

Exchange-Traded Funds (ETFs) and Stock Liquidity: Vietnamese Evidence

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Abstract

The paper examines how the introduction of Vietnamese exchange-traded funds (ETFs) impacts on the liquidity of the underlying stocks. We found that the component stock's liquidity decreased after Deutsche Bank Xtrackers (DBX) - the first Vietnamese-based ETF - was introduced in 2008, but significantly improved after the introduction of the other two ETFs, the VanEck Vectors Vietnam ETF (VNM) in 2009 and the E1VFN30 in 2014. In addition, the stock liquidity change is more pronounced for the stocks that had lower weight in the ETFs. The empirical findings may result in policy implications about the effects of ETF creation on the Vietnam stock market under different trends of the stock market. ETF creation not only provides a new and alternative investment, but is also a diversified and transparent investment tool for Vietnamese investors.

Keywords: Adverse selection; ETF; inter-arbitrage; investor recognition; liquidity.

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1. Introduction

Exchange-traded funds (ETFs) are widely considered as one of the most successful financial tools for index trackers. ETFs allow investors to trade indices quite easily, in small amounts at significantly lower costs, rather than to replicate individual securities of a particular index. At the end of September 2015, there were 5978 ETFs/ETPs (Exchanged Traded Products) listed on over 61 exchanges with total assets of US\$2.8 trillion (Young, 2015). Understanding how and why ETFs can affect the trading of underlying securities has attracted great interests from researchers. Empirical evidence of liquidity effects is mixed so far. While Hegde and McDermott (2004) find that creation of the DIAMONDS ETF (tracking the Dow Jones Industrial Average index) results in an improvement in liquidity of the underlying 30 stocks, Hamm (2010) found a significant decrease in liquidity of component stocks of 294 United States (U.S.) equity ETFs from 2002 to 2008. In the context of Vietnam's securities market, the first two domestic ETFs were introduced in 2014. Besides, there are two other ETFs based on Vietnamese stocks, namely the VanEck Vectors Vietnam ETF (VNM) and Deutsche Bank Xtrackers (DBX) which have traded on U.S. and European stock exchanges since 2008. Our study contributes to the literature with specific evidence about the significant impacts of Vietnamese ETFs on the underlying stocks' liquidity, which may lead to some implications for the development of ETFs in Vietnam.

2. Literature review

Various studies investigate how the introduction of ETFs affects the liquidity of under-

lying assets in mature capital markets, namely, the U.S. and European markets. This issue is controversial and the empirical evidence is mixed between the investor recognition hypothesis, the adverse selection hypothesis and the arbitrage hypothesis. While the adverse selection hypothesis predicts a decrease in the liquidity of underlying assets after the introduction of ETFs, the investor recognition and the arbitrage hypotheses forecast an increase in the liquidity of underlying stocks (Winne et al., 2014; Richie and Madura, 2007; Hegde and McDermott, 2004; Fremault, 1991; Merton, 1987).

According to the investor recognition hypothesis, Merton (1987) suggested that an unusual event, such as the introduction of a new financial tool, might attract the attention of newfound investors, hence, those investors would trade these stocks related to the event. Besides, the shareholder base may increase, so the required return will decrease and liquidity will increase because of a decrease in the direct transaction cost and a decline in information asymmetry (Hegde and McDermott, 2003). Stock liquidity measured by total depth, trading volume and number of trades was shown to increase after the introduction of Nasdaq 100 ETFs (Richie and Madura, 2007). Similarly, under the track of the arbitrage hypothesis, the introduction of financial instruments which are derived from existing underlying securities like ETFs may enhance market efficiency due to inter-market arbitrage opportunities (Winne et al., 2014). More precisely, liquidity measured by the absolute spread and effective spread of underlying stocks may be improved when risks are reallocated between the underlying stock

markets and ETF markets, and the order imbalances are reduced (Fremault, 1991; Hegde and McDermott, 2004). Conversely, the adverse selection hypothesis states that the introduction of ETFs may lead to a liquidity decrease of underlying stocks because individual stocks become less attractive than the composite index (i.e. low adverse selection cost). Hamm (2010) used a bid-ask spread to measure liquidity in order to analyze 294 ETFs between 2002 and 2008. In Vietnam, there is no academic research about the effect of ETFs on stock liquidity. Some studies reveal the relationship between stock liquidity and stock returns (Batten and Vo, 2014) or monetary policy (Ly, 2015), but no empirical study has investigated the introduction of Vietnam-based ETFs and their impacts on underlying stock liquidity.

The liquidity effects on the underlying stocks may be divergent between different weights of component stocks. The arbitrage hypothesis does not mention the relationship between stock weight in the ETF and the liquidity changes after the introduction of the ETF (Fremault, 1991). However, according to the recognition hypothesis, the liquidity effects on individual underlying stocks are asymmetric, based on the weights of the component stocks in the ETFs (Merton, 1987). In other words, the lower the weights of the component stocks in the Invesco QQQ ETF, the more pronounced the liquidity effect (Richie and Madura, 2007). Besides, the adverse selection hypothesis states that the liquidity of the underlying stocks with higher weights within ETFs will reduce the most after the ETFs are born. Specifically, the stocks with higher weight held in the ETFs exhibit greater adverse selection cost of individual stocks.

As a result, uninformed traders prefer the more diversified instruments, like ETFs, to avoid a high adverse selection cost when trading individual underlying stocks (Hamm, 2010).

The purpose of this paper is to find out the significant effect on liquidity of underlying stocks due to the introduction of the Vietnam-based ETFs. The construction of ETFs generally aims at tracking Vietnamese stocks. Due to the data availability, the paper focused on the three critical ETFs which are DBX (born in 2008), VNM (born in 2009) and E1VFN30 (born in 2014).

The research findings show that there was an improvement in the liquidity of underlying stocks measured by absolute and relative spreads after the introduction of VNM in 2009 and E1VFN30 in 2014. The results are consistent with Richie and Madura (2007), Hegde and McDermott (2004) and Jegadeesh and Subrahmanyam (1993). However, with the ETF introduced in 2008, DBX, the study found a decrease in the liquidity of component stocks. The possible reason may come from the unique downturn context of the Vietnamese stock market in 2008. Amihud's illiquidity measurement (Amihud, 2002) reveals no significant effect on the specific context of Vietnam. Liquidity effects also depend on the weight of each stock within the ETF. The lower weight of the stocks, the more pronounced are stock liquidity increases.

The research is structured into four sections. After the introduction and the literature review, the hypothesis development is presented in the second section. The third section outlines the data description and methodology while section four demonstrates empirical results and

discussion. The research is ended by concluding remarks.

3. Hypotheses development

The liquidity effect can be explained by the adverse selection theory, the arbitrage theory and the investor recognition theory as discussed above. Adverse selection forecasts a decrease in the liquidity of underlying stocks due to the lower attractiveness of the stock from a low level of information asymmetry and higher benefits of diversification of ETFs (Jegadeesh and Subrahmanyam, 1993). However, under the context of Vietnam, the awareness of average investors about the benefits of ETFs is still limited due to their trading behavior in stock exchanges being mostly based on traditional financial tools such as stocks and bonds. Vietnamese investors often invest money by themselves instead of pooling money to fund managers. Furthermore, most of the Vietnamese investors are individuals and they are usually confused in selecting stocks to invest with non-transparent information in an emerging market. Therefore, the investor recognition hypothesis may explain better when the formation of the ETFs will raise a signal to the investors about the good stocks selected by professional funds, like ETFs. The underlying stocks liquidity is expected to increase after the introduction of the ETFs. In addition, the arbitrage theory of Fremault (1991) may not apply well for Vietnam-based ETFs because of two reasons. Firstly, DBX and VNM are traded in foreign stock exchanges such as the U.S., Hong Kong and Singapore, among others. Risk arising from exchange rate fluctuations and differences in trading hours with Vietnam stock markets will limit arbitrage opportunities. Secondly, although

E1VFN30 is a domestic ETF traded in the Ho Chi Minh Stock Exchange, its creation and redemption process is only conducted weekly on Tuesdays which results in a low chance for arbitrage activity between the underlying stock's market and the ETF market.

With the investor recognition theory, the research expects to test the first hypothesis as follows:

H1: The introduction of Vietnam-based ETFs positively affects the underlying stock liquidity

Moreover, the recognition theory (Merton, 1987) suggests that the liquidity effects should be most pronounced for the less heavily weighted stocks in the ETFs. This is the basis for the second hypothesis of the research:

H2: The liquidity of underlying stocks is improved more for the stocks with lower weights in the ETFs' Index

4. Research methodology and variables description

The multivariate analysis is based on panel regressions with different liquidity measures as dependent variables. The research investigates three ETFs tracking the Vietnamese stock market at some specific points of time with regards to the introduction of each ETF. Although, there are four ETFs containing a huge weight of Vietnamese underlying assets, the domestic ETF E1SSHN30 is relatively new to the market with small total assets, so E1SSHN30 is excluded from the research sample due to illiquidity and big changes in E1SSHN30's structure. The three ETFs are studied around the three inception dates as follows: DBX: January 15th, 2008; VNM: August 11th, 2009 and E1VFN30: October 6th, 2014.

Table1: Description of variables

Variable	Variable name in the model	Description and computation
Dependent variables - Liquidity proxies		
Log of Absolute spread	<i>Logabsolutespread</i>	Log of absolute spread = ln(Ask price – bid price)
Relative spread	<i>Relativespread</i>	$Relative\ spread = \frac{2(Ask\ price - bid\ price)}{Ask\ price + bid\ price}$
Daily Amihud illiquidity ratio	<i>Amihud</i>	$Amihud = \frac{ R_{i,t} }{V_{i,t}}$ $V_{i,t}$ is trading value of the stock i on day t and $R_{i,t}$ is the return on stock i on day t .
ETF variables		
ETF	<i>ETF</i>	ETF is a dummy variable. ETF is zero before the introduction of ETF and one afterward.
ETF*weight	<i>ETFxw_i</i>	Interaction term between ETF and weight of each stock in each ETF, respectively
Control variables		
Price	<i>LnAdjustedclosingprice_{i,t}</i>	Adjusted closing price in the day of each stock
Trading Value	<i>LNTradingvalue</i>	Log of total trading value in Vietnam Dong traded in the day of each stock
Volatility	<i>Parkinson1980</i>	$Volatility^n = \frac{(\lnHIGH - \lnLOW)^2}{4\ln(2)}$ in which High and Low are the highest and the lowest trading prices in the day of each stock, respectively. The method is based on Parkinson (1980).
Firm size	<i>Firmsize</i>	Log of Market capitalization
Market return	<i>MarketReturn</i>	Market return = $\frac{VNindex_t - VNindex_{t-1}}{VNindex_{t-1}}$
Order imbalance	<i>Orderimbalance</i>	Order imbalance = sell trade volumes - buy trade volume /total trade volume

Data used in the paper is obtained from The Financial Times Stock Exchange (FTSE) for DBX, from Vanech for VNM and from Stox-plus for E1VFN30. The data contains the stock codes and respective weights in each fund.

In order to test the expected hypotheses, three trading windows around the event of each

ETF introduction have been selected: 50-days, 100-days and 6-months. The trading windows can be chosen differently by different researchers, for example: 50 days (Hegde and McDermott, 2004), 60 days and 30 days (Winne et al., 2014). The motivation for choosing different trading windows is based on two reasons. First, the post-ETF inception period should be

sufficiently long to contain the days when the liquidity impact is sizeable enough. Second, the trading window should be “short enough to minimize the probability of exogenous factors, not controlled for the analysis” (Winne et al., 2014). The Vietnamese stock market is featured by modest liquidity, so 50-day and 100-day trading windows are suitable to test liquidity effects. Multiple trading windows are employed with the aim to test sensitivity of the timeframe as a robustness test.

Regression models are designed as follows:

$$LV_{i,t} = a_0 + bETF_i + cETF_i * w_i + a_1 LnAdjustedclosingprice_{i,t} + a_2 LnTradingvalue + a_3 Parkinson1980 + a_4 Orderimbalance_{i,t} + a_5 LnFirm-size_{i,t} + a_6 Marketreturn_{i,t} + u_{i,t} \quad (1)$$

The model is built on Hegde and McDermott (2004), Richie and Madura (2007) and Winne et al. (2014) based on the original model of Jegadeesh and Subrahmanyam (1993) with the dependent variable liquidity, the dummy variable ETF and an interaction term ETF*weight will be used to detect liquidity effects on the underlying assets after the introduction of ETFs.

We use three proxies to capture stock liquidity, namely, Absolute Spread, Relative Spread and Amihud Ratio. Absolute spread and Relative Spread are considered as transaction cost measures of liquidity (Richie and Madura, 2007; Hegde and McDermott, 2004; Jegadeesh and Subrahmanyam, 1993). The Amihud illiquidity ratio measures the price impact of liquidity (Amihud, 2002). The choice of liquidity proxies is based on a review of previous studies by Winne et al. (2014), Hamm (2010), Richie and Madura (2007), Hegde and McDermott (2004), Jegadeesh and Subrahmanyam (1993). Winne et al. (2014) use two dummy

control variables to present for fluctuation of market return. They are $MarketUp_i$ and $MarketDown_i$ in which $MarketUp_i$ equals the index return when the index return is positive, zero otherwise; $MarketDown_i$ equals the index return when the index return is negative, zero otherwise. However, $Marketreturn_{i,t}$ is used in the research to replace two dummies $MarketUp_i$ and $MarketDown_i$ that are our variables of interest.

Six variables, namely price, trading value, volatility, firm size, order imbalance and market return, are explored as control variables of the model.

The detailed explanation of each variable is shown in the Table 1.

5. Research findings

5.1. Descriptive statistics

Table 2 reports the descriptive statistics for variables. Panel A contains 2721 observations of 27 underlying stocks of the DBX - ETFs around the inception date (i.e. January 15th, 2008). Similarly, Panel B contains trading data of 14 stocks of the VNM. Panel C contains 3090 observations of 30 stocks of the E1VFN30. Means of the two liquidity proxies: absolute spread and relative spread are lowest in Panel C (4.8675 and 0.0072, respectively). It may imply that that there was an improvement in liquidity in 2014 compared to the years 2008 and 2009. The statistics of Amihud’s measure shown in Table 2 is 0.0000 but that does not mean the Amihud ratios equal zero for the whole sample. Due to the formula of the Amihud ratio (Amihud, 2002) (return divided by trading value), the Amihud ratio is very small and close to zero.

Table 2: Data statistics

	Observation	Mean	Standard Deviation	Min	Max
Panel A: DBX					
Logabsolutespread	2716	5.9343	1.1935	3.2052	10.0273
Relativespread	2721	0.0265	0.0465	0.0000	0.3911
Amihud	2721	0.0000	0.0000	0.0000	0.0000
ETF	2721	0.5057	0.5001	0.0000	1.0000
ETFxWeight	2721	0.0187	0.0338	0.0000	0.1396
LNAdjusted_closing price	2721	10.3316	0.7261	8.3168	11.7563
LNTradingvalue	2721	22.3290	1.7063	13.4075	26.5172
Parkinson1980	2721	0.0003	0.0005	0.0000	0.0036
Orderimbalance	2721	26.2102	527.7204	0.0000	23510.0000
MarketReturn	2721	-0.0068	0.0218	-0.0470	0.0475
Panel B: VNM					
Logabsolutespread	1365	6.0601	1.3386	4.6052	11.2118
Relativespread	1365	0.0216	0.0497	0.0013	0.5827
Amihud	1364	0.0000	0.0000	0.0000	0.0000
ETF	1365	0.5143	0.5000	0.0000	1.0000
ETFxWeight	1365	0.0260	0.0282	0.0000	0.0800
LNAdjusted_closing price	1365	9.9458	0.3442	9.2720	10.8242
LNTradingvalue	1365	24.3431	1.9478	12.8790	34.5939
Parkinson1980	1365	0.0005	0.0007	0.0000	0.0070
Orderimbalance	1355	1.0542	4.6020	0.0000	122.8326
MarketReturn	1365	0.0039	0.0199	-0.0436	0.0476
Panel C: E1VFN30					
Logabsolutespread	3089	4.8675	0.7398	3.8356	8.8966
Relativespread	3090	0.0072	0.0071	0.0000	0.1387
Amihud	3090	0.0000	0.0000	0.0000	0.0000
ETF	3090	0.5049	0.5001	0.0000	1.0000
ETFxWeight	3090	0.0166	0.0259	0.0000	0.0934
LNAdjusted_closing price	3090	10.0381	0.5838	8.9359	11.4295
LNTradingvalue	3090	23.7133	1.2934	19.5044	28.2621
Parkinson1980	3090	0.0003	0.0004	0.0000	0.0059
Orderimbalance	3090	0.6307	0.8479	0.0003	17.1774
MarketReturn	3089	4.8675	0.7398	3.8356	8.8966

Table 3 shows that all correlation coefficients among independent variables are less than 0.8, which may lead to less concern about the multicollinearity problems between independent variables in the regression model (Gujarati, 2004).

5.2. Regression results

The hypothesis about an increase of underlying stock liquidity is proved to be significant after the introduction of the two ETFs: VNM

and E1VFN30, while the introduction of DBX led to a decrease of stock liquidity. Table 4 shows the regression findings of the 100-day trading window in which the coefficients of the ETF dummy are negative significantly at 1% and 5% levels as absolute spread and relative spread is considered as proxy for stock liquidity of the VNM and E1VFN30. It means we found a very significant improvement in liquidity when VNM and E1VFN30 were in-

Table 3: Pearson Correlation matrix

	Logabs-d	Relati-d	Amihud	ETF	ETFxWeight	LNAdju-e	LNTrad-e	Par~1980	Orderi-e	Marke~rn
Panel A: DBX										
Logabsolutspread	1.0000									
Relativespread	0.6835	1.0000								
Amihud	0.0905	0.0867	1.0000							
ETF	0.2169	0.3102	0.0560	1						
ETFxWeight	0.0416	0.1290	-0.0160	0.5492	1					
LNAdjusted_closing price	0.4431	-0.1169	0.0053	-0.2581	-0.1988	1				
LNTradingvalue	-0.1311	-0.1532	-0.2430	-0.1822	0.2788	0.1575	1			
Parkinson1980	0.0242	-0.0276	-0.0282	0.1642	0.0325	-0.0376	0.0453	1		
Orderimbalance	0.0410	0.0429	0.2547	0.0470	0.0072	-0.0336	-0.2003	-0.0292	1	
MarketReturn	-0.0602	-0.1455	0.0001	-0.0941	-0.0517	0.0493	0.0088	-0.0061	0.0289	1
Panel B: VNM										
Logabsolutspread	1									
Relativespread	0.6728	1								
Amihud	0.0452	0.0132	1							
ETF	-0.1603	-0.1432	-0.0859	1						
ETFxWeight	-0.0738	-0.1069	-0.0807	0.6968	1					
LNAdjusted_closing price	0.1836	0.0714	-0.0087	0.2652	0.1915	1				
LNTradingvalue	0.0058	-0.0096	-0.5521	0.1713	0.2017	-0.0301	1			
Parkinson1980	-0.0928	-0.0676	-0.0249	-0.1248	-0.1424	0.0055	0.1242	1		
Orderimbalance	0.2294	0.256	0.0107	-0.109	-0.1006	-0.0171	-0.1071	-0.0879	1	
MarketReturn	0.0885	0.1033	0.0385	0.0171	0.0153	0.0331	-0.064	-0.0888	0.0396	1
Panel C: EIVFN30										
Logabsolutspread	1									
Relativespread	0.5164	1								
Amihud	0.0078	0.0514	1							
ETF	-0.0257	-0.0122	0.0929	1						
ETFxWeight	0.2237	0.0007	0.0155	0.6348	1					
LNAdjusted_closing price	0.6549	-0.0748	-0.0764	-0.0151	0.2868	1				
LNTradingvalue	0.1166	0.0868	-0.4744	-0.1222	-0.0099	0.1237	1			
Parkinson1980	0.1365	0.3036	0.0161	-0.0186	-0.0772	-0.0856	0.3483	1		
Orderimbalance	0.0141	0.0812	0.4276	0.0397	0.0041	-0.0691	-0.365	-0.0906	1	
MarketReturn	-0.028	-0.0756	-0.0594	-0.1625	-0.1031	0.0141	-0.0286	-0.1665	-0.0382	1

Table 4: Regression results of ETFs' impacts to liquidity based on 100 trading days

VARIABLES	Panel A: DBX			Panel B: VNM			Panel C: E1FVN30		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
<i>ETF</i>	Absolute spread 0.619*** (0.0539)	Relative spread 0.0223*** (0.00241)	Amihud illiquidity ratio 0 (0)	Absolute spread -1.509*** (0.169)	Relative spread -0.0253*** (0.00591)	Amihud illiquidity ratio -3.37e-10 (3.73e-10)	Absolute spread -0.0915*** (0.0278)	Relative spread -0.000697** (0.000349)	Amihud illiquidity ratio 0 (0)
<i>ETFxWeight</i>	3.470*** (0.874)	0.0949** (0.0390)	-6.38e-10 (3.86e-10)	17.49*** (3.130)	0.199* (0.109)	8.59e-09 (6.89e-09)	2.112*** (0.586)	0.0171** (0.00734)	-0 (0)
<i>Constant</i>	2.652*** (0.727)	0.276*** (0.0325)	4.17e-09 (3.09e-09)	-6.676** (2.836)	-0.148 (0.0991)	1.70e-08*** (6.25e-09)	-4.417*** (0.383)	0.005538 (0.00480)	0 (9.80e-11)
<i>LNAdjusted closingprice</i>	0.893*** (0.0272)	-0.00298** (0.00121)	1.65e-10 (1.50e-10)	1.021*** (0.109)	0.0166*** (0.00380)	-3.84e-10 (2.40e-10)	0.784*** (0.0204)	-0.00100*** (0.000256)	0 (0)
<i>LNTrading value</i>	-0.0527*** (0.0163)	0.000702 (0.000728)	-1.97e-10 (1.77e-10)	0.0482*** (0.0175)	0.00129** (0.000610)	-9.38e-10*** (0)	-0.0123 (0.00883)	6.14e-05 (0.000111)	-0*** (0)
<i>Parkinson1980</i>	-42.80 (40.34)	-9.354*** (1.804)	4.36e-08 (4.60e-08)	-170.8*** (48.24)	-4.054** (1.685)	2.54e-07** (1.06e-07)	453.9*** (29.68)	6.079*** (0.372)	1.17e-09*** (2.45e-10)
<i>Orderimbalance</i>	0.000359*** (0.000125)	1.69e-05*** (5.59e-06)	0* (0)	0.0592*** (0.00721)	0.00228*** (0.000252)	-0** (0)	0.0546*** (0.0133)	0.000641*** (0.000167)	0*** (0)
<i>Firmsize</i>	-0.178*** (0.0270)	-0.00851*** (0.00121)	-0 (6.14e-11)	0.0569 (0.102)	-0.000716 (0.00355)	3.25e-10 (2.24e-10)	0.0518*** (0.0121)	0.000278* (0.000152)	0 (0)
<i>MarketReturn</i>	-3.114*** (0.850)	-0.248*** (0.0380)	-4.70e-10 (6.46e-10)	4.614*** (1.680)	0.209*** (0.0587)	1.56e-09 (3.70e-09)	-0.527 (1.109)	-0.0213 (0.0139)	-0 (0)
<i>Observations</i>	2,663	2,668	2,668	1,343	1,343	1,343	3,029	3,030	3,030
<i>Number of i</i>	27	27	0.068	13	13	13	30	30	0.255

Note: The table reports the results of the regression model (1). The dependent variable is the daily absolute spread in logarithm. LNAdjusted closingprice, LNTrading Value, Parkinson1980, Orderimbalance, Firmsize, and MarketReturn are respectively, the daily adjusted closing price in logarithm, the trading value in logarithm, the price range (volatility), the imbalance between buy and sell traded volumes as a percentage of the total traded volume, the *LN*index return. *ETF* is a variable set to 0 before the introduction of the ETF and 1 afterward. *ETFxWeight* is the interaction term between the dummy *ETF* and the weight of each stock of ETF. Standard errors are unclustered in parentheses. One, two and three asterisks (*, **, and ***) indicate statistical significance at the 10%, 5% and 1% level, respectively.

troduced through tightening the spreads. With regard to the coefficients of the interaction term $ETF \cdot w_i$ of these two ETFs, four estimates are positive and strongly significant at 1% and 5% levels when liquidity is measured by absolute spread and relative spread. The reduction in spreads for more heavily weighted stocks is mitigated or its liquidity is improved less. This suggests that the liquidity improvement following the ETF inception would have been greater for the smaller index component which is consistent with recognition hypothesis (Merton, 1987; Richie and Madura, 2007; Barber and Odean, 2008).

However, DBX has a contradictory liquidity impact with positive coefficients associated with ETF dummies. In other words, there is a decrease in the liquidity of underlying stocks after the introduction of DBX. It may result from the fact that individual stocks of the DBX become less attractive than the composite index (i.e. low adverse selection cost). Instead of investing in individual stocks, investors can gain benefits of diversification from ETFs. Another possible reason is the context of 2008 in Vietnam. DBX was born in the stage of an extreme economic downturn. The Vietnamese stock market witnessed a massive outflow as a huge number of investors sold their stocks and selected different investment opportunities like saving deposits or gold. The market liquidity also declined significantly. Some investors still preferred to invest in the Vietnamese stock market, and they preferred to invest in DBX, the unique diversified index at that time, instead of individual component stocks. By operating this way, the investors got more benefit of diversification and a low adverse selection cost.

As relative spread takes the role of the dependent variable, the liquidity adjustments are similar to absolute spread but less significant. The result is presented in Table 6. We found significant deterioration of index-stock liquidity following the introduction of DBX. The evidence is consistent with all three ETF trading windows at a 1% and 5% level of significance. The regression results of the VNM subsample also indicate an improvement in the liquidity of individual component stocks in the post-VNM period (i.e. tightening relative spreads). However, we only found evidence of the increase in the liquidity of component stocks in post-E1VFN30 100 trading days at a 5% level of significance.

Regarding the Amihud ratio, we did not find any significant evidence of changes in liquidity. The result is presented in Table 7. The evidence is consistent with all three ETFs. The Amihud ratio measures the price impact of stock liquidity, which is calculated by dividing the return on stock by trading value. The higher the Amihud ratio, the more stock is illiquid (Amihud, 2002). The Amihud ratio suggests that when investors could buy a great block of stock with a minimal impact on its stock price, the stock is highly liquid. Based on the measurement of liquidity of the Amihud ratio, it is indicated that there is a strictly negative relationship between stock liquidity and return (Amihud, 2002). We did not find significant changes in the liquidity of underlying stocks after the introduction of ETFs tracking Vietnam stock markets when the Amihud ratio is used as a liquidity proxy. This finding is in agreement with Batten and Vo (2014), where the authors show the positive relationship between stock return and liquidity

Table 5: Regression results of ETFs' impacts to absolute spread of stocks

VARIABLES	Panel A: DBX			Panel B: VNM			Panel C: EIVFVN30		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Pre- and post-DBX period of 50 trading days	0.320***	0.619***	0.583***	-1.408***	-1.509***	-1.021***	-0.124***	-0.0915***	-0.0672***
Pre- and post-DBX period of 100 trading days	(0.0579)	(0.0539)	(0.0506)	(0.224)	(0.169)	(0.135)	(0.0389)	(0.0278)	(0.0252)
Pre- and post-DBX period of 6 months	2.569***	3.470***	4.589***	23.75***	17.49***	12.56***	3.072***	2.112***	1.690***
	(0.990)	(0.874)	(0.809)	(4.106)	(3.130)	(2.476)	(0.815)	(0.586)	(0.534)
Constant	0.347	2.652***	3.008***	-6.502*	-6.676**	-3.050	-4.504***	-4.417***	-4.136***
	(0.859)	(0.727)	(0.654)	(3.680)	(2.836)	(2.425)	(0.559)	(0.383)	(0.338)
LNAadjusted closingprice	0.900***	0.893***	0.896***	0.922***	1.021***	0.928***	0.799***	0.784***	0.775***
	(0.0315)	(0.0272)	(0.0247)	(0.155)	(0.109)	(0.0879)	(0.0283)	(0.0204)	(0.0184)
LNTrading value	0.0304	-0.0527***	-0.0729***	0.0167	0.0482***	0.0457***	-0.0181	-0.0123	-0.0180**
	(0.0221)	(0.0163)	(0.0134)	(0.0273)	(0.0175)	(0.0166)	(0.0131)	(0.00883)	(0.00767)
Parkinson1980	115.9**	-42.80	-32.79	-30.47	-170.8***	-112.7***	433.1***	453.9***	439.7***
	(55.58)	(40.34)	(36.68)	(80.29)	(48.24)	(37.04)	(40.54)	(29.68)	(23.89)
Orderimbalance	0.0864***	0.000359***	5.35e-05*	0.0820***	0.0592***	0.0665***	0.0761***	0.0546***	0.0476***
	(0.00868)	(0.000125)	(2.73e-05)	(0.0124)	(0.00721)	(0.00721)	(0.0226)	(0.0133)	(0.00846)
Firmsize	-0.170***	-0.178***	-0.174***	0.0921	0.0569	-0.0321	0.0540***	0.0518***	0.0499***
	(0.0334)	(0.0270)	(0.0236)	(0.129)	(0.102)	(0.0904)	(0.0172)	(0.0121)	(0.0108)
MarketReturn	0.213	-3.114***	-1.396*	12.26***	4.614***	-1.188	-0.0967	-0.527	0.891
	(0.965)	(0.850)	(0.823)	(2.596)	(1.680)	(1.277)	(1.488)	(1.109)	(0.929)
Observations	1,348	2,663	3,235	649	1,343	1,988	1,559	3,029	3,899
Number of i	27	27	27	13	13	14	30	30	30

Note: The table reports the results of the regression model (1). The dependent variable is the daily absolute spread in logarithm. LNAadjusted closingprice, LNTrading Value, Parkinson1980, Orderimbalance, Firmsize, and MarketReturn are respectively, the daily adjusted closing price in logarithm, the trading value in logarithm, the price range (volatility), the imbalance between buy and sell traded volumes as a percentage of the total traded volume, the V_i Index return. ETF is a variable set to 0 before the introduction of the ETF and 1 afterward. ETFxWeight is the interaction term between the dummy ETF and weight of each stock of ETF. Standard errors are unclustered in parentheses. One, two and three asterisks (*, **, and ***) indicate statistical significance at the 10%, 5% and 1% level, respectively.

in Vietnam during the period of 2007-2010. It means the context of Vietnam hasn't supported the implication of the negative return-liquidity relationship in the Amihud measurement. Taken into account together with empirical results of our research, there is doubt that the Amihud ratio may not be a relevant liquidity proxy in the context of Vietnam.

To sum up, we found significant improvement in the liquidity of underlying stock after the introduction of the two ETFs tracking the Vietnamese stock market in the years 2009 and 2014, but a decrease in liquidity after the introduction of the DBX in 2008. This improvement may be supported by Investor Recognition hypothesis, except for DBX – possibly due to the massive downturn of the market.

5.3. Robustness check

We used two other trading windows including 50 days and 6 months around the inception date to conduct the robustness test. The regression results are presented in Table 5, Table 6 and Table 7. The results show that when the liquidity effect is tested under different trading windows, the regression results do not change. In other words, the evidence is consistent in all three ETFs. Firstly, there is an increase of underlying stock liquidity which is proved to be significant after the introduction of the two ETFs: VNM and E1VFN30, while the introduction of DBX led to a decrease of stock liquidity (i.e. the coefficients of the ETF dummy are negative significantly at a 1% and 5% level as absolute spread and relative spread are considered as proxy for stock liquidity with all three trading windows. Secondly, DBX has a contradictory liquidity impact with positive coefficients associated with ETF dummies. The

signs of estimates are consistently negative with all three trading windows. Thirdly, with regard to coefficients of the interaction term $ETF * w_i$ of these two ETFs, four estimates are positive and strongly significant at 1% and 5% levels when liquidity is measured by absolute spread and relative spread. This suggests that, the Hypothesis 2: “The liquidity of underlying stocks is improved more for the stocks with lower weights in the ETFs Index” is confirmed. The results are consistent with all three trading windows of the VNM and E1VFN30. Finally, there are no significant changes found in the liquidity of underlying stocks after the introduction of ETFs tracking the Vietnamese stock markets when the Amihud ratio is used as a liquidity proxy.

6. Implications and conclusion

The main interest of this paper is liquidity adjustments after the introduction of three ETFs tracking the Vietnam stock market through using different liquidity proxies. The regression estimates are well consistent between three trading windows of 50 trading days, 100 trading days and 06 months around the inception dates of DBX, VNM and E1VFN30, respectively. However, there is a conflicted result with regard to stock liquidity improvement after the introduction of each ETF. As measured by absolute spreads and relative spreads, the liquidity of underlying stocks in the VNM and E1VFN30 is proven to increase. That is explained by investor recognition hypothesis, while we found a decrease in the liquidity of component stock in the DBX fund. The possible reason may come from the unique downturn context of the Vietnam stock market in 2008, which led to the activation of the adverse selection hypothesis.

Table 6: Panel regression of relative spread

VARIABLES	Panel A: DBX			Panel B: VNM			Panel C: EIVFVN30		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
<i>ETF</i>	Pre- and post-DBX period of 50 trading days 0.00933*** (0.00144)	Pre- and post-DBX period of 100 trading days 0.0223*** (0.00241)	Pre- and post-DBX period of 6 months 0.0183*** (0.00240)	Pre- and post-VNM period of 50 trading days -0.0164*** (0.00478)	Pre- and post-VNM period of 100 trading days -0.0253*** (0.00591)	Pre- and post-VNM period of 6 months -0.0138*** (0.00431)	Pre- and post-EIVFVN30 period of 50 trading days -0.000919* (0.000474)	Pre- and post-EIVFVN30 period of 100 trading days -0.000697** (0.000349)	Pre- and post-EIVFVN30 period of 6 months -0.000440 (0.000316)
<i>ETFxWeight</i>	0.00757 (0.0246)	0.0949** (0.0390)	0.156*** (0.0383)	0.242*** (0.0877)	0.199* (0.109)	0.0969 (0.0788)	0.0195** (0.00993)	0.0171** (0.00734)	0.0159** (0.00669)
<i>Constant</i>	0.108*** (0.0214)	0.276*** (0.0325)	0.304*** (0.0310)	0.0299 (0.0786)	-0.148 (0.0991)	0.00381 (0.0773)	0.00370 (0.00682)	0.00538 (0.00480)	0.00516 (0.00424)
<i>LNAdjusted closingprice</i>	-0.00260*** (0.000784)	-0.00298** (0.00121)	-0.00258** (0.00117)	0.00991*** (0.00332)	0.0166*** (0.00380)	0.00967*** (0.00280)	-0.00106*** (0.000346)	-0.00100*** (0.000256)	-0.00108*** (0.000231)
<i>LNTrading value</i>	0.00283*** (0.000549)	0.000702 (0.000728)	0.000467 (0.000634)	0.000988* (0.000583)	0.00129** (0.000610)	0.00107** (0.000528)	0.000106 (0.000160)	6.14e-05 (0.000111)	0.000110 (9.61e-05)
<i>Parkinson1980</i>	-0.246 (1.381)	-9.354*** (1.804)	-8.930*** (1.740)	0.173 (1.715)	-4.054** (1.685)	-2.057* (1.180)	5.714*** (0.495)	6.079*** (0.372)	5.613*** (0.299)
<i>Orderimbalance</i>	0.00279*** (0.000216)	1.69e-05*** (5.59e-06)	2.65e-06** (1.30e-06)	0.00175*** (0.000264)	0.00228*** (0.000252)	0.00246*** (0.000230)	0.000758*** (0.000276)	0.000641*** (0.000167)	0.000729*** (0.000106)
<i>Firmsize</i>	-0.00469*** (0.000829)	-0.00851*** (0.00121)	-0.00933*** (0.00112)	-0.00463* (0.00275)	-0.000716 (0.00355)	-0.00336 (0.00288)	0.000320 (0.000210)	0.000278* (0.000152)	0.000270** (0.000136)
<i>MarketReturn</i>	0.00320 (0.0240)	-0.248*** (0.0380)	-0.188*** (0.0390)	0.331*** (0.0555)	0.209*** (0.0587)	0.0317 (0.0407)	-0.00402 (0.0182)	-0.0213 (0.0139)	0.0130 (0.0116)
<i>Observations</i>	1,348	2,668	3,242	649	1,343	1,989	1,560	3,030	3,900
<i>Number of i</i>	27	27	27	13	13	14	30	30	30

Note: The table reports the results of the regression model (1). The dependent variable is the relative spread. *LNAdjusted closingprice*, *LNTrading Value*, *Parkinson1980*, *Orderimbalance*, *Firmsize*, and *MarketReturn* are respectively, the daily adjusted closing price in logarithm, the trading value in logarithm, the price range (volatility), the imbalance between buy and sell traded volumes as a percentage of the total traded volume, the *VnIndex* return. *ETF* is a variable set to 0 before the introduction of the *ETF* and 1 afterward. *ETFxWeight* is the interaction term between the dummy *ETF* and weight of each stock of *ETF*. Standard errors are unclustered in parentheses. One, two and three asterisks (*, **, and ***) indicate statistical significance at the 10%, 5% and 1% level, respectively.

Table 7: Panel regression of Amihud illiquidity ratio

VARIABLES	Panel A: DBX			Panel B: VNM			Panel C: EIVFVN30		
	(1) Pre- and post-DBX period of 50 trading days	(2) Pre- and post-DBX period of 100 trading days	(3) Pre- and post-DBX period of 6 months	(1) Pre- and post-VNM period of 50 trading days	(2) Pre- and post-VNM period of 100 trading days	(3) Pre- and post-VNM period of 6 months	(1) Pre- and post-EIVFVN30 period of 50 trading days	(2) Pre- and post-EIVFVN30 period of 100 trading days	(3) Pre- and post-EIVFVN30 period of 6 months
<i>ETF</i>	0** (0)	0 (0)	0 (5.05e-11)	2.22e-10* (1.20e-10)	-3.37e-10 (3.73e-10)	-5.59e-10** (2.49e-10)	0 (0)	0 (0)	0 (0.00295)
<i>ETFxWeight</i>	-7.87e-11* (0)	-6.38e-10 (3.86e-10)	-2.18e-10 (8.08e-10)	-8.41e-10 (2.20e-09)	8.59e-09 (6.89e-09)	7.51e-09* (4.56e-09)	-0 (0)	-0 (0)	-0.0230 (0.0522)
<i>Constant</i>	5.95e-10*** (1.77e-10)	4.17e-09 (3.09e-09)	-3.68e-10 (6.53e-10)	5.04e-09** (1.97e-09)	1.70e-08*** (6.25e-09)	1.31e-08*** (4.47e-09)	-0 (7.95e-11)	0 (9.80e-11)	0.281** (0.102)
<i>LNAdjusted closingprice</i>	-0* (0)	1.65e-10 (1.50e-10)	8.84e-11*** (0)	-1.60e-10* (8.31e-11)	-3.84e-10 (2.40e-10)	0 (1.62e-10)	-0 (0)	0 (0)	-6.64e-05 (0.0106)
<i>LNTrading value</i>	-0*** (0)	-1.97e-10 (1.77e-10)	-1.82e-10*** (0)	-2.88e-10*** (0)	-9.38e-10*** (0)	-8.39e-10*** (0)	-0*** (0)	-0*** (0)	-0.00837*** (0.00193)
<i>Parkinson180</i>	2.09e-09 (1.32e-09)	4.36e-08 (4.60e-08)	2.69e-08 (3.68e-08)	1.09e-07** (4.29e-08)	2.54e-07*** (1.06e-07)	1.70e-07** (6.82e-08)	9.26e-10*** (2.57e-10)	1.17e-09*** (2.45e-10)	14.82*** (3.191)
<i>Orderimbalance</i>	0*** (0)	0* (0)	0*** (0)	-0* (0)	-0** (0)	-0** (0)	0* (0)	0*** (0)	0.0167*** (0.00581)
<i>Firmsize</i>	-0* (0)	-0 (6.14e-11)	1.23e-10*** (0)	1.16e-10* (6.88e-11)	3.25e-10 (2.24e-10)	2.44e-10 (1.67e-10)	0 (0)	0 (0)	-0.00288 (0.00479)
<i>MarketReturn</i>	-0 (0)	-4.70e-10 (6.46e-10)	-5.00e-10 (8.26e-10)	1.21e-09 (1.39e-09)	1.56e-09 (3.70e-09)	1.29e-09 (2.35e-09)	-0 (0)	-0 (0)	0.110* (0.0636)
<i>Observations</i>	1,348	2,668	3,257	649	1,343	1,988	1,560	3,030	3,899
<i>R-squared</i>	0.210	0.068					0.188	0.255	0.420
<i>Number of i</i>	27	27	27	13	13	14	30	30	30

Note: The table reports the results of the regression model (1). The dependent variable is Amihud ratio. LNAdjusted closingprice, LNTrading Value, Parkinson180, Orderimbalance, Firmsize, and MarketReturn are respectively, the daily adjusted closing price in logarithm, the trading value in logarithm, the price range (volatility), the imbalance between buy and sell traded volumes as a percentage of the total traded volume, the VnIndex return. ETF is a variable set to 0 before the introduction of the ETF and 1 afterward. ETFxWeight is the interaction term between the dummy ETF and weight of each stock of ETF. Standard errors are unclustered in parentheses. One, two and three asterisks (*, **, and ***) indicate statistical significance at the 10%, 5% and 1% level, respectively.

However, the Amihud illiquidity measurement has not been found significant under the context of Vietnam during the investigated period.

Beside the context of the Vietnam stock market, the second factor that could be considered to explain the case of DBX is that it is different in the ETF structure. While VNM and E1VFN30 select physical replication, DBX is a synthetic ETF using swap agreements to track the FTSE Vietnam index instead of holding portfolio of underlying assets replicating exactly the benchmark index as a physical ETF.

With regard to policy implications, ETFs should be promoted in Vietnam due to two reasons. Firstly, ETF is a financial innovation providing index-trackers a modern investment tool with many advantages such as the benefit of diversification, transparency and intraday active

trading. Secondly, under the increasing trends of the market, the creation of ETFs may improve the liquidity of underlying assets that is important to investors, stock issuers, and fund managers in managing their portfolios. Even with the downturn side of the market, ETFs can still be considered as a diversified and low-risk investment instrument.

The empirical result also confirms that the liquidity impact is asymmetric on weights of component stocks in Vietnamese ETFs. Specifically, the liquidity improvement following the ETF inception would have been greater for smaller index components. It may suggest to investors or fund managers' forecasts about changes in the liquidity of underlying stocks when an ETF is introduced to the market.

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