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Determinants of commonality in liquidity: Evidence from an order-driven emerging market ☆,☆☆

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ABSTRACT

Using an extensive, time-series, cross-sectional data-set of actively traded Indian stocks with up to 1.75 million firm-day observations, we discern the key determinants of commonality in liquidity among emerging markets. The paper shows evidence for both supply-side and demand-side factors contributing to liquidity commonality. However, the results are more supportive towards supply-side rationale for liquidity commonality among the firms where regulators and banks play an important source of commonality in liquidity, especially during market turmoil. Results are partially driven by the fact that the Indian stick exchange is an order-driven market. Economic activities like cheap exports and undervalued currency, rather than correlated trading by the institutional investors determine the demand for liquidity. These findings endorse the effect of high firm value, market return, liquidity, volatility, turnover, and alternate proxies of commonality in liquidity estimation.

1. Introduction

> For the fact that each individual investor flatters himself that his commitment is "liquid" (though this cannot be true for all investors collectively) calms his nerves and makes him much more willing to run a risk.
>
> [John Maynard Keynes (1936, pg. 160)]

Figuratively speaking, liquidity is the lubricant that keeps the market running like a well-oiled machine by optimal price discovery for the securities, but practically market fails to comply their theoretical mandate and thus illiquidity costs stakeholders money. Reflecting on the empirical literature on liquidity in last fifteen years, Commonality in Liquidity (CiL hereafter) is an interesting phenomenon whose empirical manifestation is the co-movement between variations in individual firm-level liquidity and variations in market- and industry-wide liquidity (Chordia, Roll, & Subrahmanyam, 2000). There

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is plethora of research to document the presence of CiL under different market settings[1] but the literature on what drives CiL is still at a nascent stage. Market microstructure effects or the general variation in the market conditions can equally act as two possible sources of CiL of the stocks. Here, inventory costs and information asymmetry of the stock are the most viable explanation of the market microstructure effect on commonality (Chordia et al., 2000). Alternatively, the sources due to market conditions affect commonality due to the co-movement in market states due to common variation in supply and demand for liquidity in the market by the market-makers, regulators and investors respectively (Coughenour & Saad, 2004 and Karolyi, Lee, & van Dijk, 2012). Although the above two strands were initially developed and tested for the quote-driven markets, overtime they have been extended to the established order-driven markets (Hong Kong – Brockman & Chung, 2002, and Germany – Rösch & Kaserer, 2013). As we know, in an order-driven framework there is no obligation on the part of any market participant to submit limit orders and, consequently there is no liquidity supplier of last resort. Therefore, there still remains a caveat in the empirical finance literature to ascertain the sources of CiL for an order-driven emerging market is an unanswered empirical issue and the focus our study.

In this study, our primary interest in India is threefold. First, India is one of the most important and leading emerging markets of the world. The performance of Indian market not only affects the performance of other regional south-east Asian markets, but also has implications for investors worldwide. So, documenting comprehensive evidence related to sources of CiL for the Indian stock market leads to a better understanding of liquidity provision in emerging markets. Second, the trading system in place in the Indian markets is an order-driven market compared to the quote-driven market of the developed countries. Here, the barrier for entry is lower, due to which more market participants are interested in supplying liquidity to the market, resulting in healthy competition. Third, in contrast to the popular perception in the literature which considers India as a relatively well-developed market, in reality only a handful of large firms have in real terms liquid tradable stocks listed on the stock exchanges in India (Didier & Schmukler, 2013). So, it is interesting to examine the sources of commonality for order-driven markets with less liquidity.

The supply-side hypothesis predicts that commonality is higher during high market volatility, higher interest rates in the economy, and poor financial market conditions such as low liquidity, negative market returns, etc. affecting the availability of capital to the financial intermediaries (Brunnermeier & Pedersen, 2009). The demand-side explanation for sources of CiL mainly relies in the intense trading by institutional investors. The trading by various institutional investors such as foreign institutional investors (FIIs), mutual funds, banking and insurance companies is correlated to a large extent.

When market participants are constrained by sources of capital to trade, the market experiences a large negative return which reduces the amount of funds tied up with tradable securities resulting in a decrease of liquidity supply in the market. Hence, we examine the behavior of CiL due to change in overall market returns, especially due to large negative market returns. Brunnermeier and Pedersen (2009), argue that stock market declines either affect the liquidity demand or the supply for liquidity. Having a market-wide impact on liquidity, through simultaneously occurring transactions, we hypothesize that these market-wide liquidity demand and supply effects of market declines or extreme market declines (crisis) is a potential source of CiL (Rösch & Kaserer, 2013). Hence we examine CiL due to adverse market movements.

Unlike the extant literature, we find the bank returns, broker returns, exchange rate, and exports to be significant determinants of liquidity commonality. Unlike Karolyi et al. (2012), as envisioned in any bank-based economy, we find brokerage and banking institutions as the key supplier of liquidity to the equity market. When it comes to the demand-side elucidation, this study provides evidence against the view that CiL is higher in presence of institutional investors due to correlated trading (Karolyi et al., 2012 and Koch, Ruenzi, & Starks, 2016), rather, in emerging markets macroeconomic factors such as exchange rate and exports which directly affect the economy of the country in long-run play the deterministic role. Regardless of supply- and demand-side elements, our results reconcile with the recent studies on the impact of financial crisis on CiL (Brunnermeier & Pedersen, 2009 and Rösch & Kaserer, 2013) where we show that commonality is induced by a lack of liquidity funding of financial intermediaries during the times of market abatement, leading to market liquidity spirals.

The remaining article is organized as follows: Section 2 discusses the prior literature on CiL and its determinants while we elaborately present our data and methodology in Section 3. Section 4 presents the basic statistical analysis followed by the regression analysis on cross-sectional, supply- and demand-side determinants of commonality. Section 5 further details about the liquidity supply issues during times of financial turmoil. Finally, summary and concluding remarks are presented in the very end in section 6 of the paper.

2. Related research

Chordia et al. (2000) through their benchmark paper shifted the focus of the research on liquidity from a single asset to a market-wide context. It is the first paper to acknowledge the existence of CiL and suggest that asymmetric information and inventory costs are the two primary sources of CiL related to the market microstructure effects. They documented evidence in favor of information asymmetry as the determinant of liquidity. Post Chordia et al. (2000), researchers have not only addressed the existence of CiL globally under different market settings but have also dwelled into the determinants of liq-

[1] Developed markets like quote-driven US stock exchanges – NYSE and NASDAQ (Chordia et al., 2000; Coughenour & Saad, 2004, etc.), DJI Index (Hasbrouck & Seppi, 2001), order-driven Hong Kong Stock Exchange (Brockman & Chung, 2002) and Australian market (Domowitz, Hansch, & Wang, 2005), global stock exchanges (Brockman, Chung, & Pérignon, 2009), derivatives market (Cao & Wei, 2010), commodity market (Marshall et al., 2013) and emerging markets (Lesmond, 2005).

uidity. Harford and Kaul (2005) examine the commonality in order-flow to explore the determinants of liquidity and their implication on trading. Confirming Hasbrouck and Seppi (2001) and contradicting Chordia et al. (2000), their results suggest that commonality in order flow or returns are stronger than CiL. Hughen and McDonald (2006) find that the trading by retail investors is a significant reason of commonality across stocks which are primarily driven by the fact that the retail investors are distinctly sensitive to market factors resulting in commonality in order flow and trading.

More recently, Kamara, Lou, and Sadka (2008) and Koch et al. (2016) argue that the correlated trading behavior of institutional investors can give rise to CiL because it tends to be greater when equity market of a country experiences larger foreign capital inflow driven by institutional investors which creates common buying and selling pressure. Koch et al. (2016) show higher CiL for the stocks with higher mutual fund ownership, since these stocks owned by mutual funds have high turnover and mutual funds are more likely to experience liquidity shocks.

Next, Karolyi et al. (2012) provides a comprehensive understanding of supply- and demand-side sources of CiL in a global perspective. Using a sample of 22,447 stocks listed in 40 countries from 1995 to 2009 and employing Amihud (2002) price impact as liquidity measure at daily and monthly frequency, Karolyi et al. (2012) undertake a time-series and cross-sectional analysis of variation in determinants of CiL at individual firm-level within a country and across countries overtime. There is a weaker evidence for funding constraints of financial intermediaries with respect to the supply-side factors while for the demand-side; changes in co-variation of trading activity, globalization, presence of foreign investors, quality of information, and investor sentiment and protection play a significant role in explaining CiL. Lately Rösch and Kaserer (2013) use a sample of 272 index-listed German companies from 2003 to 2009 to examine the dynamics and drivers of CiL during the periods of financial crisis. They find a positive relationship between liquidity risk and credit risk and conclude that the market liquidity can be a driving force for financial contagion because tightening liquidity funding during periods of financial crisis prompts an increase in commonality, leading to market-wide illiquidity.

Almost all the studies on determinants of CiL to date either focuses on a country-specific quote-driven market like U.S. (*e.g.*: Hasbrouck & Seppi, 2001; Hughen & McDonald, 2006; Kamara et al., 2008; Koch et al., 2016) or Germany (Rösch & Kaserer, 2013) or a generic global setting (Karolyi et al., 2012). Indeed very little is known about the level of CiL among emerging order-driven markets and negligible about the drivers of commonality in these markets overtime. We try to address this gap in the present study.

3. Data and methodology

This study focuses on the determinants of CiL in an emerging order-driven market between the years 2001 and 2015. We choose this fifteen year sample period because of the non-availability of reliable data related to some of the key supply-side and demand-side factors prior to 2000 which have been used in this study. Also, the number of liquid firms is limited prior to our sample period in 1990s (Didier & Schmukler, 2013). The primary source of data for this study is the Economic Outlook and the Prowess database compiled by the Centre for Monitoring Indian Economy. This database has been used in a number of recent studies on India (*e.g.* Syamala, Reddy, & Goyal, 2014; Wadhwa, Reddy, Goyal, & Mohamed, 2016; etc.), and is universally acknowledged as one of the most comprehensive and reliable source of data on Indian firms and economy by the academics and practitioners alike. Other macroeconomic variables are taken from Economic Outlook. In line with Kamara et al. (2008) and Karolyi et al. (2012) we use daily price impact measure of Amihud (2002) as liquidity proxy. Moreover for National Stock Exchange (*hereafter* NSE), India, Syamala et al. (2014) shows that the Amihud factor has a high correlation with bid-ask spreads, quoted depth, Roll spread and high-low spread estimator. Amihud (2002) is defined as follows:

$$Amihud_t = \frac{|Return_t|}{Volume_t} \tag{1}$$

where Amihud (2002) illiquidity measure on day t is calculated as the ratio of absolute return of a security on day t to the total traded volume of that security on day t. To construct Amihud (2002) measure, we use daily data for a period of 15 years from January 01st, 2001 to December 31st, 2015. Next we use the R^2 of regressions of the individual stock liquidity on market liquidity to compute monthly measures of CiL. We first perform the filtering regression for each stock J based on observations for each day d within each month t:

$$LIQ_{J,t,d} = \propto_{J,t} LIQ_{J,t,d-1} + \sum_{k=1}^{5} \beta_{J,t,k} Dum_k + \varepsilon_{J,t,d} \tag{2}$$

Here Dum_k is the day of the week dummy and we capture the estimated residuals $\varepsilon_{J,t,d}$to obtain monthly measures of CiL denoted by R^2_{liq} for each firm J by making use of R^2 from the following regressions which uses daily observations within a month:

$$\varepsilon_{J,t,d} = \alpha_{J,t} + \gamma_{J,t,1}\varepsilon_{M,t,d} + \gamma_{J,t,2}\varepsilon_{M,t,d-1} + \gamma_{J,t,3}\varepsilon_{M,t,d+1} + \vartheta_{J,t,d} \tag{3}$$

Here $\varepsilon_{M,t,d}$ is the sum total of estimated market residuals from Eq. (2) which is computed as market value-weighted mean of the residuals for all the firms in the sample excluding the firm in question (Chordia et al., 2000). Finally since our raw commonality measure (R^2_t) is not appropriate to use as a dependent variable in the regression analysis because its value ranges

between 0 and 1, therefore following Morck, Yeung, and Yu (2000) we apply a logistic transformation to our CiL measure – R_t^2:

$$LiqCom_t = Ln\left[\frac{R_t^2}{1-R_t^2}\right] \tag{4}$$

Here, $LiqCom_t$is the monthly CiL for all the stocks in the sample.

For our sample period, the total number of stocks traded on NSE is 1501. Following prior literature, we apply certain data filters for our equity dataset. We start by eliminating all the stocks with a price less than INR 10 in order to avoid any contaminating effect of tick size which brings our sample to 1496 firms (Chordia et al., 2000). Following Kamara et al. (2008), we delete all the stocks with less than 40 percent active trading days over our fifteen year sample period resulting in a sample size of 1404 firms. Finally by implementing the criteria established by NSEto discern illiquid stocks, we remove the firms with an average daily trading volume of less than 10,000 shares and 50 quarterly trades eventually bringing our final sample of up to 981 firms.

4. Results and empirical analysis

4.1. Descriptive statistics

4.1.1. Descriptive statistics

Table 1 shows the descriptive statistics of the monthly time-series parameters for all the dependent, control and explanatory variables used in this study. All the parameters are calculated on per firm, per month basis over fifteen year period, and in order to avoid exchange rate bias, following Giannikos and Gousgounis (2012) and other related India-specific studies, results in this study are reported in local currency numéraire *i.e.* Indian Rupee (INR).[2] The average number of firms in our sample is 822, the minimum number of firms is 660, and the maximum is 981. There is a variation in the number of firms from 2001 to 2015. Our statistical findings are quantitatively similar to some of the recent prominent studies in the literature.

The monthly mean (median) firm-level CiL is 0.23 (0.21) ranging between 0.16 and 0.60 with almost negligible variability of 0.06. The average monthly market return (volatility) over our 180 month sample period is 1.16% (6.28%) with a standard deviation of 7.58% (3.48%) and a range of 55.41% (19.15%). The mean (median) monthly market turnover is 81.54 (78.06) within a range of 13.99 and 213.89, thereby exhibiting high variation of 40.26. Next, average monthly Amihud market liquidity of 16.73×10^{-5} over our fifteen year sample period is approximately similar to the Amihud market liquidity of 16.79×10^{-5} reported in Amihud, Hameed, Kang, and Zhang (2015). The mean return of bank stocks listed on NSE is almost twice the mean market returns while the return for the brokerage firms is about 45% (3.72%/2.56%) higher than the bank stocks. The average (median) net investment by the FIIs over the sample period is 6.58% (6.74%), whereas the net mutual funds have a monthly investment rate of a negative 1.55% (1.07%).[3,4];

4.1.2. Annual Commonality in Liquidity

In the second part of descriptive statistics we analyze annual market-wide CiL for equity market between 2001 and 2015. We do this by regressing the percentage change in individual Amihud stock liquidity measure on the percentage change in market liquidity measure. The market liquidity measure is an equally-weighted[5] average liquidity of all the stocks in the market excluding the stock under examination in order to eliminate any cross-sectional dependence in the estimated coefficients (Chordia et al., 2000; Coughenour & Saad, 2004). For each year, we test for CiL using firm-by-firm time-series regression:

$$\begin{aligned} DLIQ_{J,t} = {} & \propto_J + \beta_{1,J} DLIQ_{M,t} + \beta_{2,J} DLIQ_{M,t+1} + \beta_{3,J} DLIQ_{M,t-1} + \delta_{1,J} Return_{M,t} + \delta_{2,J} Return_{M,t+1} + \delta_{3,J} Return_{M,t-1} \\ & + \delta_{4,J} Volatility_{j,t} + \varepsilon_{J,t} \end{aligned} \tag{5}$$

Here $DLIQ_{j,t} = (LIQ_{j,t} - LIQ_{j,t-1})/LIQ_{j,t-1}$ denotes the daily percentage change in Amihud (2002) liquidity factor used in the study on a given day t for a firm j. $DLIQ_{M,t}$is the concurrent change in the corresponding daily average market liquidity measure. In Eq. (5), one of the primary variables of our interest is the contemporaneous coefficient of $DLIQ_{M,t}$ (i.e.β_1).

The annual results for the presence of commonality are reported in Table 2. Here, the average annual contemporaneous coefficient is around 0.9 and significant at 1% level for all the fifteen years in our sample period. The percentage of firms with positive (and significant) beta coefficients varies from 76% (42%) to 88% (73%) with an overall annual average of 85% (63%) over the sample period. The average yearly sum of all liquidity coefficients ($\beta_1 + \beta_2 + \beta_3$)[6] is also positive and significant for

[2] For the ease of readers – the average monthly exchange rate over the sample period is INR 46.42 per US$ with a significant variation of 3.44 between INR 39.37 and INR 56.18 (results reported in table 1).

[3] In Appendix A1, we report the pairwise correlation between our key variables of interest.

[4] In Appendix A4, we report the basic time-series and cross sectional summary stats of the market capitalization of the firms, broker firms and banking firms used in this study.

[5] Following Brockman et al. (2009), although we report the coefficients constructed using equally-weighted average, we obtain qualitatively similar results on rerunning our analysis using value-weighted averages.

[6] concurrent+lead + lag.

Table 1
Reports the descriptive statistics for the monthly firm-level CiL (computed using Amihud factor), market – capitalization, return, volatility, turnover, Amihud liquidity, commercial paper spread, short-term 91 days t-bill interest rates, brokerage firms and banking stocks returns, exchange rate (INR to US$), net percentage of fund flow from foreign institutional investors, net percentage of fund flow from mutual funds and total exports used in this study using monthly data from Jan-2001 to Dec-2015.

Variable	Mean	Median	Std. Dev.	Min	5%	25%	75%	95%	Max	N
Liq Com (CiL)	0.23	0.21	0.06	0.16	0.17	0.19	0.25	0.34	0.60	180
Market Cap (INR Million)	28,957	31,244	13,978	6790	7714	16,213	40,941	47,134	55,723	180
Market Return (%)	1.16	1.53	7.58	−30.67	−10.61	−3.19	6.32	11.72	24.74	180
Market Volatility (%)	6.28	5.27	3.48	2.25	2.84	3.94	7.24	13.43	21.40	180
Market Turnover	81.54	78.06	40.26	13.99	21.27	54.48	106.23	154.09	213.89	180
Amihud Market Liquidity ($\times 10^{-5}$)	16.73	0.929	203.9	0.000	0.606	0.736	3.76	18.31	90.33	180
CP Spread (%)	3.81	3.10	2.10	0.89	1.20	2.09	5.39	7.07	11.68	180
Short-term Interest (%)	6.09	6.02	1.53	3.08	3.55	5.00	7.16	8.50	9.08	180
Broker Returns (%)	3.72	1.50	19.92	−36.40	−25.70	−7.10	11.40	33.30	90.10	180
Bank Returns (%)	2.56	2.30	10.15	−26.10	−12.60	−3.00	7.80	19.70	45.70	180
Exchange Rate (INR/$)	46.42	46.08	3.44	39.37	40.32	44.44	48.31	53.19	56.18	180
Net % FII Flow (%)	6.58	6.74	9.01	−13.44	−7.08	0.11	11.61	22.51	30.99	180
Net % MF Flow (%)	−1.55	−1.07	10.03	−32.82	−16.40	−6.86	4.07	13.99	30.92	180
Exports (INR Million)	58,775	49,609	36,718	14,573	17,212	26,983	79,170	130,290	142,170	180

Table 2
Reports annual market-wide CiL for actively traded stocks is estimated by regressing percentage change in the Amihud (2002) liquidity measure on the percentage change in equally-weighted market liquidity measure on a daily basis. Cross-sectional mean of the time-series slope coefficient (Concurrent beta) is reported in the Fama and Macbeth (1973) fashion with the corresponding t-statistic. Concurrent, lag, and lead refers to the same, previous and the next trading day market liquidity measure. Percentage positive (and significant) is the percentage of positive (and significant) slope co-efficient (at 5% level). For brevity, we report concurrent slope coefficient along with 'Sum' which represents the sum of concurrent, lag and lead coefficients.

Year	Concurrent beta	t-Stat for concurrent beta	Percentage positive	Percentage positive and significant	Sum	t-Stat for sum
2001	0.721	14.086	76.16	42.14	0.570	5.12***
2002	0.797	5.855	79.88	45.95	0.886	4.25***
2003	0.998	7.597	85.12	60.43	1.256	3.03***
2004	0.856	7.334	86.16	72.91	0.932	5.93***
2005	1.005	11.251	87.40	70.50	0.788	5.77***
2006	0.946	44.256	86.22	66.31	0.953	24.35***
2007	0.966	44.743	87.69	69.79	0.956	23.16***
2008	0.956	66.881	87.47	72.80	0.945	39.75***
2009	0.811	10.413	85.15	66.77	0.546	4.30***
2010	0.995	36.020	87.46	70.96	0.994	24.29***
2011	0.952	56.902	86.39	58.18	0.930	33.11***
2012	0.919	28.132	87.40	54.73	0.870	22.49***
2013	0.920	24.110	84.32	61.13	0.873	22.27***
2014	0.924	33.020	85.28	59.44	0.844	25.22***
2015	0.899	28.740	84.18	56.83	0.862	27.28***

the Amihud daily liquidity parameter. This concedes that commonality is highly pervasive in the context of emerging order-driven equity market (Syamala et al., 2014).

4.2. Cross-sectional determinants of commonality in liquidity

To start with multivariate analysis, in Table 3, following Cai, Cheung, and Zhang (2009) we examine the cross-sectional determinants of CiL. We consider five firm-level factors for our analysis; monthly stock price, market capitalization, stock return, volatility and stock liquidity. Results in Table 3 (models 1 and 6), show that the stock price is positively related to CiL. This shows that the low-priced stocks behave differently from stocks whose price is around the mean price of the exchange. High priced stocks may be traded in small lots to reduce the transaction costs. Hence, CiL is higher for high priced stocks. From Table 3 (model 5, 6) we can see that again there is a positive relation between CiL and stock liquidity. It may happen that a firm with high levels of liquidity may be insulated from the market-related factors. In this case the changes in market liquidity may not impact the change in the firm liquidity. So, we see that a firm's own liquidity level is a one of the cross-sectional determinants of CiL.

Table 3 (Model 6) shows that market cap (proxy for size) has a positive and significant effect on CiL. There exists a size effect in commonality since the stock price and market cap has a significant positive effect on CiL (Chordia et al., 2000). Unlike the popular literature on the effect of market volatility on firm-specific CiL, we find a marginal negative effect of firm-specific volatility (−0.002, t-stat = −1.77 in model 4), but the effect dissipates in a fully parameterized model.

Table 3
Reports the cross-sectional determinants of liquidity for 981 actively traded stocks listed on NSE, India from Jan-2001 to Dec-2015 (180 months). Monthly CiL of each stock is regressed on mean monthly firm-level characteristics – stock price (Ln_Price), market capitalization (Ln_Mcap), stock return (Monthly_Return), stock return volatility (Volatility) and stock liquidity (Stk_Liq). We use the natural logarithm of the firm-specific proxy variables denoted by 'Ln_'. We control for the industry as well as time fixed effects. We estimate monthly Fama and Macbeth (1973) regressions and the time-series mean of cross-sectional slope coefficients are reported with Newey-West corrected t-statistics in the parenthesis. *, **, *** indicate significance at 10%, 5%, and 1% respectively.

Model	(1)	(2)	(3)	(4)	(5)	(6)
Ln_Price	0.003** (2.27)					0.008*** (5.09)
Ln_Mcap		0.001 (0.34)				0.004** (2.50)
Monthly_Return			−0.001 (−0.31)			−0.31 (−1.12)
Volatility				−0.002* (−1.77)		0.0002 (0.31)
Stk_Liq					0.01* (1.71)	0.001*** (2.64)
Constant	0.216*** (40.13)	0.198*** (20.43)	0.201*** (60.12)	0.202*** (71.99)	0.210*** (60.59)	0.202*** (22.26)
Adj. R-squared	0.12	0.08	0.03	0.11	0.10	0.17
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
N	981	981	981	981	981	981

4.3. Supply-side determinants of commonality in liquidity

Current and the following sub-section explores another important question: is the presence of CiL among the firms in the emerging markets which exhibit a higher susceptibility to liquidity risk is driven by the co-variation in supply of liquidity by the market-makers or rather affected by the demand for liquidity initiated by corroborative trading by the investors. To start with, we follow the empirical model proposed by Karolyi et al. (2012) to study the time-series pattern of supply-side sources of CiL. Monthly CiL (*LiqCom*) at firm-level is estimated using the technique outlined in Section 3 earlier. Time-series model used to analyze the supply-side determinants of liquidity are:

$$LiqCom_t = \alpha_t + \beta_1 S\_Int_t + \beta_2 CP\,Spread_t + \beta_3 Broker\,Returns_t + \beta_4 Bank\,Returns_t + \beta_5 Return_{M,t} + \beta_6 Liq_{M,t} + \beta_7 Volatility_{M,t} + \beta_8 Turnover_{M,t} + \varepsilon_t \quad (6)$$

where *S_Int* is the 91-days short-term t-bill interest rate while *CP Spread* is the promissory note commercial paper spread and *Broker* and *Bank Returns* is the equally-weighted average monthly return for the brokerage firms and banking stocks listed on NSE respectively. The above four variables serves as a proxy for the supply-side sources of CiL. Other variables are control variables.

Tables 4a and b provides the regression results for Eq. (6). In Table 4a panel A, we present the results for the market-wide control variables (model 1) and supply-side factors (model 2–7) for the full sample. Across all the models (from 1 to 7), market volatility and turnover has a significantly positive impact while average monthly returns has a negative (and significant in few model specifications) impact on firm-level commonality. Models 2–5 report the results for individualistic influence of the supply-side sources on commonality. Unlike the findings in extant literature (Karolyi et al., 2012), we find strong evidence in support for short-term interest rates and commercial paper spread, though significant at 10% level as a determinant of CiL in emerging market set-up. A possible explanation for these results is that an increase in interest rates and promissory note spread decreases supply of limit orders and hence reduces the trading activity leading to a decrease in commonality. However, the results have to be interpreted with caution. Next, unlike the prior findings, we disseminate a significant positive effect of brokerage firm returns and banking stocks on CiL. It is perhaps not surprising to see a significant influence of banking sector on firm-level liquidity in Indian set-up since India is primarily a bank-based economy. Our findings for the treasury-bill rates, brokerage firms and banking stocks remain robust even when we include all the factors side-by-side (models 6 and 7).[7]

Panel B of Table 4b shows the portfolio-wise analysis for three size-based portfolios. None of the market-specific and supply-side sources succeed in explaining CiL among the smaller firms. When we look into medium-size firms, interest rates and financial sector provides a reasonable explanation for the supply-side sources of CIL. However, the commonality among the large firms is explained significantly by the returns of the market dealers; both brokerage firms and banks alike. Thus, it will not be wrong to conclude that in an emerging bank-based economy like India, financial institutes act as a key supplier of liquidity in the stock market.

4.4. Demand-side determinants of commonality in liquidity

In this section, we answer the second part of the question raised in the last sub-section *i.e.* the time-series behavior of demand-side determinants of CiL. Monthly commonality (*LiqCom*) for all stocks in the sample is estimated as described above in Section 3. Our monthly time-series regression model is given as:

[7] We find significantly high multi-collinearity of 0.647 between broker returns and bank returns (Appendix A1) and therefore we do not include them together in one single model simultaneously.

Table 4a
Panel A reports the monthly time-series regressions for supply-side determinants of CiL for 180 months. Equally-weighted CiL for all stocks in each month is estimated by using Amihud (2002) liquidity measure. The capital market factors affecting CiL are used as controls in the model. The supply-side factors used in the study are monthly short-term interest rates, commercial paper spread, brokerage firms' return and bank returns. 'N' is the number of months. The regression coefficients are reported along with the associated t-statistics in the parenthesis. *, **, *** indicate significance at 10%, 5%, and 1% respectively.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Capital Market Conditions							
Market Return	−0.280 (−0.90)	−0.419 (−1.31)	−0.434(−1.36)	−0.824** (−1.96)	−1.559*** (−2.83)	−1.037** (−2.41)	−1.688*** (−3.05)
Market Liquidity	0.877 (0.61)	0.439 (0.30)	−0.221 (−0.14)	0.844 (0.59)	1.31 (0.93)	0.084 (0.06)	0.441 (0.29)
Market Volatility	0.267*** (4.76)	0.252*** (4.48)	0.250*** (4.45)	0.263*** (4.74)	0.277*** (5.07)	0.242*** (4.32)	0.256*** (4.61)
Market Turnover	0.001** (2.08)	0.001** (2.23)	0.002*** (2.73)	0.001** (2.05)	0.001* (1.70)	0.001** (2.23)	0.001** (2.06)
Supply-Side Factors							
Short-term Interest		−0.027* (−1.72)				−0.027* (−1.70)	−0.024 (−1.52)
CPSpread			−0.090* (−1.81)			−0.009 (−0.73)	−0.012 (−0.94)
Broker Returns				0.003* (1.89)		0.002* (1.81)	
Bank Returns					0.012*** (2.79)		0.011*** (2.58)
Constant	−0.163 (−0.58)	−0.076 (−0.27)	−0.215 (−0.76)	−0.179 (−0.64)	−0.096 (−0.35)	−0.113 (−0.40)	−0.051 (−0.18)
Adj. R-squared	0.236	0.247	0.25	0.25	0.272	0.264	0.282
F-Value	11.83***	10.19***	10.29***	10.36***	11.48***	8.13***	8.80***
N	180	180	180	180	180	180	180

Table 4b
Panel B reports the monthly time-series regressions for supply-side determinants of CiL for (180 months) for size-based portfolios. For detailed definition, construction, regression model and level of significance of the dependent, control and explanatory variables please refer to the notes in Tables 1 and 4a panel A above.

Model	Small	Small	Medium	Medium	Large	Large
Capital Market Conditions						
Market Return	−0.091 (−1.58)	−0.019 (−0.42)	−0.090 (−1.33)	0.004 (0.90)	−0.123 (−1.23)	0.045 (0.55)
Market Liquidity	0.244 (1.52)	0.224 (1.40)	0.188 (0.99)	0.147 (0.77)	−0.470* (−1.67)	−0.550* (−1.92)
Market Volatility	−0.024 (−0.07)	−0.048 (−0.34)	1.213** (2.78)	1.131** (2.55)	3.526*** (5.46)	3.345*** (5.06)
Market Turnover	0.0001 (0.09)	0.0002 (0.28)	0.0003 (0.35)	0.0005 (0.54)	0.0002 (1.54)	0.0002 (1.59)
Supply-Side Factors						
Short-term Interest	−0.008 (−0.48)	−0.001 (−0.59)	−0.002 (−1.44)	−0.003* (1.68)	−0.002 (−0.99)	−0.004 (−1.34)
CPSpread	0.007 (0.58)	0.0005 (0.58)	0.003* (1.80)	0.003** (1.95)	0.0008 (0.32)	0.001 (0.59)
Broker Returns		−0.0001 (−1.0)		0.0003 (1.54)		0.0008*** (3.03)
Bank Returns	0.0004 (1.02)		0.0005** (2.77)		0.003*** (4.06)	
Constant	0.207*** (15.92)	0.208*** (16.05)	0.185*** (12.59)	0.187*** (12.54)	0.135*** (5.99)	0.140*** (6.06)
Adj. R-squared	0.03	0.027	0.155	0.122	0.33	0.296
F-Value	1.06	1.05	4.64***	3.77***	10.82***	9.35***
N	180	180	180	180	180	180

$$Liq\,Com_t = \alpha_t + \beta_1 NetFII_t + \beta_2 NetMF_t + \beta_3 Exchange\,Rate_t + \beta_4 Ln\_Exports_t + \beta_5 Return_{M,t} + \beta_6 Liq_{M,t} + \beta_7 Volatility_{M,t} + \beta_8 Turnover_{M,t} + \varepsilon_t \quad (7)$$

Here *NetFII* is the net monthly investment undertaken by the FIIs and estimated as (Net buy/ (buy + sell/2)). *NetMF* is net investment made by the mutual funds in a month; calculated in vein with *NetFII* above. *Exchange Rate* is calculated using Karolyi et al. (2012). We use monthly percentage return in the value of India's currency relative to SDR given by IMF, where SDR is the *Special Drawing Right*, and is computed from major basket of World currencies used as a single unit. A positive exchange rate implies a depreciation of the currency with respect to SDR and vice versa. India adopted a floating rate system in 1993 and to overcome this, we follow the methodology given by Karolyi et al. (2012). *Ln_Exports* is the natural logarithm of total monthly exports. These four parameters serve as a proxy for demand-side explanation of CiL.

Table 5a Panel A, models 2–5 shows the impact of each of the demand-side determinant on CiL one-at-a-time. Out of the two investment measures, only the correlated trading undertaken by the FIIs (model 2) has a marginal positive effect on commonality whilst mutual funds (model 3 and 7) fail to exert any impact on liquidity. These findings are substantially contradictory to Karolyi et al. (2012) and Koch et al. (2016). We also hypothesize that since the emerging markets are prone to exchange rate fluctuations, foreign investors are likely to exit the market when the domestic currency depreciates leading to an increased CiL for investors in general. Our results are different compared to Karolyi et al. (2012) as they show a negative impact on commonality, but we show a positive impact of exchange rate on commonality. However, their study is multi-country study performed over a different time period. Nevertheless, a decline in domestic currency can increase

Table 5a
Panel A reports the monthly time-series regressions of demand-side determinants of CiL for 180 months data. Equally-weighted CiL for all stocks in each month is estimated by using Amihud (2002) liquidity measure. The demand-side factors used in the study are monthly net percentage of fund flow from FIIS, MFs, exchange rate, and log of total exports. 'N' is the number of months. The regression coefficients are reported along with the associated t-statistics in the parenthesis. *, **, *** indicate significance at 10%, 5%, and 1% respectively.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Capital Market Conditions							
Market Return	−0.280 (−0.90)	−0.478 (−1.35)	−0.273 (−0.87)	−0.279 (−0.90)	−0.575* (−1.82)	−0.740** (−2.36)	−0.756** (−2.19)
Market Liquidity	0.877 (0.61)	0.812 (0.572)	0.695 (0.42)	1.073 (0.71)	1.46 (1.05)	3.244** (2.14)	2.898* (1.67)
Market Volatility	0.267*** (4.76)	0.283*** (4.91)	0.261*** (4.34)	0.271*** (4.74)	0.225*** (4.05)	0.238*** (4.35)	0.232*** (3.93)
Market Turnover	0.001** (2.08)	0.001** (2.32)	0.001** (2.08)	0.001** (2.09)	0.003*** (3.52)	0.003*** (4.37)	0.003*** (4.32)
Demand-Side Factors							
Net % FII Flow		0.374* (1.75)					0.066 (1.02)
Net % MF Flow			0.064 (0.23)				0.119 (0.41)
Exchange Rate				0.003 (0.43)		0.023** (2.76)	0.023*** (2.73)
Ln_Exports					−0.147*** (−3.15)	−0.234*** (−4.22)	−0.231*** (−3.95)
Constant	−0.163 (−0.58)	−0.117 (−0.41)	−0.189 (−0.62)	−0.288 (−0.71)	1.144** (2.30)	1.001** (2.05)	0.923* (1.75)
Adj. R-squared	0.236	0.238	0.230	0.231	0.283	0.316	0.307
F-Value	11.83***	11.92***	9.41***	9.44***	11.06***	11.81***	8.76***
N	180	180	180	180	180	180	180

Table 5b
panel B reports the monthly time-series regressions for demand-side determinants of CiL for 180 months for size-based portfolios. For detailed definition, construction, regression model and level of significance of the dependent, control and explanatory variables please refer to the notes in Tables 1 and 5a panel A above.

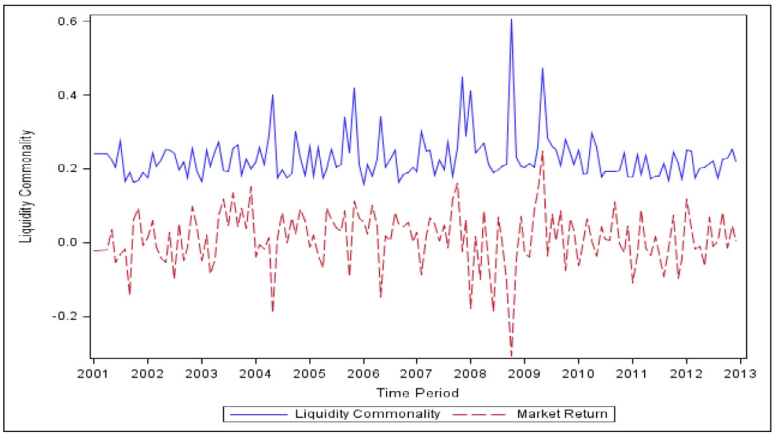
Model	Small	Medium	Large
Capital Market Conditions			
Market Return	−0.068* (−1.84)	0.139 (0.29)	0.127* (1.75)
Market Liquidity	0.235 (1.24)	0.257 (1.13)	−0.341 (−1.01)
Market Volatility	0.021 (1.11)	1.183** (2.48)	3.509*** (4.91)
Market Turnover	0.0001 (1.03)	0.0002** (2.37)	0.0005*** (2.97)
Demand-Side Factors			
Net % FII Flow	0.019 (0.53)	0.027 (0.61)	0.082 (1.21)
Net % MF Flow	0.004 (0.13)	0.004 (0.13)	0.038 (0.67)
Exchange Rate	0.0001 (0.88)	0.002** (2.22)	0.004** (2.41)
Ln_Exports	−0.005 (−1.05)	−0.011 (−1.46)	−0.017** (−1.99)
Constant	0.258*** (4.61)	0.163** (2.42)	0.098 (0.97)
Adj. R-squared	0.009	0.107	0.277
F-Value	1.02	3.10**	7.72***
N	180	180	180

the affordability of the foreign investors for finished goods and services due to increased purchase power parity resulting in elevated exports. Thus the level of domestic exports should have a negative relation with CiL. The results in panel A of Table 5a, validates our hypothesis whereby both exchange rate and domestic exports are significant in their own right. We also undertake the minute analysis of the demand-side proxies based on the firm's market capitalization by dividing them into three categories. We again find the size effect prevalent in our empirics (Panel B, Table 5b).

5. Market movement and commonality in liquidity

In this sub-section we observe the CiL pattern due to change in overall market returns, especially due to substantially large downward movement. We start by scanning the interesting relationship between CiL and market returns overtime graphically. As shown in Fig. 1A, commonality increases at the time of financial crises or states of large negative returns. Some of the significant spikes with respect to commonality are observed in May 2004, December 2006, around end of 2007 and beginning of 2008, September 2008 and February 2009. As evident in the graph, except for a relatively high commonality witnessed in February 2009, all the other instances are accompanied by a significantly large decline in market returns ranging between negative 10% and 25%. Across Fig. 1B–D, we divide our sample based on market value of the firm overtime. While on one hand we observe a decline in fluctuations of commonality as firm size increases, the overall

Panel A - Monthly time-series of CiL(Liq Com) and market returns for all the firms



Panel B - Monthly time-series of CiL(Liq Com) and market returns for small-cap firms

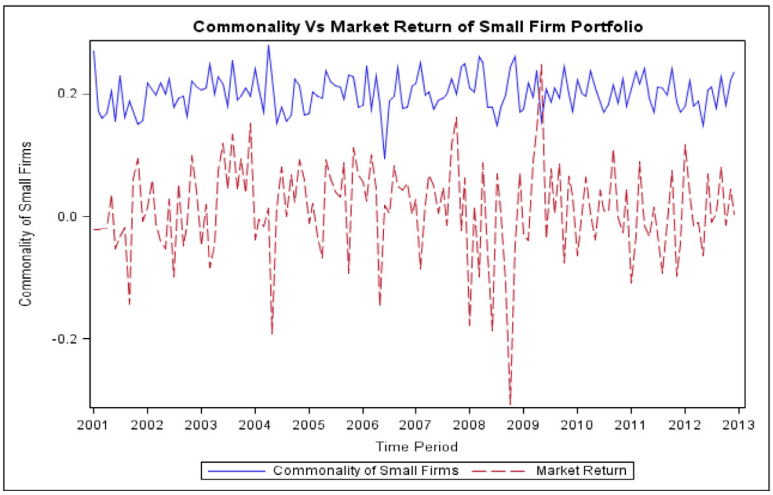


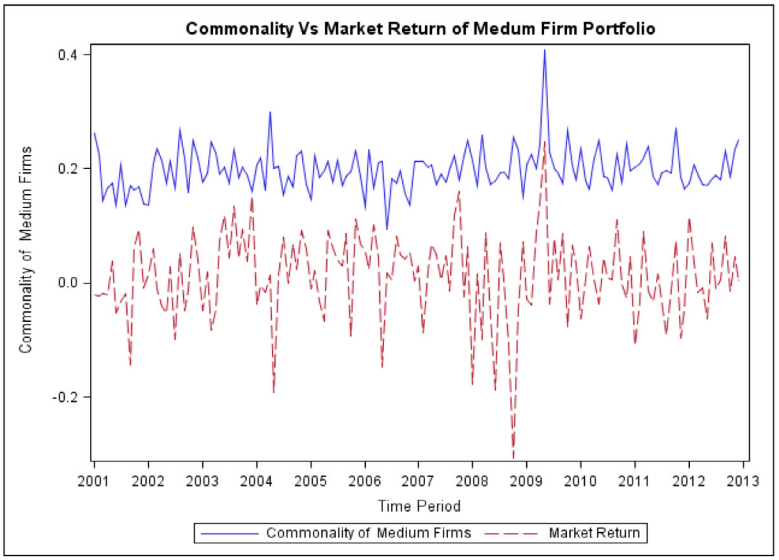
Fig. 1. This figure depicts the time-series variation of CiL (Liq Com) and market returns for 981 actively traded stocks listed on NSE, India from Jan-2001 to Dec-2015 (180 months). We use the Amihud (2002) price-volume ratio as the liquidity proxy and employ the methodology outlined across Eqs. (2)(4) for the analysis and estimation of average CiL. Panel A reports the monthly time-series of CiL and market returns for all the firms, Panel B reports the monthly time-series of CiL and market returns for small-cap firms, Panel C reports the monthly time-series of CiL and market returns for medium-size firms and Panel D reports the monthly time-series of CiL and market returns for large-cap firms. The data graph is shown only up to 2013 to save the space.

magnitude of CiL increases with the value of the firm whereby the pattern observed for the overall market is exactly the same for large firm portfolios as shown in Fig. 1D.

The schedules we observe in Fig. 1 (panels A–D) can also just be an indication of statistical noise in our Amihud factor. Therefore to prove our thesis, we regress monthly commonality proxy on the market returns, while simultaneously accounting for the return volatility. The preliminary results in model1 of Table 6 for market return and volatility are consistent with our prior findings for the supply- and demand-side setting. Interestingly our exogenous control for the supply of liquidity *i.e.* the volatility of the banking stocks gives us a theoretically consistent coefficient (4.33, t-stat = 3.28). Next, in order to manifest our conjecture of increased commonality during periods of flight-to-quality, we decipher the market returns into significant up and down movements following Rösch and Kaserer (2013) classification. From model 2 of Table 6, it can be perceived that in the state of large negative market returns there is a significant decline in firm-level liquidity (−3.312, t-stat = −2.34).

In Appendix A2, we split our sample based on size and individually test the three models discussed in Table 6.We find that the effect of market contraction increases monotonically on CiL, both in terms of magnitude and significance with respect to firm-size, hence corroborating with our initial findings in Fig. 1.

Panel C - Monthly time-series of CiL(LiqCom) and market returns for mid-cap firms



Panel D - Monthly time-series of CiL(Liq Com) and market returns for large-cap firms

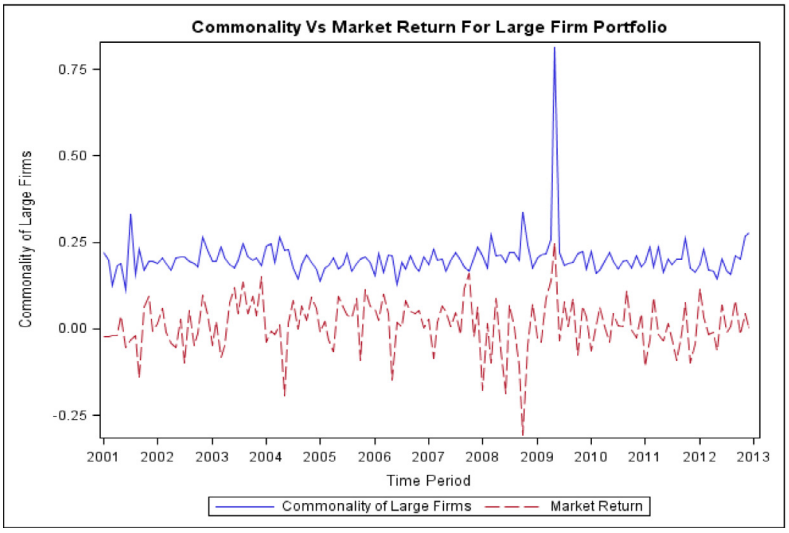


Fig. 1 (*continued*)

To further test the significance of our CiL estimates, we also perform the analysis using Zeros liquidity measure of Lesmond, Ogden, and Trzcinka (1999). We compute CiL similar to Amihud measure as described in the text. The average CiL estimated using Zeros liquidity measure is 18.4% and the average Zeros measure on a monthly basis is 0.334, which is consistent with Fong, Holden, and Trzcinka (2017).[8] The results of the analysis are given in Appendix A3.1 and Appendix A3.2.

6. Summary and conclusion

Recent studies have established the ubiquitous existence of CiL under different market settings – order- and quote-driven market, market- and bank-based economies and emerging and developed countries alike. The obvious next chapter of this

[8] Due to space constraints, we don't report these results and can be obtained on request from the authors. All the computational results are qualitatively similar with those reported for Amihud CiL analysis.

Table 6
Reports the relation between CiL and market returns for 981 actively traded stocks listed on NSE, India for the period Jan-2001–Dec-2015 (180 months). Down * Market Return (Up * Market Return) is an interaction dummy variable which takes the value of one if the market returns in a given month is at least 1.5 standard deviations below (above) the overall monthly mean market return (for 180 months) or zero otherwise. Bank Return Volatility is the monthly standard deviation of daily returns of the bank stocks. 'N' is the number of months. The regression coefficients are reported along with the associated t-statistics in the parenthesis. *, **, *** indicate significance at 10%, 5%, and 1% respectively.

Model	(1)	(2)	(3)
Market Return	−0.32	1.370*	1.178
	(−1.08)	(1.71)	(1.33)
Return Volatility	0.21***	0.196***	0.204***
	(3.94)	(3.49)	(3.62)
Down * Market Return		−3.31**	
		(−2.34)	
Up * Market Return			−0.151*
			(−1.80)
Bank Return Volatility	4.333**	1.465	2.818*
	(3.28)	(0.82)	(1.81)
CP Spread	−0.07	−0.072	−0.071
	(−0.570)	(−0.62)	(−0.66)
Short-term Interest	−0.011	−0.013	−0.011
	(−0.86)	(−0.89)	(−0.91)
Exchange Rate	0.011	0.013	0.013
	(1.44)	(1.47)	(1.48)
Constant	−0.312	−0.463	−0.381
	(−1.29)	(−1.79)	(−1.50)
Adj. R-squared	0.253	0.275	0.267
F – Value	16.63***	14.44***	13.51***
N	180	180	180

research schedule is to discern the determinants of commonality. We contribute to the rapidly growing literature on liquidity issues by examining the role of different macro-economic factors regulated by the Reserve Bank, role of the financial institutes, firm-specific characteristics, and influence of the market movement and the trading behavior of specialist firms with respect to the Indian equity market.

Our results collectively indicate strong role of government regulated policies and financial institutes as the key source of liquidity in the market. More importantly, unlike the findings for any developed market (Karolyi et al., 2012 and Koch et al., 2016); demand for liquidity in emerging markets is determined by the general performance of the economy rather than the correlated trading activity by the institutional investors. We also document a significant size and illiquidity impact on dictating the commonality, while strikingly; there is a diminished evidence of liquidity risk for volatile firms. Next, we institute that firm-level liquidity is highly correlated with the market-wide volatility and flight-to-liquidity phenomenon arises when there is a funding scare among the market participants during the times of the financial distress. Therefore our findings are in vein with the idea that liquidity spirals play an important role, more during the bear than bull market.

Our findings contribute to the literature in several ways. To the best of our knowledge, this is the first paper to study an array of determinants of CiL for an order-driven emerging market. Besides finding comparable results under specific market settings, we can easily conclude that the factors that act as a key supplier of liquidity or the trading activity that demands considerable amount of liquidity in the developed markets do not generically apply to the emerging markets since the later experience a significant amount of time-to-time regulatory intervention owing to the fact that the two markets have a completely diverse investor base, modus operandi and investor outlook. The results of this study also have a direct effect on monetary aspects and how market-wide liquidity shocks impact different types of asset classes. The results of our study are important for individual investors as well as portfolio managers since they expect higher return for holding securities with considerable liquidity risk.

A productive future research venue would be to examine how and why the CiL varies among the firms with different investor base – firms with a relatively high proportion of block ownership, family and/or management run firms, internationally cross listed firms in more than one exchanges, commonality of relatively newly listed firms compared to mature firms within a same industry to name a few.

Appendix

Appendix A1

Reports the pair-wise time-series correlation matrix between the logistic transformation of monthly CiL and the time-series supply- and demand-side factors, control variables for up to 981 actively traded stocks listed on NSE, India and an array of monthly economic parameters from Jan-2001 to Dec-2015.

Variable	Liq Com	Market Return	Market Volatility	Market Cap	Market Turnover	Market Liquidity	CP Spread	Short-term Interest	Broker Returns	Bank Returns	Exchange Rate	Exports	Net % FII Flow
Liq Com	1												
Market Return	−0.217***	1											
Market Volatility	0.548***	−0.36***	1										
Market Cap	0.051	0.055	−0.041	1									
Market Turnover	0.297***	0.140*	0.202**	0.79***	1								
Market Liquidity	−0.087	−0.171**	0.133	−0.58***	−0.56***	1							
CP Spread	0.057*	−0.141*	0.118	0.54***	0.425***	0.01	1						
Short-term Interest	−0.124*	−0.215**	−0.023	0.26***	−0.083	0.179	0.222***	1					
Broker Returns	−0.006**	0.654***	−0.228**	0.01	0.12	−0.135**	−0.171**	−0.171**	1				
Bank Returns	−0.047*	0.818***	−0.3***	0.00	0.15*	−0.123**	−0.099	−0.208**	0.647**	1			
Exchange Rate	−0.109	−0.009	−0.13	−0.14*	−0.275***	0.352	0.336***	0.159*	−0.049	0.03	1		
Exports	−0.082***	−0.067	−0.08	0.79***	0.46***	−0.299	0.683***	0.498***	−0.111	−0.096	0.362***	1	
Net % FII Flow	−0.155**	0.545**	−0.397***	−0.13	−0.045	−0.102***	−0.143*	−0.25***	0.307***	0.561***	0.04	−0.16*	1
Net % MF Flow	0.209	−0.148*	0.265**	0.13	0.207**	−0.413***	−0.117	−0.087	0.022	−0.151*	−0.333***	0.00	−0.35***

Appendix A2

Reports the relation between CiL and market returns for three size-based portfolios of stocks. Market Return is the monthly equally-weighted average return of all the stocks in the sample. Return Volatility is the monthly standard deviation of daily market returns. Down * Market Return (Up * Market Return) is an interaction dummy variable which takes the value of one if the market returns in a given month is at least 1.5 standard deviations below (above) the overall monthly mean market return (for 180 months) or zero otherwise. Bank Return Volatility is the monthly standard deviation of daily returns of the bank stocks. 'N' is the number of months.

Model	Small	Small	Small	Medium	Medium	Medium	Large	Large	Large
Market Return	−0.033	0.044	−0.069	0.027	0.249***	−0.178**	0.085	0.607***	0.165
	(−1.05)	(0.74)	(−1.39)	(0.68)	(3.39)	(−2.55)	(1.26)	(5.31)	(1.61)
Return Volatility	−0.041	−0.053	−0.034	0.583	0.549 (1.34)	0.522 (1.35)	1.547**	1.467**	1.530**
	(−0.13)	(−0.16)	(−0.10)	(1.38)			(2.23)	(2.32)	(2.21)
Down * Market Return		−0.150			−0.428***			−1.008***	
		(−1.53)			(−3.55)			(−5.37)	
Up * Market Return			0.007			0.312**			−0.016
			(0.94)			(2.43)			(−1.02)
Bank Return Volatility	0.020	0.021	0.023	0.053	0.055* (1.79)	0.043*	0.019**	0.113**	0.102*
	(0.79)	(0.81)	(0.90)	(1.63)		(1.73)	(2.06)	(2.35)	(1.91)
Constant	0.201***	0.197***	0.197***	0.188***	0.175***	0.174***	0.179***	0.150***	0.188***
	(36.79)	(32.20)	(28.40)	(27.13)	(23.35)	(24.11)	(15.76)	(12.94)	(13.05)
Observations	180	180	180	180	180	180	180	180	180
Adjusted R-Sq	0.0008	0.0014	0.0009	0.007	0.084	0.08	0.038	0.202	0.039
F-Value	0.61	1.05	0.68	1.34	4.25***	4.25***	2.89**	9.87***	2.43**

Appendix A3.1

Supply-side determinants of liquidity uisng zeros measure of liquidity. The monthly time-series regressions for supply-side determinants of CiL for 981 actively traded stocks listed on NSE, India for the period Jan-2001–Dec-2015 (180 months). Equally-weighted CiL for all stocks in each month is estimated by using Zeros liquidity measure (Lesmond et al., 1999). The capital market factors affecting CiL are used as controls in the model. The supply-side factors used in the study are monthly short-term interest rates, commercial paper spread, brokerage firms' return and bank returns. 'N' is the number of months. The regression coefficients are reported along with the associated t-statistics in the parenthesis. *, **, *** indicate significance at 10%, 5%, and 1% respectively. The average monthly CiL is 18.4% and the average monthly zeros is 0.334.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Capital Market Conditions							
Market Return	−0.280 (−0.83)	−0.719 (−1.55)	−0.634 (−1.36)	−0.824* (−1.96))			
−1.559*** (−3.72)		−1.012** (−2.31)		−1.210*** (−4.55)			
Market Liquidity	0.455 (0.11)	0.231 (1.10)	−0.442 (−0.54)	0.534 (0.77)	0.31	0.054	0.421
					(0.53)	(0.16)	(0.19)
Market Volatility	0.167*** (3.11)	0.142** (2.28)	0.148** (2.25)	0.360*** (2.74)			0.277***
							(4.23)
0.111*** (3.28)		0.297** (2.19)					
Market Turnover	0.002** (1.98)	0.000** (2.10)	0.002** (2.23)	0.001** (2.05)	0.001*	0.001*	0.002**
					(1.70)	(1.88)	(2.14)
Supply-Side Factors							
Short-term Interest Rate		−0.011 (−1.23)					−0.012
							(−1.41)
−0.024 (−1.52)							
CP Spread			−0.022* (−1.92)				−0.009
							(−0.73)
−0.012 (−0.94)							
Broker Returns				0.006** (2.22)		0.004**	
						(1.98)	
Bank Returns					0.01***		0.014***
					(3.36)		(2.58)
Constant	−0.130 (−0.68)	−0.011 (−0.89)	−0.125 (−0.66)	−0.119 (−0.64)			−0.196
							(−0.78)
−0.113 (−0.40)		−0.151 (−0.11)					
Adj. R-squared	0.191	0.198	0.211	0.221	0.23	0.224	0.232
F-Value	9.73***	9.11***	10.49***	8.31***			12.23***
7.22***		9.11***					
N	180	180	180	180	180	180	180

Appendix A3.2

Demand-side determinants of liquidity uisng zeros measure of liquidity. The monthly time-series regressions for demand-side determinants of CiL for 981 actively traded stocks listed on NSE, India for the period Jan-2001–Dec-2015 (180 months). Equally-weighted CiL for all stocks in each month is estimated by using Zeros liquidity measure (Lesmond et al., 1999). The capital market factors affecting CiL are used as controls in the model. The supply-side factors used in the study are monthly short-term interest rates, commercial paper spread, brokerage firms' return and bank returns. 'N' is the number of months. The regression coefficients are reported along with the associated t-statistics in the parenthesis. *, **, *** indicate significance at 10%, 5%, and 1% respectively. The average monthly CiL is 18.4 % and the average monthly zeros is 0.334.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Capital Market Conditions							
Market Return	−0.280 (−0.83)	−0.719 (−1.55)	−0.634 (−1.36)	−0.824* (−1.96))	−1.559*** (−3.72)	−1.012** (−2.31)	−1.210*** (−4.55)
Market Liquidity	0.455 (0.11)	0.231 (1.10)	−0.442 (−0.54)	0.534 (0.77)	0.31 (0.53)	0.054 (0.16)	0.421 (0.19)
Market Volatility	0.167*** (3.11)	0.142** (2.28)	0.148** (2.25)	0.360*** (2.74)	0.277*** (4.23)	0.111*** (3.28)	0.297** (2.19)
Market Turnover	0.002** (1.98)	0.000** (2.10)	0.002** (2.23)	0.001** (2.05)	0.001* (1.70)	0.001* (1.88)	0.002** (2.14)
Demand-Side Factors							
Short-term Interest Rate		−0.011 (−1.23)				−0.012 (−1.41)	−0.024 (−1.52)
CP Spread			−0.022* (−1.92)			−0.009 (−0.73)	−0.012 (−0.94)
Broker Returns				0.006** (2.22)		0.004* (1.98)	
Bank Returns					0.01*** (3.36)		0.014*** (2.58)
Constant	−0.130 (−0.68)	−0.012 (−0.89)	−0.125 (−0.66)	−0.119 (−0.64)	−0.196 (−0.78)	−0.113 (−0.40)	−0.151 (−0.11)
Adj. R-squared	0.191	0.192	0.211	0.221	0.23	0.224	0.232
F-Value	9.73***	10.19***	11.29***	11.36***	12.23***	7.22***	9.11***
N	180	180	180	180	180	180	180

Appendix A4.1

The table gives the descriptive statistics of market capitalization of sample firms used in this study in INR Millions.

Year	N	Mean	Std. Dev.	Median	Min	Max
2001	616	7,574.78	46,751.09	529.12	3.67	1,180,303.05
2002	677	98,66.46	71,528.38	688.83	4.82	2,135,090.43
2003	661	12,771.27	73,291.57	1,025.15	8.11	1,791,857.68
2004	711	16,572.23	73,206.95	1,603.89	7.49	1,696,587.75
2005	773	23,256.38	92,179.03	3,183.75	26.73	1,674,402.99
2006	782	31,579.16	122,609.37	4,081.37	1.94	1,869,898.54
2007	801	40,788.41	171,794.19	4,424.20	19.25	4,190,432.82
2008	822	34,866.45	156,744.65	3,058.79	13.50	3,800,564.27
2009	839	34,621.62	161,868.21	2,323.98	19.04	3,617,579.62
2010	891	47,450.89	193,381.96	3,992.31	24.80	3,587,349.06
2011	910	42,495.72	183,770.87	3,077.10	21.67	3,434,096.67
2012	935	40,720.85	179,052.62	2,772.43	20.35	2,710,484.23
2013	948	43,164.10	189,795.78	2,938.78	21.57	2,873,113.28
2014	966	44,385.73	195,167.36	3,021.95	22.18	2,954,427.81
2015	981	46,014.56	202,329.47	3,132.85	23.00	3,062,847.18

Appendix A4.2

The table gives the descriptive statistics of market capitalization of Brokerage firms used in this study in INR Millions.

Year	N	Mean	Std	Median	%MCap out of total Mcap
2001	41	235.07	1,008.65	23.07	1.09
2002	41	220.88	965.09	22.59	0.85
2003	41	423.26	1,956.66	22.35	1.24
2004	41	685.77	3,079.04	28.53	1.27
2005	42	1,980.41	9201.6	51.6	2.71
2006	44	1,984.86	8,699.52	57.88	1.91
2007	44	2,955.14	9,145.14	82.7	1.83
2008	44	2,030.08	8,701.08	77.19	1.40
2009	44	2,262.05	8,758.18	133.89	1.51
2010	44	2,291.12	8,703.22	142.62	1.01
2011	44	2,052.66	8,667.26	148.74	0.96
2012	44	2,166.58	8,690.97	118.09	1.01
2013	46	1,896.73	8,402.87	112.47	0.90
2014	47	2,110.22	8,325.10	99.07	1.00
2015	47	2,374.26	8,477.23	97.15	1.10

Appendix A4.3
The table gives the descriptive statistics of market capitalization of Banking firms used in this study in INR Millions.

Year	N	Mean	Std	Median	%MCap out of total Mcap
2001	45	8,532.83	19,116.84	2,549.57	5.18
2002	51	13,214.68	27,387.5–	4,542.51	7.82
2003	52	29,850.19	52,692.02	10,518.75	13.8
2004	53	42,313.12	68,391.36	17,450.96	12.64
2005	54	56,733.22	106,797.43	18,508.50	12.35
2006	56	73,189.46	154,931.47	19,623.25	10.94
2007	58	133,193.13	276,612.25	46,955.34	13.37
2008	58	69,839.85	148,417.54	16,790.40	7.83
2009	58	128,548.86	269,985.70	35,738.34	13.89
2010	60	170,135.51	343,775.78	44,395.14	12.65
2011	60	114,705.30	228,190.80	37,025.47	9.09
2012	60	179,657.74	364,101.99	61,612.86	14.21
2013	60	158,629.01	334,756.82	43,694.92	11.84
2014	60	263,687.28	554,754.45	69,469.31	19.14
2015	61	238,990.41	527,941.93	42,730.46	17.23

References

Amihud, Y. (2002). Illiquidity and stock returns: Cross-section and time-series effects. *Journal of Financial Markets, 5*, 31–56.
Amihud, Y., Hameed, A., Kang, W., & Zhang, W. (2015). The illiquidity premium: International evidence. *Journal of Financial Economics, 117*, 350–368.
Brockman, P., & Chung, D. Y. (2002). Commonality in liquidity: Evidence from an order-driven market structure. *The Journal of Financial Research, 25*, 521–539.
Brockman, P., Chung, D. Y., & Pérignon, C. (2009). Commonality in liquidity: A global perspective. *Journal of Financial and Quantitative Analysis, 44*, 851–882.
Brunnermeier, M. K., & Pedersen, L. H. (2009). Market liquidity and funding liquidity. *Review of Financial Studies, 22*, 2201–2238.
Cai, J., Cheung, Y. L., & Zhang, Z. (2009). Explaining country and cross-border liquidity commonality in international equity markets. *Journal of Futures Markets, 29*, 630–652.
Cao, M., & Wei, J. (2010). Option market liquidity: Commonality and other characteristics. *Journal of Financial Markets, 13*, 20–48.
Chordia, T., Roll, R. W., & Subrahmanyam, A. (2000). Commonality in liquidity. *Journal of Financial Economics, 56*, 3–28.
Coughenour, J. F., & Saad, M. M. (2004). Common market makers and commonality in liquidity. *Journal of Financial Economics, 73*(1), 37–69.
Didier, T., & Schmukler, S. L. (2013). The financing and growth of firms in China and India: Evidence from capital markets. *Journal of International Money and Finance, 39*, 111–137.
Domowitz, I., Hansch, O., & Wang, X. (2005). Liquidity commonality and return co-movement. *Journal of Financial Markets, 8*, 351–376.
Fama, E. F., & Macbeth, J. D. (1973). Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy, 81*, 607–636.
Fong, K., Holden, C., & Trzcinka, C. (2017). What are the best liquidity proxies for global research? *Review of Finance*. forthcoming.
Giannikos, C. I., & Gousgounis, E. (2012). Short sale constraints and dispersion of opinion: Evidence from the Indian equity market. *Financial Review, 47*, 115–143.
Harford, J., & Kaul, A. (2005). Correlated order flow: Pervasiveness, sources, and pricing effects. *Journal of Financial and Quantitative Analysis, 40*, 29–55.
Hasbrouck, J., & Seppi, D. J. (2001). Common factors in prices, order flows, and liquidity. *Journal of Financial Economics, 59*, 383–411.
Hughen, J. C., & McDonald, C. G. (2006). Does order flow commonality extend across trade sizes and securities? *Financial Management, 35*, 107–128.
Kamara, A., Lou, X., & Sadka, R. (2008). The divergence of liquidity commonality in the cross-section of stocks. *Journal of Financial Economics, 89*, 444–466.
Karolyi, G. A., Lee, K.-H., & van Dijk, M. A. (2012). Understanding commonality in liquidity around the world. *Journal of Financial Economics, 105*, 82–112.
Keynes, J. M. (1936). *The general theory of employment, interest and money*. London: Macmillan and Co., Ltd.
Koch, A., Ruenzi, S., & Starks, L. (2016). Commonality in liquidity: A demand-side explanation. *Review of Financial Studies, 29*, 1943–1974.
Lesmond, D. (2005). Liquidity of emerging markets. *Journal of Financial Economics, 77*, 411–452.
Lesmond, D., Ogden, J., & Trzcinka, C. (1999). A new estimate of transaction costs. *Review of Financial Studies, 12*, 1113–1141.
Marshall, B. R., Nguyen, N. H., & Visaltanachoti, N. (2013). Liquidity commonality in commodities. *Journal of Banking & Finance, 37*, 11–20.
Morck, R., Yeung, B., & Yu, W. (2000). The information content of stock markets : why do emerging markets have synchronous stock price movements? *The Journal of Financial Economics, 58*, 215–260.
Rösch, C. G., & Kaserer, C. (2013). Market liquidity in the financial crisis: the role of liquidity commonality and flight-to-liquidity. *Journal of Banking and Finance, 37*, 2284–2302.
Syamala, S. R., Reddy, V. N., & Goyal, A. (2014). Commonality in liquidity: An empirical examination of an emerging order-driven equity and derivatives market. *Journal of International Financial Markets, Institution & Money, 33*, 317–334.
Wadhwa, K., Reddy, V. N., Goyal, A., & Mohamed, A. (2016). IPOs and SEOs, real investments, and market timing: Emerging market evidence. *Journal of International Financial Markets, Institutions and Money, 45*, 21–41.