Investigating the Relationship between Stock Liquidity and Firm Value

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Citation: Shamsi, N. I., Quader, S. M. & Abdullah, M. N. (2022). Investigating the Relationship between Stock Liquidity and Firm Value. *Business Perspective Review 4(2),* 16-31. https://doi.org/10.38157/bpr.v4i2.450

Research Article

Abstract

Purpose: *This paper aims to investigate the effect of stock liquidity on firm value (MV), operating income to price (OIP), market value of equity to market value of the asset (MVEA), and operating income to assets (OIA) ratios in Bangladesh. This paper also investigates whether firm size, leverage, or financial crisis have any moderating role to play on the liquidity-firm value relationship.*

Method: *The study used panel data on 159 nonfinancial firms listed in the Dhaka Stock Exchange for the period of 2006 to 2019. Ordinary Least Squares, Fixed Effect, and Two-Stage least Squares estimation methods are used to determine the desired relationship.*

Results: *The results show that stock liquidity has a positive and significant impact on firm value and the results are robust to alternative estimation techniques. The relationship is found more acute for small and less levered firms and more intense in the post-crisis (after the 2010 stock market crash) period in Bangladesh.*

Implications: *The role of firm size, leverage, or financial crisis on the liquidity-firm value relationship will help corporate managers to adopt policies and strategies for improving the stock liquidity, changing investors' perceptions, and overall, increasing the depth and stability of the capital market in Bangladesh or elsewhere.*

Limitations: *Due to the unavailability of data, for the robustness check, we couldn't use any alternative proxy of stock liquidity such as bid-ask spreads.*

Keywords: Stock Liquidity, Firm Value, Endogeneity, 2SLS, Emerging market.

1. Introduction

Liquidity describes the degree to which an asset can be bought and sold swiftly with a nominal impact on the price which allows investors to transfer ownership of their assets. In a well-functioning and organized stock market, the easier will be the ownership transfer of the stocks without direct negotiations or contact between the buyers and sellers the more liquid the stocks are (Bernstein 1987). Liquidity is one of the key factors to be reckoned with by the investors during the formulation of investment decisions (Amihud & Mendelson 2008; Ma et al. 2016; Batten & Vo 2019). Stockholders prefer more liquid securities (see, Amihud & Mendelson 1986; Brennan & Subrahmanyam 1996; Liu 2006) as stocks with high liquidity facilitate firms to perform better (Fang et al. 2009). Maug (1998) argues that liquidity allows investors to gather a hefty amount of stocks and lift firm performance by capitalizing on governance activities. Operating performance-based theories emphasize that stock market liquidity affects firm value through firm performance and profitability (Nguyen et al. 2016) as liquid stocks are traded at a demand-induced premium

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price which exerts a positive impact on firm value. Baker & Stein (2004) assert that stock liquidity is a sentimental factor making highly liquid stocks overvalued. Hence, it can be said that the higher liquidity of stocks creates greater demand and inflates the firm value. Not only that, liquidity of securities ensures lower volatility, reduces transaction costs, allocates capital efficiently, and helps firms to get financing at lower costs (Amihud & Mendelson 2008) and thereby determining the success of firms, underwriters, and investors.

Batten & Vo (2019) emphasize that conducting a study on stock liquidity and firm value from the context of an emerging market is important due to their undeveloped stock markets, overreliance on the banking system and slower trading speed, etc. Liu & Xu (2016) also posit that a higher level of information asymmetry in emerging markets could be an important factor contributing to the extreme lack of liquidity in emerging equity markets. The situation is no different in Bangladesh, the capital market of which is still at a growing stage. Due to inadequate knowledge regarding the market mechanism, absence of transparency, poor monitoring and controlling activities, the inefficiency of the regulatory body, low and unstable liquidity, information asymmetry (Shah 2016; Rasul 2013), the severity of malpractices and particularly after the stock market crash of 2010, a sense of insecurity pushes the people of Bangladesh away from investing their money in the capital market and provokes them to invest in banks and government securities as a safer and easier alternative. Intuitively, people's risk-taking tendency and interest in investment in stocks are important aspects of maintaining stock liquidity which can eventually help increase stock price and firm value. This motivates us to investigate the relationship between stock liquidity and firm value for Bangladesh's economy which has remained unexplored in the literature. Therefore, in this study we want to investigate the following questions:

i. What is the impact of stock liquidity on firm value?
ii. How does the relationship between stock liquidity and firm value vary based on the size, and degree of leverage of the firms?
iii. Does the impact of liquidity on firm value vary before and after the stock market crash of Bangladesh in 2010?

We make three important contributions by conducting this study. First, there is very little evidence available from the context of emerging markets, and no single investigation is done on Bangladesh addressing this issue. Second, most of the previous studies identify the impact of liquidity on firm value but they do not investigate the moderating role of size and leverage. Finally, we attempt to investigate the impact of a financial crisis or stock market crash on the liquidity-firm value relationship.

The rest of the paper is organized as follows. Section 2 reviews prior work on this issue. Section 3 introduces the data and variable constructions relevant for this study, section 4 describes the methodology and model specifications, section 5 analyzes the results and section 6 concludes the paper.

2. Literature review

The relationship between liquidity and firm performance has received considerable attention from a variety of perspectives in corporate finance literature. Amihud and Mendelson (2008) advocate that the liquidity of a company's securities is one of the major factors that determine the value of the firm's assets. They claim that higher liquidity decreases the cost of equity and increases the market price and hence increases the firm value and vice versa. They also suggest that, strategies such as maintaining lower leverage ratios, increasing the investor base, and maintaining the transparency of financial disclosure help a firm to increase its stock liquidity which in turn can have a positive impact on market price and firm value.

Fang et al. (2009) find controlling rights and marketability of shares to have a great influence on a firm's valuation, performance, and governance (see also Ararat et al. 2017). They find that stock prices and healthier managerial incentives are responsible for the positive association between stock liquidity and firm

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value. Using Tobin's Q ratio to measure firm performance and decomposing that into three components, they show that more liquid stocks contain higher operating returns on their assets. Nguyen et al. (2016), Prommin et al. (2016), and many more also find positive associations between stock liquidity and firm value.

Brogaard et al. (2017) and Cheung et al. (2015) believe that liquidity increases information provided by the market prices of shares and this information can be used by the managers to take value-enhancing decisions for the firm. Rakovic (2018) reveals that companies with more liquid shares are traded more on regular basis and have higher operating income, which eventually increases the company's value. Usually, market liquidity makes the stock price more informative, creates good incentives for insiders, and diminish the monitoring cost of managerial decisions for large shareholders while market illiquidity is responsible for higher transaction cost (Tahir 2020). Atanasova and Li (2018) find that stock liquidity has a positive impact on market price using data on international firms cross-listed on the U.S stock exchange. Liquidity benefits of cross-listed firms are found to exert a positive effect on market prices compared to non-cross-listed stocks in Hong Kong by Huang et al. (2016). Ghadhab and Hellara (2016) claim that cross-listing improves stock price informativeness and offers valuation gains. On the contrary, Batten and Vo (2019) show that liquidity negatively affects firm value in a study of the Vietnamese emerging market. These firms tend to rely on bank credit for funding and the investors tend to invest more in long-term securities and trade less frequently in the stock market. This is not surprising as Subrahmanyam and Titman (2001), Fang et al. (2009), Admati and Pfleiderer (2009), and Fang et al. (2014) also argue that the results for the effect of stock liquidity on firm value are both theoretically and empirically mixed.

Overall, the theoretical background for the relationship between stock liquidity and firm value relies on several factors such as (1) better informativeness of stock price and performance monitoring (2) good incentives for value-creation to the manager (3) enhanced shareholder interference (4) better corporate governance and (5) lower bankruptcy risk of a corporation (See, Holmstrom & Tirole 1993; Chordia et al. 2008; Chung & Hrazdil 2010; Faure-Grimaud & Gromb 2004; Maug 1998; Noe 2002; Cheung et al. 2015; Edmans et al. 2013; Norli et al. 2015; Brogaard et al. 2017).

Extensive literature addresses a set of control variables in Q regressions to report the relationship between stock liquidity and firm value. Cheung et al. (2015), Jawed and Kotha (2018), and many more estimate the influence of firm age, firm size, debt to asset, short-term debt, long-term debt, and other firm-specific variables on firm value. Cheung et al. (2015) assert that firm size and age improve firm value by ensuring economies of scale or by minimizing information unevenness with established firms, whereas financial leverage can affect firm value both positively or negatively contingent on whether the rewards (i.e. tax advantage and agency cost decline) exceed the costs of leverage (i.e. risk of bankruptcy). Additionally, Zhang(2017) et al. use investment (capital expenditure), asset turnover ratio, ROA, etc. in their study and believe that capital expenditure and asset turnover can lead to an increase in firm value.

According to operating performance-based theories, stock market liquidity positively affects the profitability and performance of a firm and thus affects firm value (Nguyen et al. 2016). Agency-based theory and feedback theory also support this assumption. Agency-based theories highlight that liquid stock exhibits more information in the market and help investors to monitor firms' activities and to make profits from price appreciation (Farooq & Bouaich, 2012). Feedback theories emphasize that market liquidity increases informed investors' trading which makes share price more informative and helps the manager to take a better corporate decision, therefore enabling firms to perform well (See, Subrahmanyam & Titman 2001; Khanna & Sonti 2004). However, Subrahmanyam and Titman (2001), Khanna and Sonti (2004), Fang et al. (2009), and Loukil (2015) also believe that the feedback effect can help a firm to improve its performance by increasing operating performance and reducing financial constraints of the firm. Additionally, pricing-based theories suggest that liquid shares should trade at a premium price whereas illiquid shares at a discount which indicates a positive relation between stock liquidity and firm value (Holmström & Tirole 2001). Likewise, Farooq and Bouaich (2012) assert that the liquidity of financial

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assets is the key factor behind any investment which attracts more investors. Therefore, to survive in the market, illiquid assets need to offer high-risk premiums which cause discount rates to go up and firm value to go down (Loukil 2015). Moreover, sentiment-based theory highlights that share liquidity is an indicator of investor sentiment that leads to an increase in firm value for highly liquid stocks (Baker & Stein 2004; Nguyen et al. 2016).

Additionally, many authors present empirical evidence to support a positive link between stock market liquidity and firm value using data from advanced countries, an investigation of this issue in a developing country is crucial since these markets are characterized by a lower level of liquidity (Bekaert & Harvey 1997; Bekaert & Harvey 2003; Bekaert et al. 2006; Lesmond 2005) and higher information asymmetry (OuYang et al. 2017). We, therefore, are interested to conduct this study on Bangladesh which embodies an interesting setting for this research for several reasons. First of all, it is one of the fastest-growing economies in the world with an 8.2% growth rate in 2019 just before the pandemic (Choudhury 2021) and it is also expected to become a developed country by 2041 (Zaman 2020). Such high growth potentiality makes the country an attractive destination for investors. Secondly, many of the firms in this market are influenced by family ownership, dependent on bank financing, and suffer from the absence of a strict corporate governance policy (Biswas 2020). Third, the stock market investment in Bangladesh is typically dominated by day traders and their average shareholding period is three days (Ahmed 2016) which makes a capital gain the focal point of these active traders rather than dividend income. As a result, stock market liquidity is a very crucial issue for these investors and we feel it is important to investigate the relationship between stock liquidity and firm value from the context of Bangladesh.

3. Methodology

3.1. Data

To measure the impact of stock liquidity on firm value, we use panel data covering all non-financial firms listed on the DSEX index of the Dhaka stock exchange over the period of 2006 to 2019. We collected data related to the previous records of the Dhaka Stock Exchange and the annual reports of the firms. After excluding all variables with unexpected observations, keeping firms with minimum observations, we end up having data on 159 firms with a minimum of 1592 and a maximum of 1965 firm-year observations. All regression variables are winsorized at a 1% level to get rid of the extreme outliers.

3.2.Variables

In this study firm value, operating income to price ratio, market value of equity to market value of the asset, and operating income to assets ratio are considered as dependent variables in different models. Stock liquidity, firm size, firm age, debt ratio, total investment, asset turnover ratio, etc. are used as independent variables all of which are explained below.

3.2.1. Firm value

By definition, Tobin's Q is the ratio between the assets' market value and its replacement value or book value (Sauaia & Castro 2002). The market value of assets is defined as the market value of equity (market capitalization) plus the book value of assets minus the book value of total equity (Batten & Vo, 2019; Adams et al. 2009; Fang et al. 2009; Nguyen et al. 2016). Tobin's Q as a widely used measure of firm value allows researchers to investigate not only the past performance of the companies but also the future growth opportunities in it (Sauaia & Castro 2002). Scholars such as Brogaard et al. (2017), Cheung et al. (2015), Jawed and Kotha (2018), Raković (2018), Nguyen et al. (2016), Tahir (2020), Morck et al. (1988), Gompers et al. (2003), etc. use Tobin's Q as a measure of firm performance in their study.

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Following Fang et al. (2009), we then break down Tobin's Q ratio into three components: operating income to price ratio, financial leverage, and operating income to assets ratio to understand the fundamental mechanism of stock market liquidity and firm value based on the following equation:

$$Tobin's\ Q_{it} = \frac{1}{OIP_{it}} \times \frac{1}{MVEA_{it}} \times OIA_{it}$$

Where OIP is equal to earnings before interest and tax divided by the market value of common equity. MVEA is defined as the market value of equity divided by the market value of assets. OIA is equal to earnings before interest and taxes divided by the book value of assets. Fang et al. (2009) and Nguyen et al. (2016) argue that a high impact on OIA implies that the effect (if there is any) of stock liquidity on firm value is operating performance-based. However, the high impact on OIP and/or MVEA represents the effect of stock liquidity on firm value is pricing-based.

3.2.2. Stock liquidity

Liquidity measures can be classified either as one-dimensional measures or multidimensional measures (Wyss 2004) depending on the frequency of the data. Usually, high-frequency data are not gathered for some markets as accessing such databases is time-consuming and expensive (Fong et al. 2017; Będowska-Sójka & Echaust 2020). Thus, in this study, we include a widely used low-frequency inverse liquidity proxy, the Amihud illiquidity ratio based on our available data. We compute this proxy by using historical daily data of the Dhaka Stock Exchange.

Amihud illiquidity ratio: Brogaard et al. (2017), claim that the Amihud illiquidity ratio captures the idea of larger price variation of illiquid stock for a given quantity of trading. Goyenko et al. (2009) also reckon that Amihud's illiquidity ratio is the most reliable measure of price impact using daily data. Following Cheung et al. (2015), we calculate Amihud as the logarithm of one plus the average ratio of the daily absolute return to the trading volume in million taka on day d for stock i over year t (with D_{it} as the number of trading days for firm i in year t). This is considered as an inverse proxy of liquidity.

$$Amihud_{it} = Log(1 + \frac{1}{D_{it}} \sum_{d=1}^{Dit} (\frac{|\ R_{idt}\ |}{DVol_{idt}}))$$

3.2.3. Other control variables

We include a number of control variables that have been found to influence stock liquidity in prior empirical studies. Firm size (size) which is calculated as the logarithm of total assets at the end of the fiscal year is one of the key control variables since stock market liquidity could be strongly affected by the firm size (Batten & Vo, 2019). Firm Age is calculated as the logarithm of years from the establishment whereas asset turnover ratio is calculated as the ratio of total sales to total assets. Additionally, the total debt, capital expenditure (investment), and total fixed assets (tangibility) are also scaled by total assets. To see how the impact of liquidity on firm value varies by firm size, degree of leverage, and stock market crash (pre and post-crisis) we include dummy variables (0 and 1).

3.3. Model specifications

The baseline specification is presented as follows where, f_i captures firm fixed effect, Y_t captures year-specific effect and ε_{it} is the error term.

$$Tobin's\ Q_{it} = \alpha + \beta_1\ Amihud_{it} + \beta_2 Age_{it} + \beta_3 Debt_{it} + \beta_4\ Tangibility_{it} + \beta_5\ Tangibility^2{}_{it} + \beta_6\ Investment_{it} + \beta_7 ATR_{it} + f_i + Y_t + \varepsilon_{it} \quad (1)$$

The above equation is log-transformed which makes the log of the market value of assets (MVA) the dependent variable. We take the logarithm for our model because it helps to transform skewed data almost closer to normality (Quader & Dietrich 2014; Quader & Abdullah 2020).

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$$MVA_{it} = \alpha + \beta_1 Amihud_{it} + \beta_2 Size_{it} + \beta_3 Age_{it} + \beta_4 Debt_{it} + \beta_5 Tangibility_{it} + \beta_6 Tangibility^2_{it} + \beta_7 Investment_{it} + \beta_8 ATR_{it} + f_i + Y_t + \varepsilon_{it} \quad (2)$$

3.4. Alternative model specifications- using components of Tobin's Q

To get a broader idea about the relationship between stock liquidity and firm value, three components of Tobin's Q such as OIP; MVEA, and OIA are used separately in place of MVA in equation (2).

$$OIP_{it}/MVEA_{it}/OIA_{it} = \alpha + \beta_1 Amihud_{it} + \beta_2 Size_{it} + \beta_3 Age_{it} + \beta_4 Debt_{it} + \beta_5 Tangibility_{it} + \beta_6 Tangibility^2_{it} + \beta_7 Investment_{it} + \beta_8 ATR_{it} + f_i + Y_t + \varepsilon_{it} \quad (3)$$

The constructions of all the variables used in the different models above are shown in table 1.

Table: 1 Description of variables

Types of Variables	Variable Name	Description
Dependent variable	Tobin's Q	Market value of assets/ Book value of assets
	MVA	Logarithm of Market Value of Asset (MVA)= Log (Book value of asset + Market value of equity – Book value of equity)
	OIP	Ratio of operating income to price
	MVEA	Ratio of market value of equity- to- the market value of assets
	OIA	Ratio of operating income-to-assets
Independent Variables	Amihud illiquidity ratio	logarithm of one plus the average ratio of the daily absolute return / the dollar trading volume on day d for stock i over year t.
	Size	Logarithm of Firm's total asset
	Age	Logarithm of years from establishment
	Debt	Total debt/Total asset
	Investment	Capital expenditure/ total asset
	Tangibility	PPE/Total asset
	Tangibility Square	Square of PPE/Total asset
	Asset-turnover ratio (ATR)	Total sales/ Total assets

3.5. Method of Estimation:

Initially, the Ordinary Least Squares (OLS) estimation method is used to investigate the causal relationship between stock liquidity and firm value. Later we also estimate the fixed effect and random effect models in our study and based on Hausman Test, we adopt the fixed effect model for the rest of the estimations. However, we also address the endogeneity issue in our study by using Two Stage Least Squares (2SLS) model assuming our illiquidity measure can be endogenous. Ali et al. (2018) believe that the instrumental variable approach (i.e. 2SLS regressions) is very effective as this approach not only offers a solution to omitted variables' biases but also addresses the existence of endogeneity and measurement error.

4. Results and analysis

Table 2 reports the summary statistics for all the variables used in different models of this research. It presents the number of observations, mean, standard deviation, minimum and maximum value for each variable. The mean value of Tobin's Q and MVA are 2.073 and 22.065 respectively. However, the difference between minimum and maximum values for Tobin's Q is big, ranging from 0.253 to 21.13 with a standard deviation of 2.78 across the sample firms. The three components of Tobin's Q, OIP, MVEA, and OIA have mean values of 0.296, 0.094, and 0.609 respectively. The average illiquidity of our sample firm controlled by the Amihud ratio is .033 with a standard deviation of 0.086. A lower Amihud illiquidity value

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indicates better liquidity. With regard to the size of the firms in our sample, the mean of log total assets is 21.69, which implies that the sample firms are reasonably large. In addition to this, the average age (logged) of our sample firms is 3 and an average firm carries almost 48.5% debt out of their total asset. The firms in our sample spend 5% of their total asset on capital investment and maintain an average of 43% of their total asset as fixed assets. Our sample firms are quite efficient as their average asset turnover lies around 74.1%.

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Tobin's Q	1592	2.073	2.780	0.253	21.130
MV	1587	22.065	1.693	18.496	26.487
OIP	1591	0.296	0.715	-0.186	4.454
OIA	1761	0.094	0.081	-0.048	0.418
MVEA	1592	0.609	0.285	0.013	0.999
Amihud	1967	0.033	0.086	0.000	0.512
Size	1765	21.69	1.518	18.549	25.519
Age	1758	2.997	0.604	1.386	4.043
Debt	1755	0.485	0.258	0.030	0.994
Investment	1698	0.050	0.068	0.000	0.357
ATR	1746	0.741	0.612	0.024	3.284
Tangibility	1762	0.430	0.229	0.010	0.961

The correlation matrix for the variables of our different models is presented in Table 3. Results show that MVA are negatively correlated with our illiquidity measure, Amihud illiquidity ratio and it is statistically significant at a 5% level. This hints that stocks with high liquidity can help to increase firm value. However, firm size has a positive and significant correlation with firm value whereas asset turnover ratio and firm tangibility have an inverse relationship with firm value. Additionally, the correlation coefficients between firm value and other control variables such as firm age, total debt ratio, and investment are not statistically significant.

At first, the Amihud illiquidity ratio is replaced by the predicted variable using instruments, which include the sales growth and risk measured by the standard deviation of return which we believe can affect firm value through market liquidity. Sales growth demonstrates the success of the company and can be used as a manifestation of further growth and improvement in stock liquidity. High levels of sales growth thus can result in an increase in the value of the firm too. Similarly, our second instrument risk can capture varied factors like taxes, regulations, interest rates, wages, exchange rates, and technological changes which may create uncertainty for the firms. Higher risk or uncertainty may limit the discretionary behavior of the firm managers and positively affect their stock price and liquidity and hence their market values.[1] Later, in stage 2, the predicted value of the Amihud illiquidity ratio (from stage 1) is used along with other firm characteristics to estimate the impact of stock liquidity on the market value of assets.

The baseline model using the Amihud illiquidity ratio is shown in Table 4. The result of the OLS estimation shows that stock illiquidity has a negative and statistically significant impact on firm value at a 5% level of significance. This infers higher stock liquidity is associated with larger firm value as the Amihud illiquidity ratio is an inverse measure of liquidity. The negative and significant relationship between firm value and stock illiquidity lasts even after controlling firm fixed effect using fixed effect (FE) estimation, and possible endogeneity of the illiquidity ratio using 2SLS which ensures the consistency of our results.

[1] Sales growth is measured as the difference between current and previous year's sales divided by the previous year's sales; risk is measured as the standard deviation of daily return per year for every firm. The second stage results are only presented in the paper, but the first stage result can be provided also upon request.

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Table 3: Correlation matrix

Variables	MVA	OIP	MVEA	OIA	Amihud	Size	Age	Debt	Inv.	ATR	Tang
MVA	1.000										
OIP	-0.239*	1.000									
	(0.000)										
MVEA	0.202*	-0.549*	1.000								
	(0.000)	(0.000)									
OIA	0.221*	0.072*	0.312*	1.000							
	(0.000)	(0.004)	(0.000)								
Amihud	-0.382*	0.265*	-0.282*	-0.112*	1.000						
	(0.000)	(0.000)	(0.000)	(0.000)							
Size	0.887*	-0.094*	-0.088*	0.011	-0.339*	1.000					
	(0.000)	(0.000)	(0.000)	(0.662)	(0.000)						
Age	-0.030	0.017	-0.151*	-0.015	0.019	-0.014	1.000				
	(0.238)	(0.488)	(0.000)	(0.537)	(0.448)	(0.567)					
Debt	-0.018	0.263*	-0.538*	0.058*	0.190*	-0.016	0.175*	1.000			
	(0.463)	(0.000)	(0.000)	(0.019)	(0.000)	(0.531)	(0.000)				
Investment	-0.011	0.069*	0.066*	0.213*	0.007	-0.059*	-0.141*	0.005	1.000		
	(0.663)	(0.007)	(0.009)	(0.000)	(0.792)	(0.019)	(0.000)	(0.834)			
ATR	-0.140*	0.181*	0.046	0.579*	0.089*	-0.274*	0.180*	0.335*	0.091*	1.000	
	(0.000)	(0.000)	(0.069)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Tangiblity	-0.258*	0.042	0.071*	-0.055*	0.138*	-0.226*	-0.180*	-0.178*	0.216*	-0.131*	1.000
	(0.000)	(0.091)	(0.005)	(0.027)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
This table illustrates Pearson pair-wise correlation matrix for the whole sample. * Indicates statistical significance at 5% level or better.											

Furthermore, firm size, investment, and asset turnover ratio all exert a positive and significant impact on firm value. Usually, large firms have more expertise in managing assets and diversifying their risks which leads them to generate greater value in the market and undeniably high investment potentiality. The High asset turnover ratio of a firm also increases investors' confidence and demand and thus leads to higher firm value as well. On the contrary, firms which are young and have less debt are able to generate more firm value. The tangibility has a non-linear U-shaped relationship with the firm value which reveals that initially, firm value reduces with tangibility, but later it turns into a positive association. Such a non-monotonic tangibility market value relationship is quite common in literature (See, Quader & Dietrich, 2014; Nguyen & Swanson, 2009). Our overall results are also consistent with previous literature (Fang et al. 2009; Ali et al. 2018). The p-value of the Wu-Hausman test statistics is 0.5506 which is high and implies that there may not be any endogeneity problem in any of our regressors and both the OLS and 2SLS estimators are consistent. This is evident from our results that there are not much differences in the sizes and significance of our OLS and 2SLS estimated coefficients. The p-value of the Sargan test of over-identification is also quite large (0.968) which means that our chosen instruments are providing consistent information about the values of the illiquidity coefficient and our model is correctly specified.

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Table 4: Baseline Model

MVA	OLS	FE	2SLS
Amihud	-0.602**	-0.488*	-0.885*
	(0.303)	(0.251)	(0.514)
Size	0.945***	0.695***	0.933***
	(0.014)	(0.040)	(0.015)
Age	-0.188***	-0.474***	-0.209***
	(0.035)	(0.142)	(0.041)
Debt	-0.195**	-0.085	-0.260***
	(0.083)	(0.099)	(0.093)
Investment	0.927***	0.450*	0.899***
	(0.285)	(0.244)	(0.315)
ATR	0.361***	0.192***	0.409***
	(0.034)	(0.046)	(0.037)
Tangibility	-1.952***	-1.531***	-2.161***
	(0.285)	(0.311)	(0.311)
Tangibility^2	1.625***	0.924***	1.780***
	(0.282)	(0.280)	(0.307)
Constant	1.897***	9.055***	2.826***
	(0.358)	(0.990)	(0.411)
N	1526	1526	1272
R^2	0.823	0.597	0.821
adj. R^2	0.821	0.543	0.818

This table shows the results of OLS, Fixed Effect, and 2SLS estimations of Equation 2 (Baseline model) using MVA as a proxy of firm value and Amihud as a proxy of stock liquidity. Standard errors in parentheses, *** (**) (*) Indicates significance at 1% (5%) (10%) level.

5.1. Liquidity- firm value relationship with respect to firm size, degree of leverage, and 2010 crash:

Differences in liquidity-firm value relationships with respect to firm size and degree of leverage are presented in table 5 where we have included the estimated coefficients for the amihud illiquidity ratio only for ease of presentation. For seeing the probable difference in liquidity-firm value relationship among large and small size firms, we create dummy variable 1 for large firms (firms having total assets greater than the sample mean of 21.69) and 0 for small firms (firms having total assets less than the sample mean). The result exhibits that the Amihud illiquidity ratio has a negative impact on firm value for both small and large, but the estimated coefficients for large firms are smaller than those for the small firms and are statistically insignificant as well. The result is consistent in both fixed effects and 2SLS. According to the result, highly liquid stocks create more value for small firms than large ones. The reason behind this high and positive impact of stock liquidity on smaller firms' value can be their high growth potentiality (Myers 1977). Usually, small-size companies have more scope to grow compared to their larger counterparts which makes their stocks more attractive to the investors, stimulates trading activities, and leads to increase firm value fueled by positive expectations.

Similar to size, the relationship between liquidity and firm value is also different among the low and high-levered firms. To differentiate the sample firms according to the extent of their leverage, we create dummy variable 1 for high leverage firms (firms having debt higher than the sample mean of 48.49% of total assets) and 0 for low leverage firms (firms having debt less than the sample mean). In the case of both high and low-levered firms, the results show that amihud illiquidity has a negative and significant impact on market value. But, the negative impact is more pronounced (almost double in terms of estimated coefficients) for

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low-levered firms than the high-levered ones. Amihud and Mendelson (2008) state that the leverage ratio can affect the stock liquidity of firms due to the related transaction and information costs which can increase the associated costs for equity holders and decrease firm value. They also express that a large portion of debt in capital structure magnifies the risk of equity which makes the market price volatile, increases information asymmetry between informed and less informed investors, and makes the investors more skeptical about the tradability, and return of their stocks. These can justify our results that the impact of stock liquidity on value for more debt-burdened firms is lower than that for the low levered firms.

Table 5: Difference in liquidity on firm Value with respect to size, leverage, and pre and post-2010 stock market crash in Bangladesh

	MVA	OLS	FE	2SLS
Amihud	Small	-2.111***	-1.746***	-2.998***
		(0.723)	(-6.120)	(-4.700)
	Large	-0.947	-0.698	-2.498
		(0.723)	(-1.220)	(-1.450)
Amihud	Low leverage	-2.844***	-3.037***	-3.084*
		(0.568)	(-5.680)	(-2.290)
	High leverage	-1.229***	-1.347***	-1.696*
		(0.320)	(-4.770)	(-2.470)
Amihud	Pre-Crisis	-0.387	-0.746**	-1.627**
		(-0.402)	(-2.14)	(-2.53)
	Post-Crisis	--0.776	-1.648***	-2.734*
		(-0.625)	(-3.65)	(-1.91)

This table shows the results of OLS, Fixed Effect, and 2SLS estimations of small and large-size firms as well as low-levered and high-levered firms. A dummy variable is created which takes value 1 for large firms (if total assets > sample mean of 21.69) and 0 for small firms (if total assets < the sample mean of 21.69); dummy variable 1 for high leverage firms (if total debt > sample mean of 48.49%) and 0 for low leverage firms (if, total debt < the sample mean of 48.49%); dummy variable 1 for the pre-crisis period (if year<= 2010) and 0 for the post-crisis period (if year>2010). MVA is used as a proxy of firm value and Amihud is used as a proxy of stock liquidity. Standard errors in parentheses, *** (**) (*) Indicates significance at 1% (5%) (10%) level.

Again, to distinguish between stock liquidity and the firm value relationship between pre and post-2010 crash, we split our sample into two groups with one group having firm-year observations till 2010 and the other after 2010. The Result shows that amihud illiquidity has a negative and significant impact on firm value in both periods, however, the impact is stronger in the post-2010 period than that in the pre-crash period. Usually, while the government and regulatory bodies take different steps to regain stability and alleviate the fear and stagnancy of the investors after the crisis, the need for stock liquidity becomes more intense than before (Anderson & Stulz 2017). Therefore, the degree of the positive impact of liquidity on firm value becomes higher after the crash in our case.

5.2. Replacing MVA with the components of Tobin's Q

Tables 6, 7, and 8 show the regression results of equation no. 3 using OIP, MVEA, and OIA as dependent variables respectively using amihud illiquidity ratio as the inverse proxy of stock liquidity and keeping other control variables the same. However, when MVEA and OIA are used as dependent variables in equation no. 3, amihud illiquidity is found to have a negative and significant impact on both of them. In table 7, the inverse relationship between MVEA and amihud illiquidity ratio reflects that high liquidity of stocks (or low amihud illiquidity ratio) increases the market value of equity of the firms compared to that

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of their total assets. Intuitively this is happening as the shareholders perceive the frequent tendential trading of the liquid stocks positively due to their quick turnover and swift profit-taking opportunity and thus can create a sense of security in the mind of investors.

The negative and statistically significant impact of the illiquidity ratio on the operating income to assets ratio (OIA) in table 8 implies that firms with high stock market liquidity have a better ability to use their assets efficiently to generate high operating income. This is supported by Raković (2018) who claims that firms having more liquid shares are traded more frequently and they also tend to have higher operating and high value.

Table 6: OLS, Fixed Effect, and 2SLS - OIP (Dependent Variable)

OIP	OLS	Fixed Effect	2SLS
Amihud	1.055***	1.115***	1.138***
	(0.263)	(0.252)	(0.396)
Size	0.054***	-0.055	0.050***
	(0.012)	(0.040)	(0.012)
Age	0.0617**	0.584***	0.068**
	(0.030)	(0.143)	(0.031)
Debt	0.358***	0.204**	0.364***
	(0.072)	(0.099)	(0.072)
Investment	0.470*	-0.012	0.703***
	(0.248)	(0.245)	(0.244)
ATR	0.101***	0.018	0.075***
	(0.029)	(0.046)	(0.029)
Tangibility	0.870***	0.650**	0.781***
	(0.246)	(0.311)	(0.239)
Tangibility^2	-0.662***	-0.291	-0.627***
	(0.242)	(0.280)	(0.235)
Constant	-0.794**	-0.912	-1.669***
	(0.311)	(0.995)	(0.318)
N	1529	1529	1275
R^2	0.256	0.309	0.248
adj. R^2	0.246	0.217	0.236
This table presents the results of OLS, Fixed Effect, and 2SLS estimations of Equation 4, using OIP- operating income to price ratio (replacing MVA) as a dependent variable and Amihud as a proxy of stock liquidity. Standard errors in parentheses, *** (**) (*) Indicates significance at 1% (5%) (10%) level.			

Results in Table 6 show that amihud has a positive and significant impact on OIP. It indicates that firms with high liquidity (low amihud illiquidity) have less operating income compared to their market prices. This can limit their future growth opportunities and make their investment riskier for the outside shareholders as well. Tangibility has a non-monotonic inverted U-shaped impact on OIP and other control variables are found to affect OIP positively and significantly as well. The negative effect of illiquidity on both MVEA and OIO is also evident in Fang et al. (2009) and Nguyen et al. (2016). Nguyen et al. (2016) claim that if the liquidity-firm value relationship is pricing-based, liquidity's impact will be high on OIP and MVEA. On the other hand, if the liquidity-firm value relationship is operating performance-based, the impact of liquidity will be high on OIA. Based on the above assumption, in our study, we can see that impact of liquidity on firm value for Bangladeshi firms is both pricing and operating performance based as we find the estimated coefficients by OLS of amihud on OIP and MVEA are high (1.055 and -0.510 respectively) compared to that of OIA which is relatively low (-0.0778). Such variations are also consistent in FE and 2SLS estimations as well.

Table 7: OLS, Fixed Effect and 2SLS- MVEA (Dependent Variable)

MVEA	OLS	Fixed Effect	2SLS
Amihud	-0.510***	-0.412***	-0.691***
	(0.089)	(0.079)	(0.149)
Size	-0.033***	-0.064***	-0.036***
	(0.004)	(0.013)	(0.005)
Age	-0.075***	-0.213***	-0.078***
	(0.010)	(0.045)	(0.012)
Debt	-0.592***	-0.353***	-0.603***
	(0.024)	(0.031)	(0.027)
Investment	0.169**	0.069	0.187**
	(0.084)	(0.077)	(0.092)
ATR	0.115***	0.073***	0.124***
	(0.010)	(0.014)	(0.011)
Tangibility	-0.587***	-0.198**	-0.562***
	(0.083)	(0.097)	(0.090)
Tangibility^2	0.580***	0.145*	0.544***
	(0.082)	(0.087)	(0.089)
Constant	1.649***	2.880***	1.960***
	(0.105)	(0.311)	(0.120)
N	1529	1529	1275
R^2	0.470	0.351	0.452
adj. R^2	0.463	0.265	0.443

This table exhibits the results of OLS, Fixed Effect, and 2SLS estimations of Equation 4 using MVEA- the market value of equity to the market value of asset (replacing MVA) as a dependent variable and Amihud as a proxy of stock liquidity. Standard errors in parentheses, *** (**) (*) Indicates significance at 1% (5%) (10%) level.

Table 8: OLS, Fixed Effect, and 2SLS-OIA (Dependent Variable)

OIA	OLS	Fixed Effect	2SLS
Amihud	-0.078***	-0.050**	-0.086*
	(0.026)	(0.020)	(0.044)
Size	0.010***	-0.015***	0.098***
	(0.001)	(0.003)	(0.001)
Age	-0.011***	0.001	-0.010***
	(0.003)	(0.011)	(0.004)
Debt	-0.051***	-0.021***	-0.046***
	(0.007)	(0.008)	(0.007)
Investment	0.183***	0.050**	0.211***
	(0.024)	(0.011)	(0.027)
ATR	0.091***	0.071***	0.090***
	(0.003)	(0.004)	(0.003)
Tangibility	-0.011	-0.001	-0.015
	(0.024)	(0.025)	(0.027)
Tangibility^2	0.018	0.011	0.022
	(0.024)	(0.022)	(0.026)

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Constant	-0.140***	0.374***	-0.148***
	(0.031)	(0.079)	(0.035)
N	1560	1560	1294
R^2	0.437	0.356	0.443
adj. R^2	0.430	0.272	0.434
This table exhibits the results of OLS, Fixed Effect, and 2SLS estimations of Equation 4 using the OIA-operating income to assets ratio (replacing MVA) as a dependent variable and Amihud as a proxy of stock liquidity. Standard errors in parentheses, *** (**) (*) Indicates significance at 1% (5%) (10%) level.			

Based on the above results, it is plausible that the positive links between high stock liquidity and firm value in Bangladesh are caused by both pricing-based (liquidity premium or investor sentiment) and also by operating performance-based mechanisms (agency and stock price feedback). From the pricing-based context, Bangladeshi investors care about liquidity as the majority of them are cautious due to a number of scams and alleged manipulations in the Bangladeshi capital market in the last few decades due to its weak governance and poor surveillance mechanisms. High liquidity of stock can make these types of investors feel safe and secure regarding their investment which is likely to increase value for the firms. From the operating performance-based context related to the agency theory, firms with high liquidity stocks usually face increased monitoring from external parties, high managerial pay-for-performance benefits, and the threat of exit from the institutional investors and therefore managed more efficiently. Overall, healthier price discovery mechanisms driven by better liquidity (Jawed & Kotha 2018) for these firms can help to increase their value through high operating profitability.

6. Conclusion

This study investigates the impact of stock liquidity on firm value for 159 non-financial companies listed on the Dhaka Stock Exchange, Bangladesh. Using data on Bangladeshi firms and the stock market for the first time, we find that stock liquidity has a positive and significant impact on firm value. We use Tobin's Q representing firm value and Amihud as an inverse proxy of stock liquidity. Our results remain robust to alternative estimation techniques, and also consistent with the previous studies conducted in other countries. To learn the innate association between stock liquidity and firm value, the three multiplicative components of Tobin's Q, operating income to price ratio (OIP), the market value of equity to market value of asset ratio (MVEA) ratio, and operating income to assets ratio (OIA) are all used interchangeably as well. The results show that stock liquidity has a negative and significant impact on OIP, but a positive and significant impact on MVEA and OIA. These indicate that the high firm value for having more liquid stock is derived from both operating performance- and pricing-based mechanisms. This implies that liquidity premium, investor sentiment, and better operating performance can increase the value of Bangladeshi firms. Furthermore, this study finds that the impact of stock liquidity on firm value can vary with respect to firm size and their degree of leverage which is not investigated earlier. Using dummy variables to divide the sample into small-large and also low-levered- high-levered firms, we find that the positive association between stock liquidity and firm value is more intense for small firms, maybe due to their high growth potentiality. For less levered firms, the impact of stock liquidity on firm value is also found bigger than their highly levered counterparts due to the risk perception of the investors. The impact of liquidity on firm value is also found to be more intensified after the 2010 stock market crash in Bangladesh.

The findings of this study provide some important insights which we believe can add value to the existing literature on stock liquidity and firm value. Most of the existing evidence of liquidity-firm value relationship is from highly developed financial markets, but there is very little evidence available from the context of emerging markets and no evidence for Bangladesh which is in a number of way different than the developed countries in terms of investors' behavior and knowledge, organizational structure, information asymmetry, ownership structure and so on. Besides, our attempt to look into the role of firm size, leverage, or financial crisis on the liquidity-firm value relationship will help corporate managers to infer the finer implications of

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stock liquidity. This can enable them to look for policies and strategies to adopt for improving their stock liquidity, changing investors' perceptions positively, and overall, increasing the depth and stability of the capital market in Bangladesh or elsewhere.

7. Limitations and directions for future research

For a robustness check, we could have included bid-ask spreads as an alternative proxy of stock liquidity. However, in order to calculate the bid-ask spread, large sets of high-frequency intraday trades and quotes are usually required, which are unattainable in emerging markets, particularly in Bangladesh. Future research may include more firms from different countries to attain a more comprehensive understanding of the relationship between stock liquidity and firm value.

Author Contributions: Nahin Israt Shamsi conceived the idea, reviewed the literature, analyzed the data, and prepared the first draft. Syed Manzur Quader did the econometric analysis, supervised, and finally edited the paper and Mohammad Nayeem Abdullah reviewed the paper and suggested improvements. All authors approved the final version of the manuscript.

Conflict of Interest: The authors declare no conflict of interest.`

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