

The Causality Relationship Between Various Dimensions Of Liquidity And Risk In The Amman Stock Exchange

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Abstract: This study examined the causality relationship between various dimensions of liquidity and risk in the causality framework utilizing free float MSCI index on the Amman Stock Exchange for the time period 2011-2019. Granger causality and Toda-Yamamoto tests are used to examine the causality relationship between the measures. Price impact liquidity is measured through Amihud ratio ILLIQ and conventional liquidity ratio CLR, while to capture the depth of market liquidity trading volume TV, log trading volume LTV, and turnover rate TR are used. Volatility over volume VOV and the high-low range HLR are employed to recognize the liquidity in general. Using two proxies to measure risk, while seven proxies to measure the market liquidity, this study shows that there is bidirectional causality between risk and liquidity measures. The both relation causal risk-liquidity and liquidity-risk are generally asymmetric except of the HLR and VOV are symmetric. Among various alternatives, this paper finds that three liquidity proxies namely HLR, VOV, and LTV are most often Granger cause for risk, while risk proxied by volatility is Granger causes for liquidity namely TV, HLR, and VOV.

Index Terms: Risk, Liquidity, Causality.

1. INTRODUCTION

Liquidity and risk is an important issue in the stock market, especially as it affects the value of stocks. This means that the investor is sometimes exposed to losses due to low Liquidity in the financial market. The liquid market generally provides sufficient liquidity and allows selling financial assets easily and smoothly with minimal loss at any time during market hours. Liquid markets are also defined as markets characterized by the availability of buyers and sellers who are willing to buy and sell all the time (Levine, 1997). Engle & Lange (1997) point out that market liquidity is the ability of agents in capital market to convert assets into purchasing power quickly and easily and at agreed prices. Furthermore, risk and liquidity of stocks are considered one of the most crucial features of the financial markets because they move together and have common characteristics. Chordia, Roll, & Subrahmanyam (2000) noted that risk is a process of controlling stock price volatility, while liquidity is the ability to sell and purchase stocks with little effect on prices and at low cost. Both risk and liquidity are unobservable and estimated with parametric or nonparametric methods. This motivates us to examine the causal relationship between various dimensions of liquidity and risk on the ASE. The Amman stock exchange (ASE) is one of the main components of the capital market in Jordan. It has been able to provide large amounts of financial capital to investors during the expansion period, especially in the first decade of the twenty-first century. In particular, the market value exceeded the threshold of the \$40 billion and attracted investors from all groups from many Arab and foreign countries. Furthermore, the prices of stocks, trading volume and returns were high. However, the ASE declined after the global financial crisis in 2008, especially with the beginning of the second decade of the twenty-first century.

The market value reached about \$20 billion. Moreover, the value of daily trading dropped to less than \$10 million. In some cases, the value of daily trading was lower than the number of shares sold. This could be attributed to many factors including liquidity, which had a significant impact on market risk. Będowska-Sójka & Kliber (2019) conduct a pioneering study to examine the causality relationship between liquidity and risk using four liquidity proxies namely Amihud illiquidity (Amihud, 2002) high-low ratio spread estimator (Corwin & Schultz, 2012), adjusted quoted close spread (Chung & Zhang, 2014), and volatility over volume (Fong et al. 2017). They documented bidirectional relationship in majority of cases. Their findings show that liquidity more often Granger causes risk than risk causes liquidity. They show that the measure of high low range (HLR) provides statistical significant in all cases more than other measures. Therefore, it is suggested to use HLR as a liquidity proxy in the Granger causality framework. Given the previous studies we find that few studies such as Będowska-Sójka & Kliber (2019) discuss the causal relationship between liquidity and risk using four measures of liquidity. Therefore, this study extends the work of Będowska-Sójka & Kliber (2019) in an emerging market where causality between various dimensions of liquidity and risk in short-term has not been adequately examined. Będowska-Sójka & Kliber (2019) use four measures of liquidity while the current study adopts seven measures of liquidity to investigate the causality relationship between liquidity and risk in the ASE. This paper attempts to fill this gap directly by using seven various dimensions of liquidity in this causality relationship between liquidity and risk. This paper is motivated by the need to examine this causality relationship because of the lack of a published study looking at the causality relationship between liquidity and risk. To the best of our knowledge, the current study is the first to examine the causality relationship between seven various dimensions of liquidity and risk on the ASE. In this context, the current study could be a pioneering work in developed and developing markets. By using the Będowska-Sójka & Kliber's (2019) methodology, the purpose of this study is to shed light on the topic of possible causality between various dimensions of liquidity and risk in Granger sense. Investigating the relation of various dimensions of liquidity and risk can help to understand

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the basic structure of any market. The current study attempts to answer the following questions: Does short-term causality relationship exist between various dimensions of liquidity and risk on the ASE? Which proxy of various dimensions of liquidity is most often Granger cause for risk and vice versa on the ASE? This paper focuses on the causal relationship between various dimensions of liquidity and risk on the ASE during the period 2011 to 2019. One of the contributions of the current study is using seven various dimensions of liquidity. This study contributes to financial literature by showing that three liquidity proxies namely HLR, VOV, and LTV are most often Granger cause for risk, while risk proxied by volatility is Granger causes for liquidity namely TV, HLR, and VOV. The both relation causal risk-liquidity and liquidity-risk are generally asymmetric except of the high-low range (HLR) and volatility over volume (VOV) are symmetric. They recommend using the high-low range HLR as a proxy that leads risk and this finding is consistent with the results of Hautsch and Jeleskovic (2009), Gold, Wang, Cao, and Huang (2017) for developed markets and Będowska-Sójka & Kliber (2019) for developing market. The remainder of the current study is organized as follows. Next section reviews the relevant literature, while Section 3 describes the data, the variables and the empirical methodology utilized in this study. Section 4 presents the findings of the study. A summary of the paper is in Section 5.

2. LITERATURE REVIEW:

Studies on the risks of the stock exchange market and the various dimensions of liquidity are still few, some of these studies are as follows: Holden, Jacobsen, & Subrahmanyam (2014) illustrate that price impact liquidity as asset is rapidly sold at a competitive price in the financial market. (Liu, 2006) examine different dimensions of liquidity and define liquidity as asset has an ability to rapidly trade in bulk (market depth) at a competitive price (price impact) and at low cost (transaction cost). Literature focuses on causality in terms of providing useful information on whether risk measured by past movements of volatility enhances prediction on liquidity measured by transaction cost and trading volume, and vice versa (Będowska-Sójka & Kliber, 2019). Causal relationship between risk and liquidity can be justified by several explanations. First, using the microstructure approach, Kyle (1985) refers to the two type of investors with dissimilar information groups; informed and uninformed (noise traders). Kyle (1985) observes that the uninformed traders determine volatility of the prices and they are relatively large as compared to the insider traders. However, Kyle (1985) shows that insider traders finally set the prices. This implies that transaction volume is positively related to price change in presence of two types of investors. Amihud (2002) confirms this feature and referred to it as a price impact. Second, based on the mixture of distribution hypothesis, Epps & Epps (1976) find that the larger the level of disagreement among traders, the greater the degree of trading. Therefore, causal relationship exists from transaction volume measured by liquidity proxy to the volatility proxy. Third, Brunnermeier & Pedersen (2009) show that there is relationship between liquidity and volatility, since trading in more volatile market need larger premium, and liquidity supplier keep constant illiquidity per capital ratio. Liquidity decreases when the market is more volatile: A major slowdown in the market is negatively affecting the value of portfolios of financial intermediaries,

which tend to withdraw money from the market (Będowska-Sójka & Kliber, 2019). Subsequently, an increase in volatility is associated with a decrease in liquidity. In the New York Stock Exchange (NYSE), Hiemstra & Jones (1994) demonstrate bidirectional nonlinear causality between volumes and returns. Brooks (1998) shows the bidirectional causality between volatility and volume in NYSE, although the relation from volatility to volume prevails the relation from volume to volatility. Also for NYSE stocks based on daily data, Chordia, Sarkar, & Subrahmanyam (2005) show that liquidity of big companies causes volatility of small one. Ong (Ong, 2015) shows the bidirectional Granger volatility-volume causality in the NEYS and trading volume plays an important role. Using high-frequency data from the Australian Stock Exchange, Hautsch & Jeleskovic (2008) find that liquidity measures Granger cause future volatility, but volatility does not Granger cause future liquidity. In the Canadian stock market, Gold, et al. (2017) find that liquidity proxy is Granger cause to volatility, but the inverse relation does not hold. The current study extends previous studies and applies two risk proxies standard deviation (VORET), and squares of daily Free Float Index returns (SQRET), while seven dimensions of liquidity; Trading volume (TV), Amihud illiquidity (ILLIQ), volatility over volume (VOV), high-low range (HLR), conventional liquidity ratio (CLR), log trading volume (LTV), and turnover ratio (TR) in order to determine the most useful one for explaining the causality. In addition, using seven dimensions of liquidity measures the liquidity in general, price impact of liquidity and the market depth of liquidity in the market. Most previous studies focus on one aspect of liquidity. This paper is different from previous studies in terms of that it discovers the causality relation between risk and various dimensions of liquidity. To check whether any of risk proxies may have possible predicting ability to predict liquidity and vice versa, standard Granger causality (1980) is used for the stationary of risk and liquidity and to allow for non-linearity and integration. Furthermore, Toda-Yamamoto framework the asymmetric causality test of Toda & Yamamoto (1995) is used as a robustness check. Many previous studies have focused on trying to examine risk and liquidity relation with the help of developed financial market such as Hautsch and Jeleskovic (2009), Gold, Wang, Cao, and Huang (2017). Only a handful of published studies of risk and liquidity relation in the developing market can be found. This lack motivates us to investigate this issue. To our best knowledge this study is the first that investigate risk-liquidity relation in the causality framework on the ASE.

3. DATA AND METHODOLOGY

To meet the objectives of this study, the daily data of the ASE, the free float MSCI index were utilized. The daily closing prices, high-low prices and the daily trading volume of the ASE are employed from 15 March 2011 to 16 April 2019. The advantage of the Free Float Index is to give a better reflection for the changes in stocks prices in the market by not being biased to the firms that have big market capitalization, therefore, providing diversification in the index sample by giving better opportunities to small and medium firms to reflect the index. Both volatility and liquidity are unobservable variables. For volatility proxy, this paper considers two measures. First measure is standard deviation of daily Free Float Index returns is indicated by VORET, while the second measure is a simple volatility proxy which is squares of daily

Free Float Index returns denoted by SQRET. Among liquidity proxies, there is broad range of liquidity measures. Therefore, the current study uses seven liquidity proxies already existing in the previous literature: Trading volume is denoted by TV (Kamath & Wang, 2008), Amihud illiquidity is indicated by ILLIQ (Amihud, 2002), volatility over volume is denoted by VOV (Fong, Holden, & Tobek, 2018), high-low range is indicated by HLR (Będowska-Sójka, 2018), conventional liquidity ratio is denoted by CLR (Saeed & Hassan, 2018), log trading volume indicated by LTV (Blume, Easley, & O'hara, 1994), and turnover ratio is indicated by TR (Datar, Naik, & Radcliffe, 1998).

3.1 Liquidity Variables

3.1.1 Trading Volume

Kamath and Wang (2008) propose proxy to measure the liquidity in the market using the trading volume denoted by TV_t . It is calculated based on the following formula:

$$TV_t \text{ is } TV_t = \frac{volume_t}{volume_{t-1}} - 1 \dots\dots\dots(1)$$

percentage change functions, therefore, this measure could be positive or negative values.

3.1.2 Amihud Measure

The daily absolute return divided by the trading volume is called Amihud illiquidity (Amihud, 2002). This proxy refers to the price impact liquidity as follows:

$$ILLIQ_t = \frac{|r_t|}{\log(volume)} \dots\dots\dots(2)$$

High value of Amihud proxy refers to the market is illiquid and low volume of stocks is trading in the market.

3.1.3 Volatility over Volume

Based on an idea of prior measure ILLIQ, Fong, et al.,(2018) suggest volatility over volume denoted by VoV. They replace the absolute return with high-low prices within a given day, while log volume is replaced by square root of volume in order to reduce the effect of extreme values:

$$VoV_t = \frac{In\left(\frac{H_t}{L_t}\right)}{\sqrt{volume_t}} \dots\dots\dots(3)$$

3.1.4 High-Low Range

Będowska-Sójka (2018) introduce the equation of the quoted close spread. They replace bid and ask prices with the high and low prices. In general, bid and ask prices are not publicly presented. Therefore, the HLR_t high-low range is computed as:

$$HLR_t = \frac{H_t - L_t}{0.5(H_t + L_t)} \dots\dots\dots(4)$$

Where HLR is the high-low range, H_t is the high price in day t, while L_t is the low price in the day t.

3.1.5 Conventional Liquidity Ratio

Cooper, Groth, & Avera (1985) develop proxy to measure the price impact of liquidity which is conventional liquidity ratios.

$$CLR_{it} = \frac{PV_{it}}{|\%PC_{it}|} \dots\dots\dots(5)$$

Where PV_{it} is the price and volume of the Free Float Index i during monthly time period t, PC_{it} is the absolute percentage change in the Free Float Index i during the same month. The increase in the traditional liquidity ratio indicates an increase in market liquidity

3.1.6 Log Trading Volume

Another proxy to measure the depth of liquidity in the market is trading volume LTV. It is proposed by Blume, Easley and O'Hara (1994).

$$Log(TV_{it}) \dots\dots\dots(6)$$

is the quantity of stock i traded on the month t, increase trading volume indicates an increase in market liquidity.

3.1.7 Turnover Rate

Datar, Naik and Radcliffe (1998) propose turnover rate to determine the depth of liquidity in the market as follows:

$$TR_{it} = \frac{SH_{it}}{NSH_{it}} \dots\dots\dots(7)$$

Where SH_{it} are shares traded of Free Float Index during day t. NSH_{it} are the shares outstanding of the same Free Float Index during the same day.

Granger causality test (1980) is used in this study to test linear causality between risk and liquidity measures. If data series are stationary, then the Granger causality can be applied. Therefore, both augmented Dickey-Fuller (1979) and Phillips & Perron (1988) are used in the current study to check the data series are stationary. Next, liquidity is regressed against lagged of risk, where the number of lags is selected by reducing Schwarz information criterion. If the coefficients on lagged of risk are statistically significant, then risk Granger causes liquidity. This paper performs asymmetric regression test to confirm the opposite direction of causality. In addition, as a robustness check, this paper applies Toda-Yamamoto framework the asymmetric causality test of Toda & Yamamoto (1995).

**TABLE 1
DESCRIPTIVE STATISTICS**

Variables	Risk Measures		Liquidity Measures						
	VORET	SQRET	TV	ILLIQ	VOV	HLR	CLR	LTV	TR
Mean	0.0030	0.00002	0.1138	0.0064	0.0026	0.0054	0.5922	0.6398	1.0331
Median	0.0023	0.00001	0.0054	0.0037	0.0022	0.0047	0.1285	0.6542	0.8673
Maximum	0.0211	0.00068	15.4706	0.4026	0.0170	0.0255	87.1573	1.9731	24.7311
Minimum	0.0000	0.00000	-0.9594	0.0000	0.0000	0.0000	-0.0647	-0.2034	0.0000
Std. Dev.	0.0028	0.00004	0.7905	0.0143	0.0016	0.0029	3.6011	0.2786	0.9550
Skewness	1.8996	5.68884	10.14	18.41	2.52	1.90	17.89	0.22	12.25
Kurtosis	8.1535	51.2920	164.15	463.17	15.06	8.58	366.12	3.24	248.04
Observations	1974	1974	1974	1974	1974	1974	1974	1974	1974

Descriptive statistics is investigated in Table 1 to check the general behavior of data. Average volatility of return (VORET)

and average square return (SQRET) of Amman Stock Exchange are 0.0030 and 0.00002, respectively. The maximum VORET and SQRET during data period (from 15 March 2011 to 16 April 2019) are 0.0211 and 0.00068, respectively indicating relatively low volatility in this ASE market. Average percentage change in trading volume (TV) during sample period is 0.1138. The maximum percentage change in trading volume of this emerging market in this period is 15.4706. Low average ratio of illiquidity (ILLIQ) Amihud ratio and relatively low average value of conventional liquidity ratio (CLR), log trading volume (LTV), and turnover rate (TR) show of ASE are not liquid in nature. This low liquidity in the ASE is consistent with emerging markets where they have significantly lower liquidity than developed markets (Będowska-Sójka & Kliber, 2019). Kurtosis value is larger than 3 indicating leptokurtic distributions and the possibility of extremes value arise during 2011-2019.

Note: Table presents the descriptive statistics for risk and liquidity measures. The proxies for risk are: volatility of return VORET, and square return SQRET. The liquidity proxies are percentage change in trading volume TV, Amihud ILLIQ, volatility over volume VOV, the high-low range HLR, conventional liquidity ratio CLR, log trading volume LTV, and turnover rate TR.

Table 2 reveals about the stationarity of data during 2011-2019. Two tests: (constant and constant-trend) in Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) proposed by fisher are used as the unit root test for each variable to investigate either the data is stationary or not. Results show that all data series are stationary at level and trend.

TABLE 2**RESULT OF ADF AND PP UNIT ROOT TEST (IN LEVEL AND TREND)**

Variables	ADF test statistics	PP test statistics
Panel A: Unit Root Test based on ADF and PP (level)		
VOLRET	-32.26692	-33.46633
SQRET	-32.26692	-32.26692
TV	-50.05098	-50.56537
ILLIQ	-25.81097	-44.67289
VOV	-8.321922	-40.42888
HLR	-13.02918	-38.98407
CLR	-43.98247	-44.01025
LTV	-3.808375	-24.00007
TR	-8.777075	-44.79723
Panel B: Unit Root Test based on ADF and PP (Trend)		
VOLRET	-32.41331	-33.38759
SQRET	-32.41331	-33.38759
TV	-50.04158	-50.56000
ILLIQ	-27.19890	-43.37052
VOV	-9.001894	-39.83254
HLR	-13.38195	-38.47201
CLR	-44.03019	-44.04890
LTV	-7.945737	-35.44608
TR	-15.12718	-42.44879

Note: Table presents the results of unit root test based on level and trend for Augmented-Dickey Fulluer (ADF) and Phillips-Perron (PP) in Panel A and B, respectively. The first column

details all proxies for risk and liquidity.

To demonstrate robustness of the unit root test results, the analysis include unit root test that incorporates structural break. The sample was divided in two sub-periods. The first sub-period extends from 15 March 2011 to 30 March 2015 and the second sub-period covers the period from 1 April 2015 to 16 April 2019. These sub-periods divide the sample into roughly equal halves. Table 3 confirms the findings of Table 2 and shows that all the variables are stationary in their first and second half sample.

TABLE 3**SUP-SAMPLE RESULT OF ADF AND PP UNIT ROOT TEST (IN LEVEL AND TREND)**

Variables	ADF test statistics		PP test statistics	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
Panel A: First half Sample				
VOLRET	-22.16973	-22.16409	-22.51276	-22.50726
SQRET	-18.81285	-18.80486	-29.22255	-29.20763
TV	-35.05936	-35.05077	-35.27714	-35.27484
ILLIQ	-3.991257	-3.964759	-29.00469	-28.95935
VOV	-8.596844	-8.594687	-25.11810	-25.10739
HLR	-10.14967	-10.24637	-25.27951	-25.29015
CLR	-30.28865	-30.30731	-30.32236	-30.33698
LTV	-5.303658	-5.568624	-17.92560	-18.97339
TR	-4.593845	-4.723933	-27.24064	-27.68246
Panel B: Second half Sample				
VOLRET	-24.14119	-24.13925	-24.88606	-24.87646
SQRET	-14.32374	-14.32523	-28.29779	-28.28472
TV	-35.57761	-35.57702	-36.04308	-36.06897
ILLIQ	-31.73369	-31.73312	-31.76894	-31.77103
VOV	-5.733709	-6.451277	-25.45036	-25.47143
HLR	-15.62415	-15.64092	-26.75355	-26.74172
CLR	-31.72954	-31.93629	-31.72905	-31.94075
LTV	-4.053782	-12.43749	-20.96391	-25.40012
TR	-26.85424	-28.08498	-27.69888	-28.07008

The results of selection of optimum lag length are provided in Table 4. To checks the appropriate lag length, this study depends on the Akaike information criteria (AIC) Table 4 shows the AIC criteria suggested a larger lag length, i.e. 4. Therefore, the optimum lag length selection is 4, having the maximum AIC value.

TABLE 4**VAR LAG ORDER SELECTION CRITERIA**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	17402.47	NA	1.44e-19	-20.68308	-20.65726	-20.67351
1	19787.35	4744.238	9.10e-21	-23.44274	-23.21040*	-23.35668
2	19995.50	412.1027	7.67e-21	-23.61415	-23.17529	-23.45160*
3	20077.85	162.2444	7.50e-21	-23.63597	-22.99058	-23.39691
4	20248.32	334.2579	6.61e-21*	-23.76257*	-22.91065	-23.44702
5	20299.33	99.52796	6.71e-21	-23.74712	-22.68868	-23.35507
6	20350.27	98.91368	6.82e-21	-23.73159	-22.46663	-23.26305
7	20405.29	106.3140	6.89e-21	-23.72092	-22.24943	-23.17587
8	20452.98	91.68947*	7.03e-21	-23.70152	-22.02350	-23.07998
9	20495.11	80.61393	7.22e-21	-23.67552	-21.79098	-22.97749
10	20533.09	72.28744	7.44e-21	-23.64457	-21.55351	-22.87004

4. CAUSALITY TESTS OUTPUT AND RESULTS DISCUSSION.

Different tests are applied to examine possible causality between liquidity. Liquidity is measured by seven porxies: Trading volume (TV), Amihud illiquidity (ILLIQ), volatility over

volume (VOV), high-low range (HLR), conventional liquidity ratio (CLR), log trading volume (LTV), or turnover ratio (TR). Risk is measured by standard deviation or volatility (VORET), and squared returns (SQRET). The Granger causality test (1980) is used to investigate the unidirectional or bidirectional causality between liquidity and risk proxies.

TABLE 5
LIQUIDITY-RISK DIRECTION.

Causality from	Liquidity to Risk			
	VORET (F-Stat)	P-Value	SQRET (F-Stat)	P-Value
Panel A: Granger Causality test				
TV	0.13017	(0.9422)	0.09619	(0.9083)
ILLIQ	1.32615	(0.2579)	0.42660	(0.5137)
VOV	34.7396***	(0.0000)	1.36068	(0.2092)
HLR	94.2376***	(0.0000)	2.79759**	(0.0159)
CLR	2.23266	(0.0825)	3.04181*	(0.0813)
LTV	2.21682***	(0.0238)	0.91014	(0.5069)
TR	1.23181	(0.2761)	1.78953*	(0.0746)
	VORET (Chi-Sq)	P-Value	SQRET (Chi-Sq)	P-Value
Panel B: Causality to: Toda-Yamamoto test for levels				
TV	0.390541	(0.9422)	2.550777	(0.8627)
ILLIQ	5.304596	(0.2574)	0.314612	(0.9974)
VOV	249.1542***	(0.0000)	12.97254	(0.1128)
HLR	471.3539***	(0.0000)	17.91239**	(0.0124)
CLR	6.697965*	(0.0822)	9.277656*	(0.0985)
LTV	17.73453***	(0.0233)	6.990399	(0.5377)
TR	9.854515	(0.2754)	9.823413	(0.4561)

Note: Table details the results of causality tests for liquidity-risks direction based on Granger causality test in Panel A and Toda-Yamamoto test for level in Panel B. The proxies for risk are: volatility of return VORET, and square return SQRET. The liquidity proxies are percentage change in trading volume TV, Amihud ILLIQ, volatility over volume VOV, the high-low range HLR, conventional liquidity ratio CLR, log trading volume LTV, and turnover rate TR. The table provides the P-value of each proxy. ***, **, * denote significant at 1%, 5% and 10% level, respectively. The P-values are in parenthesis. First, Table 5 provides the results of the unidirectional Granger causality tests in Panel A and Toda-Yamamoto test in Panel B for liquidity-risk direction, respectively. The unidirectional causality shows that liquidity causes risk in the ASE. The current study shows causality in three liquidity proxies: volatility over volume (VOV), the high-low range (HLR), and log trading volume (LTV). The causal relation exists in both risk proxies; volatility (VORET), and squared returns (SQRET) when HLR is used as a measure of liquidity, while for VOV and LTV causality is only found in VORET. This paper also confirms the results using Toda-Yamamoto test. The results for both tests are relatively similar, although these two tests are slightly different in terms of dependencies. In general, the liquidity Granger causes risk depending on three liquidity proxies: volatility over volume VOV, the high-low range HLR, and log trading volume LTV. This study finds results similar to the studies conducted by Będowska-Sójka & Kliber (2019) who use only four liquidity proxies: the high-low range HLR, Amihud ILLIQ, volatility over volume VOV, the high-low spread CS and in the Polish stock market

TABLE 6
RISK-LIQUIDITY DIRECTION.

	Risk to Liquidity						
	TV	ILLIQ	VOV	HLR	CLR	LTV	TR
Panel A: Granger Causality test							
VORET (F-Stat)	3.11315**	1.72706	3.18092***	2.38200**	1.75328	1.87739*	0.50173
P-Value	(0.0253)	(0.1408)	(0.0014)	(0.0364)	(0.1541)	(0.0595)	(0.8557)
SQRET (F-Stat)	0.56360	3.46517*	2.38483**	2.38508**	0.56687	3.33943***	2.45042**
P-Value	(0.5693)	(0.0628)	(0.0148)	(0.0362)	(0.4516)	(0.0008)	(0.0122)
Panel B: Causality to: Toda-Yamamoto test for levels							
VORET (Chi-Sq)	9.339129**	11.12427*	9.190292***	11.91002**	5.259854	15.01911*	4.013816
P-Value	(0.0251)	(0.0846)	(0.0013)	(0.0360)	(0.1537)	(0.0588)	(0.8559)
SQRET (Chi-Sq)	1.127203	3.465173*	19.07865**	11.92540**	0.566870	26.71547***	19.60337**
P-Value	(0.5692)	(0.0627)	(0.0144)	(0.0358)	(0.4515)	(0.0008)	(0.0119)

Note: Table details the results of causality tests for risk-liquidity direction based on Granger causality test in Panel A and Toda-Yamamoto test for level in Panel B. The proxies for risk are: volatility of return VORET, and square return SQRET. The liquidity proxies are percentage change in trading volume TV, Amihud ILLIQ, volatility over volume VOV, the high-low range HLR, conventional liquidity ratio CLR, log trading volume LTV, and turnover rate TR. The table provides the P-value of each proxy. ***, **, * denote significant at 1%, 5% and 10% level, respectively. The P-values are in parenthesis. This study also investigates the risk-liquidity relation using Granger causality and Toda-Yamamoto tests. Table 6 shows that both tests provide similar results. The unidirectional causality shows that risk also causes liquidity in short-term in the ASE. This paper finds causality in majority of risk proxies except of risk with price impact liquidity dimension: Amihud illiquidity (ILLIQ) and conventional liquidity ratio (CLR). The risk proxies based on VORET and SQRET cause volatility over volume VOV and the high-low range HLR. The causal relation strong in both liquidity proxies; volatility over volume VOV and the high-low range HLR when volatility VORET and square return SQRET are used as a measure of risk. For depth of market liquidity dimension TV causality is only found in VORET, while LTV and TR causality is only appearing in SQRET. Both in the situation of contribution from liquidity and risk proxies in Table 5 and 6, respectively HLR provides statistical significant in all cases more than other measures. Therefore, it is suggested to use HLR as a liquidity proxy in the Granger causality framework. This means that the higher the level of disagreement among traders and high low range leads to the higher the degree of trading and risk. This result is consistent with the results of Hautsch and Jeleskovic (2009), Gold, Wang, Cao, and Huang (2017) for developed markets and Będowska-Sójka & Kliber (2019) for developing market. In short, the two risk proxies VORET and SQRET Granger causes five liquidity proxies: Trading volume TV, volatility over volume VOV, the high-low range HLR, log trading volume LTV, and turnover rate TR. This means that when the market is more volatile decreases liquidity because investors and portfolio managers tend to withdraw money from the market. Therefore, risk more often

Granger causes liquidity than liquidity causes risk. This result is not consistent with the result of Będowska-Sójka & Kliber (2019) who find that liquidity more often Granger causes risk than risk causes liquidity.

5. CONCLUSION

This paper reports the empirical findings of causal relationship between daily liquidity and risk on the ASE, the free float index. Two risk proxies are used standard deviation (VORET), and squares of daily Free Float Index returns (SQRET), while seven liquidity measures; Trading volume (TV), Amihud illiquidity (ILLIQ), volatility over volume (VOV), high-low range (HLR), conventional liquidity ratio (CLR), log trading volume (LTV), and turnover ratio (TR) in order to determine the most useful one for explaining the causality. More than 2006 observations for each variable from 15 March 2011 to 16 April 2019 were used to examine this relationship. This paper finds causality in majority of risk proxies; trading volume TV, volatility over volume VOV, the high-low range HLR, log trading volume LTV, and turnover rate TR except of risk with price impact liquidity dimension represented by Amihud illiquidity ILLIQ and conventional liquidity ratio CLR. In particular, among risk measures the current study recommends using the volatility of daily free float index return as a risk proxy that leads liquidity represented by TV, VOV and HLR, while square return as a risk proxy that leads liquidity represented by VOV, HLR, LTV and TR. In particular, risk is Granger cause to liquidity. On the other hand, the two risk proxies VORET and SQRET Granger causes five liquidity proxies: Trading volume TV, volatility over volume VOV, the high-low range HLR, log trading volume LTV, and turnover rate TR. Risk more often Granger causes liquidity than liquidity causes risk. This result contradicts with the result of Będowska-Sójka & Kliber (2019) who find that liquidity more often Granger causes risk than risk causes liquidity. This paper finds that the high-low range HLR provides significant bidirectional relationship in all cases more than other measures. This finding is consistent with the results of Hautsch and Jeleskovic (2009), Gold, Wang, Cao, and Huang (2017) for developed markets and Będowska-Sójka & Kliber (2019) for developing market. The contribution of the current study is that it presents empirical evidence about the causality relationship between risk and liquidity by employing seven liquidity measures in contrast to previous studies Chung & Zhang (2014), Chikore, Gachira, & Nkomo (2014), Ong (2015) and Chung & Chuwonganant (2018) who they use three or four liquidity measures at best. This paper shows that the relationship between liquidity and risk on the ASE, which is the emerging market, are relatively comparable to those that exist for the developed markets. The above findings of the research confirm the idea that different liquidity measures, especially the high-low range HLR should be considered while making investment decisions. The findings of the study acknowledge that liquidity and risk causality relation has important implications for domestic and international investors, as well as portfolio managers to distribute their financial resources effectively in the ASE. It also helps the portfolio managers to recognize liquidity and risk relationship of assets in short-term for portfolio selection process and for asset pricing. It is suggested to examine the liquidity and risk causality relation on other emerging markets to get better insight about the liquidity and risk behavior.

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