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COMMONALITY IN LIQUIDITY: EVIDENCE FROM EMERGING ASIAN ACTIVELY-MANAGED EQUITY FUNDS

Suresh Kumar[1], Eliza Nor[2]*, Nik Hadiyan Nik Azman[2] and Hyder Ali[1]

[1]Faculty of Business Administration, Sukkur IBA University, 65200 Sukkur, Sindh, Pakistan
[2]School of Management, Universiti Sains Malaysia, 11800 USM Pulau Pinang, Malaysia

*Corresponding author: eliza.nor@usm.my

ABSTRACT

In this study, a set of common factors of liquidity that had previously been recorded at the equity security level is examined for its effect on inter and intra-market liquidity variations in equity funds in emerging Asian markets. Cross-market liquidity co-movement between the fund's portfolio and the market portfolio, which typically measures systematic liquidity risk and market integration, is the liquidity commonality for mutual funds. This research builds on Wang Jianxin's study in 2013 by including market liquidity, return and volatility as common factors of liquidity, and the partial R^2 of the common factors reveals each factor's contribution. We find that emerging Asian countries share 24.14% of the intra-market liquidity commonality between funds and equity markets, and market liquidity is tied to such relationship. Emerging Asian region share 2.76% of inter-market liquidity commonality and regional market return and volatility majorly contribute to this liquidity commonality. The significance of domestic financial markets is evidenced by the wide disparity in liquidity commonality between domestic and regional markets.

Keywords: Liquidity, Commonality in liquidity, Common factors, Mutual funds, Emerging Asia

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INTRODUCTION

Liquidity is a dynamic variable; a security's liquidity moves with overall market liquidity, a phenomenon known as liquidity commonality (Bai & Qin, 2015; Pástor & Stambaugh, 2003). The purpose of this study is to determine if the mutual fund might be exposed to this trend that had been previously recorded at the security level. This study explores the relationship between changes in equity market liquidity and fund liquidity using data from six Morgan Stanley Capital International (MSCI) Asian emerging markets.

Commonality tests normally compare a security's liquidity to market liquidity. For mutual funds, however, this is a very intriguing and distinct case. Examining liquidity commonality is an important consideration when making mutual fund investments since it can affect the risk and performance of your investment portfolio. Investors can make well-informed choices that are in line with their investment objectives and risk tolerance by having a clear understanding of how the underlying assets of mutual funds behave in terms of liquidity. That is why, the liquidity of a mutual fund's underlying portfolio is examined here, which is dependent on security selection and portfolio management. Previous research has found that fund factors such as fund size, liquidity of fund holdings, and portfolio concentration determines mutual fund liquidity (Hodrick & Moulton, 2009; Fulkerson & Riley, 2017). Another feature that distinguishes our analysis from past commonality studies is the fund manager's ability to time market liquidity. Wattanatorn and Tansupswatdikul (2019) find that mutual fund managers can forecast market-wide liquidity. Those who do this well can adjust their portfolio exposure to market liquidity to improve performance (Cao et al., 2013, Foran & O'Sullivan, 2017). Since market liquidity is more persistent in nature, it might be easier for fund managers to time it (Cao et al., 2013*)*. Hence, commonality in liquidity and liquidity timing ability are two distinct but related concepts in the mutual fund market. Positive liquidity commonality suggests that market liquidity innovation causes systematic risk (Bai & Qin, 2015)[1]. Huberman and Halka (2001) first call this variance in liquidity, a "systematic liquidity." While the liquidity timing ability assumes that this risk associated with change in market wide liquidity is diversifiable. Therefore, Commonality in liquidity serves two purposes: first, to confirm systemic liquidity risk and second, to gauge integration (financial connection) among emerging Asian capital markets.

Commonality sources can be supply- or demand-intended (Karolyi et al., 2012). Supply-intended sources assess the limit of cash and funds offered to market makers that supply liquidity across multiple assets (Coughenour & Saad, 2004; Hameed et al., 2010) and inventory risk (Bai & Qin, 2015). Demand-intended sources consider correlated trading (Kumar & Prasanna, 2019, Karolyi

et al., 2012, Koch et al., 2016) and commonality in investor sentiment (Huberman & Halka, 2001; Hameed et al., 2010). This study adds to the body of literature that explains the demand-intended liquidity commonality. Equity mutual funds and equity markets have more in common when it comes to liquidity. When mutual funds hold similar securities in their underlying portfolios, there is an instant demand for those securities in equity market. This practice simultaneously impacts the liquidity of these securities, stock markets, and equity funds that own these securities. Common mutual fund ownership is a source of liquidity commonality, as shown by numerous studies (e.g., Agarwal et al., 2018; Koch et al., 2016; Kamara et al., 2008); however, no research has yet examined whether or how this practice causes mutual funds to have liquidity commonality, which we are incorporating in this research.

Furthermore, numerous researchers have shown that commonality in liquidity is common in emerging Asian countries (Kumar & Prasanna, 2019; Brockman et al., 2009; Bruno & Shin, 2013; Karolyi et al., 2012; Vagias & van Dijk, 2011). According to Bai and Qin (2015), emerging economies experience lower liquidity and higher commonality in liquidity than developed economies. According to Amihud et al. (2015), commonality drives market integration in nations with global capital markets and foreign investment, while foreign institutions fund 12% of Asian capital markets, according to the Organisation for Economic Co-operation and Development (OECD) (2018). The Asian mutual fund industry, especially in emerging Asia, depends on the U.S. and European capital flows (Chuen & Gregoriou, 2014). The facts stated above motivate us to quantify intermarket and intramarket commonality between equity funds, local stock markets and emerging Asian equity markets.

This research expands on Wang's (2013) model for commonality in the liquidity of funds across emerging Asian nations by considering market liquidity, return and volatility as a set of common factors of liquidity. According to Wang (2013), and Bai and Qin (2015), market liquidity is not the only factor of a stock's liquidity (and so for equity funds), as recommended by Chordia et al. (2000) market model for liquidity commonality. There are a few other factors that affect stock liquidity, i.e., turnover rate, market capitalisation, market risk and return, information risk and market perfection. Due to data limitations, Wang (2013) considers market liquidity, return, and volatility as a set of common factors of liquidity, which this study adds to the model for commonality in liquidity of funds across the emerging Asian countries. China, India, South Korea, Malaysia, Thailand and Taiwan are the six MSCI Asian emerging economies included as the sample countries. This research shows that local and regional factors are crucial in assessing the liquidity of mutual funds. Over the data period of January 2008–

December 2019, we find nationwide and cross-national commonality in liquidity. Average liquidity, return and volatility in the market collectively define the level of liquidity commonality, which in turn explains the average liquidity variation of 26.69% across individual Asian emerging markets and of 7.34% throughout the entire region. This result shows that mutual funds are more interested in and responsive to developments in their own local financial markets than in those of other regions.

DATA AND VARIABLE MEASUREMENTS

Data

This study examines emerging Asian open-ended equity funds from January 2007 to June 2019. Data is primarily derived from Datastream and Bloomberg Mutual Funds Database. Bloomberg Portfolio Database lists each fund's holdings. This database offers current and backdated fund holdings, including security names, weights (based on share price and number of shares held), and sector and country allocations. Many emerging-market funds do not reveal 100% holdings quarterly. In such a condition, we carry forward the last holding data reported for the next quarter. However, we excluded funds without holdings data for a year. Market return, volatility, and liquidity are determined from country benchmark indices. Table 1 lists the benchmark indices representing emerging Asian markets. All the returns on benchmark market indices are the sum of capital and dividend gains. The volatility (standard deviation of change in price) is calculated as:

$$100 \times \ln\left(\frac{P^H}{P_L}\right) \tag{1}$$

Where P^H and P_L are intraday high and low prices, respectively.

Table 1
Markets and benchmark indices

Market	Country code	Benchmark index
China	CH	Shanghai Composite Index (SHCOMP)
India	IN	BSE500-S&P Index (BSE500)
Korea	KO	KOSPI 100 Index
Malaysia	MA	Kuala Lumpur Index (FBMKLCI)
Taiwan	TW	TWSE Index
Thailand	TH	SET50 Index

Sample construction

Our first sample was made up of 3,049 equity funds from nine MSCI emerging Asian countries. These countries were India (IN), China (CH), South Korea (KO), Pakistan (PA), Malaysia (MA), Indonesia (ID), Thailand (TH), Taiwan (TW) and the Philippines (PH). Actively managed equity funds invest at least 80% of their assets in equities. According to SEC 35d-1, a mutual fund must indicate in its prospectus that at least 80% of its funds will be invested in a standardised industry focus classification. Second, we define emerging Asian funds as those that only invest in Asia. That is, 80% of their total investments should be in Asia. Our sample size was 2,179 funds from six countries after region-based filtering. Pakistan, Indonesia and the Philippines were not included in our sample due to insufficient data. Third, we exclude funds with less than USD5 million in assets and start dates after 1 January 2007. Consequently, 822 funds were selected by adding 152 from China, 230 from India, 123 from Malaysia, 102 from Taiwan and 149 from Korea.

Data fitting

A number of studies show that stationary data series are compulsory when measuring the liquidity commonality (Chordia et al., 2000; Chordia et al., 2004; Zhang et al., 2009; Brockman et al., 2009; Hameed et al., 2010; Wang, 2013; Bai & Qin, 2015). To eliminate this issue, past studies have either used the first difference of series, e.g., Chordia et al. (2004); Zhang et al. (2009); and Brockman et al. (2009), or seasonality adjustments of series, e.g., Wang (2013) and Hameed et al. (2010). This study uses the first difference of market volatility, market liquidity and fund liquidity to address non-stationarity.

Variable Measurements

Measurement of liquidity

Stock liquidity data is also collected from the Bloomberg liquidity database. Bloomberg's liquidity solution for equities is a combination of different models, which is fundamentally based on the transient market impact models of Bouchaud et al. (2004) and Bouchaud (2010). According to Bouchaud (2010), the transient impact model is defined as follows:

$$P_t = P_o + \lambda \sum_{n=0}^{N-1} \epsilon_n \, v_n^{\psi} \, G(N-n) \tag{2}$$

Where P_t = price at trade t, P_o = current price; ϵ_n= sign of trade (+, –); v_n = volume at time n; Ψ = price impact exponent; $G(N-n)$ = propagator of a single trade; and λ = market impact parameter.

Price effect is the link between a buy or sell order and the subsequent price change, according to Bouchaud (2010). The Price in time t, P_t, is a function of current price, P_o, and price fluctuations which are possible to capture through volume traded, v_n. The ϵ_n is sign of trade (+, –) that shows buyer and seller-initiated order flows. With a focus on buying, the latest transaction price will rise with a (+) sign and with a focus on selling, the price will fall with a (–) sign. As impact is strongly dependent on volume, where volume is determined by the number of trades for a certain block of stock, it is best described by power-law distribution (Bouchaud, 2010). Therefore, an exponent "Ψ" is placed on volume "v". The exponent "Ψ" increases with number of trades and ranges between 0.1 to 1. For example, for a single trade it may equal to 0.1 and for large number of trades it may approach to 1. If a trader makes two consecutive buys, a trader's initial buy usually is cheaper than their second buy. Bagehot (1971) says market liquidity depends on market makers' ability to bridge the supply-demand gap by placing buy and sell orders to tighten the spread. A market maker generates a profit equal to the bid-ask spread on a round turn trade given that the midpoint price does not move. Liquidity providers decrease inventory risk by guiding order flow back to the market's equilibrium price. Therefore, the mean reversion of prices (resilience) may be too high and react with trade or too weak and react later with a decaying effect. Therefore, in this framework propagator of a single trade $G(N - n)$ reflects price movement in terms of earlier trades; it describes how the trade's impact propagates across time.

The size-weighted average liquidity of each security holding is used to determine the fund and market portfolios' liquidity. The same database (Bloomberg) is mined for holdings and liquidity information. This source creates fund and market liquidity by integrating portfolio holdings and individual security liquidity data.

Measurement of commonality factors and liquidity

This research replicates Wang's (2013) approach to looking for regional patterns in Asian emerging markets' mutual fund liquidity. Following Wang (2013), one set of common factors for emerging Asian region is organised. The common factors for the region (emerging Asian region) are extracted from the average of each liquidity factor (liquidity, volatility, and return) of five sample countries, as the country being analysed is not part of the regional average, that is:

$$CF^{j}_{EA,T} = (Liq^{j}_{EA,T}, Volt^{j}_{EA,t}, Ret^{j}_{EA,T}) \tag{3}$$

Where $CF^{j}_{EA,T}$ = emerging Asian regional factors for country j; $Liq^{j}_{EA,T}$ = equity markets' average liquidity of emerging Asian region for country; $Volt^{j}_{EA,t}$ = equity markets' average volatility of emerging Asian region for country j; and $Ret^{j}_{EA,t}$ = equity markets' average return of emerging Asian region for country .

All the regional factors are equally weighted averages of sample countries. The superscript indicates that a country is not part of regional averages while estimating commonality in liquidity for a country. On the other hand, another set of common factors will speak for the local country (individual country of emerging Asian region) being analysed, that is:

$$CF^{j}_{L,t} = (Liq^{j}_{L,t}, Volt^{j}_{L,t}, Ret^{j}_{L,t}) \quad (4)$$

Where $CF^{j}_{L,t}$ = local common factors for country j; $Liq^{j}_{L,t}$ = equity market liquidity in the country of fund j; $Volt^{j}_{L,t}$ = equity market volatility in the country of fund j; and $Rer^{j}_{L,t}$ = equity market return in the country of fund j.

While superscript indicates the local country j, where j = India, Malaysia, etc. In line with Wang's (2013) work, local market liquidity, volatility and return factors are included in the model alongside those from the emerging Asian region because these factors tend to be more correlated with the liquidity of local equity mutual funds.

Finally, with local factors ($CF^{j}_{L,t}$), and emerging Asian regional factors ($CF^{j}_{EA,t}$), the liquidity of an equally weighted portfolio of equity funds of country j ($Liq_{j,t}$) is formed as:

$$Liq_{j,t} = \eta_{j,0} + \eta 1_{j}\, CF^{j}_{L,t} + \eta 2_{EA}\, CF^{j}_{EA,t} + \varepsilon_{j,t} \quad (5)$$

Where $\eta 1_{j}$ = coefficient of local common factors; $\eta 2_{EA}$ = coefficient of emerging Asian regional common factors; $\eta_{j,0}$ = Intercept; and $\varepsilon_{j,t}$ = Error term.

Commonality in liquidity

The term "commonality in liquidity" is studied by different researchers in three different contexts. First is commonality in liquidity itself, referring to the covariance between the liquidity of an individual security and the average liquidity of a group of securities (Chordia et al., 2000, Brockman & Chung, 2002, Acharya & Pedersen, 2005, Karolyi et al., 2012). The second is liquidity premium commonality, which refers to positive covariance between individual market liquidity premium and global or regional market liquidity premium, which is common in countries that are open to foreign capital investment and have global capital markets (Amihud

et al., 2015). The third concept is commonality in liquidity measures, which captures covariance among liquidity scores of individual securities as measured by various liquidity proxies (Chordia et al. 2000; Kim & Lee, 2014; Korajczyka & Sadka, 2008). This study is mostly concerned with the first context, that is commonality in liquidity.

When several factors and marketplaces determine liquidity variance in a single market, a partial R^2 (partial determination coefficient) can be used to compute liquidity commonality. When other explanatory variables in the model are held constant, the partial R^2 measures the proportion of variance in the dependent variable $Liq_{j,t}$ that is explained by the independent variable $CF^{j}_{EA,t}$. Therefore, partial R^2 "allows to directly estimate the proportion of unexplained variation of dependent variable that becomes explained with the addition of independent variable to the model" (Scherrer, 1984, p. 702). For each fund, commonality in liquidity in emerging Asian markets is the respective partial R^2, resulting from the regression based on Equation 5, with respect to common factors of emerging Asian regions. Similarly, for each country, the commonality in liquidity in the emerging Asian market is the partial R^2 of funds portfolio with respect to common factors of the emerging Asian region.

PRELIMINARY ANALYSIS

Summary Statistics of Variables

Table 2 displays the summary statistics for market returns, volatility, liquidity and average fund liquidity from China, India, Malaysia, Taiwan, Thailand and Korea. This study employs benchmark equity indices from the sample countries to show stock market total return, volatility, and liquidity.

All sample markets have positive mean returns. Thailand and India have positively skewed returns with significant kurtosis (> 3), implying greater and more volatile returns than other sample countries. In terms of riskiness, China's performance is the worst of the sample countries, with the most volatile stock market and the second-lowest mean return. Except for India and Thailand, the return data are impartially symmetrical. All emerging Asian markets show fair persistence in market returns, given first-order autocorrelation $p(1) > 0$ and the Durbin Watson test (DW) and Augmented Dickey–Fuller test (ADF) reveal such autocorrelation is not high enough to exhibit nonstationary return data. The ADF rejects the unit-roots null hypothesis and deems return data stationary.

Except for China and Malaysia, all emerging Asian equities markets are equally volatile. China has the highest volatility, and Malaysia has the lowest. Both countries' volatility kurtosis indicates stability. However, significant volatility kurtosis and skewness in Asian emerging region suggest a volatility spike. First-order autocorrelation and DW show high volatility and persistence in the Asian emerging region and ADF verifies the presence of unit roots in monthly volatility.

Emerging Asian markets vary widely in liquidity. Malaysia and India have more illiquidity than other emerging Asian markets. All Asian emerging markets show positive liquidity skewness, with Malaysia's market liquidity being symmetrical, while India and Taiwan moderately skewed, and China, Thailand, and Korea significantly skewed. Both liquidity skewness and liquidity kurtosis are notably elevated in the Asian emerging markets. These are both indicators of frequent fluctuations in volatility. The first-order autocorrelation and the DW indicate high liquidity persistence across sample markets. The ADF verifies the presence of unit roots in the market liquidity series.

Equity fund liquidity varies greatly across the Asian emerging countries. Fund portfolios are more illiquid than equity market portfolios. Except for Malaysia and Thailand, all the markets show that their fund liquidity on average has positive skewness, and except for India, all the markets have stable fund liquidity kurtosis. Similar to equity markets, fund markets feature liquidity persistence and unit roots measured by first-order autocorrelation, DW and ADF.

Table 2 presents descriptive statistics of local factors (market return, volatility and liquidity) at the individual country level, and their averages (mean) represent regional factors at the Asian emerging markets level. The first difference of all nonstationary series rejects the presence of high persistence in all adjusted series. Each value of the adjusted series is randomly far from the preceding value. Adjusted/modified market liquidity and volatility are used to derive emerging regional factors in Asia. According to ADF statistics, there are no unit roots in the modified data. The first-order difference stabilised the means and standard deviations of the modified data. The volatility kurtosis has decreased, and the liquidity kurtosis of the equity market and equity funds has both slightly increased. Table 3 displays the summary statistics of all modified series.

Table 2
Summary statistics of variables

Variables	Mean	S. D.	Kurtosis	Skewness	$\rho(1)$	DW	ADF
Return (%)							
China	1.882	15.825	0.544	0.394	0.183	1.612	–4.412
India	3.154	12.893	4.899	1.012	0.174	1.645	–5.312
Malaysia	1.854	7.131	1.221	0.173	0.162	1.664	–3.976
Taiwan	1.983	8.890	0.573	–0.281	0.255	1.478	–4.804
Thailand	3.172	11.362	3.494	0.856	0.248	1.516	–5.208
Korea	1.523	8.177	0.390	–0.173	0.225	1.538	–5.208
Mean	2.261	10.713	1.854	0.330	0.208	1.575	–4.820
Volatility (%)							
China	73.008	36.186	0.343	0.974	0.751	0.665	–2.363
India	55.964	30.168	4.720	2.069	0.759	0.976	–2.705
Malaysia	31.332	14.880	1.178	1.150	0.447	1.477	–2.896
Taiwan	50.504	23.752	0.557	1.115	0.758	1.035	–2.654
Thailand	56.586	28.235	8.234	2.119	0.593	1.489	–3.500
Korea	54.721	30.227	11.736	2.945	0.653	1.173	–2.992
Mean	53.686	27.241	4.461	1.729	0.660	1.136	–2.852
Liquidity							
China	3.241	2.702	2.753	1.434	0.801	0.808	–2.768
India	7.688	4.702	1.459	0.876	0.603	2.019	–6.181
Malaysia	10.901	4.000	–1.099	0.038	0.692	1.500	–2.669
Taiwan	0.952	1.131	0.110	0.850	0.788	0.927	–3.108
Thailand	0.556	0.776	4.463	1.869	0.826	0.677	–2.637
Korea	0.477	0.299	11.736	2.945	0.740	0.486	–2.173
Mean	3.969	2.268	3.237	1.335	0.742	1.069	–3.256
Average fund liquidity							
China	120.256	48.362	2.853	1.267	0.697	0.791	–3.263
India	594.766	647.632	14.498	3.490	0.554	0.916	–1.570
Malaysia	205.403	113.309	–0.696	0.455	0.677	1.105	–2.251
Taiwan	71.713	28.349	0.644	1.268	0.558	1.337	–4.282
Thailand	206.500	65.288	–0.241	0.600	0.583	1.271	–2.370
Korea	90.104	14.480	1.483	0.957	0.293	1.550	–1.954
Mean	214.790	152.904	3.090	1.339	0.560	1.162	–2.615

Notes: $\rho(1)$ is the first-order autocorrelation. DW is the Durbin-Watson statistic. ADF is the Augmented Dickey–Fuller test.

Table 3
Summary statistics of adjusted variables

Variables	Mean	S.D.	$\rho(1)$	DW	ADF
First difference market volatility (%)					
China	1.338	25.037	–0.295	2.588	–4.495
India	0.261	22.978	–0.351	2.677	–6.568
Malaysia	0.759	15.176	–0.564	3.086	–7.111
Taiwan	0.300	19.402	–0.372	2.741	–6.019
Thailand	0.856	28.003	–0.378	2.743	–5.196
Korea	0.258	27.448	–0.394	2.724	–5.247
Mean	0.629	23.007	–0.392	2.760	–5.773
First difference average market liquidity					
China	0.104	1.625	–0.296	2.578	–5.440
India	–0.373	3.984	–0.369	2.561	–7.252
Malaysia	–0.182	4.664	–0.577	2.867	–6.218
Taiwan	0.025	0.729	–0.262	2.523	–6.614
Thailand	0.020	0.441	–0.281	2.564	–3.675
Korea	0.477	0.299	–0.128	2.634	–4.333
Mean	0.012	1.957	–0.319	2.621	–5.589
First difference average fund liquidity					
China	1.140	34.984	–0.296	2.578	–5.440
India	8.199	98.533	–0.520	3.056	–7.171
Malaysia	2.923	80.775	–0.450	2.892	–6.400
Taiwan	0.210	22.299	–0.258	2.502	–7.137
Thailand	–2.206	53.120	–0.338	2.637	–4.254
Korea	0.588	17.399	–0.528	3.060	–4.424
Mean	1.809	51.185	–0.398	2.787	–5.804

Notes: *$\rho(1)$ is the first-order autocorrelation. DW is Durbin-Watson statistics. ADF is the Augmented Dickey–Fuller test**.**

EMPIRICAL FINDINGS/RESULTS

This section reports the empirical findings for the impact of liquidity factors and common liquidity factors for both the local markets and emerging Asian region.

Liquidity Factors for Local and Emerging Asian Region

Table 4 reports the coefficients of market liquidity, volatility and return for local and emerging Asian region. The *t*-statistics are in parentheses below the factor value. Local market liquidity coefficients, $Liq^{j}_{L,t}$, are statistically significant in all countries except Taiwan and Korea. It shows that fund liquidity is most affected by local market liquidity. The coefficients of local liquidities are significantly higher

than those of Wang (2013) reported coefficients studied at security level. It may be because the majority of the fund portfolios consist of local equity securities. Thailand's market volatility, $Volt^{j}_{L,t}$, has a statistically significant negative impact on fund market liquidity, and its mean also leans towards a negative relationship. This is consistent with Ben-Rephael (2015), who identifies a flight to liquidity in mutual funds during times of extreme market uncertainty.[2] The coefficient of equity market returns, $Ret^{j}_{L,t}$ are statistically significant for India, China and Taiwan, showing positive effects on fund market liquidity. This result demonstrates that when the market turns favorable and stable, funds tend to hold illiquid assets[3]. This is inconsistent with the results of previous studies conducted on equity market liquidity, as several scholars such as Dang and Nguyen (2020), Batten and Vo (2014), and Hameed et al. (2010) find that market return has a positive impact on equity market liquidity. A very few regional factors for emerging Asia are statistically significant. Regional liquidity, $Liq^{j}_{L,t}$, for Malaysia, volatility, $Volt^{j}_{EA,t}$, for Malaysia and Thailand, and return, $Ret^{j}_{EA,t}$, for India are statistically significant. To conclude, Asian emerging regional liquidity, volatility, and return have a small impact on individual Asian emerging market funds. In other words, local factors affect equity fund liquidity in emerging Asia more than Asian regional factors.

Table 4
Parameter estimates of local and emerging Asian regional liquidity factors

The table shows the coefficients of local and emerging Asian regional liquidity factors—market liquidity, market volatility, and market return—estimated as follows:

$$Liq_{j,t} = \eta_1 Liq^{j}_{L,t} + \eta_2 Volt^{j}_{L,t} + \eta_3 Ret^{j}_{L,t} + \eta_4 Liq^{j}_{EA,t} + \eta_5 Volt^{j}_{EA,t} + \eta_6 Ret^{j}_{EA,t} + \varepsilon_{j,t}$$

Country	Local factors			Emerging factors			R^2
	Liquidity ($Liq^{j}_{L,t}$)	Volatility $Volt^{j}_{L,t}$)	Return ($Ret^{j}_{L,t}$)	Liquidity ($Liq^{j}_{EA,t}$)	Volatility ($Volt^{j}_{EA,t}$)	Return ($Ret^{j}_{EA,t}$)	
China	13.737**	–0.1438	0.6703**	–1.015	–0.2131	0.4514	
	(5.93)	(–0.780)	(3.15)	(–0.79)	(–1.00)	(1.09)	0.6301
India	93.046**	–6.989	10.668**	–2.557	10.675	–29.053**	
	(5.37)	(–1.67)	(2.64)	(–0.08)	(1.76)	(–3.99)	0.6214
Malaysia	5.7060**	–1.0174	–0.8375	31.8957	–1.5351**	0.8738	
	(10.43)	(–1.56)	(–1.01)	(4.39)	(–2.85)	(1.31)	0.8321
Taiwan	7.6891**	0.18972	1.5531**	–0.0539	0.1796	–0.4294	
	(1.20)	(0.70)	(4.32)	(–0.05)	(0.54)	(–1.14)	0.5868
Korea	28.8343	0.21534	0.0916	–0.3167	0.0553	0.7426	
	(0.72)	(0.25)	(0.097)	(–0.17)	(0.12)	(0.82)	0.3554
Mean	45.8256**	–1.7927	2.3179	4.6834	2.2464	–5.0664	
	(3.79)	(–0.92)	(1.75)	(0.76)	(0.47)	(–0.55)	0.5836

Notes: Data in () are *t*-statistics

Factor analysis takes only the common variation of the original variables and ignores their unique variances[4] and find several solutions (factors) that fit as well.[5] Matrices are needed to figure out how to interpret the common components and how much each of the original variables contributed.

A correlation matrix between market liquidity, volatility, and return determines common liquidity factors. A weighted average of these observables may be able to reconstruct the correlation matrix. Table 5 shows correlation matrices local markets in Panel A and emerging Asian region in Panel B.

The correlation matrix shows a positive relationship among liquidity, volatility, and return across all local and Asian emerging region. Higher correlations in the data support common variables for factorability (Tabachnick & Fidell, 2001). Table 6 demonstrates that most correlations are low. The correlations for India, Malaysia and Thailand (in Panel A) and for India, Taiwan and Thailand (in Panel B) are less than the minimum recommended scale of 0.30 (Hair et al., 1995). However, if one combination's intercorrelation is below 0.30 but other combinations' is above 0.30, then significant factorability may not be denied (Beavers et al., 2013). Finally, factorability is assessed using determinant of correlation matrices and the KMO test. All correlation matrices permit linear combinations and factoring with their non-zero determinants. KMO statistics demonstrate that shared variance in market liquidity, volatility and return in local market variance for China, India and Thailand and the Asian region for Taiwan and Thailand is low but above 0.50.[6]

Table 5
Correlation matrix of liquidity factors

Panel A: Correlation Matrix of Local Markets					
China (CH)	Liq^{CH}	$Volt^{CH}$	Ret^{CH}	Determinant	KMO
Liq^{CH}	1.000	0.390	0.198		
$Volt^{CH}$	0.390	1.000	0.602		
Ret^{CH}	0.198	0.602	1.000		
				0.540	0.546
India (IN)	Liq^{IN}	$Volt^{IN}$	Ret^{IN}	Determinant	KMO
Liq^{IN}	1.000	0.182	0.177		
$Volt^{IN}$	0.182	1.000	0.314		
Ret^{IN}	0.177	0.314	1.000		
				0.857	0.520

(*Continued on next page*)

Table 2 (*Continued*)

Panel A: Correlation Matrix of Local Markets					
Malaysia (MA)	Liq^{MA}	$Volt^{MA}$	Ret^{MA}	Determinant	KMO
Liq^{MA}	1.000	0.552	0.465		
$Volt^{MA}$	0.552	1.000	0.432		
Ret^{MA}	0.465	0.432	1.000		
				0.675	0.514
Taiwan (TW)	Liq^{TW}	$Volt^{TW}$	Ret^{TW}	Determinant	KMO
Liq^{TW}	1.000	0.642	0.478		
$Volt^{TW}$	0.642	1.000	0.421		
Ret^{TW}	0.478	0.421	1.000		
				0.440	0.659
Thailand (TH)	Liq^{TH}	$Volt^{TH}$	Ret^{TH}	Determinant	KMO
Liq^{TH}	1.000	0.630	0.133		
$Volt^{TH}$	0.630	1.000	0.140		
Ret^{TH}	0.133	0.140	1.000		
				0.590	0.523
Korea (KO)	Liq^{KO}	$Volt^{KO}$	Ret^{CH}	Determinant	KMO
Liq^{KO}	1.000	0.601	0.409		
$Volt^{KO}$	0.602	1.000	0.613		
Ret^{CH}	0.409	0.613	1.000		
				0.397	0.647
Panel B: Correlation Matrix of Emerging Asia Region					
Asia ex China	$Liq^{CH}{}_{EA}$	$Volt^{CH}{}_{EA}$	$Ret^{CH}{}_{EA}$	Determinant	KMO
$Liq^{CH}{}_{EA}$	1.000	0.357	0.247	-	-
$Volt^{CH}{}_{EA}$	0.357	1.000	0.452		
$Ret^{CH}{}_{EA}$	0.247	0.452	1.000		
				0.687	0.607
Asia ex India	$Liq^{IN}{}_{EA}$	$Volt^{IN}{}_{EA}$	$Ret^{IN}{}_{EA}$	Determinant	KMO
$Liq^{IN}{}_{EA}$	1.000	0.244	0.262		
$Volt^{IN}{}_{EA}$	0.244	1.000	0.520		
$Ret^{IN}{}_{EA}$	0.262	0.520	1.000		
				0.668	0.607
Asia ex Malaysia	$Liq^{MA}{}_{EA}$	$Volt^{MA}{}_{EA}$	$Ret^{MA}{}_{EA}$	Determinant	KMO
$Liq^{MA}{}_{EA}$	1.000	0.479	0.247		
$Volt^{MA}{}_{EA}$	0.479	1.000	0.558		
$Ret^{MA}{}_{EA}$	0.247	0.558	1.000		
				0.574	0.530

(*Continued on next page*)

Table 2 (*Continued*)

Panel B: Correlation Matrix of Emerging Asia Region					
Asia ex Taiwan	$Liq^{TW}{}_{EA}$	$Volt^{TW}{}_{EA}$	$Ret^{TW}{}_{EA}$	Determinant	KMO
$Liq^{TW}{}_{EA}$	1.000	0.246	0.209		
$Volt^{TW}{}_{EA}$	0.246	1.000	0.571		
$Ret^{TW}{}_{EA}$	0.209	0.571	1.000		
				0.629	0.564
Asia ex Thailand	$Liq^{TH}{}_{EA}$	$Volt^{TH}{}_{EA}$	$Ret^{TH}{}_{EA}$	Determinant	KMO
$Liq^{TH}{}_{EA}$	1.000	0.285	0.187		
$Volt^{TH}{}_{EA}$	0.285	1.000	0.638		
$Ret^{TH}{}_{EA}$	0.187	0.638	1.000		
				0.545	0.547
Asia ex Korea	$Liq^{KO}{}_{EA}$	$Volt^{KO}{}_{EA}$	$Ret^{KO}{}_{EA}$	Determinant	KMO
$Liq^{KO}{}_{EA}$	1.000	0.480	0.516		
$Volt^{KO}{}_{EA}$	0.480	1.000	0.705		
$Ret^{KO}{}_{EA}$	0.516	0.705	1.000		
				0.355	0.671

Notes: CH = China; IN = India; MA = Malaysia; TW = Taiwan; TH = Thailand; KO = Korea; DCM = determinant of correlation matrices; KMO = Kaiser–Meyer–Olkin test.

Factor Loadings: Correlations of Common Factors

Panel A of Table 6 presents factor loading (the correlation between extracted common liquidity factor and original market variables) for each local and regional market. Higher correlations (factor loading) are better. According to Beavers et al. (2013), 0.70 factor loading extracts approximately 50% of the variance of the original variable. Local market factor loading reveals that common liquidity factors of China, India, Thailand and Korea extract more variance from market volatility than market liquidity or return. While market liquidity in Taiwan and Malaysia are most attributable to a common liquidity factor. The factor loading of the region for all the relevant countries reveals that the common liquidity factor extracts the most variance from regional market return and volatility, and the least from regional market liquidity. The uniqueness of the original market variables that are not shared with the common liquidity factor is indicated in Panel A of Table 7.

This study retained one common factor per local and regional set of data. Panel B (Table 7) shows Eigenvalue and Proportion, which explain the data fluctuation in percentage. Because the total proportion cannot exceed 1 (100%), none of the identified common factors had accurate eigenvalues and proportions. Indeed, eigenvalues and proportions of some unretained factors might be negative.

Local markets and regions had extracted more than one common factor, and some of the factors that were not retained had negative eigenvalues and proportions.

Table 6
Correlation matrix of common liquidity factors

	Factor loadings (China)			Factor loadings (Emerging Asia except China)	
Panel A					
	CF (CH)	Uniqueness		CF (Asia ex CH)	Uniqueness
Liq^{CH}	0.4151	0.8277	$Liq^{CH}{}_{EA}$	0.4609	0.7875
$Volt^{CH}$	0.7552	0.4296	$Volt^{CH}{}_{EA}$	0.6334	0.5988
Ret^{CH}	0.6592	0.5655	$Ret^{CH}{}_{EA}$	0.5598	0.6866
Panel B					
Factor	Eigenvalue	Proportion	Factor	Eigenvalue	Proportion
CF (CH)	1.17721	1.2323	CF (Asia ex CH)	0.92699	1.5
	Factor loadings (India)			Factor loadings (Emerging Asia except India)	
Panel A					
	CF (India)	Uniqueness		CF (Asia ex IN)	Uniqueness
Liq^{IN}	0.2846	0.8753	$Liq^{IN}{}_{EA}$	0.3719	0.8617
$Volt^{IN}$	0.5297	0.7192	$Volt^{IN}{}_{EA}$	0.6341	0.5979
Ret^{IN}	0.4017	0.8118	$Ret^{IN}{}_{EA}$	0.6432	0.5863
Panel B					
Factor	Eigenvalue	Proportion	Factor	Eigenvalue	Proportion
CF(IN)	0.52299	1.6239	CF (Asia ex IN)	0.95411	1.4508
	Factor loadings (Malaysia)			Factor loadings (Emerging Asia except Malaysia)	
Panel A					
	CF (MA)	Uniqueness		CF (Asia ex MA)	Uniqueness
Liq^{MA}	0.6988	0.5117	$Liq^{MA}{}_{EA}$	0.5210	0.7285
$Volt^{MA}$	0.6746	0.5450	$Volt^{MA}{}_{EA}$	0.7563	0.4279
Ret^{MA}	0.5951	0.6458	$Ret^{MA}{}_{EA}$	0.6102	0.6277

(*Continued on next page*)

Table 6 (*Continued*)

Panel B					
Factor	Eigenvalue	Proportion	Factor	Eigenvalue	Proportion
CF (MA)	1.29759	1.3333	CF (Asia ex MA)	1.21582	1.2436
	Factor loadings (Taiwan)			Factor loadings (Emerging Asia except Taiwan)	
Panel A					
	CF (TW)	Uniqueness		CF (Asia ex TW)	Uniqueness
Liq^{TW}	0.7627	0.4182	$Liq^{TW}{}_{EA}$	0.3242	0.8949
$Volt^{TW}$	0.7268	0.4717	$Volt^{TW}{}_{EA}$	0.6832	0.5332
Ret^{TW}	0.5677	0.6777	$Ret^{TW}{}_{EA}$	0.6671	0.5549
Panel B					
Factor	Eigenvalue	Proportion	Factor	Eigenvalue	Proportion
CF(TW)	1.43237	1.2512	CF (Asia ex TW)	1.01695	1.3722
	Factor loadings (Thailand)			Factor loadings (Emerging Asia except Thailand)	
Panel A					
	CF (Thailand)	Uniqueness		CF (Asia ex TH)	Uniqueness
Liq^{TH}	0.7167	0.4864	$Liq^{TH}{}_{EA}$	0.3193	0.898
$Volt^{TH}$	0.7183	0.4841	$Volt^{TH}{}_{EA}$	0.7466	0.4426
Ret^{TH}	0.188	0.9647	$Ret^{TH}{}_{EA}$	0.7092	0.4971
Panel B					
Factor	Eigenvalue	Proportion	Factor	Eigenvalue	Proportion
CF (TH)	1.06485	1.2962	CF (Asia ex TH)	1.16231	1.2598
	Factor loadings (Korea)			Factor loadings (Emerging Asia except Korea)	
Panel A					
	CF (Korea)	Uniqueness		CF (Asia ex KO)	Uniqueness
Liq^{KO}	0.6552	0.5707	$Liq^{KO}{}_{EA}$	0.5991	0.6411
$Volt^{KO}$	0.805	0.352	$Volt^{KO}{}_{EA}$	0.7796	0.3922
Ret^{CH}	0.6663	0.556	$Ret^{KO}{}_{EA}$	0.8018	0.3571

(*Continued on next page*)

Table 6 (*Continued*)

Panel B					
Factor	Eigenvalue	Proportion	Factor	Eigenvalue	Proportion
CF (KO)	1.52131	1.2005	CF (Asia ex KO)	1.60964	1.1948

Liquidity Factors and Liquidity Commonality

Table 7 reports the contribution of extracted common liquidity factors for local and emerging Asian region and cross-market commonality in liquidity between funds and equity markets. Panel A displays the R^2 and partial R^2 of Equation 5, and Panel B shows the relative contribution of each liquidity factor (original variables) of common liquidity factors to liquidity commonality. Whereas R^2 as a whole can explain the variation, the model's partial R^2 explains how each common factor and the original variable explain the variation on their own.

Table 7
Common liquidity factors and liquidity commonality

Panel A shows the R^2 and partial R^2*s* of local PR_L^2 and Asia (PR_{AE}^2) common liquidity factors, resulting from the following regression:

$$Liq_{j,t} = \eta_{j,0} + \eta 1_j CF_{j,t} + \eta 2_{EA} CF_{AE,t} + \varepsilon_{j,t}$$

Panel B shows the relative contribution of each liquidity factor, i.e., partial R^2 of market liquidity (PR_{Liq}^2), market volatility (PR_{Volt}^2), and market return (PR_{Ret}^2 towards common liquidity factors for local ($CF_{j,t}$)and Asian emerging markets ($CF_{AE,t}$)

Panel A			
	R^2 of CF	PR_L^2	PR_{AE}^2
China	34.16%	34.03%	5.48%
India	18.12%	17.66%	8.12%
Malaysia	34.34%	27.67%	0.03%
Taiwan	48.84%	34.89%	0.35%
Thailand	7.35%	7.30%	2.45%
Korea	30.85%	23.28%	0.15%
Mean	28.94%	24.14%	2.76%

Panel B							
		Partial R^2 of local factors			Partial R^2 of Asia factors		
	R^2	PR_{Liq}^2	PR_{Volt}^2	PR_{Ret}^2	PR_{Liq}^2	PR_{Volt}^2	PR_{Ret}^2
China	63.01%	46.17%	1.46%	19.51%	1.52%	2.43%	2.83%
India	62.14%	41.95%	6.57%	14.89%	0.02%	7.23%	28.55%
Malaysia	83.21%	72.14%	5.50%	2.37%	31.42%	16.23%	3.95%
Taiwan	58.69%	3.35%	1.15%	30.82%	0.01%	0.69%	3.01%

(*Continued on next page*)

Table 6 (*Continued*)

Panel B							
		Partial R^2 of local factors			Partial R^2 of Asia factors		
	R^2	PR^2_{Liq}	PR^2_{Volt}	PR^2_{Ret}	PR^2_{Liq}	PR^2_{Volt}	PR^2_{Ret}
Thailand	47.63%	32.43%	29.18%	7.09%	0.39%	17.57%	7.38%
Korea	35.54%	3.60%	0.45%	0.07%	0.20%	0.10%	4.61%
Mean	58.37%	33.27%	7.38%	12.46%	5.60%	7.37%	8.38%

This research presents numerous different findings on the commonality in liquidity across emerging Asian markets for equity funds. In Panel A (Table 7), R^2 explained an average liquidity variation of 28.94% in emerging Asian equity funds, ranging between a low of 7.35% for Thailand and a high of 48.84% for Taiwan in the group. The degree of liquidity commonality varies significantly within the group. However, this commonality in liquidity is an outcome of the combined common liquidity factors of the local and emerging Asian region. So, in Panel A's second and third columns, PR^2_L and PR^2_{EA} are partial R^2 values of common liquidity factors that describe the local and regional markets separately. PR^2_L (= 24.14%) is much higher than PR^2_{EA}(= 2.76%) on average because local portfolios of funds have a higher tendency of liquidity commonality with their local common factor than with their regional common factor. The $PR^2_L > PR^2_{EA}$ for all emerging Asian countries. This finding reflects that local market fundamentals drive the liquidity of funds and that funds follow local financial markets more seriously than regional financial markets. Moreover, results reveal that Taiwan equity funds have the highest liquidity commonality (34.89%) with local equity market. Malaysia reported the lowest liquidity commonality (0.03%) with regional equity markets, and the difference in liquidity commonality between local and regional markets (34.89%–0.35%) is widest in the group for Taiwan. Thailand shows the lowest difference in liquidity commonality between local and regional markets (7.30%–2.45%) and reports the lowest exposure to local factors in the group.

Panel B of Table 7 shows the relative contribution of each common liquidity factor (original variable) to the liquidity commonality. For this purpose, the corresponding partial R^2s are calculated from Equation 5 (regressed with liquidity factors), and their estimated coefficients are already reported in Table 5. It shows the partial R^2 of market liquidity-(PR^2_{Liq}), market volatility-(PR^2_{Volt}), and market return-PR^2_{Ret} representing each local and Asian emerging regional market.

For the local markets, the average PR^2_{Liq} (= 33.27%) is much higher than the average PR^2_{Ret} (= 12.46%) and average PR^2_{Volt} (= 7.38%). PR^2_{Liq} is greater than PR^2_{Ret} and PR^2_{Volt} for all local markets except Taiwan. The results indicate that market liquidity is the leading factor moving liquidity commonality between equity funds and local equity markets of emerging Asia. However, the results

for emerging Asian regional markets are quite different. For the emerging Asian regional markets, the average PR^2_{Ret} (= 8.38%) is higher than the average PR^2_{Volt} (= 7.37%) and average PR^2_{Liq} (= 5.60%). Except Malaysia and Thailand, four of the six emerging Asian regional markets have PR^2_{Ret} greater than PR^2_{Volt}. The contrast in results from Wang's (2013) reported volatility as a leading factor is likely as funds are studied here instead of individual securities or market portfolios. While examining the mutual fund industry in Southeast Asia, Wattanatorn and Tansupswatdikul (2019) discover that mutual fund managers have the capacity to forecast market-wide liquidity, and they adjust their portfolio exposure accordingly (Cao et al., 2013, Foran & O'Sullivan, 2017). Market liquidity and volatility, however, are persistent enough to be reliably predicted whereas market returns are not. Further, market return is a systematic variable, and there is no consensus on a mutual fund's return timing ability in the literature.

DISCUSSION

Instead of using a single component, such as weighted average market liquidity by Acharya and Pedersen (2005) and Karolyi et al. (2012), this study proposes a multi-factor model for determining liquidity commonality. This study looks at first difference of market liquidity, market return, and market volatility as a set of common factors of liquidity. Whereas one set of common factors is arranged for each individual local market and other set of common factors is arranged for emerging Asia region. The correlation matrix of market liquidity, market volatility, and market return is used to extract the common liquidity factors. Even though correlation in the data is not so high, on average, but are above the minimum acceptable level. The common liquidity factor for emerging Asia region extracts most of its variance from regional market return and volatility, with regional market liquidity contributing the least. In local markets, factor loading indicates local market volatility prevails over liquidity and return.

R^2 explained an average liquidity variation of 28.94% in emerging Asian equity funds. Overall commonality (28.94%) is significantly higher than Kumar and Prasanna's (2019) of 16%, Wang's (2013) of 15%; Wang's (2010) of 9.4%; and lower than Bai and Qin's (2015) of 34.12% common liquidity variation in emerging Asian equity markets. Where partial R^2 of local and regional common factors, PR^2_L and PR^2_{EA}, indicates that PR^2_L (= 24.14%) captures most of the variations in liquidity and PR^2_{EA} (= 2.76%) contributions are negligible. The high difference in liquidity commonality between local and external (emerging Asian region) markets (24.14%–2.76%) indicates that funds follow local financial markets more seriously than regional or external financial markets. This is consistent with

the findings of Kumar and Prasanna (2019), who found that most of the liquidity changes that occur in Asian countries (= 70%) are the result of their own country's spillovers driven by local factors. We highly support the hypothesis that open-ended mutual funds have strong intra-market liquidity commonality with their equity markets. Commonality in liquidity for mutual funds at the emerging Asian region level is too small. This means that fund managers can deal with the risk of commonality in liquidity by spreading their investments around the region. The findings are consistent with those of Caporale et al. (2019), who found that Asian markets are more integrated with global markets (such as the United Kingdom and the United States) than Asian markets are with each other.

In addition, the partial R^2 approach is applied to factors of liquidity to review the relative contribution of original variables, i.e., market liquidity, volatility and return, to the liquidity commonality. The findings reveal that local market liquidity plays a far larger role than local market return and volatility in determining local equity fund liquidity. In contrast, the role of regional market liquidity is nominal, and regional market return is most significant, as a factor for liquidity commonality in emerging Asian region. As regional analysis reveals that equity fund liquidity is influenced by emerging Asian regional characteristics such as market return and volatility. Surprisingly, for the emerging Asian region, the regional market liquidity is the least important, and regional market return is the most important factor contributing to the liquidity commonality at equity fund level. The evidence contrasts that of Wang's (2013) reported volatility and return as the leading factors affecting commonality in liquidity across emerging Asian, developed Asian and global equity markets.

This study can be expanded in several ways to further incorporate the impact of liquidity commonality on the mutual fund industry. The study's scope is inflatable to other regions, such as emerging Asian markets' integration with developed Asian markets or global markets. Moreover, for fund managers and policymakers, it might be of interest to know how liquidity commonality changes over time and how it varies with economic fluctuations due to business cycles.

CONCLUSION AND IMPLICATIONS

This is a comprehensive study on commonality in the liquidity of actively managed open-ended equity mutual funds of emerging Asian countries. The analysis of commonality hypothesis reveals that market liquidity, market return and market volatility as factors of liquidity are progressively driving liquidity fluctuations in the mutual fund industry of the emerging Asian countries.

The empirical findings show that emerging Asian countries have strong intra-market liquidity commonalities at the fund level, and market liquidity as a factor is closely tied to such a relationship. However, intermarket liquidity commonalities for mutual funds at the emerging Asian region level are too small, which may be induced by regional market returns and regional market volatility and may allow fund managers to diversify commonality risk by spreading their funds around the region.

The study has several implications for fund investors, who either directly invest in mutual funds or indirectly contribute to them through pension plans and insurance policies (e.g., life assurance). The degree of liquidity commonality is a crucial link in explaining the financial shock's spillover from the equity market to the fund market. Moreover, for fund managers, cross-market correlations in liquidity should be a big part of how they build their portfolios and handle risks.

Despite meeting the research objectives and focusing on the most significant components of this study, there are some limitations to be acknowledged. Due to a lack of data, developed nations do the majority of research on the mutual fund industry. Particularly, there are few data sets on the full portfolio disclosure of equity mutual funds in emerging Asia. Due to the lack of portfolio disclosure data throughout the study period, a number of equity funds are excluded from this analysis. The data limitation resulted in a smaller sample size. In addition, ideally, this study demands full disclosure of fund holdings on a monthly basis. However, the frequency of disclosures in Asian countries varies, ranging from monthly to annual reporting. So, quarterly disclosure data is used. The way things are done now could be underestimating co-movements and, as a result, systemic liquidity risk.

NOTES

1. Investors have been proven to demand a risk premium for keeping assets whose liquidity is exposed to systematic liquidity, which is how this component is priced (Anderson et al., 2015).
2. Flight to liquidity is a fund manager's practice of replacing illiquid holdings with liquid ones.
3. The measure of liquidity in this study assesses liquidity cost.
4. There exist multiple types of variances: common (shared) variance, specific (unique) variance, and error variance (measurement error) (Beavers et al., 2013).
5. Factor analysis has an infinite number of solutions. If a solution contains two factors, these may be rotated to form a new solution that does just as good a job at reproducing the correlation matrix.

6. The KMO index ranges from 0 to 1, with 0.50 considered suitable for factor analysis (Williams et al., 2013).

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