“Price discovery and information transmission across stock index futures: evidence from VN 30 Index Futures on Vietnam’s stock market”

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ARTICLE INFO	Nguyễn Thị Nhung, Trần Thị Vân Anh, Nguyễn Tố Nga, Vương Thùy Linh and Đinh Xuân Cường (2019). Price discovery and information transmission across stock index futures: evidence from VN 30 Index Futures on Vietnam’s stock market. *Investment Management and Financial Innovations*, *16*(4), 262-276. doi:10.21511/imfi.16(4).2019.23
DOI	http://dx.doi.org/10.21511/imfi.16(4).2019.23
RELEASED ON	Thursday, 19 December 2019
RECEIVED ON	Wednesday, 23 October 2019
ACCEPTED ON	Thursday, 05 December 2019

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JOURNAL	"Investment Management and Financial Innovations"
ISSN PRINT	1810-4967
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
36	3	5

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BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Received on: 23rd of October, 2019
Accepted on: 5th of December, 2019

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PRICE DISCOVERY AND INFORMATION TRANSMISSION ACROSS STOCK INDEX FUTURES: EVIDENCE FROM VN 30 INDEX FUTURES ON VIETNAM'S STOCK MARKET

Abstract

The introduction of the first tradable stock index futures of VN 30 is a very good signal showing that Vietnam is starting to have a high-level financial market, which brings many expectations about sustainable and safe development of its stock market. However, risk concerns of this type of derivative products have been raising with many claims since then. This article aims to provide empirical evidences to show if futures trading plays important role of price discovery and information transmission for spot market. Using daily data collected about VN 30 Index Futures, VN 30 Index, VN Index from August 10, 2017 to February 28, 2019, which is divided into three sub-periods (increase/decrease/recovery), the research verifies VN 30 Index Futures' role of price discovery and information transmission by applying Vector Error Correction Model (VECM). Empirical findings show that there is a stable equilibrium relationship between the two series groups (including VN 30 Index Futures, VN 30 Index and VN 30 Index Futures and VN Index) during three sub-periods or spot and futures markets are integrated and synchronized. In particular, VN 30 Index Futures' price discovery and information transmission are clearly seen when the market falls or does not change a lot.

Keywords VN 30 Index Futures, price discovery, information transmission, spot futures interlinkages, Vector Error Correction Model (VECM), Vietnam's derivatives market

JEL Classification G10, G40

INTRODUCTION

In August 2017, Vietnam's derivatives market officially operated with the first tradable index futures of VN 30. This event marked Vietnam as the 42nd country in the world and the 5th country in ASEAN (after Singapore, Malaysia, Indonesia, and Thailand) having this high-level financial market. VN 30 Index Futures is expected to limit the risks, and diversify the investment products, increase the liquidity and scale of the stock market, as well as help the stock market to grow stably and safe, thereby increase its attractiveness to the investors.

After more than a year of introduction in Vietnam's stock market, VN 30 Index Futures has experienced impressive achievements. There has been a continuous upward trend in both trading volume and trading value. According to the data reported by Ho Chi Minh Stock Exchange (HOSE) and Hanoi Stock Exchange (HNX), in 2018, this first product of derivative witnessed 19,697,764 negotiated contracts. The average

http://dx.doi.org/10.21511/imfi.16(4).2019.23

trading volume reached 78,791 contracts/session, nearly seven times higher than in 2017. The total value of transactions reached nearly 1.86 million billion VND in 2018, of which July recorded an impressive number of 257,870 billion VND, 5.94 times higher than January (43,376 billion VND). Besides, the number of trading accounts experienced a great increase of 3.4 times higher than the end of 2017.

However, many investors still doubt the role of VN 30 Index Futures, which is believed containing many speculative factors. Vietnam's derivatives market is dominated by individual investors (up to 99%) (Nguyễn, 2019), which is shown by the huge number of transactions, but most of them are short-term and immediately closed in the same trading session. The volume of transactions used for hedging is only around 3-4 billion USD, which accounts for only approximately 2% of the spot market portfolio. Moreover, when VN30 Index Futures experienced the boom in trading volume, the spot market witnessed a sharp decline since the peak of 1,200 points of VN Index in 2018. This market shock raised an argument about the consequences of index futures for price volatility on the stock market. Many people have described Index Futures as "weapons of mass destruction" when referring to previous crisis like tulip crisis in Holland or financial crisis of 2007–2008, etc. In particular, these concerns are raising day by day when Vietnam intends to continue implementing the futures contracts on government bonds in the coming time – according to the roadmap for derivative market development until 2020.

The above practice provides an interesting experimental setting to examine if futures trading resulted in discovering the price and transferring the information to the spot market or not. In line with this objective, the research has assessed about the role of VN 30 Index Futures after 1.5 years implemented in Vietnam's stock market through three distinct phases, including increase, decrease, and recovery. To our best knowledge, this is the first paper using daily data to investigate the price discovery and information transmission by applying Vector Error Correction Model (VECM) between the VN30 Index Futures and VN Index, as well as VN 30 Index. In particular, different methods are used and compared to each other to exactly estimate VN 30 Index Futures' roles. The findings of the paper will contribute to the literature review on derivatives in general and index futures in particular in emerging countries like Vietnam, as well as in different phases of market development (namely increase, decrease, and recovery periods). Moreover, the contributions of the study are framed in providing empirical evidences showing if stock index futures play an important role for promoting the stable development of the spot market. These important insights will be relevant to propose more appropriate solutions for complete futures market development in Vietnam in the coming time.

After Introduction, section 1 reviews the literature about index futures and their role for stock market. Methodology and data used are presented in section 2 following with the results explanation in section 3 and a discussion in section 4. Last section provides some conclusions.

1. LITERATURE REVIEW

Trading in stock futures and stock index futures has surged globally in the last decades. In comparison with 2017, the number of stock futures and stock index futures contracts traded in 2018 increased by 37.6% and 43.2%, equivalent to 1,450 million contracts and 3,380 million contracts, respectively (WFE, 2019).

The futures contracts are designed with the original purpose to meet the hedging needs (Gong, Ji, Su, & Ren, 2016). Individuals or organizations participate in a futures contract to prevent the risks and protect themselves against adverse fluctuations that may change the value of their assets or debts, ensure the stability of futures cash flows. In addition to this initial purpose, futures contracts also become an appropriate tool for speculating purposes and arbitraging transactions as risk loving investors often prefer the futures market to the spot market (Lean, McAleer, & Wong, 2015). With low transaction prices and high leverage (Antoniou, Koutmos, & Periclic, 2005; Chen and Gau, 2010), investment in the futures market is less expensive than trading goods or assets on

the underlying spot market. Therefore, the potential profitability of transactions in the futures market also promises much higher than participating in the spot market and thus attracting many investors. In addition, the futures market provides an additional channel of capital mobilization for businesses and governments, facilitating the deployment of new financial products, as well as increasing the shock resistance of the financial system (Chui, 2010). In the futures market's activities, the price discovery and information transmission mechanisms are especially important functions.

The emergence of the stock index futures market has led many debates about the connection between the spot and futures market (Aloui, Hkiri, Lau, & Yarovaya, 2017; Bohl, Diesteldorf, & Siklos, 2015), as well as whether its appearance affects the stability of the financial market (Kutan, Shi, Wei, & Zhao, 2018; Jian, Wu, & Zhu, 2018). Aloui et al. (2017) note that the interconnection between the spot and futures markets is different due to the difference in the levels of economic development or the level of market openness and trading volumes on futures markets among the countries. For instance, the intensity of information transmission between stock indexes and the stock index futures in the developed markets may be higher than in the emerging markets.

According to Bohl et al. (2015), previous researches on the impact of futures market on the underlying spot market led to two different results. Bohl et al. (2015) indicated that the futures market in developed financial markets reduces the volatility of the underlying market because market participants are mostly institutional investors who are well-informed and knowledgeable enough to make the appropriate decisions to invest. However, in emerging markets such as China, futures increase the change in price of the underlying market because many individual investors have less knowledge and tend to invest in herds. The comments on the behavior of private and institutional investors made by Bohl et al. (2015) are similar to the ones by Barber and Odean (2008), Kaniel, Saar, and Titman (2008).

It can be said that price discovery is an important function of the futures market. Price discovery is the process by which market participants incorporate all relevant information to arrive at equilibrium asset prices (Chen & Gau, 2009). In many cases, the futures market is considered as a basis for determining the prices in the underlying spot market. In theory, every asset has a spot market where people with buying/selling needs make daily transactions. However, in practice, many goods with different categories and quality can be traded at different places and times. Therefore, a lot of potential "spot" prices can be observed for the same asset. The futures market gathers that information to create a uniform price, reflecting the spot price of a specific asset used as the underlying asset for the futures contract. Although the futures contract price is not necessarily the spot price in the future, but it also reflects the price that a market participant can expect for a transaction to perform later instead of accepting uncertain spot prices in the future. The futures market price discovery function cannot directly make futures spot price forecasts; however, it provides valuable lead information about futures spot prices (Kang, Cheong, & Yoon, 2013).

The empirical results about price discovery effect such as the lead-lag relationship between spot and futures markets are mixed and diverse. Booth, Raymond, and Tse (1999) have argued that "futures markets play an important price discovery role for spot markets because of low transaction costs, the ready availability of short positions, low margins, and rapid execution." Other researchers such as Antoniou and Holmes (1995), Tse (1995), Nieto, Fernandez, and Munoz (1998), Antoniou et al. (2005), Gong et al. (2016), Miao, Ramchander, Wang, and Yang (2017) also found that the futures market is a leader in price discovery. In opposite, J. Yang, Z. Yang, and Zhou (2012), Judge and Reancharoen (2014) and Chen and Gau (2009) indicated the leading role of stock markets. Many studies such as Kang et al. (2013), Charteris and Musazdiruma (2017), Jian et al. (2018), Kutan et al. (2018) argued that the futures and spot markets experience a bidirectional causal relationship.

In terms of the relationship between the spot market and the futures market, the mechanism of information transmission is a matter of interest to many researchers. According to Liu and An (2011), "informationally linked markets refers to markets in which traded assets are fundamentally

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related to each other." However, they also argued that although those markets are interconnected, they still have various mechanisms of information transmission because of differences in transaction costs, legal frameworks, liquidity level, and other institutional factors. According to Ross's study (1989), the futures trading can increase the transparency in information, which leads to more changes in price in the spot market (Ross, 1989). This conclusion was also consistent with the results of researches conducted by Aloui et al. (2017) who investigated the dynamic relationship between stock indices and the stock index futures inelevен countries. In most cases, transactions in the futures market are often more active than the underlying market so that information from this market is often more reliable than information from the spot market. In addition, due to its lower trading cost, the futures market attracts many investors so that new information is first created in the futures market before transferred to the spot market (Cox, 1976; Charteris & Masadziruma, 2017). Therefore, Cox (1976) concluded that futures transactions would speed up the transmission of information to spot markets. This statement was also shared by other researchers such as Antoniou and Holmes (1995), Harris (1989), Chang, Cheng, and Pinegar (1999).

It is worth noting that empirical studies do not give the same result on the impact of stock index futures on the volatility of spot market. Some studies conducted by Bae, Kwon, and Park (2004) or Bohl et al. (2015), Bologna et al. (2002), Santos (2002) indicated that stock price might decrease when stock index futures are introduced. However, Antoniou and Holmes (1995) and Antoniou, Holmes, and Priestley (1998) noted that index futures increase the volatility in the spot market price. There are researches such as Kutan et al. (2018) on seven emerging countries proving there's no impact of stock index futures on prices in the spot markets. This is also the research result of previous studies such as Spyrou (2005), Baldauf and Santoni (1991).

Table 1 summarizes the researches about the role of stock index futures.

Table 1. Impact of stock index futures' introduction

Source: Authors.

Roles	Impact	Research	Methodology
Price discovery	Positive	Hong et al. (2017)	Error Correction Model (ECM)
		Gong et al. (2016)	Thermal optimal path method
		Antoniou et al. (2005), Antoniou and Homes (1995)	GARCH model
		Nieto et al. (1998)	Johansen cointegration methodology
		Tse (1995)	Error correction model Vector autoregressive method
	Negative	Yang et al. (2012)	GARCH model
		Judge and Reancharoen (2014)	Error correction model (ECM)
		Chen and Gau (2009)	Microstructure Model Hasbrouck (1995)
	Neutral	Jian et al. (2018)	Multivariate CoVaR model
		Kutan et al. (2018)	Positive feedback model GjR-Garch Model
		Charteris and Musazdiruma (2017)	GARCH model, EGARCH model
		Kang et al. (2013)	Bivariate GARCH model
		Liu and An (2011)	MGARCH model
Information transmission	Positive	Aloui et al. (2017)	Wavelet methodology
		Antoniou et al. (2005), Antoniou and Holmes (1995)	GARCH model
		Cheng et al. (1999)	Single factor returns generating model
		Cox (1976)	Efficient market model
	Negative	Bohl et al. (2015), Bologna and Cavallo (2002)	GARCH, GJR-GARCH EGARCH models
	Neutral	Kutan et al. (2018)	Positive feedback model GjR-GARCH Model
		Charteris and Musazdiruma (2017), Spyrous (2005), Baldauf and Santoni (1991)	GARCH model
		Liu and An (2011)	MGARCH model

Source: Authors.

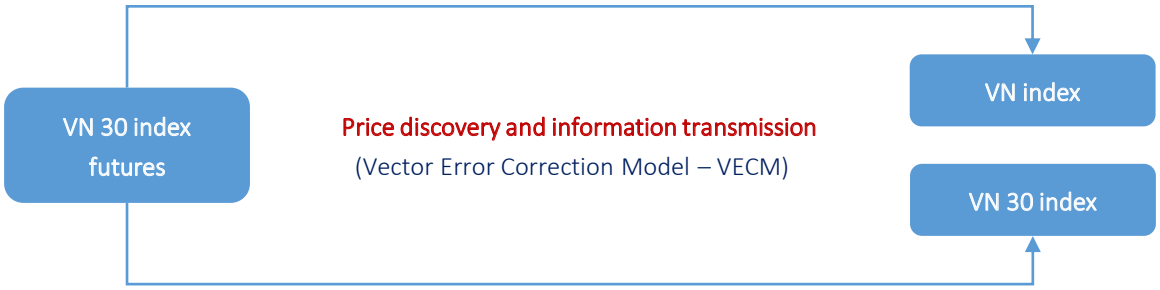

Figure 1. Research design

In short, the implementation of the stock index futures market has led to a lot of debate about its impact on the stability of the underlying market. The role of two important functions of the futures market, namely price discovery and information transmission mechanisms, is also the discussed topic of many studies. However, the results of those researches are very different. We can reasonably explain this situation because different countries have a different level of economic development or the structure of the financial system. It can be said that Vietnam is a typical case showing the impact of futures market introduction on the spot underlying market. The majority of market participants in Vietnam are small investors so that low transaction prices and high leverage make the investment in the futures market cheaper than the investment in the spot market, which has become an important reason for attracting the investors. Although the futures market in Vietnam has been in operation for only 1.5 years, it has clearly demonstrated the positive role of the price discovery function, as well as supporting the destabilization hypothesis. This is also the general conclusion of many studies on the impact of futures market implementation in the emerging countries. Going back to the reality in Vietnam, while the futures market is continuously developing, there is a decline in the underlying market. This has led to many concerns about the role of the futures market as a risk management tool for the stability of Vietnam's stock market. Therefore, the goal of our research is to evaluate this issue comprehensively.

2. METHODOLOGY

2.1. Research design

In fact, VN 30 Index is a market-capitalization weighted index, which measures the performance of 30 large cap and high liquidity stocks from VN All share. It is expected to reflect truly the market movement. Because of its effective performance benchmark, the research believes that it is necessary to refer VN Index when evaluating the role of VN30 Index Futures. That's why, in line with the objective of testing if futures trading resulted in destabilizing the spot market or not, the study investigates the relationship between VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index.

Besides, the spot-futures relationship separately focuses on both price discovery and information transmission (see Figure 1). Based on abovementioned literature review, the working paper chooses Vector Error Correction Model (VECM) to investigate these two important roles of VN 30 Index Futures on Vietnam's spot stock market. In fact, Vector Error Correction Model allows estimating the short-run and long-run relationships between VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index. This model is tested on EViews 8.

2.2. Data description

In Vietnam, the market experiences simultaneous trading of four VN 30 Index Futures contracts with four expired dates, including the third Thursday of the present month, the subsequent month, and the following two quarter-ending months. Investors are required to pay an initial margin of 10% of the total purchase value for securities. For instance, an investor wants to purchase a contract VN30F1706, which is priced at 70.000.000 VND. He/she can enter into that position by depositing an initial margin requirement of 7.000.000 VND.

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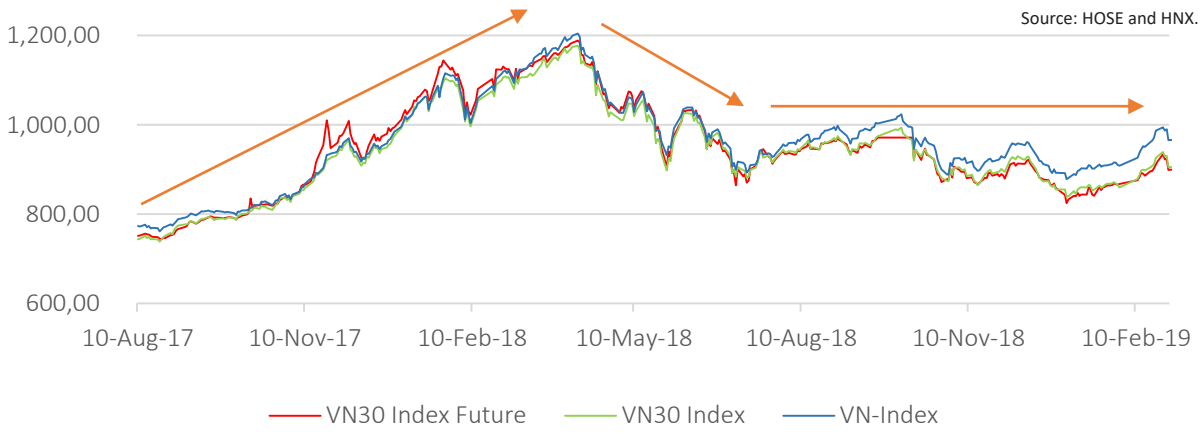

Figure 2. Price movements of VN Index, VN 30 Index, and VN 30 Index Futures

In terms of orders, there are limit order, market order, ATO, and ATC. In particular, Vietnam determines the price fluctuation range of 7%.

The study uses daily close prices of VN 30 Index Futures, VN 30 Index, and VN Index. The sample period spans from August 10, 2017 to February 28, 2019 with 388 trading days. The data are obtained from official sites of Ho Chi Minh Stock Exchange (HOSE) and Hanoi Stock Exchange (HNX). Figure 2 shows daily price movements of VN 30 Index Futures, VN 30 Index, and VN Index during a research period of 1.5 years. It is clearly seen that there are three clear phases in the price movement over the period from August 10, 2017 to February 28, 2019. On April 10, 2018, VN Index, VN 30 Index, and VN 30 Index Futures reach a peak of 1,198.12, 1,168.06, and 1,185.18 respectively, gaining about 60% of its value in comparison with the moment of launching VN 30 Index Futures. The next period from April 10 to July 11, 2018 is recognizable by a reduction of 25% in terms of price. This is followed by an accumulation phase for recovery.

Table 2. Statistics of VN Index, VN 30 Index, and VN 30 Index Futures return series

Source: Authors.

Period	Max (%)			Average (%)			Min (%)			Standard Deviation (%)		
	VN 30 Index Futures	VN 30 Index	VN Index	VN 30 Index Futures	VN 30 Index	VN Index	VN 30 Index Futures	VN 30 Index	VN Index	VN 30 Index Futures	VN 30 Index	VN Index
Panel A. Every six months												
August 10, 2017 – February 10, 2018	3.93	2.78	2.86	0.25	0.23	0.21	–4.83	–5.08	–5.10	1.32	1.04	1.07
February 11, 2018 – August 11, 2018	4.23	3.81	3.77	–0.05	–0.03	–0.02	–4.67	–4.45	–4.34	1.80	1.65	1.55
August 12, 2018 – February 28, 2019	3.60	3.15	2.93	–0.03	–0.03	0.00	–4.98	–4.79	–4.84	1.11	1.06	1.01
Panel B. Sub-periods												
August 10, 2017 – April 10, 2018	3.93	3.81	3.77	0.28	0.28	0.27	–4.83	–5.08	–5.10	1.31	1.07	1.10
April 11, 2018 – July 11, 2018	4.23	3.67	3.45	–0.47	–0.43	–0.45	–4.67	–4.45	–4.34	2.16	1.97	1.81
July 12, 2018 – February 28, 2019	3.60	3.15	2.93	0.03	0.02	0.05	–4.98	–4.79	–4.84	1.11	1.05	0.99

Given this trend, the study will investigate price discovery and information transmission between the VN 30 Index Futures and VN Index, as well as VN 30 Index, by dividing the research period into three sub-periods, including Period A: from August 10, 2017 to April 10, 2018; Period B: from April 10, 2018 to July 11, 2018 and Period C: from July 12, 2018 to February 28, 2019. Table 2 reports summary statistics (about max, average, min, and standard deviation of return) for VN 30 Index Futures, VN 30 Index and VN Index for each six months in the sample period (Panel A) and each of the three sub-periods in the sample period (Panel B). It is obviously seen that returns for VN 30 Index Futures are closer to VN 30 Index than VN Index in every sub-period. In particular, it is clearly seen that the index futures have the highest returns for every six months, as well as every sub-period.

2.3. Methods of data analysis

Firstly, the study tests each series for stationarity of VN 30 Index Futures and VN 30 Index, as well as VN Index by applying the unit root test to the residuals from this regression called Augmented Dickey-Fuller Test.

Call:

- P_0: VN 30 Index Futures;
- P_1: VN 30 Index;
- P_2: VN Index.

There are also three basic regression models as follows:

- no constant, no trend: $\Delta P_t = \beta P_{t-1} + u_t$;
- constant, no trend: $\Delta P_t = \alpha + \beta P_{t-1} + u_t$;
- constant and trend: $\Delta P_t = \alpha + \beta P_{t-1} + \delta_1 + u_t$.

There are two hypotheses:

H_0: $\beta = 0 \rightarrow$ *the time series is non-stationary;*

H_1: $\beta < 0 \rightarrow$ *the time series is stationary.*

β is considered as the coefficient in the results extracted from EViews software. In other words, if *t*-statistic is bigger than τ on Kendall's tau table, the hypothesis H_0 is rejected and otherwise.

In addition, the research tries to find out the regression between P_{0t} and P_{1t}, as well as P_{0t} and P_{2t}, which is presented in the following equations:

$$P_1 = \alpha_1 P_0 + \beta_1,$$

$$P_2 = \alpha_1 P_0 + \beta_2.$$

The higher R_{1t}^2 and R_{2t}^2 is, the better the intercept and slope coefficients. In other words, this regression shows a significant relationship between two variables.

Secondly, the study also determines optimal lag by using the Akaike Selection Criterion (AIC). In detail, the lag length is selected when this criterion has the smallest value because it can ensure the stability of the model.

Thirdly, the research tries to find out if the two series (VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index) are co-integrated in each sub-period sample by using Johansen co-integration test with 2 criteria, including Maximum Eigenvalue test and Trace test. There are two hypotheses:

H_0: *No co-integrating equation between VN 30 Index Futures and VN 30 Index or between VN 30 Index Futures and VN Index.*

H_1: *Co-integrating equation between VN 30 Index Futures and VN 30 Index or between VN 30 Index Futures and VN Index.*

The research will reject hypothesis H_0 if the value of the Trace and Max statistics is more than 5% critical value otherwise.

Fourthly, based on the econometrics of co-integrated vector autoregressions that Engle and Granger (1987) referred, the research investigates price discovery through Vector Error Correction Model (VECM). In other words, the study tries to show how VN 30 Index and VN Index change while VN 30 Index Futures is volatile.

http://dx.doi.org/10.21511/imfi.16(4).2019.23

We have to investigate two price vectors, including:

- $P_T = [P_o; P_1]$: refers to the VN 30 Index Futures and VN 30 Index;
- $P_{TT} = [P_o; P_2]$: refers to the VN 30 Index Futures and VN Index.

There is an estimated VECM as follows:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta y_{t-1} + \\ + \sum_{i=1}^{n} \delta_i \Delta x_{t-1} + \omega \mu_{t-1} + v_t. \quad (1)$$

Cointegrating equation (long-run model):

$$\mu_{t-1} = ETC_{t-1} = y_{t-1} - \beta_0 - \beta_1 x_{t-1}. \quad (2)$$

where y is P_1 or P_2, x is P_0, Δ is the difference in price, μ_{t-1} is the lagged value of the error correction term, v_t is a white noise error term.

The first above model incorporates both the short-run and long-run dynamics, while the second equation only refers to long-run dynamics. P_1 and P_0, as well as P_2 and P_0, have a long-run relationship only when the coefficient of the co-integrating equation is between –1 and 0 at a statistical significance. The coefficient of ETC ω measures the speed at which the dependent variable returns to equilibrium after a change in independent variable (P_0). Moreover, the research still determines if there is a shot-run a relationship between P_1 and P_0, as well as P_2 and P_0, by using Wald test and Breusch-Godfrey Serial Correction LM test. Finally, the study investigates if the model is dynamically stable through Stability Diagnostics/ Recursive Estimates (OLS only).

3. EMPIRICAL RESULTS

Appendices 1, 2, and 3 show the results of Augmented Dickey-Fuller test. With 388 observations, VN 30 Index Futures, VN 30 Index, and VN Index have *p*-value and *t*-statistic as bellow:

- VN 30 Index Futures: *p*-value = 0.9515 > α = *%10, t*-statistic = –0.919502, *t*-statistic = –3.982074 < 0 at 1% and $|\tau| = |-3.982074| > |\tau_{1\%}| = |-3.4361|$.
- VN 30 Index: *p*-value = 0.9772 > α = *%10, t*-statistic = –0.615743, *t*-statistic = –3.981949 < 0 at 1% and $|\tau| = |-3.981949| > |\tau_{1\%}| = |-3.4361|$.
- VN Index: *p*-value = 0.9682 > α = *%10, t*-statistic = –0.746066, *t*-statistic = –3.981949 < 0 at 1% and $|\tau| = |-3.981949| > |\tau_{1\%}| = |-3.4361|$.

It is clearly seen that VN 30 Index Futures, VN 30 Index and VN Index experience the constant and trend stationarity with negative *t*-statistic at about the 1% level.

Besides, using the regression analysis, the research has functions referring to the relationship between VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN:

$$P_{1t} = 1.0582 \cdot P_{0t} - 48.703,$$

$$P_{2t} = 1.0474 \cdot P_{0t} - 60.001.$$

It is clearly seen that R_{1t}^2 of 0.9873 and R_{2t}^2 of 0.953 (see Appendices 4 and 5) indicate a significant relationship between two variables. In other words, VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index, seem to be so closely aligned.

According to Appendix 6, 1 is the best optimal lag for the first sub-period, while the second and third sub-periods receive the optimal lag of 2.

In terms of co-integration, Trace and Max-Eigenvalue test indicate 1 co-integrating equation at the 0.05 level between VN 30 Index Futures and VN 30 Index, VN 30 Index Futures and VN Index (Tables 3, 4). In the long run, VN 30 Index Futures experiences a positive impact on VN 30 Index and VN Index. The null hypothesis of no co-integration is rejected against the alternative of a co-integrating relationship in the model. In other words, this means that these indices exhibit a long-run relationship, satisfying the requirements of Vector Error Correction Model (VECM).

Table 3. Trace and Max-Eigenvalue test for VN 30 Index Futures and VN 30 Index

Source: Results calculated from EViews software.

Unrestricted Cointegration Rank test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical value**	**Prob.****
None*	0.047222	19.17645	15.49471	0.0133
At most 1	0.001434	0.552558	3.841466	0.4573
Unrestricted Cointegration Rank test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical value	Prob.**
None*	0.047222	18.62389	14.26460	0.0096
At most 1	0.001434	0.552558	3.841466	0.4573
1 cointegrating equation(s)		Log likelihood	–2776.142	
Normalized cointegrating coefficients (standard error in parentheses)				
VN 30_INDEX	VN 30_INDEX_FUTURES			
1.000000	–0.943999			
	(0.02650)			
Adjustment coefficients (standard error in parentheses)				
D(VN 30_INDEX)	0.024923			
	(0.05039)			
D(VN 30_INDEX_FUTURES)	0.141552			
	(0.05623)			

Notes: *denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) *p*-values.

Table 4. Trace and Max-Eigenvalue test for VN 30 Index Futures and VN Index

Source: Results calculated from EViews software.

Unrestricted Cointegration Rank test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical value**	**Prob.****
None	0.028351	11.94458	15.49471	0.1596
At most 1	0.002262	0.871805	3.841466	0.3505
Unrestricted Cointegration Rank test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical value	Prob.**
None	0.028351	11.07277	14.26460	0.1506
At most 1	0.002262	0.871805	3.841466	0.3505
1 cointegrating equation(s)		Log likelihood	–2805.025	
Normalized cointegrating coefficients (standard error in parentheses)				
VN_INDEX	VN 30_INDEX_FUTURES			
1.000000	–0.929120			
	(0.05973)			
Adjustment coefficients (standard error in parentheses)				
D(VN_INDEX)	0.020273			
	(0.02902)			
D(VN30_INDEX_FUTURES)	0.074826			
	(0.03261)			

Note: **MacKinnon-Haug-Michelis (1999) *p*-values.

Appendices 7-12 show the error correction model of VN 30 Index Futures and VN 30 Index, VN 30 Index Futures and VN Index in the first sub-period, in the second one, and the last one. It is obviously seen that the equation representing the relationship between VN 30 Index Futures and VN 30 Index, VN 30 Index Futures and VN Index contains six coefficients (from 1 to 6). Table 5 summarizes the equations about estimated VECM and co-integrating equation (long-run model).

http://dx.doi.org/10.21511/imfi.16(4).2019.23

Table 5. Estimated VECM and cointegrating equation (long-run model)

Source: Results calculated from EViews Software.

Sub-periods	Estimated VECM with P1/P2 as target variable	Cointegrating equation (long-run model)
VN 30 Index and VN 30 Index Futures		
First sub-period (August 10, 2017 – April 10, 2018)	$\Delta y_t = -0.040088 \cdot ETC_{t-1} - 0.024964 \cdot \Delta y_{t-1} - 0.032062 \cdot \Delta x_{t-1} + 2.714864$	$\mu_{t-1} = ETC_{t-1} = y_{t-1} - 0.958223 x_{t-1} - 24.94102$
	Estimated equation: $D(P_1) = C(1) \cdot (P_1(-1) - 0.958223297798 \cdot P_0(-1) - 24.9410238488) + C(2) \cdot D(P_1(-1)) + C(3) \cdot D(P_0(-1)) + C(4)$	
Second sub-period (April 11, 2018 – July 11, 2018)	$\Delta y_t = -0.0416242 \cdot ETC_{t-1} - 0.197878 \cdot \Delta y_{t-1} + 0.182524 \cdot \Delta y_{t-2} + 0.178409 \cdot \Delta x_{t-1} + 0.078644 \cdot \Delta x_{t-2} - 3.153310$	$\mu_{t-1} = ETC_{t-1} = y_{t-1} - 0.775645 x_{t-1} - 215.8693$
	Estimated equation: $D(P_1) = C(1) \cdot (P_1(-1) - 0.775645053007 \cdot P_0(-1) - 215.869328825) + C(2) \cdot D(P_1(-1)) + C(3) \cdot D(P_1(-2)) + C(4) \cdot D(P_0(-1)) + C(5) \cdot D(P_0(-2)) + C(6)$	
Third sub-period (July 12, 2018 – February 28, 2019)	$\Delta y_t = -0.243575 \cdot ETC_{t-1} + 0.195839 \cdot \Delta y_{t-1} - 0.078540 \cdot \Delta y_{t-2} - 0.221257 \cdot \Delta x_{t-1} + 0.282943 \cdot \Delta x_{t-2} - 0.303877$	$\mu_{t-1} = ETC_{t-1} = y_{t-1} - 1.005177 x_{t-1} - 0.170651$
	Estimated equation: $D(P_1) = C(1) \cdot (P_1(-1) - 1.00517679944 \cdot P_0(-1) - 0.170651069946) + C(2) \cdot D(P_1(-1)) + C(3) \cdot D(P_1(-2)) + C(4) \cdot D(P_0(-1)) + C(5) \cdot D(P_0(-2)) + C(6)$	
VN Index and VN 30 Index Futures		
First sub-period (August 10, 2017 – April 10, 2018)	$\Delta y_t = -0.073072 \cdot ETC_{t-1} - 0.128959 \cdot \Delta y_{t-1} - 0.022958 \cdot \Delta x_{t-1} + 2.857903$	$\mu_{t-1} = ETC_{t-1} = y_{t-1} - 0.997170 x_{t-1} - 0.072784$
	Estimated equation: $D(P_2) = C(1) \cdot (P_2(-1) - 0.997169843843 \cdot P_0(-1) - 0.0727835852093) + C(2) \cdot D(P_2(-1)) + C(3) \cdot D(P_0(-1)) + C(4)$	
Second sub-period (April 11, 2018 – July 11, 2018)	$\Delta y_t = -0.338162 \cdot ETC_{t-1} - 0.398425 \cdot \Delta y_{t-1} + 0.019779 \cdot \Delta y_{t-2} + 0.288373 \cdot \Delta x_{t-1} + 0.192538 \cdot \Delta x_{t-2} - 3.902071$	$\mu_{t-1} = ETC_{t-1} = y_{t-1} - 0.824207 x_{t-1} - 184.6331$
	Estimated equation: $D(P_2) = C(1) \cdot (P_2(-1) - 0.824206884672 \cdot P_0(-1) - 184.633121377) + C(2) \cdot D(P_2(-1)) + C(3) \cdot D(P_2(-2)) + C(4) \cdot D(P_0(-1)) + C(5) \cdot D(P_0(-2)) + C(6)$	
Third sub-period (July 12, 2018 – February 28, 2019)	$\Delta y_t = -0.097897 \cdot ETC_{t-1} + 0.237658 \cdot \Delta y_{t-1} - 0.001104 \cdot \Delta y_{t-2} - 0.228819 \cdot \Delta x_{t-1} + 0.213972 \cdot \Delta x_{t-2} - 0.493507$	$\mu_{t-1} = ETC_{t-1} = y_{t-1} - 0.810212 x_{t-1} - 207.5733$
	Estimated equation: $D(P_2) = C(1) \cdot (P_2(-1) - 0.810212007088 \cdot P_0(-1) - 207.573296217) + C(2) \cdot D(P_2(-1)) + C(3) \cdot D(P_2(-2)) + C(4) \cdot D(P_0(-1)) + C(5) \cdot D(P_0(-2)) + C(6)$	

It can be obviously seen that all the coefficients of the co-integrating equation are between –1 to 0 (Figure 3), resulting in the conclusion that there is a long-run relationship between VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index. The reduced period (or the second sub-period) experiences the highest coefficient of the co-integrating equation for both pairs (VN 30 Index Futures and VN 30 Index, VN 30 Index Futures and VN Index), while the lowest level happens in the increased period. This means that the long-run relationship between VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index, becomes stricter when the spot market goes down. In comparison with the co-efficiency between VN 30 Index Futures and VN Index, the coefficient of the co-integrating equation between VN 30 Index Futures and VN 30 Index is always higher when there is a drop or recovery of stock market, but lower when there is an upward trend in market. In other words, VN 30 Index Futures and VN 30 Index become witnesses of much stronger co-integration when the market falls. In contrast, the co-integration between VN 30 Index Futures and VN Index is higher than between VN 30 Index Futures and VN 30 Index in case of development of market. In the other words, concerning the speed at which the dependent variable (VN 30 Index or VN Index) returns to equilibrium after a change in independent variable (VN 30 Index Futures), VN 30 Index and VN Index experience the highest level in the second sub-period, when the market is downwards and the lowest rate while there is an upward trend in spot market. After a change in VN 30 Index Futures, VN Index returns to equilibrium more quickly than VN 30 Index only when the market develops.

In brief, there is a long-run relationship between VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index. It is recognized more clearly when the market grows down or does not change a lot. The co-integration between VN 30 Index Futures and VN Index is only deeper than between VN 30 Index Futures and VN 30 Index when the market increases.

Moreover, based on *p*-value (shown in Appendices from 7-12), it is clearly seen that there is a short-run relationship between VN 30 Index Futures and VN 30 Index, as well as VN 30 Index Futures and VN Index. Similar to the long-run relationship, the short-run one experiences the differences between VN 30 Index and VN Index in each sub-period. The scenario is the same for the short-run relationship in comparison with the long-run one. And Stability Diagnostics indicates the blue trendline between red boundary. The VECM is said to be dramatically stable at about the 5% level.

Source: Authors.

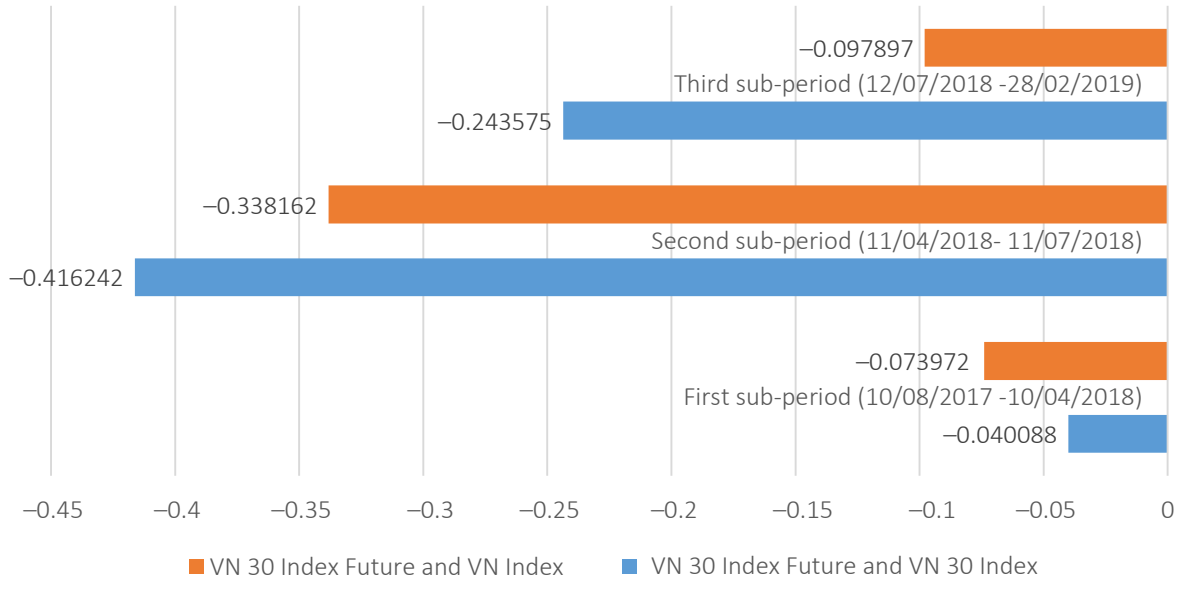

Figure 3. The coefficient of ETC (ω)

http://dx.doi.org/10.21511/imfi.16(4).2019.23

4. DISCUSSION AND POLICY IMPLICATIONS

Vector Error Correction Model shows a stable equilibrium relationship between VN 30 Index Futures and VN 30 Index, VN 30 Index Futures and VN Index. This empirical evidence supports the theories about the role of derivative instruments in general and index futures in particular. In fact, traders prefer investing in the diversified portfolios corresponding to index because stock index futures are financial instruments thanks to their lower costs of trading and greater leverage potential futures markets. These research results are totally consistent with findings shown by Tse (1995), Nieto et al. (1998), Antoniou and Homes (1995), Antoniou et al. (2005), Gong et al. (2016), and Miao et al. (2017).

In addition, VN 30 Index Futures' importance for VN 30 Index is clearer than for VN Index. In a negative or neutral trend of movement, VN 30 Index returns to equilibrium rapidly after a change in VN 30 Index Futures. It seems to be evident because VN 30 Index is the underlying asset of VN 30 Index Futures. Naturally, VN 30 Index Futures has a closer relation with VN 30 Index than with VN Index. However, when the market goes up, VN Index returns to equilibrium more rapidly than VN 30 Index, but at the lowest speed. The long-run relationship between VN 30 Index Futures and VN Index indicates VN 30 Index's capacity as an effective performance benchmark and a measure of market efficiency in Vietnam's stock market.

The VN 30 Index Futures' role of price discovery and information transmission witnesses the best level when the market downturns or does not change a lot (or stay unchangeable) and vice versa. This reflects the investors' psychology in Vietnam's stock market. In fact, the impact of psychological factors on the market has been very complicated. The Vietnamese financial market always contents many high unstable factors, causing market panic, as well as making many difficulties for implementing the macroeconomic policies. Vietnam's stock market is considered as a market of individual investors who follow the psychology of the crowd. Most of domestic individuals do not deeply receive and understand market information or consult news published by domestic and foreign experts. They are less sensitive to market information. Therefore, they participate in the market with high risks and short-term vision. In addition, the current information is considered incomplete. Many rumors affect the investors' psychology, causing confusion and crowd psychology, as observed in the previous period.

When the market grows up, the over optimism bias makes Vietnamese individual investors believe that negative market events will not affect them too much, or that the market will be quickly recovered and continue to develop. They try to avoid acknowledging that their investment decisions have potential disadvantages, leading to push stock prices above their true values. After being amplified by many factors, stock prices go down and returned to its real. The market decline can be expressed and evaluated by the experts. Information spreads through the media make investors believe that prices continue to fall further. At this time, behavioral finance theory and feedback trading model showed that many Vietnamese investors' psychology may be affected and lead to acts of selling securities, both in the underlying market and in the derivative market. The role of VN 30 Index's price discovery and information transmission is expressed the best during the period of market decline.

CONCLUSION

The introduction of VN 30 Index Futures in August 2018 in Vietnam marked the appearance of derivative market in Vietnam. It is a very good sign of a growing maturity in the national financial market. VN 30 Index Futures are expected to play a stabilizing role in the stock market. Evidently, the debate about the spot-futures relationships has been raising since this derivative product was introduced on Vietnam's stock market.

The study provides the first empirical evidence about a stable equilibrium relationship between the two series groups (including VN 30 Index Futures, VN 30 Index, and VN 30 Index Futures and VN Index)

during the period from August 10, 2017 to February 28, 2019. By using Vector Error Correction Model (VECM), the research demonstrates higher coefficient of the cointegrating equation and higher coefficient of ETC (ω) when spot market grows down or does not change a lot. The ability of VN 30 Index Futures' price discovery role is reduced while there is an upward trend in the spot market. Moreover, the relationship between VN 30 Index Futures and VN 30 Index is stricter than that of VN 30 Index Futures and VN Index while the market is reduced or recovered and vice versa. Therefore, it is clearly seen that the research contributes to enriching the existing empirical evidence on price discovery and information transmission between the stock indices and stock index futures in the emerging countries like Vietnam. The study results are very significant in the context where many claims and concerns about risks brought by this type of derivative products have been raising since it first trading. Investors, as well as policy makers, can refer these proofs to believe in VN 30 Index Futures in particular and derivatives in general, and then continue to develop different other derivative products on Vietnam's stock market in the coming time.

However, it is obviously seen that the research is executed in a short period from VN 30 Index Futures' first trading to February 29, 2019, and only focuses on the role of price discovery and information transmission, while this product still plays other important roles like hedging or risk management or reducing the costs of trading. Therefore, the research results cannot fully reflect the total nature of VN 30 Index Futures on Vietnam's stock market. There is a need for further follow-up the studies with deep analysis, highly specific recommendations and longer (richer) sample of data about all roles of VN 30 Index Futures, as well as financial behaviors of investors who are trading in Vietnam's stock market.

ACKNOWLEDGMENT

We would like to thank Vietnam National University, Hanoi (VNU) for financing the Research Project number QG.16.54. This paper has been extracted from this research.

REFERENCES

1. Aloui, C., Hkiri, B., Lau, M. C. K., & Yarovaya, L. (2017). Information transmission across stock indices and stock index futures: international evidence using wavelet framework. *Research in International Business and Finance, 44,* 411-421. https://doi.org/10.1016/j.ribaf.2017.07.112
2. Antoniou, A., & Holmes, P. (1995). Futures trading and spot price volatility: evidence for the FTSE-100 stock index futures contract using GARCH. *Journal of Banking and Finance, 19,* 151-166. https://doi.org/10.1016/0378-4266(94)00059-C
3. Antoniou, A., Koutmos, G., & Periclic, A. (2005). Index futures and positive feedback trading: evidence from major stock exchanges. *Journal of Empirical Finance, 12*(2), 219-238. https://doi.org/10.1016/j.jempfin.2003.11.003
4. Antonious, A., Holmes, O., & Priestley, R. (1998). The effects of stock index fureres trading on stock index volatility: An analysis on the asymmetric response of volatility to News. *Journal of Futures Markets, 18*(2), 151-166. https://doi.org/10.1002/(SICI)1096-9934(199804)18:2%3C151::AID-FUT2%3E3.0.CO;2-1
5. Bae, S., Kwon, T., & Park, J. (2004). Futures Trading, Spot Market Volatility and Market Efficiency: The case of Korean Index Futures Markets. *Journal of Futures Markets, 24*(2), 1195-1228. https://doi.org/10.1002/fut.20135
6. Baldauf, B., & Santoni, G. (1991). Stock price volatility: Some evidence from ARCH model. *Journal of Futures Markets, 11*(2), 191-200. https://doi.org/10.1002/fut.3990110206
7. Barber, B. M., & Odean, T. (2008). All that glitters: The effect of attention and news on the buying behavior of individual and institutional investors. *Review of Financial Studies,* 785-818. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=460660
8. Bohl, M. T., Diesteldorf, J., & Siklos, P. (2015). The effect of index futures trading on volatility: Three markets for Chinese stocks. *China Economic Review, 34,* 207-224. https://doi.org/10.1016/j.chieco.2014.11.005
9. Bologna, P., & Cavallo, L. (2002). Does the Introduction of Index Futures EffectivelyReduce Stock Market Volatility? Is the Futures

http://dx.doi.org/10.21511/imfi.16(4).2019.23

Effect Immediate? Evidence from the Italian Stock Exchange Using GARCH. *Applied Financial Economics, 12*(3), 183-192. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2023037

10. Booth, G. G., Raymond, W. S., & Tse, Y. (1999). Price Discovery in the Germany equity derivtives market. *Journal of Futures Markets, 19*(6), 619-643. https://doi.org/10.1002/(SICI)1096-9934(199909)19:6%3C619::AID-FUT1%3E3.0.CO;2-M

11. Chang, E. C., Cheng, J. W., & Pinegar, J. M. (1999). Does futures trading increase market volatility? The case of the Nikkei stock index futures markets. *Journal of Banking and Finance, 23*(5), 727-753. https://doi.org/10.1016/S0378-4266(98)00069-7

12. Charteris, A., & Musadziruma, A. (2017). Feedback trading in stock index futures: Evidence from South Africa. *Research in International Business and Finance, 42,* 1289-1297. https://doi.org/10.1016/j.ribaf.2017.07.065

13. Chen, Y. L., & Gau, Y. F. (2009). Tick sizes and relative rates of price discovery in stock, futures, and options markets: Evidence from the Taiwan stock exchange. *Journal of Futures Markets, 29*(1), 74-93. https://doi.org/10.1002/fut.20319

14. Chen, Y. L., & Gau, Y. F. (2010). News announcements and price discovery in foreign exchange spot and futures markets. *Journal of Banking and Finance, 34*(7), 1628-1636. https://doi.org/10.1016/j.jbankfin.2010.03.009

15. Chui, M. (2010). Derivatives Markets, Products and Participants: An Overview. *IFC Bulletin,* 3-11. Retrieved from https://econpapers.repec.org/bookchap/bisbisifc/35-01.htm

16. Cox, C. (1976). Futures trading and market information. *Journal of Political Economy, 84*(6), 1215-1236. Retrieved from https://www.jstor.org/stable/1831275?seq=1

17. Engle, T. F., & Granger, C. W. J. (1987, March). Co-intergration and error correction: Representation, estimation, and testing. *Econometrica, 55*(2), 251-276. Retrieved from https://www.jstor.org/stable/1913236?seq=1#page_scan_tab_contents

18. Gong, C. C., Ji, S., Su, L. L., & Ren, F. (2016). The lead-lag relationship between stock index and stock index futures: a thermal optimal path method. *Physica A,* 63-72. Retrieved from https://www.researchgate.net/publication/284012622_The_lead-lag_relationship_between_stock_index_and_stock_index_futures_A_thermal_optimal_path_method

19. Harris, L. (1989). The October 1987 S&P 500 Stock Futures Basis. *Journal of Finance, 44*(1), 77-99. https://doi.org/10.1111/j.1540-6261.1989.tb02405.x

20. Jian, Z., Wu, S., & Zhu, Z. (2018). Asymmetric extreme risk spillovers between the Chinise stock market and index futures market: An MV-CAViaR based intraday CoVaR approach. *Emerging Markets Review, 37,* 98-113. https://doi.org/10.1016/j.ememar.2018.06.001

21. Judge, A., & Reancharoen, T. (2014). An empirical examination of the lead-lag relationship between spot and futures markets: Evidence from Thailand. *Pacific-Basin Finance Journal, 29,* 335-358. https://doi.org/10.1016/j.pacfin.2014.05.003

22. Kang, S. H., Cheong, C., & Yoon, S. M. (2013). Intraday volatility spillovers between spot and futures indices: Evidence from the Korean stock market. *Physica, 392*(8), 1795-1802. Retrieved from https://www.researchgate.net/publication/257218608_Intraday_volatility_spillovers_between_spot_and_futures_indices_Evidence_from_the_Korean_stock_market

23. Kaniel, R., Saar, G., & Titman, S. (2008). Individual Investor trading and stock returns. *Journal of Finance, 63*(1), 273-310. https://doi.org/10.1111/j.1540-6261.2008.01316.x

24. Kutan, A. M., Shi, Y., Wei, M., & Zhao, Y. (2018). Does the introduction of index futures stabilize stock markets? Further evidence from emerging markets. *International Review of Economics and Finance, 57,* 183-197. https://doi.org/10.1016/j.iref.2018.01.003

25. Lean, H. H., McAleer, M., & Wong, W. K. (2015). Preferences of risk-averse and risk-seeking investor for oil spot and futures before, during and after the Global Financial Crisis. *International Review of Economics & Finance, 40,* 204-216. https://doi.org/10.1016/j.iref.2015.02.019

26. Liu, Q., & An, Y. (2011). Information transmission in informationally linked markets: Evidence from US and Chinese commodity futures markets. *Journal of International Money and Finance, 30*(5), 778-795. https://doi.org/10.1016/j.jimonfin.2011.05.006

27. Miao, H., Ramchander, S., Wang, T., & Yang, D. (2017). Role of index futures on China's stock market: Evidence from price discovery and volatility spillover. *Pacific-Basin Finance Journal, 44,* 13-26. https://doi.org/10.1016/j.pacfin.2017.05.003

28. Moffat, M. (2018). *What is the Augmented Dickey-Fuller Test?* Retrieved from https://www.thoughtco.com/the-augmented-dickey-fuller-test-1145985

29. Nguyễn, T. M. (2019). *Hạn chế nhà đầu tư cá nhân trên thị trường chứng khoán phái sinh hiện nay liệu có khả thi?* Retrieved from https://tinnhanhchungkhoan.vn/chung-khoan/han-che-nha-dau-tu-ca-nhan-tren-thi-truong-chung-khoan-phai-sinh-hien-nay-lieu-co-kha-thi-258443.html

30. Nieto, M. L, Fernandez, A., & Munoz, M. J. (1998). Market efficiency in the Spanish derivatives markets: An empirical analysis. *International Advances in Economic Research, 4*(4), 349-355. Retrieved from https://link.springer.com/article/10.1007/BF02295688

31. Ross, S. (1989). Information and volatility: the no-arbitrage martingale approach to timing

and resolution irrelevancy. *Journal of Finance, 44*(1), 1-17. Retrieved from https://www.jstor.org/stable/2328272?seq=1

32. Santos, J. (2002). In a study for US grain prices, argues that the evolution of futures markets is the principal reason why commodity spot price volatility diminished. *Journal of Agricultural Economics, 53*, 25-36.

33. Spyrou, S. (2005). Index Futures trading and spot price volatility. *Journal of Emerging Market Finance, 4,* 151-167. https://doi.org/10.1177%2F097265270500400203

34. Tse, T. (1995). Lead-lag relationship between spot index and futures price of the nikkei stock average. *Journal of forecasting, 14*(4), 553-563. https://doi.org/10.1002/for.3980140702

35. WFE. (2019). *2018 Full Year Market Highlight.* Retrieved from www.world-exchanges.org/storage/app/media/uploaded-files/WFE%202018%20FY%20Market%20Highlights%20FINAL%20PDF%20VERSION%2012.02.19.pdf (accessed on March 8, 2019).

36. Yang, J., Yang, Z., & Zhou, Y. (2012). Intraday pice discovery and volatility transimission in stock index and stock index futures market: Evidence from China. *Journal of Futures Markets, 32*(2), 99-121. https://doi.org/10.1002/fut.20514

APPENDIX

Appendices are available at:
https://www.researchgate.net/publication/337783155_VN_30_Index_Futures_Appendix

http://dx.doi.org/10.21511/imfi.16(4).2019.23