RANDOM WALK AND UNBIASEDNESS IN EMERGING DERIVATIVES MARKETS: THE RISK GOVERNANCE APPROACH

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Abstract

This study examines the efficiency of the VN30 futures market in Vietnam, an emerging derivatives market, focusing on the random walk hypothesis and the unbiasedness hypothesis. Using daily opening and closing price data from August 17, 2017, to April 1, 2025 (1,905 observations), the study employs econometric methods, including autocorrelation test (Ljung-Box Q-statistics), unit root test (augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests), runs test, variance ratio test (Lo & MacKinlay, 1988), and Johansen cointegration test (Johansen, 1988; Johansen & Juselius, 1990) to test the above two hypotheses. The results show that VN30 futures prices follow a random walk, with negligible autocorrelation, non-stationary prices but stationary returns, and variance ratios close to 1, supporting weak-form efficiency. The Johansen test confirms cointegration between futures and spot prices, with trace statistics exceeding critical values, demonstrating the Unbiasedness Hypothesis and the price discovery role of the market. These results suggest that the Vietnamese futures market demonstrates weak-form efficiency and plays a crucial role in price discovery. The findings add to the limited literature on Vietnam's derivatives market and offer practical insights for investors, traders, and policymakers in developing effective investment and hedging strategies.

Keywords: Derivatives Market, Efficiency, Random Walk Hypothesis, Unbiasedness Hypothesis, Risk Governance, Vietnam

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1. INTRODUCTION

The derivatives market in Vietnam was officially launched in August 2017, and since then, the market has expanded in terms of trading volume and investor interest. As of April 2025, after nearly eight years of operation, the derivatives market has developed steadily and has attracted interest from both domestic and foreign investors. Among the existing derivative instruments in Vietnam, VN30

Index futures — which track the 30 largest and most liquid companies listed on the Ho Chi Minh Stock Exchange (HOSE) — have become the most actively traded contract and play a significant role in the financial market (Groette, 2025). A key question in assessing market efficiency is whether VN30 futures prices incorporate all available historical information. The random walk hypothesis states that if the market is weak-form efficient, prices fully reflect all historical information, making it impossible to predict future price movements based on past prices. In this context, strategies that rely on price patterns — such as trend-following — would not be effective. Meanwhile, a critical issue in the futures market is whether VN30 futures prices serve as unbiased predictors of future spot prices. This concept is known as the unbiasedness hypothesis, which states that futures prices reflect all available information and are equal to the expected spot price at maturity (Fama, 1970; Samuelson, 1965). If this hypothesis is correct, the futures market is considered to be informationally efficient. Many international studies have examined this relationship in both developed and emerging markets (Antoniou & Holmes, 1996; Wang & Ke, 2005; Xin et al., 2006).

However, research on the Vietnamese futures market is still limited. Due to its short history, low liquidity in the early stages, and lack of institutional investors, it is still uncertain whether the VN30 Index futures market is efficient. Some studies suggest that market efficiency may improve over time as the trading system becomes more transparent and investor behavior matures. Evidence from emerging markets suggests that stock market reforms aimed at reducing transaction and information costs can improve market quality and related efficiency conditions over time (Bhaumik et al., 2021). In Vietnam, Nguyen et al. (2019) find strong cointegration between VN30 Index futures and spot prices, indicating that the futures market plays an important role in price discovery. Similarly, Truong and Friday (2021) show that the introduction of VN30 Index futures reduces certain daily return anomalies in the HOSE, suggesting that derivatives trading contributes to greater market efficiency.

This paper aims to investigate whether or not the VN30 futures contract is efficient from the inception of trading to April 1, 2025, focusing on two key hypotheses: the random walk hypothesis and the unbiasedness hypothesis. Specifically, it tests weak-form efficiency by examining whether VN30 futures prices follow a random walk, using autocorrelation, unit root tests (augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests), and the variance ratio test (Lo & MacKinlay, 1988). Additionally, it evaluates the unbiasedness hypothesis by analyzing the long-run relationship between VN30 futures and spot prices through the Johansen cointegration test (Johansen, 1988; Johansen & Juselius, 1990). If the test finds cointegration between futures and spot prices, it means that futures prices contain useful information about spot prices and support the unbiasedness hypothesis.

Compared to previous studies, this study makes three contributions. First, it uses a long-term data set of nearly eight years with 1905 daily observations, which provides deeper insights than short-term data. Second, the paper includes both open-to-open and close-to-close return measures to account for market movements during trading hours. Third, the paper applies advanced econometric techniques to a market that has rarely been studied in this way.

This paper is structured as follows. Section 2 reviews related literature. Section 3 outlines the data and methodology. Section 4 presents the empirical findings. Section 5 discusses the implications, and Section 6 concludes with key insights and recommendations.

2. LITERATURE REVIEW

Market efficiency is a central concept in financial economics. Fama (1970, 1991) introduced the efficient market hypothesis, classifying it into three forms: weak, semi-strong, and strong. Weak-form efficiency holds that asset prices reflect all past trading information, and hence, price movements should follow a random walk. This concept is often tested using the random walk hypothesis, which posits that price changes are unpredictable because new information arrives randomly (Fama, 1965; Samuelson, 1965). A number of prior studies have tested the efficiency of futures contracts in international markets using the random walk hypothesis framework. For example, Lee and Mathur (1999) investigated six Spanish futures contracts — including interest rate futures (MIBOR 90-day and MIBOR 360-day), Spanish stock index futures (IBEX 35), foreign exchange rate futures (Deutsche Mark/Spanish Peseta), and national bond futures (10-year and 3-year) — and found strong evidence supporting weak-form efficiency. Similarly, Lee et al. (2000) examined contracts traded on the *Le Marché à Terme International de France* (MATIF), including CAC40 Index Futures, ECU Bond Futures, National Bond Futures, and PIBOR 3-month Futures, and confirmed that the random walk hypothesis held true. Evans (2006) also provided evidence of weak-form informational efficiency in the United Kingdom (UK) futures market and highlighted the role of computerized trading systems in improving efficiency. In contrast, research applying the random walk hypothesis to the Vietnamese futures market is virtually nonexistent.

In addition to the random walk hypothesis, the unbiasedness hypothesis is frequently applied to futures markets. It asserts that futures prices are unbiased predictors of future spot prices. Samuelson (1965) argued that futures prices should follow a martingale process in an efficient market, while Hansen and Hodrick (1980) formalized this idea using an econometric specification that examines whether current futures prices accurately predict subsequent spot prices without systematic bias and with proportional responsiveness. Under this framework, the market is considered efficient and the futures price unbiased when this predictive relationship holds without persistent deviations. Antoniou and Holmes (1996), Moosa and Al-Loughani (1994), and Fama (1991) emphasized that deviations from these conditions could signal inefficiency or risk premia in futures pricing.

Several statistical techniques are used to test these hypotheses. Firstly, serial correlation, also known as the autocorrelation of a time series, measures the correlation between several points in time. A relatively strong serial correlation based on previous prices would suggest that stock values are predictable. Multiple correlation coefficients can be calculated and compared with critical values as part of a serial correlation study (Worthington & Higgs, 2004). Another method for measuring serial correlation is the Box-Pierce statistic, which is a weighted average of several correlation coefficients determined at various time delays. The obtained coefficient is then compared to the critical value of the chi-squared distribution. This statistic has been frequently used in studies of market efficiency (Milieška, 2004; Borges, 2010). An improved version of the Box-Pierce test is now widely used when evaluating market efficiency (Bui, 2006; Shawn et al., 2012). Although serial correlation is frequently expressed in linear terms, non-linear correlations can also be assessed (Bui, 2006; Magnus, 2008).

Secondly, run tests assess whether stock returns are random. They count positive and negative runs — sequences of price increases or decreases — and calculate test statistics using sample size and number of runs. These are compared with critical values from the normal distribution. According to Campbell et al. (1997), the runs test does not require normally distributed data and is commonly used as an initial diagnostic tool, but it should be complemented with other methods for deeper analysis.

Serial correlation is a necessary but not sufficient condition for market efficiency; therefore, the variance ratio test proposed by Lo and MacKinlay (1988) is often used to provide a more robust assessment. This test compares variance across different intervals; if the ratio is close to one, the market is considered efficient. Individual and multiple variance ratios are often classified separately (Charles & Darne, 2009). The method is widely used in recent studies, including those by Borges (2010), Li (2008), and Shawn et al. (2012).

Unit root tests applied to time series of stock returns can also be used to examine market efficiency. These tests assume that if a series has a unit root, it does not follow a deterministic process and is difficult to predict. In other words, weak-form efficiency may hold if stock returns are non-stationary. Unit root tests and autocorrelation tests are computationally similar. The two main approaches are the ADF test and the Phillips-Perron test. While ADF includes a lagged dependent variable in the regression, the Phillips-Perron method uses non-parametric corrections. The ADF test has been widely applied in market efficiency studies (Bui, 2006; Al-Zaubia & Al-Nahlehb, 2010).

Early studies often used standard regression models, such as those by Frenkel (1978) and Huang (1984), but these are unreliable when price series are non-stationary — a common feature in financial markets. In such cases, standard statistical tests of parameter restrictions become ineffective (Elam & Dixon, 1988). To address this, researchers later adopted cointegration analysis, which allows testing for long-run equilibrium relationships even when the series are non-stationary. Hakkio and Rush (1989) and Chowdhury (1991) demonstrated the usefulness of cointegration methods in testing market efficiency. A more advanced method is the Johansen cointegration method, introduced by Johansen (1988) and Johansen and Juselius (1990). This technique allows the identification of multiple cointegration vectors in a multivariate system and is based on a maximum likelihood estimation framework. Several empirical studies, such as Antoniou and Holmes (1996) and Wang and Ke (2005), have successfully applied this method in different markets, specifically in the UK index futures market and the Taiwanese market. Later, Xin et al. (2006) explored this relationship in the Chinese futures market and found varying degrees of support for this hypothesis across different types of contracts. Kenourgios (2005) tested the unbiasedness hypothesis and market efficiency for the FTSE-20 index futures contract in Greece. Using the Johansen method, the results showed that the market was not efficient and the unbiasedness hypothesis was rejected, from which the Author proposed reforms to make the market operate more efficiently. Malini (2005) examined the United States coffee futures, applied cointegration to test for unbiasedness, and found a long-term association between coffee futures and spot prices. Alexander and Beegam (2024) tested the informational efficiency and unbiasedness hypothesis of Indian equity futures prices using daily trading data of 20 companies listed on the National Stock Exchange from 2001 to 2021 and econometric tools such as the Johansen test, vector error correction model (VECM) model, and Chow break point test. The results showed that most futures prices are unbiased and efficient in the long run, and the spot market adjusts faster to short-run price disequilibrium.

Recent studies in emerging derivatives markets highlight that short-term departures from the long-run equilibrium between spot and futures prices can coexist with overall cointegration. Su (2023) shows that the price discovery role of Chinese stock index futures shifts across rising, falling, and neutral markets, indicating that temporary misalignments intensify during periods of stress. Similar intraday evidence is provided by Khan et al. (2022), who report that short-horizon spot–futures dynamics in the NIFTY 50 market become less stable during turbulent periods. Beyond these deviations, recent work also underscores the importance of risk premia in futures pricing. Alexander and Beegam (2024) find that departures from the unbiasedness condition in Indian stock futures may reflect time-varying compensation for risk. Consistent with this view, Lee et al. (2025) show that emerging equity markets in the BRICS region experience mispricing and evolving efficiency during crises, suggesting that risk premia and short-term frictions jointly influence convergence. Regulatory changes may also affect these dynamics; Zhang et al. (2024) document that adjustments to trading rules in China improve the restoration of futures price discovery, highlighting the sensitivity of short-run deviations to market microstructure conditions.

In the Vietnamese market, there is a lack of extensive research on this topic. While some studies, such as Bui (2006), have examined weak-form efficiency in the VN30 Index using tools like the variance ratio and run test, there has been little effort to directly test the unbiasedness hypothesis between VN30 futures and spot markets. No existing work has been found using the Johansen cointegration method for this purpose in Vietnam.

Given that VN30 Index futures are among the most actively traded derivatives in Vietnam, it is crucial to determine whether they serve as effective predictors of the spot index. This would not only validate the market's role in price discovery but also provide important insights for hedgers, arbitrageurs, and policymakers. Therefore, this study applies the Johansen cointegration technique to examine whether the futures prices are unbiased forecasts of the VN30 spot index over a six-year period. Together with autocorrelation tests, unit root tests, and variance ratio tests, this approach allows for a robust assessment of futures market efficiency and supports the evaluation of both weak-form efficiency and the unbiasedness of the VN30F1M futures contract.

3. RESEARCH METHODOLOGY

3.1. Data

This study uses daily opening and closing prices of the VN30 Index and VN30F1M futures contracts, collected over the period from August 17, 2017, which marks the launch of the Vietnamese derivatives market, to April 1, 2025. The data were retrieved from the official website of the HOSE and Hanoi Stock Exchange (HNX) to ensure accuracy and consistency. The VN30F1M futures contract is selected for its high liquidity and trading volume compared to other futures contracts.

To examine the difference in volatility during trading and non-trading periods for the futures contract, both close-to-close (R_{cc}) and open-to-open (R_{oo}) returns are used and calculated as follows:

$$R_{oo} = \frac{P_{o_t}}{P_{o_{t-1}}} \tag{1}$$

$$R_{cc} = Ln\left(\frac{P_{c_t}}{P_{c_{t-1}}}\right) \tag{2}$$

The table below summarizes the descriptive statistics of the VN30 spot and futures prices and returns over the sample period. *OpenF–CloseF* and *OpenS–CloseS* denote the opening and closing prices of VN30 futures and spot, respectively. Both open-to-open (R_{oo}) and close-to-close (R_{cc}) return series are used to capture price behavior across trading and non-trading periods.

Table 1. Descriptive statistics of VN30 futures, VN30 spot prices, and returns

Variable	*Obs.*	*Mean*	*Std. dev.*	*Min*	*Max*	*Skewness*	*Kurtosis*
OpenF	1905	1102.35	228.343	583	1566	0.232	2.002
CloseF	1905	1102.218	228.086	578.7	1568	0.701	2.001
$R_{oo}F$	1904	0.0327%	1.486%	-8.141%	8.932%	-0.411	7.99
$R_{cc}F$	1904	0.0318%	1.484%	-11.661%	6.763%	-0.841	9.288
OpenS	1905	1104.332	227.296	609.35	1576.52	0.254	1.985
CloseS	1905	1110.193	227.274	629.08	1587	0.267	2.012
$R_{oo}S$	1904	0.0317%	1.306%	-6.947%	6.984%	-0.627	7.086
$R_{cc}S$	1904	0.0331%	1.074%	-6.309%	5.032%	-0.698	6.866

Overall, spot returns have slightly higher means than futures returns. Notably, $R_{oo}S$ shows greater mean and standard deviation than $R_{cc}S$, indicating higher volatility during trading hours, as documented by French and Roll (1986). Futures returns ($R_{oo}F$ and $R_{cc}F$) exhibit similar means but much higher volatility compared to spot, highlighting the greater risk embedded in futures trading.

Regarding distributional properties, $R_{oo}F$ has a skewness of -0.411, suggesting a distribution more aligned with normality. However, all return series show excess kurtosis, with values ranging from 6.866 to 9.288, indicating leptokurtic behavior. In contrast, the opening and closing price series of both futures and spot have kurtosis around 2.0, suggesting platykurtic distributions with flatter peaks around the mean.

3.2. Methodology

This research applies various statistical techniques to assess the efficiency of the Vietnamese VN30 futures market. The study tests two key hypotheses:

- the random walk hypothesis (*H1*);
- the unbiasedness hypothesis (*H2*).

The random walk hypothesis posits that prices follow a random walk, implying past prices cannot predict future movements, while the unbiasedness hypothesis asserts that futures prices are unbiased predictors of future spot prices in an efficient market.

To test the random walk hypothesis, the study employs these main methods: autocorrelation (using Ljung-Box Q-statistics), unit root tests (ADF and KPSS), runs test, and the variance ratio test (Lo & MacKinlay, 1988). These methods determine whether past prices can predict future prices. Additionally, the cointegration test (Johansen, 1988; Johansen & Juselius, 1990) is used to verify the unbiasedness hypothesis by examining the long-run relationship between futures and spot prices.

The data comprises 1,905 matched daily observations of the VN30 Index (spot) and VN30F1M futures from August 17, 2017, to April 1, 2025. Both opening and closing prices are analyzed to capture intraday volatility.

Cointegration is tested using the Johansen maximum likelihood estimator, where the spot price (S_t) and the futures price (F_t) are considered cointegrated if deviations from the long-run equilibrium are stationary:

$$S_t = \alpha + \beta F_t + \varepsilon_t \tag{3}$$

where, the unbiasedness hypothesis is confirmed when $\alpha = 0$ and $\beta = 1$.

Although this study relies on the above core techniques, several alternative methods can also be used to examine market efficiency and futures-spot dynamics. Long-memory behaviour can be assessed using the Hurst exponent (Lo, 1991), while nonlinear dependence can be tested with the Brock-Dechert-

Scheinkman procedure (Brock et al., 1996). Wavelet-based approaches provide a multi-scale perspective on the spot–futures relationship and may capture short-horizon dynamics overlooked by traditional cointegration methods (Vacha & Baruník, 2012). Recent work also applies multifractal detrended fluctuation analysis to evaluate long-range dependence and weak-form efficiency (Shrestha et al., 2023). These methods, however, lie beyond the scope of the present analysis.

4. EMPIRICAL RESULTS

4.1. Autocorrelation analysis

Autocorrelation tests assess whether VN30 futures returns exhibit serial dependence, a violation of the random walk hypothesis. Table 2 reports autocorrelation coefficients for $R_{oo}F$ and $R_{cc}F$ from lags 1 to 10.

Table 2. Autocorrelation results

LAG	$R_{oo}F$					$R_{cc}F$				
	AC	Q	Prob. > Q	Q*	Prob. > Q*	AC	Q	Prob. > Q	Q*	Prob. > Q*
1	-0.0812	12.577	0.0004	3.601	0.0577	-0.0848	13.711	0.0002	4.196	0.0405
2	0.0821	25.452	0.0000	10.135	0.0063	0.0917	29.761	0.0000	10.307	0.0058
3	-0.0232	26.476	0.0000	10.155	0.0173	-0.0090	29.915	0.0000	10.424	0.0153
4	-0.0001	26.476	0.0000	10.224	0.0368	-0.0367	32.481	0.0000	11.12	0.0253
5	-0.0081	26.601	0.0001	10.316	0.0668	0.0359	34.95	0.0000	11.867	0.0367
6	0.0352	28.97	0.0001	11.211	0.0821	-0.0100	35.142	0.0000	11.872	0.0649
7	0.0016	28.975	0.0001	11.326	0.125	0.0280	36.637	0.0000	12.078	0.098
8	0.0163	29.486	0.0003	11.415	0.1793	0.0021	36.646	0.0000	12.105	0.1466
9	-0.0365	32.035	0.0002	12.834	0.1702	-0.0275	38.09	0.0000	13.186	0.1544
10	-0.0161	32.533	0.0003	13.056	0.2205	-0.0207	38.909	0.0000	13.884	0.1783

Note: AC denotes the sample autocorrelation coefficient. Q is the Ljung-Box statistic, and Q is the heteroskedasticity-adjusted Ljung-Box statistic following Andrews (1991). Prob. denotes the corresponding p-values.*

Most coefficients are statistically insignificant, suggesting independence consistent with a random walk. The Ljung-Box q-statistics and heteroskedasticity-adjusted q-statistics (Andrews, 1991) indicate that, except for lag 1, serial correlations are negligible after adjusting for heteroskedasticity. For $R_{oo}F$ and $R_{cc}F$, the white noise hypothesis is rejected only at lag 1 before adjustment, but modified q-statistics confirm no significant serial correlation, supporting the random walk hypothesis.

4.2. Unit root tests

Unit root tests determine whether the VN30 futures price series is non-stationary, a prerequisite for cointegration analysis. The ADF test results from Table 3 show that at levels, test statistics for *OpenF* (-1.584) and *CloseF* (-1.579) exceed critical values (-3.43, -2.86, -2.57 at 1%, 5%, 10%), failing to reject the null hypothesis (H_0) of a unit root. In first differences, test statistics (-29.688 for *OpenF*, -29.469 for *CloseF* at lag 1) are below critical values, rejecting the null and confirming stationarity of returns. These results are robust across lag lengths (1–6), indicating non-stationarity in price levels and stationarity in returns.

Table 3. ADF test results

Lag order	OpenF		CloseF	
	At level	First difference	At level	First difference
1	-1.584	-29.688	-1.579	-29.469
2	-1.659	-24.792	-1.664	-24.267
3	-1.656	-21.731	-1.658	-22.172
4	-1.663	-19.549	-1.635	-19.152
5	-1.677	-17.206	-1.674	-17.473
6	-1.705	-15.866	-1.668	-15.863

The KPSS test assumes the H_0 of stationarity, with a unit root (non-stationarity) as the alternative hypothesis (*H1*). If the test statistic surpasses the critical values established by Kwiatkowski et al. (1992), the unit root alternative is accepted.

Table 4. KPSS test results

Lag order	OpenF	CloseF
0	11.2	11.2
1	5.62	5.62
2	3.75	3.75
3	2.82	2.82
4	2.26	2.26
5	1.88	1.88
6	1.61	1.62
7	1.41	1.42
8	1.26	1.26
9	1.13	1.14
10	1.03	1.03
11	0.948	0.948
12	0.876	0.877
13	0.815	0.815
14	0.761	0.762
15	0.715	0.715
16	0.673	0.674
17	0.637	0.637
18	0.604	0.604
19	0.574	0.575
20	0.548	0.548

Table 4 presents the KPSS test data for VN30 futures contracts up to 20 lag lengths. For the VN30 opening and closing futures series, the KPSS test statistic values with lag 1 are 6.26 and 6.27, respectively, and they decrease monotonically as the lag length L grows. These estimates are substantially bigger than the critical values at 1%, 5%, and 10% levels (0.216, 0.146, 0.119). At L = 8, the test statistic values for opening and closing series are 1.4 and 1.41, still much bigger than the critical values. Kwiatkowski et al. (1992) settled on 8 as the maximum lag length, as the long-run variance estimate generally settled down, balancing size distortions at L = 4 and reduced power at L = 12. The KPSS test strongly rejects the H_0 of stationarity at conventional significance levels, confirming the nonstationarity of VN30 futures prices. This result is consistent with the ADF test findings and supports the application of cointegration analysis.

4.3. Variance ratio test

The efficiency of unit root tests in detecting nonstationary pricing behavior has been questioned. Lo and MacKinlay (1988) noted that unit root tests fail to capture some deviations from the random walk, proposing the variance-ratio test as an alternative. The variance-ratio test assesses futures market efficiency, where a series' variance ratio should equal one for a random walk. The degree of market efficiency is determined by how close the variance ratio is to 1, with a smaller absolute deviation from 1 indicating higher efficiency.

Table 5 presents variance ratio results for VN30 futures using natural logarithm-formed price series.

Table 5. Variance ratio test results

Price series	*q*	*2*	*4*	*8*	*16*
OpenF	VR	0.92	0.952	0.971	0.96
	Z(q)	-3.468	-1.117	-0.428	-0.390
	Z*(q)	-1.865	-0.629	-0.258	-0.251
	Delta	0.08	0.048	0.029	0.04
CloseF	VR	0.916	0.963	0.977	0.973
	Z(q)	-3.632	-0.856	-0.335	-0.271
	Z*(q)	-2.017	-0.495	-0.205	-0.176
	Delta	0.084	0.037	0.023	0.027

For lag 2, variance ratios for opening and closing prices are 0.917 and 0.908, respectively, with heteroskedasticity-adjusted Z* statistics of -1.734 and -1.897, below critical values (2.576, 1.96, 1.645 at 1%, 5%, 10%). Due to heteroscedasticity, Z* statistics are used for inference. Unadjusted Z statistics (-3.109, -3.454 for opening and closing) would reject the random walk H_0, but Z* values (-1.734, -1.897) confirm it, as they do not exceed critical thresholds. Thus, the variance ratio test fails to reject the unit-variance H_0, indicating VN30 futures prices follow a random walk, a key requirement for market efficiency.

Table 5 shows that variance ratios are nearly zero, statistically indifferent from one, suggesting randomness in the price series. The absolute deviation of the opening variance ratio (0.083 at q = 2) is smaller than the closing (0.092), indicating that opening prices are relatively more efficient.

4.4. Cointegration test

To examine whether VN30 spot and futures prices share a stable long-run equilibrium, the Johansen cointegration framework is employed in this study. Table 6 presents the trace statistics and critical values used to assess the number of cointegrating vectors between the opening and closing price series.

Table 6. Johansen cointegration results

Spot-futures relationship	*Price series specification*	*Number of CE(s)*	*Trace statistics*	*5% critical value*	*1% critical value*
Spot price versus 1-month futures price	*OpenF–OpenS*	None	2108.45	19.96	24.6
		At most 1	0.948	9.24	12.97
	CloseF–CloseS	None	1365.797	19.96	24.6
		At most 1	0.138	9.24	12.97

Futures prices in an efficient market, according to Samuelson (1965), follow a martingale process, implying they reliably predict future spot prices. The unbiasedness hypothesis states that futures prices accurately forecast future spot prices in an efficient market. The Johansen cointegration test results for VN30 monthly spot and one-month futures prices indicate the presence of a long-run relationship between the two series. Trace statistics for *OpenF–OpenS* (2108.45) and *CloseF–CloseS* (1365.797) exceed critical values (19.96 at 5%, 24.6 at 1%), confirming a cointegrating equation at the 1% significance level. For at most one cointegrating equation, trace statistics (0.948 for *OpenF–OpenS* and 0.138 for *CloseF–CloseS*) are below critical values (9.24 at 5%), indicating a single cointegrating relationship. This cointegration suggests VN30 futures prices are impartial predictors of spot prices. The results indicate that the Vietnamese futures market is efficient, supporting price discovery, as the unbiasedness hypothesis is consistently validated.

5. DISCUSSION

This study evaluates the efficiency of the VN30 futures market using daily data from August 17, 2017, to April 1, 2025, testing the random walk hypothesis and unbiasedness hypothesis. Autocorrelation tests reveal insignificant serial dependence in VN30 futures returns, with heteroskedasticity-adjusted Ljung-Box q-statistics confirming the white noise hypothesis beyond lag 1, supporting the random walk hypothesis. Unit root tests (ADF and KPSS) establish nonstationarity in price series (e.g., ADF: -1.584 for *OpenF*, -1.579 for *CloseF* at levels) and stationarity in returns (e.g., ADF: -29.688 for *OpenF*, -29.469 for *CloseF* in first differences), justifying cointegration analysis. The KPSS test further confirms nonstationarity, with test statistics (e.g., 6.26 for *OpenF*, 6.27 for *CloseF* at lag 1) exceeding critical values (0.216, 0.146, 0.119 at 1%, 5%, 10%). The variance ratio test (Lo & MacKinlay, 1988) supports random walk behavior, with variance ratios close to one (0.917 for *OpenF*, 0.908 for *CloseF* at q = 2) and Z* statistics (-1.734, -1.897) below critical thresholds (2.576, 1.96, 1.645), indicating weak-form efficiency. The Johansen cointegration test confirms a long-run relationship between spot and futures prices, with trace statistics (2108.45 for *OpenF–OpenS*, 1365.797 for *CloseF–CloseS*) exceeding critical values (19.96 at 5%, 24.6 at 1%), validating the unbiasedness hypothesis.

These findings align with studies in other markets, such as Wang and Ke (2005) and Xin et al. (2006), but contrast with Kenourgios (2005), where inefficiencies were noted. The VN30 futures market's efficiency reflects growing liquidity and transparency since its inception. The higher volatility of futures returns (e.g., $R_{cc}F$: 1.484% std. dev.) compared to spot returns ($R_{cc}S$: 1.074%) underscores greater risk in futures trading, as noted by French and Roll (1986). For instance, Firmansyah et al. (2020) found that in Indonesia's emerging market, derivative transactions increased idiosyncratic volatility when interacting with income volatility, suggesting that derivatives may amplify firm-specific risks in certain contexts. This highlights the need for careful risk management when using VN30 futures for hedging or speculation in Vietnam's market. Similar patterns are observed in other derivatives markets, where asset-specific jump risks have been documented, such as in the impact of futures trading on jump risk in the spot market (Zhang et al., 2023). For investors, the random walk behavior implies that standalone trend-following strategies are ineffective, but combining technical analysis with fundamental analysis (e.g., assessing VN30 companies' financial reports) can identify mispriced assets. For instance, long positions in VN30 futures may be taken if stocks are undervalued with an upward trend. The cointegration of futures and spot prices supports their use as hedging tools; short positions can mitigate downside risks in overvalued spot markets. Given the weak-form efficiency, passive investment strategies, such as index-based diversification, are advisable, particularly for novice investors, as outperforming the market is challenging.

The findings of weak-form efficiency and cointegration between VN30 futures and spot prices provide actionable insights for investors and financial managers navigating Vietnam's emerging derivatives market. These results shape investment strategies by highlighting the limitations of technical analysis and the potential for hedging. Firstly, the VN30 futures market follows a random walk, implying that past price patterns cannot predict future movements (Fama, 1970). Consequently, standalone trend-following strategies are unlikely to be effective. However, combining technical analysis with fundamental analysis can enhance decision-making. For instance, by analyzing annual reports of VN30 companies to assess intrinsic values and monitoring price trends, investors may identify mispriced assets. If stocks are undervalued with an upward trend, a long position in VN30 futures could be profitable; conversely, overvalued stocks with a downward trend may warrant a short position. Secondly, the cointegration of VN30 futures and spot prices supports their use as effective hedging tools. For example, if fundamental analysis indicates an overvalued spot market and technical analysis suggests a downward trend, investors can take a short position in VN30 futures to mitigate downside risk in their spot portfolio. This approach helps preserve assets during unfavorable market conditions, enhancing risk management in Vietnam's volatile market. Thirdly, the weak-form efficiency of the VN30 futures market, coupled with its potential to become more efficient as liquidity and transparency improve, encourages passive investment strategies. Novice investors, in particular, can benefit from constructing well-diversified portfolios based on the VN30 Index, as outperforming an increasingly efficient market is challenging. This strategy minimizes diversifiable risks and aligns with market performance. Finally, investors should continuously enhance their knowledge of Vietnam's dynamic derivatives market, integrating fundamental and technical analyses to make informed decisions. Policymakers are encouraged to improve market infrastructure, such as trading systems and regulations, to attract institutional investors and further enhance market efficiency.

6. CONCLUSION

This study provides strong evidence supporting the weak-form efficiency of the VN30 futures market and validates the unbiasedness hypothesis using a comprehensive dataset (2017–2025) and robust econometric methods, including autocorrelation tests, unit root tests (ADF, KPSS), variance ratio tests, and Johansen cointegration analysis. The results indicate that VN30 futures prices follow a random walk and cointegrate with spot prices, thereby confirming their role in price discovery and as a hedging instrument. These findings provide guidance for investors in adopting passive or combined analytical strategies, support the use of VN30 Index futures as effective hedging instruments, and highlight the need for policymakers to enhance transparency and investor education to foster sustainable market development.

Despite these contributions, the study is subject to several limitations. First, it focuses only on weak-form efficiency and does not cover semi-strong or strong-form efficiency. Confirmation of weak-form efficiency does not necessarily imply the absence of higher forms of efficiency, as weak-form efficiency is a necessary but not sufficient component of them. Second, while the Johansen test verifies a long-run cointegration between futures and spot prices, short-run deviations from this equilibrium are possible, which may create speculative opportunities (Antoniou & Holmes, 1996). Building on these limitations, future research could investigate short-run market dynamics using error-correction models to capture temporary departures from the long-run equilibrium. In addition, subsequent studies should extend the scope to examine semi-strong and strong-form efficiency to provide a more comprehensive understanding of the VN30 futures market.

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