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DIMENSIONS OF STOCK MARKET LIQUIDITY: EMPIRICAL EVIDENCE OF A FRONTIER MARKET

WYMIARY PŁYNNOSCI RYNKU PAPIERÓW WARTOŚCIOWYCH: WERYFIKACJA EMPIRYCZNA NA RYNKU GRANICZNYM

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Summary: The paper presents a discussion of stock market liquidity in a frontier market after the financial crisis. The paper defines the dimensions of stock market liquidity and indicates possible liquidity measures which could be applied to analyze liquidity on the stock exchange in Vietnam. The empirical result shows the aggregate liquidity, which captures various dimensions of liquidity through eight liquidity measures based on a daily basis during the period from 2011 to 2018. The analysis indicates the characteristics of liquidity in the Vietnamese stock market, and the differences in liquidity among three market capitalization groups: small, medium, and large. It is evident that there are differences in the three sizes of companies, where larger companies are found to have better liquidity.

Keywords: frontier market, depth dimension, tightness dimension, resilience dimension.

Streszczenie: W artykule przeanalizowano płynność rynku akcji na rynku wschodzącym po kryzysie finansowym. Określono wymiary płynności i wskazano możliwe miary płynności, które można zastosować do analizy płynności na giełdzie w Wietnamie. Badanie dotyczy zastosowania różnych miar w celu uchwycenia różnorodnych wymiarów płynności rynku akcji w trzech grupach kapitalizacji rynkowej: małej, średniej i dużej. W analizie wykorzystano osiem miar płynności na podstawie agregatów dziennych w latach 2011-2018. Wyniki empiryczne pokazują zagregowaną płynność w odniesieniu do dwóch metod: średniej arytmetycznej i średniej ważonej. Wykazano, że są różnice w płynności w zależności od wielkości spółki. Duże przedsiębiorstwa mają większą płynność.

Słowa kluczowe: rynek graniczny, wymiar głębokości, wymiar szczelności, wymiar elastyczności.

1. Introduction

Liquidity is a critical aspect of financial market development. As liquidity serves to deepen and strengthen financial markets, measures aimed at promoting liquidity will have a positive impact on overall financial market development. There is abundant evidence that liquidity is an inspirational topic in many studies.

The Vietnamese stock market is a typical frontier market, according to the classification of Morgan Stanley Capital International (Morgan Stanley Capital International [MSCI], 2019). A frontier market is characterized by low liquidity, lack of reliability, and less informed investors. Additionally, the frontier market has a small number of stocks with significant capitalization, outstanding shares, infrequent irregular trading and non-trading stocks (Minovic, 2012). Thus, these elements could impact market liquidity, becoming a source of liquidity risk in the market. These features make frontier markets different from developed markets. Chung and Zhang (2014) proposed that low-frequency measures as daily and monthly frequencies are the best liquidity proxies for global research. Fong et al (2017) also investigated that low-frequency liquidity measures are the best proxy for global studies. Rui Ma et al. (2016) suggested that Amihud (2002) measure is the best proxy for price impact in frontier markets.

In Vietnam, several authors also implemented empirical studies of stock market liquidity. Batten and Vo (2011) investigated the relationship between liquidity and stock returns during the financial crisis. They used only one measure, the turnover ratio, which was calculated by the number of shares traded divided by the number of shares outstanding. Tran (2018) used four measures for liquidity proxies as the relative spread, turnover ratio, Amihud's (2002) measure, and the zero-return measure, to study the impact of ownership structure on stock liquidity. These studies usually concentrate on one aspect of liquidity or several liquidity measures. This paper aims to analyze market liquidity in different dimensions on a stock exchange in a frontier market, namely the Ho Chi Minh Stock Exchange (HOSE) in Vietnam.

The research problem relates to the characteristics of stock market liquidity in a frontier market. The aim of this paper is to compare the liquidity level of small, medium and large companies on the Ho Chi Minh Stock Exchange in Vietnam.

The remainder of the study is organized as follows: Section 2 provides the theoretical concept of dimensions of stock liquidity, and the computation of the liquidity measures, Section 3 describes data and methodology, Section 4 analyzes individual stock liquidity and aggregate liquidity on HOSE, and Section 5 provides the conclusions.

2. Dimensions of stock market liquidity

Liquidity is a multi-dimensional concept, which might be defined as the ability to convert stocks into cash without affecting or minimizing impact price. According to the findings, the measures of liquidity are addressed with a diversity of approaches in previous studies.

Harris (1990) proposed that liquidity has four aspects: width, depth, immediacy, and resiliency. Sarr and Lybek (2002) argued that liquidity has five characteristics: tightness, immediacy, depth, breadth, and resiliency. Tightness is an aspect of transaction costs and is represented by the difference between the ask and bid prices. Immediacy reflects the efficient aspect of trading systems, settlement systems, and the speed to execute orders. Depth refers to cumulative orders, including all orders of the buying side and the selling side at any given bid/ask spread. Breadth refers to the costs of providing liquidity, whose orders are numerous in volume, with the smallest impact on prices. Resiliency is another aspect of markets in which orders flow quickly to correct the imbalances in trading, and prices tend to return to fundamental values. Due to the limitation of the data in a frontier market, this study will analyze three dimensions: depth dimension, tightness dimension, and resilience dimension. The study applies those most commonly used to measure liquidity, and reflects comprehensively the different dimensions of stock market liquidity.

Sarr and Lybek (2002) proposed using trading volume (VOL), trading value (VAL), and turnover ratio (TO) as proxies for depth dimensions. VOL , VAL captures the number of traded shares, and the amount of traded value during a specified period. TO is a common measure, applied in the studies on stock liquidity in Vietnam (Batten and Vo, 2011; Tran, et al. 2018). VOL , VAL , and TO are liquid proxies, the higher the proxies, the better the liquidity.

Tightness dimensions are also known as transaction cost dimensions, which are proxied by spread measures. Marshall et al. (2013) applied these measures in the study of emerging markets. Bid-Ask spread ($SPRD_{i,d}$) is one of the most common measures, $SPRD_{i,d}$ is the difference between the best ask price ($P^A_{i,d}$) and the best bid price ($P^B_{i,d}$). The relative spread ($RESPRD_{i,d}$), is calculated for stock i on day d as $RESPRD_{i,d} = (P^A_{i,d} - P^B_{i,d}) / [(P^A_{i,d} + P^B_{i,d}) / 2]$. $SPRD_{i,d}$ and $RESPRD_{i,d}$ have negative relation with the stock liquidity.

Resilience dimensions are proxied by three typical measures as Zero-return, Amihud's (2002) measure, and the FHT measure. Amihud (2002) suggested an illiquidity measure for the resilience dimensions as $AMH_{i,d} = |R_{i,d}| / VAL_{i,d}$, where $R_{i,d}$, $VAL_{i,d}$ are the return, and the trading value for stock i on day d . Bekaert et al. (Bekaert, Harvey, and Lundblad, 2007) suggested the zero-return measure ($ZEROS_{i,m}$) to proxy for resiliency, which is defined as $ZEROS_{i,m} = NOZ_{i,m} / N_m$, where $NOZ_{i,m}$ is the number of zero-return days of stock i in month m , N_m is the number of trading days in month m . AMH and $ZEROS$ have negative relation with liquidity. FHT is a measure, introduced by Fong, Holden and Trzcinka (2017), computed as formula $FHT_m = 2\sigma_m \phi^{-1} * [(1 + ZEROS_{i,m}) / 2]$,

where $s_{i,m}$ is the standard deviation of return for stock i in month m , and $\phi(\cdot)$ is the cumulative distribution of a standardized normal distribution. *FHT* indicates that stocks with higher *FHT*, are more liquid.

3. Data and methodology

3.1. Data

The companies had to meet the following criteria to be selected. First, they had to be listed on the Vietnamese Stock Exchange for the whole time during the period from January 2011 to December 2018. Second, selected companies had to be traded at least once a month over the same period; this study covers 179 non-financial companies. Intraday trading data were obtained from Thomson Reuters Datastream, and the State Securities Commission of Vietnam.

3.2. Methodology

The study conducted descriptive statistics to analyze the dimensions of liquidity on HOSE. Depth dimensions and tightness dimensions were computed daily, while resilience dimensions were computed monthly, other dimensions could not be analyzed in this study due to the limitation of the data. Then the study analyzed the liquidity by splitting 179 companies on HOSE into three groups based on the breakpoints of the market capitalization ranking, the first 30% of the sample is the small group (S), the next 40% of the sample is the medium group (M), and the last 30% of the sample is the large group (L).

To compute the aggregate liquidity on HOSE, the study applied both methods i.e. the equally-weighted average, and the value-weighted average. The calculation in value-weighted average took into account the market capitalization of each stock.

4. Analysis of dimensions of stock market liquidity on the Ho Chi Minh Stock Exchange

4.1. An introduction of the Ho Chi Minh Stock Exchange

HOSE is currently the largest stock exchange in Vietnam, established on 28 July 2000. According to the State Securities Commission of Vietnam (2019), the number of listed companies on HOSE was 373, and market capitalization on HOSE was US\$ 124.4 billion at the end of 2018. Investors on HOSE make transactions by an automated order-matching system. There are two kinds of trading auction on HOSE, a periodic auction and a continuous auction. The periodic auction takes place twice a day, at the opening and the closing of the trading day. The continuous auction occurs during the trading day between two periodic auctions.

In 2010 there were about 1 million investors in the Vietnamese stock market, including 13 thousand foreign investors. The number of accounts increased to approximately 2.2 million accounts eight years later, which included about 28.5 thousand accounts of foreign investors (State Securities Commission of Vietnam, 2019).

4.2. Analysis of descriptive statistics on the dimensions of stock market liquidity on the Ho Chi Minh Stock Exchange

Table 1 shows the descriptive statistics of three features tightness, depth and resilience dimensions on HOSE during the period from 2011 to 2018.

Table 1. Descriptive statistics of liquidity measures

	Tightness dimension		Depth dimension			Resilience dimension		
	SPRD	RESPRD	VOL	VAL	TO	AMH	ZEROS	FHT
Mean	423.14	0.0201	298830.5	5945.443	0.002463	$2*10^{-08}$	0.2422	1.3678
Median	200	0.0128	28990	495	0.000559	$1.59*10^{-10}$	0.217	1.3724
Standard deviation	658.86	0.0207	970531	21077.71	0.005665	$1.42*10^{-7}$	0.163	0.0475
Minimum	0	0	10	1	0	0	0	1.1886
Maximum	14700	2	$1.28*10^8$	2468007	0.507369	$1.25*10^{-05}$	1	1.4462

Source: own study.

Table 1 indicates that the tightness dimension on HOSE, proxied by SPRD and RESPRD, having a mean are VND 423.14 and 0.02 respectively, while SPRD varies between 0 and 14,700 and RESPRD varies between 0 and 2. The result also shows the depth dimension by liquidity proxies VOL, VAL, TO. There were 298,830 shares traded daily on average over the same period, with a standard error of trading volume of 1653.6. The largest volume traded in HOSE in a day was 128 billion shares. The biggest traded value is VND 2,468,007 million. The mean of TO is 0.0025, ranging

Table 2. Correlation among liquidity measures

	Daily measures						Monthly measures		
	SPRD	RESPRD	TO	VOL	VAL	AMH	ZEROS	FHT	
SPRD	1						ZEROS	1	
RESPRD	0.603	1					FHT	-0.985	
TO	-0.179	-0.190	1						
VOL	-0.144	-0.176	0.556	1					
VAL	-0.083	-0.186	0.347	0.632	1				
AMH	0.284	0.212	-0.063	-0.044	-0.039	1			

Source: own study.

between 0 and 0.507. The resilience dimension illustrates a brighter description of liquidity on HOSE. ZEROS measure ranges from 0 to 1 and the average is 0.24. This means that the stocks listed on HOSE have 24.2% of trading days with zero returns, while AMH and FHT have an average of 2×10^{-8} and 1.37 respectively.

Comparing the standard deviation and the mean, SPRD, RESPRD, TO, VOL, VAL, and AMH have a standard deviation higher than the mean. The two remaining measures have a smaller standard deviation than the mean. They indicate that the liquidity measures are more spread out around the mean.

The correlation between the two measures in tightness dimension, SPRD and RESPRD, is 60.3%. Proxies of depth dimension have a negative correlation with tightness dimension. The correlation coefficients between VOL and SPRD, RESPRD are -14.4%, -17.6% respectively. Similarly, the correlation coefficients of TO with SPRD, RESPRD are approximately -18%, -19.0% respectively. AMH, a measure of resilience dimension, has a positive correlation coefficient with a tightness dimension above 20%, and a negative correlation with depth dimension from -6.4% to -3.9%. Two measures (FHT, ZEROS) in resilience dimension have a high correlation coefficient of -98.5%.

4.3. Market-wide analysis in the dimensions of stock market liquidity on the Ho Chi Minh Stock Exchange

The results in Table 3 indicate that the aggregate liquidity on HOSE measured by the value-weighted average is more liquid than that by the equally-weighted average. The illiquidity measures (RESPRD, AMH, ZEROS) in the equally-weighted average have a higher mean than the other method. On the other hand, the liquidity measure (FHT) in the value-weighted average is higher than the equally-weighted average. Similarly, the proportion of zero-return on HOSE is 24% by the equally-weighted average, compared to 19.2% in the second method. This evidence shows that stocks with lower market capitalization and less liquidity determined the market liquidity.

Referring to the tightness dimension, the mean of SPRD and RESPRD are 407.07 and 0.0202, respectively. These measures with standard deviation are 58.07 and 0.0032, respectively. This indicates that market-wide liquidity is more clustered about the mean, with the standard deviation which is smaller than the mean. This characteristic is same for the depth dimension and the resilience dimension. The AMH, ZEROS, FHT measures are 1.9115×10^{-8} , 0.2406 and 1.3682 on average, respectively.

These results in Table 3 also suggested the important role of the application of the value-weighted average in the studies of stock market liquidity in the Vietnamese stock market. Specifically, the studies examine the factors' impact on stock market liquidity, which should be concerned about the influence of market capitalization.

The results in Table 4 show the liquidity measures of three groups according to their market capitalization: small, medium, and large.

Table 3. Descriptive statistics of aggregate liquidity measures

	The equally-weighted average					
	SPRD	RESPRD	TO	AMH	ZEROS	FHT
Mean	407.07	0.0202	0.00249	1.9115*10 ⁻⁸	0.2406	1.3682
Median	400.77	0.0200	0.00232	1.6671*10 ⁻⁸	0.2381	1.3688
Standard deviation	58.07	0.0032	0.00111	1.1574*10 ⁻⁸	0.0460	0.0139
Minimum	277.17	0.0123	0.00064	1.4435*10 ⁻⁹	0.1321	1.3381
Maximum	733.68	0.0403	0.00863	8.8683*10 ⁻⁸	0.3447	1.4016
	The value-weighted average					
Mean	482.41	0.0077	0.00179	4.1607*10 ⁻⁹	0.1923	1.3826
Median	520.96	0.0083	0.00158	2.8813*10 ⁻⁹	0.1876	1.3842
Standard deviation	193.60	0.0025	0.00102	4.6330*10 ⁻⁹	0.0725	0.0223
Minimum	32.94	0.0009	0.00023	2.0517*10 ⁻¹⁰	0.0535	1.3223
Maximum	2109.11	0.0213	0.00815	1.1212*10 ⁻⁷	0.4014	1.4278

Source: own study.

Table 4. Comparison of the dimensions of liquidity

Liquidity measures of three dimensions		Group	Mean	Standard deviation	Median	Minimum	Maximum
TIGHTNESS DIMENSION	SPRD	S	302.589	1.510468	296.3924	147.7273	529.4737
		M	468.558	1.881184	460.5847	278.4615	848.0769
		L	434.446	1.900065	423.5294	210	852.4
	RESPRD	S	0.02764	0.000119	0.027132	0.013106	0.047443
		M	0.02032	0.000103	0.019839	0.010505	0.067366
		L	0.01332	8.29*10 ⁻⁵	0.012934	0.005424	0.027585
DEPTH DIMENSION	TO	S	0.00254	3.91*10 ⁻⁵	0.002069	0.000262	0.012914
		M	0.00282	2.9*10 ⁻⁵	0.002648	0.000515	0.009853
		L	0.00205	2.16*10 ⁻⁵	0.002024	0.000349	0.012411
	VOL	S	99459.66	1523.489	80701.9	11824	496289.6
		M	249787	3236.047	242923.3	22025.61	1271769
		L	563448	7485.394	544498.5	55840.38	3626221
	VAL	S	927.192	16.03969	736.1034	54.36585	5815.571
		M	3200.092	41.51697	2979.125	283.2281	13313.65
		L	13300.6	215.3172	11652.06	1200.161	79001.04
RESILIENCE DIMENSION	ZEROS	S	0.27259	0.005365	0.268026	0.119529	0.385668
		M	0.24552	0.005203	0.242244	0.144444	0.379167
		L	0.20194	0.004652	0.20787	0.090123	0.295455
	FHT	S	1.35853	0.001583	1.359736	1.325953	1.405213
		M	1.36671	0.001558	1.367606	1.328188	1.397931
		L	1.37977	0.001449	1.377475	1.351122	1.415146
	AMH	S	1.98*10 ⁻⁸	3.48*10 ⁻¹⁰	1.55*10 ⁻⁸	8.38*10 ⁻¹⁰	9.99*10 ⁻⁸
		M	2.47*10 ⁻⁸	4.69*10 ⁻¹⁰	1.85*10 ⁻⁸	8.53*10 ⁻¹⁰	1.46*10 ⁻⁷
		L	1.12*10 ⁻⁸	3.63*10 ⁻¹⁰	5.42*10 ⁻⁹	1.69*10 ⁻¹⁰	2.34*10 ⁻⁷

Source: own study.

Table 4 demonstrates that the depth dimensions are higher in companies with higher market capitalization. Specifically, there are differences in trading volume between the largest group and the two smaller groups. Stocks in the small group trade approximately 100 thousand shares daily on average, while that of the large group is more than five times higher. In terms of trading value, the daily traded value of the top group is 13 times higher than in the bottom group, about VND 13,000 million on average. However, proxies of tightness dimension show different results among the three groups. The medium group has the highest spread, while the small group has the smallest spread, which means that the small group has the lowest transaction costs. This could be explained by the fact that the companies in the large group have a higher price, thus their stocks are traded with a bigger tick size, and have a bigger spread. However, the small group has the largest RESPRD, followed by the medium and large group respectively.

The resilience dimensions also indicated that the large group is the most liquid of the three groups, with the smallest proxies as ZEROS, AMH, and the highest in the FHT measure. The rate of zero-return in trading days of the large group is 20.2%, compared to that of the medium and the small group, which are 24.6% and 27.3% respectively. On the other hand, the small group has the smallest FHT at 1.36, and the large group has the largest indicator at 1.38.

The results offer a description of the market situation as a panorama of the stock market liquidity for HOSE in recent years. The empirical evidence suggests a relationship between company size and stock market liquidity, the study of which should be conducted to investigate this relationship on HOSE.

5. Conclusions

The empirical evidence captures the different dimensions of stock market liquidity on the Ho Chi Minh Stock Exchange during the period from 2011 to 2018. The results of the time series analysis illustrate stock market liquidity through eight measures, and the changes in the liquidity of HOSE during this period.

The stock market liquidity on HOSE has a consistent result in three dimensions of stock liquidity, the small companies (according to market capitalization) are less liquid than companies with higher market capitalization, and the difference is acute between the small and large group. The result of the cross-sectional analysis shows that the market liquidity as the equally-weighted average is higher than the value-weighted average. The evidence reveals that liquidity on HOSE depends on less liquid stocks. The study has its limitation in that it could not compare the dimensions of stock market liquidity between HOSE and the other appropriate stock exchanges. In fact, the liquidity measurements in other stock exchanges in the literatures, even in Vietnam, are not available, or they are from a different period than this study. The study might be developed further by investigating the relationship size, liquidity, and stock returns on other stock exchanges.

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