676	1						
γ	0.031	0.205	1					
β	0.196	0.108	0.219	1				
MV	-0.190	-0.214	0.328	0.359	1			
BM	0.069	0.124	0.138	0.069	-0.211	1		
RS	-0.083	-0.047	0.189	0.112	-0.041	0.116	1	
V	-0.211	-0.129	0.229	0.216	0.251	-0.039	-0.017	1

Liquidity synchronization was found to have positive association with the implied cost of capital and realized returns. This implies that stock's realized returns and cost of equity are higher with high liquidity synchronicity. A positive relation between cost of capital and realized returns was found with market beta and stocks' book-to-market value. This suggests that more volatile and overvalued stocks have higher returns. In addition, we found a negative association between valuation variables and measures of firm size, transaction cost and market volatility.

4.3. Liquidity Synchronization and Asset Valuation

The asset valuation effect of liquidity synchronization in the selected economies was examined using a panel regression; the results are presented in Table 3. The implied cost of the capital pricing method was applied to measure the pricing of liquidity synchronization in Models 1 and 2, and the realized returns pricing method was used in Models 3 and 4. Models 1 and 3 examined the impact of control variables on the stock pricing under both methods. Models 2 and 4 tested the effects of liquidity synchronization and control variables on the valuation models. The results revealed that liquidity synchronization is priced in the selected emerging economies of Asia. The coefficient of liquidity synchronization is positive and significant in RRet pricing model; however, the results are not significant for the implied cost of capital pricing method.

Table-3. Liquidity synchronization and asset valuation.

Variable	ICOC		RRet	
	Model 1	Model 2	Model 3	Model 4
γ		0.058 (0.114)		0.081 (2.338)
β	0.021 (2.136)	0.019 (1.982)	0.002 (1.147)	0.001 (1.271)
MV	-0.013 (-2.93)	-0.012 (-2.69)	-0.069 (-3.221)	-0.069 (-3.315)
BM	0.004 (4.161)	0.004 (4.210)	0.009 (4.596)	0.008 (4.331)
RS	-0.006 (-0.631)	-0.006 (-1.127)	-0.001 (-1.986)	-0.001 (-1.976)
Adj. R-squared (%)	16.8	20.2	21.1	22.6
F-Stat.	2.19	3.24	4.11	6.32
Durbin-Watson Stat.	1.993	1.839	2.014	2.421

Table-4. Impact of market volatility on asset valuation.

Variable	ICOC	RRet
γ^*V	0.009 (2.017)	0.011 (2.869)
γ	0.029 (0.486)	0.063 (1.971)
β	0.043 (1.128)	0.026 (1.334)
MV	-0.022 (-2.541)	-0.064 (-2.684)
BM	0.012 (4.248)	0.044 (2.856)
RS	-0.005 (-0.542)	-0.002 (-1.152)
V	-0.089 (-2.104)	-0.191 (-2.63)
Adj. R-squared (%)	22.8	29.5
F-Stat.	6.12	7.81
Durbin-Watson Stat.	2.178	2.438

4.4. Impact of Market Volatility on Asset Valuation

The pricing of liquidity synchronization under market volatility is presented in Table 4. The purpose was to investigate whether market volatility affects pricing of liquidity synchronization. In order to test the moderating role of market volatility, an interaction term of liquidity synchronicity and market volatility was included with other variables for analysis. We found evidence of a strong impact of market volatility on the pricing of liquidity synchronization. The coefficient of the interaction term was found to be positive and significant for the both the implied cost of capital pricing method and the realized returns pricing method, indicating that pricing of liquidity synchronization is amplified during volatile market conditions.

5. CONCLUSION

This study investigated the impact of liquidity synchronization on asset valuation for three emerging Asian economies - China, Pakistan and India. The results revealed that liquidity synchronicity is priced in the selected emerging economies, which confirms the notion that investors demand a premium for holding a security with a high level of liquidity synchronization. Thus, our findings 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. Moreover, market volatility was found to have a considerable impact on the pricing of liquidity synchronization. The estimated coefficients of the augmented pricing model showed a significant impact of liquidity synchronization on the implied cost of capital and realized returns. The results suggest that firms' cost of capital increases with high levels of liquidity synchronization of its stock under market volatility.

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. First, the empirical analysis was based on selected emerging economies of Asia for a limited time period. The findings may not be generalized for other markets with different institutional structures and for different time periods: therefore, future research could be extended across different markets over a longer period of time. Second, the study was 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. Third, 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. Fourth, 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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Appendix - A. List of stock exchanges.

Country	Stock Exchange	Number of Firms
China	Shanghai Stock Exchange	85
India	Bombay Stock Exchange	90
Pakistan	Pakistan Stock Exchange	75

Appendix - B. Implied cost of capital models.

Model 1. The Claus and Thomas (2001) model of residual income valuation is as follows:

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

This 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.

Model 2. The Gebhardt et al. (2001) model of residual income valuation is as follows:

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

This 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.

Model 3. The Ohlson and Juettner-Nauroth (2005) model of abnormal earning growth valuation is as follows:

$$p_t = \frac{e\hat{p}s_{t+1}}{r_{OJ}} \cdot \frac{(g_{st} + r_{OJ} \cdot \frac{\hat{d}_{t+1}}{e\hat{p}s_{t+1}} - g_{lt})}{(r_{OJ} - g_{lt})}$$

This 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.

Model 4. The Easton (2004) model of MPEG ratio is as follows:

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

This 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.

- 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+ τ , 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+ τ)
 $e\hat{p}s_{t+\tau}$ = Expected future earnings per share at time (t+ $\tau-1$, t+ τ)
 g_{st} = Short-term growth rate
 g_{lt} = Long-term growth rate
 r_{GLS} = ICOC for the Gebhardt et al. (2001) model
 r_{CT} = ICOC for the Claus and Thomas (2001) model
 r_{MPEG} = ICOC for the Easton (2004) MPEG model
 r_{oj} = ICOC for the Ohlson and Juettner-Nauroth (2005) model

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