CHAPTER 2

LITERATURE REVIEW

Our study examines commonality in liquidity on the National Stock Exchange of India and identifies the sources that contribute to liquidity commonality. We present our literature in three sections. The first section discusses the commonality literature in the quote-driven and order driven markets. The second section presents the literature on commonality in liquidity for the derivatives markets and the global studies. The third section discusses the literature on determinants of liquidity commonality.

2.1 Commonality in Liquidity in Quote-driven Markets

Chordia, Roll and Subrahmanyam (2000) is the first paper to document commonality in liquidity. They bring a different direction to the existing research and argue that liquidity is not a phenomenon of an asset in isolation and show that there is a co-movement in liquidity measures across assets. They document liquidity commonality, techniques of measurement and also give some possible evidence regarding its sources. They use transactions and quotes (TAQ) data from NYSE for their study. The sample, after applying various filters consists of 1169 stocks over a period of 254 trading days for the year 1992. They calculate five liquidity measures; quoted spread, effective spread, proportional quoted spread and effective spread, and depth for each of the transactions on a trading day in the sample. Though they calculate the liquidity measures at the intraday level, they average intraday spreads on a daily basis to overcome the problems created due to intraday irregularities. They use market model time-series regressions for each stock. They regress the changes in liquidity variable of a stock on the changes in the market liquidity measure for each of the day in the sample period. The market liquidity measure is the sum of the liquidity of all stocks in the market except the stock under study. Along with the contemporaneous value of the market liquidity, the regression includes one lead and one lag term of market liquidity as independent variables. Contemporaneous, lead, and lag variables of market returns along with squared stock returns are a part of the regression as control variables. They report cross-sectional averages of time-series slope. About 30 to 35% of the stocks in the sample have their concurrent slopes positive and significant. But, the average adjusted R^2 is 1.7% which shows that each of the regressions have very less explanatory power. Overall, the results show that market liquidity significantly affects spreads and depths providing evidence for liquidity commonality. The test for detecting industry component of commonality also shows significant results. The evidence regarding size effect on commonality shows that large firms are more affected by commonality in liquidity compared to small firms. They explain that inventory effects and asymmetric information as the causes of commonality. **Though this study is seminal, it lacks in documenting the possible sources that cause commonality in liquidity in the stock market such as supply-side, demand-side, and macroeconomic sources of liquidity. The effects of market and industry are not examined separately. An industry may dominate the market which should be taken into account. In our examination of industry-wide commonality in liquidity, we exclude the industry liquidity from market liquidity and stock liquidity from the industry liquidity.**

Similar to CRS (2000), Huberman and Halka (2001) show evidence for the systematic component of liquidity or liquidity commonality and also the variables that are correlated with liquidity commonality. They select their sample from NYSE TAQ database for the year 1996. The sample size is 240 stocks and it is divided into two mutually exclusive subsets. Then these two mutually exclusive subsets are divided into 4 groups of 60 stocks each based on size. They calculate four liquidity proxies; bid-ask spread, spread to price ratio, quantity depth, and dollar depth for the analysis. To avoid time-of-the-day effect, they take the most recent bid and ask quotes along with the associated depth quotes before noon every day for all the stocks in the sample. To overcome the problem of auto-correlation, they examine only the cross-sectional correlations of the innovations in liquidity proxies by controlling the expected components. They extract the residuals from the time-series market model regressions of the average liquidity measure for each of the stocks in the size based groups. Then they examine whether these residuals are correlated within a group and conclude that there is a systematic component present in the liquidity proxies if the correlation is positive. The results show that the residuals are positively correlated with and without the inclusion of the explanatory variables. To find the determinants impacting liquidity co-movement, they consider several explanatory variables broadly related to inventory holding costs and adverse selection effect. The variables used in the regressions are returns, trading volume, volatility, and interest rates. The variable which proxy daily negative returns correlates negatively with spread proxies and positively correlates with the depth proxies. However, the results at the portfolio level are not the same. The volume variable does not correlate with the spread variables but correlates significantly with the depth variable. Volatility correlates negatively with the depth based measures and positively with the spread based proxies. **Though the authors could find significant relation between the liquidity proxies and explanatory variables, they could not explain the possible reasons for these relations. In our analysis we explain the possible reasons why a particular source impacts liquidity commonality.**

While CRS (2000) investigates cross-sectional co-movements in various liquidity measures using TAQ data, Hasbrouck and Seppi (2001) documents cross-sectional relationships for returns, order flows and liquidity. Their sample consists of 30 most actively traded Dow stocks for the year 1994. Unlike CRS (2000), they use liquidity measures computed at 15-minute intervals in the level form for the analysis. Principal component analysis and canonical correlation analysis is used to investigate commonality. They find significant common factors for quote based proxies of liquidity, and less significant factors for price impact measures of liquidity. They obtain these results even after controlling for time-of-the-day seasonality. But, the results show that common factors exist in each of the signed order flows and absolute order flows. The results for signed and absolute returns are significant at 10% level. They could not differentiate futures-induced positive feedback trading that arises because of arbitrage trading in indices. Overall, they could not find any significant results for commonality in liquidity as measured by first principal components of spread and other liquidity measures used in the study. They get similar results even for the cross-sectional regression tests where the coefficients from price impact measures are regressed on various independent variables.

While, the above papers provide satisfactory evidence regarding co-movement of liquidity in the time-series, Coughenour and Saad (2004) argue that liquidity co-variation can arise due to the fact that each of the major NYSE specialist firms supply liquidity for many stocks. As they share combined capital, profit and loss information and inventory, there are common adjustments to liquidity provision that take place. This means that the level of stock liquidity co-movement is directly proportional to the capital constraints faced by these NYSE firms. More specifically it relates to the idiosyncratic risk of the NYSE firms providing liquidity. Unlike CRS (2000) and Hasbrouck and Seppi (2001), they sample the intra-day liquidity proxies at three time periods of the day; morning, noon, and evening. The main hypothesis of this study is to test whether sharing the same market maker result in liquidity commonality in stocks. This hypothesis is specific to testing a supply-side co-movement in liquidity. By using NYSE TAQ and specialist directory files, the sample consists of 470 firms obtained out of the top 500 market capitalization firms. The initial methodology is the firm-by-firm time series market model regression like the previous studies but they adjust the intercept for intra-day variations in liquidity. The R^2 values are around 22% which are very much different from those of CRS (2000) which report low R^2 values of about 1%. They claim that these better results are possible because of their use of distinct aggregation periods for the sampling of the spreads. They repeat the analysis by using specialist firms' portfolio liquidity instead of market liquidity and also including both. The results from these analyses show that the liquidity of an individual stock is less susceptible to the variation in liquidity of the specialist firm portfolio. Hence, the liquidity of an individual stock is more susceptible to market portfolio than the specialist portfolio. They also find that the liquidity β of the specialist portfolios are slightly greater than those of individual firms. The tests for the relation between commonality and market returns show that commonality in liquidity of the specialist portfolio and market portfolio increase with an increase in negative market returns. **Though this paper is the first paper to show some evidence on the supply-side sources of liquidity commonality, they limit their research only to the NYSE specialist firms which is applicable only to quote driven markets.**

Kamara, Lou, and Sadka (2008) explain why liquidity commonality is different for different stocks on the same exchange. Their main hypothesis is that commonality in liquidity depends on the changes in institutional ownership of a firm over time. The main reason for this argument is that institutional investing and index trading have been increasing over time in the U.S. markets as well as other markets. Institutional investing and index trading are primarily concentrated in large cap stocks which lead to an increase in demand for their stocks and a decrease in demand for the small cap stocks. By considering CRSP data for all the common stocks during the period from December, 1963 to December, 2005 they construct Amihud (2002) price impact measure as a proxy for liquidity. On an average, the number of firms in each year is around 1,200 for the final analysis. Using market model time series regressions, they analyze the systematic liquidity of stocks specifically in the largest and smallest quintiles formed on the basis of market capitalization. The results show that large firms are more sensitive to market-wide liquidity movements compared to small firms in the sample period. Over this period, betas of small firms decrease and those of large firms increase. To analyze the sensitivity of aggregate liquidity shocks to institutional ownership in the cross-section and in time, they decompose the total institutional investors into different categories. For the cross-sectional examination, they regress the liquidity beta of each year on the institutional ownership in the previous year. The results show that the liquidity commonality is positively and significantly associated with institutional investing for all the size based portfolios. The coefficients are highest for the large portfolios and smallest for small portfolios. Also, commonality is different for different institutional investors. The investment by investment companies and investment advisors have more impact than the others.

Similar to Coughenour and Saad (2004) and Kamara, Lou, and Sadka (2008), Corwin and Lipson (2011) investigate the sources of liquidity commonality. They also analyze the common components in order flow and returns by taking different group of traders. They test for the significance of firm size and other firm characteristics that drive commonality in liquidity, order flow and returns. They use a unique dataset that contains all the electronic order flow data from November, 1997 to February, 1998 for a sample of 100 firms listed on NYSE. Their methodology is closely related to Hasbrouck and Seppi (2001) as they use principal component analysis to extract and analyze common factors in a way that they do not assign any special importance to the liquidity of the market portfolio. The results show that there are common factors in a number of variables related to order flow. The majority of about 86% is by program trading and the remaining 14% is due to the institutional trading. Further analysis shows that common factors in returns contribute about 8.4% to return variation for all the firms and all time periods. The commonality in order flow is different for different firm portfolios and investor sentiment does not contribute in explaining the return commonality. Common factors' contribution in explaining the co-variation in liquidity is very less. These common factors are significant for small firms than the large firms. The common order flow components are inversely proportional to the firm bid-ask spreads even after controlling for idiosyncratic factors for all types of traders.

Hameed, Kang, and Vishwanathan (2010) investigate the impact of periods of stock market declines on liquidity co-movement. Their study fills an important gap in the literature as to what happens to commonality in liquidity after a significant decline in the stock market. They also analyze the impact of returns from the market on the liquidity commonality. Specifically, they investigate the properties of liquidity betas during the times of negative market returns. They sample 1800 stocks from 1988 to 2003 from NYSE and by using intra-day data calculate proportional quoted spread as a proxy for liquidity. Similar to Kamara, Lou, and Sadka (2008), the liquidity betas increase from 0.56 to 0.87 during market declines. They find the largest of liquidity beta to be 0.95 during large market declines. To investigate the impact of returns on commonality, they use the R^2 measure to capture the commonality. The average R^2, measuring liquidity commonality has a value of 10.1% in periods of large negative returns in the market and a value of 7.4% in the periods when market returns are positive. Overall, the results show that liquidity commonality is strongest when the average stock prices decline deeply. To test whether there is any contagion effect in liquidity commonality, they examine if decline in stock prices from other industries affect the industry commonality component of a particular industry. They test this across 17 standard industries using the R^2 measure. They regress the R^2 measure on industry portfolio returns and the market portfolio returns on a monthly basis. The regression results reveal strong significance on the commonality in liquidity within an industry by the market returns. This is more prominent when the returns are negative. For the negative market returns, the regression coefficient is -1.995 at 5% significance level and it is -0.986 for the negative industry returns. These results provide satisfactory evidence to the argument that when the market returns are negative, the capital constraints from one industry spillover to the other industries leading to an increase in liquidity co-movement.

All the above studies document liquidity commonality in the context of quote-driven markets. Our study is different from these studies, as we examine the liquidity commonality of an order-driven emerging market.

2.2 Commonality in Liquidity in Order-driven Markets

Brockman and Chung (2002) are the first to document the commonality in liquidity on an order-driven market structure. In an order driven market, there is no compulsion for any market participant to submit limit orders. Any market participant is free to enter or exit the market at any point of time. Hence, it is quite different from the quote-driven market structure where there is a designated market maker supplying liquidity services. They collect data from the Stock Exchange of Hong Kong (SHEK) for 725 firms from May, 1996 to December, 1999 which include 250 million intra-day observations. They calculate the bid-ask measures and other variables at 30-second intervals throughout the trading day. They follow CRS (2000) and apply firm-by-firm time-series regression model in estimating liquidity betas which measure commonality. The regression model includes concurrent, lead, lag market liquidity along with the control variables contemporaneous, lead, lag market returns and volatility. The lead and lag terms are included in the model to avoid any discrepancies caused by non-synchronous trading. The average coefficient from the regressions is 0.187. About 26.1% of the firms have a positive and significant coefficient. 50.2% of the firms in the sample have the coefficient positive but insignificant. It is negative and insignificant for 2% of the firms. These results show that commonality in liquidity is present in the order-driven setting of SHEK market. Similar results are obtained for all of the liquidity proxies used in the study such as absolute spread, relative spread, and depth. To analyze the size effects, they divide the sample into quintile portfolios and repeat the same analysis. For the quintile portfolios, the commonality is less for large firms when spread measures are used. These results are in contrast to the quote-driven setting. However, for the depth measures, the largest quintile portfolios are more sensitive to commonality. When they test for industry-specific commonality component, only 6.6% of the firms are positively significant for the spread measures and 26.1% of the firms are significant and positive for the depth measures. Overall, depth measures exhibit significant industry component of commonality. They test for asymmetric information as a source of commonality by considering number of trades rather than trade size for order flow commonality. In this case, the coefficient is positive and significant for 30.4% of the firms at the market level and 22% of the firms at the industry level. So, there is a common component in asymmetric information causing commonality in liquidity at both market and industry levels. **Although they could document commonality in liquidity more significantly with depth based measures, they could not get the same results for the spread based measures.**

Fabre and Frino (2004) study investigates liquidity commonality in a developed order driven market. The Australian Stock Exchange (ASX) is a pure order-driven market where only limit orders are allowed and no designated market maker is present. By taking intraday quotes and trades data of 660 stocks for the year 2000, this study does a similar analysis of commonality in liquidity as in quote-driven markets. For each of the transaction, they calculate four liquidity proxies. They are quoted bid-ask spread, percentage bid-ask spread, dollar depth, and depth in number of shares. By using the standard firm-by-firm market model regressions, the examination of market-wide commonality results show an average concurrent slope of 0.123 and 0.089 for the two spread measures. Only, 2 to 3% of the firms have a positive and significant slope coefficient at the 5% level of significance. The depth measures of liquidity also show similar kind of results. The average concurrent coefficients are 0.103 and 0.198 for shares depth and dollar depth respectively. Nearly, 31% of the firms have positive significant coefficients. Overall, the stocks show a weaker evidence of commonality on the ASX. The investigation of size effect by dividing the sample into sizes quintiles based on the market capitalization show statistical significance for coefficients in all quintiles. These coefficients are directly proportional to the firm size. But, just the largest quintile shows a significant commonality in liquidity for all the four liquidity proxies. In all, the evidence of liquidity commonality is very low on the ASX compared to other studies.

Fabre and Frino (2004) examine commonality in liquidity on the ASX market and show that it is not pervasive on the ASX. But, Domowitz, Hansch, and Wang (2005) go beyond providing evidence for liquidity commonality on ASX. They examine the causes for liquidity commonality and evaluate the implications of co-movement in liquidity on asset pricing. Specifically, they show a linkage between return co-movement and liquidity co-movement. They differ with the previous literature in terms of liquidity measurement and proxy it as a function of demand and supply phenomena. They argue that order type rather than order size determines the change in liquidity. According to them, the size of the order quantifies the magnitude of change in liquidity but not the direction and order type infers whether liquidity increase or decrease. This argument is also an empirical outcome of Hasbrouck and Seppi (2001). They use simulation techniques to explain that order flow co-movement can explain return co-movement and not liquidity commonality. They consider 19 out of the 20 stocks of the ASX-20 index for their study from March 2000 to December 2000. They construct the order book by collecting data on various variables from the ASX order book entry files. They conduct two models of regression analyses. First model is for co-movement in returns on co-movement in order type and also co-movement in order-flow. The second model is for co-movement in liquidity on co-movements in order-type and co-movements in order-flow. The regression results of model one show that order-flow co-movements explain return co-movements more significantly than the order-type co-movements. The second model shows that order-type co-movements explain liquidity co-movements significantly than the order-flow co-movements. The evidence on asymmetric information in extreme down market states reveals that liquidity commonality arises when there is a common deterioration of prices. Overall, the results signify that return co-movement and liquidity co-movement do not come from the same underlying sources.

Kempf and Mayston (2008) study the liquidity commonality of an order-driven market beyond that of best prices. It is important to understand liquidity commonality beyond best prices because in an order driven market generally small orders execute at the inside spread. When a large order arrives beyond the available depth, then the order moves up the order book till it gets filled resulting in a higher cost of execution. The sample for the study consists of the DAX-30[1] stocks listed on the Frankfurt stock exchange which is an open limit order book market for the period January 2004 to March 2004. Similar to Hasbrouck and Seppi (2001), they standardize the liquidity measure using time-specific mean and standard deviation to capture the unexpected risk. For comparison purposes, they first examine the liquidity commonality as in previous studies using market model time-series regressions. The beta is significant for 29 out of 30 stocks in the sample for the bid-ask spread as a liquidity proxy. They get an average beta value of 0.5668 with high significance. For the depth measure, 23 stocks have a positive and significant coefficient with an average coefficient value of 0.3672. For examining commonality beyond best prices, they consider price impact measure beyond the inside spread. For the ask (bid) side, they measure it as the marginal price of an order at a given volume subtracted from the best ask (bid) and then divide by the corresponding volume. They perform the commonality in liquidity analysis separately for ask and the bid price impact measures. For the price impact measure at the median level, the average coefficient is 0.5 for both the sides and significant for almost all the stocks in the sample. Liquidity commonality increases as they examine deep into the order book. It increases from 3.71% for the median depth to nearly 10% for the largest depths. This signifies that large investors have a problem in diversifying the liquidity risk.

Even though our study is similar to the above order-driven markets, NSE is an emerging open electronic order-driven market which is considered a pure order-driven market. From the above literature, the evidence on the existence of liquidity commonality is mixed and we contribute to this debate of whether commonality in liquidity exists in an emerging order-driven market.

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[1] Deutscher Aktien *Index*

2.3 Commonality in Liquidity in Derivative Markets and Global Markets

Cao and Wei (2010) investigate liquidity commonality in equity options market to find whether it is just a phenomenon of stock market or applies to other markets too. Their sample consists on an average 620 stocks per year with a total of 1,589 distinct stocks having options listed on them from January 1996 to December 2004. Since they do not have intra-day data on options, they use only proportional bid-ask spread, contract volume, trading volume in dollar terms, and Amihud (2002) illiquidity measure as measures of liquidity. They use two versions of Amihud's measure; percentage illiquidity and absolute illiquidity. They calculate the volume-weighted average of the bid-ask spread measure for the analysis. To examine commonality in liquidity, a time-series market model regression for each stock is estimated with change in liquidity measure as dependent variable and change in daily option market liquidity as the independent variable. They include the lead and the lag option and stock market liquidity measures and several control variables. The regression results show a satisfactory evidence for liquidity commonality and most of the regression coefficients are positive and significant. For the spread measure, the average coefficient is 0.863 with a t-value of 61.90. Nearly 95% of the regression coefficients are positive. Even though the coefficients of price impact measure are positive, they are insignificant and coefficients of other liquidity measures are negative. The results hold even for the analysis of calls and puts separately and both show similar properties. They find a significant size effect, with small stocks having higher significance than the large stocks differing from CRS (2000). To test for sources of liquidity commonality, they use trading volume and open interest to proxy for inventory risk and adverse selection risk. The regression results show that adverse selection risk plays a more significant role compared to inventory risk. The t-values for the adverse selection variables are large and also the relation between change in spread and volume is positive which is in contrast to stocks. This evidence shows that informed traders prefer option markets over stock markets.

Marshal, Nguyen, and Visaltanchoti (2013), investigate the commonality in liquidity in the US commodity futures market. Their sample consists of 16 different commodities which are a part of S&P Goldman Sachs Commodity Index. They measure liquidity using proportional effective spread, proportional quoted spread, and Amihud's price impact measure for the period from January 1997 to August 2009. They use the methodologies of CRS (2000) and Kamara, Lou, and Sadka (2008) for examining systematic component of liquidity in commodities. The results show that patterns in liquidity co-movement are consistent across all the commodities and the changes in liquidity of 81% of the commodities have a positive and significant relation with market liquidity for the proportional effective spread. This relation is even stronger and increases to 88% and 100% respectively for quoted spread and Amihud's measure. The results are consistent for the two different methodologies employed. This shows that liquidity commonality is stronger in commodities compared to stocks even though hedgers are common in commodity markets. To investigate the supply-side effects causing co-movement in commodities, they capture the up and down market movements using a dummy variable and find significant results. They also investigate whether commonality is a phenomenon of periods of price increases; they divide the entire time-period into two sub-periods; 1997-2003 and 2004-2009 and repeat the same analysis. The results suggest that commonality is constant when the prices are high and it increases between the two sub-periods. The tests for relation between stock market systematic liquidity on commodities market commonality show that there is positive relation between them which provides support to the argument that investors consider commodities as alternative asset class to stocks.

The above studies show evidence for the existence of liquidity commonality in the context of quote-driven derivatives markets. Our study is the first study to examine liquidity commonality for an order-driven options market.

All the previous studies discussed above are related to individual stock exchanges. Brockman, Chung, and Perignon (2009) conduct a comprehensive analysis of liquidity commonality on 47 major stock exchanges of the World. Their main hypothesis is to investigate whether commonality is a local or a global phenomenon. They also investigate the sources of commonality in liquidity both at the individual exchange level and across all the exchanges under study. Their sample is for 47 stock markets of 38 countries which they collect from Bloomberg database. They use intra-day data to calculate relative effective spread and intra-day dollar depth as proxies for liquidity from the period October 2002 to June 2004. They impose strict filtering conditions to choose the sample from these 47 stock exchanges. All those stocks which have 200 active trading days during the sample period become a part of the sample and the final sample consists of 9,247 firms. They follow CRS (2000) and use market model time-series regressions to examine liquidity commonality. Of the 47 stock exchanges in the sample, 43 (46) of them have a positive mean (median) concurrent coefficients. For the spread measure of liquidity, the average percentage adjusted R^2 ranges between -0.003 and 0.125 and for the depth measure it is between -0.0212 to 1.387. Of all the exchanges, the strongest commonality is shown by the emerging markets of Asia including India. 43% and 66% of the firms have positive and significant coefficients at the developed and emerging markets level respectively. The investigation of size effects on commonality show a positive significant coefficient across all the size based quintiles. The fourth quintile from the largest order has the largest mean concurrent coefficient implying that the small firms are more sensitive to commonality. These results are different from the results of the quote-driven NYSE listed firms where the largest quintile firms are more susceptible to commonality. But the results are consistent with respect to the depth measures of liquidity where largest quintile firms exhibit more commonality. They also test for industry level significance but, it is insignificant. When the analysis is repeated for the global level commonality on exchange level liquidity, about 44 out of 100 firms of the exchanges have positive and significant coefficients. Their analysis shows that commonality has local, regional, industry, and global level sources. To examine the sources of liquidity commonality, they collect 6,026 separate news items and aggregate them into 3,020 macro news days. These 3,020 macro news days consist of 512 announcements related to interest rate announcements, 1,352 related to inflation and consumer prices, 656 related to unemployment, and 510 related to GDP announcements. They use a three day event window from -2 to 0 days to capture the portfolio rebalancing needs. Both developed and emerging markets show a significant increase in commonality in the event period of commonality.

While Brockman, Chung, and Perignon (2009) document liquidity commonality at a global level, Karolyi, Lee, and van Dijk (2012) provide a comprehensive understanding of supply-side and demand-side sources of liquidity commonality at the global level. Their hypothesis is to test how and why level of liquidity commonality variation among stocks within a country is different from other countries and over time. Their sample is taken from 40 countries out of which 21 are developed and 19 are emerging market nations. Their sample consists of 27,447 stocks for a period of 15 years from October, 2002 to June, 2004. They use Amihud's price impact liquidity measure at daily and monthly interval as a liquidity proxy. They control for general variation in capital market conditions a daily turnover measure is included in the analysis. They use R^2 measure of the time-series regression as a proxy for commonality in liquidity. Their first test involves cross-country regressions on the liquidity commonality on various supply-side and demand-side variables. They find only one supply-side factor market volatility having a significant impact on commonality and commonality is higher in countries where market volatility is higher. There are several demand-side factors significant in explaining cross-country variation in commonality. Commonality in liquidity is lower for countries where there is high mutual fund ownership, and international investors. It is higher in countries where there is a less transparent environment and weak investor protection laws. They perform monthly time-series regressions with the supply-side and demand-side factors to understand the economic forces that cause time variation in liquidity commonality. The results show that commonality increases during periods of high fluctuations in returns. There is weaker evidence for funding constraints with respect to the supply-side factors. For the demand-side changes in co-variation of trading activity, globalization, presence of foreign investors, and investor sentiment play a significant role. For size-volatility portfolio analysis and country groups, demand-side factors are more significant. Similarly, Zhang, Cai, and Cheung (2009) examine liquidity commonality within and across global stock markets.

All the above studies examine determinants of liquidity commonality for more than one exchange by selecting the most actively traded stock of that exchange. They ignore the less liquid stocks and the results may be biased. We, examine the determinants of liquidity commonality of a single exchange by examining all the eligible stocks.

2.4 Gaps in the Literature

Based on the prior literature we identify the following gaps:There is no comprehensive study to document liquidity commonality for an order-driven emerging market India[2].

1. There is no study to analyze the commonality in liquidity for an order-driven options market[3] and also stock options market simultaneously.
2. The evidence for determinants of liquidity commonality other than asymmetric information and inventory effects such as supply-side, demand-side, macroeconomic factors is lacking in the literature.[4]
3. There is no study to understand the relationship between liquidity commonality and market returns in the context of an order-driven emerging market.

The prior research on liquidity commonality has been dealing mainly with the documentation of liquidity commonality.[5] No study discusses comprehensively the possible sources affecting liquidity commonality of a particular market. Also, almost all the studies are in the context of quote-driven/specialist-based markets and there is very limited evidence for liquidity commonality in the context of emerging markets.[6] There is no study dedicated to explore

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[2] Kumar and Shah (2005) analyze liquidity commonality in the Indian context using only price impact measure. However, we comprehensively analyze liquidity commonality at market level, industry level, portfolio level with the standard measures proposed in the literature on commonality.

[3] Cao and Wei (2010) show evidence for liquidity commonality of options market and Marshal, Nguyen, and Visaltanchoti (2012) explore liquidity commonality of commodity derivatives market. However, both these studies are based on the US markets.

[4] CRS (2000), Huberman and Halka (2001), Hasbrouck and Seppi (2001), Brockman and Chung (2002), Coughenour and Saad (2004), Fabre and Frino (2004), Domowitz, Hansch, and Wang (2005), Kempf and Mayston (2008), Brockman, Chung, and Perignon (2009), Hameed, Kang, and Vishwanathan (2010) document liquidity commonality. However, some of the studies discuss the impact of inventory effects and asymmetric information on liquidity commonality.

[5] CRS (2000), Huberman and Halka (2001), Hasbrouck and Seppi (2001), Brockman and Chung (2002), Coughenour and Saad (2004), Fabre and Frino (2004), Domowitz, Hansch, and Wang (2005), Kempf and Mayston (2008), Brockman, Chung, and Perignon (2009), Hameed, Kang, and Vishwanathan (2010) document liquidity commonality. However, some of the studies discuss the impact of inventory effects and asymmetric information on liquidity commonality.

[6] Brockman and Chung (2002), and Brockman, Chung, and Perignon (2009) are the only studies which examine liquidity commonality in the context of an order-driven emerging markets.

liquidity commonality in an order-driven derivative market.[7] Our study aims at examining liquidity commonality on the equity and options markets of NSE and comprehensively analyzes the time-series and cross-sectional factors affecting liquidity commonality along with the relation between commonality and market returns. **To the best of our knowledge, our study will be the first one to analyze liquidity commonality and its sources such as supply-side, demand-side, as well as cross-sectional determinants for any single market and especially for an emerging market with order-driven market structure like India. We also document which type of stocks are more likely to have liquidity commonality.**

Our study is similar to CRS (2000), Huberman and Halka (2001), Brockman and Chung (2002) in that we also document liquidity commonality for equity market. However, we examine the liquidity commonality of both equity and options markets and analyze the differences in commonality for these markets. Our study is also similar to Cao and Wei (2010) in that we also examine liquidity commonality for an options market. But, we differ from them as we use intra-day options data which is more informative for the analysis of liquidity commonality compared to the daily data they use.

Our study is related to Karolyi, Lee, and van Dijk (2012) as we also examine the supply and demand-side sources of liquidity commonality over a long time-series. However, their analysis is at global level with their sample composed of stocks from many stock exchanges but we study the supply and demand-side sources of liquidity commonality specific to stocks of NSE. Our study is related to Zhang, Cai, and Cheung (2009) as we also examine the cross-sectional determinants of liquidity commonality for stocks. But, our cross-sectional determinants

[7] Cao and Wei (2010) show evidence for liquidity commonality of options market and Marshal, Nguyen, and Visaltanchoti (2012) explore liquidity commonality of commodity derivatives market. However, both these studies are based on the US markets.

are different from theirs as they analyze them at cross-country and cross-border exchange level compared to our single exchange focus.