The Impact of the Introduction of VN30 Index Futures on VN30 Index Volatility

Hue Nguyen Thi Minh[1], Huyen Do Phuong[*2], Thuy Bui Phuong[1], Van Tran Thi Thanh[3]

[1]School of Banking and Finance, National Economics University, Vietnam
[2]International School, Vietnam National University, Hanoi, VNUIS, Vietnam
[3]School of Advanced Education Programs, National Economics University, Vietnam
[*]Corresponding author, E-mail: dphuyen@vnu.edu.vn

Abstract

This study aims to contribute to the empirical literature by examining how the introduction of VN30 Index futures affected the volatility of the VN30 Index in Vietnam from 2012 to 2021. Utilizing the GARCH (1,1) model, the findings indicate that the launch of index futures led to increased volatility in the spot market. The estimations also reveal that volatility persistence became more pronounced following the introduction of VN30 Index futures. Recognizing the ongoing debate among Vietnamese researchers, this research also seeks to address the second question of whether the futures market and the stock market show a unidirectional or bidirectional correlation. By applying the OLS method, the results demonstrate a positive, bidirectional correlation between Vietnam's spot and futures markets.

Keywords: *VN30 Index Futures, VN30 Index Volatility, Bidirectional Correlation*

1. Introduction

1.1 Research Background

The relationship and influence between futures markets and stock markets have been a focal point of research for economists and policymakers for decades. Understanding this relationship is crucial to using hedging tactics and managing portfolio investments (Bessembinder & Seguin, 1992). While researchers have primarily focused on how futures markets affect volatility in the underlying spot markets, the conclusions remain ambiguous, with theoretical and empirical studies presenting conflicting views. In particular, theoretical studies present arguments supporting both perspectives—that futures trading can either stabilize or destabilize spot markets by influencing market volatility (Kaldor, 1939). Empirical research similarly offers varied conclusions, typically classified into three categories: those suggesting increased volatility, those indicating reduced volatility, and those finding no significant impact on spot market volatility.

In Vietnam, the derivatives market officially commenced on August 10th, introducing VN30 Index futures contracts as the initial trading instrument. According to an announcement by the Hanoi Stock Exchange prior to the market's launch, VN30 Index futures were anticipated to be a key development in enhancing Vietnam's stock and financial markets by mitigating risks, attracting greater participation from institutional and foreign investors, and consequently improving market size and liquidity (HNX, 2017). Since its inception, trading in VN30 Index futures has seen remarkable growth in both trading volume and value. Specifically, according to figures provided by the State Securities Commission of Vietnam, by the 1,000th trading session following the establishment of VN30 futures, the number of derivative trading accounts had reached 423,639, nearly 25 times greater than the level recorded at the end of 2017 (SSC, 2021).

1.2. Research Objectives

Given the relatively recent establishment of Vietnam's derivatives market, limited research has been undertaken on this subject, creating uncertainty among financial economists regarding the market's effects, particularly considering potential speculative influences (Nguyen et al., 2019). Consequently, the primary goal of this study is to enrich the empirical literature by examining how the introduction of VN30 Index futures has influenced the volatility of the VN30 Index. Specifically, this research seeks to answer whether the launch of VN30 Index futures has led to increased volatility in the VN30 Index. To accomplish this, the paper applies an event-study approach utilizing the Generalized Autoregressive Conditional Heteroscedasticity (GARCH (1,1)) model.

Furthermore, the influences of the VN30 Index on VN30 Index futures and the reverse influences of VN30 Index futures on the spot market, are also investigated based on OLS regression.

This study is structured as follows: Section 2 presents the theoretical and empirical literature, discusses the specific situation in Vietnam, and the hypotheses development. Section 3 contains the data and methodology. Section 4 reveals the results and discussions. The final part is the conclusion and limitations of the study.

2. Literature Review

2.1. Theoretical Literature

Regarding the influence of futures markets on underlying spot markets, the theoretical literature presents two primary viewpoints. One perspective argues that futures trading activities have a stabilizing impact on spot markets, while the opposing viewpoint suggests a destabilizing effect due to increased market volatility.

According to Powers (1970), futures markets positively contribute to spot markets by enhancing market depth and improving information accessibility. Similarly, Danthine (1978) emphasized that futures traders typically have superior access to information, enabling futures prices to provide valuable insights to less informed spot-market participants. Additionally, various researchers have demonstrated that futures markets improve market efficiency by facilitating better price discovery in spot markets (He et al., 2020; Inani, 2017; Hou and Li, 2013; Schwarz and Laatsch, 1991; Stoll and Whaley, 1988).

Conversely, futures trading might negatively influence spot markets by increasing volatility due to the participation of uninformed investors. Specifically, these uninformed traders, attracted by the high leverage available in futures markets, may disrupt the price discovery process and diminish the informational value of prices. Consequently, the presence of uninformed traders in futures markets can amplify volatility in spot markets (Blasco, Corredor, and Ferreruela, 2012; Stein, 1987; Finglewski, 1981; Cox, 1976).

2.2. Empirical Literature

Empirical studies on the impact of futures markets can be classified into three groups: the first one is that futures markets reduce spot market volatility, the second one is futures markets increase volatility, and the last one is no influences.

Futures markets decrease spot market volatility

Bologna (2000) used the GARCH (1,1) model to examine the effects of futures trading on volatility in the Italian Stock Exchange (MIB30) from 1994 to 1998. The study found that daily volatility decreased after futures were introduced, though the nature of volatility remained consistent. Similarly, Bologna and Cavallo (2002) confirmed that the establishment of stock index futures significantly lowered volatility in Italy, emphasizing that no other systematic factors contributed notably to this reduction. Edwards (1988) analyzed the U.S. market using S&P 500 index data (1972–1987) and found reduced volatility after the introduction of futures contracts, highlighting that volatility increases, when observed, were only short-lived.

More recent research by Baklaci and Tutek (2006), using the GARCH model with data from the Istanbul Stock Exchange (2004–2006), also supported this stabilizing effect, demonstrating faster information transmission to the spot market, thus reducing volatility and enhancing market efficiency. Similarly, studies focusing on China by Ausloos, Zhang, and Dhesi (2020) and Bohl, Diesteldorf, and Siklos (2015) found that futures trading significantly reduced stock market volatility and supported market stability.

Futures markets can increase spot market volatility

Conversely, several studies argue that futures trading increases volatility. Lee and Ohk (1992), using the GARCH model, revealed higher volatility in stock markets of the U.S., U.K., and Japan after futures were introduced. However, they suggested that this volatility increase was beneficial, reflecting improved efficiency through rapid absorption of new information. Gulen and Mayhew (2000) reported similar findings, noting increased conditional volatility specifically in the U.S. and Japanese markets.

Antoniou and Holmes (1995), examining FTSE-100 index futures, confirmed an increase in volatility consistent with the results of Lee and Ohk (1992). They argued that increased volatility was due to improved speed and quality of information flow, rather than inherent instability. Interestingly, both Antoniou and Holmes (1995) and Bologna (2000), despite differing conclusions about volatility direction, agreed that the fundamental nature of volatility remained unchanged after the futures market introduction. Sehgal, Rajput, and Dua (2012), focusing on commodity markets in India (2004–2012), found volatility increases in five of seven commodities, supporting the destabilizing argument.

Futures markets have no influence spot market volatility

Rao, Kanagaraj, and Tripathy (2008), examining Indian stock data (1999–2006), found no significant link between futures trading and stock volatility, suggesting other market factors played a more crucial role. Similarly, Lee and Ohk (1992) found no evidence of volatility change in the Australian market post-futures, and Gulen and Mayhew (2000) identified minimal volatility impacts for most countries studied, except the U.S. and Japan.

Empirical research presents mixed results regarding the impact of futures trading on stock market volatility. Lee and Ohk (1992) suggest that these discrepancies may arise from the influence of macroeconomic variables, which differ across countries. Additionally, variations in market structure—such as unique trading practices, stabilization policies, and government regulations—could also contribute to these inconsistent findings.

2.3. Vietnamese Literature and Context

The impact of the introduction of VN30 Index futures on VN30 Index volatility

Regarding the impact of futures trading on the spot market, Nguyen and Truong (2020), using the GARCH model and Granger causality tests (2012–2019), found that introducing index futures had no significant effect on stock market performance, though it did increase in trading volume. Using a similar approach, Truong and Friday (2021) observed a day-of-the-week effect only prior to futures introduction (2012–2019). They suggested that VN30 Index futures heightened stock market volatility but also enhanced market efficiency through faster price adjustments. Likewise, Truong, Nguyen, and Vo (2021), employing the EGARCH (1,1) model (2015–2020), confirmed that the launch of VN30 Index futures raised volatility and made volatility more persistent, indicating that new market information had a greater influence in the post-futures period.

The relationship between VN30 Index and VN30 Index futures - unidirectional or bidirectional?

The relationship between VN30 Index futures and the underlying VN30 Index has drawn considerable attention from researchers. Nguyen et al. (2019), applying the Vector Error Correction Model (VECM) on data from 2017–2019, confirmed the futures market's significant role in price discovery and information transmission to the spot market, establishing a stable equilibrium relationship between the VN30 Index and its futures. In contrast, Nguyen et al. (2020), using multiple methods including Granger causality tests and VECM on VN30 Index and VN30F1M futures prices, found that the Vietnamese spot market leads futures prices both in the short and long term, suggesting that the spot market primarily drives price discovery, while futures market shocks do not significantly impact the spot market. Supporting this unidirectional perspective, Nguyen and Truong (2020) utilized GARCH (1,1) and EGARCH (1,1) models (2012–2019) and also found causality moving from spot to futures markets. However, Truong, Nguyen, and Vo (2021), analyzing data from 2015–2020 through Granger causality tests, reported a bidirectional relationship, indicating mutual influence between the spot and futures markets, where each market significantly impacts volatility and trading activities in the other.

2.4. Research Gap and Hypothesis Development

In this study, the Exchange-Traded Fund VN30 (ETF VN30) will be employed instead of the VN30 Index to investigate the impact of index futures on spot market prices. Unlike commodity markets, where investors can directly buy underlying assets based on their futures contracts (e.g., oil), the VN30 Index itself cannot be traded. Consequently, investor expectations derived from VN30 Index futures may not be fully reflected in the VN30 Index price. Using the tradable ETF VN30 (specifically the E1VFVN30 price) thus allows this research to make a clearer empirical contribution.

This study proposes two hypotheses. First, existing literature indicates that futures markets can either increase, decrease, or have no effect on stock market volatility. Given that this study focuses specifically on Vietnam, the outcomes are expected to align with findings from previous Vietnamese studies. Based on the study by Truong and Friday (2021) and Truong, Nguyen, and Vo (2021), this research has developed *Hypothesis 1* as follows:

Hypothesis 1: The introduction of VN30 Index futures led to an increase in VN30 Index volatility.

Secondly, previous research has proven that there is a unidirectional causal relationship running from the Vietnamese stock market to the futures market. Some studies have found the opposite results, that the unidirectional correlation flows from the futures market to the underlying stock market. However, some studies suggest a bidirectional relationship between these two markets in Vietnam. Therefore, *Hypothesis 2* in this study aims to examine both directions: the impact of the stock index on the futures index and the effect of the futures market on the underlying stock market.

Hypothesis 2: The relationship between the VN30 Index and VN30 Index futures is bidirectional.

3. Data and Methodology

3.1. Data Collection

First, to examine the influences of the introduction of the futures market on stock market volatility in Vietnam, this research employs daily closing prices of the VN30 Index – the underlying stock market index. Particularly, the VN30 Index prices from February 6th, 2012, to December 31st, 2021, are collected from the FiinPro software. Based on various previous research studies,, the natural logarithm or log-return formula is used to attain the continuously compounded daily returns (Truong and Friday, 2021; Bohl, Diesteldor and Siklos, 2015; Tripathy, 2014). The formula is as follows:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) = \ln(P_t) - \ln(P_{t-1})$$

In which:

- R_t is the continuous return of the market of the VN30 Index at day t
- P_t is the VN30 Index closing price at day t
- P_{t-1} is the VN30 Index closing price at day t-1

Secondly, to investigate the mutual impacts between the futures and spot markets, the data utilized includes the VN30 Index, four VN30 futures contracts (VN30F1M, VN30F2M, VN30F1Q, VN30F2Q), and the ETF E1VFVN30. The data were obtained from FiinPro and converted into continuous returns. Specifically, VN30F1M and VN30F2M represent one-month and two-month futures contracts, while VN30F1Q and VN30F2Q represent quarterly futures contracts based on the VN30 Index. The ETF E1VFVN30, representing ETF VFMVN30—the first and largest ETF in Vietnam—is used as a proxy for the VN30 Index due to its investment strategy of closely tracking VN30 fluctuations, thus enhancing result reliability.

3.2. Methodology

This study employs an event-study methodology, specifically utilizing the GARCH model to examine volatility changes in Vietnam's stock market after introducing futures contracts. The GARCH model, developed by Bollerslev (1986) from the Autoregressive Conditional Heteroscedasticity model, effectively captures volatility clustering in financial time series (Bologna and Cavallo, 2002). The widely applied GARCH (1,1) model is particularly well-suited for financial data analysis, as evidenced by previous related studies (Truong and Friday, 2021; Nguyen and Truong, 2020; Bologna and Cavallo, 2002; Antoniou and Holmes, 1995). The GARCH (1,1) framework is as follows:

$$R_t = \beta_0 + \beta_1 \times R_{t-1} + \varepsilon_t$$
$$\varepsilon_t \sim \mathrm{N}(0, \sigma_t^2)$$
$$\sigma_t^2 = \alpha_0 + \alpha_1 \times \varepsilon_{t-1}^2 + \alpha_2 \times \sigma_{t-1}^2$$

(In which ε_t denotes the error term, σ_t^2 represents the conditional variance. The current conditional variance depends on the previous squared error term and the previous condition variance).

To investigate how VN30 Index futures affect volatility, the VN30 Index data is divided into two sub-periods: the pre-futures period and the post-futures period (before and after the onset of VN30 Index futures contracts on August 10th, 2017). Hence, a dummy variable D_F is introduced into the variance equation, taking a value of 0 for the pre-futures period and 1 for the post-futures period. Therefore, the model for this study is:

$$R_t = \beta_0 + \beta_1 \times R_{t-1} + \varepsilon_t \qquad \text{(mean equation - 1)}$$
$$\varepsilon_t \sim \mathrm{N}(0, \sigma_t^2) \qquad \text{(2)}$$
$$\sigma_t^2 = \alpha_0 + \alpha_1 \times \varepsilon_{t-1}^2 + \alpha_2 \times \sigma_{t-1}^2 + \gamma \times D_F \qquad \text{(variance equation- 3)}$$

The dataset of the whole observed period is estimated using the above equations 1 and 3. Variable D_F will tell whether the introduction of VN30 Index futures on August 10th, 2017 affects the volatility of the VN30 index. To support hypothesis 1, it is expected that the coefficient γ of the variable D_F will havea positive sign. Moreover, two additional GARCH (1,1) frameworks are used for the two sub-periods: pre-futures and post-futures. The reason for separating the dataset into these two periods and running regressions for each of them is to see in more detail the effects of introducing VN30 futures through the changes in estimated coefficients from one period to another. The models used are the same as equations (1) and (3), however, the dummy variable D_F is now removed from the variance equation. Consequently,the variance equations for estimating each sub-period separately return to the original form of the GARCH (1,1) model:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \times \varepsilon_{t-1}^2 + \alpha_2 \times \sigma_{t-1}^2 \qquad \text{(3*)}$$

The empirical analysis framework is structured as follows: descriptive statistics, the Augmented Dickey-Fuller (ADF) unit root test, the Lagrange Multiplier (LM) ARCH-effects test, and estimation of the GARCH (1,1) model.

Secondly, the OLS methodology is applied to assess the impacts of the Vietnamese spot market on the futures market and the reverse impacts of the futures market on the spot market.

Four models are employed to analyze the influence of the stock market on futures returns:

$$VN30F1M\ return = \beta_1 + \beta_2 \times VN30\ Index\ return + u \qquad (4)$$
$$VN30F2M\ return = \beta_1 + \beta_2 \times VN30\ Index\ return + u \qquad (5)$$
$$VN30F1Q\ return = \beta_1 + \beta_2 \times VN30\ Index\ return + u \qquad (6)$$
$$VN30F2Q\ return = \beta_1 + \beta_2 \times VN30\ Index\ return + u \qquad (7)$$

(*VN30F1M, VN30F2M, VN30F1Q, and VN30F2Q are dependent variables; VN30 Index return is the independent variable in all four models.*)

To examine the impact of futures on the stock market, the following model is employed::

$$E1VFVN30\ return = \beta_1 + \beta_2 \times VN30F1M\ return + u \qquad (8)$$

(E1VFVN30 return is the dependent variable; VN30F1M return is the independent variable. VN30F1M was chosen to represent the VN30 Index futures because VN30F1M is the most actively traded futures contract among the four.)

4. Empirical Results and Discussion

4.1. The Introduction of VN30 Index Futures Caused Increasing VN30 Index Volatility

4.1.1 Descriptive statistics

Table 1 shows the statistical characteristics of VN30 Index daily log returns for the whole period and two sub-periods.

Table 1 Summary statistics of VN30 Index daily returns

Time period	Observation	Min	Max	Mean	Standard deviation
Whole period	2477	-0.070	0.077	0.0005	1.190%
Pre-futures period	1376	-0.058	0.042	0.0004	1.033%
Post-futures period	1101	-0.070	0.077	0.0007	1.361%

Source: Author's calculation

Throughout the entire observed period, the dataset includes 2477 observations, representing 2477 daily returns across 2478 trading days. The average return is positive at 0.0005, with a volatility level of 1.190%. Notably, the lowest (-0.070) and highest (0.077) returns of the VN30 Index occurred during the post-futures period. Furthermore, the mean and standard deviation of returns are higher in the post-futures period (mean: 0.0007; volatility: 1.361%) compared to the pre-futures period (mean: 0.0004; volatility: 1.033%). These findings suggest that since the introduction of VN30 Index futures, because both the mean and standard deviation increased, the VN30 Index experienced increased volatility.

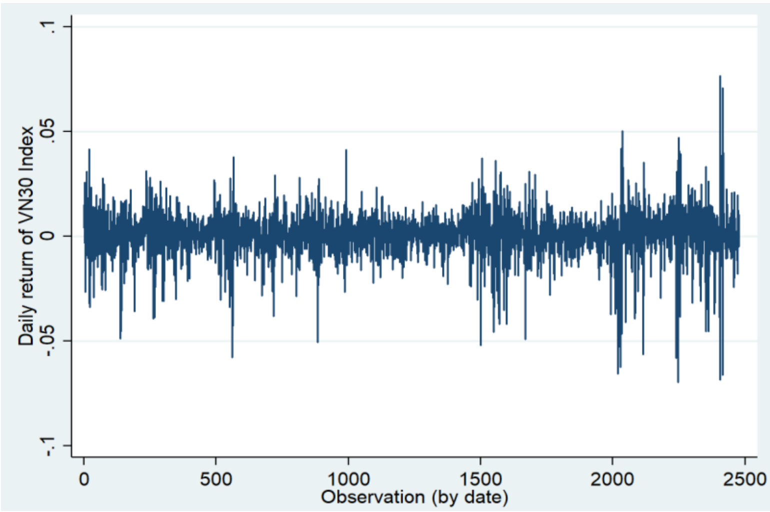

Figure 1 Volatility of the VN30 Index return throughout the Period

Figure 1 illustrates that VN30 Index daily returns fluctuate around zero, showing clear patterns of volatility clustering, where periods of high volatility are followed by similarly volatile periods and vice versa. The evidence indicates that large or small changes in returns tend to cluster together, suggesting that the variance of VN30 returns changes over time. Consequently, the ARCH/GARCH model is appropriate for analysis. Additionally, Figure 1 highlights increasingly larger swings in returns following the introduction of VN30 Index futures, supporting the notion that these futures contracts may have increased market volatility.

4.1.2. Unit root test

Table 2 indicates that the ADF test statistics for all three periods are significantly lower than their critical values at the 1%, 5%, and 10% significance levels, with corresponding p-values of 0.000, which are below the 0.01 threshold. Thus, the null hypothesis of a unit root is rejected, confirming that all data series are stationary at the 99% confidence level.

Table 2 Unit root test for VN30 Index return of the whole period and two sub-periods

Time period	ADF test statistic	ADF critical values			P value	Result
		1%	5%	10%		
Whole period	-49.005	-3.430	-2.860	-2.570	0.000	Stationary
Pre-futures period	-34.816	-3.430	-2.860	-2.570	0.000	Stationary
Post-futures period	-33.729	-3.430	-2.860	-2.570	0.000	Stationary

ARCH-effects test

Table 3 ARCH effect test for VN30 Index return of the whole period and two sub-periods

Time period	F-statistic value	P value	Result
Whole period	185.193	0.000	ARCH effects
Pre-futures period	25.442	0.000	ARCH effects
Post-futures period	97.692	0.000	ARCH effects

The Lagrange Multiplier (LM) test was performed with one lag in order to test for the existence of the ARCH effect. For data of three periods,the p-values are very small at 0.000, below the 0.01 (1%). That means, with a 1% level of significance, the null hypothesis of no ARCH effects is rejected. The significant existence of ARCH effects in the residuals of the time series model suggests that the GARCH (1,1) framework is an appropriate method to applyin the following steps.

In summary, the VN30 Index return series for all three periods has been confirmed to be stationary, exhibiting volatility clustering and ARCH effects. Therefore, the conditions necessary for applying the GARCH model have been satisfied. This study thus employs the GARCH (1,1) model to analyze how the introduction of VN30 Index futures has impacted the volatility of the VN30 Index.

4.1.3. GARCH (1,1) model estimation

Table 4 presents the results obtained from applying the GARCH (1,1) model to the VN30 Index daily returns for the full sample period, as well as the pre- and post-futures periods. These results illustrate how the onset of VN30 Index futures has influenced volatility in the underlying VN30 Index.

Table 4 Empirical results of the whole period, pre-futures period and post-futures period – GARCH (1,1) model

Estimation	**Model 1-3**	**Model 1-3***	**Model 1-3***
	Whole period	**Pre-futures period**	**Post-futures period**
β_0	0.001***	0.000**	0.001*
	(0.000)	(0.000)	(0.000)
β_1	0.059***	0.083***	0.019
	(0.022)	(0.031)	(0.031)
α_0	-12.163***	7.28e-06***	4.38e-06***
	(0.135)	(1.38e-06)	(8.82e-07)
α_1(ARCH)	0.113***	0.133***	0.094***
	(0.010)	(0.020)	(0.010)
α_2 (GARCH)	0.839***	0.799***	0.888***
	(0.013)	(0.026)	(0.010)
γ	0.544***		
	(0.076)		
$\alpha_1 + \alpha_2$		0.932	0.982
σ^2(unconditional variance)		0.00010	0.00024

*, **, ***: 10%, 5%, 1% significant levels respectively. Standard errors are written in parentheses.

Regarding the GARCH (1,1) model estimated for the whole period, every coefficient is highly significant at a 99% confidence level. In the mean equation, β_1 a value of 0.059 means that an increase in the daily return of the VN30 Index on day *t-1* would cause an increase in the VN30 return on day *t, ceteris paribus*. This paper also attempts to concentrate on the empirical findings of the conditional variance equation, which represents volatility. Statistically significant α_1 and α_2 indicate that the previous day's squared residual/return information on volatility, and the residual variance from the day before/volatility respectively can influence the current-day residual variance/volatility of the VN30 Index return. Especially, coefficient γ of the dummy variable D_F is significantly positive (0.544), implying that the launch of VN30 index futures led to more stock market volatility.

This finding supports *Hypothesis 1* of the research that the adoption of VN30 Index futures boosted the VN30 Index volatility. In comparison to other studies on the Vietnamese stock market, this result, in consistent with that of Truong, Nguyen, and Vo (2021), is different from that of Nguyen and Truong (2020) which found no effect of futures market establishment on stock market returns. In terms of foreign countries, the increasing volatility outcome of this paper is in contrast with the findings of Ausloos, Zhang, and Dhesi (2020) for China; Bologna and Cavallo (2002) for Italy; Edwards (1988) for the U.S. In the meantime, previous studies by Antoniou and Holmes (1995), Lee and Ohk (1992) revealed similar results. As explained by Truong, Nguyen, and Vo (2021), this finding appears to be suitable to the features of the Vietnamese stock and futures markets, which are the high leverage in futures trading and a larger number of speculative traders.

The estimations of the GARCH (1,1) model for two sub-periods confirm that the overall volatility of VN30 index return has increased since the onset of the VN30 index futures. All variables in the conditional variance equation are extremely significant at the 99% confidence level. It can be observed that from the pre-futures time to the post-futures time, the value of α_1 went down from 0.133 to 0.094, while that of α_2 rose from 0.799 to 0.888. Based on the research by Antoniou and Holmes (1995), α_1(ARCH effect) could be considered recent news, and α_2(GARCH effect) can be referred to as old news. Hence, diminishing $\alpha_1$might imply that the influence of today's information on VN30 Index volatility in the post-futures period is smaller than in the period preceding the index futures establishment. Thus, after the onset of VN30 Index futures, recent news is absorbed into VN30 Index prices at a lower speed. This outcome is opposite to the findings of Truong, Nguyen, and Vo (2021), and Bologna and Cavallo (2002). On the other hand, the result of rising α_2 is consistent with that of Truong, Nguyen and Vo (2021), while still in contrast to that of Bologna and Cavallo

(2002). As explained by Bologna and Cavallo (2002), a decrease in the value of α_2 is a good sign because the uncertainty about old news is curtailed thanks to the growing speed of information flow, thereby enhancing market efficiency. Based on that logic, the rising α_2 outcome of this paper (model 1-3*) seems to suggest a negative effect of the VN30 Index futures launch on VN30 Index volatility as old information becomes more influential to the volatility of the stock index. However, Truong, Nguyen and Vo (2021), and Truong and Friday (2021) interpreted the value of α_2 in another way. Specifically, they supposed that this outcome of higher α_2 implies more persistent market volatility in the post-futures time than in the pre-futures time. The increasing volatility's persistence might be a result of expanding information flow. Therefore, although the onset of VN30 Index futures increased VN30 Index volatility, the market became more efficient since the stock prices could reflect and incorporate the available information more rapidly.

To examine this further, the sum of α_1 and α_2 $(\alpha_1 + \alpha_2)$ tells the persistence of shocks. As explained by Christianti (2018), volatility persistence implies that shocks of today's conditional variance, instead of diminishing, have an influence on future conditional variances. To put it differently, current returns have a notable effect on the variance or volatility of future returns. In this study, it could be computed that the persistence of volatility has increased from the pre-futures period to the post-futures period, with its value rising from 0.932 to 0.982. However, it is still inconclusive whether higher or lower persistence of shock is a signal of developing market efficiency, as Truong, Nguyen, and Vo (2021) believed in the former while Bologna and Cavallo (2002) argued for the latter. Perhaps the differences between the two markets (Ho Chi Minh Stock Exchange versus Italian Stock Exchange) and the young age of the Vietnamese derivatives market are responsible for this contradictory result.

When the total of α_1 and α_2 is smaller than 1, the model has finite unconditional variance or steady-state variance σ^2, which is computed as:

$$\sigma^2 = \frac{\alpha_0}{1 - \alpha_1 - \alpha_2}$$

σ^2 value increases from 0.00010 during the pre-futures time to 0.00024 in the post-futures period.The higher unconditional variance in the period after the onset of index futures shows growing volatility in the VN30 Index return after the onset of VN30 Index futures.

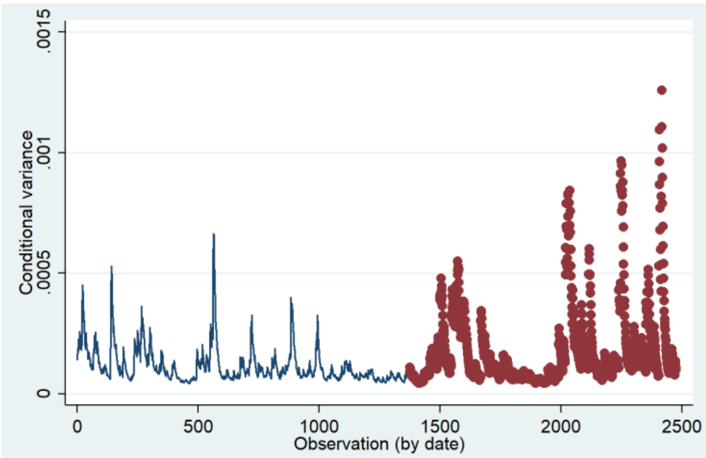

Figure 2 Conditional variance for the pre-futures period (blue line) and the post-futures period (red scatter)

Figure 2 illustrates the conditional variance obtained from applying the GARCH (1,1) model (equations 1-3) without the dummy variable effect (γ = 0) across the entire study period. To clearly demonstrate the impact of introducing VN30 Index futures on volatility, the conditional variance during the pre-futures period is shown as a solid blue line, while the post-futures period is indicated by a red dotted line.

Notably, shortly after the launch of VN30 futures, variance increased significantly, highlighting a rise in volatility due to the futures market.

4.2. The Bidirectional Relationship between VN30 Index Futures and VN30 Index

4.2.1 Descriptive statistics

This part presents descriptive statistics exclusively for VN30F1M returns and E1VFVN30 returns. The other futures contracts (VN30F2M, VN30F1Q, VN30F2Q) are not discussed since they typically share similar characteristics with VN30F1M, which is also the most actively traded among the four.

Table 5 Summary statistics of VN30F1M and E1VFVN30 daily returns

Time period	Observation	Min	Max	Mean	Std.
VN30F1M return	1085	-0.117	0.068	0.001	1.593%
E1VFVN30 return	1085	-0.072	0.067	0.001	1.477%

VN30F1M and E1VFVN30 returns each consist of 1,085 observations, corresponding to 1,086 trading days after accounting for the exclusion of missing values. Notably, the descriptive statistics for these two indicators exhibit a high degree of similarity. Specifically, the VN30F1M index exhibits a minimum return of -0.117 and a maximum return of 0.068, while the E1VFVN30 index shows a slightly narrower range, with a minimum of -0.072 and a maximum of 0.067. Regarding volatility, the standard deviation of VN30F1M returns is 1.593%, which is marginally higher than the E1VFVN30 returns' standard deviation of 1.477%. Additionally, both indices have mean return values around 0.001, indicating a positive average return of approximately 0.1%. These statistical characteristics suggest a strong and significant correlation between the futures index and the underlying stock index.

4.2.2. The impacts of the VN30 Index on VN30 Index futures

Table 6 shows the results of four regression models analyzing the effects of VN30 Index returns on VN30 Index futures returns, including VN30F1M, VN30F2M, VN30F1Q, VN30F2Q returns.

Table 6 Estimated results of the impacts of VN30 Index return on VN30 Index futures return – OLS regression

Explanatory variable	**Model 4**	**Model 5**	**Model 6**	**Model 7**
	VN30F1M return	**VN30F2M return**	**VN30F1Q return**	**VN30F2Q return**
_cons	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
VN30 Index return	0.993***	0.945***	0.914***	0.897***
	(0.018)	(0.019)	(0.018)	(0.019)
R-squared	0.728	0.689	0.694	0.666

*, **, ***: 10%, 5%, 1% significant levels respectively. Standard errors are written in parentheses.

In Model 4, the coefficient for the VN30 Index return is statistically significant at the 99% confidence level. This indicates that a 1% increase in the VN30 Index return leads to an approximately 0.993% increase in the VN30 Index futures one-month return, holding other factors constant (ceteris paribus). Similarly, in Models 5, 6, and 7, the coefficients of VN30 Index return are also positive and statistically significant at the 99% confidence level. The consistently significant coefficients and high R-squared values across all four models strongly support the existence of a positive relationship between the VN30 Index and VN30 futures contracts, confirming that movements in the VN30 Index have a considerable influence the returns of VN30 futures.

4.2.3. The impacts of VN30 Index futures on VN30 Index

Table 7 Estimated results of the impacts of VN30 Index futures return on VN30 Index return (E1VFVN30) – OLS regression

Explanatory variable	Model 8
	Dependent variable: E1VFVN30 return
_cons	0.000 (0.000)
VN30F1M return	0.678*** (0.019)
R-squared	0.536

*, **, ***: 10%, 5%, 1% significant levels respectively. Standard errors are written in parentheses.

Regarding model 8, the coefficient of VN30F1M returns is significantly positive at the 99% confidence level, confirming a positive influence of VN30 Index futures on the underlying VN30 Index.

4.2.4. Discussion on the relationship between VN30 Index and VN30 Index futures

The empirical results support Hypothesis 2, indicating a bidirectional causal relationship between the VN30 Index and VN30 futures, consistent with the findings of Truong, Nguyen, and Vo (2021). The causality from futures to spot markets occurs as investors prefer futures trading due to its lower costs and higher leverage, resulting in price changes that are eventually transfer to the spot market through arbitrage (Ameur, Ftiti & Louhichi, 2021; Nguyen et al., 2019). Conversely, the spot market guides futures prices because it disseminates information more effectively, aiding price discovery and enabling investors to predict futures prices (Tripathy, 2014).

5. Conclusion

This research confirms that introducing VN30 Index futures has increased VN30 Index volatility, evident from higher variance in the post-futures period compared to the pre-futures period. Additionally, recent news was absorbed more slowly into stock prices more slowly after futures were introduced, with past information gaining greater influence on volatility. The study also identifies a positive, bidirectional relationship between Vietnam's stock and futures markets, suggesting mutual predictive capability.

These findings have significant implications for both investors and policymakers. Investors can leverage the increased volatility persistence of the VN30 Index post-futures to improve return estimations and forecasting (Christianti, 2018). Additionally, the bidirectional relationship allows investors to use information from one market to predict movements in the other.

For policymakers, the increased volatility after futures introduction may reflect heightened speculative activities, especially from individual investors (Truong, Nguyen, & Vo, 2021). Thus, policymakers should consider strategies such as attracting institutional and international investors by lowering transaction costs, enhancing transparency, and continuously improving trading infrastructure to stabilize market volatility.

Although the primary objective was achieved, this study does not determine whether increased volatility reflects enhanced or reduced market efficiency. Additionally, using only OLS regression limits the depth of the analysis regarding market interactions. Lastly, the Vietnamese futures market's limited maturity results in fewer observations. Future studies should revisit this topic as the market develops further, incorporating advanced methodologies to clarify volatility implications on market efficiency and better assess volatility persistence

7. References

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