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**Assessing Market Liquidity Amidst Crisis:
Evidence from Indian Stock Market**

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MADRAS SCHOOL OF ECONOMICS

Gandhi Mandapam Road

Chennai 600 025

India

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Sidharth J

(Corresponding author)

Madras School of Economics, Chennai, India

phd22sidharth@mse.ac.in

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**MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India**

Phone: 2230 0304/2230 0307/2235 2157

Fax: 2235 4847/2235 2155

Email : info@mse.ac.in

Website: www.mse.ac.in

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Abstract

Liquidity is very important for the stock market as it effects the portfolio decisions of investors and influences future outlook of the economy. Liquidity is especially important to withstand economic shocks and to facilitate faster recovery. The study examines the impact of two significant market crises, the 2008 Global Financial Crisis and the COVID-19 pandemic, on liquidity in the Indian stock market. Data for 655 companies listed at the National Stock Exchange (NSE) is utilized over a time period of 17 years from 2005 to 2022 to analyze multiple dimensions of liquidity. Preliminary results suggest that both crises had a substantial effect on market liquidity. The 2008 financial crisis exhibits a more pronounced and prolonged impact compared to COVID-19 pandemic. The severity of 2008 financial crisis surpassed that of COVID-19 across all liquidity dimensions. Trading volumes saw an uptrend during COVID-19 crisis, contrasting with decline in all other liquidity measures. Conversely, the 2008 financial crisis witnessed reductions in trading volume alongside broader declines in liquidity measures.

Keywords: *Liquidity; 2008 Financial Crisis; COVID-19 pandemic; Indian Stock Market*

JEL Codes: *G01, G10*

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Sidharth J

INTRODUCTION

Capital markets are a very important component of any economy. It performs several crucial functions such as capital mobilization, efficient allocation of the capital mobilized through accurate price discovery process and liquidity provisioning (Fama, 1970). Providing liquidity is one of the most important functions of any stock market as it affects several aspects of any capital market (Le & Gregoriou, 2020). Traditional financial theories (Fama, 1970) held fast to the idea of efficient markets and therefore assumed zero friction in trading. The existence of implicit and explicit transactions introduces frictions into the system. High levels of liquidity ensure the market participants are able to overcome these frictions and trade large volumes with minimal impact on the prices (Krishnan & Mishra, 2013). Liquidity becomes especially important during times of market uncertainty. Maintaining liquidity during times of crisis becomes beneficial as liquidity is crucial for withstanding and subsequent recovery of the market (Apergis et al., 2015; Ellington, 2018).

Liquidity assumes a central role in pricing of assets as well. Studies (Amihud, 2002) have found existence of strong relationships between stock liquidity and returns. Investors seek to be compensated more for holding on to stocks that are more illiquid owing to the added risk. Systematic and idiosyncratic liquidity risk is found to significantly contribute to the stock returns India as well. Higher premiums are demanded by investors for holding stocks that become illiquid during times of low market liquidity (Kumar & Misra, 2019). Illiquidity is of crucial importance because the illiquidity premium in India is much higher than the rest of the developed and developing countries (Kundlia & Verma, 2021).

Liquidity also has a contagion effect across exchanges and countries (De Santis, 2014) and liquidity at individual stock level exhibit significant amount of commonality as well time-variability (Chordia, 2000). Indian stock market is also susceptible to such commonality especially during downturns. Studies (Syamala et al., 2017; Debata & Mahakud, 2018) find that commonality increases during situations of market stress or extreme negative returns period. Uncertainty and investor sentiment are very significant predictors of stock liquidity during market stress periods. The increased commonality during market downturns could be led by flight-to-quality (Syamala et al., 2017).

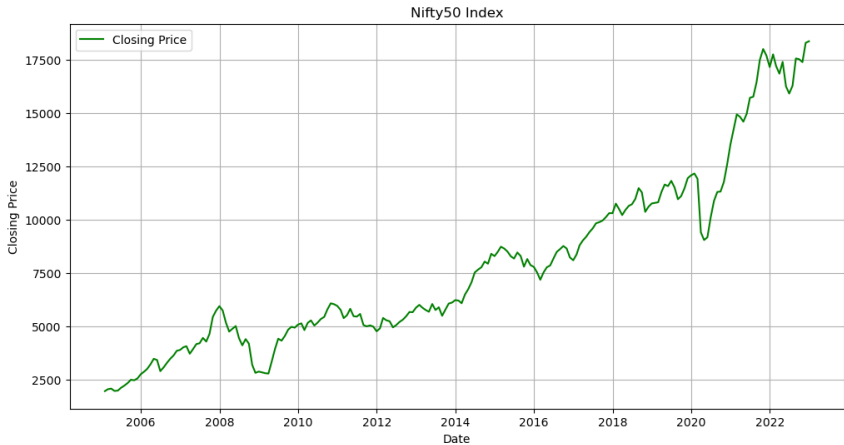
Microstructure theory suggests two main sources of variation in liquidity; they are the asymmetric information costs and inventory management cost. The asymmetric information costs suggest that the bid-ask spreads are set in such a way by the dealer so they minimize their chances of getting adversely selected against by informed traders (Glosten & Milgrom, 1985). The inventory management theory posits that dealers prefer high turnover rate for their inventories and would not prefer to hold large positions in one side of the market (long or short). To avoid accumulation of stocks on one side they actively manipulate the bid-ask spread to achieve parity (Garman, 1976). Several empirical studies (Madhavan & Smidt, 1991; Hasbrouck & Sofianos, 1993) have found evidence for both the strands of literature; however, as major economies increasingly favor order-driven markets over traditional dealer markets, the influence of inventory management costs on bid-ask spreads has decreased (Pan & Misra, 2022).

This empirical study examines how liquidity dynamics were affected during two of the most severe market crashes of the past two decades: the 2008 Global Financial Crisis (GFC) and the COVID-19 pandemic. Liquidity, an inherently elusive concept, is difficult to define or

measure due to its multidimensional nature. Liquidity measures are often categorized into high-frequency and low-frequency measures. However, Goyenko et al. (2009) found that low-frequency measures can effectively substitute high-frequency measures while maintaining a high degree of accuracy. Accordingly, this study employs three types of low-frequency measures: transaction cost-based, volume-based, and price-impact measures. Price impact measures, such as Amihud's illiquidity measure, have been widely regarded as among the most effective low-frequency measures (Goyenko et al., 2009) and are frequently utilized in empirical studies (e.g., Marozva & Magwedere, 2021; Kundlia & Verma, 2021; Umar et al., 2022; Syamala et al., 2017). Given liquidity's complex nature, it is essential to use a range of liquidity measures across dimensions to capture the full effect of market turbulence.

The study's findings indicate that liquidity across all studied dimensions deteriorated during both crises. Even though the Covid-19 pandemic originated as a public health emergency crisis it had a more devastating impact on GDP than the Global Financial crisis with India falling into a recession during initial quarters of the 2020-21 financial year. But India managed to claw its way back in the remainder of the year. Even though India did not fall into a recession during the GFC, liquidity and stock markets were severely affected. Figure 1 depicts the market crash's intensity was more pronounced during the pandemic, but the GFC had a larger effect due to its prolonged nature. Comparatively, liquidity response during the pandemic was faster and less enduring; the market took around three years to reach pre-crisis levels following the GFC, while recovery took only one year after the pandemic. Additionally, all sectors were similarly affected in both crises, with no sector disproportionately impacted during both events.

Figure 1: Nifty 50 Index Trend



Source: Author's own calculation

Note: Shows the time series trend of Nifty50 Index from 2005 – 2022. The values are calculated on a monthly basis

While there is existing literature on the two crises individually, few studies have sought to compare their respective effects on liquidity across multiple dimensions. This comparison is essential to understanding how liquidity responds to market crashes that originate from distinct sources, the financial sector in the GFC versus a global health emergency with COVID-19. Comparing these crises helps to highlight differences in market responses to shocks of varying origins, shedding light on the need for a multidimensional approach to studying liquidity during such disruptions. This study thus fills a gap in the literature by providing insight into how different types of liquidity measures reveal unique aspects of market dynamics under crisis conditions.

The study is structured as follows Section 1 covered the introduction, section 2 deals with a brief literature review, section 3 deals

with the data and methodology, section 4 presents the results and section 5 concludes.

LITERATURE REVIEW

Liquidity is very important for the smooth functioning of any stock exchange. And liquidity tends to dry up and during situations of extreme market turmoil. Market turmoil is characterized by extreme volatility. The relationship between volatility and liquidity has been well established in extant literature. An increase in volatility impairs liquidity and increases transaction costs. High volumes are indicative of speculators who increase the volatility and impair liquidity even further (Cheriyana & Lazar, 2019). In emerging markets, it was found that volatility had a positive impact on transaction cost but had a negative impact on price impacts (Marozva & Magwedere, 2021). Extreme levels of volatility is experienced during times of financial crisis. Market crashes and financial crisis preceding the 2008 crisis has given significance evidence of this. The relationship between volatility and liquidity had intensified during the Asian Financial crisis. The double threat of increased volatility and low stock returns further deteriorated liquidity (Chen & Poon, 2008). The spillover effects were much larger as well compared to normal times. Contrary to this Kaya & Engkuchik (2017) find that liquidity only deteriorated in only half of these origin countries when studying a much larger set of financial crises, the Thai, Hong Kong, Russian and Brazilian crisis. They found that liquidity contagion effects were much more muted compared to the evidences in extant literature and also found a reverse feedback effect wherein factors like reaction of global investors affected the liquidity dynamics in the country of origin of crisis.

The effect of financial crisis on India is in line with the trends seen globally. Jha et al. (2018) found that liquidity in the Indian markets deteriorated during 2008 Financial crisis but the stock market was

resilient through the period as the market did not deviate from efficient levels. Liquidity commonality also increases during times of market stress (Syamala et al., 2017) and during negative return periods. The stock market may experience flight-to-quality where investors move towards more liquid assets and markets during times of market turmoil. Bhattacharya et al. (2022) finds evidence for average liquidity plummeting during the 2008 Financial crisis but not all sectors were equally affected. They also find that there is a negative relationship between price impact measure of illiquidity and stock returns during the crisis suggesting that public sentiment drove panic selling which forced the investors to liquidate their illiquid stocks as well.

Farooque et al. (2023) looks into the effect of Economic Policy Uncertainty (EPU) and the effect it has on liquidity during the Covid-19 pandemic. The study revealed that the countries for which EPU was higher also experienced more liquidity deterioration. Debata & Mahakud (2018) also find EPU effects liquidity in the Indian stock market and the degree on this relationship intensifies during market downturns. They find that EPU and investor sentiment are better predictors of liquidity during market turmoil than monetary policy and inflation rates.

Enow (2022) studies the liquidity conditions during the 2008 Financial crisis and the Covid-19 pandemic. The study uses a sample of 5 countries to study the effect the crises have on volume. Their study found that liquidity did not deteriorate for all countries during the 2008 Financial crisis but all countries experienced illiquidity during the Covid-19 pandemic. The study points towards change in liquidity patterns from 2008 crisis to the Covid-19 pandemic like increase in margin requirements and the increased asymmetric information. The study also suggests that regulatory interventions such as market breakers may lead to more liquidity deterioration during market turmoil. A similar analysis

was done by Smales (2024) for Australia and found that there was significant deterioration of liquidity across dimensions during the 2008 Financial crisis and the Covid-19 pandemic, the only exception was with Volume during Covid-19 which showed an increase during this time. The liquidity response was short-lived for Covid-19 compared to the 2008 Financial crisis. On similar lines Jahagirdar et al. (2023). Illiquidity and Stock Market Returns during Financial Crises in India, compared the stock returns during the two crisis periods in India. The study found that during normal times only the immediacy dimension of liquidity had any positive relationship with stock market return suggestive of the liquidity premium but all other measures had a negative impact. The study also finds that the relationship between immediacy and returns intensifies during both the crises signifying that investors are expected to be compensated with high premiums for holding assets that become illiquid during times of market stress.

The Covid-19 pandemic, even though originating from outside the financial system, wreaked havoc on the global stock markets. Studies in the developed and developing economies (Umar et al., 2023; Tiwari et al., 2022; Farooque et al., 2023) found liquidity to be significantly deteriorated during the Covid 19 pandemic. The countries that were the most severely affected by the pandemic, US, UK and Italy, also experienced the most deterioration in liquidity. Umar et al. (2023) finds the countries were affected disproportionately with India taking the longest to recover from the countries in the sample although US was the most affected with China being the least. Further decomposition analysis revealed that an increase in adverse selection owing to asymmetric information was the main factor which led to an increase in illiquidity in all the markets. The study also finds that illiquidity and volatility significantly increased during the onset of the pandemic but quickly reverted back to the long-run equilibrium. Contrary to this Farooque et

al. (2023) found that the liquidity deterioration was not a short-term event but rather had long lasting implications. Studies from emerging markets (Marozva & Magwedere, 2021) also presented a similar picture with illiquidity increasing at the onset for a short time period. The study attributes the quick bounce back of liquidity to the quantitative easing and fiscal measures introduced in these countries.

Extant literature has looked into the effect on liquidity during the Covid-19 pandemic and the 2008 Global Financial Crisis as well along with some other notable periods of market turmoil. Most studies find evidence of liquidity deteriorating during these crises. Increased volatility, uncertainty, negative public sentiment all plays into this hysteria which causes liquidity to decline. Very few studies look into the comparison of liquidity and the liquidity response during two crises especially in the Indian framework.

DATA

Sample

The study uses companies listed at the National Stock Exchange of India (NSE). NSE is the leading stock exchange in India with 91% (Banarjee & Roy, 2022) of all trades occurring in NSE. It is 9th biggest stock exchange in the world in terms of market capitalization. Data for 2408 companies were available from 1995-2022. For studying the 2008 Financial crisis and Covid-19 we restrict our period of study to 2005-2022. Certain filtering criteria (Smales, 2024; Jahagirdar et al., 2023) are applied to the firms to arrive at the final sample. The filtering criteria are given below:

1. Stocks of firms need to actively traded at least for 40% of the time in the sample period.
2. At least 200 days of data should be available for each stock yearly and in total need to have more than 4000 days of data available in during the period of study

3. Only stocks listed before 2005 are considered
4. Stocks should not be suspended or delisted from NSE during the period of study

After the filtering is done the final sample amounts of 655 firm over 17 years with 2874224 firm trading days' worth of data in total.

Liquidity Measures

Even though liquidity is a heavily researched field of study a common definition or a measure has not been agreed upon by researchers. This is due to multi-dimensional nature of liquidity. Studies (Kyle, 1985; Naik et al., 2020) have brought forward 5 main dimensions of liquidity which are tightness, breadth, depth, immediacy, resiliency. The existence of several dimensions necessitates the need to study liquidity from several perspective to understand it's properties and its relationships. Due to the non-availability of high-frequency data the study uses a handful of low frequency proxies across dimensions. The paper follows the classification of Le & Gregoriou (2020) in categorizing and selecting the liquidity proxies.

Transaction Price Based Measures

Rolls Spread Measure

This measure was introduced by Roll in 1984 as a proxy for calculating the bid-ask spread. This proxy takes into the fact that in illiquid stocks, due to presence of high spreads prices tend to have reversals. This creates a serial negative correlation between successive price changes. The Roll measure takes into account this relationship to calculate a measure of spread. It is calculated using:

$$Roll_i = -2\sqrt{cov_i}$$

cov_i = first order serial covariance of returns of stock i

Corwin-Schultz High-Low Measure

The measure analyses the price ranges between one day and consecutive two-day periods. The high low prices constitute the spread due to volatility and due to the bid-ask spread. Analyzing the price range over two different time periods the measure tries to disentangle the effects of volatility from that of the bid-ask spread and obtain a value for spread. The Corwin-Schultz Spread is given by:

$$High2 = \max(high\ price_{it+1}, high\ price_{it})$$

$$Low2 = \min(low\ price_{it+1}, low\ price_{it})$$

$$\gamma_{it} = \left(\log\left(\frac{High2}{Low2}\right)\right)^2$$

$$\beta_{it} = \left(\log\left(\frac{high\ price_{it}}{low\ price_{it}}\right)\right)^2 + \left(\log\left(\frac{high\ price_{it+1}}{low\ price_{it+1}}\right)\right)^2$$

$$\alpha_{it} = \frac{\sqrt{2\beta_{it}} - \sqrt{\beta_{it}}}{3 - 2\sqrt{2}} - \sqrt{\frac{\gamma_{it}}{3 - 2\sqrt{2}}}$$

$$Spread_{it} = \frac{2(e^{\alpha_{it}} - 1)}{1 + e^{\alpha_{it}}}$$

Abdi-Ranaldo Spread

This measure uses the fact that the difference in closing price and the average price will be less for a liquid stock. But illiquid stocks could have large difference and the measures take advantage of this to arrive at a value for the spread.

$$m_{it} = \frac{high\ price_{it} + low\ price_{it}}{2}$$

$$AR_{it} = 2\sqrt{E[(close\ logprice_{it} - m_{it})(close\ logprice_{it} - m_{it+1})]}$$

The Abdi-Ranaldo is developed on the basis of the Rolls spread measure and the Corwin-Schultz spread estimator but is an improvement

over them as it does not depend on trade direction and therefore does not rely on bid-ask bounce to calculate the spread unlike the Rolls' measure and does not require adjustment for non-trading days like the Corwin-Schultz measure.

Volume Based Measures

Trading Volume

This is one of the most commonly used measure of liquidity and it measure the depth dimension of liquidity. It's easy and straightforward to calculate and the data is also generally readily available.

$$Vol_{it} = P_{it} * Q_{it}$$

It is calculated as the product of Closing price of stock i on day t and the shares traded of the same stock on the same day.

Turnover Ratio

This again a very simple measure to assess the depth dimension and uses readily available data. It is calculated as the ratio of shares traded to the total shares outstanding.

$$Turnover_{it} = \frac{Shares\ traded_{it}}{Shares\ os_{it}}$$

Price Impact Based Measures

Amihud Illiquidity

Amihud illiquidity measures the change in price due the one-unit (rupee one) change in trading volume. This calculates the impact of trading on prices. Daily Amihud illiquidity ratio is calculated as follows:

$$Ami_{it} = \frac{|returns_{it}|}{Volume_{it}}$$

$returns_{it}$ is the percent change in the closing price of stock i on day t and $Volume_{it}$ is the rupee value traded (closing price multiplied by shares traded) of stock i on day t . A high value is considered as impairing liquidity as a small change in the rupee value traded leads to the large changes in priced.

Florackis et al. (2011) Price Impact Ratio

This proxy calculates the price impact in a similar manner to that of the Amihud illiquidity ratio. It is calculated as the ratio of absolute returns of stock i on day t with the turnover ratio of the same company on the same day.

$$FPiR_{it} = \frac{|returns_{it}|}{Turnover_{it}}$$

It is interpreted as the change in price due to one percent change in turnover ratio. It is thought to be an improvement over the amihud illiquidity ratio because of the inherent size bias and because of the assumption of similar frequency of trading in stocks. Using turnover as a denominator instead of volume solves this problem as turnover is not related to size of the firm.

Control Variables

The study uses various firm specific control variables in line with similar studies (Smales, 2024; Chebbi, 2021). The natural log of market capitalization is used as a control for firm size. The riskiness of the stock is captured using beta of the stock which measures the sensitivity of the returns of individual stock to the performance of the market. Absolute returns' is used as a measure to control for the level of information about the stock. Volatility is also included as extant literature provides evidence of significant relationship between volatility and liquidity. Volatility is calculated as the ratio of the price range of the current day to the

previous day's closing price (Chebbi, 2021). Lagged values of the liquidity measures are also used as controls.

Crisis Identification

The main objective of the study is to assess the effect of Global Financial Crisis in 2008 and the Covid-19 pandemic on liquidity in the stock market. The study uses the National Bureau of Economic Research's (NBER) recession indicator along with the GDP growth rates in India to identify the dates of the crisis. Even though the India's GDP slowed down during the 2008 Global Financial crisis India did not enter a recession, so the period from January 2008 – June 2009 is taken as the period of the Global Financial Crisis, this time period coincides with the below average growth rate of Indian GDP. India went into a recession during the Covid-19 pandemic with the GDP shrinking by around 24 percentage and 7 percentage in the first and second quarter of the 2020-21. So, the period from April 2020 – September 2020 is taken as the period of Covid-19 pandemic. The time period selection for the crisis is in line with previous studies in India (Jahagirdar et al., 2021).

Model

A fixed effects panel model is used to assess the effect on liquidity during the Global Financial Crisis and the Covid 19 pandemic.

$$\begin{aligned} Liquidity_{it} = & \beta_0 + \beta_1 GFC_t + \beta_2 Covid19_t + \beta_3 Size_{i,t-1} + \beta_4 Beta_{i,t-1} + \\ & \beta_5 Abs_return_{i,t-1} + \beta_6 Volatility_{i,t-1} + \beta_7 Volume_{i,t-1} \\ & + \beta_8 Liquidity_{i,t-1} + \epsilon_{i,t} \end{aligned}$$

The variations of the above model have been used throughout the paper. Here $Liquidity_{it}$ represents any of the liquidity variables used in the study like the Rolls spread, Corwin-Schultz spread, Andi-Ranaldo spread, Volume, Amihud illiquidity ratio, Florackis et al. price impact ratio and the

share turnover ratio. GFC_t and $Covid19_t$ represent the two variables of interest which are two dummy variables which take the value one during the 2008 financial crisis and the Covid-19 respectively and zero otherwise. Firm specific controls such as size, calculated by the log of market capitalization, beta, absolute returns, volatility, volume and the lagged liquidity variables are also used. The panel regression is estimated using Ordinary Least Squares (OLS) method and account for firm fixed effects. The study also uses heteroskedasticity-robust white standard errors and two-way clustering similar to Smales (2024).

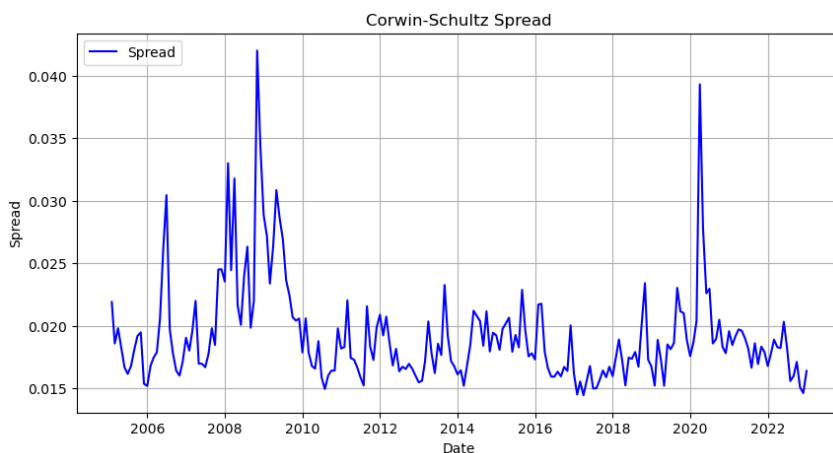
RESULTS

Descriptive Statistics

Figure 2 shows the movement of the Crowin-Schultz spread proxy over the years. Two clear spikes can be witnessed during 2008 and 2020. The spikes in 2020 are almost the same intensity as the one in 2008, but the spread remains volatile for much longer in the aftermath of 2008 than in 2020.

A similar pattern is also exhibited for volume as well in Figure 3 where volume seems to die down after 2008 and then picks up sometime after 2009. During 2020 a sharp decline is witnessed but then an equally sharp reversal is also seen. Volume keeps on rising after 2020 till 2021 after which it seems to correct itself.

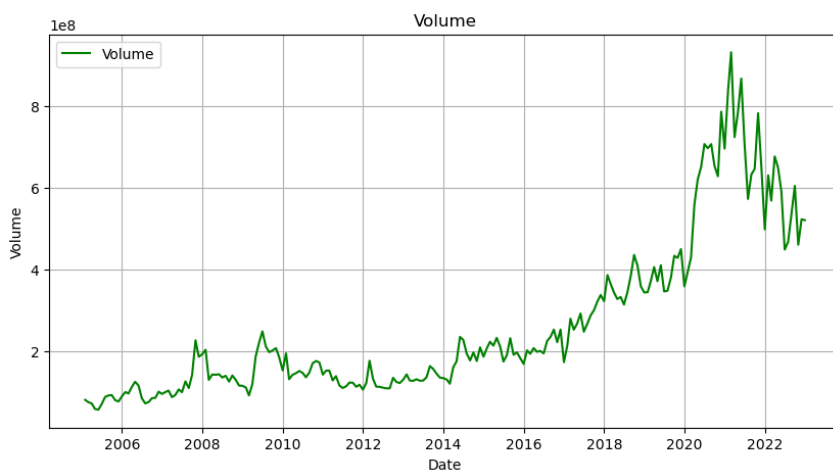
Figure 2: Corwin-Schultz spread Trend



Source: Author's own calculation

Note: Shows the time series trend of Corwin-Schultz High-Low spread proxy (rupee value traded) from 2005 – 2022. The values are calculated on a monthly basis

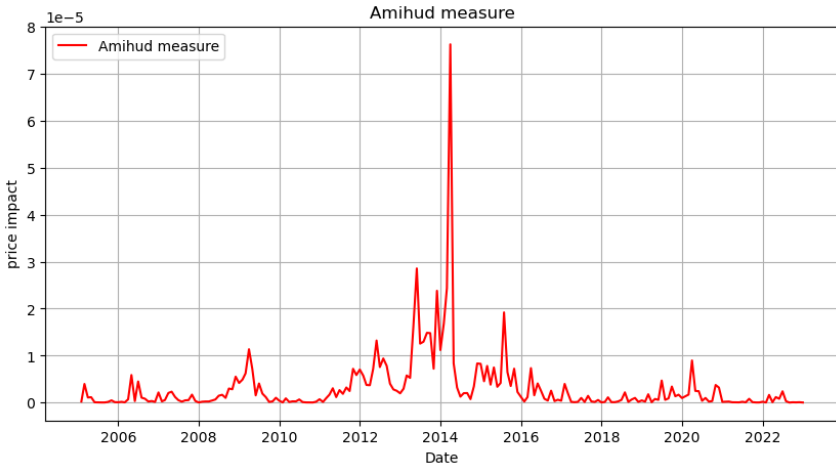
Figure 3: Volume Trends



Source: Author's own calculation

Note: Shows the time series trend of Volume (rupee value traded) from 2005 – 2022. The values are calculated on a monthly bases and scaled appropriately for better viewing

Figure 4: Amihud measure Trends



Source: Author's own calculation

Note: Shows the time series trend of Amihud illiquidity (rupee value traded) from 2005 – 2022. The values are calculated on a monthly bases and scaled appropriately for better viewing

Figure 4 depicts the amihud illiquidity ratio. Small spikes can be seen during 2009 and during 2020 but these are overshadowed by massive increase in illiquidity around 2014.

Table 1 reports the summary statistics of all the significant variables used in this study. The first part reports the overall summary statistics for the entire sample the second part shows the summary statistics for the 2008 Financial Crisis period and the third part shows the statistics for the Covid-19 pandemic. Panel A depicts the log transformed summary statistics for the liquidity variables. Panel B represents the summary data for firm level controls used in the study. Average values of for all liquidity variables are seen to be worsening during the 2008 Financial crisis, But the volume based and price-impact based measures are seen to be having positive effect during Covid-19. These measures

seem to be indicating that the depth and breadth dimension improved during the Covid-19 pandemic. Volatility is significantly higher for both crisis periods especially more so for the Global Financial Crisis. The returns fell to negative during the Global financial crises whereas returns were higher than the overall average during the Covid-19 pandemic.

Table 1: Descriptive Statistics

	Overall			GFC			Covid		
VARIABLES	mean	median	std	mean	median	std	mean	median	std
Panel A: Log Transformed liquidity Variables									
In_Roll	-3.666	-3.504	1.403	-3.322	-3.149	1.295	-3.501	-3.275	1.631
In_AR	-4.912	-4.809	1.148	-4.501	-4.378	1.233	-4.800	-4.626	1.629
In_CS	-4.418	-4.192	1.870	-4.192	-3.826	2.658	-4.249	-3.947	2.477
In_Volume	15.94	15.94	3.085	14.70	14.43	3.235	16.31	16.29	3.394
In_Amihud	-20.37	-20.40	3.312	-18.72	-18.54	3.398	-20.45	-20.42	3.646
In_Turnover	-7.143	-7.034	1.756	-7.739	-7.657	1.963	-6.815	-6.736	1.661
In_FPIR	2.756	2.662	1.931	3.750	3.679	2.124	2.731	2.684	1.917
Panel B: Firm Level Controls									
Abs_Return	0.0214	0.0176	0.0703	0.0301	0.0262	0.0187	0.0280	0.0237	0.0180
Volatility	0.0478	0.0394	0.0337	0.0692	0.0584	0.0465	0.0580	0.0483	0.0414
Market_Capitalisation	11,166	928.1	50,723	4,807	482.8	19,618	15,407	910.4	69,590
Returns	0.0009	-0.0007	0.157	-	-	0.0436	0.0012	0	0.0402
Beta	1.136	1.100	0.406	1.036	1.030	0.274	1.307	1.310	0.422

Source: Author's own calculation

Note: Descriptive statistics of all dependent and independent variables for the entire sample period and separately for GFC and Covid-19

Liquidity and Crisis

Table 2 represent the coefficients of the fixed effects regression model. The two variables of interest are the GFC and the Covid19. It is seen from

the table that liquidity is deteriorating across all dimensions during the Global Financial Crisis with positive signs for Corwin-Schultz spread (transaction cost) and the amihud illiquidity measure and negative coefficients for volume signifying a reduction in trading activity during the 2008 crisis.

Transaction cost and price impact measures also exhibit a similar trend during the Covid-19 pandemic as well, although the intensity of the liquidity deterioration is much lesser compared the Global Financial crisis as evidenced from smaller coefficients of the spread and amihud illiquidity variables.

Volume is seen to be deteriorating during the Global Financial crisis but the Covid-19 pandemic is having a positive impact on volume, these results hold true for other volume-based liquidity measures as well. Studies (Smales, 2024) suggest that the returns available during the pandemic was more than enough to compensate the investors for the increased transaction cost. Some evidence can be garnered from Table 1 where we can see that the returns during Covid-19 were higher than the overall average of the entire sample period. Studies suggest that the lockdown induced free time and the easy access to the stock markets through digital means prompted huge influx of retail traders in to the market. A massive 14.2 million new demat accounts were issued during FY 2021 in India which was a threefold jump from the previous fiscal year. Indicating huge inflow of retail traders (Pawar, 2022).

Some of the firm level controls had the expected signs. Volatility led to increase in trading activity but lead to decrease in liquidity due to heightened transaction costs and price impact costs. Volatility has a much bigger impact on transaction cost than other dimensions of liquidity. Larger firm based on market capitalization were more liquid compared to

smaller firms. Higher trading volume has a positive effect on price impact and depth but has a negative effect of the transaction cost aspect.

Table 2: Influence of crisis on Liquidity

VARIABLES	CS Spread	Volume	Amihud illiquidity
GFC	0.160***	-0.170***	0.421***
	(0.022)	(0.021)	(0.026)
Covid19	0.128***	0.069***	0.162***
	(0.020)	(0.023)	(0.035)
Beta _{t-1}	0.008	0.168***	-0.125***
	(0.015)	(0.022)	(0.025)
Abs returns _{t-1}	0.290	0.454*	0.019
	(0.192)	(0.263)	(0.025)
Volatility _{t-1}	4.191***	0.996***	1.715***
	(0.497)	(0.109)	(0.116)
Log MktCap _{t-1}	-0.100***	0.483***	-0.583***
	(0.006)	(0.011)	(0.012)
Log Volume _{t-1}	0.065***	0.640***	-0.415***
Log Volume _{t-1}	0.065***	0.640***	-0.415***
	(0.004)	(0.005)	(0.004)
Liquidity _{t-1}	0.131***		0.199***
	(0.017)		(0.003)
Constant	-4.396***	2.134***	-5.567***
	(0.080)	(0.058)	(0.077)
Observations	1,379,352	2,807,057	2,689,148
R-squared	0.054	0.883	0.838

Source: Author's own calculation

To check the robustness of the results other liquidity measures have been computed and for all the dimensions. The Rolls implicit spread measure and Abdi-Ranaldo spread measure are used for transaction cost-based measures, Turnover ratio is used for volume based measure and the measure of Florackis et al., (2017) is used for the price impact costs. Table A1 shows the results of the new measures. The results are qualitatively no different from the primary liquidity variables used. Liquidity measures are seen to be deteriorating for both the crisis periods with turnover being the notable exception during the Covid-19 which actually improved similar to volume. The liquidity deterioration is much more intense during the GFC as evidenced from the higher magnitude of coefficients during the financial crisis.

Now we have established that most liquidity dimensions deteriorated during both 2008 Global Financial crisis and the Covid-19 pandemic. Now the study looks to analyze the liquidity response during both the crisis. For this part dummy variables are created for three months prior and six months post the initial onset of both the crisis and looks at how the liquidity has evolved during this time. Here the month of initial onset of Global Financial crisis is marked with a dummy variable GFC (0) the preceding months are represented using GFC (-1), GFC (-2), GFC (-3) and a similar treatment is done for Covid-19 as well. This would provide a granular view of the magnitude and the longevity of the liquidity response to both the crisis periods.

Table 3 represents the liquidity response coefficients. It is seen that transaction cost remained significantly elevated to the months leading up to the financial crisis. But big jumps are seen after the onset of the crisis with the second month after the onset the showing the most effect and the spread remain elevated for all the six months after the initial month as well. The volume-based measure and the price impact

measure provide a much more definitive view of liquidity during the Global Financial crisis with the months prior to the initial onset exhibiting insignificant or better liquidity conditions (positive or insignificant coefficients for volume and negative or insignificant coefficients for Amihud illiquidity measure). During the initial month of the GFC Volume is insignificant but price impact deteriorates. One month into the crisis volume also starts to deteriorate and both volume and price impact continues to deteriorate for all the next six months after the beginning of the Global Financial crisis.

The liquidity response to Covid-19 presents a murkier picture. In the months leading up to the pandemic it is seen that there is no significant relationship with the transaction cost, volume seems to be deteriorating or insignificant and the price impact is high. But in the initial month of the pandemic, it is seen that transaction prices shoot up with an increased fall in volume and a significant jump in price impact. The transaction costs and the price impact costs remain elevated for two months after the onset of the pandemic and quickly becomes insignificant later on. Volume slightly reduced during the first three months of pandemic then there was a reversal after which volume started to improve in the preceding months.

From Table 3 it can be found that liquidity deterioration lasted for a much longer period during the 2008 Financial crisis than compared with the Covid-19 pandemic. In case of the pandemic deterioration in liquidity lasted for only 3 months after which some liquidity dimensions show an improvement as well after the initial deterioration.

Table 3: Liquidity Response to Crises

VARIABLES	CS Spread	Volume	Amihud illiquidity
GFC (-3)	0.169*** (0.041)	0.081* (0.044)	0.042 (0.064)
GFC (-2)	0.100*** (0.037)	0.014 (0.095)	0.119 (0.082)
GFC (-1)	0.164*** (0.027)	0.313*** (0.050)	-0.145*** (0.049)
GFC (0)	0.193*** (0.062)	-0.040 (0.063)	0.472*** (0.123)
GFC (+1)	0.162*** (0.039)	-0.256*** (0.029)	0.427*** (0.073)
GFC (+2)	0.323*** (0.039)	-0.050* (0.030)	0.524*** (0.087)
GFC (+3)	0.135*** (0.028)	-0.149*** (0.057)	0.192*** (0.051)
GFC (+4)	0.098*** (0.021)	-0.162*** (0.029)	0.197*** (0.052)
GFC (+5)	0.161*** (0.034)	-0.237*** (0.027)	0.448*** (0.062)
GFC (+6)	0.145*** (0.041)	-0.255*** (0.048)	0.461*** (0.050)
Covid19 (-3)	0.017 (0.020)	-0.165*** (0.026)	0.068* (0.035)
Covid19 (-2)	0.008 (0.027)	-0.029 (0.034)	0.039 (0.045)
Covid19 (-1)	0.052 (0.032)	-0.096*** (0.022)	0.247*** (0.054)
Covid19 (0)	0.367*** (0.051)	-0.111*** (0.042)	0.659*** (0.098)
Covid19 (+1)	0.197*** (0.049)	0.030 (0.046)	0.314*** (0.064)
Covid19 (+2)	0.186*** (0.026)	-0.080* (0.047)	0.234*** (0.066)
Covid19 (+3)	0.064 (0.047)	0.296*** (0.039)	-0.048 (0.036)

(Table 3 continued)

(Table 3 continued)

VARIABLES	CS Spread	Volume	Amihud illiquidity
Covid19 (+4)	0.000	0.094***	-0.044
	(0.026)	(0.025)	(0.039)
Covid19 (+5)	0.011	0.314***	-0.193***
	(0.030)	(0.030)	(0.056)
Covid19 (+6)	0.121***	-0.033	0.156***
	(0.031)	(0.040)	(0.058)
Controls	Yes	Yes	Yes
Observations	1,379,352	2,807,057	2,689,148
R-squared	0.054	0.883	0.838

Source: Author's own calculation

Liquidity Across Industries

Earlier analysis has provided significant evidence of deterioration of overall market liquidity during the Global Financial crisis and the Covid-19 pandemic. It is also important to analyze if different sectors in the market were affected equally during both the crisis. The Nifty 500 like our sample is dominated by firms from the manufacturing sector followed by Finance and Insurance industry and the IT sector. The study uses the National Industrial Classification (NIC) and divides the companies into seven sections, Information and communication, Manufacturing, Construction, Wholesale and retail trade; repair of motor vehicles, motor vehicles and motorcycles, Transportation and Storage, Finance and Insurance and the remaining companies have been combined to others this include firms belonging to Mining and quarrying, Administrative and support service activities, Electricity, gas, steam and air conditioning supply, Human health and social work activities, Professional, scientific and technical activities, Accommodation and Food service activities, Human health and social work activities and Education.

Table 4: Industry wise Liquidity Effects

VARIABLE	Information and Communication	Manufacturing	Construction	Automobile trade and Repair	Transportation and Storage	Finance and Insurance	Others
Corwin-Schultz Spread							
GFC	0.165***	0.159***	0.142***	0.171***	0.20***	0.130***	0.12***
	(0.051)	(0.032)	(0.045)	(0.060)	(0.053)	(0.037)	(0.036)
Covid19	0.091*	0.117***	0.187**	0.112*	0.086**	0.160***	0.108*
	(0.046)	(0.022)	(0.071)	(0.055)	(0.038)	(0.049)	(0.054)
Constant	-4.371***	-4.36***	-4.25***	-4.47***	-4.47***	-4.64***	-4.2***
	(0.203)	(0.125)	(0.207)	(0.225)	(0.110)	(0.113)	(0.151)
Obs	132,105	830,439	64,581	64,827	35,354	157,953	94,093
R-squared	0.079	0.053	0.043	0.048	0.068	0.046	0.053
Volume							
GFC	-0.121**	-0.20***	-0.074	-0.29***	-0.192**	-0.13***	-0.1***
	(0.047)	(0.024)	(0.061)	(0.083)	(0.072)	(0.042)	(0.049)
Covid19	-0.018	0.081***	0.007	0.042	0.093	0.033	0.084
	(0.044)	(0.024)	(0.056)	(0.057)	(0.078)	(0.048)	(0.053)
Constant	2.182***	2.174***	1.905***	2.158***	1.69***	2.216***	1.86***
	(0.159)	(0.075)	(0.226)	(0.252)	(0.494)	(0.126)	(0.218)
Obs	269,572	1,671,681	142,323	128,387	72,672	334,081	188,341
R-squared	0.900	0.877	0.876	0.851	0.839	0.912	0.860
Amihud illiquidity							
GFC	0.326***	0.444***	0.371***	0.538***	0.41***	0.409***	0.34***
	(0.057)	(0.028)	(0.071)	(0.081)	(0.077)	(0.045)	(0.055)
Covid19	0.212***	0.140***	0.197***	0.135**	0.086	0.237***	0.114*
	(0.050)	(0.037)	(0.065)	(0.065)	(0.090)	(0.055)	(0.058)
Constant	-5.488***	-5.67***	-4.86***	-5.56***	-5.39***	-5.68***	-5.2***
	(0.215)	(0.096)	(0.278)	(0.330)	(0.564)	(0.192)	(0.289)
Obs	255,381	1,606,659	135,764	122,632	71,349	318,001	179,362
R-squared	0.860	0.830	0.827	0.801	0.756	0.873	0.815

Source: Author's own calculation

The results are almost similar across industries and is in line with the overall results found for the entire market. The results provide clear indication of deterioration of all dimensions of liquidity. Similar results are seen during Covid-19 as well for transaction cost and price impact dimensions but the results are insignificant for Volume except for the

manufacturing sector which saw an improvement in liquidity suggesting the improvement in liquidity depth was mainly driven by the manufacturing sector. The coefficients are higher in magnitude overall for all the industries during the Global Financial crisis compared to the Covid-19 pandemic indicating much more severity of liquidity crunch in 2008. Manufacturing, Wholesale and retail trade; repair of motor vehicles, motor vehicles and motorcycles and Transport and Storage sectors were the most affected across dimension during the GFC while Manufacturing, Construction and Finance and Insurance industries were the ones most affected by liquidity crunch during the Covid-19 pandemic. Overall, the results in Table 5 corroborate the earlier results in this study.

CONCLUSION

Liquidity is an important quality of a stock exchange which aids in its proper functioning. The study of National Stock Exchange of India during financial crisis, the Global Financial Crisis and the Covid-19 pandemic, reveals that liquidity deteriorates during such conditions. The transaction costs (spread proxies) and the price impact cost (Amihud illiquidity ratio and Florackis et al., price impact ratio) had increased during the Global Financial Crisis and the Covid-19 pandemic. Market depth measures using volume and share turnover also declined during the GFC but conversely showed a slight uptick during the pandemic. All sectors saw significant deterioration of liquidity for both the crisis period with manufacturing sector being the most affected on average for both. The study also finds the liquidity response was also quicker for the pandemic compared to the financial crisis. Liquidity deterioration reversed 3 months into lockdown but continued for over 6 months for the GFC. The influx of retail traders and the quick fiscal and monetary policy is touted as the main reason for the quick revival of liquidity during the Covid-19 pandemic. This provides fruitful areas for further research.

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APPENDIX

Table A1: Influence of crisis on Liquidity (alternative measures)

	(1)	(2)	(3)	(4)
VARIABLES	Roll	AR	Turnover	FPIR
GFC	0.153*** (0.014)	0.092*** (0.013)	-0.158*** (0.020)	0.408*** (0.025)
Covid19	0.039* (0.023)	-0.010 (0.021)	0.070*** (0.021)	0.158*** (0.033)
Beta _{t-1}	0.002 (0.009)	-0.025* (0.014)	0.163*** (0.021)	-0.124*** (0.025)
Abs returns _{t-1}	1.973** (0.921)	0.122 (0.075)	0.413* (0.244)	0.092* (0.055)
Volatility _{t-1}	2.887*** (0.235)	7.047*** (0.180)	0.958*** (0.104)	1.710*** (0.111)
Log MktCap _{t-1}	-0.081*** (0.008)	-0.067*** (0.006)	0.163** (0.074)	0.213*** (0.011)
Log Volume _{t-1}	0.063*** (0.004)	0.034*** (0.003)	-0.041 (0.073)	-0.412*** (0.004)
Liquidity _{t-1}	0.440*** (0.016)	0.395*** (0.025)	0.685*** (0.073)	0.203*** (0.003)
Constant	-2.684*** (0.074)	-3.355*** (0.097)	-2.974** (1.182)	7.308*** (0.062)
Observations	1,835,223	1,143,399	2,803,527	2,686,145
R-squared	0.257	0.302	0.650	0.532

Source: Author's own calculation

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